American College of Physicians

Virtual/Live Internal Medicine Board Review

Greater Chicago – Schaumburg IL

(Course Code PG2501 &2501V)

May 13 – 17, 2025

eSyllabus

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American College of Physicians
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American College of Physicians
Virtual Live Internal Medicine Board Review
Greater Chicago – Schaumburg IL

Faculty and Disclosures

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Disclosures are listed in italics below the individuals. Individuals without anything listed have nothing to disclose. All relevant relationships have been mitigated.

American College of Physicians
2025 Internal Medicine Board Review
Greater Chicago, May 13 – 17, 2025
Central Daylight Time

Tuesday, May 13, 2025

7:45 a.m.	Introduction and Welcome	Dr. Sarah Hartley
8:00 a.m.	Oncology I	Dr. Rashmi Chugh
9:00 a.m.	Oncology II	Dr. Rashmi Chugh
10:00 a.m.	15- minute break	
10:15 a.m.	Nephrology I	Dr. Laura Mariani
11:15 a.m.	Nephrology II	Dr. Laura Mariani
12:15 p.m.	1-hour break	
1:15 p.m.	Nephrology III	Dr. Laura Mariani
2:15 p.m.	Dermatology I	Dr. Frank Wang
3:30 p.m.	Break	
3:45 p.m.	Dermatology II	Dr. Frank Wang
4:45 p.m.	Rheumatology I	Dr. Seetha Monrad
5:45 p.m.	Rheumatology II	Dr. Seetha Monrad
6:30 p.m.	Adjourn	

Wednesday, May 14. 2025

8:00 a.m.	Pulmonary 1	Dr. Madeline Lagina
8:45 a.m.	Pulmonary II	Dr. Madeline Lagina
9:45 a.m.	Critical Care Medicine	Dr. Madeline Lagina
10:45 a.m.	15-minute break	
11:00 a.m.	Infectious Disease I	Dr. Shiwei Zhou
11:45 a.m.	Infectious Disease II	Dr. Shiwei Zhou
12:30 p.m.	1-hour break	
1:30 p.m.	Infectious Disease III	Dr. Adam Ressler
2:30 p.m.	Infectious Disease IV	Dr. Adam Ressler
3:30 p.m.	15-minute break	
3:45 p.m.	Mental and Behavioral Health	Dr. Danielle Heidemann
4:45 p.m.	Cancer Screening	Dr. Danielle Heidemann
5:30 p.m.	Adjourn	

Thursday, May 15, 2025

8:00 a.m.	Gastroenterology I	Dr. Dejan Micic
9:00 a.m.	Gastroenterology II	Dr. Dejan Micic
10:00 a.m.	15- minute break	
10:15 a.m.	Gastroenterology III	Dr. Dejan Micic
11:15 a.m.	Gastroenterology IV	Dr. Dejan Micic
12:15 p.m.	1-hour break	
1:15 p.m.	Common Symptoms	Dr. Allison Ruff
2:45 p.m.	Urologic, Obstetric and Gynecological Conditions	Dr. Allison Ruff

3:45 p.m.	15- minute break	
4:00 p.m.	Geriatric Medicine I	Dr. Kahli Zietlow
5:00 p.m.	Geriatric Medicine II	Dr. Kahli Zeitlow
5:45 p.m.	Ethics and Patient Safety	Dr. Kahli Zietlow
6:15 p.m.	Adjourn	

Friday, May 16, 2025

8:00 a.m.	Cardiology I	Dr. Tanuka Piech
9:00 a.m.	Cardiology II	Dr. Tanuka Piech
10:00 a.m.	15- minute break	
10:15 a.m.	Cardiology III	Dr. Tanuka Piech
11:15 a.m.	Cardiology IV	Dr. Tanuka Piech
12:15 p.m.	1-hour break	
1:15 p.m.	Musculoskeletal Problems	Dr. Becky Northway
2:30 p.m.	Eye, Ear, Nose, and Throat Disorders	Dr. Becky Northway
3:30 p.m.	15-minute break	
3:45 p.m.	Hematology I	Dr. Marcus Geer
4:45 p.m.	Hematology II	Dr. Marcus Geer
5:45 p.m.	Adjourn	

Saturday, May 17, 2025

8:00 a.m.	Neurology I	Dr. Geeta Verma
9:30 a.m.	Neurology II	Dr. Geeta Verma
10:45 a.m.	15- minute break	
11:00 a.m.	Endocrinology I	Dr. Timothy Bodnar
12:00 p.m.	1-hour break	
1:00 p.m.	Endocrinology II	Dr. Timothy Bodnar
2:00 p.m.	Endocrinology III	Dr. Timothy Bodnar
3:00 p.m.	Endocrinology IV	Dr. Timothy Bodnar
3:30 p.m.	Adjourn	

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To claim MOC points for this activity, the American Board of Internal Medicine (ABIM) requires that you be enrolled in their Maintenance of Certification Program. They also require you to complete a comprehensive evaluation of the learning that took place in this activity, and achieving a passing score as set by the provider.

The evaluation is a quiz consisting of **40** multiple choice questions taken directly from the presentations in this course, and the passing score is set at 60%. Please go to **www.acponline.org/postgraduateMOC** and follow the instructions to complete the quiz and claim your MOC points. If you have any questions about the evaluation, please contact ACP. If you have any questions about the MOC Program, please contact ABIM. **The link to claim CME and MOC for the course will be sent to you at the conclusion of the course.**

MOC points must be claimed by December 31, 2027.

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2025 Greater Chicago Internal Medicine Board Review course
Program Schedule – In-Person and Virtual Live
Tuesday, May 13 – Saturday, May 17, 2025
Central Daylight Time

Tuesday, May 13, 2025

Time	Topic	Content	Faculty
7:00 a.m. – 8:00 a.m.	**Registration and Breakfast**		
7:45 a.m. – 8:00 a.m.	**Introduction and Welcome**		 *Sarah Hartley, MD, MHPE, FACP* Course Director  *Abigail L. Entz, MD, FACP* Course Director
8:00 a.m. – 9:00 a.m.	**Oncology I**	➢ Lung Cancer ➢ Breast Cancer ➢ Head and Neck Cancer ➢ Esophageal Cancer ➢ Colorectal Cancer ➢ Anal Cancer ➢ Prostate Cancer ➢ Cervical Cancer ➢ Vulvar Cancer	 *Rashmi Chugh, MD*
9:00 a.m. – 10:00 a.m.	**Oncology II**	➢ Renal Cancer ➢ Urothelial (Bladder) Cancer ➢ Non-Hodgkin Lymphomas ➢ Chronic Lymphocytic Leukemia/Small Cell Lymphoma ➢ Inherited Cancer Risk ➢ Spinal Cord Tumors and Compression ➢ Fever and Neutropenia ➢ Malignancy-Induced Hypercalcemia ➢ Lymphedema ➢ Nausea and Vomiting	*Rashmi Chugh, MD*

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Tuesday, May 13, 2025			
10:00 a.m. – 10:15 a.m.	**15-Minute Break**		
10:15 a.m. – 11:15 a.m.	**Nephrology I: Hypertension and Nephrolithiasis**	➢ Hypertension ➢ Hypertensive Urgency and Emergency ➢ Renovascular and Renal Parenchymal Hypertension ➢ Hematuria ➢ Nephrolithiasis	 *Laura Mariani, MD, MS*
11:15 a.m. – 12:15 p.m.	**Nephrology II: Acute and Chronic Kidney Injury**	➢ Hypotension- or Shock-Induced Acute Kidney Injury ➢ Hepatorenal Syndrome ➢ Toxic Kidney Injury ➢ Rhabdomyolysis ➢ Obstructive Uropathy ➢ Myeloma-Induced Kidney Disease ➢ Nephrotic Syndrome ➢ Diabetic Kidney Disease ➢ Strategies to Prevent Progression of Kidney Disease	*Laura Mariani, MD, MS*
12:15 p.m. – 1:15 p.m.	**1-Hour Break**		
1:15 p.m. – 2:15 p.m.	**Nephrology III: Electrolytes and Acid-Base Disorders**	➢ Hypernatremia ➢ Hyponatremia ➢ Hyperkalemia ➢ Hypokalemia ➢ Hypomagnesemia ➢ Metabolic Acidosis ➢ Respiratory Acidosis	*Laura Mariani, MD, MS*
2:15 p.m. – 3:30 p.m.	**Dermatology I**	➢ Atopic Dermatitis ➢ Contact Dermatitis ➢ Hand Dermatitis ➢ Seborrheic Dermatitis ➢ Stasis Dermatitis ➢ Venous Disease of the Lower Extremities ➢ Leg Ulcers ➢ Drug Eruptions ➢ Urticaria ➢ Acne Vulgaris ➢ Rosacea	 *Frank Wang, MD*
3:30 p.m. – 3:45 p.m.	**15-Minute Break**		

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Tuesday, May 13, 2025			
3:45 p.m. – 4:45 p.m.	**Dermatology II**	➢ Psoriasis ➢ Dermatophytosis (Tinea) ➢ Warts, Corns, and Skin Tags ➢ Seborrheic Keratosis ➢ Actinic Keratosis ➢ Squamous Cell Carcinoma of the Skin ➢ Basal Cell Carcinoma of the Skin ➢ Melanoma	*Frank Wang, MD*
4:45 p.m. – 5:45 p.m.	**Rheumatology I**	➢ Gout ➢ Pseudogout ➢ Osteoarthritis ➢ Rheumatoid Arthritis ➢ Infectious Arthritis	 *Seetha U. Monrad, MD*
5:45 p.m. – 6:30 p.m.	**Rheumatology II**	➢ Fibromyalgia ➢ Systemic Lupus Erythematosus ➢ Systemic Vasculitis ➢ Serum Sickness ➢ Adult Still Disease ➢ Mixed Connective Tissue Disease ➢ Psoriatic Arthritis	*Seetha U. Monrad, MD*
6:30 p.m.	**Adjourn**		

Oncology I

2025 Virtual / Live Internal Medicine Board Review

Rashmi Chugh, MD
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ACP Internal Medicine Board Review Course

Oncology I

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Table of Contents: Oncology I

- Lung cancer
- Breast cancer
- Head and neck cancer
- Esophageal cancer
- Colorectal cancer
- Anal cancer
- Prostate cancer
- Cervical cancer
- Vulvar cancer

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Oncology Q1

A 64-year-old man has a left apical lung mass.

He has a 35-pack-year smoking history.

Physical exam reveals multiple firm, nonmobile lymph nodes in the left supraclavicular space.

Chest CT scan shows left upper lobe opacity and bilateral hilar lymphadenopathy.

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Oncology Q1

A 64-year-old man has a left apical lung mass. He has a 35-pack-year smoking history. Physical exam reveals multiple firm, nonmobile lymph nodes in the left supraclavicular space. Chest CT scan shows left upper lobe opacity and bilateral hilar lymphadenopathy.

Which of the following is the most appropriate next diagnostic test?

A: Bronchoscopy with needle aspiration of mediastinal lymph nodes

B: Bronchoscopy with transbronchial biopsy of the left apical mass

C: Core biopsy of the left supraclavicular lymph nodes

D: CT-guided percutaneous biopsy of the left apical mass

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Lung Cancer

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Lung Cancer: Risk Factors

- Tobacco smoking
- Radiation therapy
- Asbestos
- Pulmonary fibrosis
- Radon exposure
- Family history

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Lung Cancer: Diagnosis

Symptoms

- Cough, dyspnea
- Chest pain
- Weight loss
- Hemoptysis
- Hoarseness

Findings

- Consolidation
- Effusion
- Bone tenderness
- Neurologic findings

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Superior Vena Cava Syndrome

- Swelling of face, neck, upper extremities
- Cough
- Dyspnea/orthopnea
- Headache
- JVD and dilated anterior chest veins



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Lung Cancer: Screening Recommendations

USPSTF

- Annual screening with low-dose CT for patients who meet the following criteria:
  - Aged 50 to 80 years *and*
  - ≥20-pack-year smoking history
- Stop screening if: no smoking for 15 years, limited life expectancy, or not willing or able to have surgery

American Cancer Society

- Screen all former smokers who meet the criteria regardless of when they last smoked

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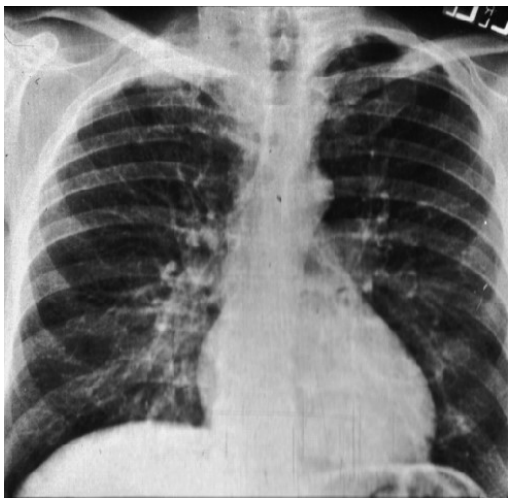
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Lung Cancer: Testing

If chest radiograph shows a lung nodule or mass

- Compare to previous imaging
- Stable ≥2 years → cancer unlikely

CBC, serum chemistries



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Lung Cancer: Testing



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CT scan of the chest

- Irregular or spiculated borders
- Upper lobe location
- Thick-walled cavitation
- Solid component within a ground-glass lesion
- Growth on follow-up imaging

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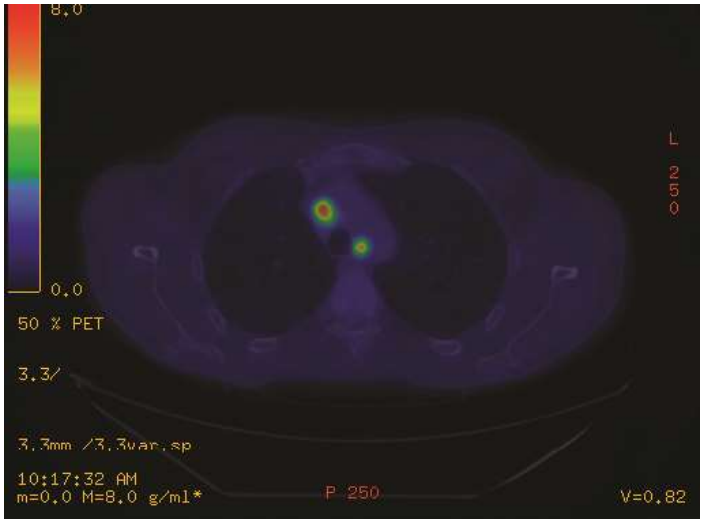
Lung Cancer: Testing

PET

- Unsuspected mediastinal involvement
- Distant disease

PET false negatives

- Cancers <1 cm
- Slow-growing cancers



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Lung Cancer: Testing

Histologic confirmation

- Mediastinal/central lesions → bronchoscopy
- Peripheral lesions → transthoracic needle biopsy
- Peripheral lymph node → biopsy
- Pleural fluid → thoracentesis with cytology

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Lung Cancer: Testing

Ideal biopsy site provides simultaneous diagnosis and staging

- Peripheral lymph node
- Pleural effusion

Sputum cytology

- Unsuitable for molecular studies
- Does not provide staging information

Next-generation sequencing

- If biopsy confirmative

Circulating tumor DNA (to guide treatment)

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Non–Small Cell Lung Cancer: Treatment

Surgery (stage I/II, some stage III)

- Adjuvant therapies in stage Ib/II/III disease:
  - Chemotherapy ± immunotherapy or targeted therapy

Combined chemotherapy and radiation ± immunotherapy or targeted therapy (nonsurgical treatment for stage II/III)

Chemotherapy and immunotherapy/targeted therapy (advanced/metastatic disease)

- PD-L1, *EGFR*, *ALK*, *ROS1*, *BRAF*, *NTRK*, *MET*, *RET, HER2*

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Small Cell Lung Cancer: Treatment

Limited disease

- Chemotherapy, radiation, immunotherapy; surgery (rarely)

Extensive disease

- Chemotherapy, immunotherapy, ± radiation, BiTE (tarlatamab)

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Oncology Q2

A 42-year-old woman undergoes partial mastectomy and postoperative radiation therapy for intermediate-grade DCIS that was ER positive and PR positive.

She is premenopausal.

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Oncology Q2

A 42-year-old woman undergoes partial mastectomy and postoperative radiation therapy for intermediate-grade DCIS that was ER positive and PR positive. She is premenopausal.

Which of the following is the most appropriate additional therapy?

A: Anastrozole

B: Chemotherapy

C: Raloxifene

D: Tamoxifen

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Breast Cancer

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Breast Cancer: Risk Factors*

- *BRCA1* or *BRCA2* gene mutations
- Family history
- Chest irradiation at age 10-30 years
- Atypical hyperplasia/lobular carcinoma in situ
- Reproductive history
- Alcohol
- Estrogen-containing supplement/OCP use

*Consider chemoprevention in high-risk patients.

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Breast Cancer: Diagnosis

- Breast mass
- Nipple discharge, eczema, excoriation, retraction, inversion
- Localized breast pain
- Dimpling, thickening, discolored skin
- Axillary mass



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Breast Cancer: Testing

Abnormal mammogram/ultrasound/MRI

Core needle biopsy

- If palpable mass, perform even if imaging is negative
- ER and PR receptor and *HER2*/*neu* assays

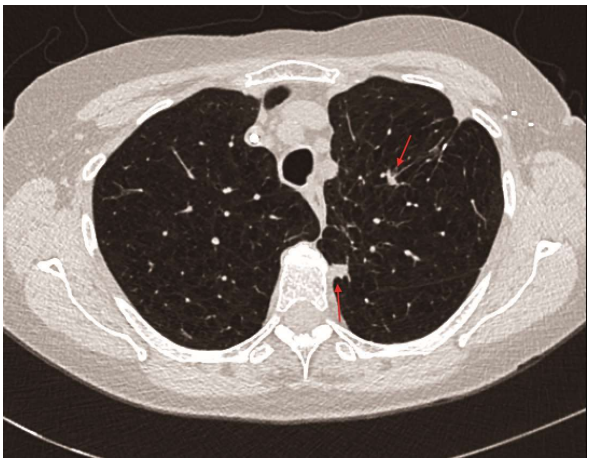
Assess suspicious lymph nodes

- Fine-needle aspiration biopsy or core needle biopsy

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Breast Cancer: Testing



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Chest CT, abdominal ultrasonography, PET, and/or bone scan indications (stage III)

- Positive axillary lymph nodes
- Tumor ≥5 cm
- Suggestive signs of metastatic disease
- No imaging studies needed in stage 0 to II if no symptoms

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Ductal Carcinoma In Situ: Diagnosis and Treatment

Diagnosis

- Noninvasive breast cancer
- Usually presents as calcifications on mammogram

Treatment

- Lumpectomy +/- radiation
- Mastectomy if extensive
- Hormone therapy an option if hormone receptor positive

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Invasive Breast Cancer: Treatment

Lumpectomy

- Small enough for good cosmetic result

Mastectomy

- Skin involvement
- Inflammatory
- Genetic predisposition (*BRCA* variation)
- Contraindication to radiation



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Invasive Breast Cancer: Treatment

Sentinel node biopsy

- Perform at time of surgery if clinically negative axillary lymph nodes (may defer in low-risk patients and/or older adults)

Axillary lymph node dissection

- Not needed if <3 positive sentinel lymph nodes and no clinically involved nodes

Post-excision irradiation

- Lumpectomy; some mastectomy

Systemic adjuvant therapy for nonmetastatic cancer

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ER/PR Receptor–Positive Breast Cancer: Adjuvant Antiestrogen Therapy

Premenopausal Selective Estrogen Receptor Modulator	**Postmenopausal** Aromatase Inhibitor (AI)
Tamoxifen 5-10 years Adverse effects • Menopausal symptoms • Endometrial cancer (once postmenopausal) • VTE • CVA Ovarian suppression + AIs if higher risk CDK4/6 inhibitors if higher risk	Anastrozole, letrozole, exemestane 5-10 years Adverse effects • Arthralgia • VMS • Genitourinary symptoms • Osteoporosis • CV events CDK4/6 inhibitors if higher risk

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Breast Cancer: Adjuvant Chemotherapy

Recommended with usually anthracycline and/or taxane based on stage and biology for the following:

- *HER2* positive (along with *HER2* directed therapy)
- Hormone receptor–negative, *HER2*-negative (triple-negative) cancers
  - Chemotherapy plus immunotherapy
- Hormone receptor positive/*HER2* negative if high risk based on number of nodes involved, gene expression profiling score, and menopausal status

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HER2-Positive Breast Cancer: Treatment

Anti-*HER2* therapy and chemotherapy (trastuzumab, pertuzumab, ado-trastuzumab emtansine)

- Improves results in adjuvant and metastatic setting

Adverse effect: cardiomyopathy

- Evaluate LVEF before and periodically during treatment
- Higher risk if combined with anthracycline chemotherapy

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Metastatic Breast Cancer: Treatment

Hormone receptor–positive metastatic disease

- Antiestrogen therapy (may combine with targeted agents)

Hormone receptor–negative metastatic disease

- Chemotherapy

Bone metastases

- Add bisphosphonate or denosumab
- Surgical stabilization for impending fracture
- Radiation therapy for pain

Triple-negative

- Chemotherapy plus immunotherapy if PD-L1 (+)

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Oncology Q3

A 45-year-old man has a 6-month history of a painless, enlarged right upper cervical lymph node.

He does not smoke. He drinks alcohol socially.

A firm, 3-cm lymph node is palpable beneath the angle of the right jaw.

Oral cavity exam shows no abnormalities.

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Oncology Q3

A 45-year-old man has a 6-month history of a painless, enlarged right upper cervical lymph node. He does not smoke. He drinks alcohol socially. A firm, 3-cm lymph node is palpable beneath the angle of the right jaw. Oral cavity exam shows no abnormalities.

Which of the following is the most appropriate diagnostic test to perform next?

A: Endoscopic evaluation

B: Excisional lymph node biopsy

C: MRI of the neck

D: Whole-body PET/CT

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Head and Neck Cancer

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Head and Neck Cancer: Risk Factors

Tobacco use

- Smoked and smokeless

Alcohol use

HPV infection

- Favorable outcome in patients with oropharyngeal squamous cell cancer

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Head and Neck Cancer: Diagnosis

- Persistent/progressive lymph node enlargement
- Neck mass
- Unilateral tonsillar enlargement
- Unilateral hearing loss, tinnitus, ear pain
- Nasal obstruction
- Nonhealing oral ulcers, oral pain
- Dysphagia/odynophagia
- Hoarseness

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Head and Neck Cancer: Testing

Flexible fiberoptic laryngoscopy

- Pharynx and larynx

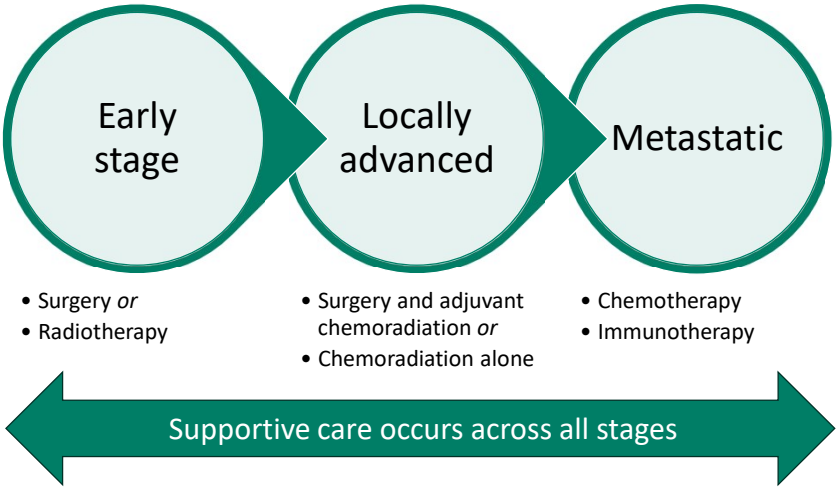
Diagnosis → FNA

Staging → CT and MRI, PET/CT

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Head and Neck Cancer: Treatment



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Esophageal Cancer

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Esophageal Cancer: Diagnosis

Presents with dysphagia

- Typically more for solids than liquids initially

Evaluation may include the following:

- Barium swallow
- Upper endoscopy
- Endoscopic ultrasonography
- CT
- PET

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Esophageal Cancer: Diagnosis

Squamous cell

- More proximal
- More associated with smoking and alcohol

Adenocarcinoma

- More distal/GE junction
- Associated with Barrett esophagus

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Esophageal Cancer: Treatment

Very superficial disease

Endoscopic treatment

Proximal disease (SCC)

Combined radiation and chemotherapy

Mid/distal cancers (adenocarcinoma)

- Neoadjuvant chemotherapy, surgical resection, adjuvant chemotherapy

Metastatic disease

- May include chemotherapy, immunotherapy, anti-*HER2*–directed therapy

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Oncology Q4

A 55-year-old woman is evaluated after testing positive on FIT obtained for colorectal cancer screening.

She has no GI symptoms. Family history is unremarkable.

Physical exam is normal.

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Oncology Q4

A 55-year-old woman is evaluated after testing positive on FIT obtained for colorectal cancer screening. She has no GI symptoms. Family history is unremarkable. Physical exam is normal.

Which of the following is the most appropriate diagnostic test to perform next?

A: Colonoscopy

B: High-sensitivity guaiac FOBT

C: Repeat FIT

D: Stool DNA testing

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Colorectal Cancer (CRC)



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Colorectal Cancer: Risk Factors

- CRC diagnosed in first-degree relative aged <60 years
- CRC in ≥2 first-degree relatives
- FAP syndrome
- Lynch syndrome
- Primary sclerosing cholangitis
- IBD (UC, Crohn disease) for ≥8 years
- Personal history of adenoma/colorectal cancer

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Colorectal Cancer: Diagnosis and Testing

Signs and symptoms

- May be asymptomatic
- GI bleeding/iron deficiency anemia
- Altered bowel movements
- Abdominal pain
- Weight loss

Colonoscopy with biopsy for diagnosis

- Test for mismatch repair proteins by IHC or microsatellite instability genes by PCR

Rectal cancer: higher risk of local recurrence



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Colon Cancer: Treatment

Stage I Confined to colon/does not invade full bowel wall thickness, node negative	Stage II Invades full bowel thickness, node negative
• Resection for cure	• Resection for cure • Adjuvant chemotherapy if high risk

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Colon Cancer: Treatment

Stage III Metastatic to regional LNs	Stage IV Distant metastases
• Resection • Adjuvant chemotherapy	• Resection of primary lesion for palliation only • Resection of metastases limited to liver/lung • Palliative chemotherapy

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Colon Cancer: Post-treatment Surveillance

CEA testing

- 3-6 months × 2 years
- Then every 6 months × 5 years

Colonoscopy

- 1 year
- 3 years
- Then every 5 years

CT of chest, abdomen, pelvis

- Annually × 5 years for patients at high risk

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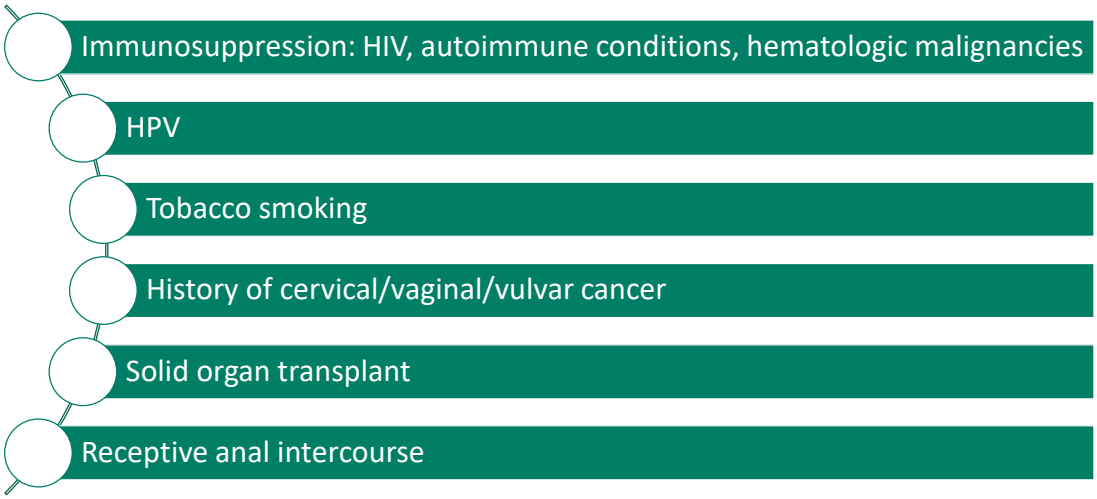
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Anal Cancer



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Anal Cancer: Risk Factors



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Anal Cancer: Diagnosis

Symptoms

- Anorectal pain
- Hematochezia
- Pruritis in perianal area

Evaluation

- Digital rectal exam
- Anoscopy and endoanal ultrasonography
- Biopsy and HPV testing
- PET/CT
- HIV testing important for planning treatment

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Oncology Q5

A 68-year-old man is hospitalized for new severe, nontraumatic low back pain.

He had localized prostate cancer treated with irradiation 6 years ago.

Point tenderness is noted over the lower spine.

PSA level is 50 ng/mL.

Spine radiograph shows an osteoblastic metastasis at L4.

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Oncology Q5

A 68-year-old man is hospitalized for new severe, nontraumatic low back pain. He had localized prostate cancer treated with radiation 6 years ago. Point tenderness is noted over the lower spine. PSA level is 50 ng/mL. Spine radiograph shows an osteoblastic metastasis at L4.

Which of the following is the most appropriate treatment?

A: Abiraterone

B: Androgen deprivation therapy plus abiraterone and prednisone

C: Chemotherapy

D: 5α-Reductase inhibitor therapy

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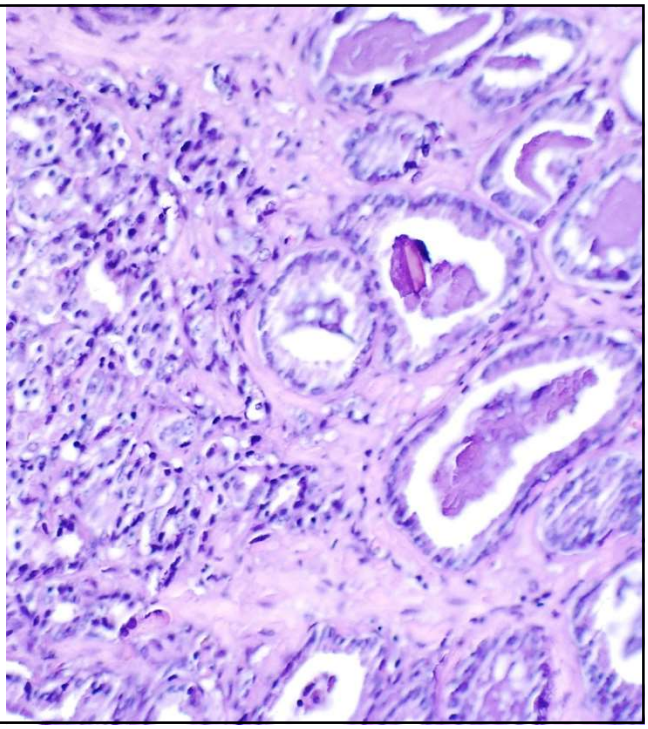
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Prostate Cancer

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Prostate Cancer: Signs and Symptoms

- Usually asymptomatic
- Lower urinary tract symptoms (LUTS)
- Bone or back pain indicative of metastases



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Prostate Cancer: Testing

Digital rectal exam

- May reveal firmness/nodularity

MRI to assess for cancer (PI-RADS score) and direct biopsies

Transrectal/transperineal ultrasound-guided biopsy

- Perform if persistently elevated/rapidly rising PSA level or abnormal digital rectal exam or suspicious MRI

PSMA PET for staging after diagnosis

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Prostate Cancer: Treatment of Localized Disease

Low-risk disease (early stage, PSA <10, Gleason 3+3)

- Active surveillance
- Watchful waiting (life expectancy <10 years)
- Radiation therapy

Intermediate-risk disease

- Androgen deprivation therapy (increased benefit in unfavorable disease)
- Surgery or radiation (life expectancy >10 years)

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Prostate Cancer: Treatment of Localized Disease

High-risk disease (combination therapy)

- Radiation therapy or surgery
- ADT (GnRH agonist or antagonist)
  - GnRH agonist: leuprolide, goserelin, triptorelin, histrelin
  - GnRH antagonist: degarelix, relugolix (oral)
  - Abiraterone and prednisone can be considered in very high-risk disease

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Prostate Cancer: Treatment of Metastatic Disease

- ADT + abiraterone and prednisone
- ADT and androgen receptor pathway inhibitor (enzalutamide, apalutamide, darolutamide)
- ADT + docetaxel + abiraterone or darolutamide (high-volume disease)
- Subsequent treatments: cabazitaxel, lutetium Lu 177, PARP inhibitors

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Prostate Cancer: Bone Preservation Therapy

Supplemental calcium + vitamin D if using ADT

Bisphosphonates or denosumab

- Reverse/prevent ADT-related osteopenia
- ↓ Skeletal events in castrate-resistant bone disease

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Oncology Q6

A 32-year-old woman tests positive for HPV genotype 16 on high-risk HPV testing. She is asymptomatic.

Results of a Pap smear 3 years ago were normal, as were results of all previous Pap testing.

Pelvic exam findings are normal.

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Oncology Q6

A 32-year-old woman tests positive for HPV genotype 16 on high-risk HPV testing. She is asymptomatic. Results of a Pap smear 3 years ago were normal, as were results of all previous Pap testing. Pelvic exam findings are normal.

Which of the following is the most appropriate management?

A: Colposcopy now

B: Pap testing now

C: Pap and HPV co-testing in 1 year

D: Repeat high-risk HPV testing in 1 year

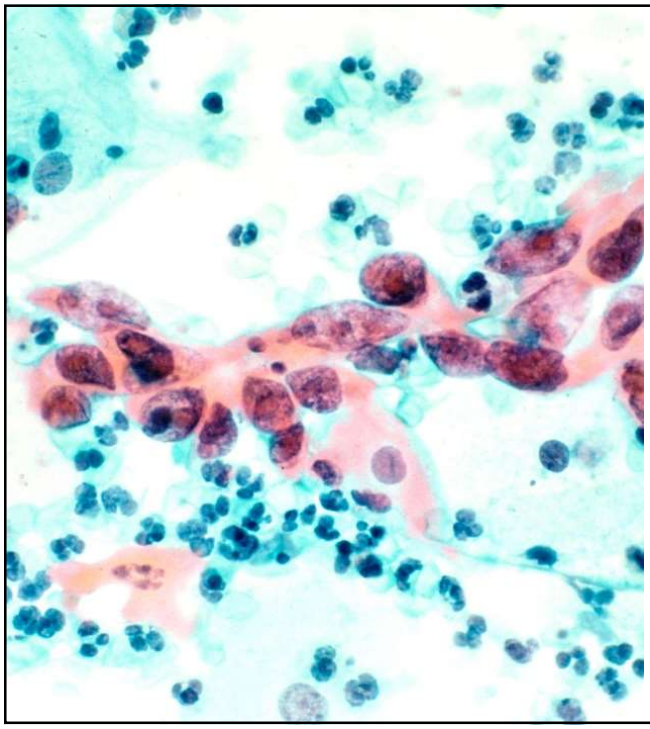
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Cervical Cancer



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Cervical Cancer: Signs and Symptoms

Persistent HPV infection

- Highest-risk genotypes: 16, 18

Asymptomatic

Vaginal bleeding

Postcoital bleeding

Vaginal discharge

Ulcer, induration, tumor mass

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Cervical Cancer: Testing

Biopsy visible lesion

Abnormal screening cytology

- ASCUS at age 21-29 years → repeat PAP in 1 year
- ASCUS at age ≥30 years → reflex HPV testing
  - If high-risk genotype → colposcopy
- Higher-grade cytology → colposcopy

Abnormal screening HPV test

- Genotype 16, 18 → colposcopy
- Other genotypes → 1-year surveillance Pap + HPV



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Vulvar Cancer

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Vulvar Cancer: Diagnosis

HPV-associated

- Multifocal lesions
- Often associated with concurrent cervical neoplasia

Lesions

- Ulcer, plaque, nodular or wart-like mass
- Most located in labia majora
- Asymptomatic or itching, pain, bleeding

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Oncology I

- Answers to Multiple-Choice Questions

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Oncology Q1

A 64-year-old man has a left apical lung mass. He has a 35-pack-year smoking history. Physical exam reveals multiple firm, nonmobile lymph nodes in the left supraclavicular space. Chest CT scan shows left upper lobe opacity and bilateral hilar lymphadenopathy.

Which of the following is the most appropriate next diagnostic test?

A: Bronchoscopy with needle aspiration of mediastinal lymph nodes

B: Bronchoscopy with transbronchial biopsy of the left apical mass

C: Core biopsy of the left supraclavicular lymph nodes

D: CT-guided percutaneous biopsy of the left apical mass

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Oncology Q2

A 42-year-old woman undergoes partial mastectomy and postoperative radiation therapy for intermediate-grade DCIS that was ER positive and PR positive. She is premenopausal.

Which of the following is the most appropriate additional therapy?

A: Anastrozole

B: Chemotherapy

C: Raloxifene

D: Tamoxifen

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Oncology Q3

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C: Chemotherapy

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Oncology II

2025 Virtual / Live Internal Medicine Board Review

Rashmi Chugh, MD
Professor, Hematology and Oncology
Associate Division Chief of Clinical Services
University of Michigan
Ann Arbor, MI

ACP Internal Medicine Board Review Course

Oncology II

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- Non-Hodgkin lymphomas
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- Inherited cancer risk
- Spinal cord tumors and compression
- Fever and neutropenia
- Malignancy-induced hypercalcemia
- Lymphedema
- Nausea and vomiting

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Renal Cancer

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Renal Cancer: Diagnosis

- Classic triad (uncommon)
  1. Hematuria
  2. Flank pain
  3. Mass
- Also hypercalcemia, polycythemia, FUO
- Most commonly now detected as incidental finding on body imaging
- Clear cell carcinoma is most common histology

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Renal Cancer: Treatment

Observation alone for small renal masses in older adults

Cryoablation for small lesion and poor surgical candidates

Resect with partial nephrectomy (nephron-sparing surgery) when possible

Metastatic disease

- Limited benefit of nephrectomy
- Commonly immunotherapy and targeted therapy (TKIs)

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Urothelial Cancer (Bladder Cancer)

ACP

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Urothelial Cancer: Diagnosis

Includes bladder cancer but also renal pelvis, ureteral, and urethral cancers

Evaluation

- Cystoscopy
- Ureteroscopy
- Urine cytology
- FISH
- Imaging: CT urography, MRI, or PET

Majority are transitional cell

- Less common: squamous cell, adenocarcinoma, other variants

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Urothelial Cancer: Treatment

Superficial bladder cancer

- Transurethral resection + BCG or other intravesical therapies

Muscle-invasive bladder cancer

- Neoadjuvant chemotherapy + immunotherapy, followed by cystectomy or radiation + immunotherapy

Metastatic disease

- Chemotherapy, immunotherapy, targeted therapies

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Oncology Q7

A 70-year-old asymptomatic woman is evaluated during a routine visit.

Physical exam is normal.

Hemoglobin level is 12.5 g/dL.

Leukocyte count is 15,000/µL, with 30% neutrophils and 70% lymphocytes.

Platelet count is 190,000/µL.

Peripheral blood smear shows numerous small lymphoid cells.

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Oncology Q7

A 70-year-old asymptomatic woman is evaluated during a routine visit. Physical exam is normal. Hemoglobin level is 12.5 g/dL. Leukocyte count is 15,000/µL, with 30% neutrophils and 70% lymphocytes. Platelet count is 190,000/µL. Peripheral blood smear shows numerous small lymphoid cells.

Which of the following is the most appropriate next step in evaluation?

A: Bone marrow biopsy and aspirate

B: CT of the chest, abdomen, and pelvis

C: Flow cytometry

D: PET

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Non-Hodgkin Lymphomas (NHLs)

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Non-Hodgkin Lymphomas

Lymphadenopathy is most common sign

- Extranodal presentation can occur (15%)

Lymph node biopsy establishes diagnosis

- Excisional biopsy (preferred) or core needle biopsy

Flow cytometry

- B-cell or T-cell markers
- Monoclonality

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Indolent NHL

Most common indolent NHLs

- Follicular lymphoma
- Marginal zone lymphoma (e.g., mucosa-associated lymphoid tissue [MALT] lymphoma)
- Hairy cell leukemia
- Chronic lymphocytic leukemia/small lymphocytic lymphoma

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Follicular Lymphoma: Diagnosis

- Lymphadenopathy on presentation
- B-cell [t(14:18)] origin
- Disseminated at diagnosis (80%-90%)
- Indolent, asymptomatic
  - No treatment if non-bulky, asymptomatic
- Responds to therapy but relapses
- Can transform

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MALT Lymphomas: Diagnosis

Presents in extranodal sites

- Stomach, lung, thyroid, salivary glands, breast, conjunctiva
- May be cured with low-dose radiation therapy if localized

Gastric MALT lymphoma

- Associated with *Helicobacter pylori* infection
- May regress with antibiotic/PPI therapy

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Hairy Cell Leukemia: Diagnosis

Lymphoid leukemic cells

- Hairy-like cytoplasmic projections

Progressive cytopenias and splenomegaly with adenopathy

Flow cytometry

- Monoclonal B cells expressing CD103, CD11c, CD25;
- *BRAF* variant

Highly responsive to treatment

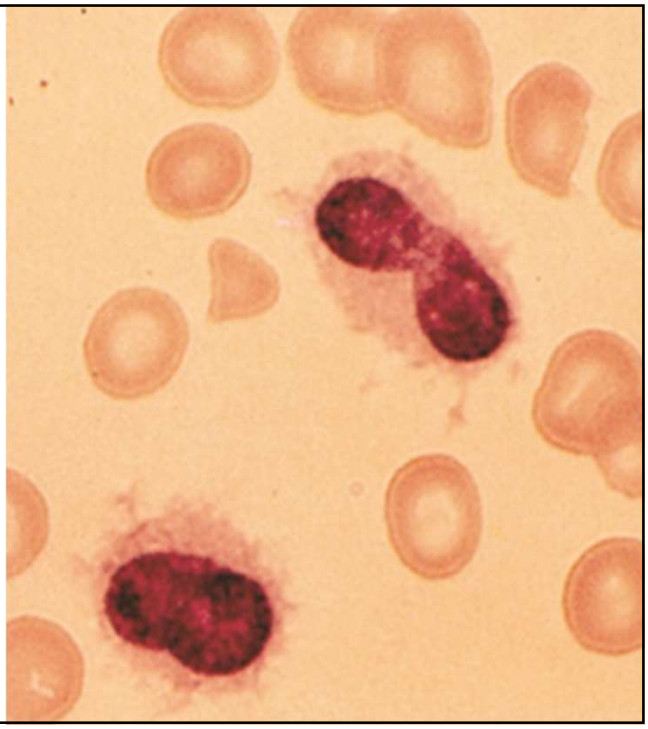


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Chronic Lymphocytic Leukemia (CLL)/Small Cell Lymphoma

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CLL: Diagnosis, Presentation, Staging

CLL and small lymphocytic leukemia are same disorder

- Name depends on primary manifestation

Commonly asymptomatic

B symptoms (fever, night sweats, weight loss)

Cytopenias

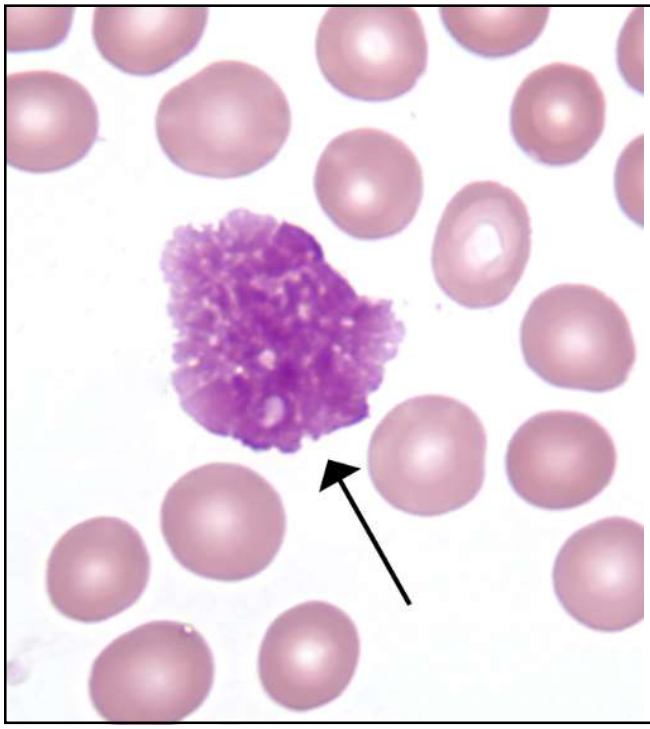
Splenomegaly, lymphadenopathy

Staging: Binet system and Rai system

Prognosis: related to IGHV and chromosomal (FISH) testing

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CLL: Testing and Treatment

Lymphocytosis

- Mature small lymphocytes
- "Smudge" cells

Flow cytometry

- CD5 (typically), CD19, CD20, CD23

Hypogammaglobulinemia

Bone marrow aspirate/biopsy

- Not necessary

Treat only symptomatic patients

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CLL: Complications

Cytopenias from marrow infiltration

Increased infections

Autoimmune hemolytic anemia and autoimmune thrombocytopenia

Transformed CLL (Richter transformation)

- Relapse with B symptoms
- Aggressive large cell lymphoma is most common
- Massive lymphadenopathy/hepatosplenomegaly
- Poor prognosis

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Aggressive NHL

Rapidly progressive disease with B symptoms

Requires immediate therapy; often curable

Most common aggressive NHLs

- Diffuse large B-cell lymphoma
- Burkitt lymphoma
- Lymphoblastic lymphoma
- Mantle cell lymphoma

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Diffuse Large B-Cell Lymphoma: Diagnosis

- Most common aggressive lymphoma overall
- Bulky lymphadenopathy and B symptoms
- Advanced disease common at diagnosis
- Commonly treated with multiagent chemotherapy and rituximab

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Burkitt and Lymphoblastic Lymphoma: Diagnosis

Most aggressive forms of lymphoma

Acute onset

Life-threatening metabolic and structural abnormalities

Significant risk for tumor lysis syndrome

- AKI, ↑ uric acid level, ↑ phosphate and potassium levels

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Mantle Lymphoma: Diagnosis

- Typically diagnosed at advanced stage
- Diffuse lymphadenopathy and B symptoms
- GI tract, bone marrow, and peripheral blood involvement
- Responds to treatment but high rate of relapse

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Cutaneous T-Cell Lymphoma

Skin infiltration (mycosis fungoides)

- Pruritic erythema, raised plaques, erythroderma

Circulating T-cells (Sézary syndrome)

- Cerebriform-appearing nuclei

Progresses to organ infiltration and immunodeficiency



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Oncology Q8

A 32-year-old man asks about his risk for colon cancer, which was diagnosed in his 55-year-old mother.

Colon cancer was diagnosed in his maternal grandmother at age 64 years and his maternal uncle at age 46 years.

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Oncology Q8

A 32-year-old man asks about his risk for colon cancer, which was diagnosed in his 55-year-old mother. Colon cancer was diagnosed in his maternal grandmother at age 64 years and his maternal uncle at age 46 years.

Which of the following is the most appropriate management?

A: Colonoscopy at age 36 years

B: FIT at age 35 years

C: Genetic counseling

D: Stool DNA testing now

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Inherited Cancer Risk

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Inherited Cancer Risk: Lynch Syndrome

Autosomal dominant

- Germline variations in DNA MMR genes
- Epithelial cell adhesion molecule (*EPCAM*) gene

Colorectal and endometrial cancer are most common

Other cancers

- GI, biliary, ovarian, bladder, sebaceous, brain

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Inherited Cancer Risk: Lynch Syndrome/HNPCC

"3-2-1-1-0" rule (specific but not sensitive)

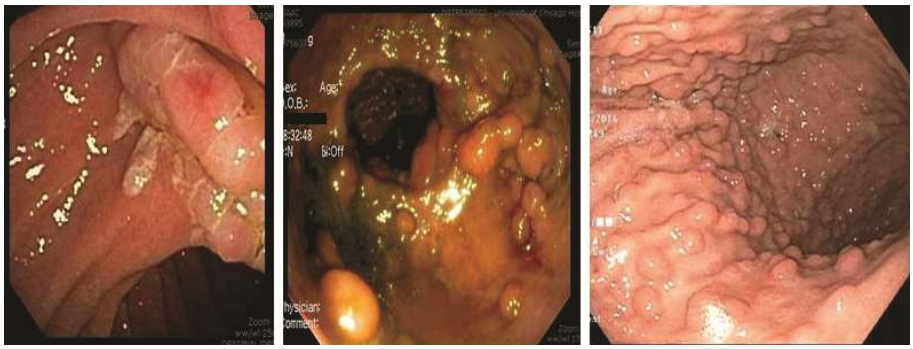
- 3 family members with Lynch-related cancers
- 2 generations
- 1 family member a first-degree relative of the other two
- ≥1 member affected at age <50 years
- 0 familial polyposis

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Inherited Cancer Risk: Familial Adenomatous Polyposis

- >100 colon adenomatous polyps
- Autosomal dominant; germline variations in *APC* gene
- Colon cancer occurs in 100% of patients without colectomy



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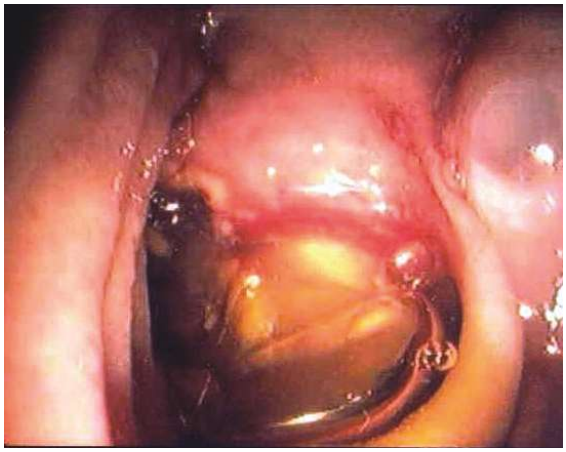
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Inherited Cancer Risk: Familial Adenomatous Polyposis

Extracolonic manifestations

- Duodenal adenomas/adenocarcinoma
- Gastric polyps
- Desmoid tumor(s)
- Papillary thyroid cancer
- Hepatoblastoma
- Brain tumors



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Inherited Cancer Risk: *BRCA1/2* Variants

- Autosomal dominant
- Lifetime breast cancer risk → 85%
- Lifetime ovarian cancer risk → 40%
- Lifetime male breast cancer risk → 8%

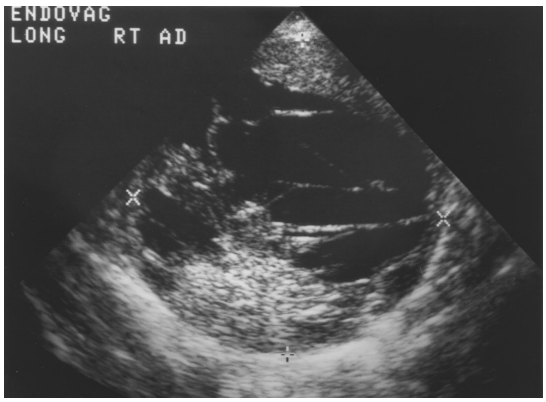
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Inherited Cancer Risk: *BRCA1/2* Variants

Consider if

- Multiple family members with breast cancer
- Both breast and ovarian cancer
- Breast cancer at age <50 years
- Breast cancer in a male family member
- Bilateral breast cancer
- Ashkenazi Jewish heritage
- Triple negative breast cancer irrespective of age and family history

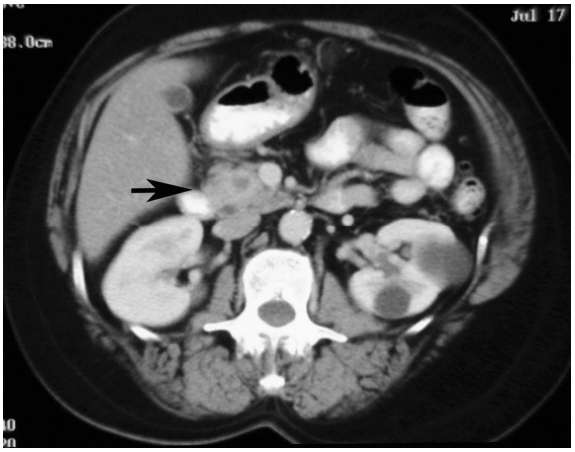


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Inherited Cancer Risk: *BRCA1/2* Variants



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Other associated cancers

- Pancreas
- Prostate
- Fallopian tube
- Endometrial
- Peritoneal (primary)
- Uterine

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Inherited Cancer Risk: Genetic Counseling and Testing

Obtain three-generation family history

Confirm tumor genetic variation in family member

All at-risk patients should receive genetic counseling

Direct-to-consumer testing

- No relevance for clinical decisions
- No counseling provided

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Spinal Cord Tumors and Compression

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Spinal Cord Tumors and Compression

Thoracic spine most commonly affected (80%)

Lumbar spine (20%)

Cervical spine (<10%)

Cancers that routinely cause spinal metastases

- Lung
- Breast
- Prostate
- Multiple myeloma
- Renal cell carcinoma
- Non-Hodgkin lymphoma

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Spinal Cord Tumors and Compression: Diagnosis

Symptoms are related to level of cord/nerve roots affected

- Pain: classically severe at night
- Weakness
- Sensory deficits
- Bowel and bladder pattern change
- Cauda equina syndrome
  - Involvement of multiple lumbosacral nerve roots
  - Bladder/bowel symptoms very common

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Spinal Cord Tumors and Compression: Diagnosis

Biopsy and confirming the primary tumor if clinically stable

MRI of the entire spine with/without contrast (preferred)

- If MRI is contraindicated, CT myelography is indicated (injection of contrast into spinal CSF)

Clinical and radiologic severity grade assessment

- Spinal Instability Neoplastic Score (SINS)
  - Based on extent of cord compression (high grade vs. low grade)

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Spinal Cord Tumors and Compression: Treatment

Neurosurgery and radiation therapy (RT) evaluation

Glucocorticoids: dexamethasone

High-grade spinal instability

- Surgical decompression and stabilization ± RT

Low grade without instability

- RT and treatment of primary tumor

Treatment modality also depends on previous RT treatments and sensitivity of primary tumor to RT

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Oncology Q9

A 37-year-old woman reports fever after chemotherapy for AML. She has no localizing findings.

Temperature is 101.8 °F, and pulse rate is 100/min; other vital signs are normal.

Leukocyte count is 0.3/µL, with 0 neutrophils.

Chest radiograph is normal.

Blood and urine cultures are pending.

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Oncology Q9

A 37-year-old woman reports fever after chemotherapy for AML. She has no localizing findings. Temperature is 101.8 °F, and pulse rate is 100/min; other vital signs are normal. Leukocyte count is 0.3/µL, with 0 neutrophils. Chest radiograph is normal. Blood and urine cultures are pending.

Which of the following is the most appropriate next step in management?

A: Administer granulocyte-macrophage colony-stimulating factor

B: Await culture results before starting antimicrobial therapy

C: Begin levofloxacin

D: Begin piperacillin-tazobactam

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Fever and Neutropenia

ACP

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Febrile Neutropenia: Diagnosis

Fever (either)

- Single episode ≥101.0 °F
- Sustained ≥100.4 °F for >1 hour

Localizing sites of infection

- Oropharynx
- Perineum
- Vascular catheter sites
- Skin
- GI tract
- Lungs
- Sinuses



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Febrile Neutropenia: Testing

ANC (either)

- <500/µL
- <1000/µL with expected nadir <500/µL

Blood cultures

Other cultures as indicated

- Urine, CSF, lower respiratory tract

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Febrile Neutropenia: Testing

Imaging of chest/other sites as indicated

± Fungal biomarker in high-risk patients

- Galactomannan antigen, β-D-glucan assay

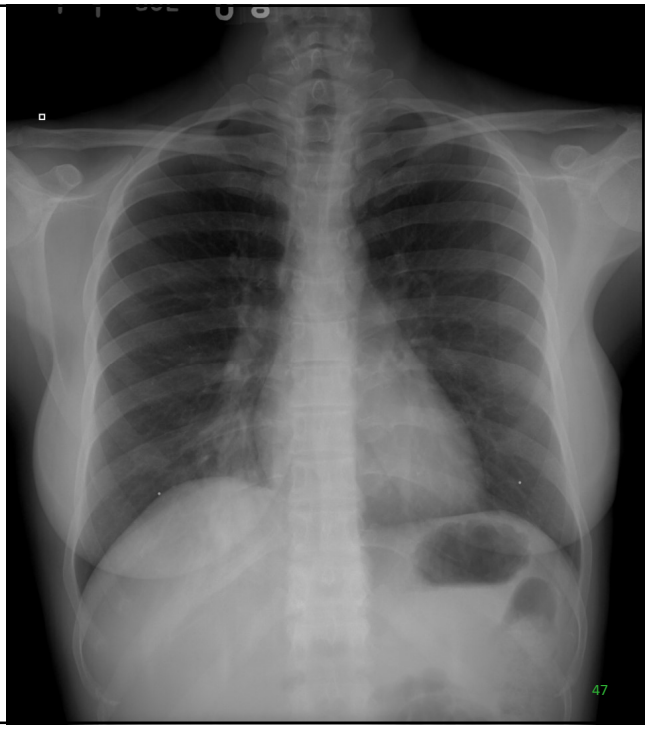


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Febrile Neutropenia: Risk Assessment

High risk

- Neutropenia ≥7 days
- ANC ≤100/µL or significant comorbidities
- ↓ BP, pneumonia, abdominal pain, neurologic changes

Low risk

- Anticipated neutropenia <7 days
- No or few comorbidities

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High-Risk Febrile Neutropenia: Treatment

Hospitalize for empiric IV antibiotics (any of the following)

- Antipseudomonal β-lactam (e.g., cefepime, piperacillin-tazobactam)
- Carbapenem (e.g., imipenem-cilastatin, meropenem)

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High-Risk Febrile Neutropenia: Treatment

Add vancomycin

- Hemodynamic instability/severe sepsis
- Skin/soft tissue infection
- Pneumonia
- Gram-positive bacteremia
- CLABSI
- MRSA colonization

Add antifungal

- Febrile neutropenia × 5 days

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Low-Risk Febrile Neutropenia: Treatment

Oral ciprofloxacin + amoxicillin-clavulanate

- Except patients already taking a fluoroquinolone

Transition home if stable for 4-24 hours

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Malignancy-Induced Hypercalcemia

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Malignancy-Induced Hypercalcemia: Diagnosis and Testing



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- Nausea/vomiting, constipation
- Polyuria/polydipsia
- Weakness, confusion
- Hypercalcemia

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Malignancy-Induced Hypercalcemia: Pathogenesis

PTHrP related in solid tumors

- Squamous cell lung cancer, bladder cancer, renal cell carcinoma

Osteolytic metastases

- Breast cancer, multiple myeloma most common

Excess 1,25-dihydroxyvitamin D production by inflammatory/tumor cells

- Common in lymphomas

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Malignancy-Induced Hypercalcemia: Treatment

Severity	Total Corrected Calcium	Treatment
Mild	<12 mg/dL	Hydration, stop supplements, and treat primary malignancy
Moderate	12-14mg/dL	Hydration +/- bisphosphonates, denosumab; glucocorticoid in lymphoma
Severe	>14 mg/dL	Aggressive volume repletion with 0.9% saline • Urine output goal of 100-150 mL/h Furosemide only for volume overload, CKD IV pamidronate or zoledronic acid (↓ calcium level in 48-72 h) IM or subcutaneous calcitonin (second line) • ↓ Calcium level in 12-48 h Denosumab: bisphosphonate-resistant hypercalcemia, presence of kidney failure Glucocorticoids (myeloma and lymphoma)

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Oncology Q10

A 50-year-old woman reports a 2-month history of progressive swelling of the entire right upper extremity.

She underwent surgery and irradiation for localized right-sided breast cancer 6 months ago.

Physical exam shows only nonpitting edema of the right arm.

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Oncology Q10

A 50-year-old woman reports a 2-month history of progressive swelling of the entire right upper extremity. She underwent surgery and irradiation for localized right-sided breast cancer 6 months ago. Physical exam shows only nonpitting edema of the right arm.

Which of the following is the most appropriate next step in management?

A: Antibiotics

B: Compression therapy and physical therapy

C: Duplex venous ultrasonography

D: Furosemide

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Lymphedema

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Lymphedema: Diagnosis and Testing

Risk factors in breast cancer patients

- Complete axillary lymph node dissection
- Axillary radiation therapy
- Tumor infiltration
- High BMI

Insidious onset of asymmetric nonpitting edema

Discomfort, impaired ROM, skin thickening

Imaging if diagnosis unclear

- Ultrasonography, lymphoscintigraphy, MRI, CT

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Lymphedema: Treatment

Early physical therapy

Compression

- Sleeves, bandages, pneumatic compression

Skin and nail care to prevent infections

Avoid venipunctures and IV on affected side when possible

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Oncology Q11

A 50-year-old woman is scheduled for a second cycle of adjuvant chemotherapy for breast cancer.

Before her first chemotherapy cycle, she received dexamethasone, aprepitant, and palonosetron but was hospitalized 4 days later because of uncontrolled nausea and vomiting.

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Oncology Q11

A 50-year-old woman is scheduled for a second cycle of adjuvant chemotherapy for breast cancer. Before her first chemotherapy cycle, she received dexamethasone, aprepitant, and palonosetron but was hospitalized 4 days later because of uncontrolled nausea and vomiting.

Which of the following is the most appropriate additional measure for nausea and vomiting?

A: Add dronabinol

B: Add lorazepam

C: Add olanzapine

D: Switch palonosetron to IV ondansetron

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Nausea and Vomiting

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Chemotherapy-Induced Nausea and Vomiting: Diagnosis

Acute emesis

- Hours after chemotherapy

Delayed emesis

- >24 hours after chemotherapy

Anticipatory emesis

- Beings before chemotherapy
- Related to previous poor control of symptoms

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Acute Emesis: Prophylaxis and Treatment

Prophylaxis based on emetogenic risk of chemotherapy, which varies greatly

Available regimens highly effective against acute emesis

Single agent or combination

- Serotonin antagonists (e.g., palonosetron, ondansetron)
- Glucocorticoids (e.g., dexamethasone)
- Neurokinin-1-receptor antagonists (e.g., aprepitant)
- Olanzapine

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Delayed Emesis: Prophylaxis and Treatment

Prophylaxis for highly emetogenic chemotherapy

- Before, during, and 2-5 days after chemotherapy
- Less well controlled with available regimens than acute emesis
- Serotonin antagonist (palonosetron)
- Glucocorticoids
- Neurokinin-1 receptor antagonist (e.g., aprepitant)
- Olanzapine

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Breakthrough Emesis: Treatment

Add drug class not included in initial prophylaxis

- Olanzapine
- Benzodiazepine
  - Alprazolam, lorazepam
- Dopamine antagonist
  - Metoclopramide, prochlorperazine, haloperidol
- Consider cannabinoid (dronabinol)

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Anticipatory Emesis: Treatment

- Optimal primary prophylaxis
- Benzodiazepines
- Behavioral therapy

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Oncology II

- Answers to Multiple-Choice Questions

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Oncology Q7

A 70-year-old asymptomatic woman is evaluated during a routine visit. Physical exam is normal. Hemoglobin level is 12.5 g/dL. Leukocyte count is 15,000/µL, with 30% neutrophils and 70% lymphocytes. Platelet count is 190,000/µL. Peripheral blood smear shows numerous small lymphoid cells.

Which of the following is the most appropriate next step in evaluation?

A: Bone marrow biopsy and aspirate

B: CT of the chest, abdomen, and pelvis

C: Flow cytometry

D: PET

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Oncology Q8

A 32-year-old man asks about his risk for colon cancer, which was diagnosed in his 55-year-old mother. Colon cancer was diagnosed in his maternal grandmother at age 64 years and his maternal uncle at age 46 years.

Which of the following is the most appropriate management?

A: Colonoscopy at age 36 years

B: FIT at age 35 years

C: Genetic counseling

D: Stool DNA testing now

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Oncology Q9

A 37-year-old woman reports fever after chemotherapy for AML. She has no localizing findings. Temperature is 101.8 °F, and pulse rate is 100/min; other vital signs are normal. Leukocyte count is 0.3/µL, with 0 neutrophils. Chest radiograph is normal. Blood and urine cultures are pending.

Which of the following is the most appropriate next step in management?

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A 50-year-old woman reports a 2-month history of progressive swelling of the entire right upper extremity. She underwent surgery and irradiation for localized right-sided breast cancer 6 months ago. Physical exam shows only nonpitting edema of the right arm.

Which of the following is the most appropriate next step in management?

A: Antibiotics

B: Compression therapy and physical therapy

C: Duplex venous ultrasonography

D: Furosemide

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Oncology Q11

A 50-year-old woman is scheduled for a second cycle of adjuvant chemotherapy for breast cancer. Before her first chemotherapy cycle, she received dexamethasone, aprepitant, and palonosetron but was hospitalized 4 days later because of uncontrolled nausea and vomiting.

Which of the following is the most appropriate additional measure for nausea and vomiting?

A: Add dronabinol

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Nephrology I – Hypertension and Nephrolithiasis

2025 Virtual/Live Internal Medicine Board Review

Laura Mariani, MD, MSCE
Associate Professor, Nephrology
University of Michigan
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ACP Internal Medicine Board Review Course

Nephrology I: Hypertension and Nephrolithiasis

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- Hypertension
- Hypertensive urgency and emergency
- Renovascular and renal parenchymal hypertension
- Hematuria
- Nephrolithiasis

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Hypertension and Nephrolithiasis Q1

A 55-year-old woman is evaluated for elevated BP noted at previous visits.

She is asymptomatic.

In the office, BP is 152/88 mm Hg, and pulse rate is 88/min.

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Hypertension and Nephrolithiasis Q1

A 55-year-old woman is evaluated for elevated BP noted at previous visits. She is asymptomatic. In the office, BP is 152/88 mm Hg, and pulse rate is 88/min.

Which of the following is the most appropriate management?

A: Chlorthalidone

B: PAC/PRA ratio

C: 24-Hour ambulatory BP monitoring

D: 24-Hour urine metanephrines testing

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Hypertension

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Hypertension: Screening

USPSTF Screening Recommendations	
Aged 18-39 years	Every 3 to 5 years
Aged ≥40 years	Annually
CVD risk factors or increased risk	Annually



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Hypertension: Diagnosis

Asymptomatic

End-organ damage

- Retinopathy
  - Vasoconstriction/arteriolar narrowing
  - Optic neuropathy
- Aortic aneurysm/PAD
  - Endothelial damage



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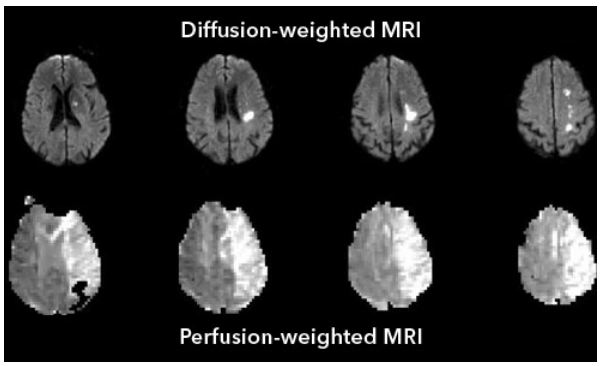
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Hypertension: Diagnosis

End-organ damage (*cont.*)

- TIA/stroke (ischemic or hemorrhagic)
  - Distal cerebral ischemia
- Heart disease
  - Left ventricular hypertrophy
  - Heart failure
  - Acute MI
- Chronic kidney disease
  - Hypertensive nephrosclerosis



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Hypertension: Diagnosis

ACC/AHA Definitions	
Normal	<120/<80 mm Hg
Elevated	120-129/<80 mm Hg
Stage 1	130-139/80-89 mm Hg
Stage 2	≥140/≥90 mm Hg

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Hypertension: Diagnosis

Blood pressure measurement

- AHA-recommended office approach
  - Automated office BP oscillometric device
  - Average ≥3 BP measurements, unattended
- Ambulatory BP measurements before treatment
  - Ambulatory BP monitoring (preferred)
  - Home BP determinations

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Hypertension: Diagnosis

Dipping on ambulatory BP monitoring

- 10% to 20% ↓ in nighttime BP compared with daytime BP
- No "dipping"
  - LVH and ↑ CVD risk and mortality

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White Coat Hypertension

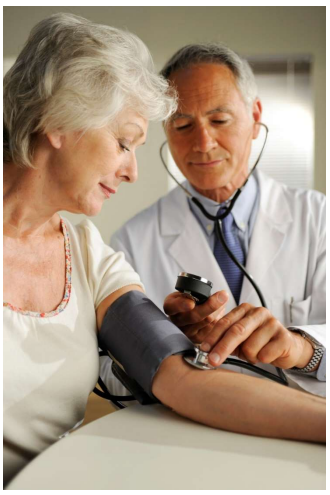


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Normal ambulatory BP but ↑ office BP

Screen for white coat hypertension if either:

- SBP >130 mm Hg to <160 mm Hg
- DBP >80 mm Hg to <100 mm Hg

Screening strategies

- Ambulatory BP monitoring (preferred)
- Home BP monitoring

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Masked Hypertension

Normal office BP but ↑ home BP

Screen for masked hypertension if both:

- Office BP at goal
- New target organ damage or increased overall CVD risk

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Secondary Hypertension: Screening

Condition	Screening Criteria	Preferred Test
Primary aldosteronism	Any of the following: Resistant or severe hypertension Hypokalemia* Incidentally discovered adrenal mass Early-onset hypertension CVA at age <40 years	PAC/PRA ratio
Obstructive sleep apnea	Daytime sleepiness	Polysomnography or home sleep study

*With or without diuretic use.

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Secondary Hypertension: Screening

Condition	Screening Criteria	Preferred Test
Pheochromocytoma	Episodic hypertension, palpitations, diaphoresis, headache	Plasma fractionated metanephrines 24-Hour urine metanephrines and catecholamines
Fibromuscular dysplasia	Young woman, difficult-to-control hypertension	CT angiography

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Secondary Hypertension: Screening

Condition	Screening Criteria	Preferred Test
Thyroid disease	Symptoms of hypo- or hyperthyroidism	TSH; free thyroxine (T_4)
Primary hyperparathyroidism	Elevated serum calcium level Kidney stones, osteoporosis	Intact PTH; serum calcium and phosphorus
Cushing syndrome	Proximal muscle weakness, facial plethora, supraclavicular or dorsocervical fat pads, central obesity	Dexamethasone suppression test; 24-hour urine cortisol excretion; salivary cortisol

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Secondary Hypertension: Screening

Condition	Screening Criteria	Preferred Test
Aortic coarctation	Upper extremity hypertension and low BP in the lower extremities, radio-femoral delay	BP measurements in arms and legs; CT or MR angiography; TTE
Drug induced (e.g., NSAIDs, OCPs, stimulants, calcineurin inhibitors, chemotherapeutic agents, anabolic steroids)	New hypertension related to exposure of a drug	Clinical history

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Hypertension: Nonpharmacologic Treatment

- Weight loss if patient has obesity or overweight
- Heart-healthy diet (e.g., DASH)
- Tobacco cessation
- ↓ Dietary sodium (<2,300 mg) and ↑ dietary potassium
- ↑ Physical activity
- Reduce or eliminate alcohol: men, ≤2 drinks/day; women, ≤1 drink/day

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Hypertension: ACC/AHA Pharmacologic Treatment Thresholds

Primary ASCVD prevention

- 10-year ASCVD risk ≥10% and either:
  - SBP ≥130 mm Hg
  - DBP ≥80 mm Hg
- 10-year ASCVD risk <10% and either:
  - SBP ≥140 mm Hg
  - DBP ≥90 mm Hg

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Hypertension: ACC/AHA Pharmacologic Treatment Thresholds

Secondary prevention of ASCVD when either:

- SBP ≥130 mm Hg
- DBP ≥80 mm Hg

Target BP <130/80 mm Hg

Monthly evaluation/titration until control is achieved

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Hypertension: Target BP for Community-Dwelling Older Adults

ACC/AHA recommendation for adults aged ≥65 years

- <130 mm Hg
- Higher target if many comorbidities or limited life expectancy

2017 ACP/AAFP recommendations for adults aged >60 years

- <150 mm Hg
- <140 mm Hg following CVA or TIA
- <140 mm Hg with high cardiovascular risk

2022 AAFP recommendations for adults aged >60 years

- <140/90 mm Hg

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Hypertension and Nephrolithiasis Q2

A 48-year-old woman is evaluated for persistent hypertension despite lifestyle modifications.

Home BP recordings average 158/92 mm Hg.

Kidney function is normal.

Urinalysis is unremarkable.

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Hypertension and Nephrolithiasis Q2

A 48-year-old woman is evaluated for persistent hypertension despite lifestyle modifications. Home BP recordings average 158/92 mm Hg. Kidney function is normal. Urinalysis is unremarkable.

Which of the following is the most appropriate treatment?

A: Amlodipine

B: Amlodipine and lisinopril

C: Lisinopril

D: Losartan

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Hypertension: Initial Pharmacologic Therapy

Condition	Treatment
Stage 1 hypertension	Thiazide diuretics, CCBs, ACE inhibitors, or ARBs
Stage 2 hypertension or >20/10 mm Hg above target BP	Two first-line agents of different classes
Hypertension in pregnancy or women planning pregnancy	Labetalol, methyldopa, nifedipine Contraindicated: ACE inhibitors, ARBs, direct renin inhibitors
Stage G3 or higher CKD or CKD with albuminuria	ACE inhibitor or ARB

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Hypertension and Nephrolithiasis Q3

A 72-year-old woman is evaluated in the ED for chest pain that radiates to her back.

BP is 198/120 mm Hg; pulse rate is 90/min.

Chest CT scan shows aortic dissection extending from the subclavian artery into the left renal artery.

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Hypertension and Nephrolithiasis Q3

A 72-year-old woman is evaluated in the ED for chest pain that radiates to her back. BP is 198/120 mm Hg; pulse rate is 90/min. Chest CT scan shows aortic dissection extending from the subclavian artery into the left renal artery.

Which of the following is the most appropriate initial IV treatment?

A: Esmolol

B: Fenoldopam

C: Hydralazine

D: Nitroglycerin

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Hypertensive Urgency and Emergency

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Hypertensive Emergency: Diagnosis

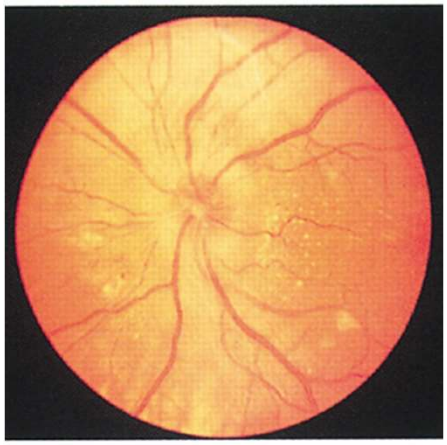
Elevated BP and end-organ damage

No specific BP measurement

- Symptoms often occur at BP >180/120 mm Hg

Most common end-organ damage

- CNS
  - Ischemic or hemorrhagic stroke, encephalopathy
- Cardiovascular
  - Acute MI, aortic dissection, acute heart failure
- AKI

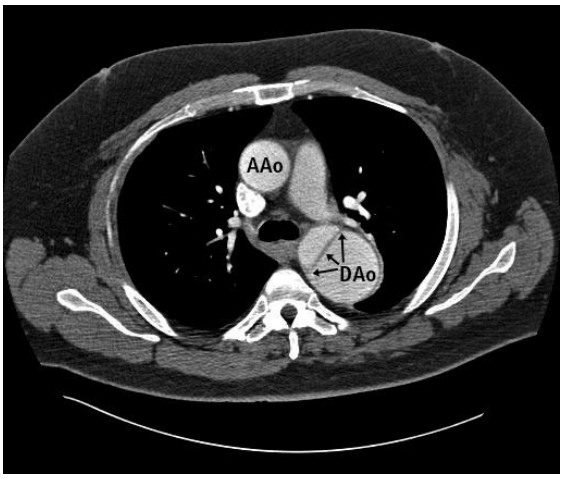


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Hypertensive Emergency: Treatment



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ICU admission

Compelling indications to ↓ BP quickly

- Aortic dissection
- Pheochromocytoma crisis
- Severe preeclampsia or eclampsia

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Hypertensive Emergency: Treatment

Aortic dissection	• ↓ SBP to <120 mm Hg during first hour
Severe preeclampsia, eclampsia, pheochromocytoma crisis	• ↓ SBP to <140 mm Hg during first hour
No compelling indication	• ↓ SBP by 10%-20% within first hour (maximum of 25%) • ↓ SBP additional 5%-15% over 23 hours • Normal BP within next 24-48 hours

Management of neurologic emergencies will vary based on the cause and may not include BP lowering.

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Hypertensive Emergency: Treatment

- Short-acting titratable IV bolus or IV infusion
- β-Blockers (labetalol, esmolol)
- CCBs (nicardipine)
- Nitroprusside

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Hypertensive Emergency: Treatment in Patients with Comorbidities

Acute aortic dissection

- Esmolol, labetalol
- Rapid SBP lowering to ≤120 mm Hg
- β-Blockade should precede vasodilator (e.g., nicardipine or nitroprusside) administration

Acute pulmonary edema

- Nitroglycerin, nitroprusside, clevidipine
- β-Blockers contraindicated

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Hypertensive Emergency: Treatment in Patients with Comorbidities

Acute coronary syndromes

- Esmolol, labetalol, nicardipine, nitroglycerin
- Esmolol and nitroglycerin are first-line drugs

Acute kidney injury

- Labetalol, nicardipine, fenoldopam (avoid nitroprusside)

Eclampsia or preeclampsia

- Hydralazine, labetalol, nicardipine
- Contraindicated: ACE inhibitors, ARBs, direct renin inhibitors, and nitroprusside

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Hypertensive Emergency: Treatment in Patients with Comorbidities

Pheochromocytoma crisis

- Nicardipine, phentolamine, clevidipine
- Requires rapid lowering of BP
- β-blocker is added once α-blockade complete

Scleroderma renal crisis

- Enalaprilat
- Treat even if serum creatinine elevated
- CCBs or α-blockers may be added to manage blood pressure

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Hypertensive Urgency

- Most represent medication nonadherence
- BP typically ≥180/110 mm Hg
- No acute end-organ damage
- Reinstitute or intensify outpatient regimen

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Hypertension and Nephrolithiasis Q4

A 27-year-old woman is evaluated for resistant hypertension.

There is a bruit in the right epigastric region.

Kidney function is normal; urinalysis is unremarkable.

Kidney angiogram is shown.

Duplex ultrasound reveals elevated velocities and resistive indices in the mid and distal renal artery.



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Hypertension and Nephrolithiasis Q4

A 27-year-old woman is evaluated for resistant hypertension. There is a bruit in the right epigastric region. Kidney function is normal; urinalysis is unremarkable. Duplex ultrasound reveals elevated velocities and resistive indices in the mid and distal renal artery.

Which of the following is the most appropriate next step in management?

A: ACE inhibitor

B: CCB/ACE inhibitor combination

C: Renal artery angioplasty

D: Surgical revascularization

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Renovascular and Renal Parenchymal Hypertension

ACP

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Renovascular Hypertension: Diagnosis

Flank or epigastric bruits

Resistant hypertension

Atherosclerotic renovascular disease

- Older adults with ASCVD
- Recurrent flash pulmonary edema
- Refractory heart failure
- AKI after ACE inhibitor/ARB
  - Renal artery stenosis
- Asymmetry in kidney sizes
- Unilateral small kidney



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Renovascular Hypertension: Diagnosis

Fibromuscular dysplasia

- Young women
- Renal, carotid, and vertebral artery involvement
- TIA, MI, CVA

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Renovascular Hypertension: Testing

Avoid routine testing for atherosclerotic renovascular disease

Fibromuscular dysplasia

- CT angiography
- Intra-arterial angiography: “string of beads”
- Duplex Doppler ultrasonography

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Renovascular Hypertension: Treatment

Atherosclerotic renovascular disease

- Antihypertensive therapy (include ACE inhibitor or ARB)
  - Avoid ACE inhibitor or ARB with bilateral RAS
- Treat ASCVD risk factors
- Angioplasty is no better than medical therapy in most patients

Fibromuscular dysplasia

- Antihypertensive therapy (include ACE inhibitor or ARB)
- Percutaneous balloon angioplasty and stenting

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Renal Parenchymal Hypertension: Diagnosis and Testing

- Asymptomatic
- Family history of CKD
- Hypertension plus CKD
- Hypertensive end-organ damage
- Elevated serum creatinine level
- Abnormal UA or albuminuria/proteinuria
- Testing for diabetes
- Kidney ultrasound showing small, echogenic kidneys

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Renal Parenchymal Hypertension: Treatment

Goal BP <120 mm Hg (KDIGO); <130/80 mm Hg (ACC/AHA)

ACE inhibitor or ARB

- Albumin-creatinine ratio ≥30 mg/g
- Accept 30% ↑ in creatinine

Sodium restriction to <2000 mg/d

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Renal Parenchymal Hypertension: Treatment

Diuretics

- Thiazide diuretics
- Loop diuretic if GFR <30 mL/min/1.73 m^2
- Spironolactone for resistant BP
  - If hyperkalemia is not present
- Combination of loop and thiazide diuretics

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Hypertension and Nephrolithiasis Q5

A 72-year-old man is evaluated for routine follow-up 3 months after MI treated with a drug-eluting stent. He reports intermittent dysuria but has not seen any blood in his urine.

Medical history is significant for hypertension and CAD. He takes GDMT for his conditions and reports adherence to all medications, including DAPT with aspirin and clopidogrel.

UA with microscopy shows 10-15 erythrocytes/hpf, 0-3 leukocytes/hpf, no bacteria, and no crystals.

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Hypertension and Nephrolithiasis Q5

A 72-year-old man is evaluated for routine follow-up 3 months after MI treated with a drug-eluting stent. He reports intermittent dysuria but has not seen any blood in his urine. Medical history is significant for hypertension and CAD. He takes GDMT for his conditions and reports adherence to all medications, including DAPT with aspirin and clopidogrel. Urinalysis with microscopy shows 10-15 erythrocytes/hpf, 0-3 leukocytes/hpf, no bacteria, and no crystals.

Which of the following is the most appropriate management?

A: Discontinue clopidogrel

B: Repeat urinalysis with microscopy

C: Prescribe nitrofurantoin

D: Refer to urology

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Hematuria

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Hematuria: Definitions

Microscopic hematuria

- ≥3 erythrocytes/hpf in two of three urinalysis samples
- UA dipstick may be suggestive, but diagnosis must be confirmed with microscopy

Gross hematuria

- ≥3 erythrocytes/hpf and visible blood in urine

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Hematuria: Causes

Etiologies of concern	Common etiologies of benign microscopic hematuria
• Urological malignancy • Glomerular disease • Prostate pathology • Kidney stones • Infection • Inherited disorders (e.g., ADPKD, SCD)	• UTI • Viral illness • Vigorous exercise • Menstruation • Recent GU procedure

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Microscopic Hematuria: Testing

Kidney function testing

Cystoscopy

CT, CT or MR urogram, or ultrasound

- Modality based on clinical situation

Nephrology evaluation if kidney function testing suggests glomerular bleeding

- RBC casts or dysmorphic RBC on microscopic analysis
- Proteinuria
- Reduced eGFR

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Microscopic Hematuria: AUA Recommendations

Risk Level	Patient Factors	Management

Low	3-10 RBC/hpf noted
	AND
	Women aged <50 years
	Men aged <40 years (lifetime nonsmokers)
	NO additional risk factors for urothelial cancer
		Repeat urinalysis within 6 months
		• **Normal**: Stop
		• **Persistent**:
		  • Intermediate risk if <25 RBC/hpf
		  • High risk if >25 RBC/hpf

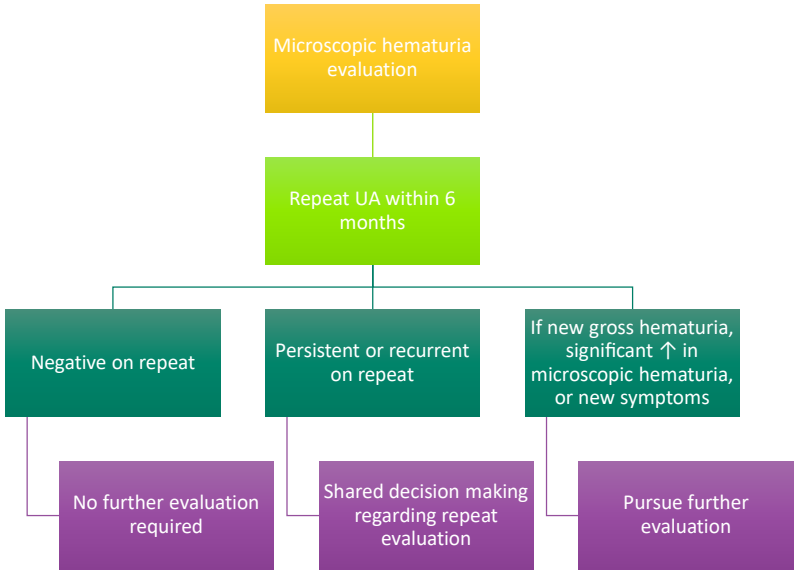
Intermediate	All other patients	Kidney ultrasound Cystoscopy
High	≥60 years of age >30 pack-year history of smoking >25 erythrocytes/hpf Gross hematuria	CT or MR urogram Cystoscopy

Information from Barocas DA, Boorjian SA, Alvarez RD, Downs TM, et al. Microhematuria: AUA/SUFU Guideline. J Urol. 2020 Oct;204(4):778-786. [PMID: 32698717]

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Hematuria



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Hematuria

- Do not use UA to screen for urothelial cancer in asymptomatic adults
- Hematuria cannot be attributed to anticoagulation
  - Evaluate as usual
- Do not obtain urine cytology in initial evaluation of microscopic hematuria
- Ask patient about gross hematuria
- Even a single self-limited episode of gross hematuria must be evaluated
- If history of glomerular disease and gross hematuria with clots, investigate other causes

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Hypertension and Nephrolithiasis Q6

A 35-year-old man is evaluated for recurrent calcium oxalate kidney stones.

He is adherent to fluid intake and low-sodium diet recommendations.

A 24-hour urine collection shows normal calcium, uric acid, and citrate levels but high urine oxalate.

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Hypertension and Nephrolithiasis Q6

A 35-year-old man is evaluated for recurrent calcium oxalate kidney stones. He is adherent to fluid intake and low-sodium diet recommendations. A 24-hour urine collection shows normal calcium, uric acid, and citrate levels but high urine oxalate.

Which of the following is the most appropriate treatment?

A: Begin hydrochlorothiazide

B: Begin sodium citrate

C: Low-calcium diet

D: Low-oxalate diet

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Nephrolithiasis

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Nephrolithiasis: Risk Factors

- Personal/family history
- Gout
- Oxalate malabsorption (Crohn disease, ileostomy, bariatric surgery)
- Primary hyperparathyroidism
- Medications (protease inhibitors, acetazolamide, topiramate)
- High-protein diet (Atkins diet)
- Recurrent UTIs

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Acute Nephrolithiasis: Diagnosis and Testing

Acute colicky flank pain that radiates to groin; hematuria

Nausea/vomiting, dysuria

Urinalysis

- Blood and isomorphic erythrocytes

Crystal identification when present



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Acute Nephrolithiasis: Diagnosis and Testing

Basic metabolic panel

Helical CT without contrast

Ultrasonography

- Pregnant women
- Reproductive-age women
- Children aged <14 years

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Acute Nephrolithiasis: Treatment

Pain control

- First line: NSAIDs; second line: opioids combined with acetaminophen (often with antiemetics)

IV or oral hydration

- No role for forced hydration

Stones <5 mm: pass spontaneously

Stones >5 mm to ≤10 mm

- Tamsulosin, nifedipine, silodosin, tadalafil: may promote passage

Stones >10 mm: unlikely to pass spontaneously

- Urologic intervention

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Recurrent Nephrolithiasis: Testing

CBC, metabolic panel, UA with microscopy

Strain urine for stone fragment for stone analysis

24-Hour urine

- Volume
- pH
- Calcium, oxalate, citrate, uric acid, sodium, creatinine
- Supersaturation index

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Recurrent Nephrolithiasis: Treatment

↑ Fluid intake: urine output >2500 mL/d

Calcium stones and hypercalciuria

- ↓ Dietary sodium to ↓ calciuria
- Thiazide diuretics to ↓ calciuria
- Potassium citrate supplementation
- ↑ Dietary fruit and vegetable intake
- Maintain normal dietary calcium (low calcium = ↑ GI absorption of oxalate)
- ↓ Dietary oxalate (if calcium oxalate stone)
- ↓ Animal protein intake
- Treat hyperparathyroidism

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Recurrent Nephrolithiasis: Treatment

Uric acid stones and hyperuricosuria

- Increase fluids
- Urinary alkalinization with potassium citrate or bicarbonate to achieve urine pH of 6.0-6.5
- Allopurinol
- Low-purine diet

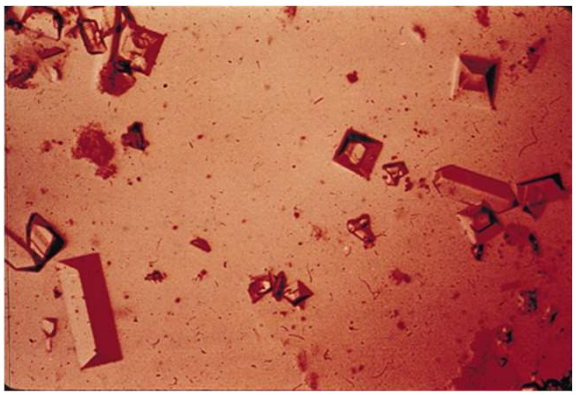
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Recurrent Nephrolithiasis: Treatment

Large struvite stones

- Recurrent UTI with urea-splitting organisms
  - *Proteus, Pseudomonas,* or *Klebsiella*
  - ↑ Urine pH and staghorn calculi (struvite stones)
- Percutaneous nephrolithotomy



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Nephrology I

- Answers to Multiple-Choice Questions

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Hypertension and Nephrolithiasis Q1

A 55-year-old woman is evaluated for elevated BP noted at previous visits. She is asymptomatic. In the office, BP is 152/88 mm Hg, and pulse rate is 88/min.

Which of the following is the most appropriate management?

A: Chlorthalidone

B: PAC/PRA ratio

C: 24-Hour ambulatory BP monitoring

D: 24-Hour urine metanephrines testing

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Hypertension and Nephrolithiasis Q2

A 48-year-old woman is evaluated for persistent hypertension despite lifestyle modifications. Home BP recordings average 158/92 mm Hg. Kidney function is normal. Urinalysis is unremarkable.

Which of the following is the most appropriate treatment?

A: Amlodipine

B: Amlodipine and lisinopril

C: Lisinopril

D: Losartan

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Hypertension and Nephrolithiasis Q3

A 72-year-old woman is evaluated in the ED for chest pain that radiates to her back. BP is 198/120 mm Hg; pulse rate is 90/min. Chest CT scan shows aortic dissection extending from the subclavian artery into the left renal artery.

Which of the following is the most appropriate initial IV treatment?

A: Esmolol

B: Fenoldopam

C: Hydralazine

D: Nitroglycerin

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Hypertension and Nephrolithiasis Q4

A 27-year-old woman is evaluated for resistant hypertension. There is a bruit in the right epigastric region. Kidney function is normal; urinalysis is unremarkable. Duplex ultrasound reveals elevated velocities and resistive indices in the mid and distal renal artery.

Which of the following is the most appropriate next step in management?

A: ACE inhibitor

B: CCB/ACE inhibitor combination

C: Renal artery angioplasty

D: Surgical revascularization

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Hypertension and Nephrolithiasis Q5

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Hypertension and Nephrolithiasis Q6

A 35-year-old man is evaluated for recurrent calcium oxalate kidney stones. He is adherent to fluid intake and low-sodium diet recommendations. A 24-hour urine collection shows normal calcium, uric acid, and citrate levels but high urine oxalate.

Which of the following is the most appropriate treatment?

A: Begin hydrochlorothiazide

B: Begin sodium citrate

C: Low-calcium diet

D: Low-oxalate diet

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Nephrology II – Acute Kidney Injury and Chronic Kidney Disease

2025 Virtual/Live Internal Medicine Board Review

Laura Mariani, MD, MSCE
Associate Professor, Nephrology
University of Michigan
Ann Arbor, MI

ACP Internal Medicine Board Review Course

Nephrology II: Acute Kidney Injury and Chronic Kidney Disease

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Table of Contents: Acute Kidney Injury and Chronic Kidney Disease

- Approach to AKI
- Hepatorenal syndrome
- Toxic kidney injury and rhabdomyolysis
- Myeloma-induced kidney disease
- Obstructive uropathy
- Nephrotic syndrome
- Diabetic kidney disease
- Strategies to prevent progression of kidney disease

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Acute Kidney Injury and Chronic Kidney Disease Q1

A 47-year-old man is hospitalized for severe sepsis.

His initial BP is 95/60 mm Hg on vasopressors and broad-spectrum antibiotics.

Two days later, he is oliguric, and his serum creatinine level has increased from 0.8 mg/dL to 2.2 mg/dL.

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Acute Kidney Injury and Chronic Kidney Disease Q1

A 47-year-old man is hospitalized for severe sepsis. His initial BP is 95/60 mm Hg on vasopressors and broad-spectrum antibiotics. Two days later, he is oliguric, and his serum creatinine level has increased from 0.8 mg/dL to 2.2 mg/dL.

Which of the following is the most appropriate diagnostic test?

A: CT of the abdomen and pelvis

B: Fractional excretion of urea

C: Response to low-dose dopamine infusion

D: Urinalysis with microscopy

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Approach to AKI

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AKI: Diagnosis and Prognosis

KDIGO defines stage 1 AKI by any of the following three criteria:

1. ↑ Creatinine by ≥0.3 mg/dL within 48 hours
2. ↑ Creatinine to ≥1.5 × baseline in 7 days
3. ↓ Urine volume to <0.5 mL/kg/h for 6 hours

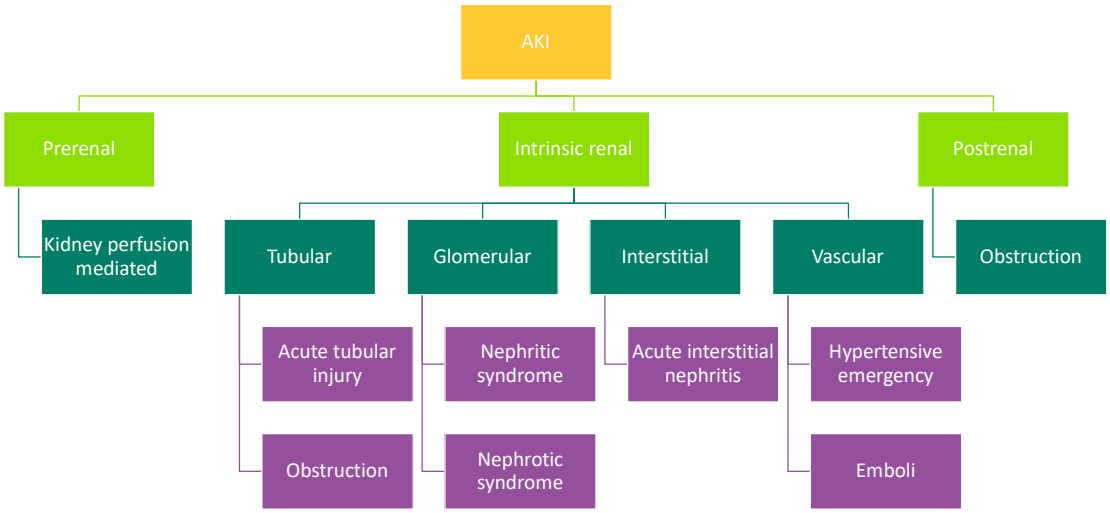
AKI, even with renal recovery, increases risk for:

- Short-term morbidity and mortality
- Future risk for CKD

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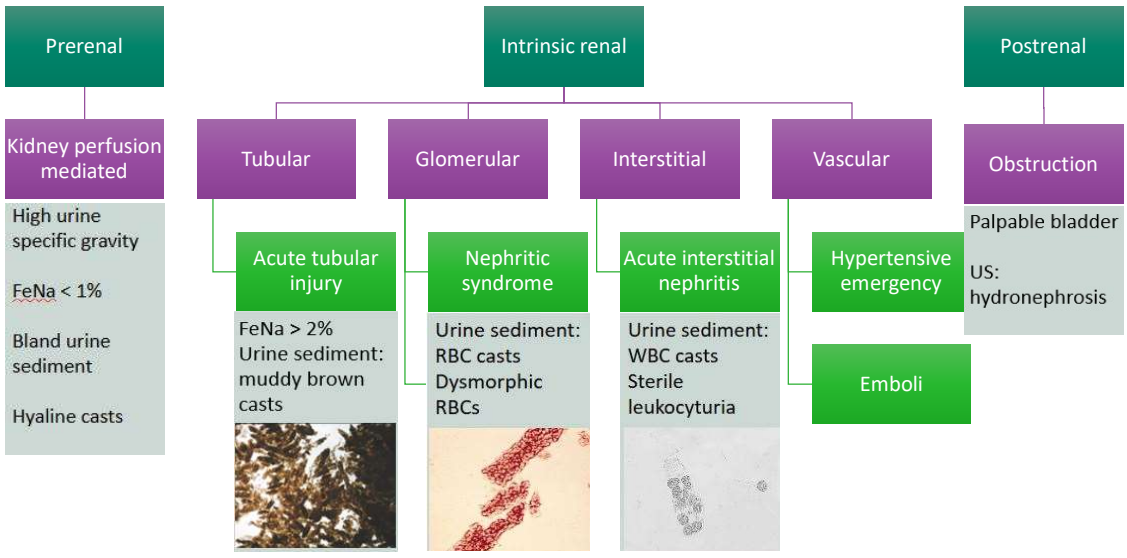
AKI: Differential Diagnosis



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Acute Kidney Injury: Differential Diagnosis



High-yield findings to support diagnosis

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Hepatorenal Syndrome

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Prerenal Acute Kidney Injury

Causes

- Hypotension
- Volume loss
- Sepsis
- Hepatorenal syndrome
- Cardiorenal syndrome

Urine findings

- Bland urinalysis, FE_{Na} <1%
- Bland urine sediment

Treatment: reverse cause before progression to intrinsic injury

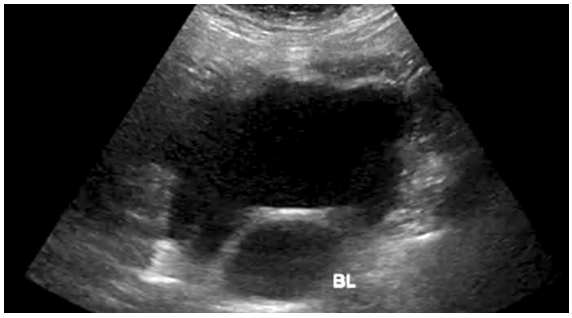
- Treat underlying cause
- Crystalloid volume expansion
- Avoid nephrotoxins
- Dose medications for reduced GFR

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Hepatorenal Syndrome (HRS): Diagnosis and Testing

- Portal hypertension or severe hepatic failure
- Low blood pressure
- ↑ Serum creatinine
- Oliguria
- Benign urine sediment
- Sodium retention
- Urine sodium <10 mEq/L; low FE_{Na}
- No other causes of AKI (diagnosis of exclusion)



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Types of HRS

International Club of Ascites updated classification of HRS

- Based on KDIGO AKI classification

HRS-AKI (formerly Type 1)	HRS-NAKI (formerly Type 2)
• Can be diagnosed even when serum creatinine is below 2.5 mg/dL • Updated definition aims to improve earlier diagnosis and treatment	• Defined by eGFR • Divided into HRS-acute kidney disease (HRS-AKD) and HRS-chronic kidney disease (HRS-CKD)

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Acute Kidney Injury and Chronic Kidney Disease Q2

A 65-year-old man is hospitalized for osteomyelitis caused by a foot ulcer.

On day 1, he underwent angiography and stenting of the iliac artery.

On day 3, bone culture–directed vancomycin and gentamicin were initiated.

On day 10, he developed nonoliguric AKI.

Urinalysis shows brown granular casts.

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Acute Kidney Injury and Chronic Kidney Disease Q2

A 65-year-old man is hospitalized for osteomyelitis caused by a foot ulcer. On day 1, he underwent angiography and stenting of the iliac artery. On day 3, bone culture–directed vancomycin and gentamicin were initiated. On day 10, he developed nonoliguric AKI. Urinalysis shows brown granular casts.

Which of the following is the most likely cause of this patient's AKI?

A: Cholesterol emboli

B: Contrast-associated nephropathy

C: Gentamicin

D: Infection-related glomerulonephritis

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Toxic Kidney Injury and Rhabdomyolysis

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Intrinsic Acute Kidney Injury

Prerenal AKI → If not reversed quickly → Intrinsic Tubular Injury: Acute Tubular Injury



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Causes
- Hypotension, volume loss, sepsis

Urine findings
- Muddy brown casts + tubular epithelial cells
- FE_{Na} >2%

Treatment
- Supportive care in hopes of tubular regeneration and renal recovery
- Treat underlying cause
- Avoid nephrotoxins
- Dose medications for reduced GFR

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Toxic Acute Tubular Injury (ATI): Causes

Medication causes

- Commonly aminoglycosides, vancomycin
- Cisplatin
- Tenofovir
- Amphotericin B
- Acyclovir
- Methotrexate
- Sucrose-containing infusions (IVIG)
- Mannitol
- Iodinated contrast (in setting of stage G4 or greater CKD)

Pigment induced

- Rhabdomyolysis, intravascular hemolysis
- Bilirubin/bile acids

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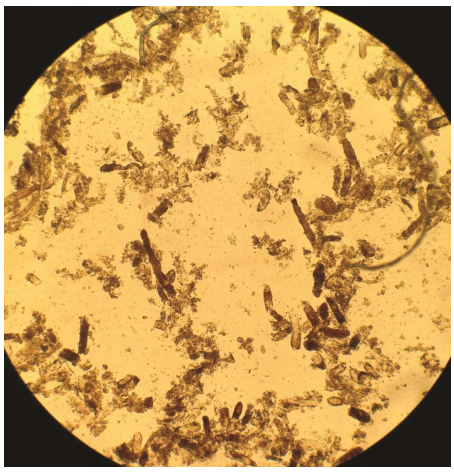
ATI: Urine Findings

Urinalysis with microscopy

- Muddy brown (coarse granular) casts
- Renal tubule epithelial cells

FE_{Na} >2%

UOsm = 300 mOsm/kg H_2O

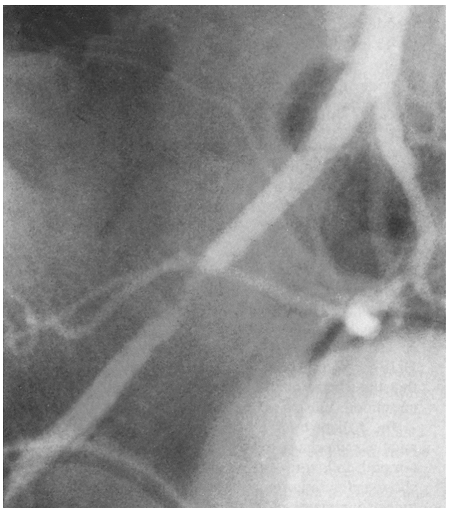


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Toxic ATI: Contrast-Associated Nephropathy



Baseline eGFR <30 mL/min/1.73 m^2 is most important risk factor

↑ Serum creatinine 24-48 hours after exposure

Urine sediment: often bland or may have some granular casts; muddy brown casts are rare

Prevention for patients with low eGFR who require iodinated contrast

- Prehydration with IV 0.9% saline unless congestive HF is present
- Minimal volume of contrast
- Avoid nephrotoxins

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Acute Kidney Injury and Chronic Kidney Disease Q3

An 18-year-old man is evaluated after being found unconscious.

Serum creatinine is 3.2 mg/dL.

Urinalysis is 4+ for occult blood and negative for erythrocytes.

CBC with reticulocyte count is normal.

Toxicology testing is positive for opioids and cocaine.

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Acute Kidney Injury and Chronic Kidney Disease Q3

An 18-year-old man is evaluated after being found unconscious. Serum creatinine is 3.2 mg/dL. Urinalysis is 4+ for occult blood and negative for erythrocytes. CBC with reticulocyte count is normal. Toxicology testing is positive for opioids and cocaine.

Which of the following is the most appropriate serum measurement to obtain in this patient?

A: Acetaminophen

B: Ammonia

C: Creatine kinase

D: Haptoglobin

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Rhabdomyolysis: Risk Factors

Trauma/immobilization

Exertional

- Seizures
- Extreme exercise

Nontraumatic, nonexertional

- Drugs and toxins
- Metabolic and electrolyte disorders
- Infection/sepsis
- Endocrinopathies (DKA, HHS, hypothyroidism)

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Rhabdomyolysis: Diagnosis and Testing

- Inciting event
- Weakness, myalgia
- Tea-colored urine (50% of patients)
- Urinalysis positive for blood
- Urinalysis with microscopy negative for erythrocytes
- FE_{Na} <1%
- ↑ Serum creatinine, LDH, and CK (>5000 U/L)
- Hyperkalemia, hypocalcemia, hyperphosphatemia, hyperuricemia, metabolic acidosis

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Rhabdomyolysis: Treatment

Reverse underlying cause

IV fluids (isotonic fluids)

- 1-2 L per hour with goal urine output >200-300 mL

Monitor for compartment syndrome

Indications for dialysis

- Severe electrolyte and acid-base abnormalities
- Volume overload

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Intratubular Obstruction

Drug exposure associated with crystal formation

Predisposing factors

- Volume depletion
- CKD
- Changes in urine pH

May see urine crystals specific for causative agent

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Acute Interstitial Nephritis (AIN): Diagnosis

Classic triad of rash, fever, eosinophilia

- <10% of patients

Drug exposure is most common cause

- >70% of cases

Occurrence close to time of drug exposure

- Most common causes: antibiotics, NSAIDs, and PPIs
- Creatinine ↑ 7-10 days after exposure
  - Increase may be delayed for months with certain drugs (NSAIDs, PPIs, immune checkpoint inhibitors)



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AIN: Diagnosis

Delayed occurrence

- NSAIDs, COX-2 inhibitors
  - 6-18 months after exposure
- Proton pump inhibitors
  - Usually, 10-11 weeks after exposure
- Immune checkpoint inhibitors
  - Usually, 2-12 weeks after exposure

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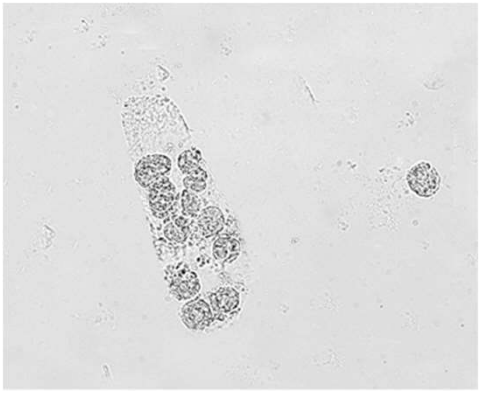
AIN: Testing

AIN urinalysis with microscopy

- Classic findings: WBCs, WBC casts
- Do not order urine eosinophils: not sensitive or specific

Kidney biopsy if either

- Diagnosis unclear
- No improvement with stopping drugs



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Acute Glomerulonephritis

Testing

- Urinalysis with microscopy
  - Dysmorphic RBC or RBC casts
- Serologic blood tests
- Kidney biopsy

Treatment

- Immunosuppressive medications

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Acute Kidney Injury and Chronic Kidney Disease Q4

A 67-year-old man has an increase in serum creatinine level from 1.1 mg/dL to 1.9 mg/dL during a 4-day hospitalization for pneumonia.

He has BPH.

Suprapubic fullness is noted.

Urinalysis with microscopy is bland. Urine output was 700 mL in the past 24 hours.

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Acute Kidney Injury and Chronic Kidney Disease Q4

A 67-year-old man has an increase in serum creatinine level from 1.1 mg/dL to 1.9 mg/dL during a 4-day hospitalization for pneumonia. He has BPH. Suprapubic fullness is noted. Urinalysis with microscopy is bland. Urine output was 700 mL in the past 24 hours.

Which of the following is the most appropriate diagnostic test?

A: FE_{NA}

B: Kidney biopsy

C: Kidney ultrasonography

D: Serum creatine kinase

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Obstructive Uropathy

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Obstructive Uropathy: Causes

Common Causes	Other Causes
• BPH • Nephrolithiasis • Trauma • Stricture	• Malignancy • Infection • Blood clot • Neurogenic bladder • Radiation therapy • Retroperitoneal fibrosis

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Obstructive Uropathy: Diagnosis and Testing

Clinical presentation varies

- Asymptomatic
- Abdominal pain and suprapubic fullness

Variable urine output

- Depends on obstruction location
- Bilateral, complete obstruction is associated with anuria

Lab findings may include

- RTA, hyperkalemia, hematuria, or mild proteinuria

Best test for diagnosis: kidney ultrasonography

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Obstructive Uropathy: Treatment

Bladder catheter placement is immediate management

Percutaneous nephrostomy tube placement required for most forms of obstruction above bladder

Postobstructive diuresis

- Solute diuresis
- Close monitoring of electrolytes
- May require IV fluid repletion

Most kidney function recovery occurs within 1-2 weeks

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Myeloma-Induced Kidney Disease

ACP

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Myeloma-Induced Kidney Disease

Key features

- Production of monoclonal antibodies and monoclonal heavy and light chains
- Hypercalcemia due to bone involvement

Clues to diagnosis

- Older patient age
- AKI
- Hypercalcemia
- Anemia
- Bone pain
- ↑ Serum total protein to albumin gap (reflects monoclonal proteins in serum)

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Myeloma-Induced Kidney Disease: Diagnosis and Testing

- SPEP, UPEP, free serum light chains
- UA = minimal protein on dipstick
- Urine spot protein/creatinine ratio = elevated because of light chains in urine

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Myeloma-Induced Kidney Disease: Diagnosis and Testing

- Presentation varies based on mechanism of myeloma-induced kidney injury
- For intrinsic injury, pattern depends on unique features of monoclonal protein that determines kidney deposition

	Prerenal	Intrinsic	
Cause of AKI	Hypercalcemia-induced diuresis hypovolemia	**Cast nephropathy** Light chain precipitates in tubules, causing obstruction and direct tubular toxicity	**AL amyloid** Deposition of monoclonal protein as amyloid in glomerulus and tubular basement membranes
Expected lab findings	AKI High urine specific gravity No proteinuria	AKI UA: minimal protein U spot protein/creatinine: elevated UPEP positive ↑ Serum free light chains and abnormal kappa-lambda light chain ratio	AKI UA: minimal protein U spot protein/creatinine: elevated, often in nephrotic range UPEP positive

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Acute Kidney Injury and Chronic Kidney Disease Q5

A 35-year-old man is evaluated for acute dyspnea and progressive edema.

He is in respiratory distress and has bilateral lower extremity edema.

Albumin is 1.8 g/dL; creatinine is 1.1 mg/dL. Urinalysis shows 3+ protein.

Chest CTA shows a right pulmonary embolism.

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Acute Kidney Injury and Chronic Kidney Disease Q5

A 35-year-old man is evaluated for acute dyspnea and progressive edema. He is in respiratory distress and has bilateral lower extremity edema. Albumin is 1.8 g/dL; creatinine is 1.1 mg/dL. Urinalysis shows 3+ protein. Chest CTA shows a right pulmonary embolism.

Which of the following is the most likely underlying diagnosis?

A: Acute interstitial nephritis

B: Membranous nephropathy

C: Poststreptococcal glomerulonephritis

D: Thrombotic microangiopathy

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Nephrotic Syndrome

ACP

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Glomerular Disease

- **Nephrotic**
  - **Primary**

Minimal change disease	*Drugs*: NSAIDs, 5-ASA, lithium, bisphosphates *Allergy* *Malignancy*: hematologic *Infections*: syphilis, HIV, TB, *Mycoplasma*, strongyloidiasis
Focal segmental glomerulosclerosis	*Drugs*: IFN, anabolic, bisphosphonates *Infection*: HIV, parvovirus B19 *Podocyte loss/adaptive* *Prior AKI* *Genetic* *Infections*: COVID-19
Membranous nephropathy	*Drugs*: NSAIDs, anti-TNF *Malignancy*: Solid tumor *Infections*: HBV *Lupus*
	Diabetes Amyloidosis Multiple myeloma

  - **Secondary**
- **Nephritic**
  - **Low Complement**

Infection-related GN
Lupus, class II-IV
Cryoglobulinemia
MPGN, C3GN
Endocarditis

  - **Normal Complement**

IgAN/IgAV
Anti–glomerular basement membrane
ANCA vasculitis
Hereditary nephritis

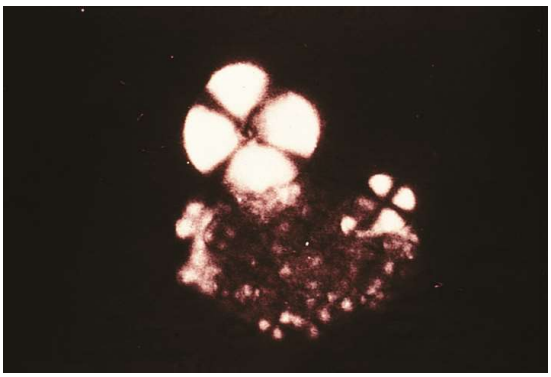
Evaluation

- Quantify proteinuria
- Serologic lab testing
- Kidney biopsy

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Nephrotic Syndrome

- >3.5 g protein/24 h
- Hypoalbuminemia
- Hypercholesterolemia
- Edema
- Hyperlipiduria



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Membranous Nephropathy: Diagnosis

Primary: most cases

- Anti-PLA2R antibody positive

Secondary

- SLE, HBV infection, solid tumors, medications (NSAIDs, penicillamine, anti-TNF therapy)

Nephrotic syndrome, preserved kidney function, ↑ risk for thrombosis

Diagnosis: serum anti-PLA2R antibody or kidney biopsy

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Focal Segmental Glomerulosclerosis (FSGS): Diagnosis and Testing

FSGS is a histologic finding

Common cause of nephrotic syndrome

Causes of FSGS

- Primary
- Secondary (virus related, medications, obesity, prematurity, sickle cell disease; hyperfiltration injury); usually subnephrotic
- Genetic
- Unknown causes

Nephrotic syndrome, HTN, reduced GFR

Diagnosis: kidney biopsy

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Nephrotic Diseases: Treatment

All nephrotic diseases

- BP control with first-line agent (ACE inhibitor or ARB)
- SGLT2 inhibitor for kidney protection
- Statin for lipid lowering
- Low-sodium diet
- Diuretic for edema as needed
- Measure vitamin D and TSH
  - May require repletion because binding proteins lost in urine

Special consideration

- Prophylactic anticoagulation decision requires consideration of albumin level and bleeding risk

Individual nephrotic diseases

- Primary: often treated with immune suppression
- Secondary: treat underlying cause

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Acute Kidney Injury and Chronic Kidney Disease Q6

A 49-year-old man is evaluated in follow-up for hypertension, dyslipidemia, and type 2 diabetes mellitus.

Medications are losartan, simvastatin, and metformin.

BP is 118/76 mm Hg.

Urine albumin-creatinine ratio is 400 mg/g; serum creatinine level is 2.0 mg/dL.

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Acute Kidney Injury and Chronic Kidney Disease Q6

A 49-year-old man is evaluated in follow-up for hypertension, dyslipidemia, and type 2 diabetes mellitus. Medications are losartan, simvastatin, and metformin. BP is 118/76 mm Hg. Urine albumin-creatinine ratio is 400 mg/g; serum creatinine level is 2.0 mg/dL.

Which of the following medications is most appropriate to slow progression of kidney disease in this patient?

A: Aliskiren

B: Canagliflozin

C: Lisinopril

D: Metoprolol

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Diabetic Kidney Disease

ACP

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Diabetic Kidney Disease: Diagnosis

10- to 20-year history of diabetes

Early

- Urine albumin-creatinine ratio >30 mg/g

Late

- Retinopathy
- Neuropathy
- Nephrotic-range proteinuria
- Decreased eGFR
- Hypertension



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Diabetic Kidney Disease: Treatment

Lifestyle modification

Maximize glycemic control

Blood pressure control

- ACC/AHA recommends
  - BP <130/80 mm Hg
  - ACE inhibitors or ARBs as first line
- ADA recommends
  - BP <130/80 mm Hg
- KDIGO recommends
  - BP <120 mm Hg
  - ACE inhibitors or ARBs for albuminuria

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Diabetic Kidney Disease: Treatment

SGLT2 inhibitor (regardless of urine albumin-creatinine ratio)

- Canagliflozin, empagliflozin, dapagliflozin
- Slows CKD progression

GLP-1 receptor agonist

- Liraglutide, dulaglutide
- Slows CKD progression

Finerenone (nonsteroidal mineralocorticoid receptor antagonist)

- If persistent albuminuria despite max RAS inhibition (must have normal K^+)
- Slows CKD progression

Lipid lowering with statin therapy

- For primary and secondary CV risk reduction
- Statins have not been shown to slow CKD progression

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Acute Kidney Injury and Chronic Kidney Disease Q7

A 59-year-old woman is evaluated for recently diagnosed type 2 diabetes mellitus and dyslipidemia.

Medications are metformin and atorvastatin.

Physical examination is normal.

eGFR is >60 mL/min/1.73 m^2, and urinalysis is normal.

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Acute Kidney Injury and Chronic Kidney Disease Q7

A 59-year-old woman is evaluated for recently diagnosed type 2 diabetes mellitus and dyslipidemia. Medications are metformin and atorvastatin. Physical examination is normal. eGFR is >60 mL/min/1.73 m^2, and urinalysis is normal.

Which of the following is the most appropriate diagnostic test to perform next?

A: 24-Hour urine collection for protein

B: Kidney ultrasonography

C: Spot urine albumin-creatinine ratio

D: No additional testing

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Strategies to Prevent Progression of Kidney Disease

ACP

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CKD: Diagnosis

Asymptomatic

- Usually until eGFR <30 mL/min/1.73 m^2

Late symptoms (uremic symptoms)

- Polyuria (inability to concentrate urine)
- Nausea, vomiting, loss of appetite
- Fatigue
- Edema or anasarca
- Insomnia
- Difficulty concentrating, confusion
- Pruritus

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CKD: Testing

- Dipstick and microscopic urinalysis
- Spot urine albumin-creatinine ratio (diabetes)
- Spot urine protein-creatinine ratio
- Serum electrolytes
- $HgbA_{1c}$
- Kidney ultrasonography

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CKD: Testing

Abnormal kidney structure or function (albuminuria or eGFR <60 mL/min/1.73 m^2)

Kidney biopsy indications

- Glomerulonephritis
- Unexplained AKI or CKD
- Severe proteinuria
- Diabetes and either
  - Glomerular hematuria but no retinopathy, neuropathy, *or*
  - Sudden-onset nephrotic syndrome

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CKD: Treatment

Employ strategies to prevent CKD progression

Statins

- Secondary ASCVD prevention
- Primary ASCVD prevention
  - AHA/ACC
    - Age 40-75 years
    - LDL 70-189 mg/dL
    - 10-year ASCVD risk ≥7.5%
  - KDIGO
    - Age ≥50 years with non-dialysis–dependent CKD
    - Age 18-49 years with non-dialysis–dependent CKD and any of the following:
      - CAD, DM, prior CVA, or ASCVD risk >10%
- Don't initiate statins for patients with ESKD on dialysis

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CKD: Treatment

Erythropoiesis-stimulating agents (ESAs) for Hgb <10 g/dL

- Target Hgb: 10.0-11.0 g/dL
- Avoid if history of CVA or malignancy

Treat iron deficiency

- ESA hyporesponsiveness
- IV iron for patients on dialysis

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CKD: Treatment

Preemptive transplantation before dialysis

- Improves patient survival

Dialysis indications

- Uremic symptoms
- Electrolyte disorders, volume overload
- Refractory acidosis
- Malnutrition

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Acute Kidney Injury and Chronic Kidney Disease Q8

A 58-year-old woman is evaluated for a 5-year history of hypertension-related CKD.

She has normal anion gap metabolic acidosis with a serum potassium level of 5.4 mEq/L and serum bicarbonate level of 18 mEq/L.

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Acute Kidney Injury and Chronic Kidney Disease Q8

A 58-year-old woman is evaluated for a 5-year history of hypertension-related CKD. She has normal anion gap metabolic acidosis with a serum potassium level of 5.4 mEq/L and serum bicarbonate level of 18 mEq/L.

Which of the following will slow the progression of her CKD?

A: Atorvastatin

B: Patiromer

C: Potassium citrate

D: Sodium bicarbonate

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Strategies to Prevent Progression of CKD

Renin-angiotensin system blockade

- Proteinuria results in CKD progression, ↑ CVD morbidity/mortality
- ACE inhibitors and ARBs ↓ proteinuria
- Avoid combinations of ACE inhibitors, ARBs, direct renin inhibitors
  - Combination increases risk of AKI and hyperkalemia without providing additional benefit

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Strategies to Prevent Progression of CKD

SGLT2 inhibitors

- Kidney-protective benefits in patients with proteinuria
- Indicated regardless of diabetes status

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Strategies to Prevent Progression of CKD

Blood pressure

- BP <130/80 mm Hg (ACC/AHA); SBP <120 mm Hg (KDIGO)
- ACE inhibitor or ARB
  - Recommended for CKD stages G1-G4; uACR >300 mg/g
  - Suggested for CKD stages G1-G4; uACR 30-300 mg/g
  - Recommended for diabetes and uACR ≥30 mg/g

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Strategies to Prevent Progression of CKD

Alkali therapy

- Low [HCO_3] may lead to CKD progression and ↑ mortality
- Sodium bicarbonate or sodium citrate
  - Delays CKD progression
  - Begin when [HCO_3] <18 mEq/L
  - Target is normal [HCO_3]
- Metabolic alkalosis results in ↑ mortality

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Strategies to Prevent Progression of CKD

- Avoid high-protein diets
- Insufficient evidence for low-protein diets
- Smoking cessation to slow CKD progression
- Avoid NSAIDs, including COX-2 inhibitors

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Strategies to Prevent Progression of CKD

Patients with type 2 diabetes

- Reduce CKD progression and ASCVD events
  - SGLT2 inhibitor
  - GLP-1 receptor agonist
- Reduce CKD progression if persistent albuminuria despite maximal RAS inhibition
  - Finerenone (in diabetic CKD)

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Nephrology II

- Answers to Multiple-Choice Questions

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Acute Kidney Injury and Chronic Kidney Disease Q1

A 47-year-old man is hospitalized for severe sepsis. His initial BP is 95/60 mm Hg on vasopressors and broad-spectrum antibiotics. Two days later, he is oliguric, and his serum creatinine level has increased from 0.8 mg/dL to 2.2 mg/dL.

Which of the following is the most appropriate diagnostic test?

A: CT of the abdomen and pelvis

B: Fractional excretion of urea

C: Response to low-dose dopamine infusion

D: Urinalysis with microscopy

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Acute Kidney Injury and Chronic Kidney Disease Q2

A 65-year-old man is hospitalized for osteomyelitis caused by a foot ulcer. On day 1, he underwent angiography and stenting of the iliac artery. On day 3, bone culture–directed vancomycin and gentamicin were initiated. On day 10, he developed nonoliguric AKI. Urinalysis shows brown granular casts.

Which of the following is the most likely cause of this patient's AKI?

A: Cholesterol emboli

B: Contrast-associated nephropathy

C: Gentamicin

D: Infection-related glomerulonephritis

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Acute Kidney Injury and Chronic Kidney Disease Q3

An 18-year-old man is evaluated after being found unconscious. Serum creatinine is 3.2 mg/dL. Urinalysis is 4+ for occult blood and negative for erythrocytes. CBC with reticulocyte count is normal. Toxicology testing is positive for opioids and cocaine.

Which of the following is the most appropriate serum measurement to obtain in this patient?

A: Acetaminophen

B: Ammonia

C: Creatine kinase

D: Haptoglobin

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Acute Kidney Injury and Chronic Kidney Disease Q4

A 67-year-old man has an increase in serum creatinine level from 1.1 mg/dL to 1.9 mg/dL during a 4-day hospitalization for pneumonia. He has BPH. Suprapubic fullness is noted. Urinalysis with microscopy is bland. Urine output was 700 mL in the past 24 hours.

Which of the following is the most appropriate diagnostic test?

A: FE_{NA}

B: Kidney biopsy

C: Kidney ultrasonography

D: Serum creatine kinase

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Acute Kidney Injury and Chronic Kidney Disease Q5

A 35-year-old man is evaluated for acute dyspnea and progressive edema. He is in respiratory distress and has bilateral lower extremity edema. Albumin is 1.8 g/dL; creatinine is 1.1 mg/dL. Urinalysis shows 3+ protein. Chest CTA shows a right pulmonary embolism.

Which of the following is the most likely underlying diagnosis?

A: Acute interstitial nephritis

B: Membranous nephropathy

C: Poststreptococcal glomerulonephritis

D: Thrombotic microangiopathy

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Acute Kidney Injury and Chronic Kidney Disease Q6

A 49-year-old man is evaluated in follow-up for hypertension, dyslipidemia, and type 2 diabetes mellitus. Medications are losartan, simvastatin, and metformin. BP is 118/76 mm Hg. Urine albumin-creatinine ratio is 400 mg/g; serum creatinine level is 2.0 mg/dL.

Which of the following medications is most appropriate to slow progression of kidney disease in this patient?

A: Aliskiren

B: Canagliflozin

C: Lisinopril

D: Metoprolol

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A 59-year-old woman is evaluated for recently diagnosed type 2 diabetes mellitus and dyslipidemia. Medications are metformin and atorvastatin. Physical examination is normal. eGFR is >60 mL/min/1.73 m^2, and urinalysis is normal.

Which of the following is the most appropriate diagnostic test to perform next?

A: 24-Hour urine collection for protein

B: Kidney ultrasonography

C: Spot urine albumin-creatinine ratio

D: No additional testing

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Acute Kidney Injury and Chronic Kidney Disease Q8

A 58-year-old woman is evaluated for a 5-year history of hypertension-related CKD. She has normal anion gap metabolic acidosis with a serum potassium level of 5.4 mEq/L and serum bicarbonate level of 18 mEq/L.

Which of the following will slow the progression of her CKD?

A: Atorvastatin

B: Patiromer

C: Potassium citrate

D: Sodium bicarbonate

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Nephrology III – Electrolytes and Acid-Base Disorders

2025 Virtual/Live Internal Medicine Board Review

Laura Mariani, MD, MSCE
Associate Professor, Nephrology
University of Michigan
Ann Arbor, MI

ACP Internal Medicine Board Review Course

Nephrology III: Electrolytes and Acid-Base Disorders

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- Hyponatremia
- Hyperkalemia
- Hypokalemia
- Hypomagnesemia
- Metabolic acidosis
- Respiratory acidosis

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Electrolytes and Acid-Base Disorders Q1

A 44-year-old man is evaluated for nocturia, polyuria, and polydipsia.

He has bipolar disorder treated with lithium.

Vital signs are normal.

Blood glucose is 100 mg/dL, serum sodium is 152 mEq/L, and urine osmolality is 117 mOsm/kg H_2O.

Desmopressin injection causes no significant increase in urine osmolality.

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Electrolytes and Acid-Base Disorders Q1

A 44-year-old man is evaluated for nocturia, polyuria, and polydipsia. He has bipolar disorder treated with lithium. Vital signs are normal. Blood glucose is 100 mg/dL, serum sodium is 152 mEq/L, and urine osmolality is 117 mOsm/kg H_2O. Desmopressin injection causes no significant increase in urine osmolality.

Which of the following is the most likely cause of this patient's hypernatremia?

A: Arginine vasopressin deficiency (formerly central diabetes insipidus)

B: Arginine vasopressin resistance (formerly nephrogenic diabetes insipidus)

C: Osmotic diuresis

D: Primary polydipsia

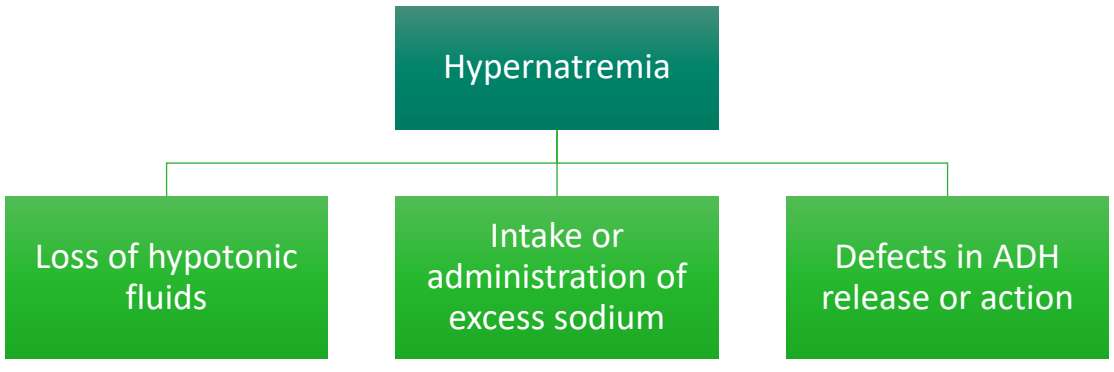
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Hypernatremia

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Hypernatremia



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Loss of Hypotonic Fluids: Diagnosis and Testing

Orthostatic hypotension or hypotension

Extrarenal losses

- Diarrhea
- Sweating
- Respiratory tract

Renal losses → osmotic diuresis

- Postobstructive diuresis
- Hyperglycemic hyperosmolar syndrome

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Loss of Hypotonic Fluids: Diagnosis and Testing

Urine osmolality >300 mOsm/kg H_2O

- If >600 mOsm/kg H_2O, losses are nonrenal

Free water not available/administered

Inadequate thirst mechanism

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Loss of Hypotonic Fluids: Treatment

Mild deficit, minimal symptoms

- If able to drink, use oral water replacement

Hypotensive

- IV 0.45% NS until volume repletion
- Volume replete: 5% dextrose (monitor glucose)
- Chronic hypernatremia: IV rate of correction ~10 mEq/L in 24 hours
- Acute hypernatremia (uncommon): Replace entire water deficit in 24 hours

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Administration of Excess Sodium: Diagnosis and Testing

- Often acute
- Lethargy, seizures, coma
- IV hypertonic saline, sodium bicarbonate
- Salt ingestion

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Administration of Excess Sodium: Treatment

- Acute → complete correction within 24 hours
- IV 5% dextrose (monitor blood glucose)
- Diuretics to manage hypervolemia

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Defects in ADH Release/Action: Diagnosis and Testing

Polydipsia, polyuria (~3 L/d)

Urine osmolality <300 mOsm/Kg H_2O

Modest hypernatremia, minimal symptoms

Arginine vasopressin (AVP) deficiency (formerly central diabetes insipidus)

- Hypothalamic, pituitary disorder

AVP resistance (formerly nephrogenic diabetes insipidus)

- Lithium, tolvaptan, or kidney disease

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Defects in ADH Release/Action: Diagnosis and Testing

Water deprivation test if diagnosis in doubt

Desmopressin test

- ↑ Urine osmolality (AVP deficiency; formerly central DI)
- Unchanged urine osmolality (AVP resistance; formerly nephrogenic DI)

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Defects in ADH Release/Action: Treatment

AVP deficiency

- Desmopressin (intranasal, oral, or subcutaneous)

AVP resistance

- Low-sodium diet
- Discontinue offending drug (e.g., lithium)
- Adjunctive therapy with thiazide or amiloride

Provide medical alert bracelet about presence of AVP deficiency/resistance

- To avoid hypernatremia when person is not alert/unable to provide history

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Electrolytes and Acid-Base Disorders Q2

A 66-year-old woman has a 1-day history of nausea, vomiting, and confusion.

Fluoxetine was started 3 weeks ago for depression.

Vital signs and physical exam findings, other than confusion, are normal.

Lab studies reveal hyponatremia, low serum osmolality, and urine osmolality higher than serum osmolality.

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Electrolytes and Acid-Base Disorders Q2

A 66-year-old woman has a 1-day history of nausea, vomiting, and confusion. Fluoxetine was started 3 weeks ago for depression. Vital signs and physical exam findings, other than confusion, are normal. Lab studies reveal hyponatremia, low serum osmolality, and urine osmolality higher than serum osmolality.

Which of the following is the most appropriate treatment?

A: Furosemide

B: 0.9% Saline infusion

C: 3% Saline infusion

D: Tolvaptan

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Hyponatremia

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Hyponatremia: Symptoms

- Anorexia, nausea, vomiting
- Fatigue, headache
- Altered mental status, agitation, seizures

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Hyponatremia: Diagnosis

Review medications and drugs

- Thiazides, antidepressants, haloperidol, carbamazepine, valproic acid, MDMA (ecstasy)

Assess volume status

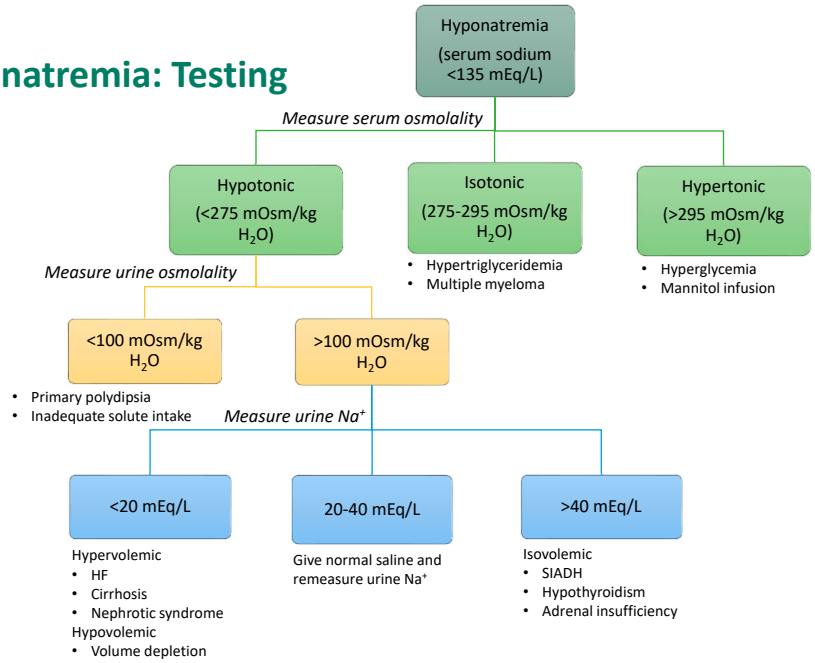
- Hypovolemic (hypotension, tachycardia)
- Isovolemic (normal exam)
- Hypervolemic (edema, ascites, HF)

Determine if acute (<48 h), chronic (>48 h), or unknown

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Hyponatremia: Testing



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Hyponatremia: Testing

Isotonic hyponatremia

- Hypertriglyceridemia, multiple myeloma

Hypertonic hyponatremia

- Hyperglycemia, mannitol infusion

Hypotonic hyponatremia

- Assess volume status, urine osmolality, and urine sodium

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Hypotonic Hyponatremia: Common Causes and Urine Findings

Hypervolemic

- Heart failure, cirrhosis, nephrotic syndrome
- Urine sodium <20 mEq/L
- Urine osmolality >300 mOsm/kg H_2O

Hypovolemic

- Volume depletion
- Urine sodium <20 mEq/L
- Urine osmolality >300 mOsm/kg H_2O

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Hypotonic Hyponatremia: Common Causes and Urine Findings

Isovolemic (urine osmolality >300 mOsm/kg H_2O)

- Normal volume status
- Urine sodium >40 mEq/L
- SIADH (medications most common cause)
- Hypothyroidism, adrenal insufficiency

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Hypotonic Hyponatremia: Common Causes and Urine Findings

Isovolemic (urine osmolality <100 mOsm/kg H_2O)

- Compulsive water drinking
- Inadequate food (solute) intake (e.g., beer potomania)

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SIADH: Treatment

Minimally symptomatic

- First, water restriction (typically ≤1 L to be effective)
- Second, loop diuretics plus oral sodium or urea
- Third, oral tolvaptan (limited to 1 month)
- Goal: 4.0-6.0 mEq/L in 24 hours

Acute symptomatic hyponatremia

- 100-mL bolus of 3% saline
- If symptoms persist, repeat bolus once or twice
- Goal: ↑ sodium by 4.0-6.0 mEq/L in ≤6 hours

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SIADH: Treatment

Chronic symptomatic hyponatremia (>48 h) or of unknown duration

- 100-mL boluses of 3% saline
- Increase sodium by 4.0-6.0 mEq/L over 24 hours
- Desmopressin coadministration to prevent overcorrection
- IV 5% dextrose to treat overcorrection

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Hypovolemic and Hypervolemic Hyponatremia: Treatment

Hypovolemic hyponatremia

- Volume expansion with 0.9% saline

Hypervolemic hyponatremia

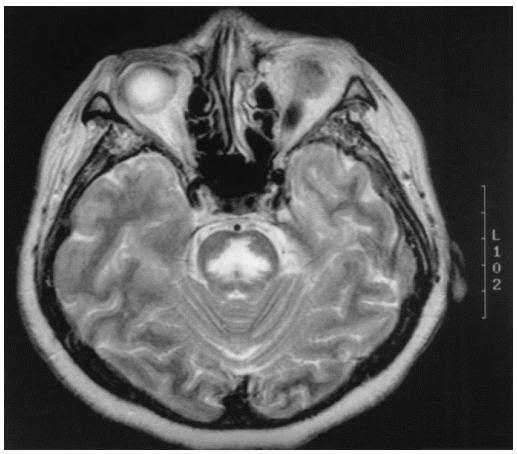
- Treatment of underlying disorder
- Diuresis

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Osmotic Demyelination Syndrome

- Too-rapid correction of hyponatremia
- Symptoms begin 2 to 6 days after overly rapid correction
- Paresis, movement disorders, seizures, obtundation
- Generally irreversible



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Electrolytes and Acid-Base Disorders Q3

A 45-year-old man is evaluated for worsening muscle weakness.

He has end-stage kidney disease and has not been dialyzed for 7 days.

Serum potassium level is 8.0 mEq/L.

ECG shows peaked T waves.

IV calcium gluconate is administered, and emergent hemodialysis is planned.

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Electrolytes and Acid-Base Disorders Q3

A 45-year-old man is evaluated for worsening muscle weakness. He has end-stage kidney disease and has not been dialyzed for 7 days. Serum potassium level is 8.0 mEq/L. ECG shows peaked T waves. IV calcium gluconate is administered, and emergent hemodialysis is planned.

Which of the following is the most appropriate additional treatment?

A: IV glucose and insulin

B: IV high-dose bumetanide

C: IV sodium bicarbonate

D: Oral sodium polystyrene sulfonate in sorbitol (kayexalate)

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Hyperkalemia

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Hyperkalemia: Causes

Increased release from cells

- Rhabdomyolysis
- Tumor lysis syndrome
- Hemolysis
- Metabolic acidosis (non-anion gap or mineral metabolic acidosis)
- Medications (β-blockers)
- Insulin deficiency/hyperglycemia

Reduced urinary excretion

- Acute and chronic kidney disease
- Hypoaldosteronism (type 4 renal tubular acidosis [RTA])
- Medications (RAS inhibitors, heparin, potassium-sparing diuretics)
- Volume depletion

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Hyperkalemia: Diagnosis and Testing

Muscle weakness, fatigue, palpitations, syncope

ECG abnormalities

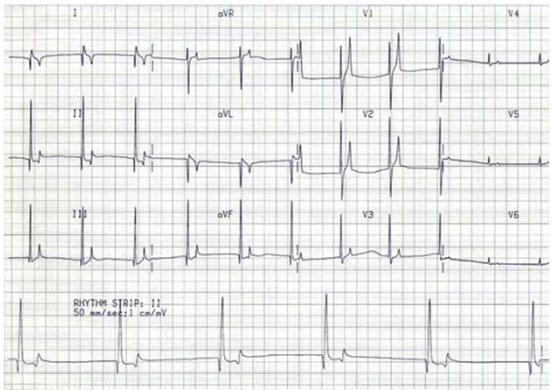
- Tall, peaked T waves
- Loss of P waves
- Wide QRS complexes
- Arrhythmias

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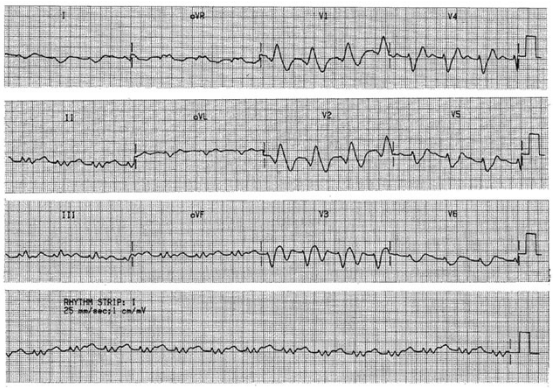
Hyperkalemia: Diagnosis and Testing

Early changes



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Late changes



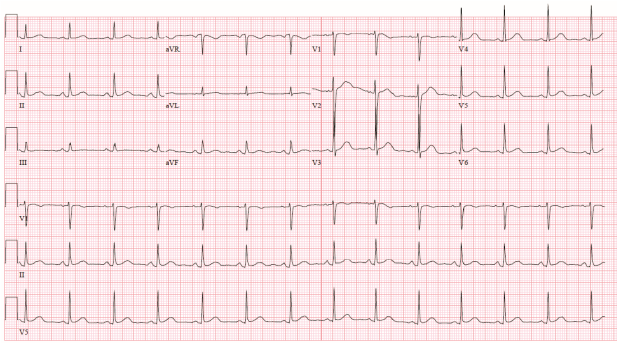
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Hyperkalemia: Diagnosis and Testing

Pseudohyperkalemia must be excluded

- Not true hyperkalemia; release from cells after blood draw
- Common cause of high serum potassium
- Very high leukocyte or platelet count
- Familial pseudohyperkalemia (temperature-dependent RBC membrane abnormality)
- Potassium released during clotting process or cell lysis
- ECG is normal



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Hyperkalemia: Emergent Treatment

IV calcium gluconate

- ECG changes or arrhythmias
- Does not alter potassium level (stabilizes cardiac membrane)

Insulin and glucose

- Intracellular shift of potassium

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Hyperkalemia: Emergent Treatment

Inhaled β_2-agonist (albuterol; higher dose than usual nebulized albuterol)

- Intracellular shift of potassium
- Not monotherapy
- Complementary to insulin/glucose

Hemodialysis for sustained refractory hyperkalemia

Avoid sodium bicarbonate (not reliably effective)

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Hyperkalemia: Nonemergent Treatment

Discontinue culprit drugs

- ACE inhibitors, ARBs
- Potassium-sparing diuretics
- Pentamidine, trimethoprim-sulfamethoxazole
- Cyclosporine, tacrolimus
- NSAIDs

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Hyperkalemia: Nonemergent Treatment

Elimination of potassium

- Dietary restriction
- GI binders (patiromer, sodium zirconium cyclosilicate, sodium polystyrene sulfonate)
- Loop diuretics and normal saline (GFR >5 mL/min and not volume overloaded)

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Electrolytes and Acid-Base Disorders Q4

A 23-year-old woman is evaluated for generalized weakness and lightheadedness.

She has orthostatic hypotension.

Serum potassium is 2.8 mEq/L, serum bicarbonate is 36 mEq/L, urine sodium is 45 mEq/L, and urine chloride is 5.0 mEq/L.

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Electrolytes and Acid-Base Disorders Q4

A 23-year-old woman is evaluated for generalized weakness and lightheadedness. She has orthostatic hypotension. Serum potassium is 2.8 mEq/L, serum bicarbonate is 36 mEq/L, urine sodium is 45 mEq/L, and urine chloride is 5.0 mEq/L.

Which of the following is the most likely cause of this patient's hypokalemia?

A: Bartter syndrome

B: Hypokalemic periodic paralysis

C: Sjögren disease

D: Vomiting

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Hypokalemia

ACP

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Hypokalemia: Presentation

- Weakness or paralysis
- Decreased GI motility or ileus
- Arrhythmias

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Hypokalemia: Causes

Diuretic use (most common cause)

Intracellular potassium shifts

- Insulin
- β_2-Agonists
- Other drugs: methylxanthines

Vomiting (hypovolemia and metabolic alkalosis)

Diarrhea (normal anion gap metabolic acidosis)

Primary hyperaldosteronism

- Potassium normal in 50% of cases
- Hypertension

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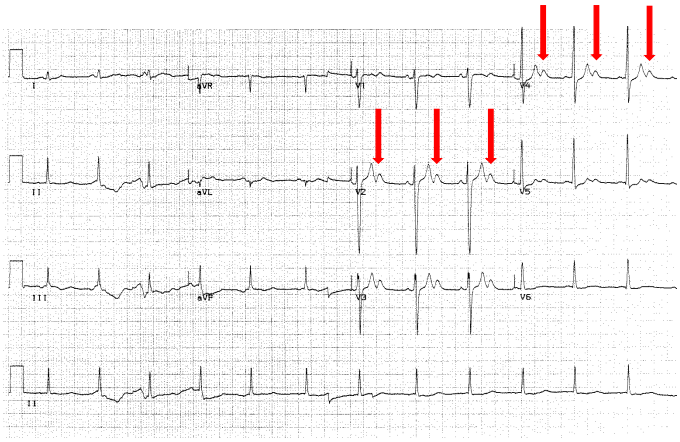
Hypokalemia: Testing

ECG

- ST-segment depression
- ↓ T-wave amplitude
- ↑ U-wave amplitude

Spot urine potassium-creatinine ratio

- <13 mEq/g seen with
  - Lack of intake
  - Transcellular shifts
  - GI loss from diarrhea



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Hypokalemia: Treatment

- Oral potassium for asymptomatic hypokalemia
- IV potassium for cardiac or neuromuscular symptoms
- Correction of concurrent hypomagnesemia

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Electrolytes and Acid-Base Disorders Q5

A 47-year-old man is evaluated for weakness and diarrhea.

He has alcohol use disorder.

Spontaneous twitching in major muscle groups is noted.

Serum calcium is 6.5 mg/dL, and serum albumin is 2.6 g/dL.

ECG shows QT prolongation.

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Electrolytes and Acid-Base Disorders Q5

A 47-year-old man is evaluated for weakness and diarrhea. He has alcohol use disorder. Spontaneous twitching in major muscle groups is noted. Serum calcium is 6.5 mg/dL, and serum albumin is 2.6 g/dL. ECG shows QT prolongation.

Which of the following is the most appropriate next diagnostic test?

A: 1,25-Dihydroxyvitamin D level

B: 24-Hour urine calcium excretion

C: Parathyroid hormone level

D: Serum magnesium level

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Hypomagnesemia

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Hypomagnesemia: Diagnosis

- Muscle weakness, tremors, fasciculations
- Tetany, Chvostek sign, Trousseau sign (due to concomitant hypocalcemia)
- Seizures
- Arrhythmias
- Symptoms usually occur when magnesium levels <1.2 mg/dL

Causes

- Inadequate intake or excessive excretion
- Renal loss
- Endocrine disease
- Redistribution
- Burns
- Lactation

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Hypomagnesemia: Testing and Treatment

Hypokalemia and hypocalcemia

- Not correctable until magnesium is replete

ECG

- Wide QRS complexes
- Peaked T waves
- Prolonged PR intervals
- Prolonged QT; torsades de pointes

Stable patients: use oral slow-release magnesium

Neuromuscular or cardiovascular symptoms: use IV magnesium sulfate

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Electrolytes and Acid-Base Disorders Q6

A 34-year-old woman reports joint pain and chronic dry eyes and mouth. Her only medication is acetaminophen. Parotid enlargement is noted.

Laboratory studies:	
Creatinine	0.9 mg/dL
Sodium	138 mEq/L
Potassium	3.1 mEq/L
Chloride	118 mEq/L
Bicarbonate	12 mEq/L

Urinalysis is normal; urine pH is 7.0.

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Electrolytes and Acid-Base Disorders Q6

A 34-year-old woman reports joint pain and chronic dry eyes and mouth. Her only medication is acetaminophen. Parotid enlargement is noted. Laboratory studies: creatinine, 0.9 mg/dL; sodium, 138 mEq/L; potassium, 3.1 mEq/L; chloride, 118 mEq/L; bicarbonate, 12 mEq/L. Urinalysis is normal; urine pH is 7.0.

Which of the following is the most likely cause of this patient's acidosis?

A: Acetaminophen

B: Type 1 (hypokalemic distal) RTA

C: Type 2 (proximal) RTA

D: Type 4 (hyperkalemic distal) RTA

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Metabolic Acidosis

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Metabolic Acidosis: Diagnosis and Testing

Symptoms related to underlying disorder

Severe acidosis → cardiac dysfunction, arrhythmias

Defined as ↓ pH and ↓ $[HCO_3]$

Calculate anion gap (normal, 8-10 ± 2)

- Anion gap = serum $[Na^+]$ − (serum $[Cl^-]$ + serum $[HCO_3^-]$)

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Increased Anion Gap Metabolic Acidosis: Diagnosis and Testing

Δ Anion gap / Δ bicarbonate

<1 → coexisting normal anion gap metabolic acidosis

>2 → coexisting metabolic alkalosis

Respiratory compensation: P_{CO_2} = (1.5) $[HCO_3]$ + 8 ±2

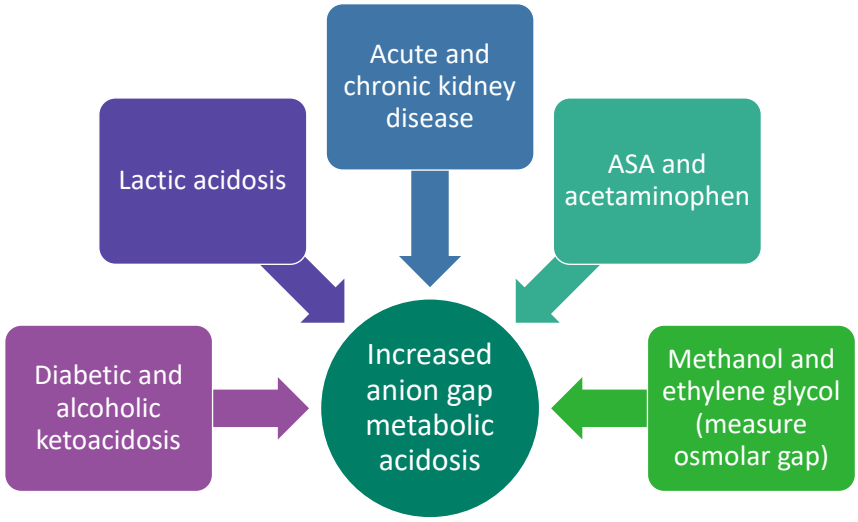
P_{CO_2} > expected → coexisting respiratory acidosis

P_{CO_2} < expected → coexisting respiratory alkalosis

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Increased Anion Gap Metabolic Acidosis: Causes



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Increased Anion Gap Metabolic Acidosis: Diagnosis and Testing

Osmolal gap → Δ calculated and measured plasma osmolality

- Calculated = 2 × $[Na^+]$ + [BUN]/2.8 + [glucose]/18
- Normal: <10 mOsm/kg H_2O
- Elevated: methanol, ethylene glycol, diethylene glycol, propylene glycol

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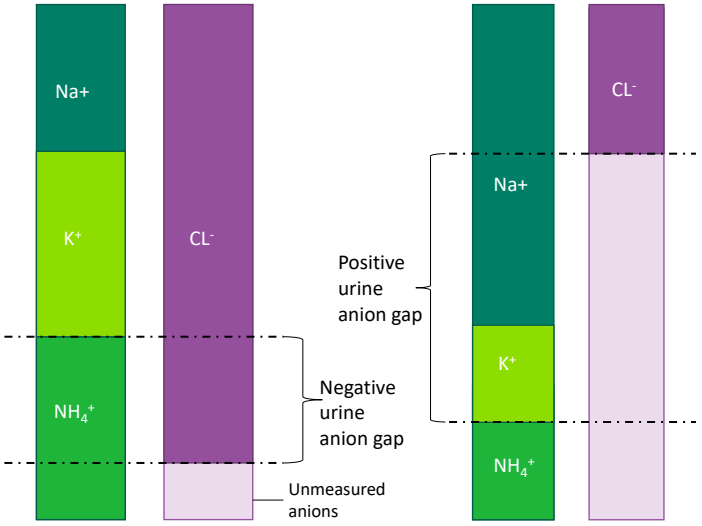
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Normal Anion Gap Metabolic Acidosis: Diagnosis and Testing

Urine anion gap (UAG): use to differentiate extrarenal vs. renal cause

UAG = (urine [Na^+] + urine [K^+]) – urine [Cl^-]

- NEGATIVE: acidosis of extrarenal origin
- POSITIVE or zero: acidosis of renal origin



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Normal Anion Gap Metabolic Acidosis: Renal Tubular Acidosis (RTA) Diagnosis and Testing

Type 1 (hypokalemic distal) RTA	Type 2 (proximal) RTA
• Urine pH of ≥6.0 • Hypokalemia • Calcium phosphate stones • Positive urine anion gap	• Urine pH <5.5 (in absence of bicarbonate therapy) • Hypokalemia • When part of Fanconi syndrome: glycosuria, phosphaturia, aminoaciduria, hypouricemia • Positive urine anion gap

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Normal Anion Gap Metabolic Acidosis: RTA Diagnosis and Testing

Type 4 (hyperkalemic distal) RTA

- Urine pH <5.5
- Hyperkalemia
- Hyporeninemic hypoaldosteronism
  - Diabetic kidney disease
  - ACE inhibitors
- Positive urine anion gap

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Electrolytes and Acid-Base Disorders Q7

A 66-year-old man reports worsening dyspnea.

He has COPD.

ABGs show a pH of 7.32, P_{CO_2} of 64 mm Hg, and P_{O_2} of 59 mm Hg.

Serum bicarbonate is 32 mEq/L.

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Electrolytes and Acid-Base Disorders Q7

A 66-year-old man reports worsening dyspnea. He has COPD. ABGs show a pH of 7.32, P_{CO_2} of 64 mm Hg, and P_{O_2} of 59 mm Hg. Serum bicarbonate level is 32 mEq/L.

Which of the following acid-base disorders is present?

A: Metabolic acidosis

B: Metabolic acidosis and respiratory acidosis

C: Respiratory acidosis

D: Respiratory alkalosis

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Respiratory Acidosis

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Respiratory Acidosis: Diagnosis and Testing

Symptoms

- Mild: headache, anxiety, tremor
- Severe: confusion, somnolence, seizures

↓ pH, ↑ PCO_2, ↑ HCO_3

Frequently associated with hypoxemia

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Respiratory Acidosis: Testing

Expected compensation

- Acute = 1 mEq/L ↑ [HCO_3] for each 10 mm Hg ↑ PCO_2
- Chronic = 3.5 mEq/L ↑ [HCO_3] for each 10 mm Hg ↑ PCO_2

[HCO_3] < expected: coexisting metabolic acidosis

[HCO_3] > expected: coexisting metabolic alkalosis

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Respiratory Acidosis: Treatment

Treatment of underlying disorder

Mechanical ventilation

- May be needed for O_2 supplementation and to ↓ CO_2

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Nephrology III

- Answers to Multiple-Choice Questions

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Electrolytes and Acid-Base Disorders Q1

A 44-year-old man is evaluated for nocturia, polyuria, and polydipsia. He has bipolar disorder treated with lithium. Vital signs are normal. Blood glucose is 100 mg/dL, serum sodium is 152 mEq/L, and urine osmolality is 117 mOsm/kg H_2O. Desmopressin injection causes no significant increase in urine osmolality.

Which of the following is the most likely cause of this patient's hypernatremia?

A: Arginine vasopressin deficiency (formerly central diabetes insipidus)

B: Arginine vasopressin resistance (formerly nephrogenic diabetes insipidus)

C: Osmotic diuresis

D: Primary polydipsia

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Electrolytes and Acid-Base Disorders Q2

A 66-year-old woman has a 1-day history of nausea, vomiting, and confusion. Fluoxetine was started 3 weeks ago for depression. Vital signs and physical exam findings, other than confusion, are normal. Lab studies reveal hyponatremia, low serum osmolality, and urine osmolality higher than serum osmolality.

Which of the following is the most appropriate treatment?

A: Furosemide

B: 0.9% Saline infusion

C: 3% Saline infusion

D: Tolvaptan

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Electrolytes and Acid-Base Disorders Q3

A 45-year-old man is evaluated for worsening muscle weakness. He has end-stage kidney disease and has not been dialyzed for 7 days. Serum potassium level is 8.0 mEq/L. ECG shows peaked T waves. IV calcium gluconate is administered, and emergent hemodialysis is planned.

Which of the following is the most appropriate additional treatment?

A: IV glucose and insulin

B: IV high-dose bumetanide

C: IV sodium bicarbonate

D: Oral sodium polystyrene sulfonate in sorbitol (kayexalate)

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Electrolytes and Acid-Base Disorders Q4

A 23-year-old woman is evaluated for generalized weakness and lightheadedness. She has orthostatic hypotension. Serum potassium is 2.8 mEq/L, serum bicarbonate is 36 mEq/L, urine sodium is 45 mEq/L, and urine chloride is 5.0 mEq/L.

Which of the following is the most likely cause of this patient's hypokalemia?

A: Bartter syndrome

B: Hypokalemic periodic paralysis

C: Sjögren disease

D: Vomiting

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Electrolytes and Acid-Base Disorders Q5

A 47-year-old man is evaluated for weakness and diarrhea. He has alcohol use disorder. Spontaneous twitching in major muscle groups is noted. Serum calcium is 6.5 mg/dL, and serum albumin is 2.6 g/dL. ECG shows QT prolongation.

Which of the following is the most appropriate next diagnostic test?

A: 1,25-Dihydroxyvitamin D level

B: 24-Hour urine calcium excretion

C: Parathyroid hormone level

D: Serum magnesium level

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Electrolytes and Acid-Base Disorders Q6

A 34-year-old woman reports joint pain and chronic dry eyes and mouth. Her only medication is acetaminophen. Parotid enlargement is noted. Laboratory studies: creatinine, 0.9 mg/dL; sodium, 138 mEq/L; potassium, 3.1 mEq/L; chloride, 118 mEq/L; bicarbonate, 12 mEq/L. Urinalysis is normal; urine pH is 7.0.

Which of the following is the most likely cause of this patient's acidosis?

A: Acetaminophen

B: Type 1 (hypokalemic distal) RTA

C: Type 2 (proximal) RTA

D: Type 4 (hyperkalemic distal) RTA

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Electrolytes and Acid-Base Disorders Q7

A 66-year-old man reports worsening dyspnea. He has COPD. ABGs show a pH of 7.32, P_{CO_2} of 64 mm Hg, and P_{O_2} of 59 mm Hg. Serum bicarbonate level is 32 mEq/L.

Which of the following acid-base disorders is present?

A: Metabolic acidosis

B: Metabolic acidosis and respiratory acidosis

C: Respiratory acidosis

D: Respiratory alkalosis

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Dermatology I

2025 Virtual/Live Internal Medicine Board Review

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ACP Internal Medicine Board Review Course

Dermatology I

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Table of Contents: Dermatology I

- Atopic dermatitis
- Contact dermatitis
- Hand dermatitis
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- Leg ulcers
- Drug eruptions
- Urticaria
- Acne vulgaris
- Rosacea

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Dermatology Q1

A 26-year-old woman with atopic dermatitis has had acute worsening of her rash and itching during the past week despite use of petrolatum and triamcinolone ointment treatment.

She is otherwise well.

Exam shows eczematous plaques with scattered pustules and honey-colored crusting in the areas of rash and pruritus.

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Dermatology Q1

A 26-year-old woman with atopic dermatitis has had acute worsening of her rash and itching during the past week despite use of petrolatum and triamcinolone ointment treatment. She is otherwise well. Exam shows eczematous plaques with scattered pustules and honey-colored crusting in the areas of rash and pruritus.

Which of the following is the most likely cause of this patient's worsening rash?

A: Herpes simplex virus infection

B: Soap allergy

C: *Staphylococcus aureus* superinfection

D: Topical glucocorticoids

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Atopic Dermatitis

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Atopic Dermatitis: Diagnosis

Atopic triad (dermatitis, asthma, allergic rhinitis)

- Face and flexural surfaces

Acute atopic dermatitis

- Pruritic, erythematous patches or plaques
- Weeping and crusting



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Atopic Dermatitis: Diagnosis





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Chronic atopic dermatitis

- Scaling
- Lichenified and hyperpigmented

Bacterial superinfection (*S. aureus*)

- Acute worsening with pustules and honey-colored crusting

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Atopic Dermatitis: Treatment

Fragrance-free, non–soap-based cleansers; bland emollients

Topical glucocorticoids

Topical calcineurin inhibitors: tacrolimus and pimecrolimus

- Steroid-sparing → face and skin folds

Phototherapy

Systemic therapy

- Traditional disease-modifying antirheumatic drugs (MMF, MTX, AZA, CsA)
- Biologic therapy: dupilumab, tralokinumab
- JAK inhibitors: topical (ruxolitinib) and oral (upadacitinib, abrocitinib)

Oral antihistamines

- Concurrent allergic symptoms

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Dermatology Q2

A 46-year-old woman reports a 4-day history of an intensely pruritic rash after using a new facial moisturizer that contains fragrance.

Medical history is otherwise unremarkable.

Exam reveals eczematous-appearing patches with a few fine vesicles on the cheeks and neck.

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Dermatology Q2

A 46-year-old woman reports a 4-day history of an intensely pruritic rash after using a new facial moisturizer that contains fragrance. Medical history is otherwise unremarkable. Exam reveals eczematous-appearing patches with a few fine vesicles on the cheeks and neck.

Which of the following is the most appropriate and safest topical glucocorticoid treatment?

A: Betamethasone dipropionate

B: Clobetasol propionate

C: Desoximetasone

D: Hydrocortisone

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Contact Dermatitis

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Allergic Contact Dermatitis: Diagnosis

Delayed type IV hypersensitivity reaction

- Onset: hours to days

Pruritic, eczematous skin; vesicles

Vesicle fluid not antigenic

Toxicodendron plants (urushiol)

- Poison ivy, oak, sumac
- Linear pattern

Nickel (wristwatch, jewelry, buckles, buttons)

- Localized patches



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Allergic Contact Dermatitis: Diagnosis and Testing



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Fragrance

- Patches or plaques: flexor wrists, neck, behind ears, face, or diffuse

Neomycin, bacitracin

- "Worsening" superficial infection

Patch testing: diagnostic gold standard

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Allergic Contact Dermatitis: Treatment

Avoid precipitant

Treat skin inflammation

Low-potency topical glucocorticoids

- Face, axillae, inguinal folds, under breasts/pannus
- Hydrocortisone, 1.0% or 2.5%; triamcinolone acetonide, 0.025%

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Allergic Contact Dermatitis: Treatment

High-potency topical glucocorticoids

- Hands, feet, or nonflexural areas
- Avoid on face
  - Use only low-potency topical glucocorticoids on face
- Betamethasone dipropionate, 0.05%; triamcinolone acetonide, 0.5%

Systemic glucocorticoids for severe, extensive reactions

- May require 3- to 4-week taper (risk for rebound)

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Irritant Contact Dermatitis: Diagnosis and Treatment

Non–immune-modulated localized inflammatory response

- Minutes to hours after exposure
- Contact with chemical or physical agents

Avoid/remove irritant, reduce inflammation

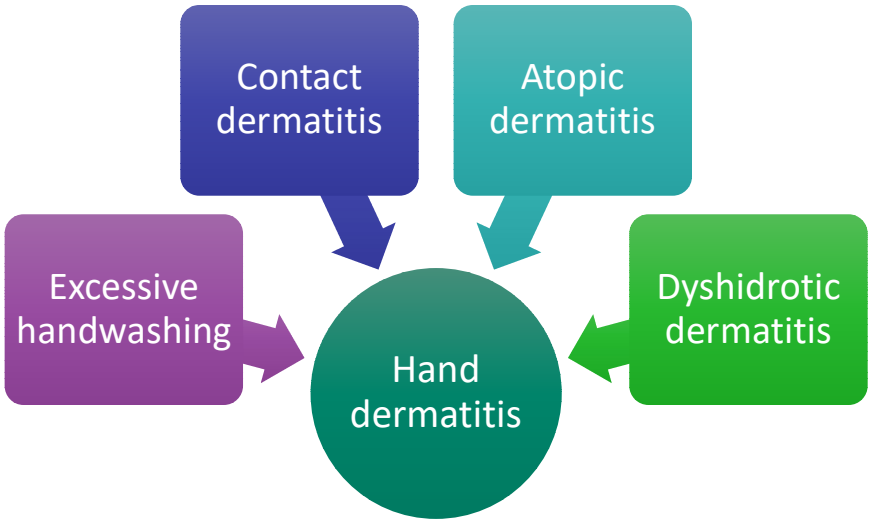
- Early combination therapy
  - Emollients and topical glucocorticoids
- Gloves, barrier creams

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Hand Dermatitis

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Hand Dermatitis: Causes



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Hand Dermatitis: Diagnosis and Testing

Acute contact dermatitis

- Erythema, edema, weeping, and vesiculation

Chronic hand dermatitis

- Scaling, thickening, and fissuring

Dyshidrotic eczema

- Tapioca-like vesicles on palms and sides of fingers

Patch testing for suspected acute contact dermatitis





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Hand Dermatitis: Treatment

- Avoidance of trigger
- Skin protection
- Emollients
- Potent topical glucocorticoids

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Seborrheic Dermatitis

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Seborrheic Dermatitis: Diagnosis

Ill-defined erythema

Dry or greasy scale on erythematous base

Pustules (rarely)

Location

- Scalp (dandruff)
- Nasolabial folds, cheeks
- Eyelids, eyebrows
- External auditory canals
- Post-auricular

Disseminated/severe → consider HIV or neurologic (post-CVA, PD)



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Seborrheic Dermatitis: Treatment



Ketoconazole cream and/or hydrocortisone

Medicated shampoos

- Tar
- Ketoconazole
- Zinc pyrithione
- Selenium sulfide

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Dermatology Q3

A 53-year-old woman reports an acute, pruritic rash on her legs without fever or drainage.

She has chronic venous insufficiency.

Skin findings are shown.



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Dermatology Q3

A 53-year-old woman reports an acute, pruritic rash on her legs without fever or drainage. She has chronic venous insufficiency.

Which of the following is the most likely diagnosis?

A: Acute stasis dermatitis

B: Cellulitis

C: Contact dermatitis

D: Deep venous thrombosis

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Stasis Dermatitis

ACP

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Stasis Dermatitis: Diagnosis

Inflammatory dermatitis involving legs

- Often bilateral
- Erythematous patches and plaques
- Vesicles, exudates
- Pruritus

Associated with chronic venous insufficiency

- Edema
- Varicose veins
- Hyperpigmentation
- Lipodermatosclerosis
- Venous ulcers



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Stasis Dermatitis: Treatment

Treat chronic venous insufficiency

- Leg elevation, exercise, compression

Reduce inflammation

- Emollients
- Topical glucocorticoids (acute stasis dermatitis)
- Systemic and topical antibiotics only for concomitant superinfection

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Dermatology Q4

A 65-year-old man reports a 3-year history of bilateral progressive discomfort, discoloration, and swelling of his legs.

His symptoms are worse at the end of the day. Pedal pulses are normal.

BMI is 32. Vital signs are normal.

Representative left leg changes are shown.



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Dermatology Q4

A 65-year-old man reports a 3-year history of bilateral progressive discomfort, discoloration, and swelling of his legs. His symptoms are worse at the end of the day. Pedal pulses are normal. BMI is 32. Vital signs are normal.

Which of the following is the best management for this patient?

A: Cephalexin

B: Compression stockings

C: Furosemide

D: Skin biopsy

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Venous Disease of the Lower Extremities

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Chronic Venous Insufficiency: Risk Factors

- Older age
- Obesity
- History of DVT
- Sedentary lifestyle
- Leg injury

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Chronic Venous Insufficiency: Diagnosis

- Clinical diagnosis
- Leg aching, itching, heaviness, swelling, and pain
- Edema
- Varicosities
- Hyperpigmented (red-brown) skin



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Chronic Venous Insufficiency: Diagnosis



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Stasis dermatitis

- Erythematous, eczematous patches/plaques

Lipodermatosclerosis

- Induration
- Fibrosis (scarring)
- "Inverted wine bottle"

Ulceration

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Chronic Venous Insufficiency: Testing

ABI to exclude PAD in at-risk patients

Diagnosis unclear or planning surgery

- Venous duplex Doppler ultrasonography

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Chronic Venous Insufficiency: Treatment

Lifestyle changes (weight loss)

Exercise (walking, heel lifts)

Leg elevation

Compression therapy

Systemic therapy

- Pentoxifylline

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Chronic Venous Insufficiency: Treatment

Skin care

- Emollients
- Topical glucocorticoids for stasis dermatitis

Venous ablation, stripping, excision, or stenting

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Dermatology Q5

A 60-year-old woman has had an ulcer over the right lateral malleolus (shown) for several weeks.

The ulcer is painful and is worse with leg elevation and improved with the leg in a dependent position.

She has claudication, hypertension, hyperlipidemia, and a 40-pack-year smoking history.



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Dermatology Q5

A 60-year-old woman has had an ulcer over the right lateral malleolus for several weeks. The ulcer is painful and is worse with leg elevation and improved with the leg in a dependent position. She has claudication, hypertension, hyperlipidemia, and a 40-pack-year smoking history.

Which of the following is the most likely diagnosis?

A: Arterial ulcer

B: Neuropathic ulcer

C: Pyoderma gangrenosum

D: Venous ulcer

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Leg Ulcers

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Leg Ulcers: Diagnosis

Ulcer Type	Location	Clinical Presentation	Associated Findings
Venous stasis ulcers	Mid-calf to ankle, often over medial malleolus	Pain variably present; irregularly shaped, shallow, weeping serous fluid; normal arterial pulses	Edema, venous varicosities, eczematous changes, hyperpigmentation, lipodermatosclerosis
Arterial insufficiency ulcers	Distal toes, anterior lower leg, pressure points (i.e., lateral malleolus)	Painful; sharply demarcated erythematous borders; dry, pale gray or yellow wound base	Evidence of atherosclerosis, poor pulses, shiny skin ABI ≤0.9
Neuropathic ulcers	Plantar aspect of feet	Painless, occur over pressure points	Decreased sensation, callus formation, neuropathic (Charcot) arthropathy

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Leg Ulcers: Treatment

Based on the underlying cause

Surgical debridement if significant devitalized tissue

- Do not debride pyoderma gangrenosum

Identify and treat infection if present

- Fever, leukocytosis often absent
- Increased localized pain, purulent (not fibrinolytic) exudate, acute erythema, warmth

Local wound care

- Dressings

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Leg Ulcers: Treatment

Venous stasis ulcers	Arterial insufficiency ulcers	Neuropathic ulcers
		
• Leg elevation • Compression therapy	• Treat modifiable ASCVD risk factors • Surgical or endovascular revascularization	• Diabetes control • Pressure offloading (total contact casts or nonremovable cast walkers) • Avoid trauma

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Dermatology Q6

A 55-year-old man has a rash on over half of his body and mouth sores after starting carbamazepine.

Temperature is 102.9 °F, BP is 110/60 mm Hg, and pulse rate is 116/min.

Skin findings are shown.



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Dermatology Q6

A 55-year-old man has a rash on over half of his body and mouth sores after starting carbamazepine. Temperature is 102.9 °F, BP is 110/60 mm Hg, and pulse rate is 116/min.

Which of the following is the most appropriate treatment?

A: Hospitalization and discontinuation of carbamazepine

B: Infliximab

C: Intravenous methylprednisolone

D: Intravenous vancomycin and ceftriaxone

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Drug Eruptions

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Cutaneous Drug Reactions



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Most easily recognizable patterns

- Morbilliform
- Urticaria
- Fixed drug eruption
- Erythema multiforme

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Cutaneous Drug Reactions

Most common causes

- Antibiotics: penicillin and sulfa drugs
- Anticonvulsants: phenytoin and carbamazepine

Treatment

- Drug discontinuation
- Antihistamines
- Topical or systemic glucocorticoids if severe



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Toxic Epidermal Necrolysis (TEN) and Stevens-Johnson Syndrome (SJS): Diagnosis

Potentially lethal skin and mucosal necrosis

Distinguished by amount of skin sloughing

Characteristic	Erythema Multiforme	Stevens-Johnson Syndrome	Toxic Epidermal Necrolysis
Morphology	Typical three-zone target (dark central area or blister, a ring of pale edema, an outer red inflammatory ring); lesions with only two rings are common as well	Atypical targets with only 2 colors/zones and confluent erythema with sloughing	Extensive, confluent erythema with sloughing
Distribution	Favors extremities	Trunk and extremities; <10% body surface area involvement	Trunk and extremities; >30% body surface area involvement
Mucosal disease (oral, eye, genitourinary)	One or two sites	Two or more sites	Two or more sites
Constitutional symptoms	+	++/+++	+++
Cause			
Infection (%)	50	26	6
Drugs implicated (%)	50	74	94
Mortality rate (%)	0	5-13	25-39

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TEN/SJS: Diagnosis



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TEN and SJS are caused by medications

Begin 1-3 weeks after starting responsible drug

- Carbamazepine, lamotrigine, phenytoin
- Sulfonamide, β-lactam antibiotics
- Allopurinol

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TEN/SJS: Diagnosis

Dermatologic findings

- Skin pain is prominent
- ≥2 mucosal surfaces
- Red-purple macules or papules
- Bullae and vesicles
- Skin sloughing

Fever

Multiorgan involvement

Clinical diagnosis

Punch biopsy



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TEN/SJS: Treatment

Drug discontinuation

ICU/burn unit care

Supportive therapy

- Wound care, fluid, electrolytes
- Infection control
- Avoid prophylactic antibiotics

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Drug-Induced Hypersensitivity Syndrome (Drug Reaction With Eosinophilia and Systemic Symptoms [DRESS]): Diagnosis



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Drug rash

- Morbilliform
- Pruritus
- Face/upper trunk, spreading distally
- Facial edema and redness (hallmark feature)

Eosinophilia, peripheral

- Atypical lymphocytosis alongside or instead of eosinophilia

Systemic symptoms

- Fever, lymphadenopathy
- ↑ Aminotransferase levels

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Drug-Induced Hypersensitivity Syndrome: Diagnosis and Treatment

Clinical diagnosis: 2-6 weeks after starting responsible drug

- Sulfonamide, penicillin, cephalosporin antibiotics
- Allopurinol
- Anticonvulsants

Treatment

- Drug discontinuation
- Systemic glucocorticoids

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Acute Generalized Exanthematous Pustulosis (AGEP): Diagnosis and Treatment



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Acute onset of erythema and pustules

- First on face/intertriginous zones
- Hours to few days after starting responsible drug

80% due to antibiotics

Fever, leukocytosis ± eosinophilia

Drug discontinuation

Self-limited over the course of ~2 weeks

Topical glucocorticoids for pruritus

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Dermatology Q7

A 34-year-old woman reports a 1-week history of intensely pruritic red plaques that appear suddenly, last <24 hours, and disappear.

Skin findings are shown.



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Dermatology Q7

A 34-year-old woman reports a 1-week history of intensely pruritic red plaques that appear suddenly, last <24 hours, and disappear.

Which of the following is the most likely diagnosis?

A: Acute urticaria

B: Angioedema

C: Erythema multiforme

D: Hereditary angioedema

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Urticaria

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Urticaria: Diagnosis

- Well-demarcated pruritic, edematous pink-to-red plaques
- Round, oval, annular, arciform, and serpiginous shapes
- Trunk and extremities



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Urticaria: Diagnosis and Treatment

Clinical diagnosis

- Individual lesions last <24 hours
- Recurrent episodes may last weeks

Treatment

- Avoidance of triggers
- Nonsedating H_1 blockers
- Omalizumab (anti-IgE biologic)

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Acne Vulgaris

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Acne Vulgaris: Diagnosis

- Open (blackheads) and closed (whiteheads) comedones
- Erythematous papules, pustules, occasionally nodules
- Face, neck, chest, upper back, shoulders

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Acne Vulgaris: Classification

Mild acne	Moderate acne	Severe acne
• Few comedones and/or inflammatory papules	• Several comedones and/or inflammatory papules • Few nodules	• Many comedones and inflammatory papules • Nodules and cysts • Scarring







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Acne Vulgaris: Treatment

Topical retinoids (tretinoin, adapalene, tazarotene)

- First-line treatment for all forms of acne
- Contraindicated in pregnancy

Topical antibiotics (clindamycin, erythromycin)

- Mild, moderate, severe acne
- Never used as monotherapy
- Combined with topical benzoyl peroxide with or without topical retinoids

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Acne Vulgaris: Treatment

Oral antibiotics (tetracyclines)
- Moderate to severe acne
- Acne resistant to topical treatment alone
- Avoid in pregnancy

Spironolactone
- Acne with hormonal flares

Oral isotretinoin
- Severe acne with scarring
- Teratogenic
- Mandatory FDA risk-mitigation program



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Dermatology Q8

A 41-year-old man reports "pimples" on his cheeks and facial redness that worsens in the sun, after he drinks coffee, and after showering.

His skin is not itchy or painful.

Skin findings are shown.



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Dermatology Q8

A 41-year-old man reports “pimples” on his cheeks and facial redness that worsens in the sun, after he drinks coffee, and after showering. His skin is not itchy or painful.

Which of the following is the most likely diagnosis?

A: Acute cutaneous lupus erythematosus

B: Periorificial dermatitis

C: Rosacea

D: Seborrheic dermatitis

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Rosacea

ACP

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Rosacea: Diagnosis

Erythrotelangiectatic rosacea

- Sensitive facial skin, persistent erythema, and telangiectasias on central face
- May or may not involve the nasolabial folds
- Flushing precipitated by:
  - Stress
  - Alcohol consumption
  - Heat
  - Excessive sunlight
  - Spicy foods



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Rosacea: Diagnosis



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Papulopustular rosacea

- Central facial erythema with numerous papules or pustules
- No comedonal lesions

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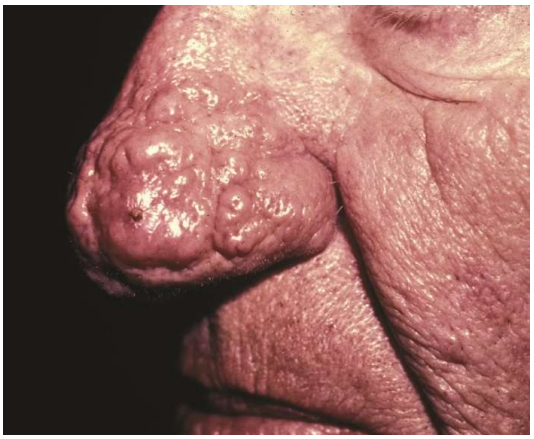
Rosacea: Diagnosis

Phymatous rosacea

- Oily, thickened skin; prominent pores; telangiectasias
- Rhinophyma: most frequent form (men)

Ocular rosacea

- Red eyes, watering, foreign body sensations, burning, and dryness
- May occur in isolation or with associated skin findings



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Rosacea: Treatment

Condition	Treatment
Erythrotelangiectatic rosacea	Trigger avoidance and photoprotection Mild cleansing and moisturizing
Papulopustular rosacea	Topical metronidazole, azelaic acid, topical ivermectin, oral tetracyclines
Ocular rosacea	Eyelash hygiene/artificial tears Oral tetracyclines
Severe rhinophyma	Laser therapy or surgery

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Dermatology I

- Answers to Multiple-Choice Questions

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Dermatology Q1

A 26-year-old woman with atopic dermatitis has had acute worsening of her rash and itching during the past week despite use of petrolatum and triamcinolone ointment treatment. She is otherwise well. Exam shows eczematous plaques with scattered pustules and honey-colored crusting in the areas of rash and pruritus.

Which of the following is the most likely cause of this patient's worsening rash?

A: Herpes simplex virus infection

B: Soap allergy

C: *Staphylococcus aureus* superinfection

D: Topical glucocorticoids

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Dermatology Q2

A 46-year-old woman reports a 4-day history of an intensely pruritic rash after using a new facial moisturizer that contains fragrance. Medical history is otherwise unremarkable. Exam reveals eczematous-appearing patches with a few fine vesicles on the cheeks and neck.

Which of the following is the most appropriate and safest topical glucocorticoid treatment?

A: Betamethasone dipropionate

B: Clobetasol propionate

C: Desoximetasone

D: Hydrocortisone

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Dermatology Q3

A 53-year-old woman reports an acute, pruritic rash on her legs without fever or drainage. She has chronic venous insufficiency.

Which of the following is the most likely diagnosis?

A: Acute stasis dermatitis

B: Cellulitis

C: Contact dermatitis

D: Deep venous thrombosis

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Dermatology Q4

A 65-year-old man reports a 3-year history of bilateral progressive discomfort, discoloration, and swelling of his legs. His symptoms are worse at the end of the day. Pedal pulses are normal. BMI is 32. Vital signs are normal.

Which of the following is the best management for this patient?

A: Cephalexin

B: Compression stockings

C: Furosemide

D: Skin biopsy

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Dermatology Q5

A 60-year-old woman has had an ulcer over the right lateral malleolus for several weeks. The ulcer is painful and is worse with leg elevation and improved with the leg in a dependent position. She has claudication, hypertension, hyperlipidemia, and a 40-pack-year smoking history.

Which of the following is the most likely diagnosis?

A: Arterial ulcer

B: Neuropathic ulcer

C: Pyoderma gangrenosum

D: Venous ulcer

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Dermatology Q6

A 55-year-old man has a rash on over half of his body and mouth sores after starting carbamazepine. Temperature is 102.9 °F, BP is 110/60 mm Hg, and pulse rate is 116/min.

Which of the following is the most appropriate treatment?

A: Hospitalization and discontinuation of carbamazepine

B: Infliximab

C: Intravenous methylprednisolone

D: Intravenous vancomycin and ceftriaxone

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Dermatology Q7

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Which of the following is the most likely diagnosis?

A: Acute urticaria

B: Angioedema

C: Erythema multiforme

D: Hereditary angioedema

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Dermatology Q8

A 41-year-old man reports “pimples” on his cheeks and facial redness that worsens in the sun, after he drinks coffee, and after showering. His skin is not itchy or painful.

Which of the following is the most likely diagnosis?

A: Acute cutaneous lupus erythematosus

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Dermatology II

2025 Virtual/Live Internal Medicine Board Review

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ACP Internal Medicine Board Review Course

Dermatology II

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- Dermatophytosis (tinea)
- Warts, corns, and skin tags
- Seborrheic keratosis
- Actinic keratosis
- Squamous cell carcinoma of the skin
- Basal cell carcinoma of the skin
- Melanoma

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Dermatology Q9

A 64-year-old man reports an acute painful rash.

He has mild psoriasis and recently completed a course of prednisone for asthma exacerbation.

Temperature is 38.9 °C (102.0 °F).

Exam shows erythema on >90% of his body.

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Dermatology Q9

A 64-year-old man reports an acute painful rash. He has mild psoriasis and recently completed a course of prednisone for asthma exacerbation. Temperature is 38.9 °C (102.0 °F). Exam shows erythema on >90% of his body.

Which of the following is the most likely diagnosis?

A: *Candida albicans* infection

B: Erythrodermic psoriasis

C: Sweet syndrome

D: Toxic shock syndrome

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Psoriasis

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Plaque Psoriasis: Diagnosis

- Most common form of psoriasis
- Well-circumscribed papules and plaques with silvery white scale



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Plaque Psoriasis: Diagnosis



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- Pinpoint bleeding after removal of scale
- Extensor surfaces, buttocks, scalp, trunk

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Plaque Psoriasis: Diagnosis

- Nail psoriasis: nail pitting (most common), onycholysis, “oil spots”
- New-onset, severe psoriasis: Consider testing for HIV infection





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Inverse Psoriasis: Diagnosis

- Erythematous plaques with minimal scale
- Skin folds or flexural surfaces

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Guttate Psoriasis: Diagnosis

- Sudden onset (eruptive)
- Small, drop-like pink papules with fine scale
- Trunk and proximal extremities
- Can appear several weeks after group A streptococcal pharyngitis
- Occurs most often in children and adolescents



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Erythrodermic Psoriasis: Diagnosis

- Generalized erythema
- Painful or itchy
- Patients often have history of psoriasis
- Recent glucocorticoid use, abrupt discontinuation of antipsoriatic drugs

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Psoriasis: Treatment

Manage cardiovascular (CV) risk factors

- Psoriasis associated with increased CV risk and metabolic syndrome

Smoking cessation

- Smoking increases risk for developing or worsening psoriasis

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Psoriasis: Treatment

Disease severity	Treatment options
Mild to moderate plaque disease	• Emollients • Topical glucocorticoids
Widespread (>10% body surface area), recalcitrant, or severe disease	• Nonbiologic: methotrexate, acitretin, cyclosporine, apremilast (PDE4 inhibitor) • Narrow-band ultraviolet B phototherapy • Biologics: Tumor necrosis factor inhibitors, interleukin (-17, -23, -12/23) inhibitors

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Dermatology Q10

A 55-year-old man reports an itchy, scaly eruption on the medial arm of 3 months' duration.

It initially improved after treatment with over-the-counter hydrocortisone but recurred when the cream was discontinued for several days.

Skin findings are shown.



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Dermatology Q10

A 55-year-old man reports an itchy, scaly eruption on the medial arm of 3 months' duration. It initially improved after treatment with over-the-counter hydrocortisone but recurred when the cream was discontinued for several days.

Which of the following is the most likely diagnosis?

A: Atopic dermatitis

B: Nummular dermatitis

C: Psoriasis

D: Tinea corporis

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Dermatophytosis (Tinea)

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Tinea Corporis: Diagnosis



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- Annular, scaly patches with central clearing
- Varying degrees of inflammation

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Tinea Corporis: Diagnosis

- Pruritus or burning
- May be asymptomatic





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Tinea Pedis: Diagnosis

- Interdigital scale and maceration
- Scale and erythema on soles, sides of feet
- One hand, two feet involvement



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Tinea Cruris and Capitis: Diagnosis

Tinea cruris

- Erythematous, arciform, or polycyclic plaques
- Thighs, perineum, perianal region, buttocks



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Tinea capitis

- Small broken hairs
- Occipital adenopathy



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Tinea Manuum: Diagnosis





- Annular, scaly patches/plaques on dorsal hand
- Palmar hyperkeratosis
- Typically unilateral

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Dermatophytosis: Treatment

Non–hair-bearing skin with limited involvement

- Topical imidazoles (miconazole, clotrimazole, ketoconazole)
- Topical allylamine, benzylamine (terbinafine, naftifine)

Hair-bearing skin or extensive involvement

- Oral antifungals (terbinafine, itraconazole)

Avoid

- Combined topical antifungals and glucocorticoids
- Oral ketoconazole (liver failure)

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Warts, Corns, and Skin Tags

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Warts: Diagnosis

- Flesh-colored, exophytic, hyperkeratotic papules or nodules
- Obscure skin lines
- Pared-down lesions reveal thrombosed capillaries



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Warts: Treatment

Treat for cosmetic reasons or functional impairment

Plantar, palmar warts

- Topical salicylic acid
- Liquid nitrogen

Anogenital warts/condyloma (human papillomavirus [HPV]-caused)

- Imiquimod
- Liquid nitrogen

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Corns: Diagnosis and Treatment

Diagnosis

- Locally thickened stratum corneum
- Sides or tops of toes, soles: often painful
- Pushing on corn elicits pain
- Skin lines retained

Treatment

- Mechanical paring or salicylic acid
- Removing pressure from site prevents reformation

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Skin Tags: Diagnosis and Treatment



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Diagnosis

- Skin-colored, soft, pedunculated papules
- Neck, axilla, inguinal areas

Treatment

- Most require no treatment
- Cryotherapy or snip excision

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Dermatology Q11

A 78-year-old man reports a 5-year history of irregularly pigmented "bumps" on the back that are mostly asymptomatic but occasionally pruritic.

He thinks the lesions may be getting larger.

Skin findings are shown.



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Dermatology Q11

A 78-year-old man reports a 5-year history of irregularly pigmented “bumps” on the back that are mostly asymptomatic but occasionally pruritic. He thinks the lesions may be getting larger. On exam, lesions are raised and waxy in appearance.

Which of the following is the most likely diagnosis?

A: Atypical nevi

B: Melanomas

C: Seborrheic keratoses

D: Solar lentigines

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Seborrheic Keratosis

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Seborrheic Keratosis: Diagnosis



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- Common in older adults
- Painless, slow-growing
- Round or oval, well demarcated
- Early lesions: light tan macule
- Mature lesions: "stuck-on" waxy, brown-to-tan plaque
- Face, trunk, upper extremities

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Actinic Keratosis

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Actinic Keratosis: Diagnosis



Poorly defined, erythematous macules/papules with adherent scale

- Feel gritty like “sandpaper”

Precancerous

Sun-exposed areas

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Actinic Keratosis: Treatment

Treatment prevents squamous cell skin cancers

Isolated lesions

- Cryotherapy
- Curettage with electrodessication

Multiple lesions

- Topical fluorouracil, imiquimod
- Photodynamic therapy



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Dermatology Q12

A 68-year-old woman reports a rapidly growing, firm lower-lip lesion of 6 months' duration.

She has no enlarged lymph nodes.

She has a 40-pack-year smoking history and significant sun exposure history.

Skin findings are shown.



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Dermatology Q12

A 68-year-old woman reports a rapidly growing, firm lower-lip lesion of 6 months' duration. She has no enlarged lymph nodes. She has a 40-pack-year smoking history and significant sun exposure history.

Which of the following is the most appropriate next step in management?

A: Bacterial culture

B: Biopsy

C: Cryotherapy

D: Electrodesiccation and curettage

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Squamous Cell Carcinoma of the Skin

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Squamous Cell Carcinoma: Risk Factors

- Ultraviolet (UV) light and ionizing radiation
- HPV infection
- Immunosuppression
- Inflammatory skin diseases/previous cutaneous injury

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Squamous Cell Carcinoma: Risk Assessment

High-risk lesions

- Ear, genitalia, or nonglabrous lip location
- Tumor diameter >2 cm
- Tumor thickness ≥6 mm
- Poorly differentiated
- Perineural invasion

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Squamous Cell Carcinoma: Diagnosis

SCC in situ (Bowen disease)

- Circumscribed, thin, pink and tan plaques with keratotic surface

Invasive SCC

- Firm, pink papules, plaques, nodules
- May ulcerate, bleed, crust





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Squamous Cell Carcinoma: Diagnosis

Keratoacanthoma

- Rapidly growing erythematous nodule (volcaniform or crateriform)
- Central plug of scale and crust
- May spontaneously involute

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Squamous Cell Carcinoma: Testing and Treatment

- Shave, excisional, or punch biopsy
- Surgical excision
- Mohs surgery
- Radiation therapy
- Intralesional chemotherapy (5-FU, methotrexate) off-label
- Cemiplimab (advanced/metastatic)

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Dermatology Q13

A 75-year-old man has a lesion on the anterior portion of his left ear.

The lesion has been slowly enlarging for the past year.

Skin findings are shown.



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Dermatology Q13

A 75-year-old man has a lesion on the anterior portion of his left ear. The lesion has been slowly enlarging for the past year.

Which of the following is the most likely diagnosis?

A: Actinic keratosis

B: Basal cell carcinoma

C: Melanoma

D: Squamous cell carcinoma

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Basal Cell Carcinoma of the Skin

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Basal Cell Carcinoma



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- Most common type of skin cancer
- UV light exposure: major risk factor
- Rarely metastasizes
- May cause significant tissue destruction

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Basal Cell Carcinoma: Diagnosis

Nodular (most common)

- Pearly nodule/papule with telangiectasias
- ± Central depression/ulceration with rolled border



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Superficial

- Pink-red patch with or without scale
- ± Slight threadlike, pearly rolled border



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Basal Cell Carcinoma: Diagnosis





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Pigmented

- Most common in dark skin
- Shiny blue-black papules, nodules, plaques
- Translucent with dark speckles and rolled border

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Basal Cell Carcinoma: Diagnosis

Sclerotic (morpheaform)

- Least common; aggressive subtype
- Atrophic plaques/papules
- Resembles a scar





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Basal Cell Carcinoma: Testing and Treatment

- Shave or punch biopsy
- Excision
- Mohs surgery → tissue conservation
- Electrodessication and curettage

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Dermatology Q14

A 72-year-old man reports an asymptomatic, slowly enlarging brown patch on his cheek that has been present "for a long time." The patient is a retired farmer.

On physical exam, the lesion is flat and smooth, with multiple shades of brown (as shown).



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Dermatology Q14

A 72-year-old man reports an asymptomatic, slowly enlarging brown patch on his cheek that has been present "for a long time." The patient is a retired farmer. On physical exam, the lesion is flat and smooth, with multiple shades of brown.

Which of the following is the most likely diagnosis?

A: Lentigo maligna melanoma

B: Pigmented actinic keratosis

C: Seborrheic keratosis

D: Solar lentigo

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Melanoma

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Melanoma: Risk Factors



- UV sunlight, sunburns
- Family history; *CDKN2A*, *CDK4* gene mutations
- Large number of nevi
- Dysplastic nevi
- Fair skin

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Melanoma: Diagnosis

- **A** – Asymmetry
- **B** – Border irregularities
- **C** – Color variation
- **D** – Diameter >6 mm
- **E** – Evolving

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Melanoma: Diagnosis

Superficial spreading melanoma

- Most common
- Macule or plaque with lateral growth



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Nodular melanoma

- Blue/black, smooth, or eroded
- Rapid vertical growth



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Melanoma: Diagnosis

Acral lentiginous melanoma

- Ill-defined macule
- Most common subtype in darkly pigmented skin
- Palms, soles of feet, distal fingers/toes



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Melanoma: Diagnosis



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Lentigo maligna/lentigo maligna melanoma

- Ill-defined macule or patch
- Older person
- Face, neck, or upper trunk

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Melanoma: Factors Associated With Poor Prognosis

- Increased tumor thickness (Breslow depth)
- Ulceration
- Increased tumor mitotic rate



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Melanoma: Testing and Treatment

Complete excisional biopsy

Superficial lesions: wide local excision only (punch or shave biopsy inadequate)

- Margin based on tumor depth
- Often necessitates re-excision of biopsy site

Deeper lesions: wide excision + sentinel lymph node (SLN) biopsy

- Complete lymph node dissection
  - Depends on whether SLN biopsy is (+) and burden of disease in SLN

Metastatic: BRAF/MEK inhibitors, immunotherapy

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Dermatology II

- Answers to Multiple-Choice Questions

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Dermatology Q9

A 64-year-old man reports an acute painful rash. He has mild psoriasis and recently completed a course of prednisone for asthma exacerbation. Temperature is 38.9 °C (102.0 °F). Exam shows erythema on >90% of his body.

Which of the following is the most likely diagnosis?

A: *Candida albicans* infection

B: Erythrodermic psoriasis

C: Sweet syndrome

D: Toxic shock syndrome

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Dermatology Q10

A 55-year-old man reports an itchy, scaly eruption on the medial arm of 3 months' duration. It initially improved after treatment with over-the-counter hydrocortisone but recurred when the cream was discontinued for several days.

Which of the following is the most likely diagnosis?

A: Atopic dermatitis

B: Nummular dermatitis

C: Psoriasis

D: Tinea corporis

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Dermatology Q11

A 78-year-old man reports a 5-year history of irregularly pigmented “bumps” on the back that are mostly asymptomatic but occasionally pruritic. He thinks the lesions may be getting larger. On exam, lesions are raised and waxy in appearance.

Which of the following is the most likely diagnosis?

A: Atypical nevi

B: Melanomas

C: Seborrheic keratoses

D: Solar lentigines

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Dermatology Q12

A 68-year-old woman reports a rapidly growing, firm lower-lip lesion of 6 months' duration. She has no enlarged lymph nodes. She has a 40-pack-year smoking history and significant sun exposure history.

Which of the following is the most appropriate next step in management?

A: Bacterial culture

B: Biopsy

C: Cryotherapy

D: Electrodesiccation and curettage

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Dermatology Q13

A 75-year-old man has a lesion on the anterior portion of his left ear. The lesion has been slowly enlarging for the past year.

Which of the following is the most likely diagnosis?

A: Actinic keratosis

B: Basal cell carcinoma

C: Melanoma

D: Squamous cell carcinoma

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66

Dermatology Q14

A 72-year-old man reports an asymptomatic, slowly enlarging brown patch on his cheek that has been present “for a long time.” The patient is a retired farmer. On physical exam, the lesion is flat and smooth, with multiple shades of brown.

Which of the following is the most likely diagnosis?

A: Lentigo maligna melanoma

B: Pigmented actinic keratosis

C: Seborrheic keratosis

D: Solar lentigo

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Rheumatology I

2025 Virtual/Live Internal Medicine Board Review

Seetha U. Monrad, MD
Clinical Professor of Internal Medicine, Rheumatology
Clinical Professor of Learning Health Sciences
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ACP Internal Medicine Board Review Course

Rheumatology I

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Table of Contents: Rheumatology

- Gout
- Pseudogout
- Osteoarthritis
- Rheumatoid arthritis
- Infectious arthritis

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Rheumatology Q1

A 72-year-old man reports acute left knee pain and swelling.

He has diabetes and CKD.

Exam shows swelling, redness, warmth, and tenderness of the left knee.

Serum creatinine level is 1.7 mg/dL.

Synovial fluid demonstrates intracellular urate crystals and negative Gram stain.

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Rheumatology Q1

A 72-year-old man reports acute left knee pain and swelling. He has diabetes and CKD. Exam shows swelling, redness, warmth, and tenderness of the left knee. Serum creatinine level is 1.7 mg/dL. Synovial fluid demonstrates intracellular urate crystals and negative Gram stain.

Which of the following is the most appropriate initial treatment to relieve his knee pain?

A: Allopurinol

B: High-dose colchicine

C: Indomethacin

D: Intra-articular glucocorticoids

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Gout

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Gout: Disease of Hyperuricemia

Risk factors

- Age
- Male sex
- Genetics + family history
- Metabolic syndrome, obesity
- CKD
- Alcohol use
- Medications (diuretics)

Epidemiology

- Men in 4th to 5th decade
- Postmenopausal women

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Gout: Presentation and Diagnosis

Acute intermittent gout

- Great toe (podagra): 50% of initial attacks
- Other joints include forefoot, ankles, knees, fingers, wrist, elbow
- Nocturnal onset
- Fever, erythema, swelling, significant pain

Intercritical gout: asymptomatic period between attacks

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Gout: Presentation and Diagnosis

Chronic gouty arthritis

- Increasingly severe/frequent attacks
- Arthritis may become persistent, polyarticular
- Soft tissue involvement (cellulitis mimic, bursitis)

Tophaceous gout

- Chronic gouty arthritis + tophi
- Tophi on extensor elbows, Achilles tendon, fingers

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Gout: Synovial Fluid Testing

Leukocyte count >2,000-100,000/µL

- Neutrophil predominance

Urate crystal

- Needle-shaped, negatively birefringent

Acute gout

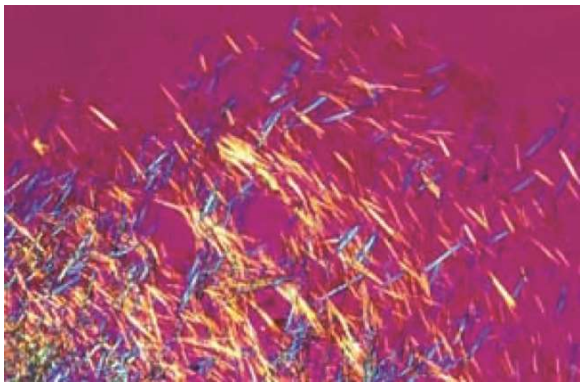
- Intracellular (leukocyte) crystals

Intercritical gout

- Crystals still present

Gram stain and culture

- Diagnose concomitant infection



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Gout: Testing

Serum urate

- Normal level does not exclude diagnosis

↑ CRP level, ↑ ESR, leukocytosis

- Nonspecific findings

Imaging

- Plain films (chronic gout) → erosions with overhanging cortical bone
- Uncertain diagnosis or arthrocentesis not possible
- Ultrasound → double contour sign
- Dual-energy CT scan → MSU deposits

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Gout: Management (Nonpharmacologic and Pharmacologic)

Nonpharmacologic – ↓ Acute gout risk	Pharmacologic – Anti-Inflammatory
Discontinue diuretics; consider losartan (uricosuric agent) Weight loss Dietary modifications: reduce • Alcohol • High-purine foods • High-fructose corn syrup	Glucocorticoids (oral, intra-articular) NSAIDs Oral colchicine • Dose adjustments/avoidance in kidney or liver impairment • Coadministration with CYP3A4 inhibitors or P-glycoprotein inhibitors contraindicated

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Gout: Pharmacologic Treatment (Antihyperuricemic)

Serum urate level target <6 mg/dL

Allopurinol: first-line therapy

Indications

- ≥2 attacks in a year
- 1 attack + serum urate level >9 mg/dL, stage ≥3 CKD, or nephrolithiasis
- Tophi
- Radiographic signs of chronic gout

Concomitant low-dose colchicine, NSAIDs, or prednisone for prophylaxis against acute attacks



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Gout: Pharmacologic Treatment (Other Urate-Lowering Medications)

Febuxostat → patients intolerant of allopurinol; boxed warning

Probenecid → unless moderate to severe CKD (stage ≥3)

IV pegloticase → severe recurrent or tophaceous gout

- Oral drug failure
- Risk for severe allergic reactions

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Rheumatology Q2

An 80-year-old woman has acute right knee pain.

She is afebrile.

The right knee is swollen, warm, tender, and erythematous.

Synovial fluid analysis reveals a leukocyte count of 25,000/µL; intracellular, positively birefringent, rhomboid-shaped crystals; and negative Gram stain.

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Rheumatology Q2

An 80-year-old woman has acute right knee pain. She is afebrile. The right knee is swollen, warm, tender, and erythematous. Synovial fluid analysis reveals a leukocyte count of 25,000/µL; intracellular, positively birefringent, rhomboid-shaped crystals; and negative Gram stain. Estimated GFR is normal.

Which of the following is the most appropriate treatment?

A: Allopurinol

B: Colchicine

C: Intra-articular triamcinolone

D: Probenecid

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Pseudogout (CPPD Disease)

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Calcium Pyrophosphate Deposition (CPPD) Disease

Mostly idiopathic/result of trauma: increasing prevalence with age

Can also be due to metabolic disorders

- Hemochromatosis
- Hyperparathyroidism
- Hypomagnesemia/hypophosphatasia
- Gout

NOT due to hyperuricemia

Can present like gout ("pseudogout")

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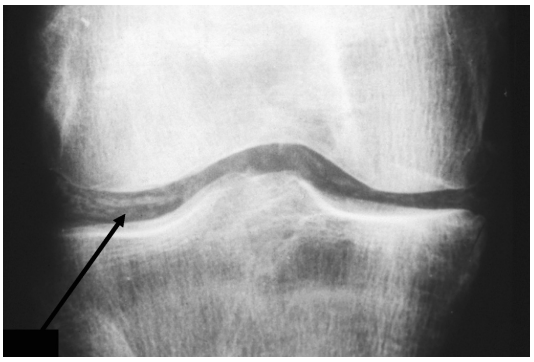
Acute Pseudogout: Diagnosis and Testing

Acute monoarticular inflammatory arthritis

Synovial fluid

- Leukocyte count >2000-100,000/µL; neutrophil predominance
- CPP crystals
  - Rhomboid shaped
  - Weakly positively birefringent or not birefringent
- Gram stain, culture used to diagnose concomitant infection

Imaging may show chondrocalcinosis



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Acute Pseudogout: Treatment

Acute monoarticular CPPD disease

- Intra-articular glucocorticoids

Acute polyarticular CPPD disease

- Systemic glucocorticoids
- NSAIDs
- Colchicine

CPPD disease prophylaxis for ≥2 attacks

- Long-term colchicine

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Rheumatology Q3

A 60-year-old woman reports 5 years of finger joint swelling, morning stiffness lasting 10 minutes, and use-related pain.

She has had no other symptoms.

Exam reveals bony enlargement and tenderness of the first CMC and DIP joints.

No joint warmth, redness, or effusions are noted.

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Rheumatology Q3

A 60-year-old woman reports 5 years of finger joint swelling, morning stiffness lasting 10 minutes, and use-related pain. She has had no other symptoms. Exam reveals bony enlargement and tenderness of the first CMC and DIP joints. No joint warmth, redness, or effusions are noted.

Which of the following is the most appropriate next test?

A: Antinuclear antibodies

B: Radiography of the hands

C: Rheumatoid factor

D: No further testing

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Osteoarthritis (OA)

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Osteoarthritis: Risk Factors

- Age >55 years
- Obesity
- Female sex
- Joint injury (overuse or trauma)
- Malalignment
- Cartilage defects

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Osteoarthritis: Diagnosis

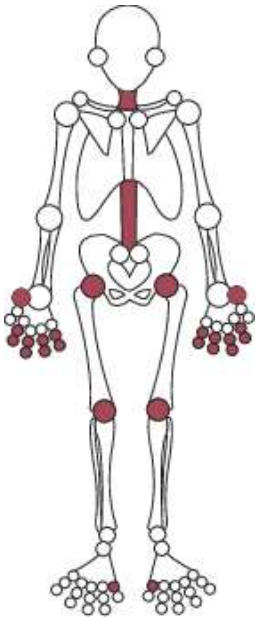
Distribution

- Spine, hips, knees
- DIP, PIP, first CMC joints
- First MTP joint, mid-foot

Morning stiffness <30 min

Stiffness after inactivity

Pain with activity



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Osteoarthritis: Diagnosis



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Joint line tenderness

Decreased ROM

Bony hypertrophy

- "Squaring" of base of thumb (CMC joint)

Secondary osteoarthritis → may be present in atypical joints

- CPPD

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Osteoarthritis: Testing

Laboratory testing

- Not necessary for diagnosis (high value care)
- Indicated if other causes probable

Synovial fluid analysis

- Not necessary for diagnosis
- Indicated if other causes probable
- Leukocyte count ≤2000/µL; <25% neutrophils

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Osteoarthritis: Testing

Radiography

- Asymmetric joint-space narrowing (JSN)
- Subchondral sclerosis (SS)
- Bone cysts (BC)
- Osteophytes (OP)

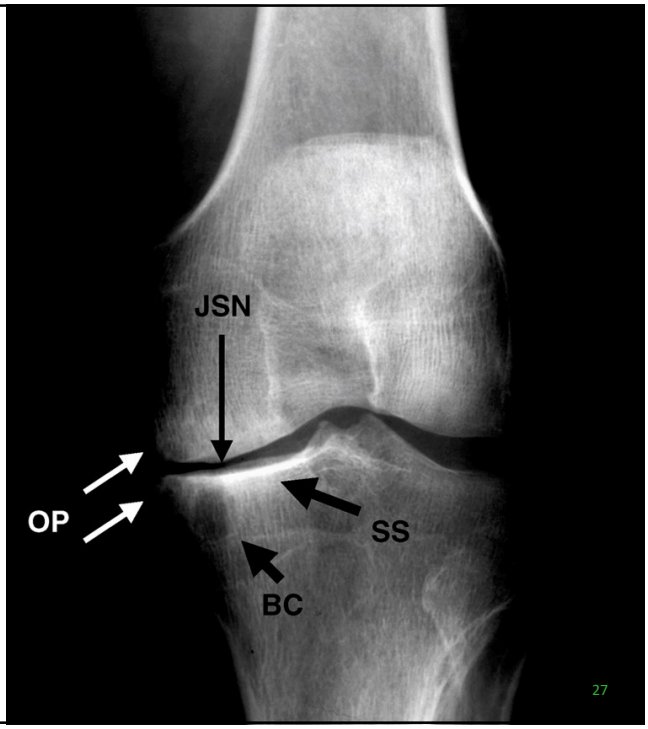


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Erosive Osteoarthritis: Diagnosis and Testing

Subset of primary hand osteoarthritis

DIP and PIP joints

- Erythema, swelling
- More common in women

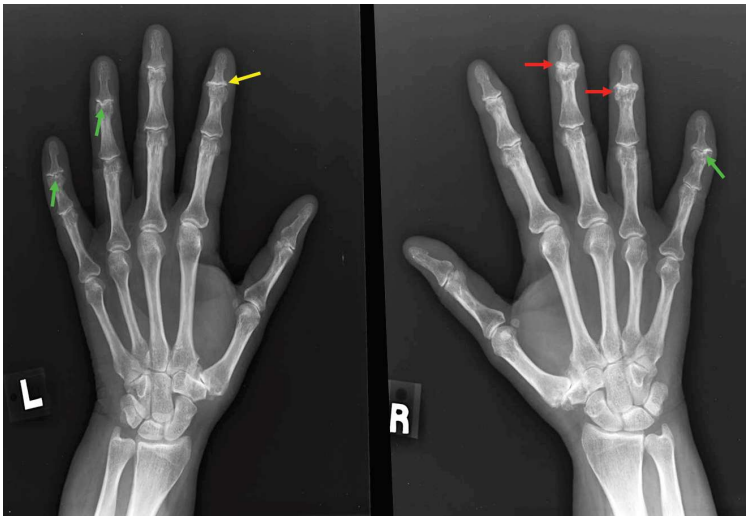
Radiography

- "Gull-wing" appearance of interphalangeal joints
- Joint ankylosis (bony fusion)

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Erosive Osteoarthritis: Testing



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Rheumatology Q4

A 76-year-old woman is evaluated for chronic, use-related left knee pain.

BMI is 32. Left knee exam reveals a small effusion without redness or warmth, crepitus, and tenderness to palpation along the medial joint line.

Knee radiographs reveal medial tibiofemoral compartment joint-space narrowing and sclerosis along with small medial osteophytes.

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Rheumatology Q4

A 76-year-old woman is evaluated for chronic, use-related left knee pain. BMI is 32. Left knee exam reveals a small effusion without redness or warmth, crepitus, and tenderness to palpation along the medial joint line. Knee radiographs reveal medial tibiofemoral compartment joint-space narrowing and sclerosis along with small medial osteophytes.

Which of the following is the most appropriate treatment?

A: Acetaminophen

B: Glucosamine

C: Oxycodone

D: Weight loss and exercise

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Osteoarthritis Nonpharmacologic Treatments: ACR Strong Recommendations (2019 guidelines)

Intervention	Hand	Knee	Hip
Exercise	Yes	Yes	Yes
Balance training		Yes	Yes
Tai chi		Yes	Yes
Weight loss		Yes	Yes
Self-management	Yes	Yes	Yes
Tibiofemoral braces		Yes	
Cane		Yes	Yes
Hand orthosis	Yes (1st CMC joint)		
TENS		No	No

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Osteoarthritis Pharmacologic Treatments: ACR Recommendations (2019 guidelines)

Intervention	Hand	Knee	Hip
Topical NSAIDs	Conditional	Strong	
Topical capsaicin	Conditional No	Conditional	
Oral NSAIDs	Strong	Strong	Strong
Acetaminophen	Limited efficacy	Conditional	Conditional
Duloxetine	Conditional	Conditional	Conditional
Tramadol	Conditional	Conditional	Conditional
IA glucocorticoids	Conditional	Strong	Strong
Glucosamine	Strong No	Strong No	Strong No
Chondroitin	Conditional	Strong No	Strong No

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Rheumatology Q5

A 30-year-old woman is evaluated for progressive bilateral foot, hand, and wrist pain associated with 90 minutes of morning stiffness.

Her exam shows tenderness and swelling of the second and fifth PIP joints bilaterally, the second and third MTP joints bilaterally, and the right wrist.

Radiographs are normal.

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Rheumatology Q5

A 30-year-old woman is evaluated for progressive bilateral foot, hand, and wrist pain associated with 90 minutes of morning stiffness. Her exam shows tenderness and swelling of the second and fifth PIP joints bilaterally, the second and third MTP joints bilaterally, and the right wrist. Radiographs are normal.

Which of the following tests will be most helpful in confirming the diagnosis?

A: Anti–cyclic citrullinated peptide antibodies and antinuclear antibodies

B: Antinuclear antibodies and C-reactive protein

C: Anti–cyclic citrullinated peptide antibodies and rheumatoid factor

D: Antinuclear antibodies and rheumatoid factor

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Rheumatoid Arthritis (RA)

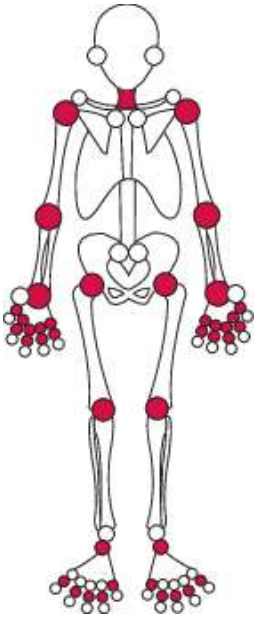
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Rheumatoid Arthritis

Symmetric inflammatory polyarthritis

- Soft-tissue swelling: synovitis or effusion
- PIPs, MCPs, wrists, elbows, knees, ankles, MTPs
- Proximal joints including hips and shoulders may also be involved
- Cervical spine involvement may cause neurologic pathology

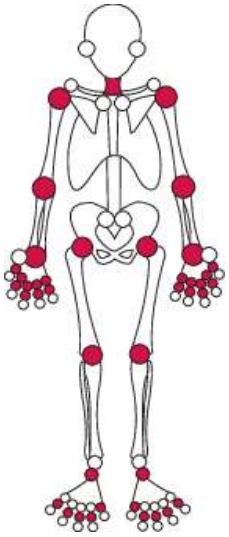


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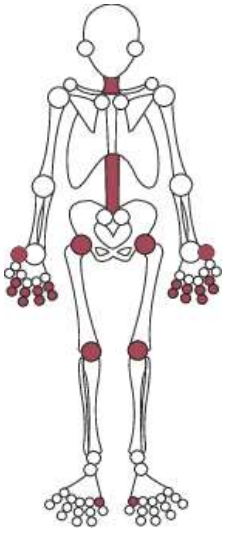
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Rheumatoid Arthritis



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Osteoarthritis



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Rheumatoid Arthritis: Diagnosis

Symptoms

- Inflammatory joint pain
- Morning stiffness >1 hour
- Symptoms present for >6 weeks

Clinical features

- Synovitis
- Visible and palpable joint swelling
- Joint tenderness



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Rheumatoid Arthritis: Testing

Laboratory studies

- Positive rheumatoid factor and positive anti-CCP antibody
- ↑ ESR/CRP level

Synovial fluid

- Leukocyte count of 2000-100,000/µL

Radiographic findings

- Periarticular osteopenia
- Marginal joint erosions
- Symmetric joint-space narrowing



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Rheumatoid Arthritis: Treatment

Symptom management: anti-inflammatories

- NSAIDs
- Short courses of glucocorticoids

Nonbiologic DMARDs

- Methotrexate
- Combination therapy with methotrexate, hydroxychloroquine, and sulfasalazine (triple DMARD therapy)

Biologic therapy: most commonly TNF inhibitors

- Indicated if disease not controlled with oral DMARDs

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Rheumatology Q6

A 61-year-old man is evaluated for a 6-month history of nonproductive cough. He has long-standing seropositive RA controlled with methotrexate.

Vital signs and cardiac exam are normal. Fine bibasilar inspiratory crackles, chronic RA changes in his hands, and a rubbery nodule overlying the left elbow are noted.

CBC (with platelet and differential) and chest radiograph are normal.

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Rheumatology Q6

A 61-year-old man is evaluated for a 6-month history of nonproductive cough. He has a 20 pack-year smoking history and long-standing seropositive RA controlled with methotrexate. Vital signs and cardiac exam are normal. Fine bibasilar inspiratory crackles, chronic RA changes in his hands, and a rubbery nodule overlying the left elbow are noted. CBC (with platelet and differential) and chest radiograph are normal.

What is the most appropriate next step in management?

A: Discontinuation of methotrexate

B: Echocardiography

C: High-resolution chest CT

D: Purified protein derivative skin test

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Rheumatoid Arthritis: Extra-articular Manifestations

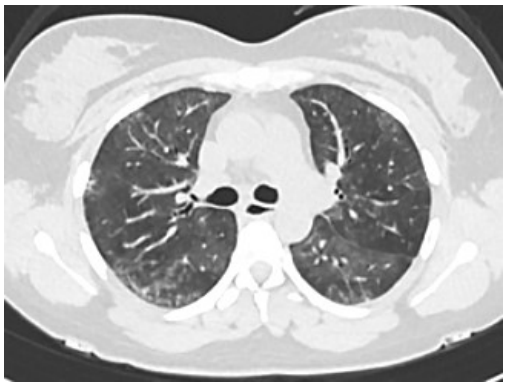
- Up to 40% of patients with RA have extra-articular manifestations
- Typically in more severe and seropositive disease; smoking
  - Smoking associated with RA-ILD (not other extra-articular manifestations)
- Associated with increased overall morbidity and premature mortality
- Many associated with systemic inflammation
  - With earlier and better treatments, some extra-articular manifestations decreasing in frequency

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Rheumatoid Arthritis: Extra-articular Manifestations

Lungs

- RA-ILD: up to 50%
  - Frequently asymptomatic; clinically significant in 10%-15% of patients with RA
  - 2-3 times more likely in men vs. women
  - Can precede joint disease



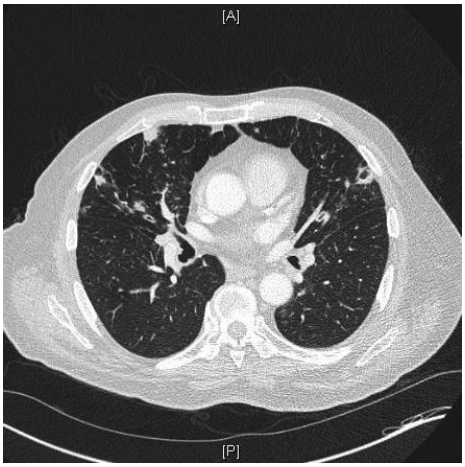
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Rheumatoid Arthritis: Extra-articular Manifestations

Lungs *(cont.)*

- Rheumatoid nodules
- Airway
  - Obliterative bronchiolitis
  - Bronchiectasis
- Pleural disease: 5%
  - Usually subclinical
  - Effusions: exudative
    - <5000/µL; lymphocytic
    - pH <7.2
    - Glucose <29 mg/dL



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Rheumatoid Arthritis: Extra-articular Manifestations

Skin

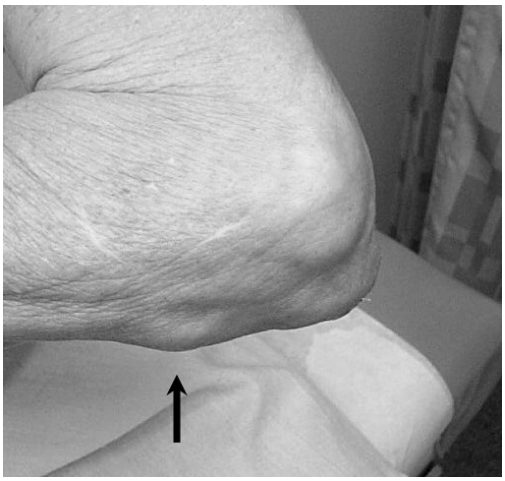
- Rheumatoid nodules (30%)

Bones

- Osteopenia/osteoporosis

Eyes

- Keratoconjunctivitis sicca (15%-40%)
- Episcleritis, scleritis



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Rheumatoid Arthritis: Extra-articular Manifestations

Cardiovascular	Hematologic
Premature atherosclerosis Vasculitis • Cutaneous • Neurologic	Anemia of inflammation Felty syndrome • Neutropenia • Splenomegaly Increased risk for B-cell lymphoma

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Rheumatology Q7

A 78-year-old man reports 24 hours of severe right knee pain. He has gout and type 2 DM; recent HgbA1C was 8.7%. His only medication is allopurinol.

Temperature is 100.7 °F. The right knee is warm, swollen, and tender.

Synovial fluid analysis shows leukocytes (100,000/µL), with negatively birefringent needle-shaped crystals. Gram stain is negative. Culture is pending.

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Rheumatology Q7

A 78-year-old man reports 24 hours of severe right knee pain. He has gout and type 2 DM; recent HgbA1C was 8.7%. His only medication is allopurinol. Temperature is 100.7 °F. The right knee is warm, swollen, and tender. Synovial fluid analysis shows leukocytes (100,000/µL), with negatively birefringent needle-shaped crystals. Gram stain is negative. Culture is pending.

Which of the following is the most appropriate treatment?

A: Colchicine

B: Intra-articular glucocorticoid injection

C: Prednisone

D: Vancomycin

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Infectious Arthritis

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Infectious Arthritis: Diagnosis

Most often bacterial

Most often hematogenous spread

Presentation

- Acute monoarthritis (including in setting of otherwise well-controlled polyarthritis)
- Gonococcal arthritis: can present with tenosynovitis, dermatitis, polyarthralgia

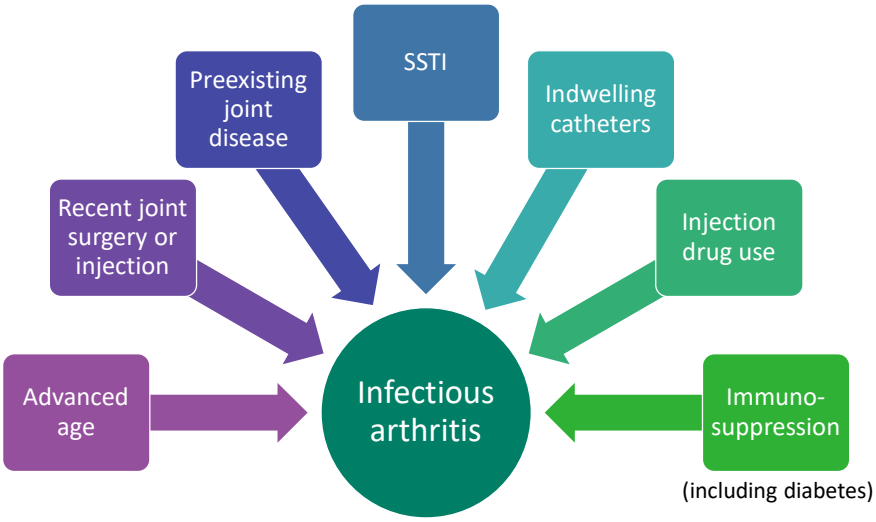
Clinical findings

- Warmth, overlying erythema (superficial joints)
- Effusion
- Pain with passive/active motion
- Newly painful joint prosthesis

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Infectious Arthritis: Risk Factors



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Infectious Arthritis: Testing

↑ ESR, CRP level, leukocyte count

- Infection and/or crystalline arthritis

Synovial fluid leukocyte count >50,000/µL

- Infection or crystalline arthritis
- >100,000/µL is highly specific for infection
- **Crystals do not exclude infection**

Blood cultures → 50% positive

Suspected gonococcal arthritis

- NAAT of urine, rectum, pharynx, vagina

Radiograph or ultrasound

- Normal early
- Late cortical bone destruction
- Prosthetic joint loosening

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Infectious Arthritis: Treatment

Immediate antibiotic treatment, modified by culture

Empiric antibiotics → Gram stain negative, culture pending/negative

- Vancomycin → immunocompetent
- Vancomycin + ceftazidime → immunocompromised, injection drug use
- Ceftriaxone + doxycycline → risk for *Neisseria gonorrhoeae* (presumptive chlamydia coverage)

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Infectious Arthritis: Treatment

Complete joint drainage

- Repeated needle aspiration, arthroscopy, arthrotomy

Infected prosthetic joints

- Prolonged antibiotics
  - At least 6 weeks and dependent on surgical management
- Debridement and prosthetic retention
- Removal of prosthesis ± reimplantation

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Rheumatology I

- Answers to Multiple-Choice Questions

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Rheumatology Q1

A 72-year-old man reports acute left knee pain and swelling. He has diabetes and CKD. Exam shows swelling, redness, warmth, and tenderness of the left knee. Serum creatinine level is 1.7 mg/dL. Synovial fluid demonstrates intracellular urate crystals and negative Gram stain.

Which of the following is the most appropriate initial treatment to relieve his knee pain?

A: Allopurinol

B: High-dose colchicine

C: Indomethacin

D: Intra-articular glucocorticoids

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Rheumatology Q2

An 80-year-old woman has acute right knee pain. She is afebrile. The right knee is swollen, warm, tender, and erythematous. Synovial fluid analysis reveals a leukocyte count of 25,000/µL; intracellular, positively birefringent, rhomboid-shaped crystals; and negative Gram stain. Estimated GFR is normal.

Which of the following is the most appropriate treatment?

A: Allopurinol

B: Colchicine

C: Intra-articular triamcinolone

D: Probenecid

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Rheumatology Q3

A 60-year-old woman reports 5 years of finger joint swelling, morning stiffness lasting 10 minutes, and use-related pain. She has had no other symptoms. Exam reveals bony enlargement and tenderness of the first CMC and DIP joints. No joint warmth, redness, or effusions are noted.

Which of the following is the most appropriate next test?

A: Antinuclear antibodies

B: Radiography of the hands

C: Rheumatoid factor

D: No further testing

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Rheumatology Q4

A 76-year-old woman is evaluated for chronic, use-related left knee pain. BMI is 32. Left knee exam reveals a small effusion without redness or warmth, crepitus, and tenderness to palpation along the medial joint line. Knee radiographs reveal medial tibiofemoral compartment joint-space narrowing and sclerosis along with small medial osteophytes.

Which of the following is the most appropriate treatment?

A: Acetaminophen

B: Glucosamine

C: Oxycodone

D: Weight loss and exercise

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Rheumatology Q5

A 30-year-old woman is evaluated for progressive bilateral foot, hand, and wrist pain associated with 90 minutes of morning stiffness. Her exam shows tenderness and swelling of the second and fifth PIP joints bilaterally, the second and third MTP joints bilaterally, and the right wrist. Radiographs are normal.

Which of the following tests will be most helpful in confirming the diagnosis?

A: Anti–cyclic citrullinated peptide antibodies and antinuclear antibodies

B: Antinuclear antibodies and C-reactive protein

C: Anti–cyclic citrullinated peptide antibodies and rheumatoid factor

D: Antinuclear antibodies and rheumatoid factor

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Rheumatology Q6

A 61-year-old man is evaluated for a 6-month history of nonproductive cough. He has a 20 pack-year smoking history and long-standing seropositive RA controlled with methotrexate. Vital signs and cardiac exam are normal. Fine bibasilar inspiratory crackles, chronic RA changes in his hands, and a rubbery nodule overlying the left elbow are noted. CBC (with platelet and differential) and chest radiograph are normal.

What is the most appropriate next step in management?

A: Discontinuation of methotrexate

B: Echocardiography

C: High-resolution chest CT

D: Purified protein derivative skin test

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Rheumatology Q7

A 78-year-old man reports 24 hours of severe right knee pain. He has gout and type 2 DM; recent HgbA1C was 8.7%. His only medication is allopurinol. Temperature is 100.7 °F. The right knee is warm, swollen, and tender. Synovial fluid analysis shows leukocytes (100,000/µL), with negatively birefringent needle-shaped crystals. Gram stain is negative. Culture is pending.

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D: Vancomycin

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Rheumatology II

2025 Virtual/Live Internal Medicine Board Review

Seetha U. Monrad, MD
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University of Michigan
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ACP Internal Medicine Board Review Course

Rheumatology II

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Table of Contents: Rheumatology

- Fibromyalgia
- Systemic lupus erythematosus
- Systemic vasculitis
- Serum sickness
- Adult Still disease
- Mixed connective tissue disease
- Psoriatic arthritis

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Rheumatology Q8

A 35-year-old woman is evaluated for a 6-month history of generalized body aches, poor sleep, waking unrefreshed, and fatigue.

NSAIDs have provided no relief.

Exam reveals widespread pain to palpation of muscles and joints.

Laboratory studies, including TSH and CK levels, are normal.

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A 35-year-old woman is evaluated for a 6-month history of generalized body aches, poor sleep, waking unrefreshed, and fatigue. NSAIDs have provided no relief. Exam reveals widespread pain to palpation of muscles and joints. Laboratory studies, including TSH and CK levels, are normal.

Which of the following is the most appropriate treatment?

A: Hypnotherapy

B: Low-impact aerobic exercise

C: Prednisone

D: Pregabalin

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Fibromyalgia

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Fibromyalgia

- Not an inflammatory or autoimmune disease
- Not a primary disease of the musculoskeletal system
- Disorder of sensory perception and processing at the level of the CNS
- Can manifest as musculoskeletal pain

Symptoms

- Widespread chronic pain
- Disordered sleep
- Impaired cognitive function
- Exercise intolerance

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Fibromyalgia: Diagnosis

Long-standing duration

Normal labs, other evaluation

Comprehensive evaluation (exclude/address other conditions):

- Hypothyroidism, hypoadrenalism
- Depression, anxiety
- Sleep apnea, sleep disorders

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Fibromyalgia: Treatment

First-line treatment	FDA-approved drugs	Useful, off-label drugs	Do not use
• Symptom validation • CBT • Supervised aerobic exercise program	• Pregabalin • Duloxetine • Milnacipran	• TCAs • Cyclobenzaprine • Gabapentin	• Opioids • NSAIDs

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Rheumatology Q9

A 32-year-old woman is evaluated for an intermittent photosensitive rash and polyarthralgia that has recently worsened.

Physical exam shows a malar rash and tenderness and swelling of multiple PIP and MCP joints and bilateral ankles.

ANA titer is 1:320, anti-dsDNA antibodies are positive, and complement levels are low. CBC shows mild anemia, and CMP is normal. Urine dipstick with microscopy is normal.

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In addition to prednisone, which of the following is the most appropriate treatment?

A: Cyclophosphamide

B: Etanercept

C: Hydroxychloroquine

D: No additional treatment

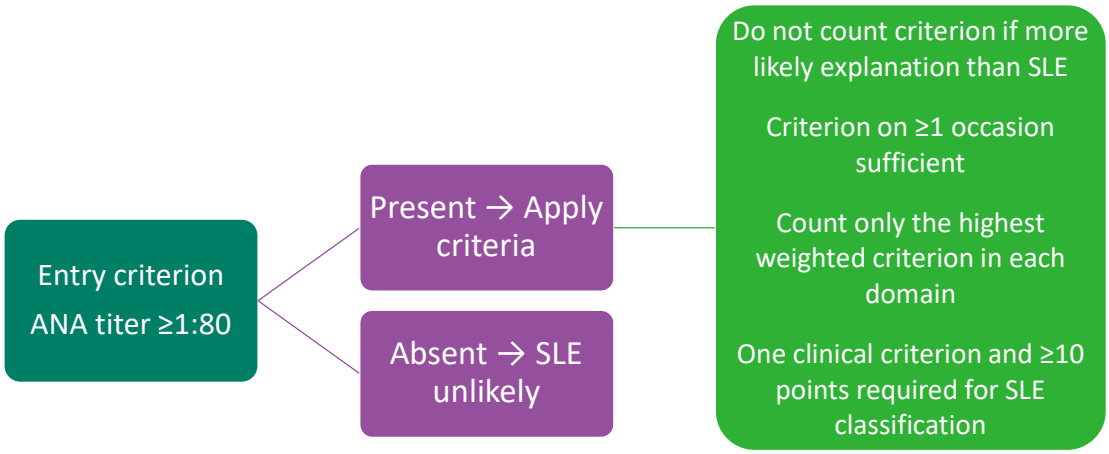
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Systemic Lupus Erythematosus (SLE)

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Systemic Lupus Erythematosus: Classification Criteria



Information from BMJ: Aringer M, Costenbader K, Daikh D, et al. 2019 European League Against Rheumatism/American College of Rheumatology classification criteria for systemic lupus erythematosus. Ann Rheum Dis. 2019;78:1151-1159. [PMID: 31383717] doi:10.1136/annrheumdis-2018-214819.

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Systemic Lupus Erythematosus: Classification Criteria

Clinical Domain	Criteria	Pts
Constitutional	Fever	2
Hematologic	Leukopenia	3
	Thrombocytopenia	4
	Autoimmune hemolysis	4
Neuropsychiatric	Delirium	2
	Psychosis	3
	Seizure	5
Mucocutaneous	Nonscarring alopecia	2
	Oral ulcers	2
	Subacute cutaneous or discoid lupus	4
	Acute cutaneous lupus	6
Serosal	Pleural or pericardial effusion	5
	Acute pericarditis	6
Musculoskeletal	Joint involvement	6
Renal	Proteinuria >0.5 g/24 h	4
	Kidney biopsy class II or V lupus nephritis	8
	Kidney biopsy class III or IV lupus nephritis	10

Immunology Domain	Criteria	Pts
Antiphospholipid antibodies	Anticardiolipin antibodies or anti-β_2-glycoprotein I antibodies or lupus anticoagulant	2
Complement proteins	Low C3 or low C4	3
	Low C3 and low C4	4
SLE-specific antibodies	Anti-dsDNA antibody or Anti-Smith antibody	6

Information from BMJ: Aringer M, Costenbader K, Daikh D, et al. 2019 European League Against Rheumatism/American College of Rheumatology classification criteria for systemic lupus erythematosus. Ann Rheum Dis. 2019;78:1151-1159. [PMID: 31383717] doi:10.1136/annrheumdis-2018-214819.

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Systemic Lupus Erythematosus: Diagnosis

ANA immunofluorescence assay >95% sensitive (not specific)

Assays for anti-dsDNA and anti-Smith antibodies are highly specific

Disease activity markers can be helpful in some cases

- Anti-dsDNA positively correlated
- Complement negatively correlated
- ANA titers do not correlate

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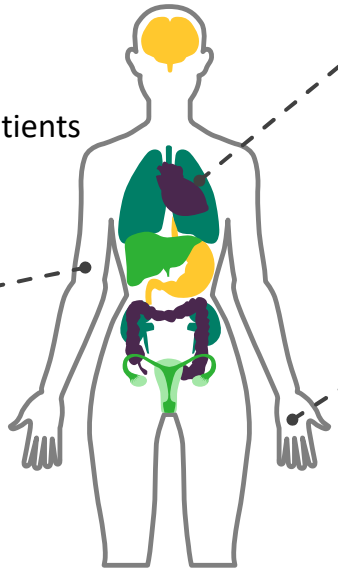
Systemic Lupus Erythematosus: Baseline Treatment

Prevention of SLE flares

- Hydroxychloroquine indefinitely in most patients
  - Pregnancy safe

Photosensitive cutaneous lupus

- Sun protection, topical glucocorticoids, hydroxychloroquine



Treat ASCVD risk factors in all patients

- CAD is common cause of death

Arthritis

- NSAIDs and hydroxychloroquine

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Rheumatology Q10

A 70-year-old man is evaluated for progressive headache, jaw discomfort, and transient vision loss of the right eye.

The right temporal artery is tender.

Laboratory studies reveal an ESR of 110 mm/h.

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Rheumatology Q10

A 70-year-old man is evaluated for progressive headache, jaw discomfort, and transient vision loss of the right eye. The right temporal artery is tender. Laboratory studies reveal an ESR of 110 mm/h.

Which of the following is the most appropriate next step in management?

A: High-dose glucocorticoids

B: Infliximab

C: Temporal artery biopsy

D: Tocilizumab

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Systemic Vasculitis



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Vasculitis Overview: Key Points

Inflammation of blood vessels; may be primary or secondary to underlying disease (malignancy, infection)

Primary vasculitides are categorized by

- Blood vessel size (large, medium, small)
- Organ involvement
- Histopathology

Presentation

- Tissue ischemia, aneurysms, hemorrhage
- Systemic symptoms and inflammatory lab studies

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Large-Vessel Vasculitis: Giant Cell Arteritis (GCA)

Age typically ≥50 years (most >70 years)

- Headache
- Scalp tenderness
- Jaw claudication
- Visual symptoms

↑ ESR and/or CRP level

33% also have polymyalgia rheumatica

Diagnosis

- Temporal artery biopsy
- Temporal artery ultrasound

Must initiate treatment immediately to prevent vision loss, CVA

- High-dose prednisone
- Tocilizumab: IL-6 antagonist

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Polymyalgia Rheumatica (PMR)

Present in 33% of patients with GCA

Can also occur as a primary condition

Age ≥50 years

- Inflammatory myalgia and stiffness of shoulder and hip girdle

↑ ESR and/or CRP level

Treatment

- Low-dose prednisone
  - Rapid and dramatic response
- Sarilumab: IL-6 antagonist

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Large-Vessel Vasculitis: Takayasu Arteritis

Young women

Nonspecific febrile prodrome

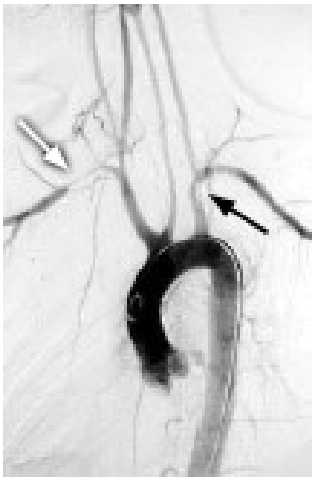
Arm/leg claudication

Pulse deficits

Asymmetric arm BP measurements

Treatment

- Prednisone
- Nonbiologic immunosuppressants
- TNF inhibitor for refractory disease
- Possible revascularization



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Medium-Vessel Vasculitis: Polyarteritis Nodosa

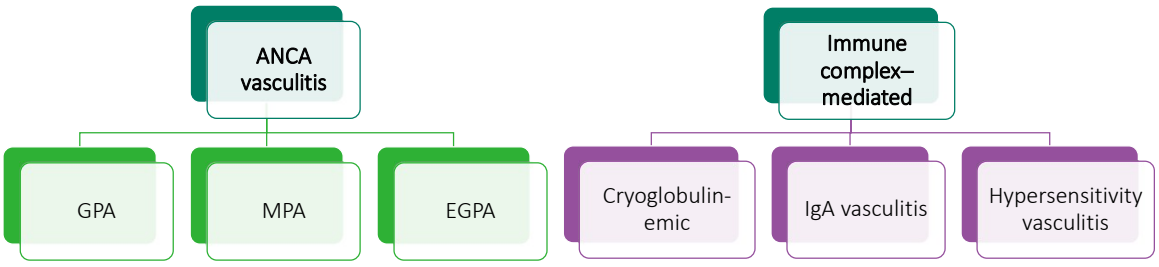
Systemic symptoms, neuropathy, arthralgia/myalgia, skin lesions, hypertension, GI pain, orchitis

Diagnosis

- Biopsy of involved tissue (skin, nerve)
- Mesenteric/kidney angiography

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Small-Vessel Vasculitis



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ANCA-Associated Vasculitis

	Common Features	Differential Findings
GPA	• Constitutional symptoms • Sinus • Lung	• Clinical: saddle nose deformity, septal perforation, ocular • Labs: (+) c-ANCA anti-proteinase 3 • Biopsy: granulomas
MPA	• Kidney • Skin	• Labs: (+) p-ANCA and anti-MPO • Biopsy: non-granulomatous
EGPA	• Peripheral nerves	• Clinical: prodrome asthma/nasal polyps; cardiac involvement • Labs: (+) p-ANCA and anti-MPO; peripheral eosinophilia • Biopsy: granulomas, tissue eosinophils

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Immune Complex–Mediated Vasculitis

	Common Features	Differential Findings
IgA vasculitis	• Skin (palpable purpura)	• Associated with preceding URI • Clinical: GI pain/bleeding, glomerulonephritis • Biopsy: IgA immune complexes
Cryoglobulinemic	 • Biopsy reveals immune complex deposition	• Associated with HCV • Clinical: peripheral nerves, membranoproliferative GN • Labs: (+) cryoglobulins, low C4, (+) RF
Hypersensitivity		• Associated with medications or infection • Clinical: isolated to skin

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Rheumatology Q11

A 48-year-old woman is evaluated for new-onset fever, diffuse rash, and worsening rheumatoid arthritis.

Medications are methotrexate and rituximab; her second infusion of rituximab was 7 days ago.

Physical exam reveals fever, purpura over the trunk and extremities, and multi-joint swelling.

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A 48-year-old woman is evaluated for new-onset fever, diffuse rash, and worsening rheumatoid arthritis. Medications are methotrexate and rituximab; her second infusion of rituximab was 7 days ago. Physical exam reveals fever, purpura over the trunk and extremities, and multi-joint swelling.

Which of the following is the most likely diagnosis?

A: Infusion reaction

B: Rheumatoid vasculitis

C: Serum sickness

D: SLE

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Serum Sickness

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Serum Sickness: Diagnosis

Foreign protein or drug exposure

Onset 1-2 weeks after exposure: Many drugs have been implicated

Fever, pruritic rash, polyarthritis, polyarthralgia

- Various types of rashes
- MCP joint, knees, wrists, ankles, shoulders



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Adult Still Disease

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Adult Still Disease

Autoinflammatory disorder

- No autoantibodies
- High inflammatory markers
- Very high ferritin

Mimics many multisystem disorders

FUO

Differential diagnosis

- Systemic infection
- Malignancy
- Systemic autoimmune diseases
- Other autoinflammatory syndromes
  - Macrophage activation syndrome (MAS)
  - Hemophagocytic lymphohistiocytosis (HLH)

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Adult Still Disease: Diagnosis

Yamaguchi criteria: Diagnosis → ≥5 criteria, including at least two major criteria

Major Criteria	Minor Criteria
1-2 times daily spiking fever (102.2 °F) returning to normal in between spikes	Lymphadenopathy and/or splenomegaly
Arthralgia/arthritis for >2 weeks	↑ AST, ALT, or LDH levels
Nonpruritic, evanescent, salmon-colored macular/maculopapular rash on trunk or extremities; seen during fever, often + Koebner phenomenon	Negative ANA Negative RF
Leukocyte count >10,000/µL, with >80% neutrophils	Sore throat

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Adult Still Disease: Treatment

Anti-inflammatories

- NSAIDs
- Glucocorticoids

Biologic agents → severe or unresponsive disease

- Canakinumab (anti-IL-1β): only FDA-approved, on-label indication
- Off-label biologic agents
  - Anakinra, rilonacept (anti-IL-1α and -1β), TNF inhibitors, tocilizumab (anti-IL-6)

Can transform to HLH/MAS

- Leukocytosis → leukopenia
- Soluble IL-2R
- Natural killer cell function
- Serum CXCL9

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Mixed Connective Tissue Disease

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Mixed Connective Tissue Disease: Diagnosis

Includes features of at least two of the following (over time, not necessarily concurrently):

- SLE
- SSc
- Autoimmune myositis

Associated with positivity for anti–U1-RNP antibodies

Clinical features

- Raynaud phenomenon
- Edema of hands
- Sclerodactyly
- Synovitis
- Myositis

Mortality largely attributable to PAH

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Mixed Connective Tissue Disease: Diagnosis

Comparison with other CTDs

- Undifferentiated CTD
  - Autoimmune signs and symptoms
    - Often Raynaud phenomenon
    - Not indicative of specific rheumatologic condition
- Overlap syndromes
  - Features of >1 rheumatologic disease *or*
  - Criteria met for ≥2 specified CTDs

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Mixed Connective Tissue Disease: Treatment

Condition	Typical Clinical Features	Diagnosis	Treatment
MCTD	• Raynaud phenomenon • Puffy fingers • Inflammatory arthritis • Sclerodactyly • Serositis • Esophageal dysmotility • Myositis • Interstitial lung disease • PAH	Anti–U1-RNP antibodies, 70-kD protein Fulfills diagnostic criteria for ≥2 of the following: SSc, autoimmune myositis, SLE	Determined by diagnoses/organs involved Vasodilators for PAH and Raynaud phenomenon PPI for esophageal disease
Undifferentiated CTD	Variable Can include Raynaud phenomenon, arthritis/arthralgias, skin rash, cytopenias, and serositis	Does not meet diagnostic criteria for any specific CTD Usually positivity for ANA, with titer >1:80	Same as for MCTD

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Psoriatic Arthritis (PsA)

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Psoriatic Arthritis

One of four categories of seronegative spondyloarthritis

- Axial spondyloarthritis (ankylosing spondylitis and nonradiographic axial spondyloarthritis)
- Reactive arthritis
- Enteropathic (IBD-associated) arthritis

Associated with HLA-B27

- Increased in PsA vs. psoriasis

Associated with dactylitis, enthesitis

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Psoriatic Arthritis: Clinical Manifestations

Arthritis

- Peripheral: oligo-, polyarthritis
  - DIPs
  - Ray pattern (rather than symmetric)
- Axial: sacroiliitis, spondylitis

Periarticular

- Enthesitis: tendon/ligament insertion
- Dactylitis: "Sausage digit"

Nail lesions: pits, onycholysis





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Psoriatic Arthritis: Diagnosis and Treatment

Diagnosis

- Physical exam
  - Psoriasis
  - Inflammatory arthritis
- Labs: nonspecific, to help exclude other disorders (RA, gout)

Treatment

- NSAIDs
- Apremilast (PDE-4 inhibitor): peripheral arthritis, enthesitis, dactylitis
- DMARDs
- Biologics
  - Similar to RA: TNF-α inhibition, JAK inhibition, abatacept (CTLA4-Ig)
  - Different than RA: IL-17 inhibition; IL-23 and -12/23 inhibition

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Rheumatology II

- Answers to Multiple-Choice Questions

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Rheumatology Q8

A 35-year-old woman is evaluated for a 6-month history of generalized body aches, poor sleep, waking unrefreshed, and fatigue. NSAIDs have provided no relief. Exam reveals widespread pain to palpation of muscles and joints. Laboratory studies, including TSH and CK levels, are normal.

Which of the following is the most appropriate treatment?

A: Hypnotherapy

B: Low-impact aerobic exercise

C: Prednisone

D: Pregabalin

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Rheumatology Q9

A 32-year-old woman is evaluated for an intermittent photosensitive rash and polyarthralgia that has recently worsened. Physical exam shows a malar rash and tenderness and swelling of multiple PIP and MCP joints and bilateral ankles. ANA titer is 1:320, anti-dsDNA antibodies are positive, and complement levels are low. CBC shows mild anemia, and CMP is normal. Urine dipstick with microscopy is normal.

In addition to prednisone, which of the following is the most appropriate treatment?

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B: Etanercept

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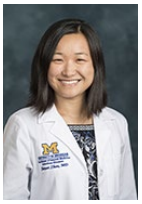
D: SLE

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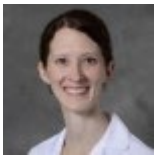
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2025 Greater Chicago Internal Medicine Board Review course
Program Schedule – In-Person and Virtual Live
Tuesday, May 13 – Saturday, May 17, 2025
Central Daylight Time

Wednesday, May 14, 2025

Time	Topic	Content	Faculty
7:00 a.m. – 8:00 a.m.	**Breakfast**		
8:00 a.m. – 8:45 a.m.	**Pulmonary Medicine I: Obstructive Lung Disease**	➢ Asthma ➢ Exercise- and Cold-Induced Asthma ➢ COPD (Chronic Bronchitis and Emphysema)	 *Madeline Lagina, MD, MPH*
8:45 a.m. – 9:45 a.m.	**Pulmonary Medicine II: Nonobstructive Lung Disease**	➢ Obstructive Sleep Apnea ➢ Obesity Hypoventilation Syndrome ➢ Solitary Pulmonary Nodule ➢ Noninfectious Pleural Effusion ➢ Infections of the Pleural Space and Empyema ➢ Pneumothorax ➢ Pulmonary Hypertension	*Madeline Lagina, MD, MPH*
9:45 a.m. – 10:45 a.m.	**Critical Care Medicine**	➢ Acute Respiratory Distress Syndrome ➢ Noninvasive Ventilation ➢ Hemoptysis ➢ Sepsis and Septic Shock ➢ Neuroleptic Malignant Syndrome ➢ General Anaphylaxis ➢ Stinging Insect Hypersensitivity ➢ Contrast-Related Allergy ➢ Angioedema	*Madeline Lagina, MD, MPH*
10:45 a.m. – 11:00 a.m.	**15-Minute Break**		
11:00 a.m. – 11:45 a.m.	**Infectious Disease I**	➢ Cellulitis ➢ Necrotizing Soft Tissue Infections ➢ Toxic Shock Syndrome ➢ Diabetic Foot Infections ➢ Osteomyelitis ➢ Meningitis ➢ Focal CNS Infections	 *Shiwei Zhou, MD*

2025 Greater Chicago Internal Medicine Board Review course
Program Schedule – In-Person and Virtual Live
Tuesday, May 13 – Saturday, May 17, 2025
Central Daylight Time

Wednesday, May 14, 2025			
11:00 a.m. – 11:45 a.m.	**Infectious Disease I (*cont.*)**	➢ Progressive Multifocal Leukoencephalopathy	*Shiwei Zhou, MD*
11:45 a.m. – 12:30 p.m.	**Infectious Disease II**	➢ Pneumonia ➢ Tuberculosis ➢ Influenza ➢ COVID ➢ Herpesvirus Infections ➢ Postherpetic Neuralgia ➢ *Clostridioides Difficile* Colitis	*Shiwei Zhou, MD*
12:30 p.m. – 1:30 p.m.	**1-Hour Break**		
1:30 p.m. – 2:30 p.m.	**Infectious Disease III**	➢ Asymptomatic Bacteriuria ➢ Cystitis and Pyelonephritis ➢ Prostatitis ➢ Urinary Tract Infections in Pregnancy ➢ Sexually Transmitted Infections ➢ Transmission and Prevention of HIV	 *Adam Ressler, MD, MPH*
2:30 p.m. – 3:30 p.m.	**Infectious Disease IV**	➢ Immunization ➢ Infectious Disease Outbreaks ➢ Infection Control ➢ Hospital-Acquired Infections and Prevention ➢ Procedure- and Device-Associated Infections ➢ Travel-Related Illness	*Adam Ressler, MD, MPH*
3:30 p.m. – 3:45 p.m.	**15-Minute Break**		
3:45 p.m. – 4:45 p.m.	**General Internal Medicine: Mental and Behavioral Health**	➢ Depression and Suicide ➢ Generalized Anxiety Disorder ➢ Other Mood Disorders (Psychogenic ED, PMDD) ➢ Substance Use Disorders ➢ Smoking Cessation ➢ Schizophrenia: Complications of Drug Therapy	 *Danielle Heidemann, MD, FACP*

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Wednesday, May 14, 2025			
3:45 p.m. – 4:45 p.m.	**General Internal Medicine: Mental and Behavioral Health (*cont.*)**	➢ Delusional Disorder, Somatic Type	*Danielle Heidemann, MD, FACP*
4:45 p.m. – 5:30 p.m.	**General Internal Medicine: Cancer Screening**	➢ Breast Cancer Screening ➢ Lung Cancer Screening ➢ Colorectal Cancer Screening ➢ Cervical Cancer Screening ➢ Prostate Cancer Screening	*Danielle Heidemann, MD, FACP*
5:30 p.m.	**Adjourn**		

Pulmonary Medicine I

2025 Virtual/Live Internal Medicine Board Review

Madeline Lagina, MD, MPH
Assistant Professor, Pulmonary & Critical Care
University of Michigan
VA Ann Arbor Healthcare System
Ann Arbor, MI

ACP Internal Medicine Board Review Course

Pulmonary Medicine I: Obstructive Lung Disease

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Table of Contents: Obstructive Lung Disease

- Asthma
- Exercise- and cold-induced asthma
- COPD (chronic bronchitis and emphysema)

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Obstructive Lung Disease Q1

A 44-year-old woman is evaluated for severe asthma requiring frequent hospitalization and oral glucocorticoids. She avoids triggers.

Medications are high-dose inhaled budesonide, formoterol, montelukast, tiotropium, and albuterol.

Blood eosinophil percentage is normal. Serum IgE level is elevated.

Skin testing is positive for multiple allergens.

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Obstructive Lung Disease Q1

A 44-year-old woman is evaluated for severe asthma requiring frequent hospitalization and oral glucocorticoids. She avoids triggers. Medications are high-dose inhaled budesonide, formoterol, montelukast, tiotropium, and albuterol. Blood eosinophil percentage is normal. Serum IgE level is elevated. Skin testing is positive for multiple allergens.

Which of the following is the most appropriate treatment?

A: Allergen immunotherapy

B: Daily prednisone

C: Omalizumab

D: Reslizumab

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Asthma

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Asthma: Epidemiology and Risk Factors

Increased prevalence

- Women
- Patients with low socioeconomic status

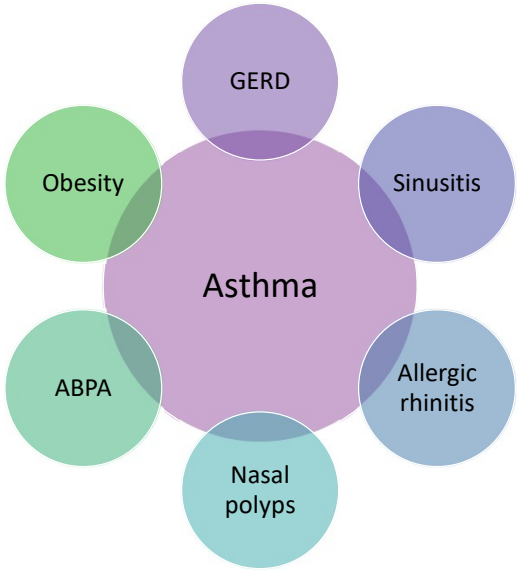
Risk factors

- Genetic predisposition
- Childhood allergic rhinitis/respiratory infections
- Environmental/occupational exposures

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Asthma: Common Comorbidities



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Asthma: Diagnosis

Intermittent cough, wheezing, chest tightness, dyspnea

Worse in evening/early morning

Triggered by upper respiratory infection, allergens

Aspirin-exacerbated respiratory disease

- Characteristic triad
  1. Asthma
  2. Chronic rhinosinusitis with nasal polyposis
  3. Reactions to aspirin or NSAIDs

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Asthma: Testing

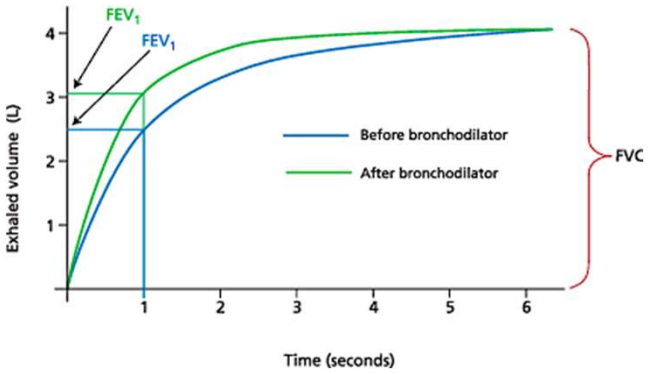
Normal airflow at baseline

Reversible airflow obstruction

- Before/after bronchodilator or 4 weeks of treatment
- Postbronchodilator FEV_1, FVC, or both ↑ ≥12% and ≥200 mL of baseline

Bronchial challenge (methacholine)

- Reduction in FEV_1 ≥20%
- Sensitive but not specific
- Negative test rules out asthma (high negative predictive value)



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Asthma: Pharmacologic Treatment

Teach/assess inhaler technique

Guidelines vary (GINA, NAEPP)

Intermittent asthma

- Preferred: as-needed low-dose ICS-formoterol combination
- Alternative: as-needed low-dose ICS with SABA

Mild persistent asthma

- Daily controller medication
- Preferred: daily low-dose ICS or daily low-dose ICS-formoterol combination



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Asthma: Pharmacologic Treatment

Moderate persistent asthma

- Preferred: daily low-dose ICS + LABA as maintenance and reliever therapy
- Alternative: Medium-dose ICS daily *and* SABA as needed

Severe persistent asthma

- Preferred: daily medium-dose ICS + LABA as maintenance and reliever therapy
- Consider adding LAMA or switching to triple therapy LABA-LAMA-ICS

Difficult-to-treat severe persistent asthma

- Preferred: Medium- to high-dose ICS-LABA *plus* LAMA daily *and* SABA as needed
- Consider biologic therapy based on asthma phenotype or LTRA

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Asthma: Biologic Therapy

Anti-IgE, anti-IL-5/5R, anti-IL-4R, and anti-thymic stromal lymphopoietin (TSLP) therapies

- Severe asthma not controlled with standard therapy
- Reduce symptoms and exacerbations
- Reduce need for oral glucocorticoids

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Asthma: Biologic Therapy

Anti-IgE therapy (omalizumab)

- Asthma with ↑ IgE level (30-700 IU/mL)
- Sensitivity to allergens
  - Positive skin testing *or*
  - ↑ Serum allergen-specific IgE level

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Asthma: Biologic Therapy

Anti-IL-5/5R, anti-IL-4R, and anti-TSLP therapies

- Indicated on the basis of blood eosinophil level
  - Threshold eosinophil levels vary among specific therapies
- Anti-IL-5/5R
  - Mepolizumab, benralizumab, reslizumab
- Anti-IL-4R
  - Dupilumab
- Anti-TSLP
  - Tezepelumab

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Asthma: Exacerbation Therapy

Repeated doses of SABA

Inhaled ipratropium may be helpful when added to SABA

- Nebulized SABA or SABA-ipratropium every 20 minutes for first hour, then as needed

Early short course of oral glucocorticoids

- 5-7 days of prednisolone, 40-50 mg/d

IV magnesium sulfate for life-threatening exacerbations

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Asthma: Exacerbation Therapy

Hospitalize if no response after 1 hour of therapy

Severe exacerbations may require ICU-level care with consideration for intubation

Discharge plan

- Complete course of oral glucocorticoids
- Add or increase ICS
- Asthma action plan
- Assess adherence and proper inhaler technique

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Obstructive Lung Disease Q2

A 26-year-old man reports chest tightness, cough, and shortness of breath shortly after vigorous exercise and continuing for 30 minutes.

Symptoms are worse in cold weather.

Physical exam and office spirometry are normal.

After exercise, FEV_1 decreases by 15% from baseline.

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Obstructive Lung Disease Q2

A 26-year-old man reports chest tightness, cough, and shortness of breath shortly after vigorous exercise and continuing for 30 minutes. Symptoms are worse in cold weather. Physical exam and office spirometry are normal. After exercise, FEV_1 decreases by 15% from baseline.

Which of the following is the most appropriate treatment?

A: ICS with SABA or SABA alone before exercise

B: Inhaled LABA daily

C: Inhaled ipratropium before exercise

D: Oral LTRA just before exercise

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Exercise- and Cold-Induced Asthma

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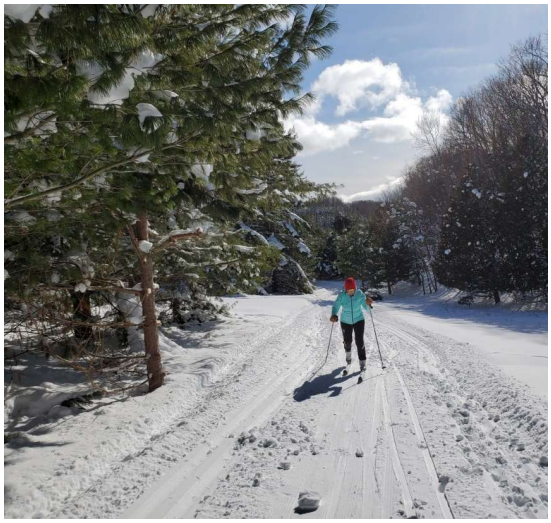
Exercise- and Cold-Induced Asthma: Diagnosis and Testing

Airway obstruction in response to exercise

- Common bronchospasm trigger in patients with asthma
- Can occur in patients without asthma
- During or shortly after intense exercise/conditioning
- Worse in cold weather

Bronchial challenge testing

- Exercise (preferred)
  - FEV_1 drop ≥10%
- Methacholine
  - FEV_1 drop ≥20%



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Exercise- and Cold-Induced Asthma: Treatment

Treatment

- ICS + SABA or SABA alone before exercise
- Low-dose budesonide-formoterol before exercise

Prevention

- Control chronic asthma
- Cover nose and mouth in cold weather
- Warm up before exercise

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Obstructive Lung Disease Q3

A 68-year-old man is evaluated for a 1-year history of dyspnea. He has a 45-pack-year smoking history.

Pulmonary exam shows normal breath sounds that are equal bilaterally without wheezing.

Chest radiograph is normal.

Spirometry reveals an FEV_1/FVC ratio of 0.63 and FEV_1 of 75% of predicted, with no significant change after bronchodilator administration.

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Obstructive Lung Disease Q3

A 68-year-old man is evaluated for a 1-year history of dyspnea. He has a 45-pack-year smoking history. Pulmonary exam shows normal breath sounds that are equal bilaterally without wheezing. Chest radiograph is normal. Spirometry reveals an FEV_1/FVC ratio of 0.63 and FEV_1 of 75% of predicted, with no significant change after bronchodilator administration.

Which of the following is the most likely diagnosis?

A: Asthma

B: Chronic thromboembolic disease

C: COPD

D: Idiopathic pulmonary fibrosis

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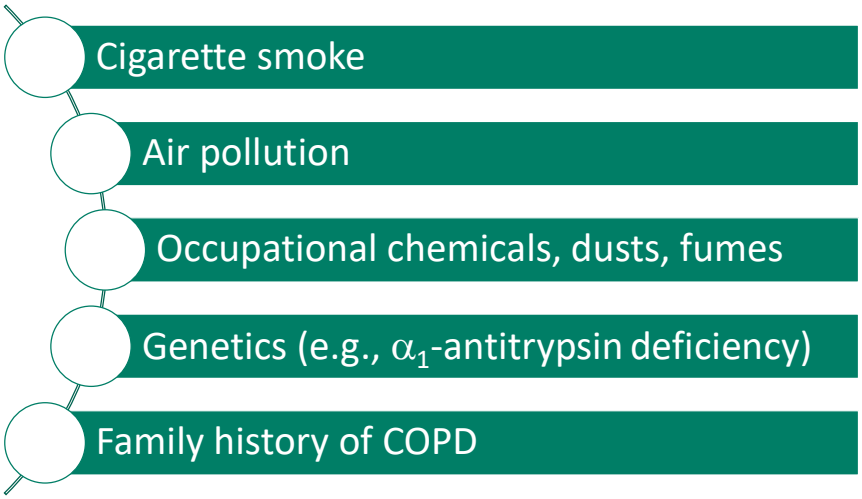
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COPD (Chronic Bronchitis and Emphysema)

ACP

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COPD: Risk Factors



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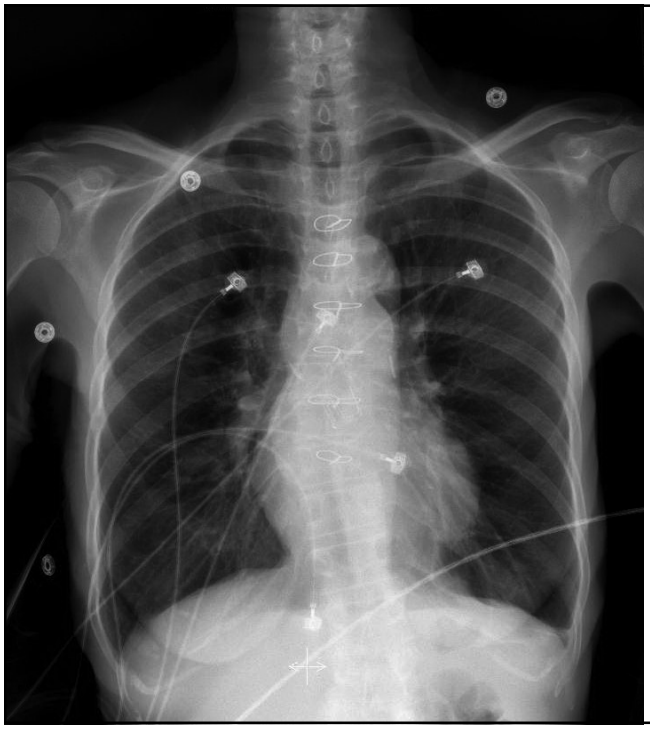
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COPD: Diagnosis

- Chronic cough, sputum
- Dyspnea
- One symptom may predominate
- Intermittent exacerbations

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COPD: Testing

Spirometry

- Postbronchodilator FEV_1/FVC ratio <0.70 (or less than the lower limit of normal)

Chest radiography

- Exclude alternative diagnoses
- Evaluate common comorbidities
- Diagnose complications (pneumonia, pneumothorax)

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COPD: Testing

Flow-volume loop on spirometry

- Represents maximally forced I:E flow (on the Y-axis) against volume (on the X-axis)
- Differentiates obstructive from restrictive patterns
  - Can suggest anatomic location of airway obstruction

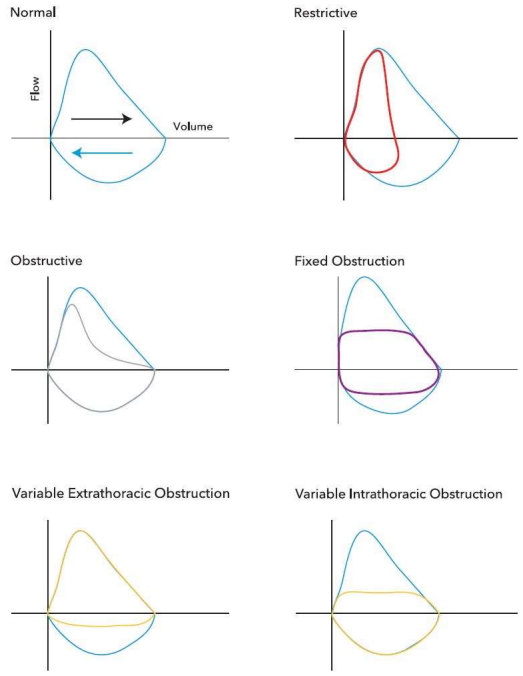
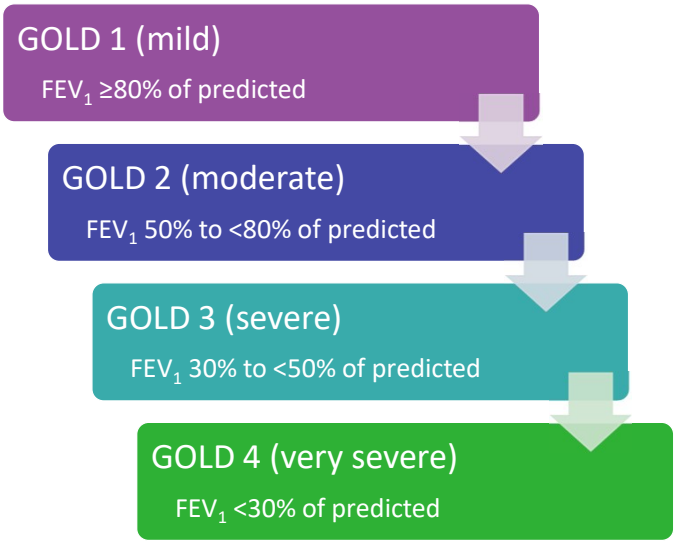


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COPD: Assessment of Airflow Obstruction



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COPD: Assessment of Disease Severity

Higher-risk disease (GOLD group E)

- ≥2 exacerbations in the last year *or*
- 1 exacerbation requiring hospital admission

Lower-risk disease (GOLD group A or B)

- ≤1 exacerbation in the last year *and*
- No hospitalizations

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COPD: Assessment of Disease Severity

Pulse oximetry

- At rest and with exertion
- Determines oxygen need

BODE Index

- BMI
- Obstruction (FEV_1)
- Dyspnea
- Exercise capacity

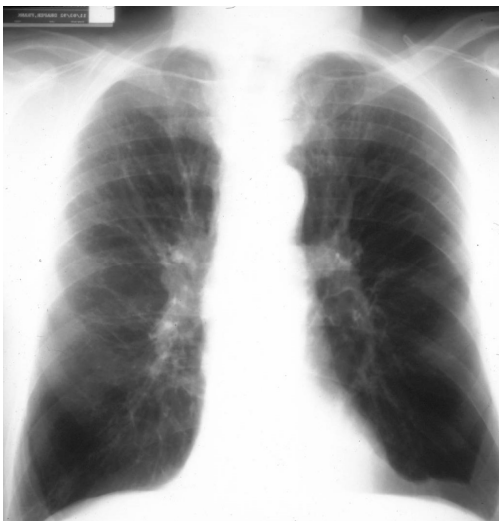
ABG to assess for hypercapnia

- FEV_1 <30% of predicted
- Change in mental status
- Acute COPD exacerbation
- Elevated serum bicarbonate level
- Oxygen saturation <92%

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COPD: Assessment of Disease Severity



α_1-Antitrypsin disease

- Check level in **all** patients with COPD
- No other COPD risk factors
- Basilar predominant emphysematous bullae
  - Wide variation seen
  - Panacinar (panlobular) emphysema
- Liver disease

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Obstructive Lung Disease Q4

A 70-year-old patient is evaluated for severe COPD, with two exacerbations last year requiring hospitalization despite smoking cessation, pulmonary rehabilitation, and 1 year of daily azithromycin.

Medications are tiotropium, fluticasone-salmeterol, and albuterol.

Oxygen saturation is normal.

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Obstructive Lung Disease Q4

A 70-year-old patient is evaluated for severe COPD, with two exacerbations last year requiring hospitalization despite smoking cessation, pulmonary rehabilitation, and 1 year of daily azithromycin. Medications are tiotropium, fluticasone-salmeterol, and albuterol. Oxygen saturation is normal.

Which of the following is the most appropriate long-term COPD treatment?

A: Azithromycin

B: Daily prednisone

C: Roflumilast

D: Simvastatin

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Stable COPD: Pharmacologic Treatment

Teach/assess inhaler technique and adherence

As-needed SAMA or SABA

- Combined SAMAs and SABAs are superior

LAMAs better than LABAs as monotherapy

- Combination LAMA-LABA therapy is superior for significantly symptomatic patients (GOLD group B)

Theophylline

- Modest benefit
- Risk of adverse effects

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Stable COPD: Pharmacologic Treatment

Reducing exacerbations (moderate to very severe COPD/GOLD group E)

- Add ICS if blood eosinophil count ≥300/μL
  - Contraindications: recurrent pneumonia, blood eosinophil count <100/μL, history of mycobacterial infection
- ICS-LAMA-LABA therapy
  - Improves health status
  - Reduces exacerbations

Reducing recurrent exacerbations

- Add PDE-4 inhibitor (oral roflumilast) or PDE-3/PDE-4 inhibitor (nebulized ensifentrine)
- 1 year of azithromycin
- Consider dupilumab as biologic add-on therapy if
  - Refractory eosinophilic COPD (peripheral blood eosinophil count ≥300/μL)

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COPD: Other Therapy

Smoking cessation

- Medical therapy

Pulmonary rehabilitation

- Improves quality of life
- Reduces rehospitalization

NPPV for hypercapnia

Oxygen (>15 hours/d) for hypoxia

- Po_2 ≤55 mm Hg or oxygen saturation ≤88%
- Titrate oxygen saturation >90%

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COPD: Other Therapy and Immunization

Lung volume reduction therapy with surgery or bronchoscopic endobronchial valves

- Upper lobe emphysema and low exercise capacity
- Improved mortality, quality of life
- Contraindicated if FEV_1 or DLCO <20% of predicted

Vaccinations

- Annual influenza vaccination
- Pneumococcal vaccination
- COVID-19 vaccination
- RSV vaccination if over age 60 years
- Tdap, shingles



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Stable COPD: Management

Patient Classification	Management
All patients	Smoking cessation Vaccinations Consider pulmonary rehabilitation Oxygen therapy if appropriate SABA as needed
GOLD A	Short- or long-acting bronchodilator (preferred)
GOLD B	Combined long-acting bronchodilator (LABA + LAMA)
GOLD E	Combined long-acting bronchodilator (LABA + LAMA) Add ICS if blood eosinophil count ≥300/µL

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COPD: Exacerbation

Change in symptoms that leads to

- Change in medical therapy *or*
- Requires hospitalization

Manifestations

- Increased sputum production
- Purulent sputum
- Worsening dyspnea

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COPD: Exacerbation Therapy

Maintain oxygen saturation at 89% to 92%

SABA ± SAMA

NPPV

- If oxygenation or ventilation cannot be maintained

Invasive mechanical ventilation

- If failure to respond to noninvasive ventilation

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COPD: Exacerbation Therapy

Prednisone, 40 mg for 5 days

Antibiotics for 5-7 days if either

- Moderate or severe exacerbation *or*
- Increase or change in sputum production

Consider evaluation for venous thromboembolism

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Pulmonary Medicine I

- Answers to Multiple-Choice Questions

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Obstructive Lung Disease Q1

A 44-year-old woman is evaluated for severe asthma requiring frequent hospitalization and oral glucocorticoids. She avoids triggers. Medications are high-dose inhaled budesonide, formoterol, montelukast, tiotropium, and albuterol. Blood eosinophil percentage is normal. Serum IgE level is elevated. Skin testing is positive for multiple allergens.

Which of the following is the most appropriate treatment?

A: Allergen immunotherapy

B: Daily prednisone

C: Omalizumab

D: Reslizumab

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Obstructive Lung Disease Q2

A 26-year-old man reports chest tightness, cough, and shortness of breath shortly after vigorous exercise and continuing for 30 minutes. Symptoms are worse in cold weather. Physical exam and office spirometry are normal. After exercise, FEV_1 decreases by 15% from baseline.

Which of the following is the most appropriate treatment?

A: ICS with SABA or SABA alone before exercise

B: Inhaled LABA daily

C: Inhaled ipratropium before exercise

D: Oral LTRA just before exercise

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Obstructive Lung Disease Q3

A 68-year-old man is evaluated for a 1-year history of dyspnea. He has a 45-pack-year smoking history. Pulmonary exam shows normal breath sounds that are equal bilaterally without wheezing. Chest radiograph is normal. Spirometry reveals an FEV_1/FVC ratio of 0.63 and FEV_1 of 75% of predicted, with no significant change after bronchodilator administration.

Which of the following is the most likely diagnosis?

A: Asthma

B: Chronic thromboembolic disease

C: COPD

D: Idiopathic pulmonary fibrosis

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Obstructive Lung Disease Q4

A 70-year-old patient is evaluated for severe COPD, with two exacerbations last year requiring hospitalization despite smoking cessation, pulmonary rehabilitation, and 1 year of daily azithromycin. Medications are tiotropium, fluticasone-salmeterol, and albuterol. Oxygen saturation is normal.

Which of the following is the most appropriate long-term COPD treatment?

A: Azithromycin

B: Daily prednisone

C: Roflumilast

D: Simvastatin

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Pulmonary Medicine II

2025 Virtual/Live Internal Medicine Board Review

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ACP Internal Medicine Board Review Course

Pulmonary II: Nonobstructive Lung Disease

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- Obstructive sleep apnea (OSA)
- Obesity hypoventilation syndrome
- Solitary pulmonary nodule
- Noninfectious pleural effusion
- Infections of the pleural space and empyema
- Pneumothorax
- Pulmonary hypertension

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Nonobstructive Lung Disease Q1

A 58-year-old man has a 6-month history of snoring, gasping during sleep, and daytime somnolence.

BP is 130/82 mm Hg; BMI is 34.

Neck circumference is 18 inches.

The soft palate is low lying.

Polysomnography discloses severe OSA.

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Nonobstructive Lung Disease Q1

A 58-year-old man has a 6-month history of snoring, gasping during sleep, and daytime somnolence. BP is 130/82 mm Hg; BMI is 34. Neck circumference is 18 inches. The soft palate is low lying. Polysomnography discloses severe OSA.

In addition to weight loss, which of the following is the most appropriate treatment?

A: Continuous positive airway pressure

B: Nocturnal oxygen therapy

C: Oral appliance

D: Upper airway surgery

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Obstructive Sleep Apnea

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Obstructive Sleep Apnea: Major Risk Factors

- Neck circumference >17 inches
- Crowded pharynx
- Male sex
- Obesity
- Hypothyroidism/acromegaly

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Obstructive Sleep Apnea: Diagnosis

Inspiratory upper airway obstruction

- Loud snoring
- Choking, gasping, witnessed apneas

Excessive daytime sleepiness

Night waking

Nocturia

STOP-BANG questionnaire

- Suggestive, not diagnostic

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Obstructive Sleep Apnea: Testing

In-lab polysomnography or home sleep study: AHI >5/h = OSA

5 to <15/h = mild OSA

15 to <30/h = moderate OSA

≥30/h = severe OSA

Home sleep study

- No EEG
- No CPAP titration
- Less sensitive and specific vs. in-lab polysomnography

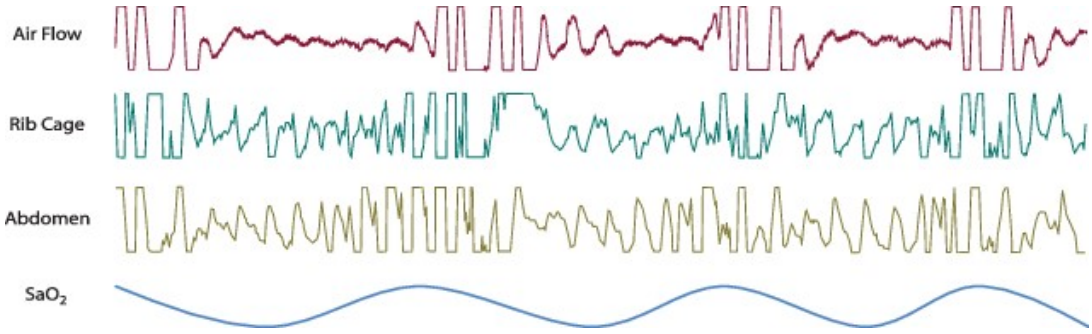
Home testing eligibility

- No cardiopulmonary or neuromuscular disease
- High pretest probability of moderate to severe OSA

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Obstructive Sleep Apnea: Testing



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Obstructive Sleep Apnea: Treatment

Lifestyle modifications

- Lose weight, exercise, consider bariatric surgery
- Avoid alcohol, opioids, sedatives
- Sleep in lateral position

Positive airway pressure

- Improves quality of life, cognitive function
- Decreases blood pressure, daytime sleepiness, and motor vehicle accidents

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Obstructive Sleep Apnea: Treatment

OSA often associated with obesity hypoventilation syndrome

- OSA plus obesity and daytime hypercapnia
- Oxygen for hypoxemia

Oral appliances

- Mild/moderate OSA and intolerant of CPAP

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Obstructive Sleep Apnea: Treatment

Supplemental oxygen

- Not primary therapy

Upper airway surgery

- For intolerance of CPAP

Hypoglossal nerve stimulator

- For severe OSA intolerant to CPAP

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Nonobstructive Lung Disease Q2

A 54-year-old man presents with drowsiness and dyspnea without cough. He has OSA.

Vital signs are normal; BMI is 47. Respirations are shallow without wheezing. Other than drowsiness, neurologic exam is unremarkable.

Laboratory studies:	
Arterial blood gases (ambient air):	
pH	7.31
P_{CO_2}	69 mm Hg
P_{O_2}	59 mm Hg
Bicarbonate	30 mEq/L

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Nonobstructive Lung Disease Q2

A 54-year-old man presents with drowsiness and dyspnea without cough. He has obstructive sleep apnea. Vital signs are normal; BMI is 47. Respirations are shallow without wheezing. Other than drowsiness, neurologic exam is unremarkable. Arterial blood gases (ambient air): pH, 7.31; P_{CO_2}, 69 mm Hg; P_{O_2}, 59 mm Hg. Bicarbonate level is 30 mEq/L.

Which of the following is the most likely diagnosis?

A: COPD

B: Guillain-Barré syndrome

C: Primary central sleep apnea

D: Obesity hypoventilation syndrome

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Obesity Hypoventilation Syndrome

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Obesity Hypoventilation Syndrome: Diagnosis

BMI >30

Chronic hypercapnic/ventilatory failure

- Hypercapnia: P_{CO_2} ≥45 mm Hg
- Hypoxemia: P_{O_2} <70 mm Hg
  - Improves with supplemental oxygen

Sleep-disordered breathing

Exclusion of other causes of hypoventilation (e.g., COPD)

Hypersomnolence

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Obesity Hypoventilation Syndrome: Management

Address contributing conditions

- Obesity
- Sedative/opioid use
- Severe hypothyroidism

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Obesity Hypoventilation Syndrome: Treatment

- Noninvasive positive-pressure ventilation
- Supplemental oxygen if hypoxemic
- Treat coexisting sleep apnea

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Nonobstructive Lung Disease Q3

A 58-year-old asymptomatic woman is evaluated for an incidentally discovered pulmonary nodule.

She has no risk factors for lung cancer.

Chest radiograph 10 years ago was normal.

CT scan reveals a 6-mm solid nodule with a smooth, well-defined border in the peripheral right lung.

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Nonobstructive Lung Disease Q3

A 58-year-old asymptomatic woman is evaluated for an incidentally discovered pulmonary nodule. She has no risk factors for lung cancer. Chest radiograph 10 years ago was normal. CT scan reveals a 6-mm solid nodule with a smooth, well-defined border in the peripheral right lung.

Which of the following is the most appropriate next step in management?

A: Bronchoalveolar lavage

B: CT in 6 to 12 months

C: PET

D: Transthoracic needle biopsy

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Solitary Pulmonary Nodule (SPN)

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SPN: Diagnosis and Testing

Usually asymptomatic, found incidentally

Rounded opacity ≤3 cm in diameter

- No hilar, mediastinal adenopathy
- No atelectasis, pleural effusion
- No invasion of other structures

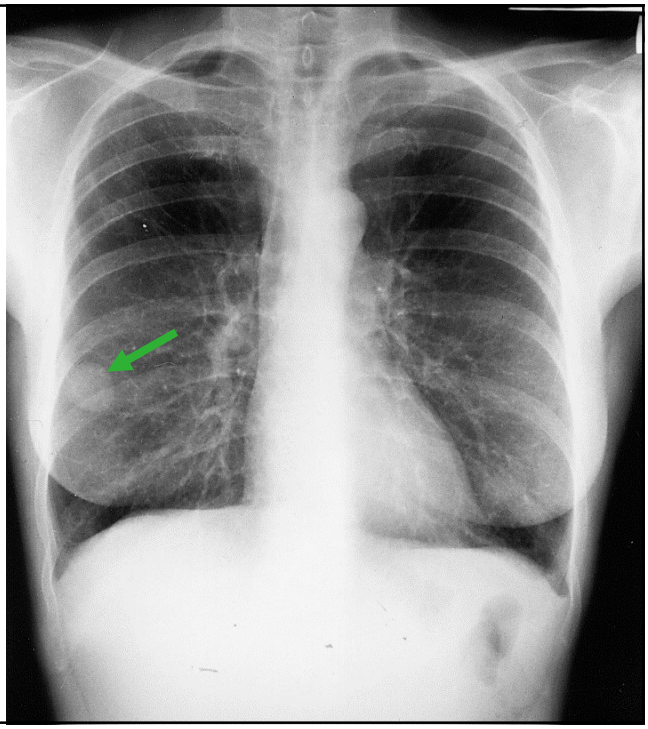
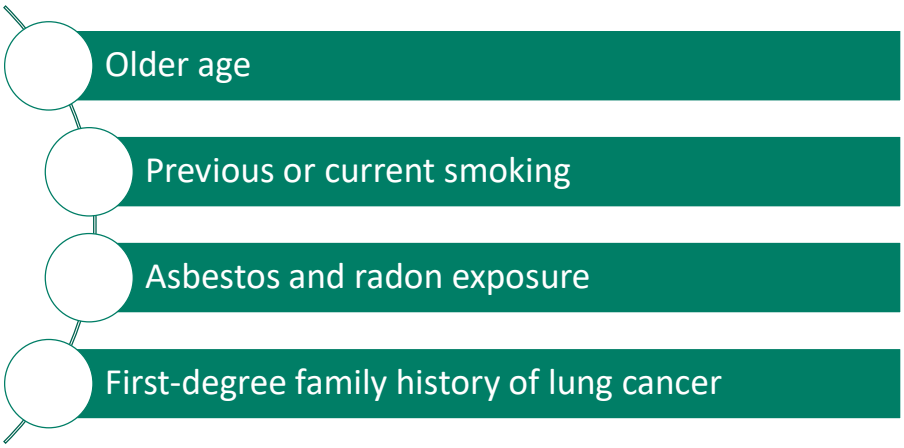


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SPN: Risk Factors for Malignancy



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SPN: High-Risk Nodule Characteristics

- Larger size
- Spiculated, lobular, or irregular border
- Metabolic activity on PET scan
- Upper lobe location
- Part-solid nodule

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Fleischner Society Recommendations for Follow-up of Solitary Solid Nodules

Risk Factors for Lung Cancer?	Size	Recommended Follow-Up
No (Low-risk patient)	<6 mm	No follow-up
	6-8 mm	CT at 6-12 months, then consider CT at 18-24 months
	>8 mm	Consider CT at 3 months, PET/CT, or tissue sampling
Yes (High-risk patient)	<6 mm	Optional CT at 12 months
	6-8 mm	CT at 6-12 months, then CT at 18-24 months
	>8 mm	Consider CT at 3 months, PET/CT, or tissue sampling

Information from MacMahon H, Naidich DP, Goo JM, Lee KS, Leung ANC, Mayo JR, et al. Guidelines for management of incidental pulmonary nodules detected on CT images: from the Fleischner Society 2017. Radiology. 2017;284:228-43. [PMID: 28240562]

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Nonobstructive Lung Disease Q4

A 78-year-old man is hospitalized for worsened heart failure.

Chest radiograph shows bilateral pleural effusions.

Thoracentesis is performed.

Laboratory studies:	
Pleural fluid/serum LDH ratio	0.53
Pleural fluid LDH % of serum LDH ULN	46%
Pleural fluid/serum protein ratio	0.51
Gram stain	Negative

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Nonobstructive Lung Disease Q4

A 78-year-old man is hospitalized for worsened heart failure. Chest radiograph shows bilateral pleural effusions. Thoracentesis is performed. Laboratory studies: pleural fluid/serum LDH ratio, 0.53; pleural fluid LDH % of serum LDH ULN, 46%; pleural fluid/serum protein ratio, 0.51; Gram stain, negative.

Which of the following is the most likely cause of this patient's pleural effusion?

A: Heart failure

B: Malignancy

C: Pulmonary embolism

D: Pneumonia

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Noninfectious Pleural Effusion

ACP

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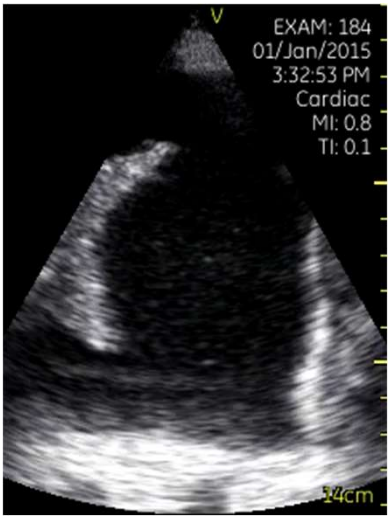
Pleural Effusion: Diagnosis

- Dyspnea, cough, pleuritic chest pain
- Dullness to percussion
- Diminished or absent fremitus
- Diminished breath sounds

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Pleural Effusion: Testing



Imaging

- Chest radiography
- Chest CT
- Ultrasonography

Unexplained effusions

- Ultrasound-guided diagnostic thoracentesis

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Pleural Effusion: Testing

Light criteria for exudate (any of the following)

- Ratio of pleural fluid LDH level to serum LDH level >0.6
- Ratio of pleural fluid protein to serum protein level >0.5
- Pleural-fluid LDH level >0.67 × the upper limit of normal for serum LDH

Serum-pleural fluid albumin gradient

- Used to identify pleural effusions due to HF that are suspected to be misclassified as exudate
- Pseudoexudate: >1.2
- True exudate ≤1.2

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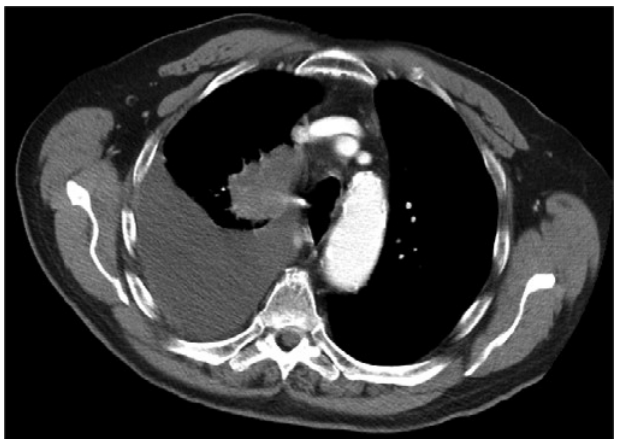
Pleural Effusion: Testing

Most common causes of transudates

- Heart failure
- Cirrhosis (hepatic hydrothorax)

Most common causes of exudates

- Parapneumonic
- Malignancy
- Tuberculosis (worldwide)



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Pleural Effusion: Testing

Finding	Noninfectious Causes	Infectious Causes
Erythrocyte count >5000/µL	Malignancy, PE, asbestos-related, trauma	
Lymphocytosis >80%	Lymphoma, chylous effusion, post-CABG, autoimmunity	TB
pH <7.0	RA, esophageal rupture	Complicated parapneumonic effusion, TB
Glucose level <60 md/dL	Malignancy, RA, SLE, esophageal rupture	Complicated parapneumonic effusion, TB
Nucleated cells >50,000/µL		Complicated parapneumonic effusion
Nucleated cells >10,000/µL	Acute pancreatitis, SLE	Simple parapneumonic effusion

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Nonobstructive Lung Disease Q5

A 66-year-old man has fever and worsening dyspnea after completing antibiotic therapy for pneumonia.

Breath sounds are decreased over the lower right hemithorax.

Lateral decubitus radiograph shows a right-sided, moderate in size (2.5-cm) pleural effusion.

Ultrasound shows a pleural effusion with loculations.

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Nonobstructive Lung Disease Q5

A 66-year-old man has fever and worsening dyspnea after completing antibiotic therapy for pneumonia. Breath sounds are decreased over the lower right hemithorax. Lateral decubitus radiograph shows a right-sided, moderate in size (2.5-cm) pleural effusion. Ultrasound shows a pleural effusion with loculations.

Which of the following is the most appropriate initial step in management?

A: Ciprofloxacin

B: Diagnostic thoracentesis

C: Small-bore pleural drain placement

D: Therapeutic thoracentesis

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Infections of the Pleural Space and Empyema

ACP

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Infections of the Pleural Space and Empyema: Diagnosis

- Fever
- Pleuritic chest pain
- Dyspnea
- Cough
- Decreased breath sounds, fremitus
- Percussion dullness

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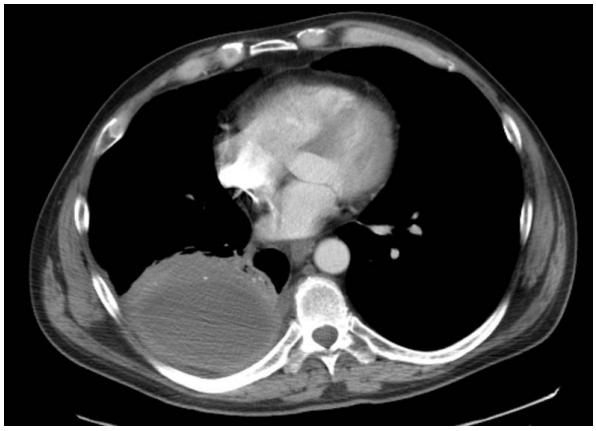
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Infections of the Pleural Space and Empyema: Testing

Pleural effusion on chest imaging

Pleural fluid analysis

- Diagnostic
  - Pus
  - Positive Gram stain
  - Positive pleural fluid culture
- Strongly suggestive
  - Glucose level <40-60 mg/dL
  - pH <7.2

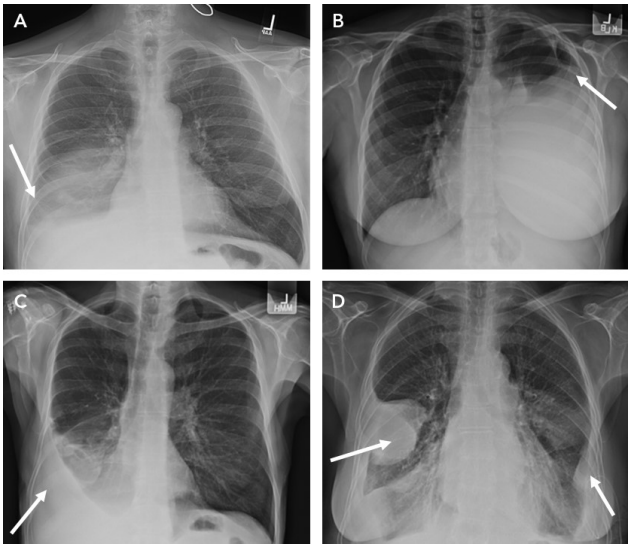


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Infections of the Pleural Space and Empyema: Testing



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Infections of the Pleural Space and Empyema: Treatment

Thoracostomy tube drainage

Empiric antibiotic regimens

- Ceftriaxone plus metronidazole
- A β-lactam/β-lactamase inhibitor combination (e.g., ampicillin-sulbactam)

Combine antibiotic therapy with

- Tissue plasminogen activator and deoxyribonuclease (through thoracostomy tube)

Surgical debridement if refractory

- Video-assisted thoracoscopic surgery

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Pneumothorax

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Pneumothorax: Diagnosis

- Primary: no known underlying lung disease
- Secondary: underlying lung disease
- Acute pleuritic chest pain and dyspnea
- Unilateral decreased breath sounds
- Hyperresonance to percussion

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Pneumothorax: Diagnosis

Tension pneumothorax

- Tachycardia
- Hypotension
- Decreasing oxygen saturation
- Tracheal deviation
- Distended neck veins

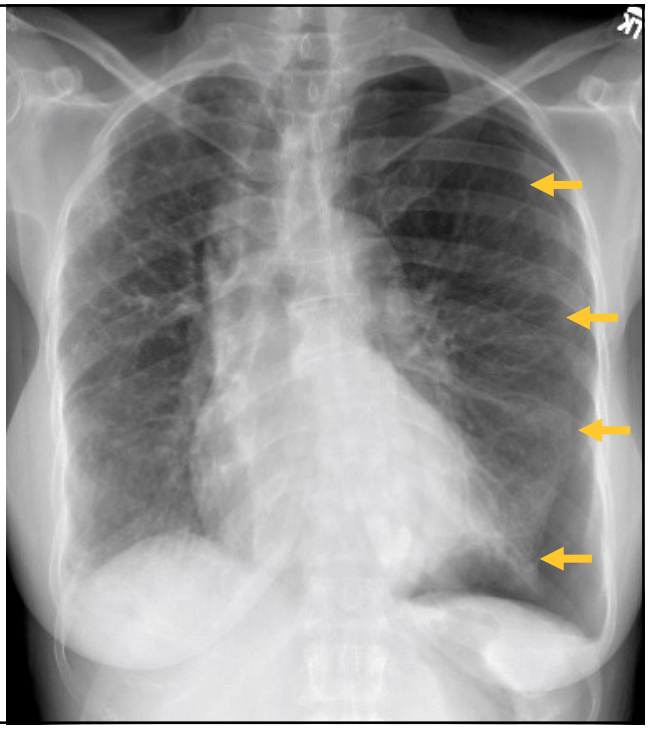
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Pneumothorax: Testing

Chest radiography

- Small: <2 cm at level of hilum or <3 cm between the pleural line and the chest wall at the level of the apex
- Large: ≥2 cm at level of hilum or ≥3 cm between the pleural line and the chest wall at the level of the apex



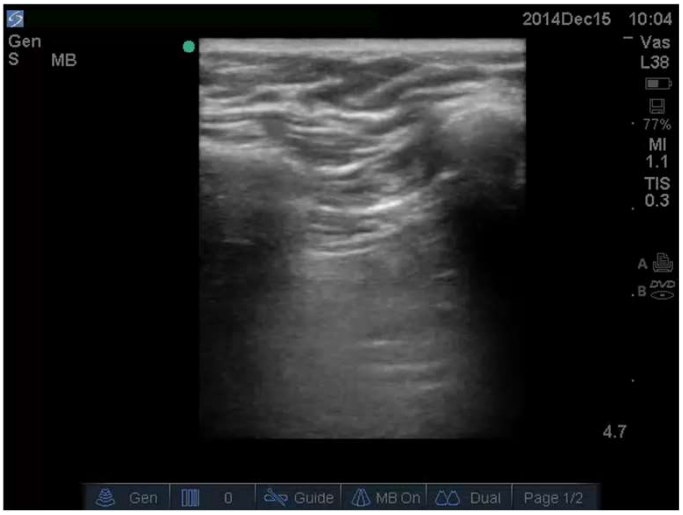
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Pneumothorax: Testing

Ultrasonography

- Lung sliding absent
- Lung point present



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Primary Spontaneous Pneumothorax: Treatment

All patients	• Smoking cessation
Small and minimal symptoms	• Hospitalize for supplemental oxygen and observation
Large symptomatic (clinically stable)	• Aspiration (needle or catheter) • Small-bore catheter thoracostomy if air reaccumulates
Clinically unstable	• Thoracostomy tube • Needle decompression
Recurrent ipsilateral	• Pleurodesis

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Secondary Spontaneous Pneumothorax (SSP): Treatment

All patients	• Smoking cessation
Small and minimal or no symptoms	• Hospitalize for observation and supplemental oxygen
Large or symptomatic	• Thoracostomy tube or catheter
First episode of SSP	• Pleurodesis

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Nonobstructive Lung Disease Q6

A 38-year-old woman reports progressive exertional dyspnea. She has limited cutaneous systemic sclerosis.

Exam shows a prominent S_2 and sclerodactyly.

Chest radiograph and CT scan are normal, CT angiogram is negative, and pulmonary function tests show DLCO is 47% of predicted.

Echocardiogram shows right ventricular enlargement; estimated right ventricular systolic pressure is 52 mm Hg.

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Nonobstructive Lung Disease Q6

A 38-year-old woman reports progressive exertional dyspnea. She has limited cutaneous systemic sclerosis. Exam shows a prominent S_2 and sclerodactyly. Chest radiograph and CT scan are normal, CT angiogram is negative, and pulmonary function tests show D_{LCO} is 47% of predicted. Echocardiogram shows right ventricular enlargement; estimated right ventricular systolic pressure is 52 mm Hg.

Which of the following is the most appropriate diagnostic test to perform next?

A: 6-Minute walk test

B: Overnight pulse oximetry

C: Polysomnography

D: Right heart catheterization

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Pulmonary Hypertension



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Pulmonary Hypertension: Group Classifications

Group	Description	Comments
1	Pulmonary arterial hypertension (PAH) Idiopathic and heritable PAH Drug- and toxin-induced PAH PAH associated with connective tissue diseases, HIV infection, congenital heart disease, schistosomiasis, and portal hypertension	Primary disease of pulmonary arterioles Also includes vasoresponsive PAH and PAH due to pulmonary veno-occlusive disease or pulmonary capillary hemangiomatosis
2	Pulmonary hypertension due to left-sided heart disease	**Most common form of PH**
3	Pulmonary hypertension due to lung diseases or hypoxia	Examples: COPD, ILD, and sleep-related breathing disorders
4	CTEPH and other pulmonary artery obstructions	
5	Pulmonary hypertension with unclear or multifactorial causes	

Information from Simonneau G, Montani D, Celermajer DS, et al. Haemodynamic definitions and updated clinical classification of pulmonary hypertension. Eur Respir J. 2019;53. [PMID: 30545968] doi:10.1183/13993003.01913-2018

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Pulmonary Hypertension/Cor Pulmonale: Diagnosis

- Dyspnea on exertion/decreased exercise tolerance
- Syncope or near-syncope
- Chest pain
- ↑ Intensity P_2 and fixed split S_2
- Functional tricuspid regurgitation
- Prominent jugular *a* wave
- RV heave
- Lower extremity edema, hepatomegaly, ascites

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Pulmonary Hypertension: Testing

Chest radiograph

- Enlarged central pulmonary arteries (*arrows*)
- Prominent right ventricle (*in the lateral view, not shown*)

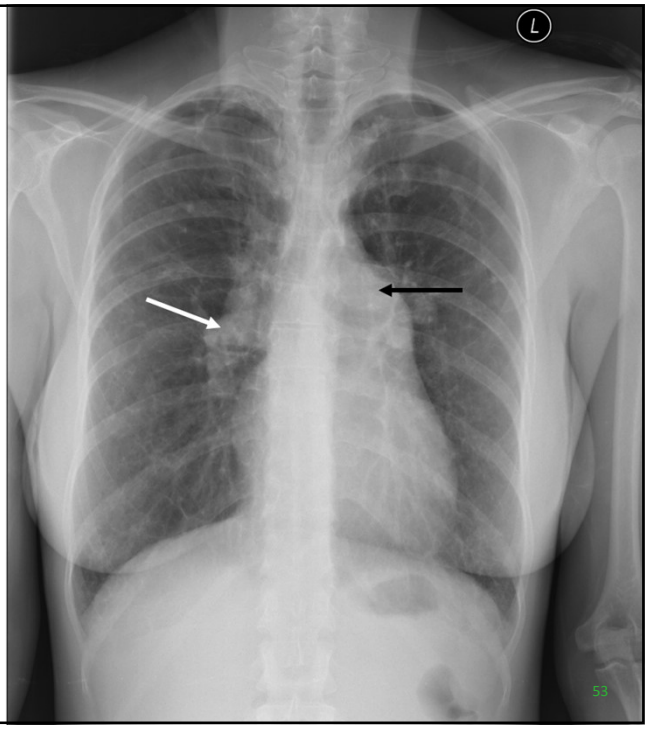


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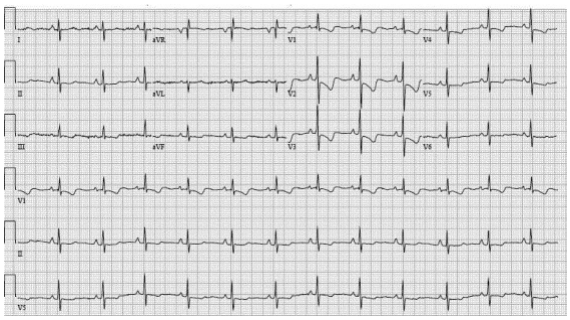
Pulmonary Hypertension: Testing

ECG (specific but not sensitive)

- Right axis deviation
- R wave/S wave ratio >1 in lead V_1
- Incomplete or complete right bundle branch block
- Increased P wave amplitude in lead II

Echocardiography

- Estimate pulmonary artery systolic pressure



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Pulmonary Hypertension: Testing

Right heart catheterization

- Confirms diagnosis of pulmonary hypertension

Additional testing guided by clinical history

- Left heart catheterization for left heart failure
- Pulmonary function test for obstructive or restrictive lung disease
- High-resolution CT for interstitial lung disease
- V/Q scan for CTEPH
- Polysomnography for sleep apnea

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Pulmonary Hypertension: Treatment

Lung disease

- Treat underlying lung condition
- Vaccination, smoking cessation, exercise
- Oxygen, diuretics

HF with reduced ejection fraction → GDMT

PAH → vasodilator therapies

CTEPH → anticoagulant therapy, thromboendarterectomy, riociguat

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Pulmonary Medicine II

- Answers to Multiple-Choice Questions

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Nonobstructive Lung Disease Q1

A 58-year-old man has a 6-month history of snoring, gasping during sleep, and daytime somnolence. BP is 130/82 mm Hg; BMI is 34. Neck circumference is 18 inches. The soft palate is low lying. Polysomnography discloses severe OSA.

In addition to weight loss, which of the following is the most appropriate treatment?

A: Continuous positive airway pressure

B: Nocturnal oxygen therapy

C: Oral appliance

D: Upper airway surgery

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Nonobstructive Lung Disease Q2

A 54-year-old man presents with drowsiness and dyspnea without cough. He has obstructive sleep apnea. Vital signs are normal; BMI is 47. Respirations are shallow without wheezing. Other than drowsiness, neurologic exam is unremarkable. Arterial blood gases (ambient air): pH, 7.31; P_{CO_2}, 69 mm Hg; P_{O_2}, 59 mm Hg. Bicarbonate level is 30 mEq/L.

Which of the following is the most likely diagnosis?

A: COPD

B: Guillain-Barré syndrome

C: Primary central sleep apnea

D: Obesity hypoventilation syndrome

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Nonobstructive Lung Disease Q3

A 58-year-old asymptomatic woman is evaluated for an incidentally discovered pulmonary nodule. She has no risk factors for lung cancer. Chest radiograph 10 years ago was normal. CT scan reveals a 6-mm solid nodule with a smooth, well-defined border in the peripheral right lung.

Which of the following is the most appropriate next step in management?

A: Bronchoalveolar lavage

B: CT in 6 to 12 months

C: PET

D: Transthoracic needle biopsy

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Nonobstructive Lung Disease Q4

A 78-year-old man is hospitalized for worsened heart failure. Chest radiograph shows bilateral pleural effusions. Thoracentesis is performed. Laboratory studies: pleural fluid/serum LDH ratio, 0.53; pleural fluid LDH % of serum LDH ULN, 46%; pleural fluid/serum protein ratio, 0.51; Gram stain, negative.

Which of the following is the most likely cause of this patient's pleural effusion?

A: Heart failure

B: Malignancy

C: Pulmonary embolism

D: Pneumonia

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Nonobstructive Lung Disease Q5

A 66-year-old man has fever and worsening dyspnea after completing antibiotic therapy for pneumonia. Breath sounds are decreased over the lower right hemithorax. Lateral decubitus radiograph shows a right-sided, moderate in size (2.5-cm) pleural effusion. Ultrasound shows a pleural effusion with loculations.

Which of the following is the most appropriate initial step in management?

A: Ciprofloxacin

B: Diagnostic thoracentesis

C: Small-bore pleural drain placement

D: Therapeutic thoracentesis

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Nonobstructive Lung Disease Q6

A 38-year-old woman reports progressive exertional dyspnea. She has limited cutaneous systemic sclerosis. Exam shows a prominent S_2 and sclerodactyly. Chest radiograph and CT scan are normal, CT angiogram is negative, and pulmonary function tests show D_{LCO} is 47% of predicted. Echocardiogram shows right ventricular enlargement; estimated right ventricular systolic pressure is 52 mm Hg.

Which of the following is the most appropriate diagnostic test to perform next?

A: 6-Minute walk test

B: Overnight pulse oximetry

C: Polysomnography

D: Right heart catheterization

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Critical Care Medicine

2025 Virtual/Live Internal Medicine Board Review

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ACP Internal Medicine Board Review Course

Critical Care Medicine

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Table of Contents: Critical Care Medicine

- Acute respiratory distress syndrome (ARDS)
- Noninvasive ventilation
- Hemoptysis
- Sepsis and septic shock
- Neuroleptic malignant syndrome
- General anaphylaxis
- Stinging insect hypersensitivity
- Contrast-related allergy
- Angioedema

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Critical Care Medicine Q1

A 63-year-old man is hospitalized with ARDS.

He is sedated and mechanically ventilated in assist/control mode, with PEEP of 8 cm H_2O.

Vital signs are stable. Ideal body weight is 50 kg.

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Critical Care Medicine Q1

A 63-year-old man is hospitalized with ARDS. He is sedated and mechanically ventilated in assist/control mode, with PEEP of 8 cm H_2O. Vital signs are stable. Ideal body weight is 50 kg.

Which of the following is the most appropriate tidal volume?

A: 300 mL

B: 450 mL

C: 500 mL

D: 600 mL

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Acute Respiratory Distress Syndrome

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ARDS: Diagnosis

Common causes: pneumonia, aspiration, sepsis

Berlin definition must have all of the following:

- Respiratory failure within 1 week of clinical insult or with new/worsening symptoms
- Bilateral opacities on chest radiograph, CT scan, or ultrasound not fully explained by effusions, collapse, or nodules
- Unrelated to cardiac failure/fluid overload
- Arterial Po_2/Fio_2 ≤300 or Spo_2/Fio_2 ≤315 (if oxygen saturation as measured by pulse oximetry is ≤97%)

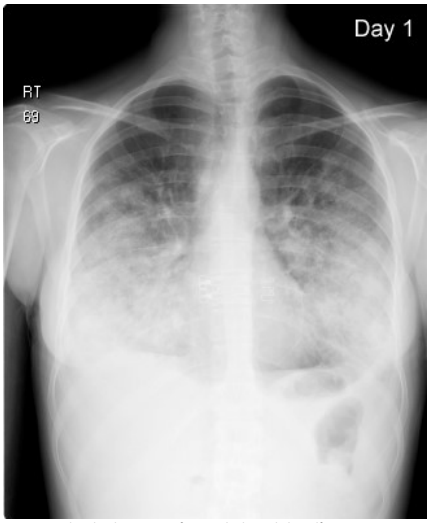


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ARDS: Diagnosis (for Intubated Patients)

Severity determination → arterial Po_2/Fio_2 ratio or Spo_2/Fio_2 ratio with PEEP ≥5 cm H_2O

Mild ARDS
- Arterial Po_2/Fio_2 ratio: 201-300 mm Hg
- Spo_2/Fio_2 ratio: 236-315, assuming Spo_2 ≤97%

Moderate ARDS
- Arterial Po_2/Fio_2 ratio: 101-200 mm Hg
- Spo_2/Fio_2 ratio: 149-235, assuming Spo_2 ≤97%

Severe ARDS
- Arterial Po_2/Fio_2 ratio: ≤100 mm Hg
- Spo_2/Fio_2 ratio: ≤148, assuming Spo_2 ≤97%

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ARDS: Ventilator Management

Tidal volume 4-8 mL/kg ideal body weight

Plateau pressure <30 mm Hg

- May require tidal volume <6 mL/kg

PEEP: optimal level unknown (but should be at least 5 cm H_2O)

- Can use ARDSNet tables

Lower PEEP/Higher Fio_2														
Fio_2	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.7	0.7	0.8	0.9	0.9	0.9	1.0
PEEP	5	5	8	8	10	10	10	12	14	14	14	16	18	18-24
Higher PEEP/Lower Fio_2														
Fio_2	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.5	0.5	0.5-0.8	0.8	0.9	0.9	1.0
PEEP	5	8	10	12	14	14	16	16	18	20	22	22	22	22-24

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ARDS: Ventilator Management

Prone positioning for severe ARDS

- >12-16 h/day
- Decreases mortality

Minimize sedation

- Intermittent, bolus administration if needed
- Daily awakening
- Early mobility while intubated if safe and feasible

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ARDS: Supportive Care

- Treatment of underlying cause
- Conservative fluid management
- Enteral nutrition
- VTE and GI bleeding prophylaxis
- Pulmonary artery catheterization: not routine for hemodynamic monitoring

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Noninvasive Ventilation

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Modes of Noninvasive Ventilation

Mode	Function	Indications
Continuous positive airway pressure (CPAP)	Constant airway pressure throughout respiratory cycle	Obstructive sleep apnea Cardiogenic pulmonary edema Excessive dynamic airway collapse Pre-intubation Post-extubation
Bilevel positive airway pressure (BPAP)	Two different levels of airway pressure (inspiratory and expiratory)	COPD exacerbation Obesity hypoventilation syndrome Neuromuscular disease Cardiogenic pulmonary edema

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Noninvasive Ventilation: Contraindications

Unable to protect airway

- Excessive secretions
- Excessive somnolence/encephalopathy/agitation
- High aspiration risk or vomiting

Mechanical issues

- Unable to fit mask, resulting in large air leak
- Recent facial trauma or surgery
- Upper airway obstruction
- Recent esophageal anastomosis

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Noninvasive Ventilation: Contraindications

Medical instability

- Respiratory or cardiac arrest
- Hypotension/shock
- Upper GI bleeding

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Noninvasive Ventilation: Monitoring

Blood gas values and clinical condition should improve within 2 hours of NPPV

- If not, consider intubation to prevent respiratory arrest

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High-Flow Humidified Nasal Cannula Devices

High-flow air and oxygen

- ≥20 L/min
- FIO_2 0.21-1.00

High flow leads to ↓ work of breathing

- Creates a small increase in positive airway pressure/FRC
- Reduction of physiologic dead space

Indications

- Pre-intubation
- Postoperative hypoxemic respiratory failure
- Acute hypoxemic respiratory failure

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Critical Care Medicine Q2

A 62-year-old man is evaluated for a 2-week history of blood-tinged sputum.

He has had a productive cough for years.

He has a 52-pack-year smoking history.

Vital signs are normal.

Chest radiograph is normal.

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Critical Care Medicine Q2

A 62-year-old man is evaluated for a 2-week history of blood-tinged sputum. He has had a productive cough for years. He has a 52-pack-year smoking history. Vital signs are normal. Chest radiograph is normal.

Which of the following is the most appropriate next step in management?

A: Chest CT with contrast

B: Oral antibiotics

C: Reevaluation in 3 months

D: Sputum culture and cytology

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Hemoptysis

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Hemoptysis: Diagnosis and Causes

Acute infection (bronchitis, pneumonia)
- Duration <1 week

Lung cancer/malignancy
- Cigarettes, asbestos, other exposures

Bronchiectasis
- Chronic cough, sputum production
- Common in cystic fibrosis

Other causes:
- Heart failure
- Mitral stenosis
- Pulmonary embolism
- Trauma
- Bleeding disorders
- Rheumatic diseases and pulmonary-renal syndromes (anti-GBM antibody disease)
- Drugs and toxins (e.g., cocaine)

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Hemoptysis: Diagnosis and Causes

Tuberculosis

- Patients from endemic areas
- Low-income populations, persons experiencing homelessness, persons living in shelters, incarcerated persons
- Persons with alcohol use disorder or who use injection drugs
- HIV-positive or immunocompromised persons



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Hemoptysis: Testing and Treatment

Exclude oropharyngeal or GI source

Chest radiography

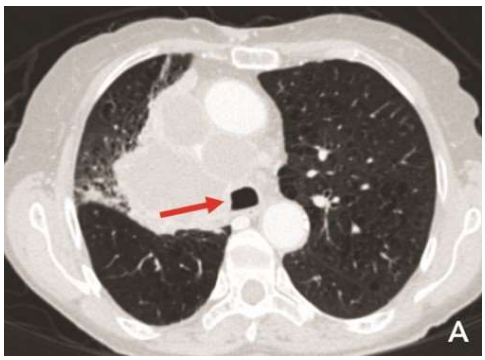
Chest CT

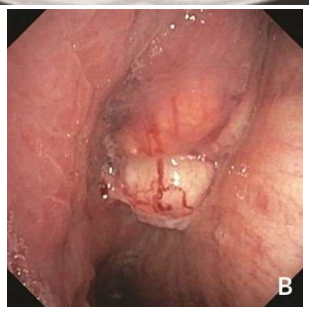
- Positive radiography findings
- Negative radiography findings but high risk for cancer

Fiberoptic bronchoscopy

- Recurrent or persistent bleeding without established cause on chest CT scan or radiograph

Treat underlying cause



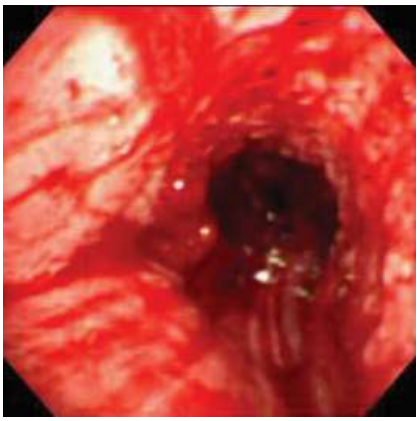


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Life-Threatening Hemoptysis (Massive Hemoptysis)



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- Airway management first
- Lateral decubitus positioning with bleeding side down
- Early bronchoscopy for diagnosis and therapy
- Angiography and embolization for profuse bleeding

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Critical Care Medicine Q3

A 74-year-old woman has fever and altered mental status.

Temperature is 100.0 °F, blood pressure is 88/50 mm Hg, pulse rate is 112/min, and respiration rate is 28/min.

She is confused.

Empiric broad-spectrum antibiotics are initiated.

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Critical Care Medicine Q3

A 74-year-old woman has fever and altered mental status. Temperature is 100.0 °F, blood pressure is 88/50 mm Hg, pulse rate is 112/min, and respiration rate is 28/min. She is confused. Empiric broad-spectrum antibiotics are initiated.

Which of the following is the most appropriate next step in treatment?

A: Glucocorticoids

B: IV fluid bolus

C: Intubation

D: Norepinephrine

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Sepsis and Septic Shock

ACP

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Sepsis: Diagnosis and Testing

Sepsis	• Known or suspected infection *and* • Organ dysfunction
Septic shock	• ↓ BP requiring vasopressors to maintain MAP >65 mm Hg *and* • Serum lactate level >2 mEq/L after volume resuscitation

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Sepsis: Treatment

Rapid intravenous fluid infusion

- 30 mL/kg body weight within first 3 hours
- Balanced crystalloids preferred

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Sepsis: Treatment

Broad-spectrum antibiotics within first hour

Coverage based on likely organisms and risk factors

- Double gram-negative coverage if high risk for MDRO
- MRSA coverage if high risk
- Antibiotic de-escalation is guided by culture results

Prompt source control

- Abscess drainage, tissue debridement
- Removal of infected IV catheters or hardware

Antibiotic duration depends on source

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Septic Shock: Refractory Hypotension Treatment

Norepinephrine: first-line vasopressor

Fixed-dose vasopressin can be added to norepinephrine

- Further ↑ blood pressure
- ↓ Dose of norepinephrine

Glucocorticoids

- Hypotension despite fluids/vasopressors
- No role in sepsis without shock

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Critical Care Medicine Q4

A 73-year-old woman is evaluated for altered mental status. She has Parkinson disease.

An empty bottle of levodopa-carbidopa was found at her house.

She is diaphoretic and disoriented.

Temperature is 102.0 °F. BP is 170/120 mm Hg; pulse rate is 120/min.

Generalized muscular rigidity is noted.

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Critical Care Medicine Q4

A 73-year-old woman is evaluated for altered mental status. She has Parkinson disease. An empty bottle of levodopa-carbidopa was found at her house. She is diaphoretic and disoriented. Temperature is 102.0 °F. BP is 170/120 mm Hg; pulse rate is 120/min. Generalized muscular rigidity is noted.

Which of the following is the most likely diagnosis?

A: Heat stroke

B: Malignant hyperthermia

C: Neuroleptic malignant syndrome

D: Serotonin syndrome

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Neuroleptic Malignant Syndrome

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Neuroleptic Malignant Syndrome: Diagnosis

Idiosyncratic reaction to dopamine D_2-receptor antagonists

- Antipsychotic/neuroleptic drugs
- Antiemetic drugs
- Abrupt withdrawal of levodopa/dopamine agonist

Cardinal features

- Hyperthermia, muscular rigidity, altered mentation

Clinical diagnosis

- Compatible drug ingestion, clinical syndrome

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Neuroleptic Malignant Syndrome: Testing

Supporting laboratory data

- Hyperkalemia
- Hypo-/hypernatremia
- Hypocalcemia, hypomagnesemia
- Metabolic acidosis
- Rhabdomyolysis
  - ↑ CK, phosphorus, LDH, ALT/AST levels
  - Myoglobinuria

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Neuroleptic Malignant Syndrome: Treatment

- Discontinue triggering agent
- Reinstate antiparkinsonian drug
- Active cooling (e.g., cooling blankets, ice packs) and rehydration
- Short-acting benzodiazepines to control agitation
- Dantrolene for moderate to severe cases with significant muscle rigidity

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Serotonin Syndrome/NMS/Malignant Hyperthermia

All characterized by hypertension, tachycardia, tachypnea, hyperthermia, diaphoresis, increased neuromuscular tone, and altered mental status

Condition	Onset	Medication	Pupils	Mucosa	Bowel Sounds	Reflexes
Serotonin syndrome	Within 12-24 hours	Serotonin agonist	Mydriasis	Sialorrhea	Hyperactive (nausea, vomiting, diarrhea)	Hyperreflexia
NMS	Days to weeks	Dopamine antagonist	Normal	Sialorrhea	Normal or decreased	Bradyreflexia
Malignant hyperthermia	Within 12-24 hours	Gas anesthesia or succinyl-choline	Normal	Normal	Decreased	Hyporeflexia

Information from Boyer EW, Shannon M. The serotonin syndrome. N Engl J Med. 2005 Mar 17;352(11):1112-20. [PMID: 15784664]

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General Anaphylaxis

ACP

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Anaphylaxis: Signs and Symptoms

Systemic, life-threatening, IgE-mediated allergic hypersensitivity reaction to protein allergens

Can cause the following:

- HEENT: hoarseness, dysphagia, edema and pruritis of lips and palate, conjunctival edema
- Respiratory: rhinorrhea, wheezing, cough, dyspnea
- CV: hypotension, syncope, arrythmia
- Skin: flushing, pruritis, angioedema
- GI: nausea, vomiting, diarrhea



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Anaphylaxis: Triggers

Foods

- Especially milk, tree nuts, shellfish, eggs

Medications

- β-Lactams (but beware of false penicillin allergy)
- Fluoroquinolones
- NSAIDs

Vaccines containing allergens (e.g., egg protein)

Latex

Insect venom

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Anaphylaxis: Treatment

Intramuscular or IV epinephrine upon recognition

- May require repeated doses or IV infusion

Supplemental oxygen

IV crystalloid fluid resuscitation

Nebulized bronchodilators for bronchospasm

IV antihistamines for pruritis and rash

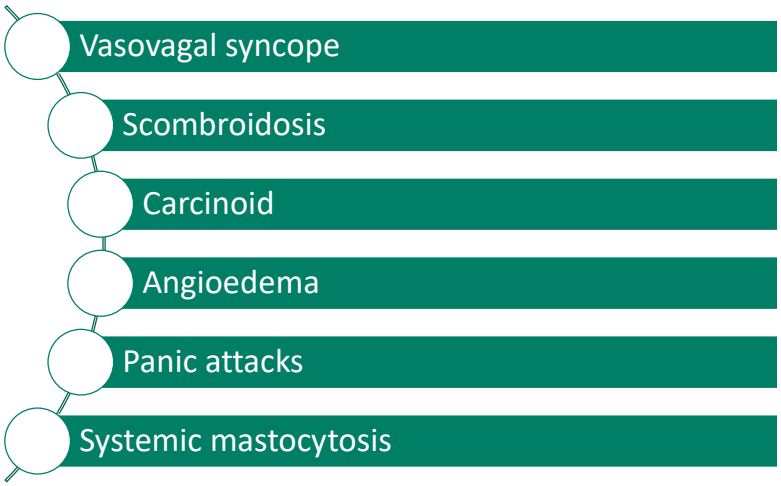
Limited evidence for glucocorticoids

Albuterol for bronchospasm

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Anaphylaxis: Mimics



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Critical Care Medicine Q5

A 21-year-old man is evaluated for dyspnea after a bee sting.

BP is 98/60 mm Hg, pulse rate is 100/min, and respiration rate is 24/min.

Chest exam reveals wheezing.

No stridor; rash; or swelling of the face, tongue, or oropharynx is noted.

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Critical Care Medicine Q5

A 21-year-old man is evaluated for dyspnea after a bee sting. BP is 98/60 mm Hg, pulse rate is 100/min, and respiration rate is 24/min. Chest exam reveals wheezing. No stridor; rash; or swelling of the face, tongue, or oropharynx is noted.

Which of the following is the most appropriate treatment?

A: Endotracheal intubation

B: Intramuscular epinephrine

C: IV diphenhydramine and methylprednisolone

D: IV epinephrine

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Stinging Insect Hypersensitivity

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Local Reactions to Stinging Insect: Diagnosis and Treatment

- Local pain, swelling, erythema, itching
- Cold compresses
- Antihistamines/oral glucocorticoids for pruritus and swelling



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Anaphylaxis to Stinging Insect: Diagnosis



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Skin symptoms
- Urticaria, flushing
- Angioedema

Respiratory symptoms
- Shortness of breath/wheezing
- Stridor

Cardiovascular symptoms
- Hypotension
- Tachycardia

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Anaphylaxis to Stinging Insect: Treatment

Ensure airway, breathing, circulation
- IV access
- Intubation for airway compromise

Intramuscular epinephrine: first line
- Repeat every 5-15 min as needed

Removal of stinger

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Anaphylaxis to Stinging Insect: Treatment

IV epinephrine for refractory hypotension

Antihistamines/glucocorticoids

- Do not impact outcome

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Contrast-Related Allergy

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Contrast-Related Allergy: Diagnosis

Not related to dose

May occur in patients without previous exposure

May not recur after reexposure

Allergic symptoms/findings

- Itching, urticaria, erythema
- Stridor, bronchospasm
- Angioedema
- Shock

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Contrast-Related Allergy: Treatment

Stop contrast

Epinephrine (IM or IV)

- Multiple doses may be required

IV 0.9% saline

Intubation for respiratory compromise

Adjunctive antihistamine for pruritus and rash

No evidence for glucocorticoids

Premedication prophylaxis (glucocorticoid and H1 antihistamine)

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Critical Care Medicine Q6

A 54-year-old man reports 24 hours of progressive mouth swelling and hoarseness.

He takes lisinopril for hypertension.

Respiration rate is 22/min with inspiratory stridor; oxygen saturation is 96%.

Lungs are clear. Lips and tongue are edematous.

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Critical Care Medicine Q6

A 54-year-old man reports 24 hours of progressive mouth swelling and hoarseness. He takes lisinopril for hypertension. Respiration rate is 22/min with inspiratory stridor; oxygen saturation is 96%. Lungs are clear. Lips and tongue are edematous.

Which of the following is the most appropriate next step in management?

A: Endotracheal intubation

B: IM epinephrine

C: IV methylprednisolone

D: NPPV

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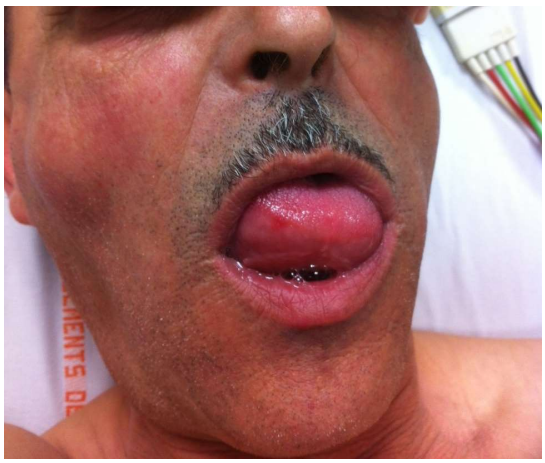
Angioedema

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Angioedema: Diagnosis

Localized swelling of skin and mucous membranes

- Upper respiratory tract → airway obstruction
- Bowel → abdominal pain



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Angioedema: Diagnosis

Mast cell mediated

- Allergic IgE reaction
- Foods, drugs, insect stings, contrast, latex
- Onset in minutes
- Hypotension, urticaria, bronchospasm
- Elevated serum tryptase level (specific, not sensitive)

Bradykinin mediated

- Hereditary angioedema, ACE inhibitor
- Slow onset: 1-2 days
- **No** hypotension, urticaria, or bronchospasm
- Bowel wall edema with nausea, diarrhea, or obstruction
- Hereditary angioedema → depressed C4 required

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Angioedema: Treatment

Mast cell mediated (urticaria)

- Antihistamines, glucocorticoids for allergic symptoms
- Epinephrine for anaphylaxis
- Discharge with epinephrine auto-injector

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Angioedema: Treatment

Bradykinin mediated (no urticaria)

- Monitor airway
  - Airway compromise → intubate
- ACE inhibitor associated
  - Discontinue and avoid ACE inhibitors
- Acute hereditary angioedema
  - Plasma-derived C1 inhibitor or recombinant C1 inhibitor
  - Ecallantide (kallikrein inhibitor)
  - Icatibant (bradykinin receptor antagonist)
  - FFP as second-line therapy

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Critical Care Medicine

- Answers to Multiple-Choice Questions

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Critical Care Medicine Q1

A 63-year-old man is hospitalized with ARDS. He is sedated and mechanically ventilated in assist/control mode, with PEEP of 8 cm H_2O. Vital signs are stable. Ideal body weight is 50 kg.

Which of the following is the most appropriate tidal volume?

A: 300 mL

B: 450 mL

C: 500 mL

D: 600 mL

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Critical Care Medicine Q2

A 62-year-old man is evaluated for a 2-week history of blood-tinged sputum. He has had a productive cough for years. He has a 52-pack-year smoking history. Vital signs are normal. Chest radiograph is normal.

Which of the following is the most appropriate next step in management?

A: Chest CT with contrast

B: Oral antibiotics

C: Reevaluation in 3 months

D: Sputum culture and cytology

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Critical Care Medicine Q3

A 74-year-old woman has fever and altered mental status. Temperature is 100.0 °F, blood pressure is 88/50 mm Hg, pulse rate is 112/min, and respiration rate is 28/min. She is confused. Empiric broad-spectrum antibiotics are initiated.

Which of the following is the most appropriate next step in treatment?

A: Glucocorticoids

B: IV fluid bolus

C: Intubation

D: Norepinephrine

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A 73-year-old woman is evaluated for altered mental status. She has Parkinson disease. An empty bottle of levodopa-carbidopa was found at her house. She is diaphoretic and disoriented. Temperature is 102.0 °F. BP is 170/120 mm Hg; pulse rate is 120/min. Generalized muscular rigidity is noted.

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A 21-year-old man is evaluated for dyspnea after a bee sting. BP is 98/60 mm Hg, pulse rate is 100/min, and respiration rate is 24/min. Chest exam reveals wheezing. No stridor; rash; or swelling of the face, tongue, or oropharynx is noted.

Which of the following is the most appropriate treatment?

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C: IV diphenhydramine and methylprednisolone

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Critical Care Medicine Q6

A 54-year-old man reports 24 hours of progressive mouth swelling and hoarseness. He takes lisinopril for hypertension. Respiration rate is 22/min with inspiratory stridor; oxygen saturation is 96%. Lungs are clear. Lips and tongue are edematous.

Which of the following is the most appropriate next step in management?

A: Endotracheal intubation

B: IM epinephrine

C: IV methylprednisolone

D: NPPV

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Infectious Disease I

2025 Virtual/Live Internal Medicine Board Review

Shiwei Zhou, MD
Clinical Associate Professor, Infectious Diseases
University of Michigan Health System
Ann Arbor, MI

ACP Internal Medicine Board Review Course

Infectious Disease I

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- Cellulitis
- Necrotizing soft tissue infections
- Toxic shock syndrome
- Diabetic foot infections
- Osteomyelitis
- Meningitis
- Focal central nervous system infections
- Progressive multifocal leukoencephalopathy

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Infectious Disease Q1

A 25-year-old woman is evaluated for redness over the right leg at the site of a small scratch.

Temperature is 99.0 °F.

A warm, erythematous, 3-cm × 3-cm patch without purulence is present on the right thigh.

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Infectious Disease Q1

A 25-year-old woman is evaluated for redness over the right leg at the site of a small scratch. Temperature is 99.0 °F. A warm, erythematous, 3-cm × 3-cm patch without purulence is present on the right thigh.

Which of the following is the most appropriate empiric outpatient therapy?

A: Cephalexin

B: Daptomycin

C: Doxycycline

D: Trimethoprim-sulfamethoxazole

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Cellulitis

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Cellulitis: Diagnosis

- Acute onset
- Poorly demarcated area of erythema, warmth, induration, and tenderness
- Non-purulent
- ± Fever/malaise
- Almost always unilateral



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Cellulitis: Testing

Usually caused by β-hemolytic streptococci (GAS, group B *Streptococcus*)

Diagnosis can be made by clinical appearance alone

Blood and skin tissue cultures only recommended in the following:

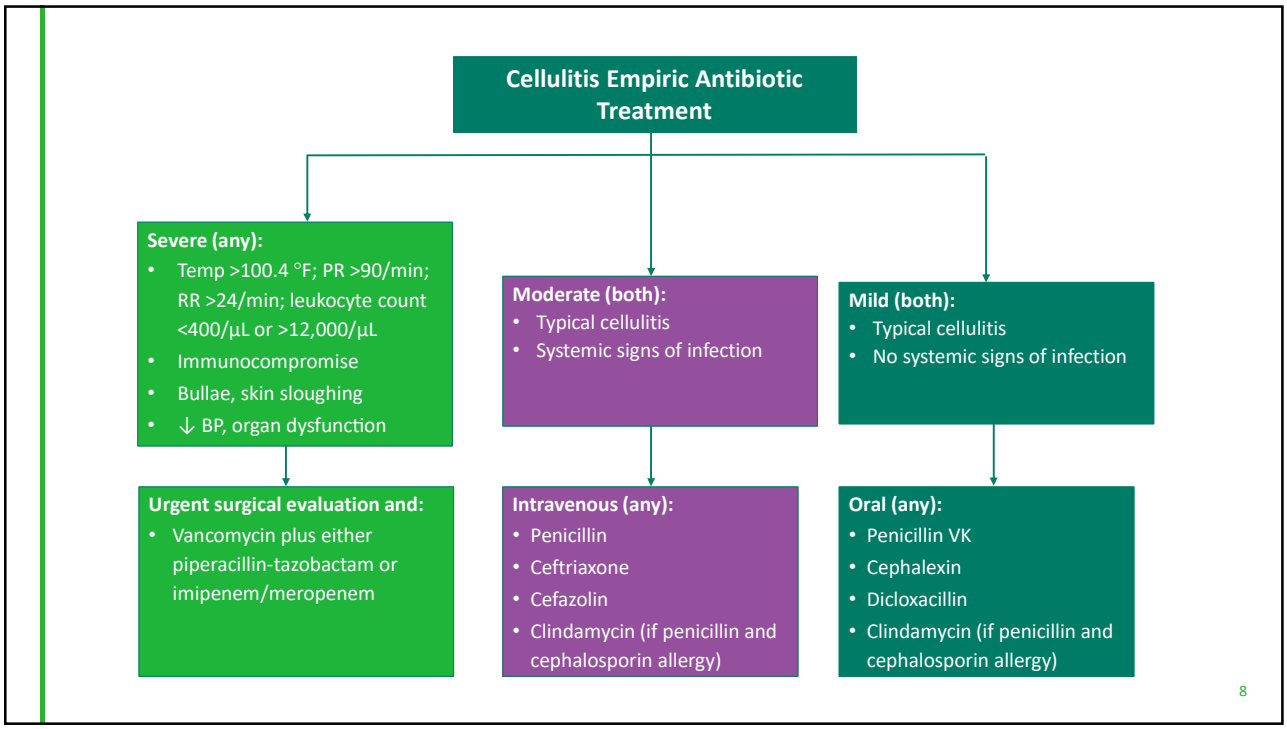
- Immunocompromise
- Immersion injury or animal bites
- Toxic appearance

Imaging reserved for suspected complications

- Abscess
- Bone/fascia involvement
- Suspected necrotizing infection

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Necrotizing Soft Tissue Infections

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Necrotizing Soft Tissue Infections: Diagnosis and Testing

Consider with soft tissue infection and:

- Hemodynamic instability
- Fever
- Hyperesthesia, later anesthesia
- Crepitus
- Rapid progression
- Wound color changes
- Bullous lesions
- "Woody" induration

Testing: blood cultures, surgical exploration



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Necrotizing Soft Tissue Infections: Treatment

Debridement

- CT scan may demonstrate gas and swelling in soft tissues
- Do not delay surgical exploration for imaging when suspicion is high

Empiric antibiotic therapy

- Vancomycin or daptomycin *and*
- Piperacillin-tazobactam or carbapenem *and*
- Clindamycin (for antitoxin effect)
  - Linezolid may be used for antitoxin effect in place of clindamycin

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Necrotizing Soft Tissue Infections: Treatment

Targeted antibiotic therapy for monomicrobial infection

Staphylococcus aureus	• Vancomycin, linezolid, or daptomycin if MRSA • Nafcillin, oxacillin, or cefazolin if MSSA
GAS/*Clostridium* spp.	• Penicillin + clindamycin
Aeromonas (fresh or saltwater exposure)	• Doxycycline + ciprofloxacin
Vibrio vulnificus (cirrhosis + brackish water exposure)	• Doxycycline + ceftriaxone

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Toxic Shock Syndrome

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Toxic Shock Syndrome: Diagnosis

Exotoxin-producing *S. aureus* or GAS strains

- Proinflammatory cytokines
  - Shock and multisystem organ failure

Risk factors

- *S. aureus* TSS: associated with retained packing/tampons, IV drug use
- GAS TSS: associated with necrotizing fasciitis

Clinical features include fever, hypotension, and ≥2 of the following:

- Erythrodermic rash that desquamates
- Respiratory, kidney, or liver failure
- Coagulopathy
- Mental status change

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Toxic Shock Syndrome: Treatment

Streptococcus pyogenes (GAS) infection:

- Penicillin plus clindamycin (inhibit toxin production)

S. aureus infection:

- Nafcillin or oxacillin plus clindamycin (if MSSA)
- Vancomycin plus clindamycin (if MRSA)

Clinical considerations

- In cases of clindamycin resistance, linezolid may be used to inhibit toxin
- Surgical debridement (GAS) and removal of foreign body (*S. aureus*) usually necessary for resolution
- Adjunctive IV immunoglobulin may have mortality benefit

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Infectious Disease Q2

A 49-year-old man with diabetes has a new right heel ulceration.

He is afebrile.

A 1-cm rim of erythema is present around an ulceration measuring 3 x 3 mm.

The area is tender and warm without drainage or exposed bone.

Foot radiograph shows no osteomyelitis.

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Infectious Disease Q2

A 49-year-old man with diabetes has a new right heel ulceration. He is afebrile. A 1-cm rim of erythema is present around an ulceration measuring 3 x 3 mm. The area is tender and warm without drainage or exposed bone. Foot radiograph shows no osteomyelitis.

Antibiotic therapy against which of the following pathogens is most appropriate in this patient?

A: Aerobic gram-negative bacilli

B: Aerobic gram-positive cocci

C: Aerobic gram-positive cocci and anaerobic organisms

D: Anaerobic organisms

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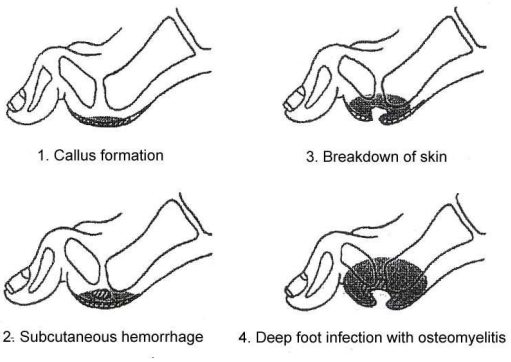
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Diabetic Foot Infections

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Diabetic Foot Infections: Risk Factors

- Vasculopathy
- Neuropathy
- Suboptimal glucose control
- Additional immunologic deficits



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Diabetic Foot Infections: Diagnosis

Mild

- Skin and subcutaneous tissue
- No systemic toxicity
- Erythema ≤2 cm surrounding ulcer
- Organisms: staphylococci, streptococci



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Diabetic Foot Infections: Diagnosis



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Moderate

- Erythema >2 cm or involving deeper structures
  - Abscess, osteomyelitis, septic arthritis
- No systemic toxicity
- Organisms
  - Staphylococci, streptococci
  - Aerobic gram-negative bacilli
  - ± Anaerobes

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Diabetic Foot Infections: Diagnosis

Severe

- Erythema >2 cm or involving deeper structures
  - Abscess, osteomyelitis, septic arthritis
- Systemic toxicity ± hemodynamic instability
- Acidosis, hyperglycemia, kidney injury
- Organisms
  - Same as in moderate infection + anaerobes

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Diabetic Foot Infections: Testing

Wound swab cultures discouraged

Only culture wounds that appear infected

- Purulent, red, painful, swollen
- Biopsy or curettage for cultures
- Obtain cultures before antibiotics

Possible osteomyelitis

- Obtain bone culture
- Probe-to-bone test has 90% sensitivity

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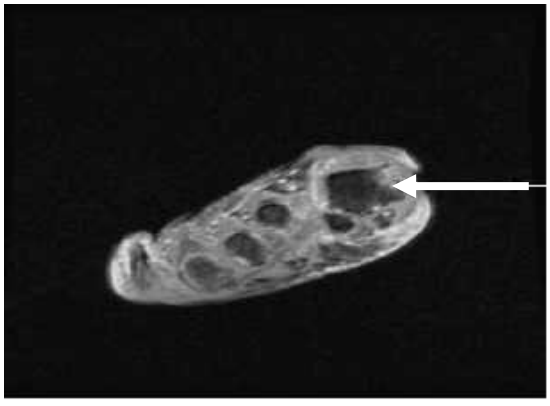
Diabetic Foot Infections: Testing

Plain radiography for all mild infections

- May be normal in early osteomyelitis

MRI indications

- Suspicion of deep abscess
- Plain radiography findings are equivocal for osteomyelitis



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Diabetic Foot Infections: Treatment

- Surgical debridement
- Vascular assessment
- Wound care
- Glycemic control
- Wound offloading

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Diabetic Foot Infections: Treatment

Mild infections (oral)

- Cephalexin, dicloxacillin, or amoxicillin-clavulanate (latter if previous antibiotic exposure)
- Clindamycin (if penicillin and cephalosporin allergy)

Moderate (oral or parenteral) or severe (parenteral) infections

- Polymicrobial coverage of staphylococci (including MRSA), streptococci, aerobic gram-negative bacilli, and anaerobes

Definitive therapy based on culture and sensitivity testing

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Diabetic Foot Infections: Treatment

Duration of antibiotic therapy

- 1-2 weeks for mild soft tissue infection
- 2-4 weeks for moderate to severe soft tissue infection
- Osteomyelitis
  - If radical resection (i.e., below-knee amputation) with no remaining infected tissue: no longer than 2-5 days
  - Persistent infection involving bone: ≥4 weeks

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Infectious Disease Q3

A 59-year-old woman reports a 1-week history of increasing pain in the right foot.

She stepped on a nail 1 month ago.

Exam reveals tenderness and warmth directly below the proximal fifth metatarsal bone.

Plain radiograph of the foot is normal.

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Infectious Disease Q3

A 59-year-old woman reports a 1-week history of increasing pain in the right foot. She stepped on a nail 1 month ago. Exam reveals tenderness and warmth directly below the proximal fifth metatarsal bone. Plain radiograph of the foot is normal.

Which of the following is the most appropriate next imaging test?

A: CT

B: Gallium scanning

C: MRI

D: Three-phase bone scanning

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Osteomyelitis

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Osteomyelitis

Mechanisms

- Hematogenous seeding (e.g., vertebral osteomyelitis)
- Contiguous spread from adjacent nonhealing wound, ulcer, or soft tissue infection





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Osteomyelitis: Diagnosis



Acute osteomyelitis

- Pain for a few days or weeks
- Fever may or may not be present

Chronic osteomyelitis

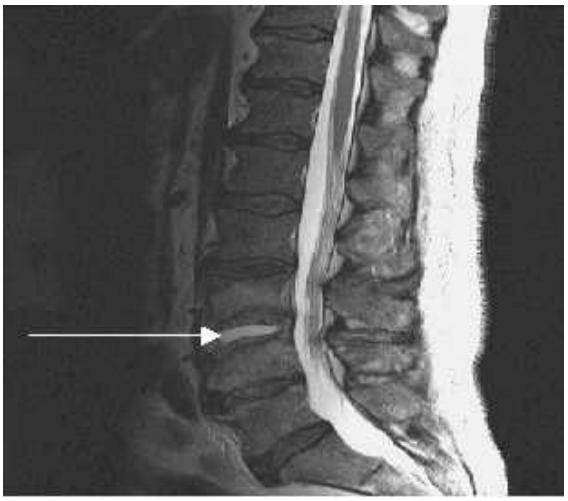
- Long-standing infection over months or years
- Draining sinus tract
- Fever usually absent

Prosthetic joint infection: chronic pain, loosening of prosthetic components

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Osteomyelitis: Testing



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Plain radiography

- Initial test if symptoms >2 weeks
- Low cost
- Positivity establishes diagnosis

MRI

- Preferred modality
- Symptoms <2 weeks
- High suspicion, negative radiograph

CT if MRI contraindicated

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Osteomyelitis: Testing

ESR, CRP level frequently elevated

- Normal values do not exclude osteomyelitis

Blood cultures should be obtained if

- Hematogenous osteomyelitis (e.g., vertebral)
- Sepsis

Deep bone culture/histopathologic exam

- Not required if blood culture (+)
- Obtain bone culture before antibiotic treatment, if patient is stable

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Osteomyelitis: Treatment

Antibiotic therapy based on bone or blood culture

- Acute osteomyelitis treatment duration is 4-6 weeks
- Chronic osteomyelitis treatment may require longer courses, surgery

Surgical debridement for extensive necrosis

Orthopedic hardware removal (if possible)

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Meningitis

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Acute Meningitis: Epidemiology/Causes

Bacterial

- *Streptococcus pneumoniae*: most common
- *Neisseria meningitidis*: second most common
  - Younger patients
  - Complement deficiencies (C5-C9)
- *Listeria monocytogenes*
  - Age >50 years
  - Cell-mediated immunodeficiency
- *Haemophilus influenzae*

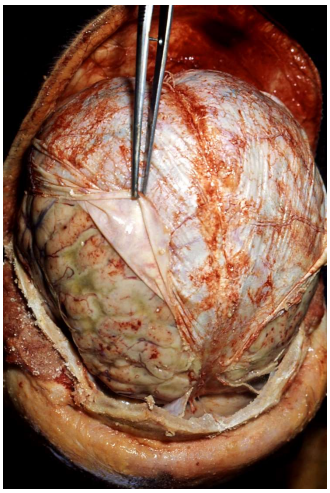


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Acute Meningitis: Epidemiology/Causes

Viral

- Enteroviruses most common
- HSV type 2
- VZV
- Acute HIV
- West Nile virus (meningitis/encephalitis)

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Acute Meningitis: Diagnosis

- Fever
- Headache
- Photophobia
- Nausea/vomiting
- Nuchal rigidity ± mental status changes



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Acute Meningitis: Testing

Blood cultures

CT before lumbar puncture if

- Focal neurologic findings
- Altered mentation
- Immunocompromise
- Papilledema
- New seizure
- History of CNS disease
  - Examples: mass lesion, stroke with edema

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Acute Meningitis: CSF Analysis

CSF Parameter	Viral Meningitis	Bacterial Meningitis
Opening pressure	≤250 mm H_2O	200-500 mm H_2O
Leukocyte count	50-1000/µL	1000-5000/µL
Leukocyte predominance	Lymphocytes	Neutrophils
Glucose	>45 mg/dL	<40 mg/dL
Protein	<200 mg/dL	100-500 mg/dL

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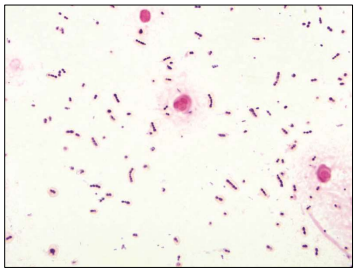
Acute Meningitis: Testing

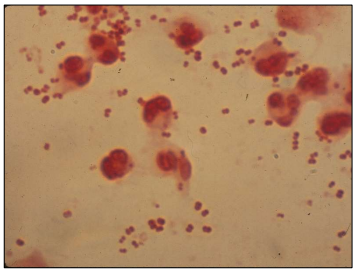
Gram stain findings

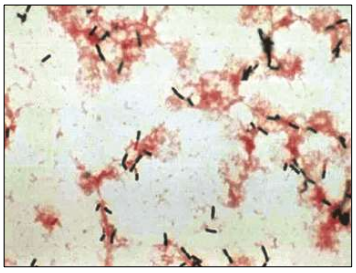
- Gram-positive diplococci indicate *S. pneumoniae*
- Gram-negative diplococci indicate *N. meningitidis*
- Gram-positive rods indicate *Listeria*

CSF culture/multiplex PCR testing

Blood cultures (two sets)







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Acute Meningitis: Treatment

Immediate empiric antibiotic therapy

- Vancomycin + ceftriaxone
- Add ampicillin (*Listeria* coverage)
  - Age >50 years
  - Immunocompromise

Adjunctive dexamethasone if community-acquired bacterial meningitis suspected

- Before or at time antibiotics given
- Continue if *S. pneumoniae* (or *H. influenzae*) identified

Symptomatic treatment sufficient for most viral meningitis

- Acyclovir if suspicion for HSV or VZV

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Focal Central Nervous System Infections

ACP

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Bacterial Brain Abscess: Diagnosis

Arises through hematogenous seeding or contiguous spread (from adjacent ENT source, penetrating trauma, or iatrogenic seeding)

- Cause: *S. aureus, s*treptococci*, Enterobacterales*, anaerobes

Usually presents with headaches

- Altered mental status, focal deficits, and seizures can be present
- Neck stiffness and fever may be absent

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Spinal Epidural Abscess: Diagnosis

Most commonly arises through hematogenous seeding

- Cause: *S. aureus* (>50%), *Streptococcus* species, and gram-negative bacilli

Predisposing risk factors:

- Endocarditis
- IV drug use
- Long-term IV catheters
- Spine surgery or neurosurgical procedures/epidural injection

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Spinal Epidural Abscess: Diagnosis

Presents with localized spine pain at site that radiates downward:

- Radiculopathy
- Occasionally fevers
- Focal neurologic deficits indicate possible need for prompt surgical evaluation
  - Extremity weakness
  - Numbness
  - Bowel and/or bladder dysfunction

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Spinal Epidural Abscess: Management

Diagnostics

- CBC, ESR/CRP
- Blood cultures (before antibiotics)
  - If culture (-):
    - Consider travel/exposure history
      - TB (Pott disease) or *Brucella*
- MRI of spine
- Surgical evaluation if focal neurologic signs

Treatment

- At least 6 weeks antimicrobial therapy
- Surgical drainage if neurologic symptoms or signs

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Progressive Multifocal Leukoencephalopathy (PML)

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PML: Epidemiology and Risk Factors

JC polyomavirus

- Demyelinating disease

Risk factors

- HIV/AIDS with CD4 <100-200/µL
- Immunomodulatory therapy for multiple sclerosis (e.g., natalizumab, efalizumab)

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PML: Diagnosis

- Heterogeneous focal neurologic deficits
  - Dementia most common
- Insidious onset
- Progressive worsening over several weeks
- Fever/headaches uncommon

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PML: Testing

MRI

- Demyelinating white matter lesions
- No mass effect
- Contrast enhancement unlikely

CSF PCR for JC polyomavirus

Brain biopsy when diagnosis unclear

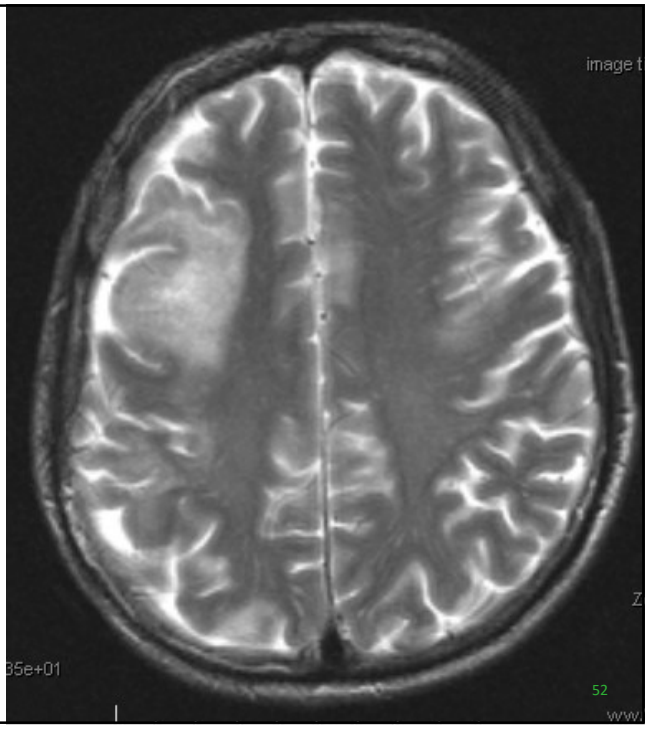


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Infectious Disease I

- Answers to Multiple-Choice Questions

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Infectious Disease Q1

A 25-year-old woman is evaluated for redness over the right leg at the site of a small scratch. Temperature is 99.0 °F. A warm, erythematous, 3-cm × 3-cm patch without purulence is present on the right thigh.

Which of the following is the most appropriate empiric outpatient therapy?

A: Cephalexin

B: Daptomycin

C: Doxycycline

D: Trimethoprim-sulfamethoxazole

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Infectious Disease Q2

A 49-year-old man with diabetes has a new right heel ulceration. He is afebrile. A 1-cm rim of erythema is present around an ulceration measuring 3 x 3 mm. The area is tender and warm without drainage or exposed bone. Foot radiograph shows no osteomyelitis.

Antibiotic therapy against which of the following pathogens is most appropriate in this patient?

A: Aerobic gram-negative bacilli

B: Aerobic gram-positive cocci

C: Aerobic gram-positive cocci and anaerobic organisms

D: Anaerobic organisms

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Infectious Disease Q3

A 59-year-old woman reports a 1-week history of increasing pain in the right foot. She stepped on a nail 1 month ago. Exam reveals tenderness and warmth directly below the proximal fifth metatarsal bone. Plain radiograph of the foot is normal.

Which of the following is the most appropriate next imaging test?

A: CT

B: Gallium scanning

C: MRI

D: Three-phase bone scanning

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Infectious Disease II

2025 Virtual/Live Internal Medicine Board Review

Shiwei Zhou, MD
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University of Michigan Health System
Ann Arbor, MI

ACP Internal Medicine Board Review Course

Infectious Disease II

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- Pneumonia
- Tuberculosis
- Influenza
- COVID
- Herpesvirus infections
- Postherpetic neuralgia
- *Clostridioides difficile* colitis

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Infectious Disease Q4

A 26-year-old man is evaluated for a 3-day history of fever, myalgia, and cough. He was previously healthy.

Temperature is 100.9 °F.

He is comfortably breathing ambient air.

Crackles are heard at the left lung base.

Chest radiograph shows a left lower lobe infiltrate.

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Infectious Disease Q4

A 26-year-old man is evaluated for a 3-day history of fever, myalgia, and cough. He was previously healthy. Temperature is 100.9 °F. He is comfortably breathing ambient air. Crackles are heard at the left lung base. Chest radiograph shows a left lower lobe infiltrate.

Which of the following oral agents is recommended for treatment?

A: Amoxicillin-clavulanate

B: Cefuroxime

C: Ciprofloxacin

D: Doxycycline

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Pneumonia

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CAP: Epidemiology

Typical bacterial pathogens

- *Streptococcus pneumoniae*
  - Most common bacterial cause
- *Haemophilus* species
- *Moraxella*
  - Patients with chronic pulmonary disease

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CAP: Epidemiology

Atypical bacterial pathogens

- *Mycoplasma pneumoniae*
  - Patients aged 20-40 years
- *Chlamydophila pneumoniae*
  - Patients aged 20-40 years
- *Legionella pneumophila*
  - Water exposure (e.g., hot tubs, air conditioning units)

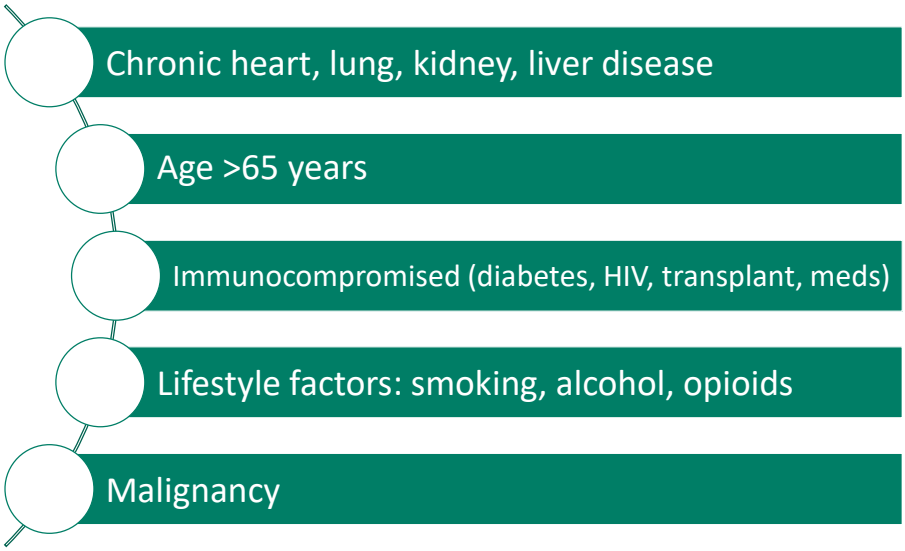
Respiratory viruses

- Rhinovirus
- Influenza virus
- Parainfluenza viruses
- RSV
- SARS-CoV-2
- Adenovirus

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CAP: Comorbidities That Increase Risk for Poor Outcomes



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CAP: Diagnosis and Testing

Fever, productive cough, dyspnea, pleuritic chest pain

Infiltrates on chest radiograph

Microbiologic testing to identify cause not routinely indicated in outpatient setting

- Exception: influenza rapid molecular assay (PCR) recommended during seasonal outbreaks

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CAP: Testing

Sputum Gram stain and culture/blood culture indications

- Moderate to severe CAP (hospitalized)
- Empiric treatment for *P. aeruginosa* or MRSA
- Previous respiratory infection with *P. aeruginosa* or MRSA
- Previously hospitalized + parenteral antibiotics in previous 90 days

Urinary antigens (*Legionella, S. pneumoniae*)

- Indicated in severe CAP

Consider bronchoscopy if severe CAP/critically ill

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CAP: Hospitalization

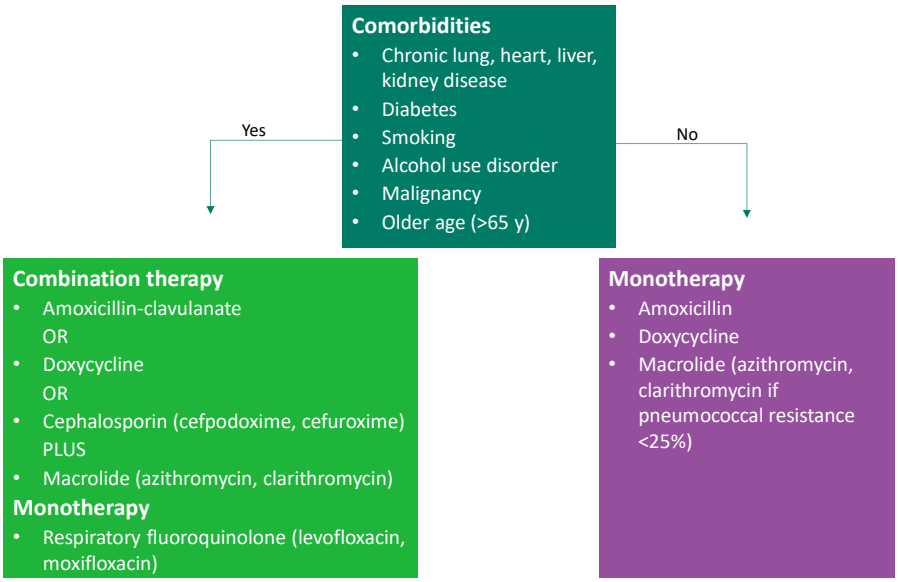
Use clinical prediction rule to determine prognosis/site of care

- Pneumonia Severity Index (PSI)
- Infectious Diseases Society of America/American Thoracic Society (IDSA/ATS) consensus guideline criteria

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Initial Outpatient CAP Treatment by Comorbidities



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Initial Inpatient CAP Treatment

Pneumonia Severity	Standard Treatment	Previous Respiratory Isolation of MRSA	Previous Respiratory Isolation of *P. aeruginosa**
Nonsevere	**Combination therapy** • β-Lactam (ampicillin-sulbactam, cefotaxime, ceftriaxone) *and* • Macrolide (azithromycin, clarithromycin) **Monotherapy** • Respiratory fluoroquinolone (levofloxacin, moxifloxacin)	Add MRSA coverage (vancomycin, linezolid)	Include *P. aeruginosa* coverage (piperacillin-tazobactam, cefepime, ceftazidime, aztreonam, imipenem, meropenem)
Severe	**Combination therapy** • β-Lactam + macrolide *or* • β-Lactam + respiratory fluoroquinolone	Add MRSA coverage (vancomycin, linezolid)	Include *P. aeruginosa* coverage (piperacillin-tazobactam, cefepime, ceftazidime, aztreonam, imipenem, meropenem)

*Recent hospitalization and parenteral antibiotic exposure in the previous 90 days are additional risk factors for MRSA and *P. aeruginosa* infection; empiric coverage of these pathogens is indicated when severe pneumonia is present.

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CAP: Antibiotic Treatment

Therapy duration of 5 days for uncomplicated CAP if (≥48 hours prior to discontinuing therapy):

- Normalization of vital signs
- Ability to eat
- Normal mentation

If symptoms resolve within 5-7 days, follow-up chest radiography usually not necessary

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Tuberculosis (TB)

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Latent Tuberculosis: Diagnosis and Testing

More than two thirds of U.S. cases are in foreign-born persons

Diagnosis

- Positive interferon-γ release assay (IGRA) (preferred) or tuberculin skin testing (TST)
- No symptoms
- Normal chest radiograph

IGRA preferred for:

- High likelihood of infection/low-to-intermediate risk for progression
- History of bacillus Calmette-Guérin vaccination
- Unlikely to return for TST interpretation

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Criteria for TST Positivity by Risk Group

≥5 mm	≥10 mm	≥15 mm

• HIV positivity
• Contact with active TB
• Radiograph consistent with old TB
• Immunosuppressive conditions
• TNF-α inhibitor therapy
	• Recent (<5 years) arrivals from high-prevalence countries
	• Intravenous drug use
	• Residents/employees of high-risk congregate settings and mycobacteriology lab workers
	• High-risk comorbidities
	  ○ Silicosis
	  ○ Diabetes
	  ○ Severe kidney disease
	  ○ Jejunoileal bypass
	  ○ Solid organ transplantation
	  ○ Head/neck cancer
		All others

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Latent Tuberculosis: Treatment

Short course with rifamycins preferred

- Isoniazid (INH) and rifapentine once weekly for 3 months
- INH and rifampin once daily for 3 months
- Rifampin daily for 4 months

Rifamycins are potent CYP3A4 inducers

- Drug–drug interactions should be checked

Alternative regimens

- INH daily for 9 months
- INH daily for 6 months: adequate in persons with adherence challenges

Pyridoxine supplementation to prevent INH-induced neuropathy

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Active Tuberculosis: Diagnosis

- Fever, chills, night sweats
- Weight loss, anorexia, fatigue
- Cough >3 weeks ± hemoptysis
- Abnormal chest radiograph

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Active Tuberculosis: Radiography

Primary infection

- Hilar lymphadenopathy or infiltrates

Reactivation

- Apical-posterior segments of the upper lobe
- Superior segments of the lower lobe

Cavities without air-fluid levels

Miliary TB (disseminated)

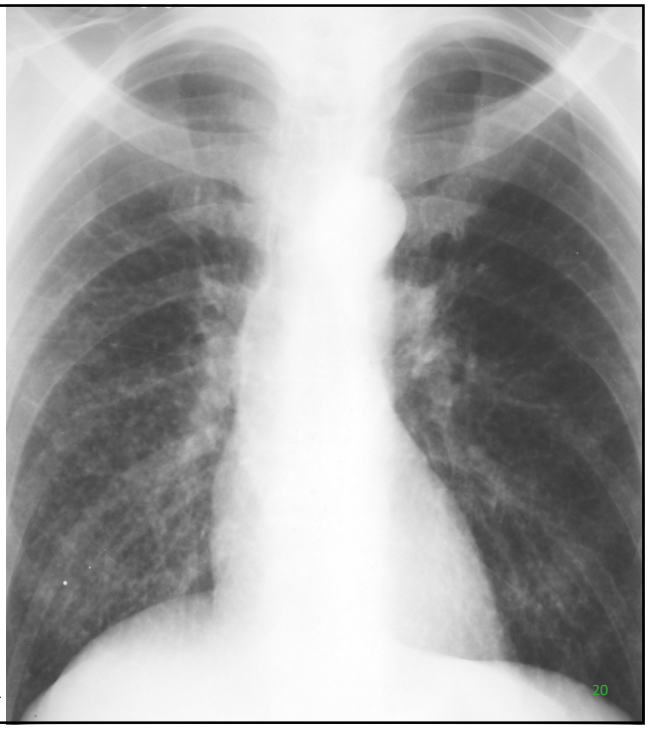


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Active Pulmonary Tuberculosis: Diagnostic Testing

Sputum acid-fast bacilli (AFB) smear

- Rapid but relatively low sensitivity
- Obtaining three smears increases sensitivity

Sputum nucleic acid amplification test (NAAT)

- More sensitive than AFB smear but less sensitive than AFB culture

AFB sputum culture

- Gold standard but takes several weeks

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Active Pulmonary Tuberculosis: Treatment

Initial intensive phase (2 months)

- Typical 4-drug regimen of INH, rifampin, pyrazinamide, ethambutol

Continuation phase (at least 4 months)

- Typical 2-drug regimen of INH and rifampin

No longer contagious when the following achieved (all required):

- Adequate treatment for TB >2 weeks
- Clinical improvement
- 3 consecutive negative sputum AFB smears

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Infectious Disease Q5

A 42-year-old woman is evaluated for 4 days of fever, headache, myalgia, cough, and pharyngitis. She has no other medical problems.

Temperature is 100.8 °F.

She does not appear ill, and exam is normal.

Testing for SARS-CoV-2 is negative.

Influenza A is prevalent.

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Infectious Disease Q5

A 42-year-old woman is evaluated for 4 days of fever, headache, myalgia, cough, and pharyngitis. She has no other medical problems. Temperature is 100.8 °F. She does not appear ill, and exam is normal. Testing for SARS-CoV-2 is negative. Influenza A is prevalent.

Which of the following is the most appropriate management?

A: Influenza PCR testing

B: Oseltamivir

C: Zanamivir

D: No testing or treatment

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Influenza

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Influenza: Diagnosis and Testing

High fever, headache, fatigue

Nonproductive cough

Sore throat

Nasal congestion, rhinorrhea

Myalgia

Nasopharyngeal PCR test

- Preferred test
- Highly sensitive and specific

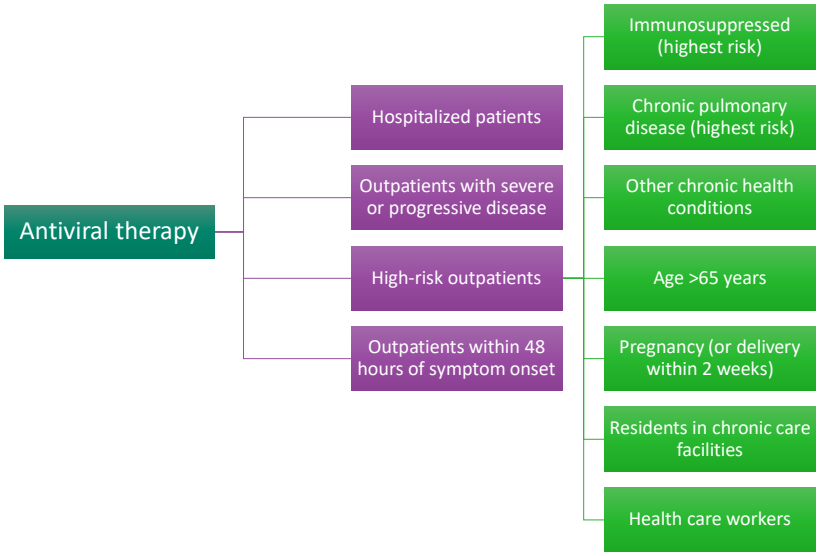
Rapid antigen test

- Insensitive
- If negative test but high suspicion, do PCR testing

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Influenza: Treatment



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Influenza: Treatment

Oseltamivir, oral (5 days)

Zanamivir, inhalation (5 days)

- Avoid in asthma, COPD

Peramivir, IV (uncomplicated: 1 dose; hospitalized: 5 days)

Baloxavir, oral (1 dose)

- Not in hospitalized patients

Adamantanes (amantadine, rimantadine) not recommended

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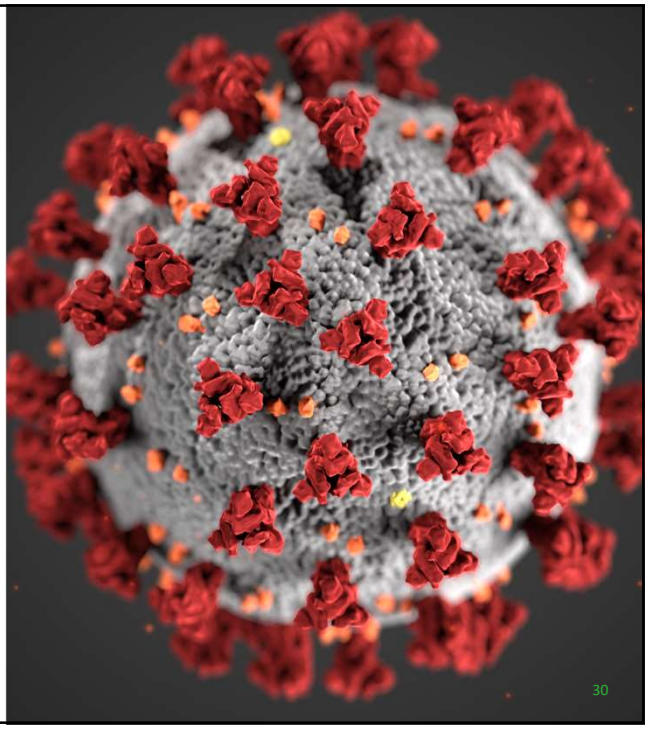
COVID

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COVID-19: Diagnosis

- Various presentations possible
- Asymptomatic
- Influenza-like symptoms
- Fever, cough, myalgias
- Sore throat, rhinorrhea, nasal congestion
- Dyspnea
- Diarrhea
- Loss of taste and smell

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COVID-19: Testing

PCR testing (first line)

- Specific

Point-of-care antigen test

- Lower sensitivity than PCR test
- Sensitivity improved with serial testing

Lymphocytopenia, thrombocytopenia

Suggestive: ↑ Aminotransferase, ↑ LDH, ↑ D-dimer

Chest radiograph

- Can be normal
- Bilateral ground-glass opacities

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COVID-19: Prevention and Treatment

All adults should receive recommended COVID-19 vaccines

General treatment principles

- Antivirals in early disease
- Immunomodulation in later disease, hypoxia

Resources

IDSA guidelines on treatment and management

ACP COVID-19 Resource Hub

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Infectious Disease Q6

A 62-year-old man is evaluated for a 2-day history of a painful rash (shown).

Antiviral therapy is initiated.



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Infectious Disease Q6

A 62-year-old man is evaluated for a 2-day history of a painful rash. Antiviral therapy is initiated.

Which of the following is the most appropriate next step in management?

A: Herpes zoster vaccination

B: Mupirocin

C: Urgent ophthalmologic evaluation

D: Urgent otolaryngologic evaluation

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Herpesvirus Infections

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VZV Primary Infection (Chickenpox): Clinical Presentation

Fever/constitutional symptoms, pruritic rash

- Face and trunk, then extremities
- Mucous membranes involved
- Crops develop as papules, to vesicles, to pustules within 24 hours
- Different stages in any anatomic area



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VZV Primary Infection (Chickenpox): Testing and Treatment

Testing

- VZV PCR testing from vesicle base (preferred)
- Direct fluorescent antibody testing

Transmission

- Aerosol droplets from nasopharyngeal secretions or direct contact with fluid from vesicles
- Airborne precautions

Treatment

- Immunocompetent adults
  - Oral acyclovir, valacyclovir, or famciclovir
- Immunocompromise or severe complications (pneumonia/dissemination)
  - Intravenous acyclovir

Prevention

- Immunization with varicella vaccine

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VZV Reactivation (Shingles): Risk Factors and Diagnosis



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Risk factors

- Age >60 years
- Immunocompromise

Prodromal pain/paresthesia

Grouped vesicles on erythematous base

One or two dermatomes, not crossing midline

Disseminated infection

- ≥3 dermatomes involved

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VZV Reactivation (Shingles): Complications

Postherpetic neuralgia

Herpes zoster ophthalmicus

Ramsay Hunt syndrome

- Rash in external ear, facial palsy, altered taste

Pneumonia

Hepatitis

Meningitis, encephalitis, myelitis, stroke



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VZV Reactivation (Shingles): Testing

Most often a clinical diagnosis

If diagnosis uncertain, perform:

- VZV PCR testing from vesicle base (preferred)
- Direct fluorescent antibody testing

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VZV Reactivation (Shingles): Treatment

Oral acyclovir, famciclovir, or valacyclovir

- Immunocompetent patients
- Within 72 hours of symptom onset

Hospitalization, intravenous acyclovir

- Immunosuppressed patients
- Neurologic involvement
- Disseminated disease

Analgesics

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VZV Reactivation (Shingles): Prevention

Recombinant herpes zoster vaccine

- Age ≥50 years
- Age ≥19 years and immunocompromised
- Regardless of infection history
- Regardless of vaccination with live attenuated varicella virus vaccine

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EBV Primary Infection: Diagnosis



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Fever, headache, sore throat

Posterior cervical lymphadenopathy

Splenomegaly

Elevated AST/ALT levels

Atypical lymphocytosis

Ampicillin causes morbilliform rash

- Not penicillin allergy

Heterophile antibody (monospot)

- May be negative first week of illness

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EBV Primary Infection: Treatment

Supportive therapy

Glucocorticoids

- Tonsillar enlargement compromising airway
- Hemolytic anemia

No role for antiviral therapy

Limit contact sports if splenomegaly present

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Cytomegalovirus Infection: Diagnosis and Treatment

Immunocompetent host

- Most patients are asymptomatic
- Mononucleosis-like syndrome
  - No pharyngitis
  - Negative heterophile antibody test
- Supportive treatment in most cases

Immunocompromised host

- May develop systemic or tissue-invasive disease that warrants antiviral treatment

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Infectious Disease Q7

A 71-year-old woman is evaluated for posterior chest pain.

Twelve weeks ago, she developed herpetic lesions on her right posterior thorax in a T7 distribution.

She was treated with antiviral therapy, and the lesions healed; however, she has persistent, severe burning pain.

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Infectious Disease Q7

A 71-year-old woman is evaluated for posterior chest pain. Twelve weeks ago, she developed herpetic lesions on her right posterior thorax in a T7 distribution. She was treated with antiviral therapy, and the lesions healed; however, she has persistent, severe burning pain.

Which of the following is the most appropriate treatment?

A: Gabapentin

B: Hydrocodone

C: Ibuprofen

D: Prednisone

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Postherpetic Neuralgia

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Postherpetic Neuralgia: Diagnosis

- Dermatomal pain persisting **≥3 months** after zoster rash
- Burning, stabbing, throbbing, itching
- Allodynia
- Cutaneous scarring

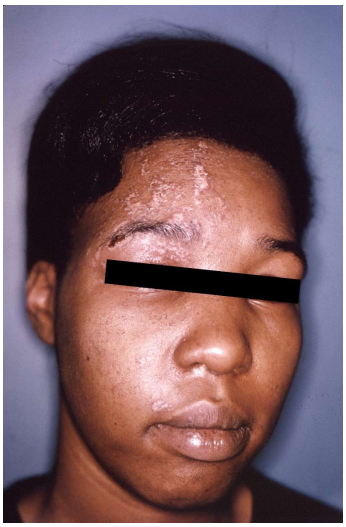


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Postherpetic Neuralgia: Treatment

Treatment	Indication
Gabapentin, pregabalin	First line; moderate to severe pain
Topical lidocaine or capsaicin	Mild local pain
Tricyclic antidepressants	Second line; moderate to severe pain
Anticonvulsants, SNRIs	Third line; moderate to severe pain
Opioids	Adjunctive or for refractory pain

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Infectious Disease Q8

A 37-year-old man receiving parenteral antibiotics develops fever, watery diarrhea, and abdominal pain.

He is febrile (100.4 °F) with a soft abdomen.

Leukocyte count is 18,800/µL, serum creatinine level is 1.6 mg/dL, and stool *Clostridioides difficile* antigen/toxin assay is positive.

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Infectious Disease Q8

A 37-year-old man receiving parenteral antibiotics develops fever, watery diarrhea, and abdominal pain. He is febrile (100.4 °F) with a soft abdomen. Leukocyte count is 18,800/µL, serum creatinine level is 1.6 mg/dL, and stool *Clostridioides difficile* antigen/toxin assay is positive.

In addition to discontinuing the associated antibiotic agent, if possible, which of the following is the most appropriate treatment?

A: Oral fidaxomicin

B: Oral metronidazole

C: Oral vancomycin plus IV metronidazole

D: Oral vancomycin plus oral metronidazole

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Clostridioides difficile Colitis

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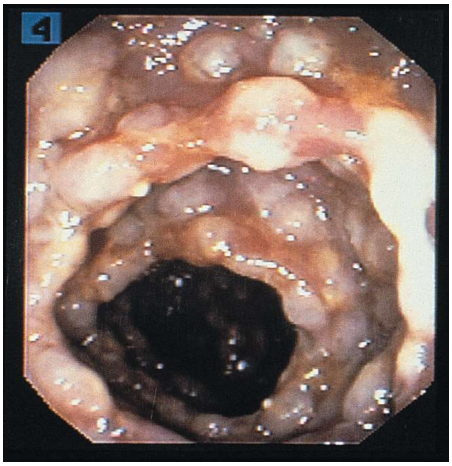
C. difficile Infection: Epidemiology

Leading cause of hospital-acquired diarrhea

Associated with:

- Antibiotics
- Immunosuppression
- Chemotherapy
- Older age, IBD, GI surgery

Increasingly seen in community settings



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C. difficile Infection: Diagnosis

Nonsevere

- Leukocyte count ≤15,000/µL *and*
- Serum creatinine level <1.5 mg/dL

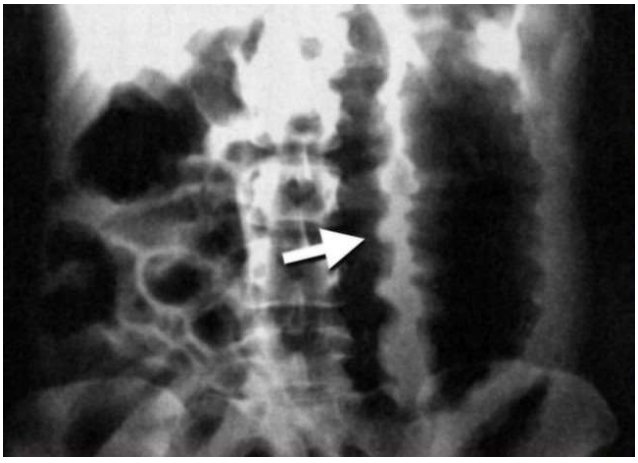
Severe

- Leukocyte count >15,000/µL *or*
- Serum creatinine level ≥1.5 mg/dL

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C. difficile Infection: Diagnosis



Fulminant

- Hypotension
- Shock
- Ileus

Complications

- Sepsis
- Toxic megacolon
- Perforation

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C. difficile Infection: Testing

NAAT for *C. difficile* toxin

- Very sensitive but can be obtained alone in a patient with new-onset diarrhea in the hospital in the absence of recent laxatives

Two-step EIA algorithm:

- EIA test for glutamate dehydrogenase plus toxin
- If both are positive, diagnosis is confirmed
- If discordant, perform NAAT (if positive, diagnosis is confirmed)

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C. difficile Infection: Treatment

Discontinue antibiotic

Nonsevere or severe disease

- Oral fidaxomicin (preferred) or oral vancomycin

Fulminant colitis

- Oral vancomycin + intravenous metronidazole
- Surgical evaluation for megacolon
- Vancomycin enema if ileus is present

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C. difficile Infection: Treatment

First recurrence

- Oral fidaxomicin (preferred) or oral vancomycin (tapered/pulsed)

Additional recurrences

- Oral fidaxomicin
- Oral vancomycin (tapered/pulsed)
- Oral vancomycin followed by oral rifaximin
- Fecal microbiota transplantation

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Infectious Disease II

- Answers to Multiple-Choice Questions

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Infectious Disease Q4

A 26-year-old man is evaluated for a 3-day history of fever, myalgia, and cough. He was previously healthy. Temperature is 100.9 °F. He is comfortably breathing ambient air. Crackles are heard at the left lung base. Chest radiograph shows a left lower lobe infiltrate.

Which of the following oral agents is recommended for treatment?

A: Amoxicillin-clavulanate

B: Cefuroxime

C: Ciprofloxacin

D: Doxycycline

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Infectious Disease Q5

A 42-year-old woman is evaluated for 4 days of fever, headache, myalgia, cough, and pharyngitis. She has no other medical problems. Temperature is 100.8 °F. She does not appear ill, and exam is normal. Testing for SARS-CoV-2 is negative. Influenza A is prevalent.

Which of the following is the most appropriate management?

A: Influenza PCR testing

B: Oseltamivir

C: Zanamivir

D: No testing or treatment

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Infectious Disease Q6

A 62-year-old man is evaluated for a 2-day history of a painful rash. Antiviral therapy is initiated.

Which of the following is the most appropriate next step in management?

A: Herpes zoster vaccination

B: Mupirocin

C: Urgent ophthalmologic evaluation

D: Urgent otolaryngologic evaluation

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Infectious Disease Q7

A 71-year-old woman is evaluated for posterior chest pain. Twelve weeks ago, she developed herpetic lesions on her right posterior thorax in a T7 distribution. She was treated with antiviral therapy, and the lesions healed; however, she has persistent, severe burning pain.

Which of the following is the most appropriate treatment?

A: Gabapentin

B: Hydrocodone

C: Ibuprofen

D: Prednisone

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Infectious Disease Q8

A 37-year-old man receiving parenteral antibiotics develops fever, watery diarrhea, and abdominal pain. He is febrile (100.4 °F) with a soft abdomen. Leukocyte count is 18,800/µL, serum creatinine level is 1.6 mg/dL, and stool *Clostridioides difficile* antigen/toxin assay is positive.

In addition to discontinuing the associated antibiotic agent, if possible, which of the following is the most appropriate treatment?

A: Oral fidaxomicin

B: Oral metronidazole

C: Oral vancomycin plus IV metronidazole

D: Oral vancomycin plus oral metronidazole

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Infectious Disease III

2025 Virtual/Live Internal Medicine Board Review

Adam Ressler, MD, MPH
Clinical Associate Professor, Infectious Diseases
University of Michigan
Ann Arbor, MI

ACP Internal Medicine Board Review Course

Infectious Disease III

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Table of Contents: Infectious Disease III

- Asymptomatic bacteriuria
- Cystitis and pyelonephritis
- Prostatitis
- Urinary tract infections in pregnancy
- Sexually transmitted infections
- Transmission and prevention of HIV

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Asymptomatic Bacteriuria

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Asymptomatic Bacteriuria: Risk Factors

- Female anatomy
- Pregnancy
- Diabetes
- Advanced age
- Spinal cord injury
- Indwelling urinary catheter

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Asymptomatic Bacteriuria: Diagnosis

Bacteria in an appropriately collected urine sample

No symptoms specifically related to UTI

- No dysuria, frequency, urgency, suprapubic pain
- Patients with spinal cord injury may not have specific UTI symptoms

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Asymptomatic Bacteriuria: Diagnosis

Bacteriuria + nonspecific symptoms ≠ UTI

- Dementia, delirium, failure to thrive

Pyuria ≠ UTI

Pyuria + bacteriuria ≠ UTI

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Asymptomatic Bacteriuria: Testing and Treatment

Indications for screening with treatment

- Pregnancy
- Upcoming invasive urologic procedure

Do not routinely screen/treat patients with:

- A urinary catheter
- Nonspecific symptoms

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Infectious Disease Q9

A 62-year-old woman reports fever, nausea, and abdominal pain.

She has diabetic kidney disease.

She has fever, hypotension, and tachycardia with left-sided costovertebral angle tenderness.

Leukocyte count is 24,000/µL; serum creatinine level is 2.8 mg/dL.

UA shows 220 leukocytes/hpf and many bacteria.

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Infectious Disease Q9

A 62-year-old woman reports fever, nausea, and abdominal pain. She has diabetic kidney disease. She has fever, hypotension, and tachycardia with left-sided costovertebral angle tenderness. Leukocyte count is 24,000/µL; serum creatinine level is 2.8 mg/dL. UA shows 220 leukocytes/hpf and many bacteria.

Which of the following is the most appropriate empiric antibiotic treatment?

A: Cefazolin

B: Gentamicin

C: Piperacillin-tazobactam

D: Vancomycin

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Cystitis and Pyelonephritis

ACP

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Urinary Tract Infections: Definitions

Uncomplicated

A UTI in a female who meets the following criteria:

- Premenopausal
- Nonpregnant
- Without urologic abnormalities
- Without comorbidities
- Without signs or symptoms of infection beyond the bladder

Complicated

A UTI that does not meet criteria for uncomplicated

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Uncomplicated Cystitis: Epidemiology and Risk Factors

Microbiology

- *Escherichia coli* (>75% of infections)
- Other Enterobacteriaceae, streptococci, enterococci, *Staphylococcus saprophyticus*

Risk factors

- Sexual activity
- Previous UTI
- Spermicide use

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Uncomplicated Cystitis: Diagnosis and Testing

- Dysuria, urgency, frequency
- Suprapubic pain
- Hematuria
- Testing (urinalysis/culture) not necessary before empiric treatment

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Uncomplicated Cystitis: Treatment

Nitrofurantoin for 5 days

Trimethoprim-sulfamethoxazole (TMP-SMX) for 3 days

- Avoid if used in preceding 3 months
- Avoid if local resistance >20%

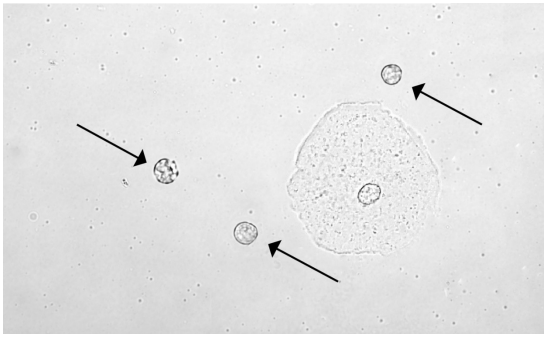
Fosfomycin single dose (lower efficacy)

Avoid fluoroquinolones as first line (antibiotic stewardship)

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Complicated Cystitis: Testing and Treatment



Urinalysis and culture

Empiric treatment (nonpregnant patients)

- Oral fluoroquinolone for 5-7 days preferred (ciprofloxacin, levofloxacin)
- TMP-SMX, oral β-lactams, fosfomycin (given every 48 hours for a total of 3 doses) are alternatives

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Pyelonephritis: Diagnosis

- Fever, chills
- Flank pain
- Nausea, vomiting
- Costovertebral angle tenderness

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Pyelonephritis: Testing

Urinalysis and culture

Blood cultures (critically ill patients)

Imaging if:

- Fever for >72 hours
- Persistent bacteremia



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Pyelonephritis: Outpatient Treatment

Patients without comorbidities not requiring hospitalization

- Fluoroquinolone
  - Ciprofloxacin for 7 days
  - Levofloxacin for 5 days
- If fluoroquinolone resistance rates exceed 10%
  - Initial dose of a long-acting parenteral antibiotic (e.g., ceftriaxone or a once-daily aminoglycoside)

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Pyelonephritis: Inpatient Treatment

Hospitalized patients without critical illness

- If at least one risk factor for multidrug-resistant (MDR) organism (recent hospitalization, recent antibiotic use, past MDR infection, travel to areas of high MDR prevalence):
  - Piperacillin-tazobactam
  - Cefepime
  - Antipseudomonal carbapenem
- If no risk factors for MDR organism:
  - Ceftriaxone or fluoroquinolone

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Pyelonephritis: Inpatient Treatment

Hospitalized patients with critical illness

- Severe sepsis and/or urinary tract obstruction
  - Piperacillin-tazobactam or cefepime
    - Depending on local MDRO prevalence
  - Antipseudomonal carbapenem (*Pseudomonas*, ESBL)
  - Imaging to evaluate for obstruction

Remember in each case to de-escalate per culture results

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Recurrent UTI

Reinfection (different bacteria)

- Most common cause of recurrent infection
- >2 weeks after original infection
- Treat with same first-line agent

Relapsed infection (same organism)

- Recurrence within 2 weeks of treating original infection
- Culture to guide antibiotic selection
- Treat for 7-10 days

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Prevention of Recurrent UTI

Prophylactic antibiotic indications

- Women with ≥3 UTIs in previous 12 months
- Women with ≥2 UTIs in 6 months

Daily prophylaxis

Postcoital prophylaxis

Self-diagnosis and self-treatment

Nonantibiotic preventive measures:

- Hydration, spermicide contraception avoidance, clean intermittent catheterization for neurogenic bladder, methenamine, vaginal estrogen for postmenopausal women

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Infectious Disease Q10

A 46-year-old man is evaluated for fever, dysuria, frequency, and perineal pain.

He is not sexually active.

Temperature is 101.8 °F.

Rectal exam reveals a tender, tense prostate.

Cultures are pending.

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Infectious Disease Q10

A 46-year-old man is evaluated for fever, dysuria, frequency, and perineal pain. He is not sexually active. Temperature is 101.8 °F. Rectal exam reveals a tender, tense prostate. Cultures are pending.

Which of the following is the most appropriate treatment?

A: Ampicillin

B: Ceftriaxone (single dose) and doxycycline

C: Ciprofloxacin

D: Meropenem

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Prostatitis

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Acute Bacterial Prostatitis: Diagnosis and Testing

- Fever, dysuria, urgency
- Pelvic pain
- Obstructive symptoms
- Tender, tense, or boggy prostate
- Urinalysis, urine Gram stain/culture
- Imaging not generally indicated

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Acute Bacterial Prostatitis: Treatment

Outpatient empiric treatment

- Ciprofloxacin or levofloxacin (preferred)
- TMP-SMX if susceptible or *E. coli* resistance <20%

Inpatient empiric treatment

- Extended-spectrum penicillin or cephalosporin (or carbapenem if recent urologic procedure or other risk factors for resistant pathogen)

De-escalate based on culture results

Treat for 4-6 weeks

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Chronic Bacterial Prostatitis: Diagnosis, Testing, and Treatment

Symptoms for >3 months

- Frequency, dysuria, hesitancy, prostatic pain
- Prostate tenderness, enlargement, ± bogginess

Urinalysis and urine culture

Treatment

- Empiric fluoroquinolone or TMP-SMX for 4-6 weeks
- NSAIDs

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Infectious Disease Q11

A 22-year-old asymptomatic woman is evaluated during an initial prenatal care visit at 6 weeks' gestation.

Urine dipstick is positive for nitrites and leukocyte esterase.

Urine culture grows >100,000 CFU/mL of *E. coli* susceptible to amoxicillin-clavulanate, nitrofurantoin, and TMP-SMX.

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Infectious Disease Q11

A 22-year-old asymptomatic woman is evaluated during an initial prenatal care visit at 6 weeks' gestation. Urine dipstick is positive for nitrites and leukocyte esterase. Urine culture grows >100,000 CFU/mL of *E. coli* susceptible to amoxicillin-clavulanate, nitrofurantoin, and TMP-SMX.

Which of the following is the most appropriate treatment?

A: Amoxicillin-clavulanate

B: Nitrofurantoin

C: TMP-SMX

D: No treatment

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Urinary Tract Infections in Pregnancy

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UTIs in Pregnancy: Diagnosis

Asymptomatic bacteriuria

Cystitis

- Frequency, urgency, dysuria, hematuria

Pyelonephritis

- Fever, chills, flank pain, nausea/vomiting

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UTIs in Pregnancy: Testing

Asymptomatic bacteriuria

- Routine screening with urine culture at 12-16 weeks or first prenatal visit
- Bacterial load ≥100,000 CFU/mL

Cystitis and pyelonephritis

- Urinalysis, urine culture

Blood cultures in critically ill patients

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UTIs in Pregnancy: Treatment

Treat asymptomatic bacteriuria and UTIs

Pyelonephritis requires hospitalization and parenteral β-lactam antibiotics

Culture guides therapy

Antibiotics safe for use in pregnancy include:

- β-Lactam antibiotics
- Fosfomycin

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UTIs in Pregnancy: Treatment

Antibiotics to be used cautiously in pregnancy include

- Nitrofurantoin
  - Should not be used in the first or third trimesters or in G6PD deficiency
- TMP-SMX
  - Use only during the second trimester

Antibiotics contraindicated during pregnancy

- Tetracyclines
- Fluoroquinolones

Obtain posttreatment urinalysis and culture

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Infectious Disease Q12

A 26-year-old man has a painless penile lesion with shotty, nontender inguinal lymphadenopathy that developed 3 days ago.

He has had multiple unprotected sexual encounters during the past 6 months.

No other lesions or discharge are noted.



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Infectious Disease Q12

A 26-year-old man has a painless penile lesion with shotty, nontender inguinal lymphadenopathy that developed 3 days ago. He has had multiple unprotected sexual encounters during the past 6 months. No other lesions or discharge are noted.

Which of the following is the most likely diagnosis?

A: Chancroid

B: HPV infection

C: HSV infection

D: Syphilis

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Sexually Transmitted Infections (STIs)

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Chlamydia trachomatis Infection: Diagnosis

Increased risk

- Age <25 years
- History of other STIs, new/multiple partners
- Women

Often asymptomatic

Women may develop cervicitis, urethritis, pelvic inflammatory disease (PID)

Men may develop urethritis, epididymitis

Receptive anal intercourse can cause proctitis

May cause reactive arthritis

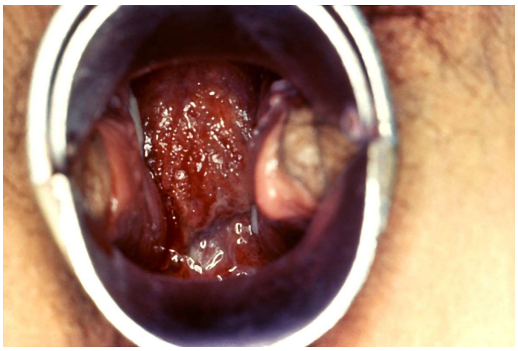


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Chlamydia trachomatis Infection: Testing

NAAT

- Urine or endocervical swabs for women
- Urine or urethral swab for men
- Swabs from other potentially infected sites (anorectal, oropharyngeal) for both

Annual screening

- Women aged <25 years
- Women aged ≥25 years with STI risk factors
- MSM (every 3-6 months if increased risk)

Transgender and gender-diverse patients

- Screen based on anatomy and risk

Test for reinfection

- 3 months or next visit

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Chlamydia trachomatis Infection: Treatment

- Doxycycline (preferred) for 7 days
- Azithromycin (pregnancy) as single dose

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Neisseria gonorrhoeae Infection: Diagnosis



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Epidemiology same as *C. trachomatis*

Clinical presentation

- Can be asymptomatic
- Women may develop cervicitis, urethritis, PID
- Men may develop urethritis, epididymitis
- Proctitis
- Pharyngitis

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Disseminated Gonococcal Infection (DGI)

Arthritis-dermatitis syndrome

- Migratory polyarthralgia(s) without purulent arthritis
- Tenosynovitis
- Necrotic and vesiculopustular skin lesions

Purulent arthritis (large joint, usually monoarticular)



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Neisseria gonorrhoeae Infection: Testing

NAAT

- Urine or endocervical swabs in women
- Urine or urethral swabs in men
- Swabs from other potentially infected sites in both

For DGI, obtain cultures from infected sites (antibiotic susceptibility testing)

Annual screening

- Women aged <25 years
- Women aged ≥25 years with STI risk factors
- MSM (every 3-6 months if increased risk)

Transgender and gender-diverse patients

- Screen based on anatomy and risk

Test for reinfection at 3 months or next visit

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Neisseria gonorrhoeae Infection: Treatment

Single-dose intramuscular (IM) ceftriaxone

- 500 mg (1 g for persons ≥150 kg)

Add oral doxycycline (azithromycin in pregnancy) if chlamydia has not been excluded

Disseminated gonococcal infection

- Ceftriaxone for 7-14 days

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Trichomonas vaginalis Infection: Diagnosis

- Vaginal foul-smelling yellow/green discharge, pruritus
- Vaginal, cervical erythema
- Vaginal discharge pH >4.5
- Urethritis in men

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Trichomonas vaginalis Infection: Testing and Treatment

Wet mount microscopy

NAAT

Rapid antigen testing and culture

Test for other STIs

Metronidazole for 7 days

- Safe for pregnant patients
- Treat male partner (single dose)

Retest women 3 months after treatment



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Syphilis: Epidemiology

- MSM
- Commercial sex workers
- Patients with HIV
- Patients with multiple sex partners
- Patients with previous syphilis
- Rates in women and rates of congenital syphilis have recently increased

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Syphilis: Diagnosis



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Primary infection

- Chancre (painless) + regional lymphadenopathy

Secondary infection

- 2-8 weeks after chancre
- Fever, lymphadenopathy
- Generalized maculopapular rash + palms/soles
- Mucous patches
- Condylomata lata
- Alopecia

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Syphilis: Diagnosis



Mucous patches



Condylomata lata



Palmar lesions

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Syphilis: Diagnosis

Latent syphilis = serologic evidence of infection but no symptoms

- Early latent indicates infection for ≤1 year
- Late latent indicates infection for >1 year

Tertiary (late)

- Cardiovascular involvement
- Gummas

Neurosyphilis can occur at any stage

- Ocular/otic symptoms
- Meningitis or meningovascular disease
- Tertiary forms include general paresis and tabes dorsalis

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Syphilis: Testing

Dark-field or direct fluorescent antibody testing (not routinely available)

- Evaluates chancre, erosions, condylomata lata

RPR or VDRL (nontreponemal test)

- Confirm positive test with specific enzyme immunoassay (treponemal test): remains positive lifelong
  - Fluorescent treponemal antibody absorption test
  - *Treponema pallidum* particle agglutination

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Syphilis: Testing

"Reverse" serologic testing strategy

- Initial test should be specific enzyme immunoassay
- If positive, perform RPR or VDRL
  - RPR or VDRL positive: provide treatment
  - RPR/VDRL negative: could indicate previous treatment of syphilis
    - Perform alternate specific treponemal test if high suspicion for untreated syphilis

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Syphilis: Treatment

Primary, secondary, or early latent syphilis

- Benzathine penicillin, single IM dose

Late latent or syphilis of unknown duration

- Benzathine penicillin G, three weekly IM doses

Neurosyphilis (including ocular and otic)

- Penicillin G, intravenous (IV) 10-14 days

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Genital Herpes Simplex: Diagnosis and Testing

Primary infection

- Painful genital ulcers
- Nonhealing erosions seen in immunosuppressed patients
- Fever, headache, lymphadenopathy

Recurrences usually less severe

NAAT (preferred), direct immunofluorescence assay



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Genital Herpes Simplex: Treatment

Primary

- Acyclovir, famciclovir, or valacyclovir

Recurrence

- Treat to decrease symptom duration, viral shedding

Suppressive therapy

- Frequent recurrences and in immunosuppressed

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Infectious Disease Q13

A 39-year-old healthy man receives a consultation for HIV prevention.

His male sex partner has HIV infection with detectable HIV viral load. Condom use is intermittent.

He is asymptomatic, and his exam is unremarkable.

STI and HIV testing are negative. Kidney function is normal.

Hepatitis B serology confirms previous vaccination.

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Infectious Disease Q13

A 39-year-old healthy man receives a consultation for HIV prevention. His male sex partner has HIV infection with detectable HIV viral load. Condom use is intermittent. He is asymptomatic, and his examination is unremarkable. STI and HIV testing are negative. Kidney function is normal. Hepatitis B serology confirms previous vaccination.

Which of the following is the most appropriate management?

A: Counsel that consistent condom use provides adequate protection

B: Prescribe daily combination tenofovir-emtricitabine

C: Prescribe daily combination tenofovir-emtricitabine and raltegravir

D: Prescribe daily tenofovir

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HIV Prevention

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HIV Prevention

Barrier contraception

Needle exchange programs

Universal blood donor testing

PrEP or PEP (depending on indication) in individuals without HIV

Antiretroviral therapy in individuals with HIV (treatment as prevention)

- U=U (“undetectable equals untransmittable”)
- HIV RNA <200 copies/mL for ≥6 months

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HIV Prevention: Treatment

Postexposure prophylaxis (PEP)

- Following occupational and nonoccupational HIV exposure
- <72 hours
- Tenofovir disoproxil fumarate (TDF) or tenofovir alafenamide (TAF) and emtricitabine plus either bictegravir or dolutegravir for 4 weeks
- HIV testing at baseline, 4 to 6 weeks, and 3 months

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HIV Prevention: Pre-Exposure Prophylaxis (PrEP) Indications

Sexually active adults

- Sex partner with HIV infection
- Bacterial STI in past 6 months
- Inconsistent condom use

Persons who inject drugs

- Equipment sharing
- Injection partner with HIV

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HIV Prevention: PrEP Treatment

TDF (or tenofovir alafenamide) and emtricitabine

Before PrEP

- HIV, HAV, HBV, HCV, STI testing; kidney function testing; pregnancy testing

During PrEP

- HIV testing: every 3 months
- STI testing: every 3-6 months depending on risk
- Kidney function testing: every 6-12 months depending on initial creatinine clearance
- HCV testing: every 12 months

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HIV Prevention: PrEP Treatment

Cabotegravir

Before PrEP

- HIV, viral hepatitis screen, STI, pregnancy testing

During PrEP

- HIV testing: every 2 months
- STI testing: every 4-6 months depending on risk
- HCV testing: annually

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Infectious Disease III

- Answers to Multiple-Choice Questions

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Infectious Disease Q9

A 62-year-old woman reports fever, nausea, and abdominal pain. She has diabetic kidney disease. She has fever, hypotension, and tachycardia with left-sided costovertebral angle tenderness. Leukocyte count is 24,000/µL; serum creatinine level is 2.8 mg/dL. UA shows 220 leukocytes/hpf and many bacteria.

Which of the following is the most appropriate empiric antibiotic treatment?

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B: Gentamicin

C: Piperacillin-tazobactam

D: Vancomycin

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A 46-year-old man is evaluated for fever, dysuria, frequency, and perineal pain. He is not sexually active. Temperature is 101.8 °F. Rectal exam reveals a tender, tense prostate. Cultures are pending.

Which of the following is the most appropriate treatment?

A: Ampicillin

B: Ceftriaxone (single dose) and doxycycline

C: Ciprofloxacin

D: Meropenem

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Infectious Disease Q11

A 22-year-old asymptomatic woman is evaluated during an initial prenatal care visit at 6 weeks' gestation. Urine dipstick is positive for nitrites and leukocyte esterase. Urine culture grows >100,000 CFU/mL of *E. coli* susceptible to amoxicillin-clavulanate, nitrofurantoin, and TMP-SMX.

Which of the following is the most appropriate treatment?

A: Amoxicillin-clavulanate

B: Nitrofurantoin

C: TMP-SMX

D: No treatment

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Infectious Disease Q12

A 26-year-old man has a painless penile lesion with shotty, nontender inguinal lymphadenopathy that developed 3 days ago. He has had multiple unprotected sexual encounters during the past 6 months. No other lesions or discharge are noted.

Which of the following is the most likely diagnosis?

A: Chancroid

B: HPV infection

C: HSV infection

D: Syphilis

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Infectious Disease Q13

A 39-year-old healthy man receives a consultation for HIV prevention. His male sex partner has HIV infection with detectable HIV viral load. Condom use is intermittent. He is asymptomatic, and his examination is unremarkable. STI and HIV testing are negative. Kidney function is normal. Hepatitis B serology confirms previous vaccination.

Which of the following is the most appropriate management?

A: Counsel that consistent condom use provides adequate protection

B: Prescribe daily combination tenofovir-emtricitabine

C: Prescribe daily combination tenofovir-emtricitabine and raltegravir

D: Prescribe daily tenofovir

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Infectious Disease IV

2025 Virtual/Live Internal Medicine Board Review

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ACP Internal Medicine Board Review Course

Infectious Disease IV

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Table of Contents: Infectious Disease IV

- Immunization
- Infectious disease outbreaks
- Infection control
- Hospital-acquired infections and prevention
- Procedure- and device-associated infections
- Travel-related illness

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Infectious Disease Q14

A 27-year-old woman is pregnant at 30 weeks' gestation.

She delivered her first child 20 months ago.

During her previous pregnancy, she received the Tdap vaccine.

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Infectious Disease Q14

A 27-year-old woman is pregnant at 30 weeks' gestation. She delivered her first child 20 months ago. During her previous pregnancy, she received the Tdap vaccine.

Which of the following vaccination strategies is most appropriate for this patient?

A: Tdap vaccine after 36 weeks' gestation

B: Tdap vaccine 10 years after her last dose

C: Tdap vaccine now

D: Tetanus and diphtheria vaccine now

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Immunization

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Tetanus, Diphtheria, and Pertussis Vaccine

Tdap or Td vaccine every 10 years

- Provided that one Tdap dose has already been administered

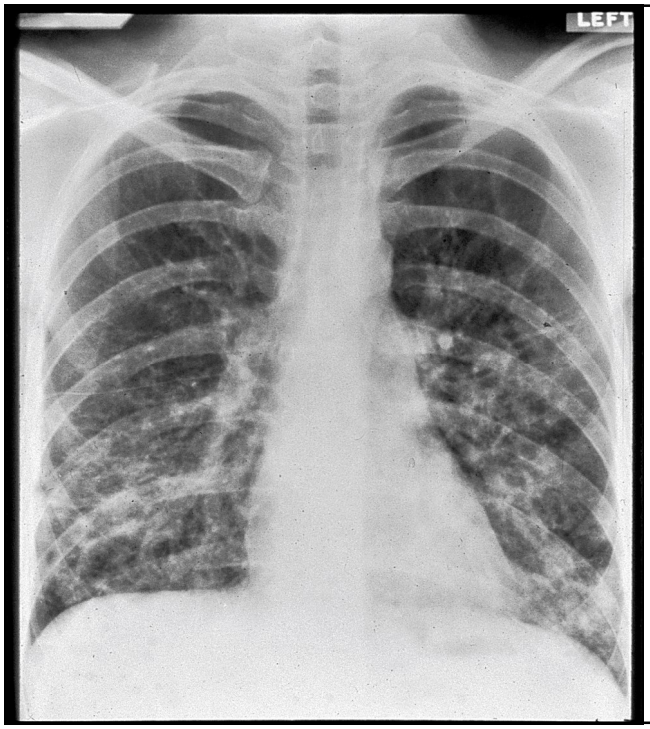
Single dose of Tdap vaccine with every pregnancy

- 27 to 36 weeks' gestation
- Close contacts of infants aged <12 months must be current with Tdap ("cocooning" against pertussis)

Single dose of Tdap vaccine for wound management if >5 years since last dose

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Influenza Vaccine

Annual immunization

Inactivated influenza vaccine or recombinant influenza vaccine

- All patients eligible
- High-dose vaccine 24% more effective in patients aged ≥65 years
- Should be given during pregnancy

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Influenza Vaccine

Live attenuated vaccine (nasal spray)

- Ages 2 to ≤49 years
- Avoid in:
  - Immunocompromised patients
  - Patients who have contact with severely immunocompromised persons
  - Patients with HIV, regardless of CD4 count
  - Pregnant patients

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Recombinant Zoster Vaccine

Immunocompetent adults aged ≥50 years including:

- Never immunized
- Previously received the live zoster vaccine
- Previously had an episode of shingles

Immunocompromised adults aged 19-49 years

Consider deferring if pregnant



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Measles, Mumps, and Rubella (MMR) Vaccine



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Patients born in 1957 or later

Contraindicated in pregnancy and severe immunodeficiency

Pregnant and not immune

- Vaccinate after delivery but before discharge

HIV positive and not immune

- Vaccinate after cell count >200/µL and CD4 >15% for ≥6 months

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Varicella Vaccine in Adults

Persons born in 1980 or later

Contraindicated in pregnancy and severe immunodeficiency

Pregnant and not immune

- Vaccinate after delivery but before discharge

HIV positive and not immune

- Vaccination may be considered after cell count >200/µL and CD4 >15%



Photo by J.D. Millar, MD, MPH, DTPH. Reproduced from the CDC Public Health Image Library.

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Human Papillomavirus (HPV) Vaccine

All persons through age 26 years

Persons aged 27-45 years: shared decision making

Protects against cancers caused by HPV, such as cervical, penile, and anal cancers

Not recommended during pregnancy

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Infectious Disease Q15

A 35-year-old man is awaiting urgent laparotomy and splenectomy after sustaining a splenic laceration.

He has no chronic conditions or allergies and takes no medications.

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Infectious Disease Q15

A 35-year-old man is awaiting urgent laparotomy and splenectomy after sustaining a splenic laceration. He has no chronic conditions or allergies and takes no medications.

Which of the following vaccines should be administered to this patient?

A: Hepatitis B vaccine

B: MMR vaccine

C: Recombinant herpes zoster vaccine

D: 20-Valent pneumococcal conjugate vaccine

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Pneumococcal Vaccine

All adults aged ≥50 years

Adults aged 19-49 years with chronic medical conditions

- For example, heart, lung, or liver disease; diabetes; alcohol use disorder; smoking

Options

- PCV20 *or*
- PCV21 *or*
- PCV15 followed by PPSV23
  - PCV15 first, PPSV23 ≥1 year later
  - Minimum 8-week interval in high-risk patients

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Pneumococcal Vaccine



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Adults with immunocompromising conditions

- CSF leaks
- Cochlear implants
- Functional/anatomic asplenia
- Other immunocompromising conditions

Options

- PCV20 *or*
- PCV21 *or*
- PCV15 followed by PPSV23 ≥8 weeks later

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Hepatitis A Vaccine

- Persons who desire vaccination
- Chronic liver disease
- HIV infection
- Men who have sex with men
- Injection or noninjection drug use
- Persons experiencing homelessness
- Travel to endemic areas
- Households with children adopted from endemic areas
- Persons living or working in settings that increase risk for exposure
- Pregnant patients at increased risk (best to give prepregnancy)

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Hepatitis B Vaccine

All adults aged 19-59 years

Adults aged ≥60 years

- Persons who desire vaccination
- Chronic liver disease
- End-stage renal disease
- Diabetes mellitus
- HIV infection
- Sexual exposure risk (non-monogamous, STI history, MSM)
- Current or recent injection drug use
- Percutaneous or mucosal risk for exposure to blood
- Persons who are incarcerated or institutionalized
- Travel to endemic areas
- Household contact with chronic HBV

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Meningococcal Vaccine (A,C,W,Y) and MenB

For adults in the following risk groups, MenACWY *and* MenB are recommended:

- Anatomic/functional asplenia
- Persistent complement deficiency
- Complement inhibitor therapy (eculizumab, ravulizumab)
- Microbiologists
- Exposure during outbreak
- Persons aged 16-23 years: shared decision making for MenB



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Meningococcal Vaccine (A,C,W,Y) Alone

- Travel to endemic area
- HIV infection
- Military recruits
- First-year college students living in residential housing

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Meningococcal Vaccine (MenB)

- Persistent complement deficiency
- Complement inhibitor therapy (eculizumab, ravulizumab)
- Functional/anatomic asplenia
- Persons aged 16-23 years: shared decision making
- These subgroups should also receive A,C,W,Y vaccine

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Haemophilus influenzae Type B (Hib) and RSV Vaccines

Hib vaccine

- Anatomic/functional asplenia
- Patients with hematopoietic stem cell transplantation

RSV vaccine

- Adults older than 60 years with risk factors for severe disease
- Pregnant persons at 32-36 weeks' gestation

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Infectious Disease Q16

A 56-year-old man has a 3-day history of fever, dyspnea, and anterior chest pain following crop dusting in nearby fields.

Temperature is 101.7 °F; hypotension, tachycardia, and tachypnea are present. He is confused.

Breath sounds are diminished.

Chest radiograph shows bilateral lower lobe infiltrates and mediastinal widening.

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Infectious Disease Q16

A 56-year-old man has a 3-day history of fever, dyspnea, and anterior chest pain following crop dusting in nearby fields. Temperature is 101.7 °F; hypotension, tachycardia, and tachypnea are present. He is confused. Breath sounds are diminished. Chest radiograph shows bilateral lower lobe infiltrates and mediastinal widening.

Which of the following is the most likely infectious agent?

A: *Bacillus anthracis*

B: *Francisella tularensis*

C: *Salmonella enteritidis*

D: *Yersinia pestis*

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Infectious Disease Outbreaks

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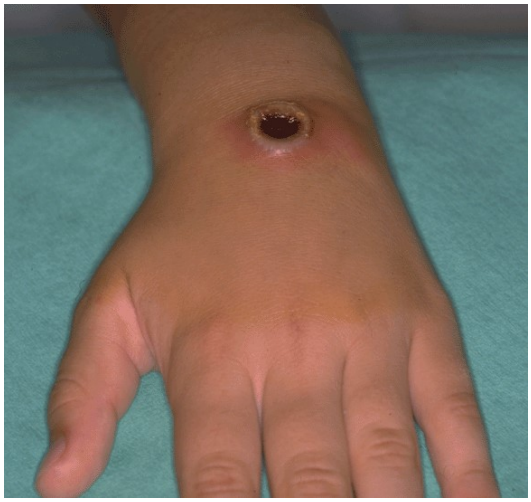
Anthrax (*Bacillus anthracis*): Diagnosis and Testing

Inhalational anthrax

- Influenza-like symptoms followed by rapid deterioration
- Chest pain, dyspnea, hypoxia, shock
- Hematogenous spread (can lead to meningitis)

Cutaneous anthrax

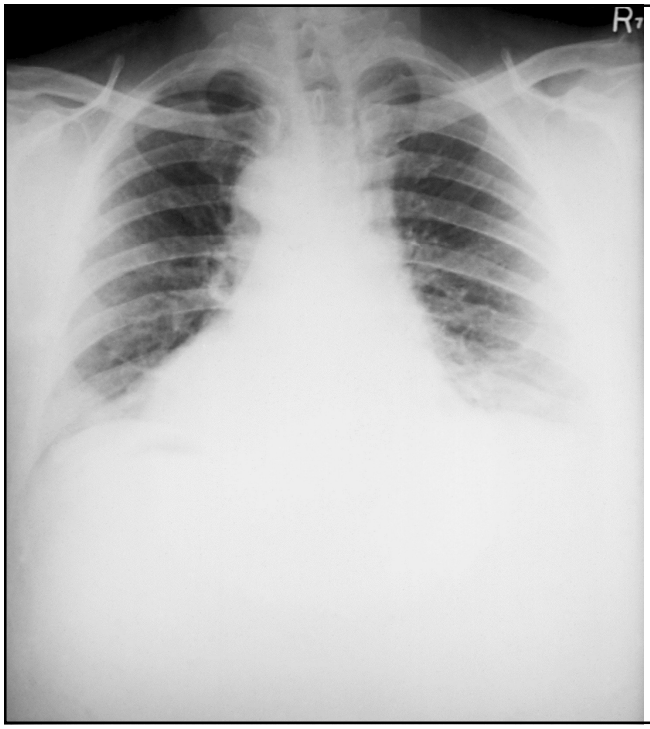
- Painless necrotic ulcer
- Black eschar
- Extensive edema



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Anthrax (*Bacillus anthracis*): Diagnosis and Testing

Chest radiography

- Mediastinal widening

Culture, PCR

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Anthrax (*Bacillus anthracis*): Treatment

Systemic disease without meningitis

- Two bactericidal agents from different classes (ciprofloxacin preferred, and meropenem) *plus*
- Protein synthesis inhibitor (minocycline or doxycycline preferred) *plus*
- Antitoxin therapy

Cutaneous anthrax without systemic involvement

- Fluoroquinolone or doxycycline or minocycline

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Plague (*Yersinia pestis*): Diagnosis

Pneumonic plague

- Very rare; likely bioterrorism event

Bubonic plague

- Fever, chills, weakness, headache
- Painful lymphadenopathy near inoculation site

Septicemic plague

- Usually follows pneumonic or bubonic
- Sepsis, ARDS, DIC

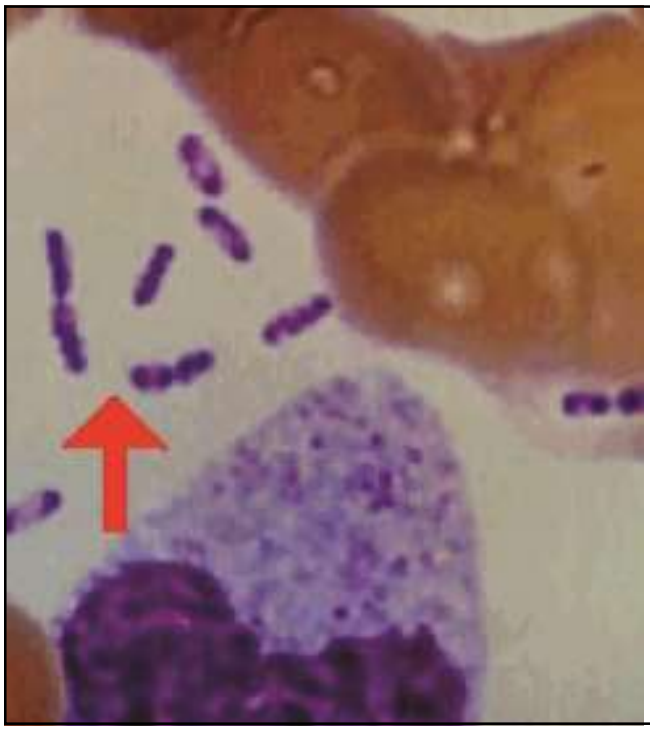




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Plague (*Yersinia pestis*): Management

Testing

- Bipolar staining shows "safety pin" bacillus
- Culture, PCR testing

Treatment

- Ciprofloxacin, levofloxacin, moxifloxacin, gentamicin, or streptomycin

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Botulism (*Clostridium botulinum*): Diagnosis

Transmission

- Inhalation or ingestion of botulinum neurotoxin
- Wound contamination

Clinical features

- Afebrile
- Symmetric, descending flaccid paralysis
- Diplopia, dysarthria, dysphonia, and dysphagia
- Nausea, abdominal pain, and dry mouth

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Botulism (*Clostridium botulinum*): Testing and Treatment

Specimen collection to identify toxin

Immediate empiric treatment

- Antitoxin prevents progression
- Will not reverse existent paralysis

Antibiotics not useful

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Infectious Disease Q17

A 62-year-old woman receiving chemotherapy for breast cancer is hospitalized with herpes zoster involving the right flank, buttock, and thigh.

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Infectious Disease Q17

A 62-year-old woman receiving chemotherapy for breast cancer is hospitalized with herpes zoster involving the right flank, buttock, and thigh.

Which of the following are the most appropriate infection control precautions?

A: Airborne and contact

B: Contact

C: Contact and droplet

D: Droplet

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Infection Control

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Infection Control: Standard Precautions

- Hand hygiene before/after every patient contact
- Gowns, gloves, mask, eye protection for body fluid exposure
- Add other precautions (airborne, contact, droplet) as indicated



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Isolation Precautions for Infectious Diseases

Precaution Type	Indications	Precautions
Airborne	Organisms transmitted from respiratory tract by small droplet nuclei (≤5 microns) that travel long distances on air currents: • COVID-19 • Measles • Tuberculosis • Varicella • Avian influenza	Airborne infection isolation room (negative-pressure room) Health care personnel wear fit-tested N95 respirator

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Isolation Precautions for Infectious Diseases

Precaution Type	Indications	Precautions
Contact	Organisms transmitted by direct or indirect contact: • Multidrug-resistant organisms • Enteric infections (*C. difficile,* norovirus, *E. coli* O157:H7) • Localized zoster • Disseminated skin HSV • Lice/scabies	Single room Gloves and gown for health care personnel entering room

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Isolation Precautions for Infectious Diseases

Precaution Type	Indications	Precautions
Droplet	Organisms transmitted from respiratory tract by large droplet nuclei (>5 microns) that travel <3 feet on air currents • *N. meningitidis* **(<24 h treatment)** • Plague • *Mycoplasma* • Diphtheria, pertussis, mumps, rubella • Respiratory viruses • Parvovirus B19	Single room Health care personnel wear face or surgical mask when within 3 feet of patient

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Combination Isolation Precautions

Droplet plus contact

- Respiratory syncytial virus
- Group A *Streptococcus* (pneumonia or uncovered wound)

Airborne plus contact

- Smallpox
- Disseminated varicella zoster
- Immunocompromised patient with localized zoster
- SARS-CoV-1/2
- Hemorrhagic fever (Ebola, Lassa, Marburg)
- Mpox

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Infectious Disease Q18

A 36-year-old man is diagnosed with ventilator-associated pneumonia 48 hours after intubation.

Bronchoalveolar lavage culture grows MRSA.

The isolate is susceptible to vancomycin, daptomycin, linezolid, rifampin, and tigecycline.

After receiving vancomycin, he develops urticaria.

Vancomycin is discontinued.

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Infectious Disease Q18

A 36-year-old man is diagnosed with ventilator-associated pneumonia 48 hours after intubation. Bronchoalveolar lavage culture grows MRSA. The isolate is susceptible to vancomycin, daptomycin, linezolid, rifampin, and tigecycline. After receiving vancomycin, he develops urticaria. Vancomycin is discontinued.

Which of the following is the most appropriate treatment?

A: Daptomycin

B: Linezolid

C: Rifampin

D: Tigecycline

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Hospital-Acquired Infections and Prevention

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Health Care–Associated Infection (HCAI)

Develops after 48 hours of hospitalization

Major classes

- Catheter-associated urinary tract infection (CAUTI)
- Hospital-acquired pneumonia (HAP)
- Ventilator-associated pneumonia (VAP)
- Surgical site infection (SSI)
- Central line–associated bloodstream infection (CLABSI)
- *Clostridioides difficile* infection

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CAUTI: Risk Factors, Diagnosis, and Testing

Risk factors

- Indwelling catheter
- Nonadherence to aseptic technique

Indwelling catheter or intermittent catheterization and all of the following:

- UTI symptoms
- ≥10^3 CFU/mL bacteria
  - Catheter exchange should occur before obtaining culture sample

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CAUTI: Treatment

- Removal or exchange of catheter
- Culture-guided antibiotics for 5-14 days, depending on time to resolution of symptoms

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CAUTI: Prevention

Follow evidence-based indications for indwelling catheters

Use indwelling catheters for shortest time possible

Use alternatives

- Condom catheters
- Intermittent catheterization

Closed catheter systems

Collection bag below level of bladder

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CAUTI: Prevention

Evidence-based Indications for Indwelling Bladder Catheter
Acute urinary retention
Chronic urinary retention, intermittent self-catheterization not feasible
Stage 3/4 pressure injuries plus incontinence
Hourly urine volume measurement
Daily urine volume not assessable by other methods
24-Hour urine sample not obtainable by other strategies
Hospice comfort care
Blood clots in urine

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HAP and VAP

HAP

- Not associated with mechanical ventilation
- Develops >48 hours after admission

VAP

- Develops >48 hours after intubation

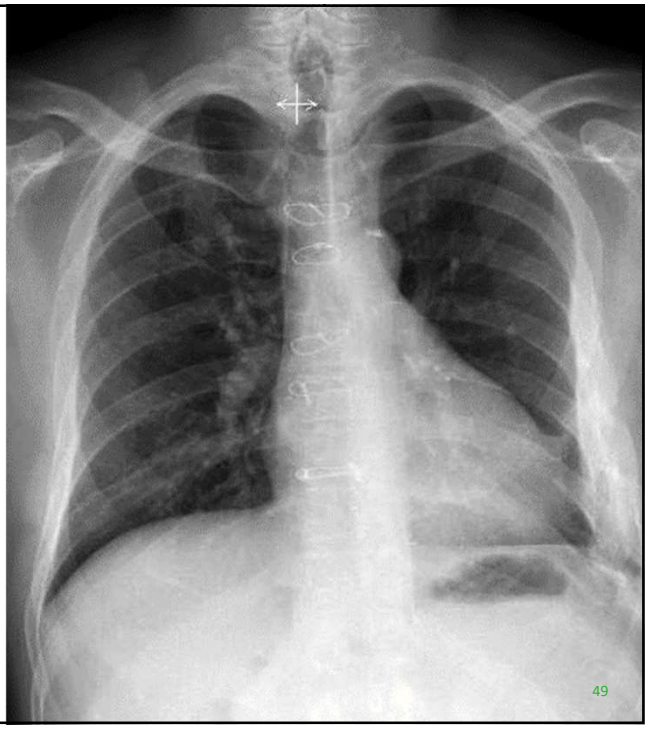


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HAP and VAP: Multidrug-Resistant Organism (MDRO) Risk Factors

- IV antibiotic use in previous 90 days
- Septic shock at time of VAP
- ARDS preceding VAP
- ≥5 days of hospitalization before VAP development
- Dialysis before VAP development
- Colonization or previous isolation of MDRO

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HAP and VAP: Diagnosis and Testing

- New or progressive infiltrates
- Fever, purulent sputum, hypoxemia
- Leukocytosis/leukopenia
- Positive lower respiratory tract cultures

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HAP and VAP: Treatment

Empiric antibiotic coverage

- MRSA, *Pseudomonas*, other gram-negative bacilli
- Duration of 7 days

Culture-guided therapy

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HAP and VAP: Prevention

- Noninvasive positive pressure ventilation instead of invasive ventilation
- Early extubation (sedation reduction, weaning trials)
- Head of bed at 30 to 45 degrees
- Daily chlorhexidine oral care
- Facilitate early mobility
- Ventilator bundles: subglottic suctioning, avoiding gastric overdistension, PUD/DVT prophylaxis

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SSI: Diagnosis and Testing

Superficial (incisional) SSI

- Purulent drainage, pain, warmth, redness
- Cultures obtained from deepest layer involved

Deep (surgical organ/space)

- Systemic illness
- Requires CT to guide deep cultures

Avoid superficial wound swabs, which typically indicate colonization (low specificity)

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SSI: Treatment

Superficial	• Culture-guided antibiotics
Deep	• Surgical debridement • Culture-guided antibiotics

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SSI: Prevention

- Preoperative antibiotic prophylaxis (60 min before incision)
- Smoking cessation
- Optimize nutrition (weight loss if indicated)
- Glucose control (<180 mg/dL for 48 h postoperatively)
- Chlorhexidine preoperative skin antisepsis
- *Staphylococcus aureus* decolonization 1-2 weeks preoperatively (for cardiovascular and orthopedic surgeries)
- Hair clipping (not shaving)
- Maintaining perioperative normothermia
- Sterile dressing over incision for 24-48 h

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Infectious Disease Q19

A 58-year-old man reports a 2-week history of fever.

A dual-chamber pacemaker was implanted 5 years ago.

Temperature is 100.4 °F.

The skin overlying the pacemaker pocket is erythematous, warm, and tender.

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Infectious Disease Q19

A 58-year-old man reports a 2-week history of fever. A dual-chamber pacemaker was implanted 5 years ago. Temperature is 100.4 °F. The skin overlying the pacemaker pocket is erythematous, warm, and tender.

Which of the following is the most appropriate management?

A: Blood cultures

B: Pacemaker pocket aspiration

C: Repeat evaluation in 1 week

D: Ultrasonography of the pacemaker pocket

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Procedure- and Device-Associated Infections

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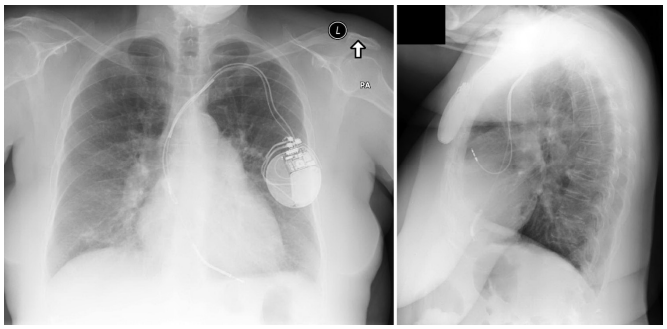
Procedure- and Device-Associated Infections: Diagnosis

Superficial incisional infection

- Superficial erythema or stitch abscess within 30 days of device placement

Pocket infection

- Local inflammation (pain over pocket, erythema, warmth, fluctuance, purulent drainage, skin erosion)



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Procedure- and Device-Associated Infections: Diagnosis

Systemic infection and device-associated infective endocarditis (IE)

- Fever, chills, night sweats
- Septic pulmonary emboli
- Vertebral osteomyelitis/diskitis
- Positive Modified Duke Criteria for IE
- Long-duration procedure and symptoms possible

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Procedure- and Device-Associated Infections: Testing

Blood cultures at different sites, 30 minutes apart

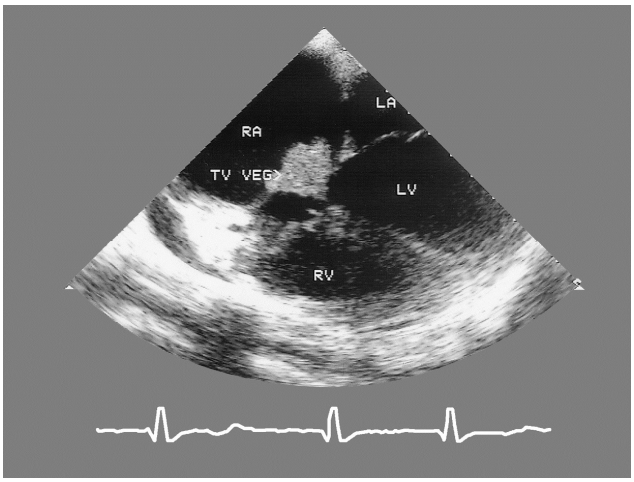
Transesophageal echocardiography

- Lead vegetations
- Valvular involvement

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Procedure- and Device-Associated Infections: Treatment



Superficial incisional infection

- Treat with oral antibiotics directed at *Staphylococcus*/*Streptococcus* for 2 weeks

Pocket infection

- Remove all parts of device
- Culture-driven antibiotics for 2 weeks

Device-associated endocarditis

- Positive blood cultures AND positive lead or valve vegetation
- Remove all parts of device
- Treat as endocarditis for 4-6 weeks

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Travel-Related Illness

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Travel-Related Illness

Consultation at least 4-6 weeks before travel

Immunizations for travel available in the United States	
Hepatitis A and B	Polio
Typhoid	Measles
Rabies	Yellow fever
Japanese encephalitis	Meningococcal

Country-specific information (CDC):

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Travel-Related Illness: Traveler's Diarrhea

Enterotoxigenic *E. coli*

Nonbloody loose stools (≥3 per day)

Fever, cramps, nausea, abdominal pain

Within first 2 weeks of travel; usually self-limited

Treatment

- Fluid replacement
- Antimotility agents without antibiotics for mild to moderate diarrhea
- Antibiotics in severe cases (azithromycin, 500 mg, for 3 days)

Prevention: Consume only boiled or sealed, bottled water; peeled fruits; cooked meats and vegetables

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Travel-Related Illness: Malaria

- Parasitic infection transmitted by mosquito bite
- Severe illness commonly due to *Plasmodium falciparum*
- Incubation period generally 10-14 days
- Fever, chills, headache, myalgia
- Severe disease: mental status change, kidney disease, hemolytic anemia, elevated liver chemistry tests, metabolic acidosis, seizures

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Travel-Related Illness: Malaria

Testing
- Peripheral blood smear (gold standard)
- Rapid antigen test may be used in resource-limited settings

Treatment
- Artemisinin-based combination therapy

Prevention
- Mosquito vector control, minimize mosquito exposure

Chemoprophylaxis: atovaquone-proguanil, mefloquine, doxycycline, tafenoquine

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Travel-Related Illness: Typhoid Fever (*Salmonella enterica*)

Consumption of contaminated food, water

Enteric fever

- Prolonged fever (up to 4 weeks)
- Pulse-temperature dissociation
- Hepatosplenomegaly
- Macular rash on the trunk (“rose spots”)
- Diarrhea (presents early and resolves) or constipation
- Abdominal pain

Complications

- Intestinal hemorrhage or perforation
- Gallbladder infection leads to carrier state



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Travel-Related Illness: Typhoid Fever

Testing

- Cultures of blood, bone marrow, stool, urine

Treatment

- Treat according to culture sensitivity
- Empiric ceftriaxone for severe disease

Prevention

- Vaccinate before travel

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Travel-Related Illness: Dengue, Chikungunya, and Zika

- Mosquito transmission
- Diagnosis: PCR, serology
- Treatment: supportive

	Dengue fever	Chikungunya virus	Zika virus
Clinical manifestations	Fever, headache, retro-orbital pain, backache, petechial rash	Fever, severe polyarthralgias, rash	Fever, rash, arthralgias, conjunctivitis; <25% of infected persons are symptomatic
Key features	Reinfection with a different serotype may result in severe infection with hemorrhage and shock	Rheumatologic symptoms may persist for months/years	Infection in pregnant patients poses major risk to fetal development

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Travel-Related Illness: Yellow Fever

- Transmitted by mosquitoes in endemic areas of sub-Saharan Africa and South America
- Clinical manifestations range from mild to severe disease with internal hemorrhage and multiorgan failure
- Treatment: supportive
- Prevention: live attenuated vaccine (may be required for travelers going to endemic countries)

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Travel-Related Illness: Hepatitis

Hepatitis A

- Ingestion of contaminated food and water
- Travel to Central and South America, Mexico, South Asia, Africa
- Persons with chronic liver disease at risk for fulminant hepatitis
- Vaccinate nonimmune persons before travel

Hepatitis B

- Transmitted through blood and sex
- Travelers seeking medical care or likely to engage in sex are at risk
- Vaccinate nonimmune persons before travel

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Infectious Disease IV

- Answers to Multiple-Choice Questions

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Infectious Disease Q14

A 27-year-old woman is pregnant at 30 weeks' gestation. She delivered her first child 20 months ago. During her previous pregnancy, she received the Tdap vaccine.

Which of the following vaccination strategies is most appropriate for this patient?

A: Tdap vaccine after 36 weeks' gestation

B: Tdap vaccine 10 years after her last dose

C: Tdap vaccine now

D: Tetanus and diphtheria vaccine now

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Infectious Disease Q15

A 35-year-old man is awaiting urgent laparotomy and splenectomy after sustaining a splenic laceration. He has no chronic conditions or allergies and takes no medications.

Which of the following vaccines should be administered to this patient?

A: Hepatitis B vaccine

B: MMR vaccine

C: Recombinant herpes zoster vaccine

D: 20-Valent pneumococcal conjugate vaccine

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Infectious Disease Q16

A 56-year-old man has a 3-day history of fever, dyspnea, and anterior chest pain following crop dusting in nearby fields. Temperature is 101.7 °F; hypotension, tachycardia, and tachypnea are present. He is confused. Breath sounds are diminished. Chest radiograph shows bilateral lower lobe infiltrates and mediastinal widening.

Which of the following is the most likely infectious agent?

A: *Bacillus anthracis*

B: *Francisella tularensis*

C: *Salmonella enteritidis*

D: *Yersinia pestis*

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Infectious Disease Q17

A 62-year-old woman receiving chemotherapy for breast cancer is hospitalized with herpes zoster involving the right flank, buttock, and thigh.

Which of the following are the most appropriate infection control precautions?

A: Airborne and contact

B: Contact

C: Contact and droplet

D: Droplet

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Infectious Disease Q18

A 36-year-old man is diagnosed with ventilator-associated pneumonia 48 hours after intubation. Bronchoalveolar lavage culture grows MRSA. The isolate is susceptible to vancomycin, daptomycin, linezolid, rifampin, and tigecycline. After receiving vancomycin, he develops urticaria. Vancomycin is discontinued.

Which of the following is the most appropriate treatment?

A: Daptomycin

B: Linezolid

C: Rifampin

D: Tigecycline

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Infectious Disease Q19

A 58-year-old man reports a 2-week history of fever. A dual-chamber pacemaker was implanted 5 years ago. Temperature is 100.4 °F. The skin overlying the pacemaker pocket is erythematous, warm, and tender.

Which of the following is the most appropriate management?

A: Blood cultures

B: Pacemaker pocket aspiration

C: Repeat evaluation in 1 week

D: Ultrasonography of the pacemaker pocket

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Mental and Behavioral Health

2025 Virtual/Live Internal Medicine Board Review

Danielle Heidemann, MD, FACP
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Henry Ford Health
Detroit, MI

ACP Internal Medicine Board Review Course

General Internal Medicine: Mental and Behavioral Health

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Table of Contents: Mental and Behavioral Health

- Depression
- Generalized anxiety disorder
- Other mood disorders (psychogenic ED, PMDD)
- Substance use disorders
- Smoking cessation
- Schizophrenia: complications of drug therapy
- Delusional disorder, somatic type

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Mental and Behavioral Health Q1

A 50-year-old woman has been taking maximal-dose bupropion for depression for 3 months. She does not have suicidal ideation, significant anxiety, or bipolar disorder.

Neither her PHQ-9 score nor her symptoms have improved.

She is not interested in psychotherapy.

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Mental and Behavioral Health Q1

A 50-year-old woman has been taking maximal dose bupropion for depression for 3 months. She does not have suicidal ideation, significant anxiety, or bipolar disorder. Neither her PHQ-9 score nor her symptoms have improved. She is not interested in psychotherapy.

Which of the following is the most appropriate next step in treatment?

A: Add buspirone

B: Continue bupropion for an additional 8 weeks

C: Discontinue bupropion; begin sertraline

D: Start electroconvulsive therapy

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Depression

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Depression: Screening

Routine screening for all adults

Validated screening tool for depression

PHQ-2

- Further testing if one positive response
- Use PHQ-9

"Over the past 2 weeks, have you felt down, depressed, hopeless?"

"Over the past 2 weeks, have you felt little interest or pleasure in doing things?"

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Depression: Diagnosis



Photo by Rawpixel.com/Shutterstock.

- Depressed mood
- Loss of interest
- Insomnia or hypersomnia
- Weight change
- Psychomotor retardation or agitation
- Fatigue
- Difficulty concentrating or making decisions
- Thoughts of worthlessness or guilt
- Suicidal ideation or attempt

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Depression: Diagnosis and Testing

Document manic and hypomanic symptoms to rule out bipolar disorder

Evaluate for anxiety with GAD-7

PHQ-9 score to diagnose, measure severity, monitor depression

- No depression, 0-4
- Mild depression, 5-9
- Moderate depression, 10-14
- Moderately severe depression, 15-19
- Severe depression, 20-27

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Depression: Treatment

Initial therapy: CBT or second-generation antidepressants

- CBT may be first-line therapy for mild depression
- Exclude manic/hypomanic episodes before initiating therapy

Psychiatric referral indications

- Severe depression
  - Vegetative symptoms
  - Psychosis
- Failure of initial therapy
- Complex comorbid psychiatric conditions such as bipolar disorder
- High suicide risk

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Depression: Treatment

Drug selection: based on side effects, patient characteristics

Second-generation antidepressants preferred

- SSRIs, SNRIs, serotonin modulators (nefazodone), atypical antidepressants (bupropion)

SSRIs

- Also effective for anxiety
- Can increase manic symptoms
  - Especially fluoxetine in high doses in first 12 weeks
  - Patients with bipolar syndrome and depression are treated with mood stabilizers

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Depression: Treatment

Duloxetine: beneficial in chronic pain

Bupropion

- Beneficial for smoking cessation
- Contraindicated with seizures, eating disorders
- Can aid weight loss
- High doses can cause agitation
- Not effective for anxiety
- Modest increase in BP, heart rate

Mirtazapine: increases appetite and weight

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Depression: Treatment

Sexual dysfunction

- SSRIs: decreased desire, anorgasmia, delayed orgasm
- Bupropion: fewer sexual side effects, can be combined with SSRI/SNRI with good effect and improved sexual function

Serotonin syndrome

- Hyperthermia, hyperreflexia, myoclonus
- Caused by SSRIs, SNRIs, bupropion, MAO inhibitors, usually at high doses or in combination

Discontinuation syndrome

- Dizziness, fatigue, headache, and nausea
- 1-7 days after abrupt discontinuation
- More likely with paroxetine and venlafaxine

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Depression: Treatment

Decrease in PHQ-9 score to <5 → remission

- Continue same dose for 4-9 months
- ≥3 depression episodes → long-term maintenance therapy

50% decrease in PHQ-9 score → partial response

- Increase dose of current drug, add second agent, and/or add psychotherapy

No response

- Switch to another second-generation antidepressant or add second agent and/or psychotherapy

Continued no response

- Refer to psychiatry
- Electroconvulsive therapy or esketamine

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Peripartum Depression

- During pregnancy or within 4 weeks of delivery
- Depression worsens during pregnancy in two thirds of women
- Treatment: same as in nonpregnant patients
- Avoid paroxetine (pregnancy category D)
- Antidepressants can be safe in breastfeeding

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Mental and Behavioral Health Q2

A 29-year-old woman has an 8-month history of insomnia, difficulty concentrating, and irritability, all of which interfere with her work.

She lies awake at night thinking about career issues and personal concerns.

Appetite is unchanged, and weight is stable.

PHQ-9 is negative for depression.

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Mental and Behavioral Health Q2

A 29-year-old woman has an 8-month history of insomnia, difficulty concentrating, and irritability, all of which interfere with her work. She lies awake at night thinking about career issues and personal concerns. Appetite is unchanged, and weight is stable. PHQ-9 is negative for depression.

Which of the following is the most appropriate first-line pharmacologic treatment?

A: Alprazolam

B: Imipramine

C: Quetiapine

D: Sertraline

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Generalized Anxiety Disorder (GAD)

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GAD: Diagnosis

Use GAD-7 for screening

Excessive anxiety surrounding events or activities

- Most days for ≥6 months
- Causes distress and/or functional impairment
- Difficult to control
- Not caused by substance use

Plus ≥3 of the following:

- Restlessness
- Fatigue
- Irritability
- Muscle tension
- Sleep disturbance
- Difficulty concentrating

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GAD: Treatment

First-line therapy (either)

- CBT
- SSRIs, SNRIs

Second-line therapy

- Benzodiazepines: short-term use (addictive)
  - For as-needed use and for panic
- Pregabalin
- Buspirone

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Mental and Behavioral Health Q3

A 19-year-old woman reports 6 months of episodic irritability, anxiety, fatigue, binge eating, and difficulty concentrating at work.

Symptoms occur during the last half of the menstrual cycle and resolve after menses onset.

She is the mother of an 18-month-old child.

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Mental and Behavioral Health Q3

A 19-year-old woman reports 6 months of episodic irritability, anxiety, fatigue, binge eating, and difficulty concentrating at work. Symptoms occur during the last half of the menstrual cycle and resolve after menses onset. She is the mother of an 18-month-old child.

Which of the following is the most likely diagnosis?

A: Major depressive disorder

B: Peripartum depression

C: Persistent depressive disorder

D: Premenstrual dysphoric disorder

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Other Mood Disorders (PMDD, Psychogenic ED)

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Premenstrual Dysphoric Disorder (PMDD): Diagnosis

Symptom onset/offset

- Develop week or two before menses
- Remits within a week after menses

Primary symptoms

- Mood swings
- Irritability or anger
- Feeling hopeless
- Depressed mood
- Anxiety



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PMDD: Diagnosis

Other symptoms

- Breast tenderness, joint/muscle pain
- Bloating
- Appetite changes

Repeated occurrence of symptoms with most cycles

Significant distress and/or functional disturbance

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PMDD: Treatment

Mild symptoms

- Exercise
- Relaxation techniques
- CBT

Moderate or severe symptoms

- SSRIs may be taken daily or only during the luteal phase (typically days 14-28 of menstrual cycle)
- Monophasic oral contraceptive pills

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Psychogenic Erectile Dysfunction (ED): Diagnosis and Treatment

Often a symptom of depression

Sudden onset of ED

Persistence of nocturnal/morning erections

Depression or depressive symptoms

Treatment

- CBT
- Biofeedback therapy
- Depression treatment with SSRIs
- Couples and/or sexual therapy

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Mental and Behavioral Health Q4

A 48-year-old man is discharged after his third inpatient admission for acute alcohol detoxification.

He does not have depression or use illicit drugs.

He is enrolled in an alcohol treatment program.

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Mental and Behavioral Health Q4

A 48-year-old man is discharged after his third inpatient admission for acute alcohol detoxification. He does not have depression or use illicit drugs. He is enrolled in an alcohol treatment program.

Which of the following is the most appropriate first-line pharmacologic treatment?

A: Diazepam

B: Disulfiram

C: Naltrexone

D: Paroxetine

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Substance Use Disorders

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Hazardous Alcohol Use: Screening

USPSTF recommendation: universal screening (grade B)

Single Alcohol Screening Question	How many times in the past year have you had more than five (men)/four (women, adults aged >65 years) drinks in one sitting? Positive screen: response of >1
AUDIT-C	1. How often do you have a drink containing alcohol? 2. How many drinks containing alcohol do you have on a typical day when you are drinking? 3. How often do you have six or more drinks on one occasion? Each question scored with 0-4 points based on answer Positive screen: ≥3 points in women; ≥4 points in men

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Hazardous Alcohol Use: Screening and Treatment

Positive screen

- Assess for alcohol use disorder, health consequences of alcohol use

Hazardous alcohol use

- Brief behavioral counseling
- Safe drinking for men and women
- Refer for treatment

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Alcohol Use Disorder: Diagnosis

- Drinking in hazardous situations
- Alcohol-related social/interpersonal problems
- Tolerance, withdrawal
- Craving, no control
- Time spent obtaining, using, recovering
- Missing important activities
- Physical/psychological problems

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Alcohol Use Disorder: Treatment

Assess and treat alcohol withdrawal symptoms if needed

Psychotherapy for all patients

- CBT or 12-step facilitation

Naltrexone for moderate or severe disorder

- Preferred in mild/moderate chronic kidney disease (CKD)
- Avoid with opioid use, pregnancy/breastfeeding
- Acamprosate is an alternative if contraindications to naltrexone

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Alcohol Use Disorder: Treatment

Acamprosate

- Can be used with naltrexone
- Avoid in severe CKD (eGFR ≤30 mL/min/1.73 m^2), pregnancy/breastfeeding

Disulfiram

- Second-line treatment (aversive agent)
- Avoid with continued drinking, metronidazole, cardiac disease

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Alcohol Withdrawal: Diagnosis

Withdrawal seizures 6-48 hours after cessation

Alcoholic hallucinosis

- 12-24 hours after cessation
- Hallucinations without clouding of sensorium

Delirium tremens

- 72-96 hours after cessation
- Hypertension, tachycardia, fever
- Altered mental status

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Alcohol Withdrawal: Treatment

- Hospitalization for moderate to severe withdrawal
- Benzodiazepines: first-line therapy
- Symptom-triggered regimen (based on CIWA-Ar score)
- β-Blockers and clonidine: adjunctive therapy (↑ BP, ↑ HR)
- Phenobarbital, propofol, and dexmedetomidine may be useful in refractory cases

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Mental and Behavioral Health Q5

A 32-year-old man is evaluated for opioid overdose.

He receives intravenous naloxone and, after overnight monitoring, is ready for discharge.

Upon assessment, he states that he has no interest in discontinuing opioid use.

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Mental and Behavioral Health Q5

A 32-year-old man is evaluated for opioid overdose. He receives intravenous naloxone and, after overnight monitoring, is ready for discharge. Upon assessment, he states that he has no interest in discontinuing opioid use.

Which of the following is the most appropriate medication to prescribe?

A: Buprenorphine

B: Gabapentin

C: Intranasal naloxone

D: Naltrexone

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Opioid Use Disorder: Screening and Diagnosis

Insufficient evidence for routine screening

Diagnosis

- Opioids taken in increasing amounts or for longer than intended
- Continued use despite impaired social functioning
- Repeated episodes of withdrawal
- Abandonment of important events or activities
- Physical and psychological problems

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Opioid Use Disorder: Risk Assessment

Increased risk for overdose/death

- Patients prescribed opioids
  - >50 mg morphine equivalents/day
  - Concurrent benzodiazepine use
  - COPD or obstructive sleep apnea, mental health disorders
- Patients not prescribed opioids
  - Illicit drug use
  - Recent prison release with opioid use disorder
  - Undergoing treatment for opioid use disorder

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Opioid Use Disorder: Treatment

Intranasal naloxone for overdose

- ↓ Overdose-related death
- Provide to patients at high risk and their friends, family members, caretakers

Chronic opioid use disorder treatment

- Psychosocial support
- Methadone
- Buprenorphine-naloxone
- Buprenorphine
- Naltrexone

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Mental and Behavioral Health Q6

A 45-year-old man states that he is interested in quitting smoking.

He has a history of seizures but has not had a seizure in 15 years and discontinued his seizure medication 4 years ago.

His only medication is amlodipine.

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Mental and Behavioral Health Q6

A 45-year-old man states that he is interested in quitting smoking. He has a history of seizures but has not had a seizure in 15 years and discontinued his seizure medication 4 years ago. His only medication is amlodipine.

Which of the following is the most effective monotherapy?

A: Bupropion

B: Electronic cigarettes

C: Nicotine patches

D: Varenicline

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Smoking Cessation

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Smoking Cessation

↓ All-cause mortality by up to 50%

Best strategy: behavioral modification + pharmacologic treatment

Combination therapies work best

Behavioral and motivational techniques

- The Five A's (Ask, Advise, Assess, Assist, Arrange)
- The Five 5 R's (Relevance, Risks, Rewards, Roadblocks, and Repetition)

Relationship between counseling intensity and quit rates

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Smoking Cessation: Pharmacologic Therapy

Varenicline

- Most effective monotherapy
- Varenicline + NRT (including long- and fast-acting nicotine) is most effective therapy

Bupropion

- Increases smoking cessation
- Avoid with seizure disorder
- Avoid with eating disorder

Safe in patients with CAD

Recommended in patients with ACS before hospital discharge

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Smoking Cessation: Nicotine Replacement Therapy

Combine long-acting and short-acting agents for maximum efficacy

Short-acting agents

- Sublingual, gum, lozenges
- Spray (mouth and nasal)
- Inhaler

Long-acting agent: patch

E-cigarettes and nicotine pouches

- Popular in teenagers and young adults and can be addictive
- Generally less harmful than smoking tobacco products and can be used to help with smoking cessation (literature evolving)

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Mental and Behavioral Health Q7

A 25-year-old man is evaluated during a routine primary care visit.

He has a 5-year history of schizophrenia treated with olanzapine.

He was last seen 1 year ago and has no concerning symptoms.

Physical exam is unremarkable.

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Mental and Behavioral Health Q7

A 25-year-old man is evaluated during a routine primary care visit. He has a 5-year history of schizophrenia treated with olanzapine. He was last seen 1 year ago and has no concerning symptoms. Physical exam is unremarkable.

Which of the following is the most appropriate screening test?

A: Bone mineral density testing

B: ECG

C: Measurement of lipid and fasting glucose levels

D: Serum CK measurement

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Schizophrenia: Complications of Drug Therapy

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Schizophrenia: Diagnosis of Drug Therapy Complications

Drug Therapy Complication	Description
Akathisia	Motor restlessness/compelling urge to move
Dystonia	Continuous, involuntary spasms
Parkinsonism	Tremor, rigidity, bradykinesia
Tardive dyskinesia	Repetitive choreiform movements

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Schizophrenia: Diagnosis of Drug Therapy Complications

Metabolic syndrome → routine monitoring

- Weight gain (weight and BMI)
- Abdominal obesity (waist circumference)
- Hypertension
- Diabetes
- Dyslipidemia

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Mental and Behavioral Health Q8

A 45-year-old woman reports a 2-month history of a recurring, disfiguring lump in her neck without other symptoms.

She works as a successful investment banker and does not appear distressed by the symptom.

Exam reveals no palpable or visible mass in the area she identifies as abnormal.

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Mental and Behavioral Health Q8

A 45-year-old woman reports a 2-month history of a recurring, disfiguring lump in her neck without other symptoms. She works as a successful investment banker and does not appear distressed by the symptom. Exam reveals no palpable or visible mass in the area she identifies as abnormal.

Which of the following is the most likely diagnosis?

A: Delusional disorder

B: Generalized anxiety disorder

C: Schizophrenia

D: Social anxiety disorder

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Delusional Disorder, Somatic Type

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Delusional Disorder: Diagnosis

Delusions present for >1 month

- Persisting despite counterevidence
- Not usually bizarre
- Cause minimal social and occupational dysfunction
- Not a result of schizophrenia or primary mood disorder
- Not caused by medical condition, medication, or substance use

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Delusional Disorder: Diagnosis

Common delusion themes

- Paranoia/persecution (most common)
- Partner infidelity
- Grandiosity
- Erotomania
- Somatic symptoms

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Delusional Disorder: Treatment

- Need therapeutic relationship
- Antipsychotic medication with second-generation antipsychotic
- Adjunctive psychotherapy
- Patients often reject psychiatric treatment

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Mental and Behavioral Health

- Answers to Multiple-Choice Questions

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Mental and Behavioral Health Q1

A 50-year-old woman has been taking maximal dose bupropion for depression for 3 months. She does not have suicidal ideation, significant anxiety, or bipolar disorder. Neither her PHQ-9 score nor her symptoms have improved. She is not interested in psychotherapy.

Which of the following is the most appropriate next step in treatment?

A: Add buspirone

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C: Discontinue bupropion; begin sertraline

D: Start electroconvulsive therapy

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A 29-year-old woman has an 8-month history of insomnia, difficulty concentrating, and irritability, all of which interfere with her work. She lies awake at night thinking about career issues and personal concerns. Appetite is unchanged, and weight is stable. PHQ-9 is negative for depression.

Which of the following is the most appropriate first-line pharmacologic treatment?

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A 19-year-old woman reports 6 months of episodic irritability, anxiety, fatigue, binge eating, and difficulty concentrating at work. Symptoms occur during the last half of the menstrual cycle and resolve after menses onset. She is the mother of an 18-month-old child.

Which of the following is the most likely diagnosis?

A: Major depressive disorder

B: Peripartum depression

C: Persistent depressive disorder

D: Premenstrual dysphoric disorder

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Mental and Behavioral Health Q4

A 48-year-old man is discharged after his third inpatient admission for acute alcohol detoxification. He does not have depression or use illicit drugs. He is enrolled in an alcohol treatment program.

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D: Serum CK measurement

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A 45-year-old woman reports a 2-month history of a recurring, disfiguring lump in her neck without other symptoms. She works as a successful investment banker and does not appear distressed by the symptom. Exam reveals no palpable or visible mass in the area she identifies as abnormal.

Which of the following is the most likely diagnosis?

A: Delusional disorder

B: Generalized anxiety disorder

C: Schizophrenia

D: Social anxiety disorder

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Cancer Screening

2025 Virtual/Live Internal Medicine Board Review

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ACP Internal Medicine Board Review Course

General Internal Medicine: Cancer Screening

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Table of Contents: Cancer Screening

- Breast cancer screening
- Lung cancer screening
- Colorectal cancer screening
- Cervical cancer screening
- Prostate cancer screening

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Cancer Screening Q1

A 52-year-old woman is evaluated for breast cancer screening.

She is healthy and has no family or personal history of cancer or thyroid disease. She has not had a breast biopsy.

Previous breast cancer screening demonstrated extremely dense breast tissue and no other abnormalities.

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Cancer Screening Q1

A 52-year-old woman is evaluated for breast cancer screening. She is healthy and has no family or personal history of cancer or thyroid disease. She has not had a breast biopsy. Previous breast cancer screening demonstrated extremely dense breast tissue and no other abnormalities.

Which of the following modalities is the most appropriate subsequent breast cancer screening test?

A: Breast MRI

B: Breast thermography

C: Digital mammography

D: Whole breast ultrasonography

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Breast Cancer Screening

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Breast Cancer Screening

Benefits	Harms
• ↓ Breast cancer mortality in patients aged 40-74 years • Patients aged 40-49 years benefit least • Patients aged 60-69 years benefit most	• Overdiagnosis • Patient anxiety • Unnecessary biopsies • Unnecessary treatments

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Breast Cancer Screening

Average risk (<15% lifetime risk) defined by absence of the following:

- Personal/family history of breast, ovarian, peritoneal, prostate cancers
- Personal/family history of *BRCA1/2* gene variants or other variant conferring a higher risk for breast cancer
- Previous breast biopsy showing high-risk pathology
  - Atypical hyperplasia, lobular carcinoma in situ, or other proliferative lesion and (+) family history
- Previous chest irradiation at age 10-30 years

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Breast Cancer Screening in Average-Risk Women

USPSTF Recommendations	
Age 40-74 y	Biennial screening mammography
Age ≥75 y	Insufficient evidence to weigh benefits and risks
Imaging modalities: insufficient evidence to recommend	Adjuvant screening with breast ultrasonography, MRI, or digital breast tomosynthesis in women with dense breast tissue

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Breast Cancer Screening in High-Risk Women

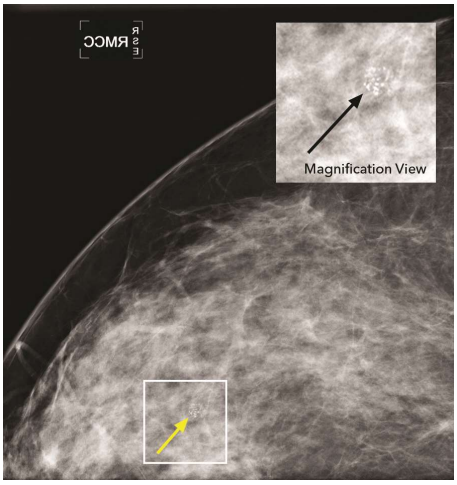
American Cancer Society Recommendations*
Annual mammography and MRI for women with:
BRCA1/2 variants
First-degree relative who is *BRCA1/2* carrier
Lifetime breast cancer risk ≥20% (risk calculator)
Chest irradiation between ages 10 and 30 y
History of other rare familial breast cancer syndromes

**Typically starting at age 30 years. High risk: consider chemoprevention; Intermediate risk: use risk calculator.*

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Breast Cancer Screening



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Imaging results are categorized by BI-RADS

Biopsy needed:

- BI-RADS category 4 and 5 findings
- Any suspicious mass, even if "negative" imaging results
  - Image-guided core-needle biopsy
- Any mass or concern from the patient deserves close follow-up regardless of imaging results

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Cancer Screening Q2

A 60-year-old woman is evaluated during a wellness visit.

She is asymptomatic.

She has a 40-pack-year smoking history but quit 5 years ago.

Physical exam is unremarkable.

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Cancer Screening Q2

A 60-year-old woman is evaluated during a wellness visit. She is asymptomatic. She has a 40-pack-year smoking history but quit 5 years ago. Physical exam is unremarkable.

Which of the following is the most appropriate screening test to perform?

A: Autofluorescence bronchoscopy

B: Chest radiography

C: Low-dose chest CT

D: Sputum cytology

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Lung Cancer Screening

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Lung Cancer Screening

Benefit	20% ↓ in lung cancer mortality 6.7% ↓ in all-cause mortality
Harms	Overdiagnosis High false-positive rates Unnecessary surgery Incidental findings Radiation exposure

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Lung Cancer Screening

Annual low-dose CT

- Aged 50-80 years
- ≥20-pack-year smoking history
- Current smoker or quit in the past 15 years

Discontinue screening

- No smoking for 15 years
- Limited life expectancy
- Unwilling to have curative lung surgery



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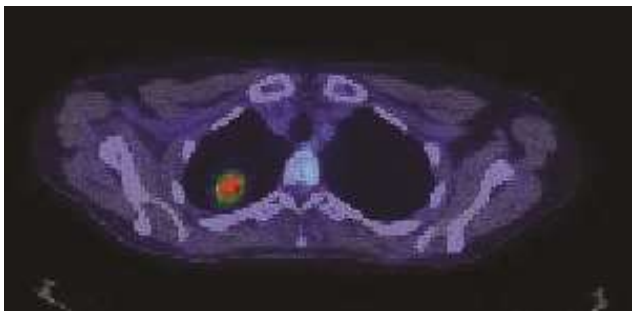
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Lung Cancer Screening

Initial evaluation of positive screen results

- PET/CT
- Biopsy



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Cancer Screening Q3

A 35-year-old man asks about colorectal cancer screening.

He has no symptoms.

His uncle was diagnosed with colorectal cancer at age 65 years.

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Cancer Screening Q3

A 35-year-old man asks about colorectal cancer screening. He has no symptoms. His uncle was recently diagnosed with colorectal cancer at age 65 years.

Based on the strongest evidence, when should colorectal cancer screening begin for this patient?

A: Now

B: Age 40 years

C: Age 45 years

D: Age 55 years

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Colorectal Cancer Screening

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Colorectal Cancer (CRC) Screening

Benefits

- ↓ Cancer-related mortality

Harms

- Colonoscopy: perforation, bleeding
- False-positive tests with downstream testing

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CRC Screening

Average risk is defined as patients **without**:

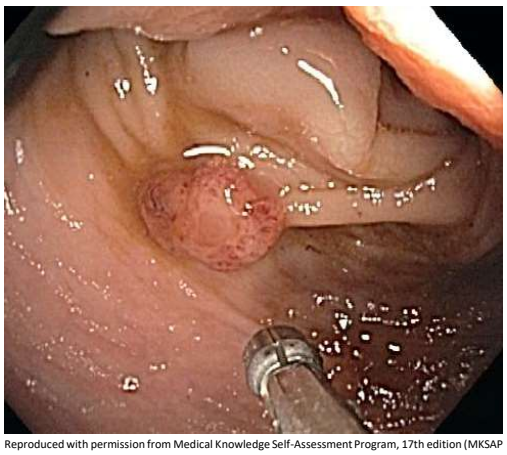
- History of CRC
- History of adenomatous polyp
- First-degree relative with CRC at age <60 years
- Two first-degree relatives with CRC at any age
- Family history of CRC-related genetic syndrome
- Inflammatory bowel disease
- Primary sclerosing cholangitis
- Abdominal radiation for childhood cancer

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CRC Screening: USPSTF Recommendations

- Average-risk patients aged 50-75 years (grade A recommendation)
- Average-risk patients aged 45-49 years (grade B recommendation)
- Shared decision making in patients aged 76-85 years
- Stop at age >85 years
- Stop if life expectancy <10 years
- Use test most likely to be completed



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CRC Screening: Stool-Based Tests*

Screening Strategy	Frequency	Comments
gFOBT	Every year	High-sensitivity gFOBT has superior test performance Requires dietary restrictions
FIT	Every year	Improved sensitivity compared with gFOBT No dietary restrictions needed
FIT-DNA	Every 1 to 3 y	Detects genetic variants of colorectal neoplasms shed in stool

*For average-risk patients only. Positive tests require colonoscopy.

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CRC Screening: Direct Visualization Tests

Screening Strategy	Frequency	Comments
Colonoscopy	Every 10 y	High sensitivity for CRC and adenomatous polyps Allows for lesion visualization and polyp removal
CT colonography	Every 5 y	Imaging only (cannot remove polyps or biopsy)
Flexible sigmoidoscopy	Every 5 y	Visualization limited to 60 cm of colon
Flexible sigmoidoscopy with FIT	Flexible sigmoidoscopy every 10 y with FIT every year	

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Cancer Screening Q4

A 37-year-old asymptomatic man is evaluated during a routine exam.

His mother was diagnosed with colon cancer at age 57 years.

He has no other history of familial polyps, colon cancer, or other cancer diagnoses.

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Cancer Screening Q4

A 37-year-old asymptomatic man is evaluated during a routine exam. His mother was diagnosed with colon cancer at age 57 years. He has no other history of familial polyps, colon cancer, or other cancer diagnoses.

Which of the following is the most appropriate timing for screening colonoscopy in this patient?

A: Now

B: At age 40 years

C: At age 45 years

D: At age 47 years

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CRC Screening in High-Risk Patients

Risk	Colonoscopy Screening Strategy
CRC in FDR aged <60 y CRC in ≥2 FDRs at any age	Begin at age 40 y or 10 y earlier than age of youngest FDR at diagnosis (whichever comes first) Repeat every 5 y
CRC personal history	Upon diagnosis Repeat at years 1 and 3 Then every 5 y
Familial adenomatous polyposis	Begin at age 10-12 y Repeat every 1-2 y until colectomy

FDR = first-degree relative.

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CRC Screening in High-Risk Patients

Risk	Colonoscopy Screening Strategy
Lynch syndrome	Begin at age 20-25 y or 2-5 y before the age of diagnosis of the earliest cancer in the family Repeat every 1-2 y
Inflammatory bowel disease	Begin after 8 y of chronic colitis Repeat every 1-2 y
Primary sclerosing cholangitis	Upon diagnosis Repeat every 1-2 y

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Cancer Screening Q5

A 25-year-old healthy woman is evaluated for a routine exam.

Pelvic exam and cervical cytology 1 year ago were normal.

She does not smoke.

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Cancer Screening Q5

A 25-year-old healthy woman is evaluated for a routine exam. Pelvic exam and cervical cytology 1 year ago were normal. She does not smoke.

In addition to screening for sexually transmitted infections and discussing reproductive planning, what is the most appropriate next step in management?

A: Cervical cytology and hrHPV co-test now

B: Cervical cytology in 2 years

C: Cervical cytology in 3 years

D: hrHPV test now

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Cervical Cancer Screening

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Cervical Cancer Screening

Benefit

- ↓ Cancer incidence and mortality

Harms

- More frequent follow-up testing
- More frequent invasive diagnostic procedures

Note: Transgender patients with cervix need cervical cancer screening

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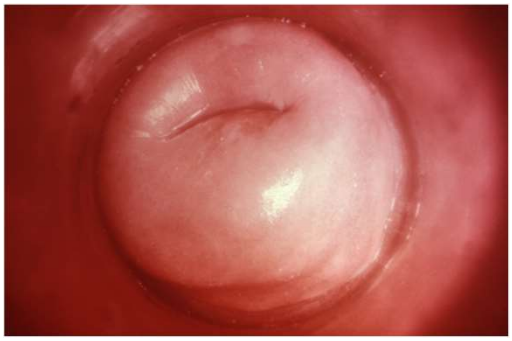
Cervical Cancer Screening

USPSTF recommendations

- Aged 21-29 years: Pap testing (cervical cytology) every 3 years
- Aged 30-65 years (any one of the following)
  - Pap testing every 3 years
  - hrHPV testing every 5 years
  - hrHPV/Pap co-testing every 5 years

American Cancer Society recommendations

- Initiate screening at age 25 years, perform primary HPV testing every 5 years through age 65 years (preferred) *or*
- Co-testing every 5 years or cytology every 3 years



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Cervical Cancer Screening

Aged >65 years

- Discontinue in those with adequate previous screening in past 10 years
  - Three consecutive negative Pap tests
  - Two consecutive negative Pap plus hrHPV tests, with most recent test in past 5 years
  - Two consecutive negative hrHPV tests

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Cervical Cancer Screening

Aged >65 years (*cont'd*)

- Continue in women with risk factors and ≥10 years' life expectancy
  - Abnormal Pap tests
  - High-grade precancerous lesion
  - In utero exposure to diethylstilbestrol
  - Immunocompromise
  - Previous HPV infection
- Continue in women with no previous screening

Hysterectomy with cervix removal (benign disease)

- Discontinue screening

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Cancer Screening Q6

A 62-year-old healthy man is seen for a health maintenance exam.

Medical history is unremarkable, and he takes no medications.

He has no personal or family history of cancer.

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Cancer Screening Q6

A 62-year-old healthy man is seen for a health maintenance exam. Medical history is unremarkable, and he takes no medications. He has no personal or family history of cancer.

Which of the following is the most appropriate next step in prostate cancer screening for this patient?

A: Discussion of risks and benefits

B: Digital rectal exam now

C: PSA testing now

D: PSA testing now and in 6 months

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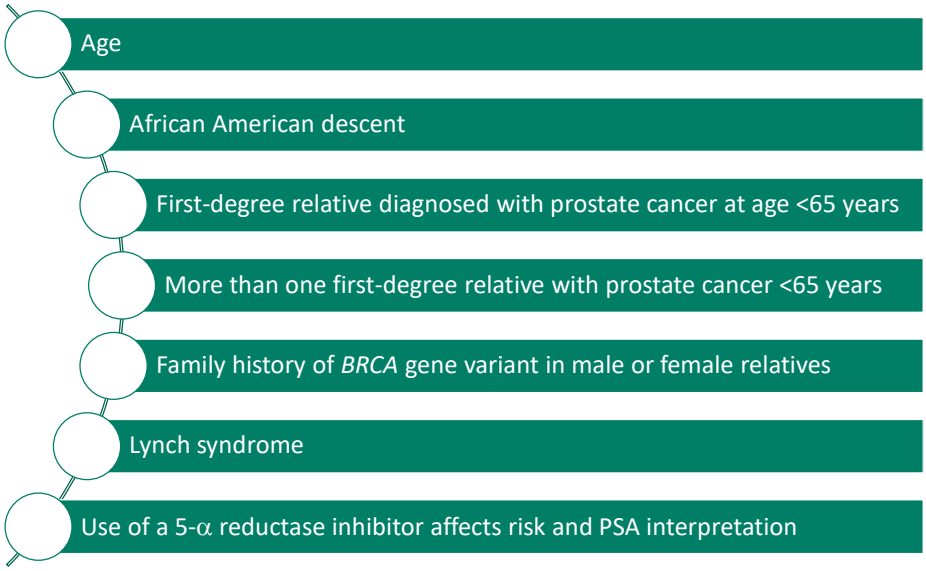
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Prostate Cancer Screening

ACP

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Prostate Cancer: Risk Factors



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Prostate Cancer Screening

Benefit

- Annual screening between ages 55 and 69 years projected to result in 9 fewer prostate cancer deaths per 1000 males followed for their lifetime
- Greater benefit potentially with higher risk
- One-time screening: improved 15-year prostate cancer mortality compared with no screening (*JAMA*, April 2024)

Risks

- Overdiagnosis
- Lead time bias
- Overtreatment with risk for incontinence and erectile dysfunction
- Downstream testing
- Biopsy: bleeding, infection, pain

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Prostate Cancer Screening

Guidelines agree	Guidelines disagree
• Shared decision making • Screen with PSA • Stop if life expectancy <10-15 years	• Age to start • Screening frequency • High-risk screening • When to stop

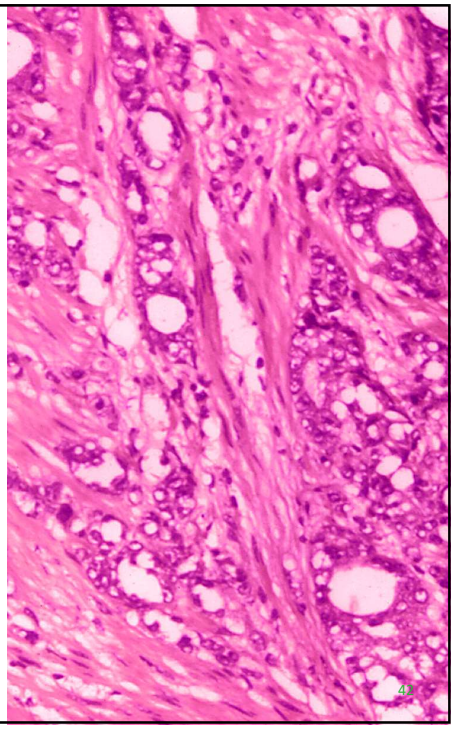
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Prostate Cancer Screening: Results

Elevated PSA level of ≥4 ng/mL

- Urologic referral indicated to determine need for biopsy based on further testing, life expectancy, results of imaging
- MRI of prostate often performed with guided biopsy if indicated



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Cancer Screening

- Answers to Multiple-Choice Questions

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Cancer Screening Q1

A 52-year-old woman is evaluated for breast cancer screening. She is healthy and has no family or personal history of cancer or thyroid disease. She has not had a breast biopsy. Previous breast cancer screening demonstrated extremely dense breast tissue and no other abnormalities.

Which of the following modalities is the most appropriate subsequent breast cancer screening test?

A: Breast MRI

B: Breast thermography

C: Digital mammography

D: Whole breast ultrasonography

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Cancer Screening Q2

A 60-year-old woman is evaluated during a wellness visit. She is asymptomatic. She has a 40-pack-year smoking history but quit 5 years ago. Physical exam is unremarkable.

Which of the following is the most appropriate screening test to perform?

A: Autofluorescence bronchoscopy

B: Chest radiography

C: Low-dose chest CT

D: Sputum cytology

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Cancer Screening Q3

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C: Cervical cytology in 3 years

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Cancer Screening Q6

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D: PSA testing now and in 6 months

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2025 Greater Chicago Internal Medicine Board Review course
Program Schedule – In-Person and Virtual Live
Tuesday, May 13 – Saturday, May 17, 2025
Central Daylight Time

Thursday, May 15, 2025

Time	Topic	Content	Faculty
7:00 a.m. – 8:00 a.m.	**Breakfast**		
8:00 a.m. – 9:00 a.m.	**Gastroenterology I**	➢ Esophageal Motility Disorders ➢ Gastroesophageal Reflux ➢ Pill-Induced Esophagitis ➢ Barrett Esophagus ➢ Dyspepsia ➢ Peptic Ulcer Disease ➢ *Helicobacter Pylori* Infection ➢ Gastritis and Gastropathy ➢ Disorders of Gastric Emptying	 *Dejan Micic, MD*
9:00 a.m. – 10:00 a.m.	**Gastroenterology II**	➢ Irritable Bowel Syndrome ➢ Celiac Disease ➢ Crohn Disease Including Crohn Colitis ➢ Ulcerative Colitis ➢ Diverticular Disease ➢ Acute Appendicitis ➢ Mesenteric Ischemia ➢ Colonic Ischemia	*Dejan Micic, MD*
10:00 a.m. – 10:15 a.m.	**15-Minute Break**		
10:15 a.m. – 11:15 a.m.	**Gastroenterology III**	➢ Cholelithiasis ➢ Cholecystitis ➢ Choledocholithiasis ➢ Acute Pancreatitis ➢ Gallbladder Cancer ➢ Upper Gastrointestinal Bleeding ➢ Lower Gastrointestinal Bleeding ➢ Hemorrhoids and Fissures	*Dejan Micic, MD*
11:15 a.m. – 12:15 p.m.	**Gastroenterology IV**	➢ Metabolic Dysfunction–Associated Steatotic Liver Disease and Steatohepatitis ➢ Viral Hepatitis ➢ Alcohol Hepatitis	*Dejan Micic, MD*

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Thursday, May 15, 2025			
11:15 a.m. – 12:15 p.m.	**Gastroenterology IV (*cont.*)**	➢ Cirrhosis and Portal Hypertension ➢ Acute Liver Failure	*Dejan Micic, MD*
12:15 p.m. – 1:15 p.m.	**1-Hour Break**		
1:15 p.m. – 2:45 p.m.	**General Internal Medicine: Common Symptoms**	➢ Cough ➢ Bronchitis ➢ Dyspnea ➢ Chest Pain ➢ Syncope ➢ Dizziness and Vertigo ➢ Insomnia	 *Allison L. Ruff, MD, MHPE*
2:45 p.m. – 3:45 p.m.	**General Internal Medicine: Urologic, Obstetric and Gynecological Conditions**	➢ Benign Prostatic Hyperplasia ➢ Other Causes of Lower Urinary Tract Symptoms (LUTS) in Men ➢ Erectile Dysfunction ➢ Breast Mass ➢ Vitamin Deficiency in Pregnancy ➢ Abnormal Uterine Bleeding ➢ Menopause ➢ Hormonal Therapy	*Allison L. Ruff, MD, MHPE*
3:45 p.m. – 4:00 p.m.	**15-Minute Break**		
4:00 p.m. – 5:00 p.m.	**General Internal Medicine: Geriatric Medicine I**	➢ Pressure Injuries ➢ Urinary Incontinence ➢ Falls ➢ Hip Fracture in Older Adults ➢ Nutrition in Older Adults ➢ Clinical Pharmacology and Aging ➢ Constipation in Older Adults	 *Kahli Zietlow, MD*
5:00 p.m. – 5:45 p.m.	**General Internal Medicine: Geriatric Medicine II**	➢ Elder Mistreatment ➢ Home Care ➢ End-of-Life and Palliative Care ➢ Pain Management	*Kahli Zietlow, MD*

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Thursday, May 15, 2025			
5:45 p.m. – 6:15 p.m.	**General Internal Medicine: Ethics and Patient Safety**	➢ Ethics ➢ Assessment of Decisional Capacity and Competency; Surrogate Decision Making ➢ Safety and Quality Improvement	*Kahli Zietlow, MD*
6:15 p.m.	**Adjourn**		

Gastroenterology I

2024 Virtual/Live Internal Medicine Board Review

Dejan Micic, MD
Associate Professor of Medicine
Associate Chief, Gastroenterology and Nutrition
Loyola University Medical Center
Maywood IL

ACP Internal Medicine Board Review Course

Gastroenterology I

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- Esophageal motility disorders
- Gastroesophageal reflux
- Pill-induced esophagitis
- Barrett esophagus
- Nonulcer dyspepsia
- Peptic ulcer disease other than *Helicobacter pylori* infection
- *Helicobacter pylori* infection
- Gastritis and gastropathy
- Disorders of gastric emptying

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Gastroenterology Q1

A 54-year-old man reports a 2-year history of dysphagia with both solid food and liquids and regurgitation of undigested food.

He has no associated heartburn, weight loss, or chest pain.

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Gastroenterology Q1

A 54-year-old man reports a 2-year history of dysphagia with both solid food and liquids and regurgitation of undigested food. He has no associated heartburn, weight loss, or chest pain.

Which of the following is the most likely diagnosis?

A: Achalasia

B: Esophageal web

C: GERD

D: Pseudoachalasia

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Esophageal Motility Disorders

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Esophageal Dysphagia: Diagnosis

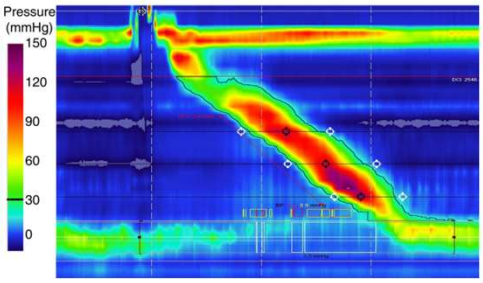
Symptom	Diagnosis
Intermittent solid-food dysphagia present for months to years	Esophageal web, distal esophageal ring (Schatzki ring), or eosinophilic esophagitis (EoE)
Progressively worsening solid-food dysphagia	Peptic stricture or carcinoma
Solid food and liquid or liquid-only dysphagia	Esophageal motility disorder

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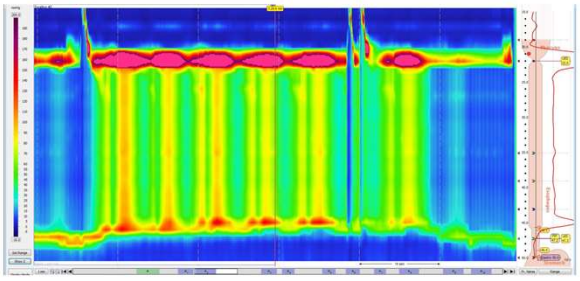
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Esophageal Dysphagia: Testing

- Suspected esophageal motility disorder → manometry
- Suspected structural disorder → EGD



Normal Peristalsis



Achalasia

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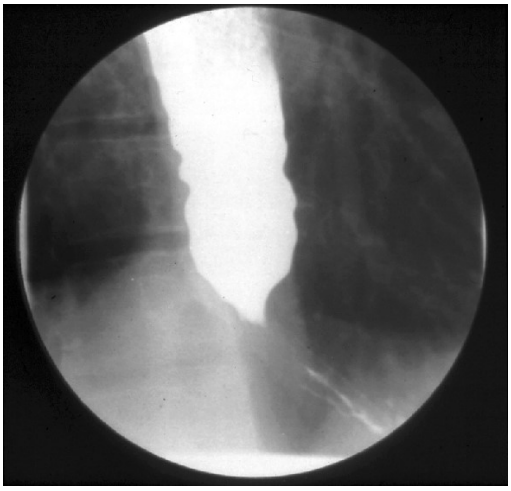
Achalasia: Diagnosis

- Dysphagia to both solids and liquids
- Regurgitation of undigested food
- Chest pain
- Heartburn (from fermentation of retained food in esophagus, not reflux)

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Achalasia: Testing



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Upper endoscopy

- Exclude gastroesophageal junction adenocarcinoma

High-resolution esophageal manometry

- Absence of peristalsis
- Failure of lower esophageal sphincter to relax

Barium swallow

- "Bird's beak" narrowing of the gastroesophageal junction
- Useful if manometry unclear

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Gastroenterology Q2

A 40-year-old woman reports heartburn and regurgitation of gastric contents several times a week for 3 months.

She has taken omeprazole once daily for 2 months without relief.

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Gastroenterology Q2

A 40-year-old woman reports heartburn and regurgitation of gastric contents several times a week for 3 months. She has taken omeprazole once daily for 2 months without relief.

Which of the following is the most appropriate next step in management?

A: Esophageal pH monitoring

B: H_2 blocker therapy

C: Laparoscopic fundoplication

D: Upper endoscopy

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Gastroesophageal Reflux (GERD)

ACP

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GERD: Diagnosis

Heartburn (substernal burning sensation) and acid regurgitation

Chest pain

Extraesophageal manifestations

Laryngeal and pulmonary symptoms

- Hoarseness, throat clearing, chronic cough

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GERD: Testing

Upper endoscopy indications → PPI failure or alarm symptoms

- Dysphagia/odynophagia
- Unintentional weight loss
- Hematemesis/melena
- Vomiting
- Anemia

Therapeutic trial of PPI

- Once-daily trial for 8 weeks
  - Complete relief → discontinue PPI
  - Incomplete relief/treatment failure/symptom recurrence → upper endoscopy after 2-4 weeks off PPI

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GERD: Testing

Ambulatory reflux monitoring (pH or impedance pH)

- PPI failure + negative upper endoscopy
- Impedance testing

Esophageal manometry

- Refractory GERD when upper endoscopy and pH monitoring are inconclusive
- Before antireflux surgery (exclude motility disorders)

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GERD: Complications

Erosive esophagitis

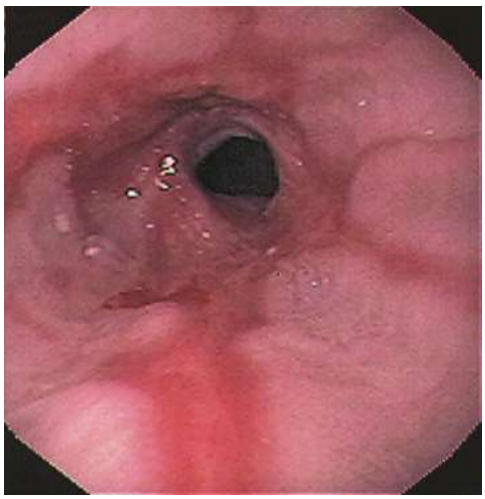
Stricture

Barrett esophagus

Esophageal adenocarcinoma

Extraesophageal complications

- Cough
- Laryngitis
- Asthma
- Dental erosion



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GERD: Nonpharmacologic Treatment

- Reduce weight
- Avoid “trigger” foods: caffeine, spicy foods, citrus
- Finish eating 3-4 hours before going to bed
- Stop smoking
- Elevate head of bed

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GERD: Treatment

PPI therapy once daily

- Partial PPI response in confirmed GERD → PPI twice daily
- Lowest dose to effectively control symptoms
- Symptom resolution → attempt to discontinue
- Common adverse effects
  - Headache, diarrhea, dyspepsia
- Uncommon adverse effects
  - Vitamin B_{12} deficiency
  - Hypomagnesemia
  - Enteric bacterial infections (*Clostridioides difficile, Salmonella*)
  - Community-acquired pneumonia

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GERD: Treatment

Antireflux surgery

- Failure of optimal therapy
- Desire to stop medication
- Intolerable medication adverse effects

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Gastroenterology Q3

A 48-year-old woman reports a 2-day history of severe retrosternal chest pain and odynophagia.

She is being treated for rosacea but has no other medical problems.

Her only medication is doxycycline.

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Gastroenterology Q3

A 48-year-old woman reports a 2-day history of severe retrosternal chest pain and odynophagia. She is being treated for rosacea but has no other medical problems. Her only medication is doxycycline.

Which of the following is the most likely diagnosis?

A: Barrett esophagus

B: *Candida* esophagitis

C: Eosinophilic esophagitis

D: Pill-induced esophagitis

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Pill-Induced Esophagitis

ACP

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Pill-Induced Esophagitis: Diagnosis

- Common history: swallowing pills without water
- Severe retrosternal chest pain
- Odynophagia
- Hours to days after taking medication

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Pill-Induced Esophagitis: Diagnosis

Common causative medications

- Tetracycline, doxycycline
- Aspirin, NSAIDs
- Iron
- Potassium chloride
- Oral bisphosphonates

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Pill-Induced Esophagitis: Treatment

Stop the offending drug

Unclear role for antacids, H_2 blockers, PPIs

- PPIs if GERD is a premorbid condition

Prevention

- Take medications with large bolus of water
- Remain upright for 30 minutes after ingestion

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Gastroenterology Q4

A 58-year-old man is evaluated at a follow-up visit for Barrett esophagus with low-grade dysplasia.

He takes a PPI twice daily.

Endoscopic biopsy reveals high-grade dysplasia.

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Gastroenterology Q4

A 58-year-old man is evaluated at a follow-up visit for Barrett esophagus with low-grade dysplasia. He takes a PPI twice daily. Endoscopic biopsy reveals high-grade dysplasia.

Which of the following is the most appropriate additional treatment?

A: Endoscopic ablation

B: Endoscopic fundoplication

C: Esophagectomy

D: Metoclopramide

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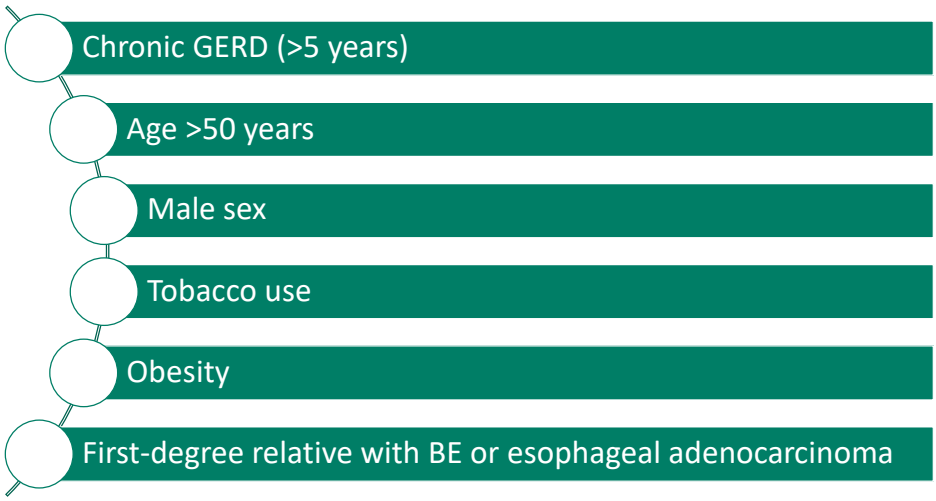
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Barrett Esophagus

ACP

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Barrett Esophagus: Risk Factors



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Barrett Esophagus: Diagnosis

Many patients are asymptomatic (~50%)

Symptoms from GERD

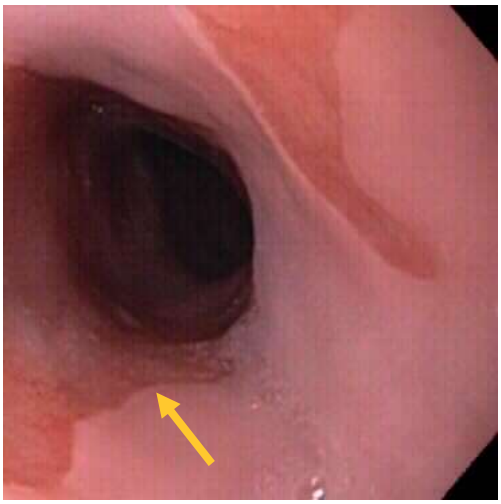
- Heartburn
- Acid regurgitation

Physical exam typically normal

30

30

Barrett Esophagus: Testing



Upper endoscopy

- Routine screening not recommended
- Screen those with chronic GERD symptoms and ≥3 risk factors

Columnar epithelium above gastroesophageal junction

Pathology

- Columnar metaplasia ± dysplasia

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Barrett Esophagus: Treatment

No dysplasia
- PPIs heal esophagitis
- Surveillance endoscopy every 3-5 years

Low-grade dysplasia
- Endoscopic eradication (preferred)
- Endoscopic surveillance (alternative)

High-grade dysplasia
- Endoscopic eradication therapy
- Esophagectomy if eradication unsuccessful

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Gastroenterology Q5

A 36-year-old woman is evaluated for an 8-month history of daily postprandial bloating and early satiety.

She is otherwise healthy.

Abdominal exam shows no abnormalities.

H. pylori testing is negative.

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Gastroenterology Q5

A 36-year-old woman is evaluated for an 8-month history of daily postprandial bloating and early satiety. She is otherwise healthy. Abdominal exam shows no abnormalities. *H. pylori* testing is negative.

Which of the following is the most appropriate treatment?

A: Amitriptyline

B: Esomeprazole

C: Metoclopramide

D: Sertraline

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Nonulcer Dyspepsia

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Dyspepsia: Diagnosis

Predominant epigastric pain ≥1 month

- Postprandial fullness or early satiety
- Epigastric pain or burning

Functional dyspepsia

- No organic cause following upper endoscopy and other testing

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Dyspepsia: Testing

Age ≥60 years OR alarm symptoms (weight loss, anemia, dysphagia, persistent vomiting)

- Upper endoscopy

Age <60 years and NO alarm symptoms

- No upper endoscopy
- *H. pylori* "test and treat" strategy
- Celiac disease testing

Routine motility studies: not recommended

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Dyspepsia: Treatment

Positive *H. pylori* test

- Eradication treatment
- Symptomatic following eradication → use PPI

Negative *H. pylori* test

- Single-dose PPI for 4-6 weeks

If PPI treatment fails, use amitriptyline

- If PPI and amitriptyline fail, try metoclopramide

If drug therapy fails, try psychologic therapies

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Gastroenterology Q6

A 64-year-old man has a 1-week history of melena and mid-epigastric pain.

He takes ibuprofen daily.

Exam reveals hypotension, generalized abdominal distension, and abdominal rigidity.

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Gastroenterology Q6

A 64-year-old man has a 1-week history of melena and mid-epigastric pain. He takes ibuprofen daily. Exam reveals hypotension, generalized abdominal distension, and abdominal rigidity.

Which of the following is the most appropriate diagnostic test?

A: Abdominal angiography

B: Abdominal CT

C: Barium swallow

D: Upper endoscopy

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Peptic Ulcer Disease Other Than *Helicobacter pylori* Infection

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Peptic Ulcer Disease: Presentation

Asymptomatic

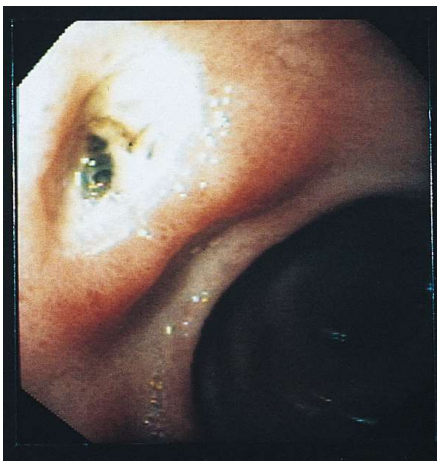
Epigastric pain (intermittent)

Bleeding is most common complication

Gastric outlet obstruction

- Epigastric pain
- Early satiety, nausea/vomiting
- Abdominal distension/bloating
- Weight loss

Penetration/perforation: abdominal pain, tachycardia, abdominal rigidity



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Peptic Ulcer Disease: Testing

NSAID use and *H. pylori* are most common causes

Young patients, no alarm features → *H. pylori* "test and treat" strategy

- Urea breath test
- Stool test for *H. pylori* antigen

Older adults, alarm features → endoscopy and *H. pylori* testing

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Peptic Ulcer Disease: Testing



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Bleeding

- Endoscopy within 24 hours

Gastric outlet obstruction

- Endoscopy

Penetration/perforation

- Urgent CT

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Peptic Ulcer Disease: Treatment

With significant hemorrhage, warfarin and DOACs should be held

- Reversal of warfarin and DOACs not routinely necessary
  - Only if supratherapeutic, significant bleeding, or blood transfusion undesirable
- Intravenous PPI, then oral PPI therapy for 8 weeks

H. pylori–associated PUD → treat with *H. pylori* eradication

NSAID-induced PUD

- Stop NSAID, begin PPI
- If unable to stop NSAID, add PPI; consider COX-2 inhibitor

Aspirin-induced PUD

- If aspirin held, then restart aspirin as soon as hemostasis obtained if patient has ASCVD
- Stop aspirin permanently if used for primary prevention

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Gastroenterology Q7

A 38-year-old man has epigastric pain 8 weeks after completing treatment with amoxicillin, clarithromycin, and omeprazole for a *Helicobacter pylori*–positive duodenal ulcer.

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Gastroenterology Q7

A 38-year-old man has epigastric pain 8 weeks after completing treatment with amoxicillin, clarithromycin, and omeprazole for a *Helicobacter pylori*–positive duodenal ulcer.

Which of the following is the most appropriate diagnostic test?

A: *H. pylori* stool antigen test

B: IgG *H. pylori* antibody test

C: Stool culture

D: Upper endoscopy

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Helicobacter pylori Infection

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H. pylori Infection: Diagnosis

Dyspepsia

- Early satiety, epigastric burning, nausea
- Postprandial pain, bloating, belching

PUD

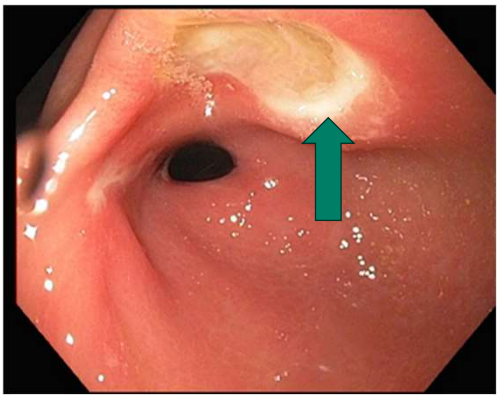
- Epigastric pain, upper gastrointestinal bleeding

Extranodal marginal zone lymphoma of the mucosa-associated lymphoid tissue (MALT lymphoma)

- Dyspepsia, PUD symptoms, weight loss

Gastric adenocarcinoma

- Anorexia, weight loss, epigastric pain



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H. pylori Infection: Testing

Noninvasive

- Urea breath test
- Stool antigen test

Endoscopic biopsy

- Histology
- Urease test
- Culture

Antibody test

- Does not distinguish current from past infection

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H. pylori Infection: Treatment

Therapeutic Approach	Medications
Quadruple bismuth-based therapy • First-line therapy	PPI + bismuth subcitrate–subsalicylate + tetracycline + metronidazole
Macrolide-based triple therapy • Not first line • High rates (>15%) of clarithromycin resistance in United States	PPI + clarithromycin + amoxicillin

Eradication testing: ≥30 days after treatment

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H. pylori Infection: Prognosis



Treatment is effective in preventing complications

- PUD
- Gastric atrophy
- Intestinal metaplasia, gastric cancer
- Extranodal marginal zone lymphoma of mucosa-associated lymphoid tissue (MALT lymphoma)

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Gastroenterology Q8

A 63-year-old woman reports postprandial fullness.

She has hypothyroidism and remote history of *H. pylori* infection.

Abdominal exam is normal.

Vitiligo and absent vibratory sensation in the lower extremities are noted.

CBC shows anemia with an MCV of 110 fL. Stool antigen for *H. pylori* is negative.

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Gastroenterology Q8

A 63-year-old woman reports postprandial fullness. She has hypothyroidism and remote history of *H. pylori* infection. Abdominal exam is normal. Vitiligo and absent vibratory sensation in the lower extremities are noted. CBC shows anemia with an MCV of 110 fL. Stool antigen for *H. pylori* is negative.

Which of the following is the most likely diagnosis?

A: Chronic autoimmune atrophic gastritis

B: Gastric ulcer

C: Gastroparesis

D: *H. pylori* infection

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Gastritis and Gastropathy

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Chronic Atrophic Gastritis

Environmental metaplastic atrophic gastritis (EMAG) → *H. pylori* infection

Chronic autoimmune atrophic gastritis (CAAG)

- Autoimmune destruction → parietal cells and intrinsic factor
  - Achlorhydria, hypergastrinemia
  - Iron malabsorption, vitamin B_{12} deficiency
- Associated immune disorders
  - Hypothyroidism, vitiligo, type 1 diabetes mellitus, Addison disease

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Chronic Atrophic Gastritis: Diagnosis

Dyspepsia, heartburn

B_{12} deficiency

- Abnormal proprioception and vibratory sense
- Cognitive symptoms, depression



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Chronic Atrophic Gastritis: Testing and Treatment

EMAG

- *H. pylori* testing and eradication

CAAG

- Parietal cell antibodies → sensitive
- Intrinsic factor antibodies → specific
- Upper endoscopy with biopsy → most accurate
- Replace iron and vitamin B_{12}

↑ Risk for gastric cancer, MALT, gastric neuroendocrine tumors

- Routine surveillance not recommended

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Gastroenterology Q9

A 34-year-old woman has a 6-month history of nausea, persistent vomiting, early satiety, and postprandial bloating.

She frequently takes ibuprofen for migraines.

There is epigastric tenderness on examination.

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Gastroenterology Q9

A 34-year-old woman has a 6-month history of nausea, persistent vomiting, early satiety, and postprandial bloating. She frequently takes ibuprofen for migraines. There is epigastric tenderness on examination.

Which of the following is the most appropriate management?

A: Biliary ultrasonography

B: Esomeprazole

C: Gastric scintigraphy

D: Upper endoscopy

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Disorders of Gastric Emptying

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Disorders of Gastric Emptying: Causes

Outlet obstruction

- PUD
- Crohn disease

Gastroparesis

- Idiopathic (most common)
- Diabetes mellitus
- Foregut surgery
- Drugs (opioids, anticholinergics)

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Disorders of Gastric Emptying: Diagnosis and Testing

- Nausea, vomiting, early satiety
- Abdominal fullness, bloating
- Upper abdominal pain
- ± Succussion splash
- Upper endoscopy to exclude mechanical obstruction (first test)
- Gastric scintigraphy to test gastric emptying (gastroparesis)

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Disorders of Gastric Emptying: Treatment

Mechanical obstruction

- Treat underlying disorder

Gastroparesis

- Dietary modification (small particle, low fat, low nondigestible food)
- Metoclopramide (risk for tardive dyskinesia)
- Erythromycin (short-term use)
- Acupuncture alone or combined with a prokinetic may have benefit
- Laparoscopic pyloroplasty
- Venting gastrostomy, feeding jejunostomy

Pain

- Avoid opioids and central neuromodulators

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Gastroenterology I

- Answers to Multiple-Choice Questions

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Gastroenterology Q1

A 54-year-old man reports a 2-year history of dysphagia with both solid food and liquids and regurgitation of undigested food. He has no associated heartburn, weight loss, or chest pain.

Which of the following is the most likely diagnosis?

A: Achalasia

B: Esophageal web

C: GERD

D: Pseudoachalasia

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Gastroenterology Q2

A 40-year-old woman reports heartburn and regurgitation of gastric contents several times a week for 3 months. She has taken omeprazole once daily for 2 months without relief.

Which of the following is the most appropriate next step in management?

A: Esophageal pH monitoring

B: H_2 blocker therapy

C: Laparoscopic fundoplication

D: Upper endoscopy

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Gastroenterology Q3

A 48-year-old woman reports a 2-day history of severe retrosternal chest pain and odynophagia. She is being treated for rosacea but has no other medical problems. Her only medication is doxycycline.

Which of the following is the most likely diagnosis?

A: Barrett esophagus

B: *Candida* esophagitis

C: Eosinophilic esophagitis

D: Pill-induced esophagitis

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Gastroenterology Q4

A 58-year-old man is evaluated at a follow-up visit for Barrett esophagus with low-grade dysplasia. He takes a PPI twice daily. Endoscopic biopsy reveals high-grade dysplasia.

Which of the following is the most appropriate additional treatment?

A: Endoscopic ablation

B: Endoscopic fundoplication

C: Esophagectomy

D: Metoclopramide

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Gastroenterology Q5

A 36-year-old woman is evaluated for an 8-month history of daily postprandial bloating and early satiety. She is otherwise healthy. Abdominal exam shows no abnormalities. *H. pylori* testing is negative.

Which of the following is the most appropriate treatment?

A: Amitriptyline

B: Esomeprazole

C: Metoclopramide

D: Sertraline

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Gastroenterology Q6

A 64-year-old man has a 1-week history of melena and mid-epigastric pain. He takes ibuprofen daily. Exam reveals hypotension, generalized abdominal distension, and abdominal rigidity.

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D: Upper endoscopy

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Gastroenterology II

2024 Virtual/Live Internal Medicine Board Review

Dejan Micic, MD
Associate Professor of Medicine
Associate Chief, Gastroenterology and Nutrition
Loyola University Medical Center
Maywood IL

ACP Internal Medicine Board Review Course

Gastroenterology II

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- Irritable bowel syndrome
- Celiac disease
- Crohn disease including Crohn colitis
- Ulcerative colitis
- Diverticular disease
- Acute appendicitis
- Mesenteric ischemia
- Colon ischemia

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Gastroenterology Q10

A 21-year-old woman is evaluated for diffuse abdominal pain on most days for the past 6 months.

The pain is relieved with bowel movements that occur twice per week. Stool is lumpy.

She has otherwise been well.

Physical exam is normal.

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Gastroenterology Q10

A 21-year-old woman is evaluated for diffuse abdominal pain on most days for the past 6 months. The pain is relieved with bowel movements that occur twice per week. Stool is lumpy. She has otherwise been well. Physical exam is normal.

Which of the following is the most likely diagnosis?

A: Celiac disease

B: Colon ischemia

C: Crohn disease

D: Irritable bowel syndrome

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Irritable Bowel Syndrome

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IBS: Diagnosis

Abdominal pain ≥1 day/week for the past 3 months

≥2 of the following:

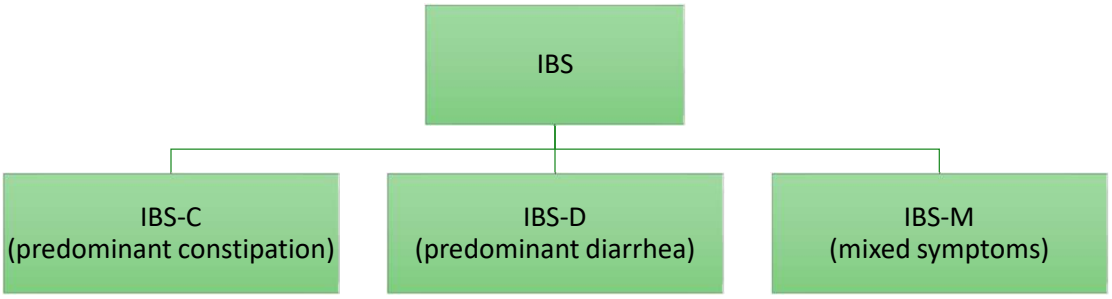
- Related to defecation
- Change in stool frequency
- Change in stool form

Symptom onset ≥6 months before diagnosis

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IBS: Subtypes



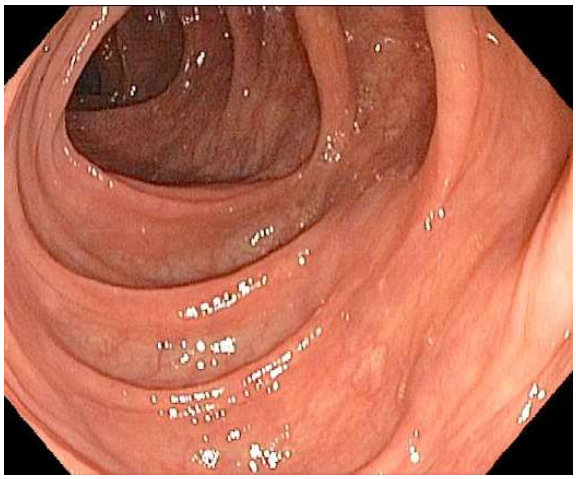
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IBS: Testing

Colonoscopy for alarm symptoms

- Onset at age >50 years
- Weight loss
- Blood in stool
- Nocturnal diarrhea
- Abdominal mass or lymphadenopathy
- Fever
- Personal/family history of CRC, IBD



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IBS: Testing

Complete blood count

C-reactive protein

- Increased level suggests IBD

Fecal calprotectin

Celiac disease testing

- Perform in patients with IBS-D

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IBS-C: Treatment

First-line therapy

- Dietary changes (fiber)
- Polyethylene glycol

Second-line therapy

- Linaclotide (GC-C)
- Lubiprostone (CIC-2)
- Plecanatide (GC-C)
- Tenapanor (NHE3)

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IBS-D: Treatment

Dietary modifications

Eluxadoline

Loperamide

- May decrease stool frequency

Rifaximin

Alosetron (5-HT3)

- Associated with risk for severe constipation and ischemic colitis

Tricyclic antidepressants

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IBS: Treatment

- Time-limited trial of low-FODMAP diet

Fructose	Honey, apples, pears, peaches, mangos, fruit juice, dried fruit
Lactose	Milk, custard, ice cream, yogurt, soft cheeses
Fructan	Wheat, rye, onions, leeks, zucchini
Galactan	Legumes
Sugar alcohol	Xylitol, sorbitol, maltitol, mannitol

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Celiac Disease

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Celiac Disease

Gluten-sensitive enteropathy

- Immune response to gliadins in diet

Affects 1% of persons in the United States

Average age at diagnosis is fifth decade of life

Disease manifestations vary; GI symptoms not always present

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Celiac Disease: Diagnosis

Requires all three of the following:

1. Presence of tissue transglutaminase antibodies in serum
2. Characteristic histologic findings on small intestinal biopsies
3. Response to gluten-free diet

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Celiac Disease: Classic Histologic Findings

- Intraepithelial lymphocytes (IEL)
  - >25 IELs/100 enterocytes
- Villous atrophy
  - Total or partial
- Crypt hyperplasia
- Chronic inflammation in lamina propria

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Celiac Disease: Treatment

Gluten-free diet: cornerstone of therapy

- Maintain for life
- Avoidance of wheat, barley, rye
- Complex with many pitfalls
- Visit with skilled dietitian

Assessment for micronutrient deficiencies

- Vitamin D level → check bone density if low

Vaccination

- Functional hyposplenism (15%)

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Gastroenterology Q11

A 36-year-old woman is evaluated for a 3-month history of right lower quadrant pain and diarrhea.

Stool is negative for *Clostridioides difficile* and enteropathogens.

Colonoscopy shows superficial serpiginous ulcers and cobblestoning in the ileum and right colon; the remainder of the exam is normal.

Histology shows nongranulomatous inflammation.

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Gastroenterology Q11

A 36-year-old woman is evaluated for a 3-month history of right lower quadrant pain and diarrhea. Stool is negative for *Clostridioides difficile* and enteropathogens. Colonoscopy shows superficial serpiginous ulcers and cobblestoning in the ileum and right colon; the remainder of the exam is normal. Histology shows nongranulomatous inflammation.

Which of the following is the most appropriate treatment?

A: Budesonide

B: Infliximab

C: Mesalamine

D: Metronidazole

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Crohn Disease Including Crohn Colitis



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Crohn Disease: Epidemiology and Risk Assessment

Bimodal age distribution

- Second to fourth decades
- Seventh to eighth decades

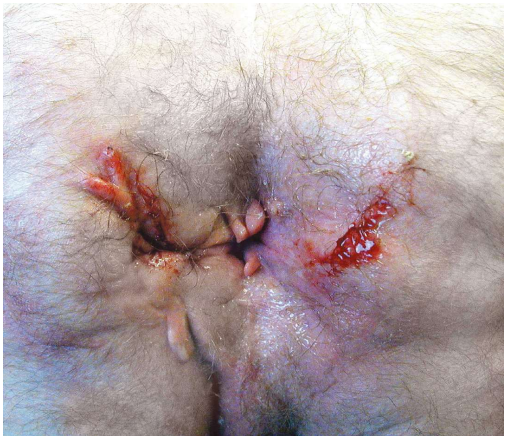
Risk factors

- Family history
- Ashkenazi Jewish descent
- Tobacco smoking

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Crohn Disease: Diagnosis



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- Fever
- Weight loss
- Abdominal discomfort/cramping
- Small bowel obstruction
- Diarrhea
- Perianal abscess, fistula, stricture
- Anemia

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Crohn Disease: Extraintestinal Manifestations

- Oral aphthous ulcers
- Arthritis, spondylitis, sacroiliitis
- Episcleritis, uveitis
- Erythema nodosum
- Pyoderma gangrenosum
- PSC → risk for CRC and cholangiocarcinoma

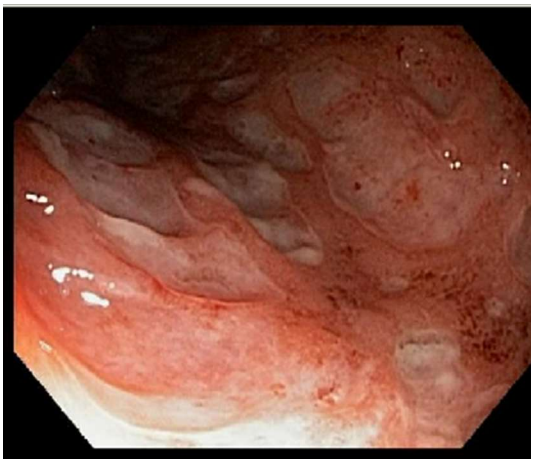


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Crohn Disease: Testing



↑ C-reactive protein and fecal calprotectin levels

Exclude enteric infection

Exclude *C. difficile* toxin

Colonoscopy with biopsy

- Aphthous ulcers
- "Cobblestone" mucosa
- Skip lesions
- Transmural involvement
- Granulomas (rare)

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Crohn Disease: Testing

Small-bowel imaging for suspected strictures

MR enterography preferred over CT (radiation)

Cancer screening should be done through colonoscopy

- Crohn disease
  - 8 years after diagnosis, then every 1-3 years
- Primary sclerosing cholangitis and IBD
  - At diagnosis, then every year

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Crohn Disease (Mild): Treatment

Smoking cessation

Nutritional counseling

Controlled ileal-release budesonide

- Induction (<4 months)

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Crohn Disease: Treatment

Systemic glucocorticoids

TNF-α inhibitors

- Infliximab, adalimumab, certolizumab
- Patients who do not benefit from methotrexate/thiopurine
- Induction/maintenance
- Glucocorticoid sparing

Immunomodulators

- Thiopurines: azathioprine and mercaptopurine
  - Maintenance; glucocorticoid sparing
- Methotrexate

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Crohn Disease: Treatment

Infliximab + thiopurine: additive effect

Infliximab for enterocutaneous, rectovaginal fistulas

Metronidazole or ciprofloxacin for simple perianal fistulas

Vedolizumab: gut-selective monoclonal antibody (integrin α4β7)

Ustekinumab: monoclonal antibody against p40 subunit shared by IL-12 and IL-23

Risankizumab: monoclonal antibody against p19 subunit of IL-23

Upadacitinib: selectively blocks JAK1 tyrosine kinase

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Crohn Disease: Surgical Treatment

- Medical therapy failure
- Small-bowel obstruction/stricture
- Internal fistulas
- Bleeding
- Perforation
- Dysplastic changes/cancer

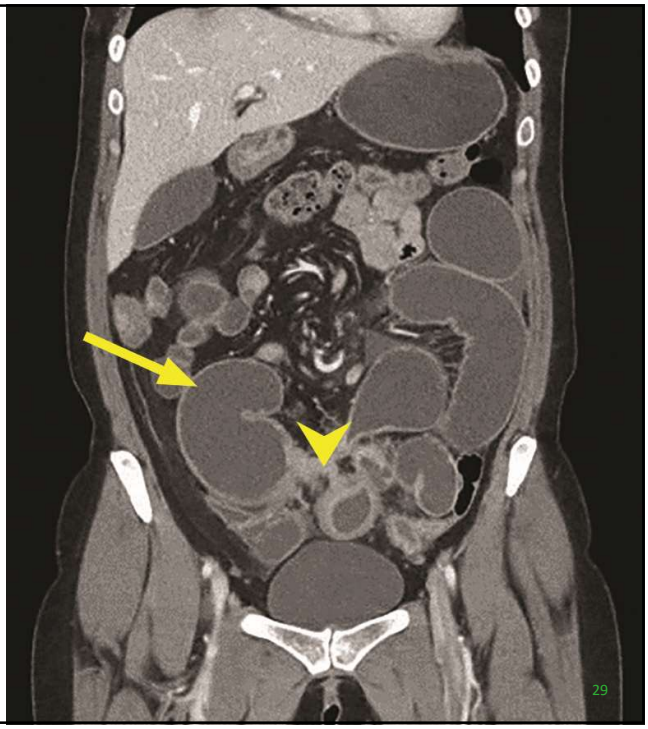


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Gastroenterology Q12

A 26-year-old woman is hospitalized with a 1-week history of fever, tenesmus, abdominal pain, and 10 daily episodes of bloody diarrhea. She has ulcerative colitis.

Stool culture and *C. difficile* assay are negative.

She improves with intravenous glucocorticoid therapy.

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Gastroenterology Q12

A 26-year-old woman is hospitalized with a 1-week history of fever, tenesmus, abdominal pain, and 10 daily episodes of bloody diarrhea. She has ulcerative colitis. Stool culture and *C. difficile* assay are negative. She improves with intravenous glucocorticoid therapy.

Which of the following is the most appropriate treatment?

A: Adalimumab

B: Azathioprine

C: Budesonide

D: Mesalamine

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Ulcerative Colitis

ACP

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Ulcerative Colitis: Diagnosis

- Diarrhea
- Abdominal discomfort
- Rectal bleeding
- Tenesmus
- Weight loss
- Fever

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Ulcerative Colitis: Extraintestinal Manifestations

- Oral aphthous ulcers
- Arthritis, spondylitis, sacroiliitis
- Episcleritis, uveitis
- Erythema nodosum
- Pyoderma gangrenosum
- PSC → risk for CRC and cholangiocarcinoma



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Ulcerative Colitis: Testing

Anemia, ↑ inflammatory markers

↑ Fecal calprotectin

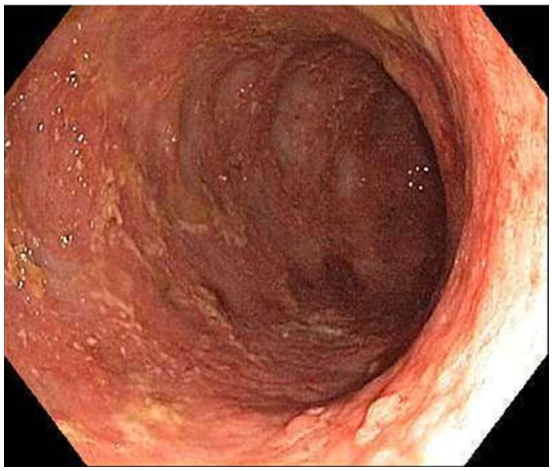
Stool tests

- Rule out enteropathogens
- *C. difficile* toxin assay

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Ulcerative Colitis: Colonoscopy



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Continuous mucosal inflammation

- Rectum and proximally

Decreased vascular pattern

Erythema, edema

Ulcerations, bleeding

Histopathology

- Chronic colitis, crypt abscesses

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Ulcerative Colitis: Treatment

Induction and maintenance

- Rectal mesalamine (proctitis)
- 5-aminosalicylic acid (mild colitis)
- Ozanimod and etrasimod
- Budesonide (mild colitis)
  - Never for maintenance
- Glucocorticoids (severe colitis or flare)
  - Never for maintenance

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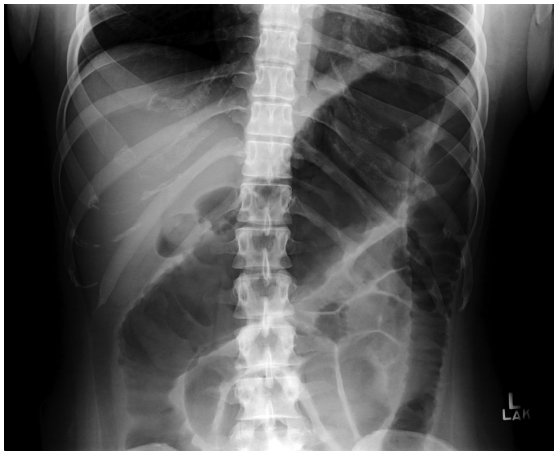
Ulcerative Colitis: Treatment

TNF-α inhibitors, vedolizumab, ustekinumab, mirikizumab, upadacitinib, and tofacitinib

- Screen for HBV and TB
- Risk for serious infections, lymphoma, CV events, thromboses, death

Surgery

- Megacolon
- Continuous bleeding
- Perforation
- Unresponsive to medical treatment



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Ulcerative Colitis: Follow-up

Colon cancer screening: colonoscopy

- Isolated proctitis: average-risk screening
- 8 years of colitis beyond the rectum: every 1 to 3 years
- PSC: at diagnosis, then yearly

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Gastroenterology Q13

A 51-year-old man reports 3 days of lower abdominal pain.

He is otherwise healthy.

There is tenderness in the left lower quadrant without guarding.

Contrast CT scan shows sigmoid diverticula with focal bowel wall thickening and inflammation of the pericolic fat.

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Gastroenterology Q13

A 51-year-old man reports 3 days of lower abdominal pain. He is otherwise healthy. There is tenderness in the left lower quadrant without guarding. Contrast CT scan shows sigmoid diverticula with focal bowel wall thickening and inflammation of the pericolic fat.

Which of the following is the most appropriate management?

A: Colonoscopy

B: Intravenous antibiotics

C: Surgical consultation

D: Observation

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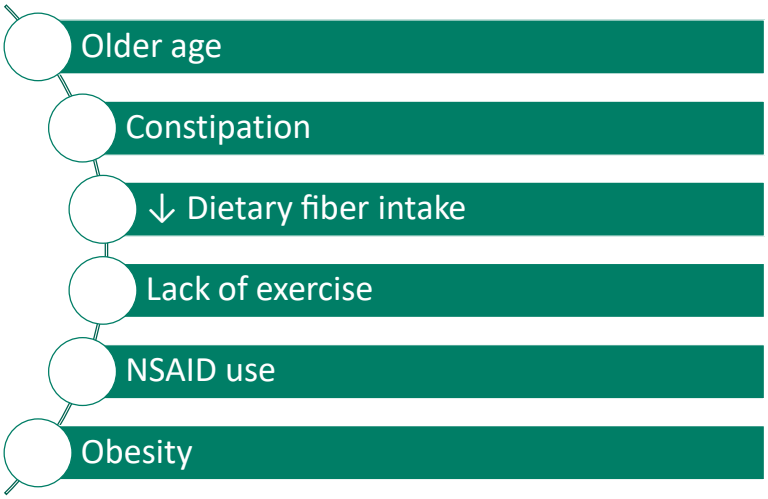
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Diverticular Disease

ACP

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Diverticular Disease: Risk Factors for Development/Progression



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Diverticular Disease: Diagnosis

Asymptomatic

Complications

- Diverticulitis
- Lower gastrointestinal bleeding, often with spontaneous resolution

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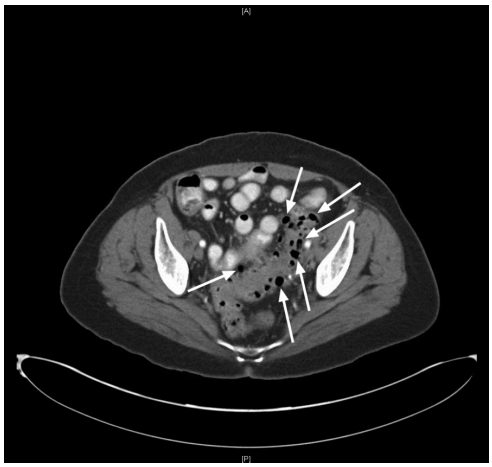
Diverticulitis: Diagnosis and Testing

Left lower quadrant pain, fever

↑ Leukocyte count, C-reactive protein level, procalcitonin level

CT: diagnostic, predicts complications

- Abscess
- Perforation
- Fistula
- Obstruction
- Stricture

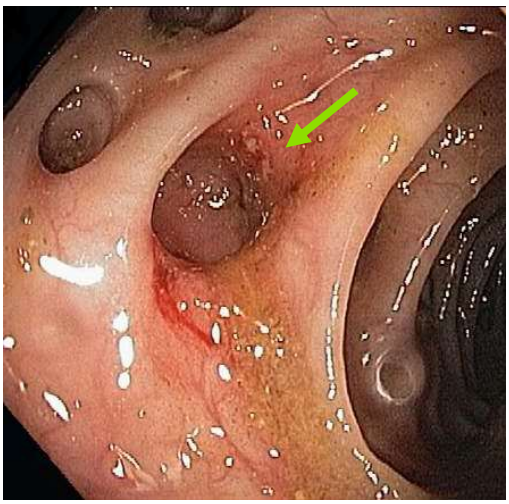


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Diverticulitis: Diagnosis and Testing



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Colonoscopy

- Avoid in acute setting (perforation risk)

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Diverticulitis: Treatment

Early uncomplicated diverticulitis (healthy patients)

- Observation (no antibiotics)
  - Can initially be treated without antibiotics and with close observation alone
- Amoxicillin-clavulanate
- Fluoroquinolone (or TMP-SMX) + metronidazole

Immunocompromised, septic, complicated (inpatients)

- Piperacillin-tazobactam
- Carbapenem
- Metronidazole + later-generation cephalosporin or fluoroquinolone

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Diverticulitis: Treatment and Follow-up

Surgery

- Medical treatment failure
- Complications
  - Abscess, fistula, obstruction, peritonitis, stricture
  - Percutaneous drainage of large abscess
- Recurrent disease

Colonoscopy

Prudent diet

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Gastroenterology Q14

A 58-year-old woman with nausea, vomiting, and fever has right lower quadrant (RLQ) pain to palpation but normal bowel sounds.

She is otherwise healthy.

Pelvic exam is unremarkable.

CBC shows leukocytosis; urinalysis is normal.

Ultrasound of the RLQ is negative for appendicitis.

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Gastroenterology Q14

A 58-year-old woman with nausea, vomiting, and fever has right lower quadrant (RLQ) pain to palpation but normal bowel sounds. She is otherwise healthy. Pelvic exam is unremarkable. CBC shows leukocytosis; urinalysis is normal. Ultrasound of the RLQ is negative for appendicitis.

Which of the following is the most appropriate next step in management?

A: Abdominal CT

B: Discharge with antibiotics

C: Laparoscopic appendectomy

D: Open appendectomy

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Acute Appendicitis

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Acute Appendicitis: Diagnosis

Abdominal pain

- Epigastrium/periumbilical
- Migrates to right lower quadrant

Fever, nausea, and vomiting

Tenderness/guarding

Complications

- Perforation
- Gangrene
- Phlegmon/abscess

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Acute Appendicitis: Testing

CT (with contrast) and ultrasonography: >90% specificity

- CT sensitivity (90%) > ultrasonography sensitivity (45%)

MRI for pregnant patients/young women

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Uncomplicated (Nonperforated) Appendicitis: Treatment

Antibiotics alone

- Low-risk young patients
- Short-term follow-up essential

Surgery

- Laparoscopic
- Early surgery (first 24 hours)

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Gastroenterology Q15

A 68-year-old man reports mid-epigastric postprandial abdominal pain and a 15-lb weight loss over the past 6 months.

He has a history of CAD. He smoked for 25 years but never used alcohol excessively.

Abdominal exam reveals a systolic bruit.

Fecal occult blood test result is negative.

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Gastroenterology Q15

A 68-year-old man reports mid-epigastric postprandial abdominal pain and a 15-lb weight loss over the past 6 months. He has a history of CAD. He smoked for 25 years but never used alcohol excessively. Abdominal exam reveals a systolic bruit. Fecal occult blood test result is negative.

Which of the following is the most likely diagnosis?

A: Chronic mesenteric ischemia

B: Chronic pancreatitis

C: Colon ischemia

D: Gastroparesis

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Mesenteric Ischemia

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Mesenteric Ischemia: Risk Factors

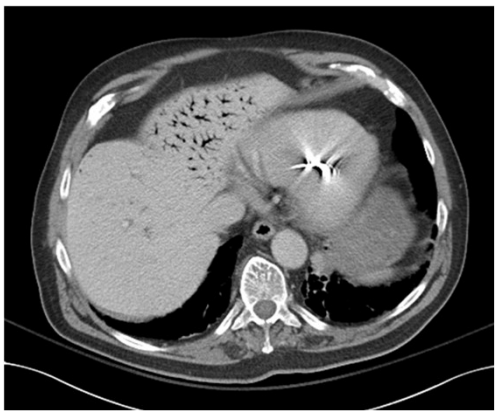
Acute mesenteric ischemia	Chronic mesenteric ischemia
• Atrial fibrillation • Significant atherosclerotic vascular disease • Low-flow states (sepsis, hypotension)	• Age >65 years • Atherosclerosis • History of aortic repair

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Acute Mesenteric Ischemia: Diagnosis and Testing

- Abrupt onset
- Poorly localized, constant severe abdominal pain
- Pain out of proportion to physical exam findings
- Leukocytosis
- Increased anion gap metabolic acidosis
- CT angiography



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Chronic Mesenteric Ischemia: Diagnosis and Testing

- Postprandial abdominal pain
- Weight loss
- Sitophobia (fear of eating)
- Duplex ultrasonography
- CT or MR angiography

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Gastroenterology Q16

A 72-year-old woman is evaluated for the acute onset of mild lower abdominal pain and bloody diarrhea 2 days ago.

Vital signs are normal.

Exam shows tenderness of the lower abdominal quadrants without guarding.

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Gastroenterology Q16

A 72-year-old woman is evaluated for the acute onset of mild lower abdominal pain and bloody diarrhea 2 days ago. Vital signs are normal. Exam shows tenderness of the lower abdominal quadrants without guarding.

Which of the following is the most appropriate diagnostic test?

A: Abdominal CT angiography

B: Abdominal CT with contrast

C: Barium enema

D: Double balloon enteroscopy

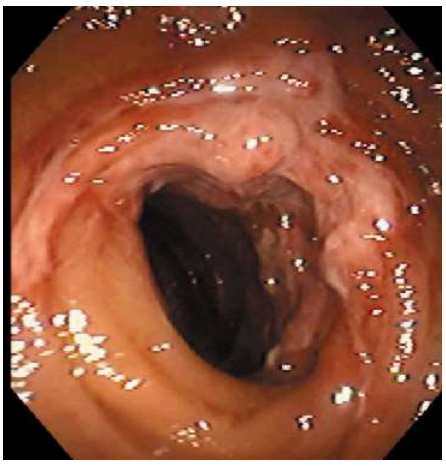
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Colon Ischemia

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Colon Ischemia: Risk Factors



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- Atherosclerosis
- Atrial fibrillation
- Low-flow states
- Drugs (immunomodulators, opioids, chemotherapy)
- Thrombophilia

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Colon Ischemia: Diagnosis

Crampy left lower quadrant pain

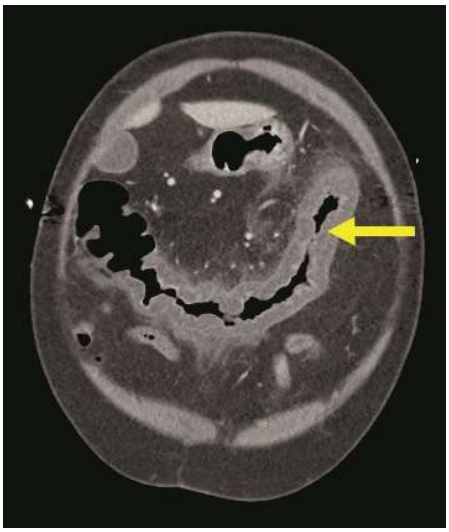
Urge to defecate

Self-limited hematochezia

No peritoneal signs

Right-sided colon ischemia

- Right lower quadrant pain
- Superior mesenteric artery involvement → risk for acute mesenteric ischemia



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Colon Ischemia: Treatment

Supportive care

Surgery reserved for

- Fulminant colitis
- Peritoneal signs
- Deteriorating clinical condition
- Failure of supportive therapy
- Development of chronic symptomatic stricture

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Gastroenterology II

- Answers to Multiple-Choice Questions

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Gastroenterology Q10

A 21-year-old woman is evaluated for diffuse abdominal pain on most days for the past 6 months. The pain is relieved with bowel movements that occur twice per week. Stool is lumpy. She has otherwise been well. Physical exam is normal.

Which of the following is the most likely diagnosis?

A: Celiac disease

B: Colon ischemia

C: Crohn disease

D: Irritable bowel syndrome

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Gastroenterology Q11

A 36-year-old woman is evaluated for a 3-month history of right lower quadrant pain and diarrhea. Stool is negative for *Clostridioides difficile* and enteropathogens. Colonoscopy shows superficial serpiginous ulcers and cobblestoning in the ileum and right colon; the remainder of the exam is normal. Histology shows nongranulomatous inflammation.

Which of the following is the most appropriate treatment?

A: Budesonide

B: Infliximab

C: Mesalamine

D: Metronidazole

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Gastroenterology Q12

A 26-year-old woman is hospitalized with a 1-week history of fever, tenesmus, abdominal pain, and 10 daily episodes of bloody diarrhea. She has ulcerative colitis. Stool culture and *C. difficile* assay are negative. She improves with intravenous glucocorticoid therapy.

Which of the following is the most appropriate treatment?

A: Adalimumab

B: Azathioprine

C: Budesonide

D: Mesalamine

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Gastroenterology Q13

A 51-year-old man reports 3 days of lower abdominal pain. He is otherwise healthy. There is tenderness in the left lower quadrant without guarding. Contrast CT scan shows sigmoid diverticula with focal bowel wall thickening and inflammation of the pericolic fat.

Which of the following is the most appropriate management?

A: Colonoscopy

B: Intravenous antibiotics

C: Surgical consultation

D: Observation

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Gastroenterology Q14

A 58-year-old woman with nausea, vomiting, and fever has right lower quadrant (RLQ) pain to palpation but normal bowel sounds. She is otherwise healthy. Pelvic exam is unremarkable. CBC shows leukocytosis; urinalysis is normal. Ultrasound of the RLQ is negative for appendicitis.

Which of the following is the most appropriate next step in management?

A: Abdominal CT

B: Discharge with antibiotics

C: Laparoscopic appendectomy

D: Open appendectomy

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Gastroenterology Q15

A 68-year-old man reports mid-epigastric postprandial abdominal pain and a 15-lb weight loss over the past 6 months. He has a history of CAD. He smoked for 25 years but never used alcohol excessively. Abdominal exam reveals a systolic bruit. Fecal occult blood test result is negative.

Which of the following is the most likely diagnosis?

A: Chronic mesenteric ischemia

B: Chronic pancreatitis

C: Colon ischemia

D: Gastroparesis

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Gastroenterology Q16

A 72-year-old woman is evaluated for the acute onset of mild lower abdominal pain and bloody diarrhea 2 days ago. Vital signs are normal. Exam shows tenderness of the lower abdominal quadrants without guarding.

Which of the following is the most appropriate diagnostic test?

A: Abdominal CT angiography

B: Abdominal CT with contrast

C: Barium enema

D: Double balloon enteroscopy

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Gastroenterology III

2024 Virtual/Live Internal Medicine Board Review

Dejan Micic, MD
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Associate Chief, Gastroenterology and Nutrition
Loyola University Medical Center
Maywood IL

ACP Internal Medicine Board Review Course

Gastroenterology III

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- Hemorrhoids and fissures

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Gastroenterology Q17

A 70-year-old man is screened for abdominal aortic aneurysm.

Abdominal ultrasound shows a normal-appearing liver and numerous gallstones that are <1 cm in size.

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Gastroenterology Q17

A 70-year-old man is screened for abdominal aortic aneurysm. Abdominal ultrasound shows a normal-appearing liver and numerous gallstones that are <1 cm in size.

Which of the following is the most appropriate management?

A: Abdominal CT

B: Laparoscopic cholecystectomy

C: Ursodeoxycholic acid

D: Observation

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Cholelithiasis

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Gallstones: Diagnosis

Typically asymptomatic

Biliary colic

- Postprandial pain
- Epigastric, right upper quadrant, right shoulder pain (4-6 hours)
- No peritoneal signs
- No fever/leukocytosis
- No or mild ↑ in aminotransferase levels

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Gallstones: Testing and Treatment

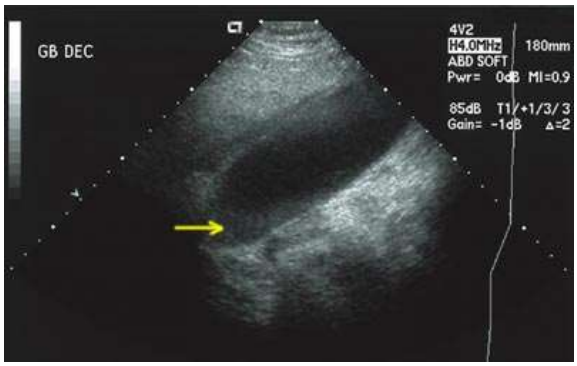
Ultrasonography or CT

Cholecystectomy

- Symptomatic patients
- Patients with high cancer risk
  - Gallstones >3 cm
  - Gallbladder adenomas/polyps >1 cm
  - Porcelain gallbladder

Serial ultrasonography

- Polyps <1 cm



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Gallstones: Complications

- Cholecystitis
- Choledocholithiasis
- Gallstone pancreatitis
- Gallbladder cancer (rare)

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Gastroenterology Q18

A 35-year-old woman has right upper quadrant (RUQ) abdominal pain of 6 hours' duration.

She has a fever and tachycardia.

Palpation of the RUQ causes inspiratory arrest.

Laboratory studies show leukocytosis, mild elevations in serum aminotransferase levels, and a normal bilirubin level.

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Gastroenterology Q18

A 35-year-old woman has RUQ abdominal pain of 6 hours' duration. She has a fever and tachycardia. Palpation of the RUQ causes inspiratory arrest. Laboratory studies show leukocytosis, mild elevations in serum aminotransferase levels, and a normal bilirubin level.

Which of the following is the most appropriate next diagnostic step?

A: Abdominal ultrasonography

B: CT of the abdomen and pelvis

C: Endoscopic retrograde cholangiopancreatography (ERCP)

D: Hepatobiliary iminodiacetic acid (HIDA) scan

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Cholecystitis

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Acute Cholecystitis: Diagnosis and Testing

- Severe RUQ/epigastric pain
- Anorexia, nausea, vomiting
- Fever
- (+) Murphy sign
- Leukocytosis
- Minimal ↑ in AST/ALT levels
- Normal bilirubin level

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Acute Cholecystitis: Testing

Ultrasonography is initial imaging test

- (+) Sonographic Murphy sign
- Pericholecystic fluid
- Thickened gallbladder wall

Nondiagnostic ultrasound

- Cholescintigraphy (HIDA scan)

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Acute Cholecystitis: Treatment

Pain control

Antibiotics

- β-Lactam/β-lactamase inhibitor
- Carbapenem
- Third-generation cephalosporin + metronidazole

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Acute Cholecystitis: Treatment

Emergent cholecystectomy for gallbladder perforation or emphysematous cholecystitis

Laparoscopic cholecystectomy (during initial hospitalization) for low-risk patients

Poor surgical candidates

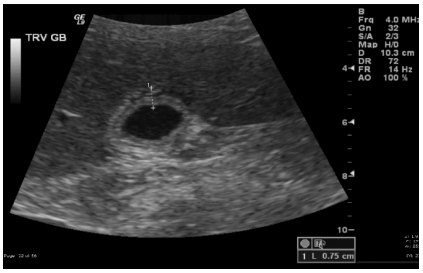
- Percutaneous cholecystostomy
- Endoscopic ultrasound (EUS)-guided gallbladder drainage
- ERCP transpapillary drainage

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Acute Acalculous Cholecystitis: Diagnosis and Testing





Occurs in critically ill patients

Classic biliary colic symptoms, fever

Ultrasonography shows:

- Absent gallstones
- Thickened gallbladder wall
- Pericholecystic fluid

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Acute Acalculous Cholecystitis: Treatment

Empiric IV antibiotics

Cholecystectomy

For critically ill patients:

- Percutaneous cholecystostomy
- EUS-guided transmural drainage
- ERCP transpapillary drainage

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Gastroenterology Q19

A 43-year-old woman has episodic RUQ abdominal pain and nausea.

Vital signs and abdominal exam are unremarkable.

Leukocyte count and amylase/lipase levels are normal; serum aminotransferase, alkaline phosphatase, and total bilirubin levels are elevated.

Ultrasound shows a dilated common bile duct, gallstones, and no gallbladder wall thickening or pericholecystic fluid.

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Gastroenterology Q19

A 43-year-old woman has episodic RUQ abdominal pain and nausea. Vital signs and abdominal exam are unremarkable. Leukocyte count and amylase/lipase levels are normal; alkaline phosphatase and total bilirubin levels are elevated. Ultrasound shows a dilated common bile duct, gallstones, and no gallbladder wall thickening or pericholecystic fluid.

Which of the following is the most likely diagnosis?

A: Cholangitis

B: Cholecystitis

C: Choledocholithiasis

D: Pancreatitis

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Choledocholithiasis



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Choledocholithiasis: Diagnosis

Common bile duct gallstone

<50% symptomatic

Symptoms and signs

- Nausea/vomiting
- RUQ/epigastric abdominal pain
- Jaundice
- Pruritus

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Choledocholithiasis: Testing and Treatment

CT, ultrasonography, or MRCP

- Intrahepatic/extrahepatic bile duct dilation

ERCP relieves obstruction



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Acute Cholangitis: Diagnosis

Complication of choledocholithiasis

Bile duct bacterial infection

- *Escherichia coli*, *Klebsiella*, *Enterobacter*, *Enterococcus*, anaerobes

Diagnostic Charcot triad

- RUQ pain, fever, jaundice
- ± Shock and mental status changes

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Acute Cholangitis: Diagnosis

Bilirubin: elevated conjugated bilirubin level

AST/ALT levels can be elevated up to 1000 U/L

Diagnostic imaging (biliary dilation) → stone, stricture

- Ultrasonography
- CT
- MRCP
- EUS

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Acute Cholangitis: Treatment

Broad-spectrum antibiotics

- β-Lactam or β-lactamase
- Third-generation cephalosporin + metronidazole

Urgent ERCP

- Stone extraction/drainage

Elective cholecystectomy

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Gastroenterology Q20

A 54-year-old woman is evaluated for a 24-hour history of severe epigastric abdominal pain radiating to her back.

She has a fever and tachycardia.

The abdomen is distended, and epigastric tenderness to palpation is present.

Serum amylase level is 34,000 U/L.

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Gastroenterology Q20

A 54-year-old woman is evaluated for a 24-hour history of severe epigastric abdominal pain radiating to her back. She has a fever and tachycardia. The abdomen is distended, and epigastric tenderness to palpation is present. Serum amylase level is 34,000 U/L.

Which of the following is the best predictor of severe disease in this patient?

A: Amylase level

B: Blood urea nitrogen

C: Leukocyte count

D: Peripancreatic edema on CT scan

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Acute Pancreatitis

ACP

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Acute Pancreatitis: Diagnosis

Most common causes

- Gallstones
- Alcohol use

Other causes

- Hypertriglyceridemia (>1000 mg/dL)
- Post-ERCP
- Drugs, toxins
- Hypercalcemia
- Abdominal trauma
- Cystic fibrosis/genetic disorders (young persons)
- Autoimmune IgG-4 (rare)
- Malignancy
- Infection
- Idiopathic

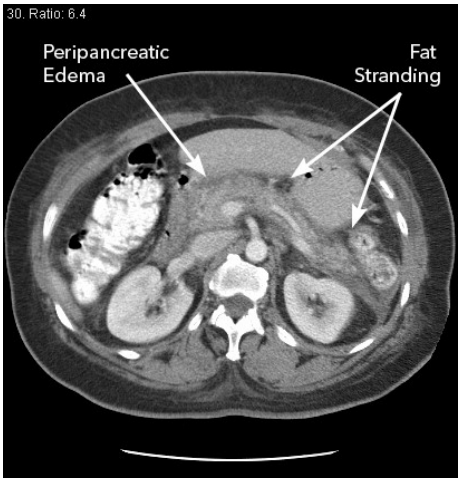
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Acute Pancreatitis: Diagnosis and Testing

Two of the following three:

- Epigastric pain ± radiation to the back
- Serum amylase/lipase levels ↑ 3 x upper limit of normal
- Characteristic imaging
  - Peripancreatic edema
  - Fat stranding around pancreas



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Acute Pancreatitis: Testing

Biliary ultrasonography in all patients

CT may be indicated with the following:

- Diagnostic uncertainty
- Severe pain >48 hours
- Suspected complications

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Acute Pancreatitis: Treatment

Early, moderate hydration (IV lactated Ringer solution) within 24 hours

- Monitor for fluid overload

Pain management

Antinausea medication

Early oral feeding (within 24 hours)

Enteral jejunal feedings if not oral

ERCP/stone removal for biliary obstruction/cholangitis

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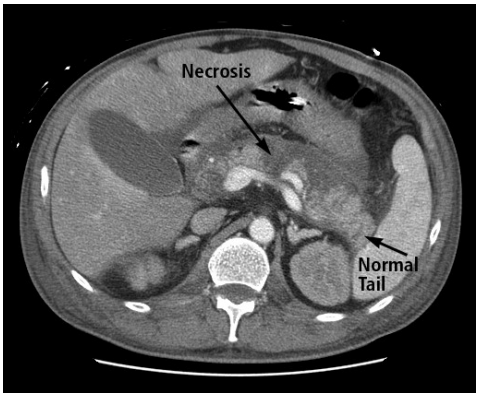
Acute Pancreatitis: Treatment

Antibiotic use: not routine

- Cholangitis
- Infected pancreatic necrosis
- Infected pseudocysts

Surgery or endoscopic indications

- Cholelithiasis (before discharge)
- Infected pancreatic necrosis, pancreatic abscess
- Infected pancreatic pseudocyst
- Symptomatic persistent pseudocyst



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Gastroenterology Q21

A 53-year-old woman is evaluated for kidney stones.

Physical exam is normal.

Abdominal ultrasound shows diffuse thickening of the gallbladder wall.

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Gastroenterology Q21

A 53-year-old woman is evaluated for kidney stones. Physical exam is normal. Abdominal ultrasound shows diffuse thickening of the gallbladder wall.

Which of the following is the most appropriate next step in management?

A: MRI and MRCP

B: Repeat ultrasonography in 6 months

C: Serum CEA level measurement

D: Ursodeoxycholic acid

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Gallbladder Cancer

ACP

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Gallbladder Cancer: Diagnosis

Most cases found incidentally

- Ultrasonography
- Cholecystectomy

Symptoms

- Biliary colic
- Nausea/vomiting
- RUQ pain
- Weight loss
- Jaundice

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Gallbladder Cancer: Testing and Treatment

High-risk findings

- Polyp >1 cm
- Polyp + sclerosing cholangitis
- Polyp + biliary colic
- Polyp + gallstones
- Porcelain gallbladder

MRI/MRCP or CT of abdomen/pelvis for high-risk findings

Treatment: cholecystectomy

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Upper Gastrointestinal Bleeding

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Upper Gastrointestinal Bleeding: Diagnosis

- Hematemesis
- "Coffee-ground" emesis
- Melena
- Hematochezia

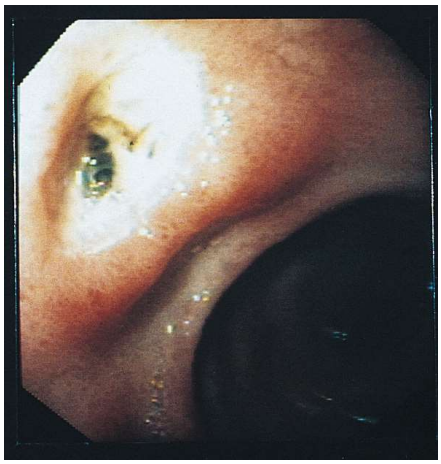
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Upper Gastrointestinal Bleeding: Common Causes

Peptic ulcer disease

- Most common
- *Helicobacter pylori* or NSAIDs



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Upper Gastrointestinal Bleeding: Common Causes

Gastroesophageal varices

Thrombocytopenia

- Stigmata of liver disease
  - Jaundice, spider angiomata, palmar erythema
  - Asterixis
  - Gynecomastia
  - Ascites, splenomegaly
  - Clubbing



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Upper Gastrointestinal Bleeding: Common Causes



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Mallory-Weiss tear

- Repeated emesis/retching before hematemesis
- Heavy ethanol use
- Bulimia

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Upper Gastrointestinal Bleeding: Treatment

Secure IV access (two sites)

Volume replacement with IV crystalloid solution

Erythrocyte transfusion

- Hemodynamically unstable: before hemoglobin level <7 g/dL
- Hemodynamically stable
  - Threshold: hemoglobin level <7.0 g/dL for most patients
  - Higher threshold for patients with cardiovascular disease
  - Transfusion target: 7 to 9 g/dL

Platelet transfusion threshold: <50,000/µL

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Upper Gastrointestinal Bleeding: Testing and Treatment

Start IV PPI

Upper endoscopy within first 24 hours (12 hours if variceal bleed suspected)

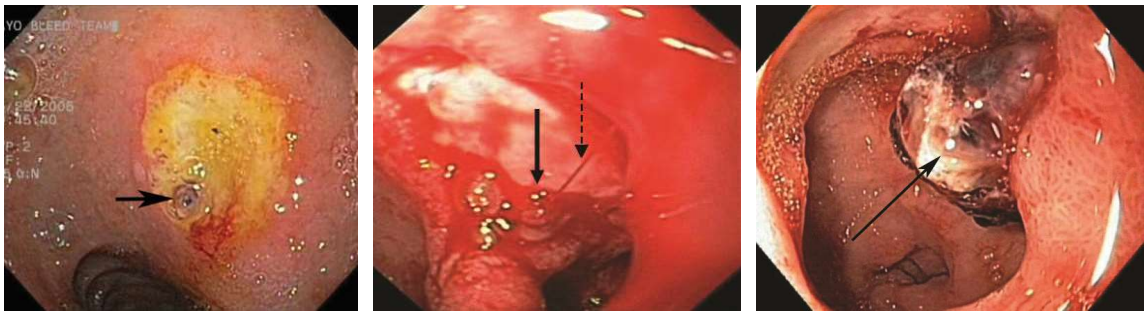
Bleeding vessel, visible vessels, adherent clots

- Endoscopic coagulation/treatment
- Test for *Helicobacter pylori*
- Continue high-dose PPI for 72 hours

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Upper Gastrointestinal Bleeding: Testing and Treatment



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Upper Gastrointestinal Bleeding: Treatment

Bleeding varices

- Octreotide
- Endoscopic band ligation
- Prophylactic antibiotics for patients with cirrhosis
  - Ceftriaxone or quinolone
  - Continue for 7 days
- Nonselective β-blocker therapy indefinitely after hemostasis



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Upper Gastrointestinal Bleeding: Treatment

Stop warfarin

- Low thrombotic risk: restart in 7 days
- High thrombotic risk: balance benefit and risk

Stop direct oral anticoagulants (DOACs)

- Resumption depends on risk profile, typically within 7 days

Reversal of warfarin and DOACs

- Only if supratherapeutic, significant bleeding, or blood transfusion undesirable
- Correction of INR with FFP not recommended for patients with cirrhosis

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Upper Gastrointestinal Bleeding: Treatment

Aspirin

- Discontinue permanently for primary cardiovascular prophylaxis
- Continue or hold temporarily for secondary cardiovascular prophylaxis
  - Restart when hemostasis is achieved

Stop NSAID

- Selective COX-2 inhibitor + PPI if cannot be stopped

Treat *H. pylori*

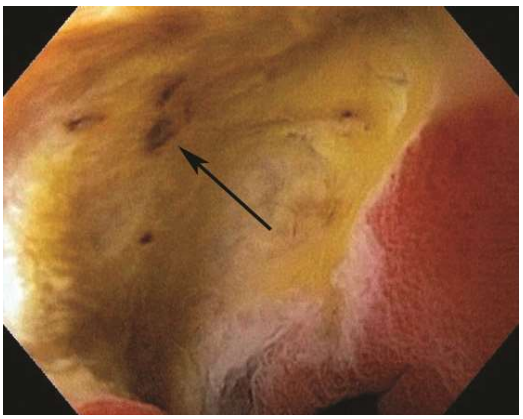
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Upper Gastrointestinal Bleeding: Treatment

Discharge stable patients with low-risk lesions

- Clean-based ulcers, pigmented spot
- Restart diet
- Oral PPI
- 12 hours of observation



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Lower Gastrointestinal Bleeding

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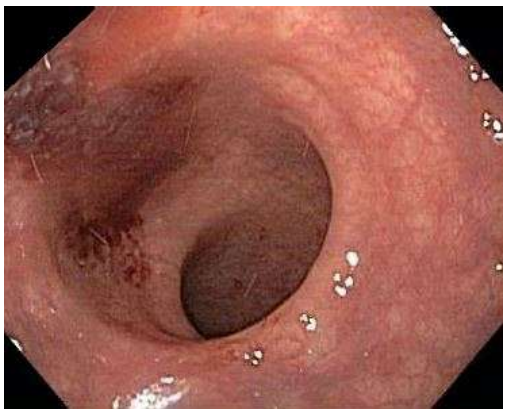
Lower Gastrointestinal Bleeding: Diagnosis

Hematochezia

- Maroon or bright red blood per rectum
- Usual presentation of LGIB

Melena

- Bleeding from cecum or right colon



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Lower Gastrointestinal Bleeding: Common Causes

Causes	Comments
Diverticular bleeding	Arterial, painless Spontaneous resolution common
Internal hemorrhoids	Second most common cause
Colonic angiodysplasia	Arterial, painless Source of chronic recurrent bleeding
Postpolypectomy bleeding	Can be immediate or weeks later
Colon ischemia	Mild to moderate abdominal pain over involved bowel Spontaneous resolution common
Inflammatory bowel disease	Bloody diarrhea, tenesmus, abdominal pain, fever

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Lower Gastrointestinal Bleeding: Testing

Hemodynamically stable

- Nonurgent colonoscopy recommended for most hospitalized with LGIB
- Urgent colonoscopy (<24 hours) does not improve major outcomes
  - Potential exceptions: positive CTA, postpolypectomy bleed

Hemodynamically unstable

- CTA
- Upper endoscopy: first choice if risk factors for UGIB
- If source of bleeding remains unidentified, perform angiography

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Lower Gastrointestinal Bleeding: Treatment

Resuscitation principles same as for UGIB

Most episodes resolve spontaneously

Hemodynamically stable patients

- Endoscopic therapy

Hemodynamically unstable patients, endoscopic failure

- Embolization of bleeding vessel

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Small Bowel Bleeding

Accounts for ~5% of all GI bleeding

Undiagnosed recurrent bleeding despite upper/lower endoscopy

Angiectasia, mass lesions, Meckel diverticulum

Repeat upper endoscopy

- First step
- Diagnostic in 25%-40% of cases

Wireless capsule endoscopy

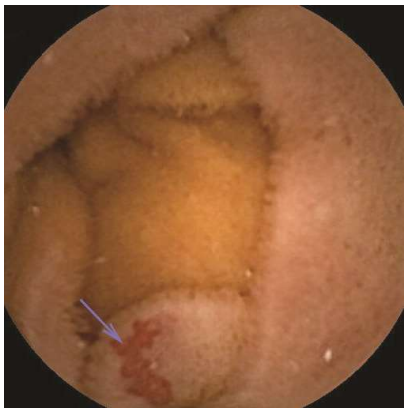
- Second step

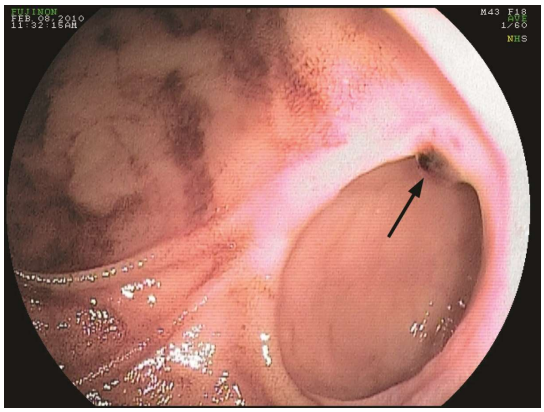
Meckel scan or lower enteroscopy for young patients

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Small-Bowel Bleeding





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Gastroenterology Q22

A 25-year-old woman reports rectal pain and hematochezia that worsens after bowel movements.

She has chronic constipation.

Anorectal exam reveals a posterior anal fissure but no active bleeding.

Despite sitz baths, topical hydrocortisone, and fiber supplementation, her symptoms have not resolved.

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Gastroenterology Q22

A 25-year-old woman reports rectal pain and hematochezia that worsens after bowel movements. She has chronic constipation. Anorectal exam reveals a posterior anal fissure but no active bleeding. Despite sitz baths, topical hydrocortisone, and fiber supplementation, her symptoms have not resolved.

Which of the following is the most appropriate management?

A: Colonoscopy

B: Internal sphincter botulinum toxin injection

C: Sphincterotomy

D: Topical diltiazem

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Hemorrhoids and Fissures



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Anal Fissures: Diagnosis and Testing

Painful anus ± bleeding

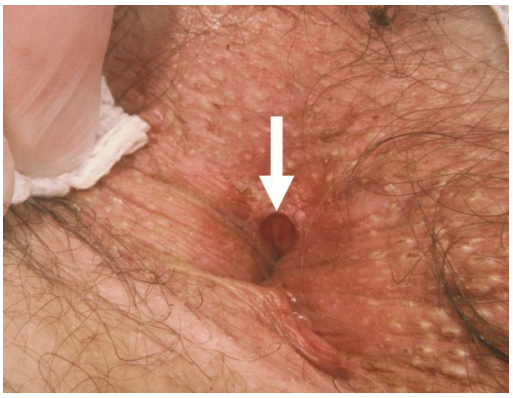
Worse with bowel movements/sitting

Precipitants

- Constipation, diarrhea
- Receptive anal intercourse
- Foreign body insertion

Anoscopy

- Mucosal tear, posterior midline



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Anal Fissures: Treatment

Acute fissures (<8 weeks) heal spontaneously

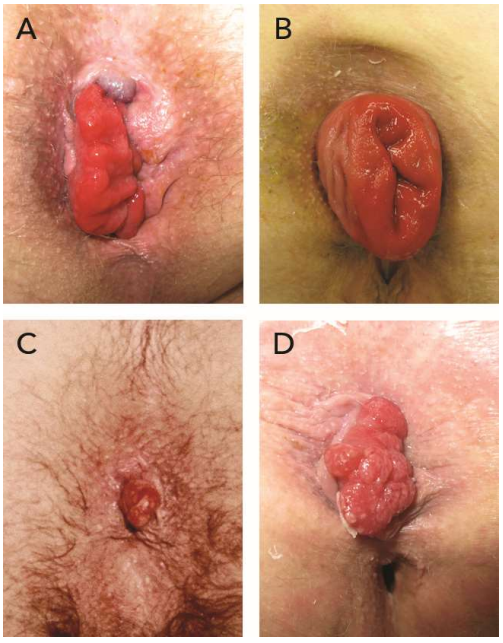
- Adequate fluids, dietary fiber, psyllium
- Sitz baths
- Topical anesthetics, anti-inflammatory agents
- Topical diltiazem
- Topical nitroglycerin can cause headaches

Chronic fissures

- Internal sphincter botulinum toxin injection
- Lateral internal sphincterotomy

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Hemorrhoids: Diagnosis and Treatment

- Painless bleeding or painful thrombosis
- ↑ Fluid and fiber intake
- Stool softener
- Sitz baths
- Topical anesthetics
- Topical glucocorticoids
- Hemorrhoid banding

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Gastroenterology III

- Answers to Multiple-Choice Questions

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Gastroenterology Q17

A 70-year-old man is screened for abdominal aortic aneurysm. Abdominal ultrasound shows a normal-appearing liver and numerous gallstones that are <1 cm in size.

Which of the following is the most appropriate management?

A: Abdominal CT

B: Laparoscopic cholecystectomy

C: Ursodeoxycholic acid

D: Observation

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Gastroenterology Q18

A 35-year-old woman has RUQ abdominal pain of 6 hours' duration. She has a fever and tachycardia. Palpation of the RUQ causes inspiratory arrest. Laboratory studies show leukocytosis, mild elevations in serum aminotransferase levels, and a normal bilirubin level.

Which of the following is the most appropriate next diagnostic step?

A: Abdominal ultrasonography

B: CT of the abdomen and pelvis

C: Endoscopic retrograde cholangiopancreatography (ERCP)

D: Hepatobiliary iminodiacetic acid (HIDA) scan

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Gastroenterology Q19

A 43-year-old woman has episodic RUQ abdominal pain and nausea. Vital signs and abdominal exam are unremarkable. Leukocyte count and amylase/lipase levels are normal; alkaline phosphatase and total bilirubin levels are elevated. Ultrasound shows a dilated common bile duct, gallstones, and no gallbladder wall thickening or pericholecystic fluid.

Which of the following is the most likely diagnosis?

A: Cholangitis

B: Cholecystitis

C: Choledocholithiasis

D: Pancreatitis

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Gastroenterology Q20

A 54-year-old woman is evaluated for a 24-hour history of severe epigastric abdominal pain radiating to her back. She has a fever and tachycardia. The abdomen is distended, and epigastric tenderness to palpation is present. Serum amylase level is 34,000 U/L.

Which of the following is the best predictor of severe disease in this patient?

A: Amylase level

B: Blood urea nitrogen

C: Leukocyte count

D: Peripancreatic edema on CT scan

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Gastroenterology Q21

A 53-year-old woman is evaluated for kidney stones. Physical exam is normal. Abdominal ultrasound shows diffuse thickening of the gallbladder wall.

Which of the following is the most appropriate next step in management?

A: MRI and MRCP

B: Repeat ultrasonography in 6 months

C: Serum CEA level measurement

D: Ursodeoxycholic acid

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Gastroenterology Q22

A 25-year-old woman reports rectal pain and hematochezia that worsens after bowel movements. She has chronic constipation. Anorectal exam reveals a posterior anal fissure but no active bleeding. Despite sitz baths, topical hydrocortisone, and fiber supplementation, her symptoms have not resolved.

Which of the following is the most appropriate management?

A: Colonoscopy

B: Internal sphincter botulinum toxin injection

C: Sphincterotomy

D: Topical diltiazem

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Gastroenterology IV

2025 Virtual/Live Internal Medicine Board Review

Dejan Micic, MD
Associate Professor of Medicine
Associate Chief, Gastroenterology and Nutrition
Loyola University Medical Center
Maywood IL

ACP Internal Medicine Board Review Course

Gastroenterology IV

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- Steatotic liver disease and metabolic dysfunction–associated steatohepatitis
- Viral hepatitis
- Alcoholic hepatitis
- Cirrhosis and portal hypertension
- Acute liver failure

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Gastroenterology Q23

A 25-year-old woman is evaluated for mildly elevated liver enzymes. She is asymptomatic.

Medical history is significant for obesity.

Results of complete metabolic profile, hepatitis serology, iron studies, antinuclear antibodies, and anti–smooth muscle antibodies are normal.

She does not consume alcohol or use illicit drugs, medications, or supplements.

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Gastroenterology Q23

A 25-year-old woman is evaluated for mildly elevated liver enzymes. She is asymptomatic. Medical history is significant for obesity. Results of complete metabolic profile, hepatitis serology, iron studies, antinuclear antibodies, and anti–smooth muscle antibodies are normal. She does not consume alcohol or take illicit drugs, medications, or supplements.

Which of the following is the most appropriate diagnostic test to perform next?

A: Abdominal ultrasonography

B: Liver biopsy

C: Magnetic resonance elastography

D: Transient elastography

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Metabolic Dysfunction–Associated Steatotic Liver Disease (MASLD) and Metabolic Dysfunction–Associated Steatohepatitis (MASH)

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MASLD and MASH: Epidemiology

MASLD

- Most common cause of liver disease
- Associated with the following:
  - Insulin resistance
  - Obesity
  - Hypertriglyceridemia
  - Type 2 diabetes mellitus
  - Chronic kidney disease

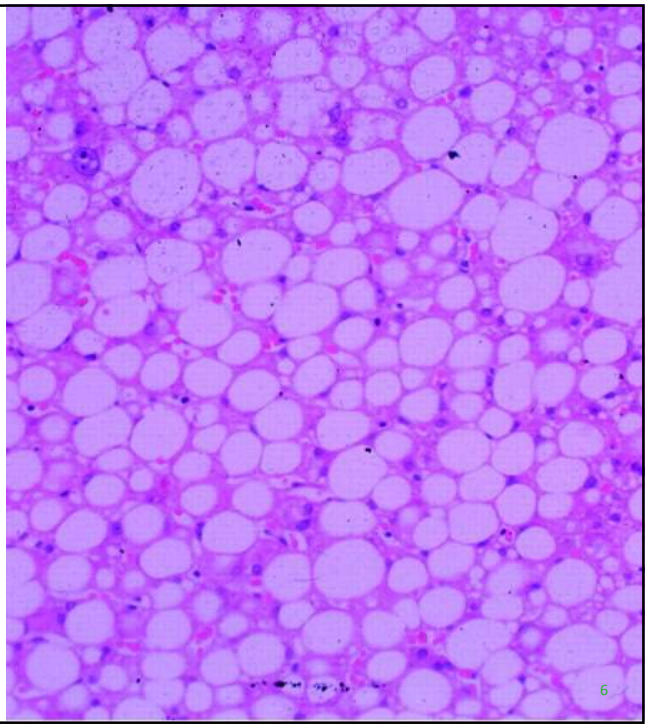


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MASLD and MASH: Epidemiology

Twenty percent of patients with MASLD have MASH

- Hepatic steatosis associated with hepatic inflammation and necroinflammatory changes
- ± Fibrosis
- May progress to cirrhosis and hepatocellular carcinoma (HCC)

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MASLD and MASH: Diagnosis and Testing

Nonspecific symptoms

- Fatigue, RUQ pain

MASH presumptive diagnosis

- ↑ in ALT and AST levels
- Risk factors for MASLD
- Alternative causes excluded
- Hyperechoic pattern on ultrasound
- Low-density parenchyma on CT scan

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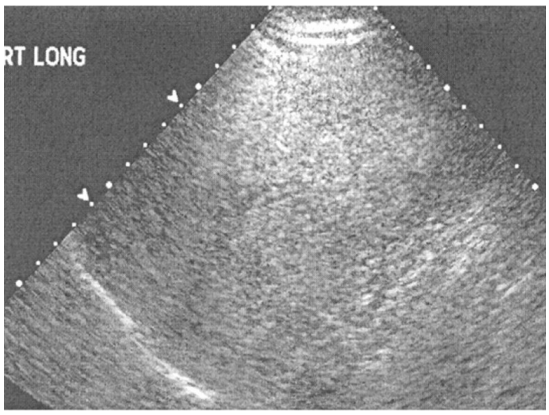
MASLD and MASH: Diagnosis and Testing

Noninvasive testing

- Fibrosis Score, FIB-4 score
- Transient elastography

Liver biopsy not necessary in most

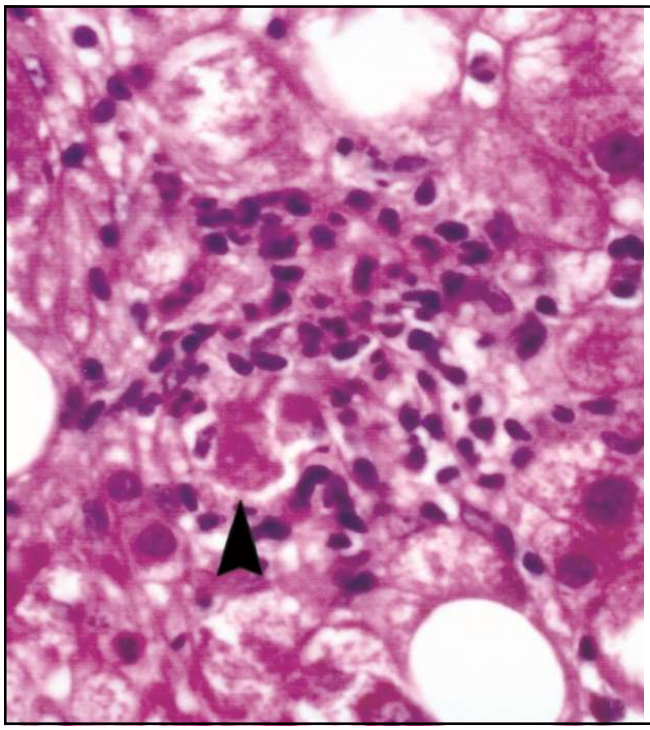
- Lobular inflammation
- Hepatocyte ballooning and Mallory bodies



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MASLD and MASH: Complications

Fibrosis

Cirrhosis

HCC

- Ultrasonography screening every 3 years
- Ultrasonography screening every 6 months if advanced cirrhosis/fibrosis

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MASLD and MASH: Treatment

Restrict alcohol intake

Regular physical activity (aerobic and anaerobic)

Weight loss

- Calorie-restricted diet/Mediterranean diet
- Bariatric surgery

Diabetes control

Lipid control

- Can use statins despite ↑ ALT/AST levels
- Cardiovascular disease is leading cause of death

Resmetirom: FDA approved to treat MASH and moderate to advanced liver fibrosis

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Gastroenterology Q24

A 19-year-old woman is evaluated during a routine appointment.

She was born in the United States, is healthy, and has no risk factors for hepatitis.

Physical exam is normal.

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Gastroenterology Q24

A 19-year-old woman is evaluated during a routine appointment. She was born in the United States, is healthy, and has no risk factors for hepatitis. Physical exam is normal.

Which of the following is the most appropriate hepatitis screening strategy?

A: Hepatitis B screening

B: Hepatitis B and C screening

C: Hepatitis C screening

D: No screening

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Viral Hepatitis

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Hepatitis A: Diagnosis and Testing

Transmitted by fecal-oral route

Acute onset

Malaise, fatigue, nausea, vomiting, jaundice

AST/ALT levels >1000 U/L

(+) Anti-hepatitis A virus IgM

Testing indications

- Unexplained acute hepatitis or acute liver failure

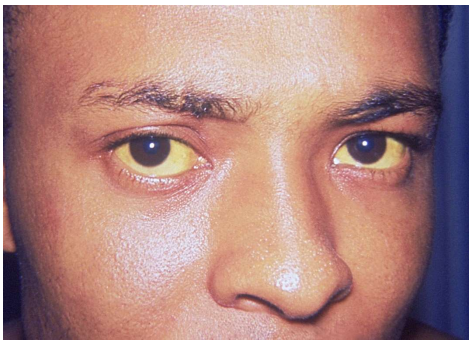
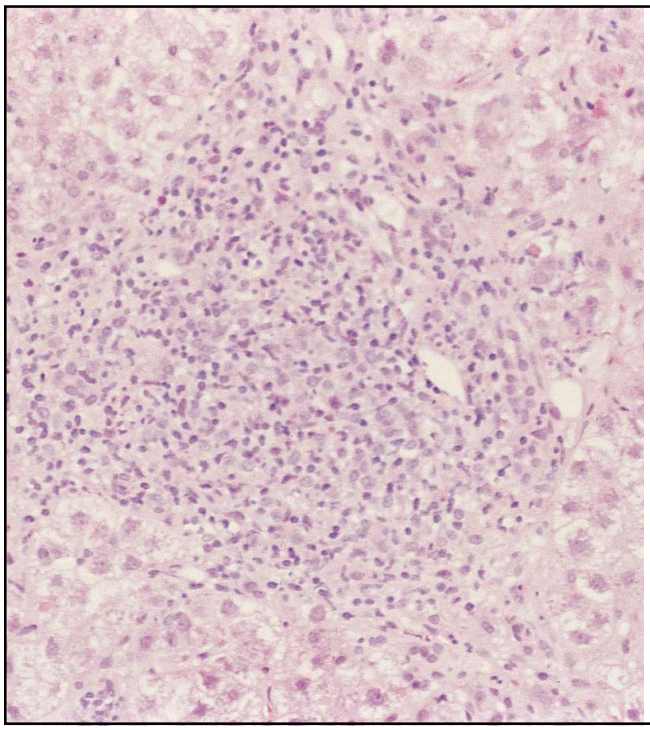


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Acute Hepatitis B: Diagnosis and Testing

Transmission

- Injection drug use
- Sexual contact
- Perinatal transmission

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Acute Hepatitis B: Diagnosis and Testing

USPSTF HBV screening recommendations (2020)	CDC HBV screening recommendations (2023)

• Persons born in countries with HBV infection prevalence >2%
• IV drug use
• Men who have sex with men
• HIV infection
• Contact with HBsAg-positive persons
  • Sex partners
  • Needle sharing
  • Household contacts
	• All adults aged ≥18 years at least once in their lifetime (triple panel test)
	• Pregnant people (during each pregnancy)
	• Persons with risk factors (periodically)
	• Anyone who requests HBV testing

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Acute Hepatitis B: Diagnosis and Testing

Acute HBV infection symptoms

- Similar to HAV infection symptoms

Anicteric/subclinical infection

- Unexplained ↑ in AST/ALT levels

Acute liver failure

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Interpretation of Screening Serology Tests for HBV Infection

Interpretation	HBsAg	Anti-HBs	Anti-HBc	HBeAg	Anti-HBe
Immunized	–	+	–	–	–
Acute infection	+	–	+ IgM	+	–
Resolved infection	–	+	+ IgG	–	±
Inactive chronic infection	+	–	+ IgG	–	+
Immune active chronic infection	+	–	+ IgG	+	–

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Hepatitis C: Screening

Transmission

- IV or intranasal drug use
- Blood transfusions before 1992
- Sexual contact

Universal one-time screening for persons aged 18-79 years

Periodic screening for patients with continued risk factors

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Hepatitis C: Diagnosis

Acute infection is asymptomatic in most

Consider hepatitis C diagnosis

- Chronic liver disease/cirrhosis
- Vasculitis
- Cryoglobulinemia
- Glomerulonephritis
- Porphyria cutanea tarda
- Immune thrombocytopenic purpura (ITP)





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Hepatitis C: Testing

Enzyme immunoassay for anti-HCV antibody

- Confirmed by PCR for viral RNA

Test for comorbidities

- HIV
- Hepatitis B

Ultrasonography to screen for cirrhosis

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Gastroenterology Q25

A 50-year-old man reports 2 weeks of jaundice.

He drinks 10 beers daily. He has no other risk factors for liver disease.

Temperature is 100.2 °F.

Tender hepatomegaly is noted.

AST level is 124 U/L, and ALT level is 57 U/L. Urinalysis is normal, and blood cultures are negative.

Model for End-Stage Liver Disease (MELD) score is >20.

Chest radiograph is clear, and ultrasound shows no ascites.

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Gastroenterology Q25

A 50-year-old man reports 2 weeks of jaundice. He drinks 10 beers daily. He has no other risk factors for liver disease. Temperature is 100.2 °F. Tender hepatomegaly is noted. AST level is 124 U/L, and ALT level is 57 U/L. Urinalysis is normal, and blood cultures are negative. MELD score is >20. Chest radiograph is clear, and ultrasound shows no ascites.

Which of the following is the most appropriate treatment?

A: Deferoxamine

B: Pentoxifylline

C: Prednisolone

D: Rifaximin

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Alcoholic Hepatitis

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Alcoholic Hepatitis: Diagnosis

- Chronic heavy alcohol use
- Jaundice
- Fever
- Tender hepatomegaly
- Ascites (portal hypertension)

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Alcoholic Hepatitis: Testing

AST and ALT levels <400 U/L

AST:ALT ratio >2

Serum total bilirubin level >3.0 mg/dL

Ultrasonography or CT

- Steatosis
- Cirrhosis/portal hypertension

Clinical diagnosis

- Routine liver biopsy not recommended

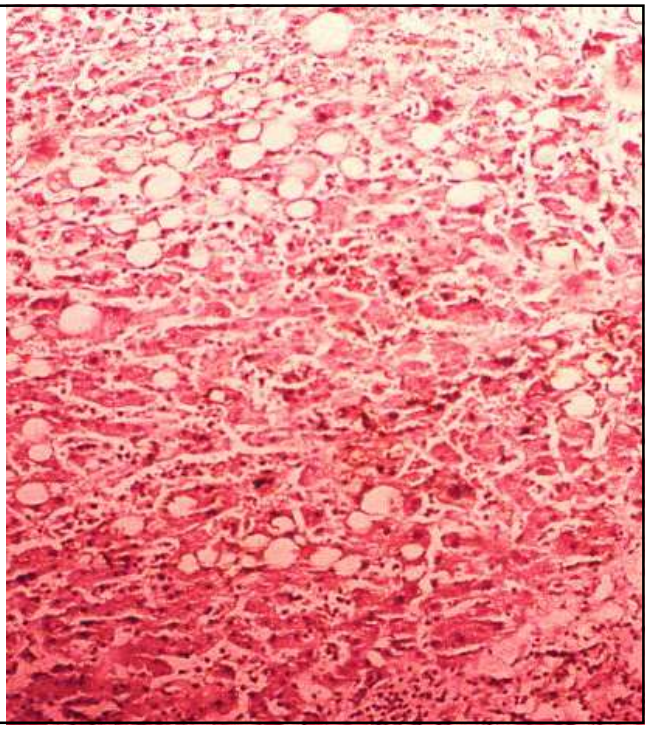


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Alcoholic Hepatitis: Risk Assessment and Treatment

Alcoholic hepatitis severity scoring tools

- MDF score
- MELD score (better)

Prednisolone for patients with MELD score ≥20 (only after infection has been excluded)

- Lille score
  - Calculated at day 4 or 7

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Alcoholic Hepatitis: Treatment

Prednisolone contraindications

- Infection (SBP, bacteremia, UTI)
- GI bleeding
- Pancreatitis, kidney disease
- Multiorgan failure

Prednisolone treatment failure

- Liver transplantation
  - No "6-month rule"
- Palliative care

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Alcoholic Hepatitis: Treatment

Supportive care for less severe disease

- MELD score <20, no evidence of hepatic decompensation
- Abstinence from alcohol
- Nutrition

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Gastroenterology Q26

A 48-year-old man has a history of alcohol use disorder.

He has no history of encephalopathy, GI bleeding, or ascites.

Evaluation reveals splenomegaly and platelet count of 85,000/µL.

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Gastroenterology Q26

A 48-year-old man has a history of alcohol use disorder. He has no history of encephalopathy, GI bleeding, or ascites. Evaluation reveals splenomegaly and platelet count of 85,000/µL.

Which of the following is the most appropriate management?

A: Nadolol

B: Surgical portocaval shunting

C: TIPS

D: Upper endoscopy

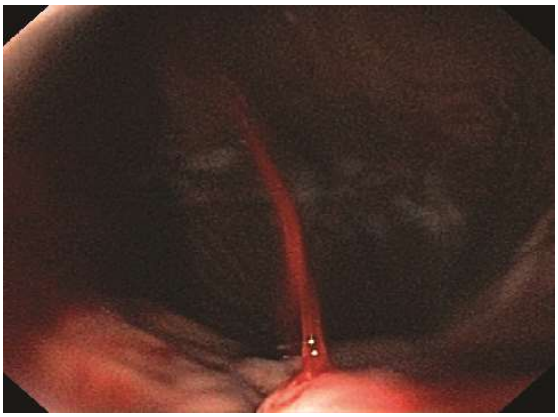
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Cirrhosis and Portal Hypertension

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Cirrhosis: Diagnosis



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Compensated

- No complications
- Asymptomatic

Decompensated

- Ascites
- Hepatic encephalopathy
- Variceal hemorrhage
- Spontaneous bacterial peritonitis
- Hepatorenal syndrome

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Cirrhosis: Testing

Noninvasive assessment

- Imaging (US, CT, MRI)
- Biochemical markers
  - Platelet count <150,000/µL
  - AST level > ALT level
  - Scoring systems (FIB-4, APRI, NFS)
  - Serum biomarker tests
- Elastography
  - Transient elastography
  - MR elastography
  - US elastography

Liver biopsy

- Gold standard
- Invasive



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Cirrhosis: Testing

Screening for esophageal varices (upper endoscopy)

- New cirrhosis diagnosis
- Platelet count <150,000/µL and elastography >20 kPa

Ascites assessment

- Ultrasonography
- New ascites → diagnostic paracentesis
  - Cell count
  - Culture
  - Cytology
  - Albumin
  - Total protein

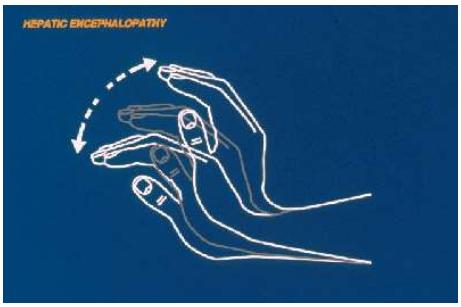
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Cirrhosis: Testing

Hepatic encephalopathy assessment

- Precipitants
  - Infection
  - Medications (narcotics, benzodiazepines)
  - Volume depletion
  - GI bleeding
- Asterixis
- Personality changes
- Somnolence → obtundation → coma
- Grading: West Haven criteria



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Cirrhosis: Testing

Spontaneous bacterial peritonitis assessment

- Any change in clinical status
- Patients requiring frequent paracentesis
- Diagnosis: paracentesis → absolute PMN count ≥250 cells/µL

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Spontaneous Bacterial Peritonitis: Diagnosis

- Decompensated cirrhosis and ascites
- General clinical decline
- Fever
- Abdominal pain
- Confusion
- Diarrhea
- Tenderness to palpation
- May be asymptomatic



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Spontaneous Bacterial Peritonitis: Testing

- ↓ Liver and kidney function
- Leukocytosis
- Ascitic absolute PMN count >250 cells/µL on paracentesis
- Culture of ascitic fluid is often negative (50%)

Ascitic Fluid Protein	SAAG ≥1.1	SAAG <1.1
<2.5 g/dL	Cirrhosis	Nephrotic syndrome
>2.5 g/dL	Right-sided heart failure, Budd-Chiari syndrome	Malignancy, tuberculosis

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Spontaneous Bacterial Peritonitis: Treatment

Third-generation cephalosporin for 5 days

- Directed therapy per culture result
- Extended prophylaxis with fluoroquinolone or TMP-SMX

Albumin

- Decreases risk for kidney dysfunction
- 1.5 g/kg on day 1 and 1.0 g/kg on day 3

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Cirrhosis: Treatment and Prevention of Cirrhosis Complications

Indication	Treatment
Variceal bleeding prevention	Nonselective β-blocker (first choice) Endoscopic band ligation
Active variceal bleeding	Octreotide, endoscopic band ligation, prophylactic antibiotics
Ascites	Low-sodium diet, diuretics (spironolactone ± furosemide)
Refractory ascites	Large-volume paracentesis with albumin infusion, TIPS

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Cirrhosis: Treatment and Prevention of Cirrhosis Complications

Indication	Treatment
SBP prevention	Chronic fluoroquinolone for previous SBP or high-risk patients During hospitalization if Child-Turcotte-Pugh class B or C, ascitic protein level <1 g/dL, and creatinine level >1.5 mg/dL Variceal/UGI bleeding
Hepatic encephalopathy secondary prevention	Lactulose with goal of 3 stools/day ± rifaximin
Hepatic encephalopathy	Correct predisposing factors, lactulose, add rifaximin if unresponsive, zinc supplements if deficient

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Cirrhosis: Complications

Hepatopulmonary syndrome

- Platypnea, orthodeoxia
- Intrapulmonary right-to-left shunting on echocardiogram with agitated saline

Portopulmonary hypertension

- Dyspnea on exertion
- Echocardiogram shows RV systolic blood pressure >50 mm Hg
- Right heart catheterization confirms diagnosis

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Cirrhosis: Treatment

Lifestyle modifications

- Avoid alcohol, sedating medications
- Avoid consumption of raw shellfish (risk for *Vibrio vulnificus*)
- Avoid contaminating wounds in brackish water

Immunizations

- All routine nonlive vaccines
- Hepatitis A and B vaccines

Nutrition

- 1.4-1.6 g/kg/d of protein (preferably vegetarian sources)
- 25-40 kcal/kg/d

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Cirrhosis: Treatment

Bone health

- DXA screening
- Osteopenia: treat with calcium + vitamin D
- Osteoporosis: treat with IV bisphosphonate

Hepatocellular carcinoma

- Ultrasonography screening ± α-fetoprotein every 6 months



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Cirrhosis: Prognosis

MELD score

- Basis for liver transplant allocation
  - MELD score ≥15
- Predicts short-term mortality in patients with advanced liver disease

Child-Pugh score 1-year survival rates

- Class A → 100%
- Class B → 80%
- Class C → 45%

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Acute Liver Failure

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Acute Liver Failure: Diagnosis and Testing

Acute liver injury

- Sudden ↑ in AST/ALT levels
- Absence of underlying liver disease

Acute liver failure

- Acute liver injury
- Encephalopathy
- Coagulopathy
- Absence of previous liver disease (<26 weeks)

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Acute Liver Failure: Treatment

- Contact liver transplantation center
- Supportive care and monitoring
- Treat underlying cause if possible

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Acute Liver Failure: Diagnosis, Testing, and Treatment

Acetaminophen overdose

- Sudden ↑ in AST and ALT levels >20 times upper limit of normal
- *N*-acetylcysteine while waiting for drug level
  - Give regardless if high clinical suspicion
- Activated charcoal if within 4 hours of ingestion
- King's College criteria
  - Arterial pH < 7.3 *or* all 3 of the following:
  - INR > 6.5
  - Serum creatinine level > 3 mg/dL
  - Encephalopathy

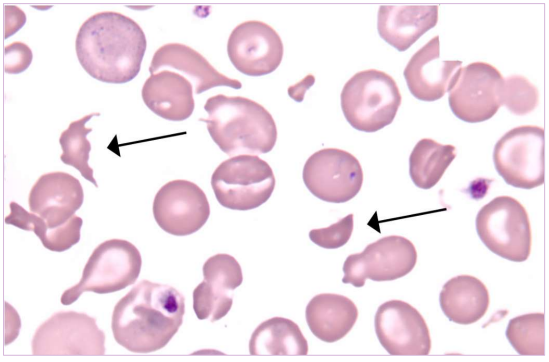
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Acute Liver Failure: Diagnosis, Testing, and Treatment

HELLP syndrome

- *H*emolysis, *E*levated *L*iver enzymes, *L*ow *P*latelet count
- Third trimester
- Preeclampsia, microangiopathic hemolytic anemia
- Treatment: urgent delivery



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Acute Liver Failure: Diagnosis, Testing, and Treatment

Acute fatty liver of pregnancy (AFLP)

- Similar to HELLP; not important to distinguish between the two
- Additional findings
  - Coagulation abnormalities
  - Hypoglycemia
  - Encephalopathy
- Treatment: urgent delivery

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Acute Liver Failure: Diagnosis, Testing, and Treatment

Acute hepatitis B infection

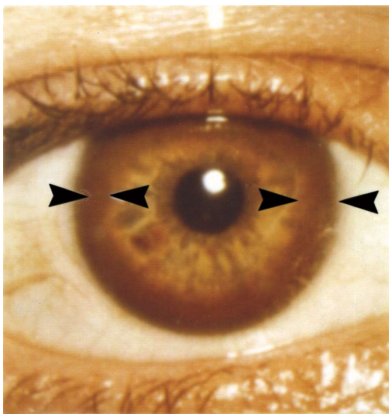
Ischemic hepatitis

- Hospitalized patients
- Episode of hypotension
- Acute ↑ in AST/ALT levels >1000 U/L
- Supportive care

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Acute Liver Failure: Diagnosis, Testing, and Treatment



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Wilson disease

- Young patient
- Low alkaline phosphatase level
- Direct antiglobulin test–negative hemolysis
- Kayser-Fleischer rings
- Psychiatric/behavioral disorder
- Athetoid movements
- Obtain serum ceruloplasmin and 24-hour urine copper levels
- Chelation with D-penicillamine or trientine
- High mortality without transplant

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Acute-on-Chronic Liver Disease

Increasingly common cause of mortality in patients with chronic liver disease

Precipitating factors

- Alcohol use
- Viral hepatitis
- Drug-induced liver injury
- Surgery
- Ischemia
- Infection

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Gastroenterology IV

- Answers to Multiple-Choice Questions

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Gastroenterology Q23

A 25-year-old woman is evaluated for mildly elevated liver enzymes. She is asymptomatic. Medical history is significant for obesity. Results of complete metabolic profile, hepatitis serology, iron studies, antinuclear antibodies, and anti–smooth muscle antibodies are normal. She does not consume alcohol or take illicit drugs, medications, or supplements.

Which of the following is the most appropriate diagnostic test to perform next?

A: Abdominal ultrasonography

B: Liver biopsy

C: Magnetic resonance elastography

D: Transient elastography

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Gastroenterology Q24

A 19-year-old woman is evaluated during a routine appointment. She was born in the United States, is healthy, and has no risk factors for hepatitis. Physical exam is normal.

Which of the following is the most appropriate hepatitis screening strategy?

A: Hepatitis B screening

B: Hepatitis B and C screening

C: Hepatitis C screening

D: No screening

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Gastroenterology Q25

A 50-year-old man reports 2 weeks of jaundice. He drinks 10 beers daily. He has no other risk factors for liver disease. Temperature is 100.2 °F. Tender hepatomegaly is noted. AST level is 124 U/L, and ALT level is 57 U/L. Urinalysis is normal, and blood cultures are negative. MELD score is >20. Chest radiograph is clear, and ultrasound shows no ascites.

Which of the following is the most appropriate treatment?

A: Deferoxamine

B: Pentoxifylline

C: Prednisolone

D: Rifaximin

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Gastroenterology Q26

A 48-year-old man has a history of alcohol use disorder. He has no history of encephalopathy, GI bleeding, or ascites. Evaluation reveals splenomegaly and platelet count of 85,000/µL.

Which of the following is the most appropriate management?

A: Nadolol

B: Surgical portocaval shunting

C: TIPS

D: Upper endoscopy

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Common Symptoms

2025 Virtual/Live Internal Medicine Board Review

Allison L Ruff, MD, MHPE
Clinical Associate Professor, General Medicine
Department of Internal Medicine
University of Michigan
Ann Arbor, MI

ACP Internal Medicine Board Review Course

General Internal Medicine: Common Symptoms

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Table of Contents: Common Symptoms

- Cough
- Bronchitis
- Dyspnea
- Chest pain
- Syncope
- Dizziness and vertigo
- Insomnia

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Common Symptoms Q1

A 24-year-old woman is evaluated for a cough of 4 weeks' duration following a typical upper respiratory infection.

Her upper respiratory symptoms improved, but she has a severe paroxysmal cough associated with post-tussive emesis.

She works in a daycare center.

Physical exam is normal.

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Common Symptoms Q1

A 24-year-old woman is evaluated for a cough of 4 weeks' duration following a typical upper respiratory infection. Her upper respiratory symptoms improved, but she has a severe paroxysmal cough associated with post-tussive emesis. She works in a daycare center. Physical exam is normal.

Which of the following is the most likely diagnosis?

A: Cough-variant asthma

B: GERD-related cough

C: Pertussis infection

D: Postinfectious cough

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Cough

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Acute Cough: Diagnosis

Cough <3 weeks' duration

Most often viral, allergic, or medication related

- Consider coronavirus
- Consider influenza during flu season
- ACE inhibitor-induced cough: up to 20% of patients taking an ACE inhibitor
  - Usually within 1-2 weeks
  - Rarely may have delayed onset
- Allergies, postnasal drip

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Acute Cough: Testing

Chest radiography considerations

- Tachycardia
- Tachypnea
- Fever
- Abnormal cardiopulmonary exam
- Altered mental status

Influenza and/or COVID-19 testing if it will change management

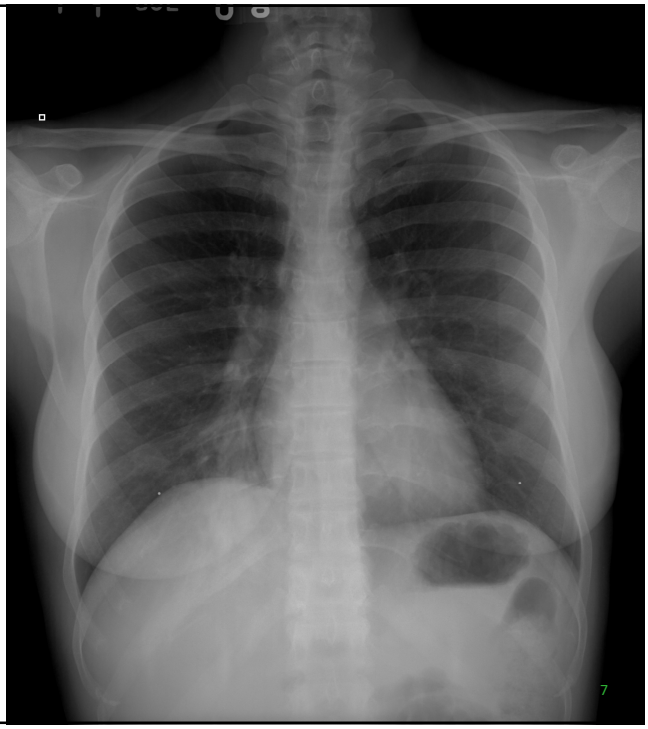


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Subacute Cough: Diagnosis, Testing, and Treatment

Cough of 3-8 weeks' duration

Most often postinfectious upper respiratory infection (viral or *Mycoplasma*)

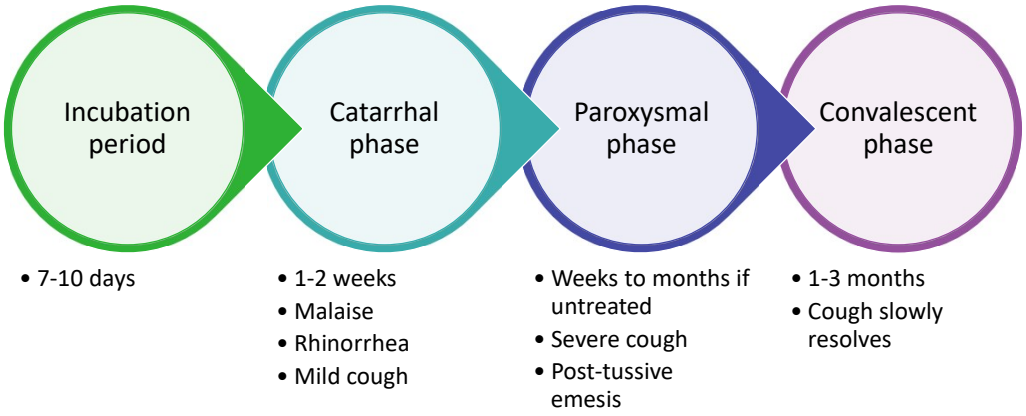
Treatment

- Postnasal drip: intranasal glucocorticoids, first-generation antihistamines/decongestants
- Wheezing: bronchodilators + inhaled glucocorticoids
- Inhaled ipratropium if no postnasal drip or airway hyperreactivity

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Subacute Cough: *Bordetella pertussis* Infection



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Subacute Cough: *Bordetella pertussis* Infection

Testing

- Bacterial culture (within 2 weeks after symptom onset)
- PCR (within 3-4 weeks after symptom onset)

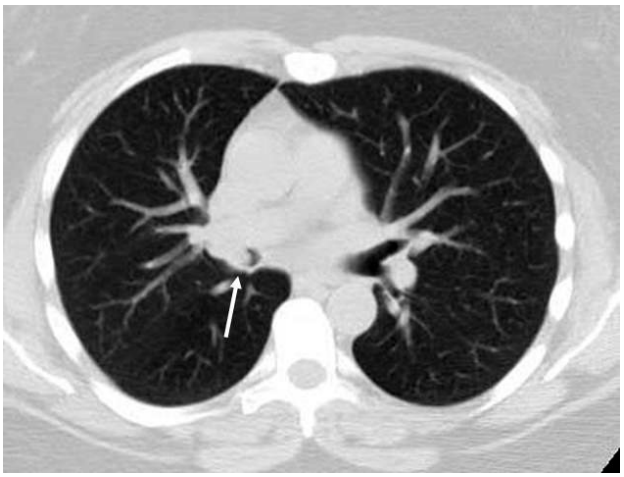
Treatment

- Macrolide antibiotic (if within 2-3 weeks after symptom onset)
- Postexposure prophylaxis
- Extended treatment in specific populations (up to 6 weeks)
  - Patients with pulmonary disease, immunocompromise, or pregnancy

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Chronic Cough: Diagnosis and Testing



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Cough lasting ≥8 weeks

Thorough history, physical exam, and chest radiography for all patients

Before additional evaluation

- Smoking cessation
- ACE inhibitor discontinuation for 4 weeks

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Chronic Cough: Diagnosis and Testing

Stepwise, proceed with additional evaluation for:

1. Upper airway cough syndrome
2. Asthma
3. Nonasthmatic eosinophilic bronchitis
4. GERD

These four causes account for 90% of patients who have a normal chest radiograph and who no longer smoke or use an ACE inhibitor

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Common Symptoms Q2

A 30-year-old man has a 3-month history of cough during the day and night. He feels a need to clear his throat often.

He has no postnasal drip, acid reflux symptoms, dyspnea, or wheezing.

Physical exam shows cobblestoning of the posterior pharynx.

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Common Symptoms Q2

A 30-year-old man has a 3-month history of cough during the day and night. He feels a need to clear his throat often. He has no postnasal drip, acid reflux symptoms, dyspnea, or wheezing. Physical exam shows cobblestoning of the posterior pharynx.

Which of the following is the most appropriate treatment?

A: Diphenhydramine and pseudoephedrine

B: Inhaled budesonide

C: Loratadine

D: Omeprazole

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Upper Airway Cough Syndrome

Postnasal drainage, throat clearing, rhinorrhea

Globus sensation

Cobblestone oropharyngeal mucosa

Mucopurulent drainage from the nasopharynx

Two-week trial of either:

- Intranasal glucocorticoid (if concurrent features of allergic rhinitis)
- Antihistamine or antihistamine-decongestant combination

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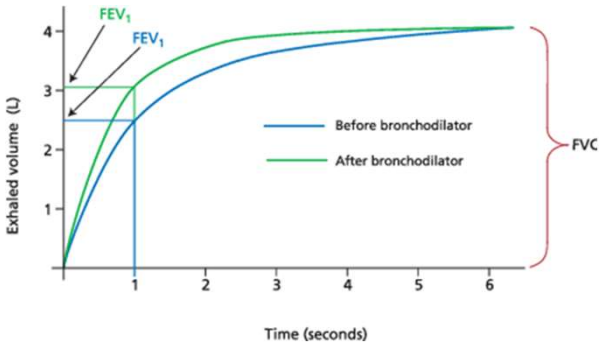
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Cough-Variant Asthma

Cough with exercise or exposure to cold

Spirometry or empiric asthma treatment

- Reversible airflow obstruction
- Positive bronchoprovocation testing



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Chronic Cough: Causes and Therapies

If you see this…	Diagnose this…	Choose this…
Postnasal drainage, frequent throat clearing, nasal discharge, cobblestone appearance of the oropharyngeal mucosa, or mucus dripping down the oropharynx	Upper airway cough syndrome	First-generation antihistamine-decongestant combination or intranasal glucocorticoid (for allergic rhinitis)
Asthma, cough with exercise or exposure to cold	Cough-variant asthma	Methacholine or exercise challenge if diagnosis is uncertain Standard asthma therapy
GERD symptoms (GERD may be silent)	GERD-related cough	Empiric PPI therapy without testing
Taking ACE inhibitor	ACE-inhibitor cough	Stop ACE inhibitor, substitute ARB
Normal chest radiograph findings, normal spirometry, and negative methacholine challenge test; failed empiric PPI therapy	Possible nonasthmatic eosinophilic bronchitis	Sputum induction or bronchial wash for eosinophils or exhaled nitric oxide testing Treat with inhaled glucocorticoids; avoid sensitizer

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Unexplained Chronic Cough

Multimodality speech pathology intervention

Symptomatic treatment trials

- Guaifenesin (if excessive sputum production)
- Benzonatate
- Dextromethorphan
- Gabapentin

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Common Symptoms Q3

A 47-year-old woman is evaluated for an 11-day history of cough with purulent sputum.

She has no other symptoms.

Vital signs, pulmonary exam, and the remainder of the exam are normal.

Testing for SARS-CoV-2 is negative.

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Common Symptoms Q3

A 47-year-old woman is evaluated for an 11-day history of cough with purulent sputum. She has no other symptoms. Vital signs, pulmonary exam, and the remainder of the exam are normal. Testing for SARS-CoV-2 is negative.

Which of the following is the most appropriate management?

A: Amoxicillin-clavulanate

B: Chest radiography

C: Sputum culture

D: Supportive care

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Bronchitis

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Acute Bronchitis: Diagnosis

Lower respiratory tract infection

- Cough
- Purulent or nonpurulent sputum

Most commonly viral in origin

- Influenza, coronavirus, rhinovirus, RSV

Bacterial cause in <10%

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Acute Bronchitis: Testing and Treatment

Sputum Gram stain/culture: not recommended

Patient education and reassurance

Supportive care

Antibiotic treatment: not routinely recommended

- Suspected pneumonia (symptoms or physical exam findings)
- Worsening or persistent symptoms
- Pertussis (within 3 weeks after symptom onset)

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Chronic Bronchitis

Cough for ≥3 months in each of 2 successive years

Other causes of chronic cough excluded (e.g., bronchiectasis)

Typically seen in cigarette smokers (current and former)

- Increased mucin production
- Associated with higher risk for exacerbations

Chronic bronchitis ≠ COPD, unless airflow obstruction

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Common Symptoms Q4

A 50-year-old man has a 2-year history of insidiously progressive exertional dyspnea.

He has no cardiac or pulmonary risk factors or other symptoms.

Other than a BMI of 35, physical exam is normal.

Oxygen saturation with the patient breathing ambient air is 97%.

Chest radiograph, hemoglobin level, ECG, spirometry, and echocardiogram are normal.

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Common Symptoms Q4

A 50-year-old man has a 2-year history of insidiously progressive exertional dyspnea. He has no cardiac or pulmonary risk factors or other symptoms. Other than a BMI of 35, physical exam is normal. Oxygen saturation with the patient breathing ambient air is 97%. Chest radiograph, hemoglobin level, ECG, spirometry, and echocardiogram are normal.

Which of the following is the most appropriate next step in evaluating this patient?

A: BNP measurement

B: Cardiopulmonary exercise testing

C: Chest CT

D: Polysomnography

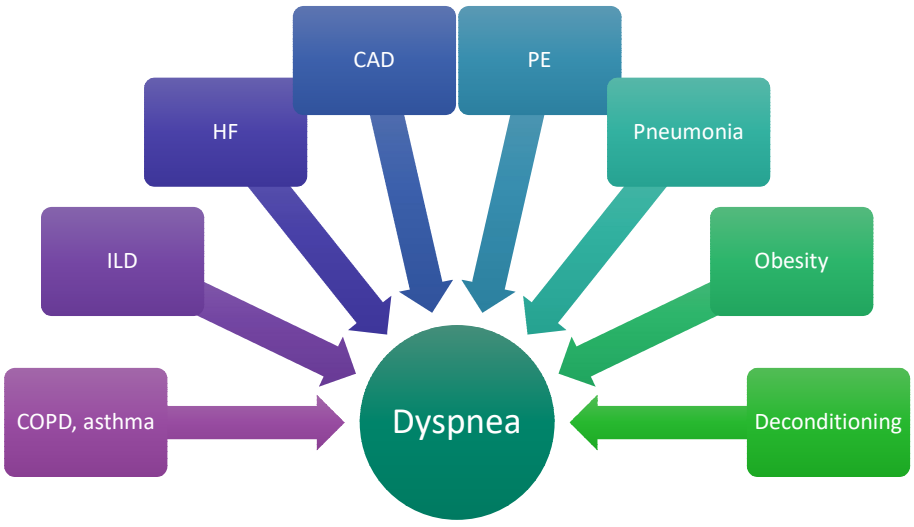
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Dyspnea

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Dyspnea: Common Causes



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Dyspnea: Diagnosis

Qualitative description

- Sensation of inadequate air flow → bronchoconstriction
- Smothering or suffocating → HF
- Inability to breathe deeply enough → hyperinflation or restrictive conditions

Position

- Orthopnea → HF
- Platypnea-orthodeoxia → hepatopulmonary syndrome, large PFO
- Bendopnea (bending over) → HF

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Dyspnea: Diagnosis

Timing

- Nocturnal dyspnea → asthma, HF, GERD

Other associated symptoms

- Exertional lightheadedness, syncope → aortic stenosis, HCM, pulmonary hypertension, ACS

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Dyspnea: Diagnosis

Sudden onset	• ACS • Acute pulmonary embolism • Spontaneous pneumothorax
Gradual onset	• Interstitial lung disease • Pulmonary hypertension • Neuromuscular disease • COPD

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Dyspnea: Diagnosis

Intermittent onset	• Aspiration • Asthma • GERD • Heart failure
Progressive symptoms	• Anemia • COPD • Heart failure • Interstitial lung disease • Cancer • Pneumonia

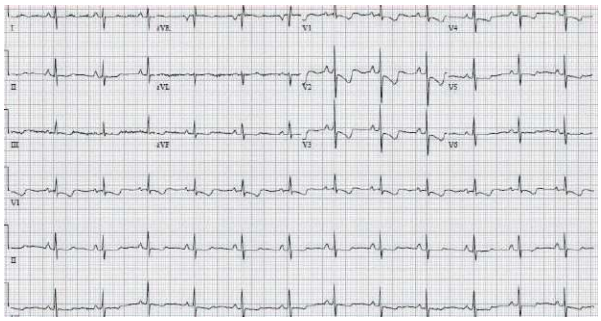
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Dyspnea: Testing

In the absence of an obvious cause:

- Oxygen saturation
- Hemoglobin level
- ECG
- Chest radiography
- Advanced imaging only if high pretest probability



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Dyspnea: Testing

If no likely pulmonary cause, evaluate cardiac causes

- Echocardiography
- BNP, NT-proBNP

If no likely cardiac cause, evaluate pulmonary causes

- Spirometry or PFTs
- Point-of-care lung ultrasonography

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Dyspnea: Testing

If initial evaluation is unrevealing:

- Cardiopulmonary exercise testing
- Poor activity tolerance without pulmonary limitation
  - Deconditioning
  - Heart disease

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Dyspnea: Treatment

- Treat underlying cause
- Pursed lip breathing, handheld fans
- Oxygen therapy for hypoxemia
- Opioids for refractory dyspnea

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Chest pain

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Acute Chest Pain

If you see this…	Consider this…	Test with this…
• Repetitive emesis • Acute retrosternal pain	• Esophageal rupture (with mediastinitis)	• Chest radiography • Chest CT

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Acute Chest Pain

If you see this…	Consider this…	Test with this…
• Tearing chest/back pain • SBP <90 mm Hg • Pulse deficit • Focal neurologic signs	• Aortic dissection	• Chest CTA, MRA, or TEE • Chest radiography (mediastinal or aortic widening)

Tall, thin patient with long arms? Consider Marfan syndrome.

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Acute Chest Pain

If you see this…	Consider this…	Test with this…
• Pleuritic chest pain • Dyspnea • Hypotension • Absent breath sounds, deviated trachea • Distended neck veins	• Tension pneumothorax	• Chest radiography

Tall, thin smoker? Consider spontaneous pneumothorax.

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Acute Chest Pain

If you see this…	Consider this…	Test with this…
• Sudden, anterior, with respirations • Tachypnea, dyspnea • Elevated CVP • Pulsus paradoxus • Worse when supine	• Pericarditis plus tamponade	• ECG • Echocardiography

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Acute Chest Pain

If you see this…	Consider this…	Test with this…
• Pain worse with inspiration • Dyspnea (RR >30/min) • Pulse rate >100/min • Cough ± hemoptysis • History of VTE • Syncope	• Pulmonary embolism	• CT angiography • D-Dimer

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Acute Chest Pain

If you see this…	Consider this…	Test with this…
• New-onset chest pain, at rest • Age >70 years • Unpredictable chest pain • New ECG findings • Previous MI history • Chest pain relieved by nitroglycerin	• Acute coronary syndrome • 12% of all chest pain	• ECG • Stress testing • Coronary angiography

Chest pain at night, at rest, or substance use history? Consider coronary vasospasm.

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Common Symptoms Q5

A 67-year-old man is evaluated for syncope occurring shortly after arising from bed.

He reports no chest pain or palpitations.

He has a 15-year history of diabetes with peripheral neuropathy and was recently diagnosed with BPH.

Medications are metformin and tamsulosin.

Vital signs, physical exam, and ECG are normal.

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Common Symptoms Q5

A 67-year-old man is evaluated for syncope occurring shortly after arising from bed. He reports no chest pain or palpitations. He has a 15-year history of diabetes with peripheral neuropathy and was recently diagnosed with BPH. Medications are metformin and tamsulosin. Vital signs, physical exam, and ECG are normal.

Which of the following diagnostic tests should be performed next?

A: CT of the head

B: Orthostatic BP measurements

C: 24-Hour ambulatory ECG

D: Ultrasonography of the carotid arteries

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Syncope

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Syncope: Classification

Neurally mediated (neurocardiogenic)	Orthostatic	Cardiac
• Vasovagal • Situational • Carotid sinus sensitivity	• Volume depletion • Drug related • Autonomic insufficiency • Postprandial (especially elderly)	• Arrhythmia • Structural heart disease (aortic stenosis, HCM) • AV block • Pulmonary embolism

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Neurally Mediated Syncope: Diagnosis

Vasovagal

- Prolonged standing, stress, heat, pain
- Prodrome of nausea, lightheadedness, warmth

Situational

- May follow cough, urination, defecation

Carotid sinus sensitivity

- Turning head
- Tight-fitting collar
- Shaving neck

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Syncope: Testing

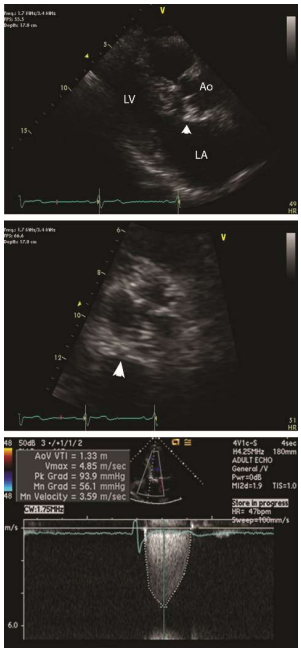
Orthostatic BP measurement in all cases

ECG obtained in all cases

- Normal ECG does not rule out a cardiac cause

Echocardiography

- If structural heart disease is suspected



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Syncope: Testing

Ambulatory ECG recording

- If cardiac arrhythmia is suspected or cause is unclear

Stress testing

- Exercise-associated syncope
- Increased risk for ischemic heart disease

Carotid sinus massage

- Suspected carotid sinus syncope

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Syncope: Testing

Tilt-table testing for either:

- Suspected recurrent vasovagal syncope
- Evaluation of delayed orthostatic hypotension

Electrophysiologic testing

- Almost never indicated
- Indeterminate diagnosis of arrhythmia
- Catheter-based intervention is being considered

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Syncope: Disposition

Discharge home without additional evaluation if all of the following are present:

- Neurocardiogenic syncope
- Normal physical exam
- Normal ECG

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Syncope: Disposition

Hospitalize and evaluate

- History of structural heart disease
- Significant cardiac risk factors
- Heart failure
- Exertional syncope
- "Drop syncope" (sudden syncope without prodrome)



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Common Symptoms Q6

A 22-year-old woman is evaluated after a second episode of syncope.

Both episodes occurred while standing in line for a prolonged period in a warm environment.

Syncope was preceded by a feeling of warmth, diaphoresis, and tunnel vision.

Physical exam, orthostatic BP measurements, and ECG are normal.

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Common Symptoms Q6

A 22-year-old woman is evaluated after a second episode of syncope. Both episodes occurred while standing in line for a prolonged period in a warm environment. Syncope was preceded by a feeling of warmth, diaphoresis, and tunnel vision. Physical examination, orthostatic BP measurements, and ECG are normal.

Which of the following is the most appropriate treatment?

A: Education and counterpressure maneuvers

B: Fludrocortisone

C: Metoprolol

D: Midodrine

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Syncope: Treatment

Neurally mediated syncope

- Reassurance
- Avoid triggers
- Counterpressure maneuvers
  - Leg crossing
  - Squatting
  - Limb/abdominal contraction

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Syncope: Treatment

Orthostatic hypotension

- Remove offending medications (especially α-blockers)
- Sit and stand slowly
- Increase salt and fluid intake
- Compression stockings or abdominal binder
- Exercise
- Pharmacologic measures
  - Low-dose fludrocortisone if volume depleted
  - Sympathomimetic pressor agent (midodrine)

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Syncope: Treatment

Cardiac syncope

- Treat underlying cause

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Common Symptoms Q7

A 58-year-old man reports episodic vertigo lasting 30 to 45 seconds.

The most severe episodes occur when arising from bed.

The Dix-Hallpike maneuver precipitates horizontal nystagmus after a 3-second latency that resolves after 30 seconds.

With repeated maneuvers, the nystagmus is less severe.

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Common Symptoms Q7

A 58-year-old man reports episodic vertigo lasting 30 to 45 seconds. The most severe episodes occur when arising from bed. The Dix-Hallpike maneuver precipitates horizontal nystagmus after a 3-second latency that resolves after 30 seconds. With repeated maneuvers, the nystagmus is less severe.

Which of the following is the most likely diagnosis?

A: BPPV

B: Brainstem infarction

C: Cerebellar infarction

D: Meniere disease

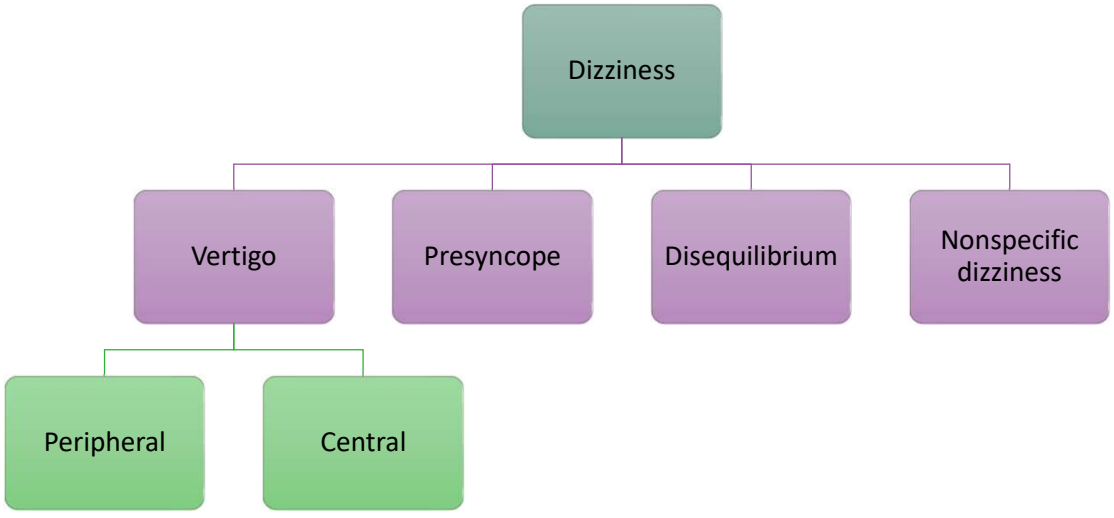
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Dizziness and Vertigo

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Dizziness: Classification



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Peripheral Vertigo: Diagnosis

Benign paroxysmal positional vertigo

- Most common cause
- Induced by positional change
- Episodes last <1 minute
- Multiple episodes per day

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Peripheral Vertigo: Diagnosis

Vestibular neuronitis

- Severe persistent vertigo and normal hearing
- May be preceded by viral illness

Labyrinthitis

- Severe persistent vertigo and impaired hearing

Meniere disease

- Vertigo, hearing loss, tinnitus

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Central Vertigo: Diagnosis

Brainstem stroke

- Spontaneous, usually sustained vertigo
- 80% have multiple brainstem findings
- 20% may have isolated vertigo
- Consider in high-risk patients
  - Hypertension, diabetes, hyperlipidemia, advanced age

Cerebellar infarction or hemorrhage

- Acute onset, sustained vertigo
- 55% accompanied by gait or truncal ataxia

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Central Vertigo: Diagnosis

Vertebrobasilar TIA

- Episodes usually last several minutes to hours
- Other brainstem symptoms usually

Vestibular migraine

- Migraine history
- Central or peripheral characteristics

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Vertigo: Dix-Hallpike Maneuver

Findings	Peripheral Disease	Central Disease
Latency of nystagmus	Delayed	No delay
Duration of nystagmus	<1 min	>1 min
Fatigability of nystagmus	Fatigable	Not fatigable
Direction of nystagmus	Unidirectional or mixed upbeat-torsional	Variable (vertical or horizontal)
Severity of symptoms	More severe	Less severe

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Vertigo: Testing

HINTS exam

- For patients with acute, persistent vertigo
- Central finding on any component → possible central vertigo

Test	Method	Interpretation
Head **I**mpulse	Patient's head moved slowly 20 degrees from midposition and quickly back	(+) Catch-up saccades: peripheral vertigo (–) Catch-up saccades: central vertigo
Nystagmus	Nystagmus on lateral gaze	Unidirectional: peripheral vertigo Bidirectional, vertical: central vertigo
Test of **S**kew	Cover/uncover eye to assess presence of vertical adjustment	(–) Skew: peripheral vertigo (+) Skew: central vertigo

MRI, CT for central vertigo

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Vertigo: Treatment

Peripheral vertigo

- BPPV: canalith repositioning maneuver
- Meniere disease: diuretics
- Neuronitis/labyrinthitis
  - Antihistamines, benzodiazepines: short-term suppression
- All dizziness/vertigo: vestibular rehabilitation (as needed)

Central vertigo

- Treat underlying cause

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Presyncope

- Lightheadedness, dizziness
- Visual changes (tunnel vision), auditory changes
- Warmth, nausea
- Near loss of consciousness
- Evaluate and treat like syncope

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Disequilibrium

Primarily in older adults

Imbalance or unsteadiness with positional changes

Symptoms relieved with sitting or lying down

Detailed neurologic examination

Evaluate for orthostasis

Multifactorial treatment

- Visual and auditory corrective measures
- Discontinue contributing drugs
- Mobility aids; balance and gait training
- Weight-bearing and resistance exercises

Fall prevention

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Common Symptoms Q8

A 55-year-old woman is evaluated for chronic insomnia.

She reports insufficient sleep 5 days/week, on average, during the past 5 months.

She has difficulty initiating and maintaining sleep.

She reports no nocturnal leg movements or symptoms of depression.

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Common Symptoms Q8

A 55-year-old woman is evaluated for chronic insomnia. She reports insufficient sleep 5 days/week, on average, during the past 5 months. She has difficulty initiating and maintaining sleep. She reports no nocturnal leg movements or symptoms of depression.

Which of the following is the most appropriate treatment?

A: CBT for insomnia

B: Iron supplementation

C: Trazodone

D: Zolpidem

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Insomnia

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Insomnia: Risk Factors

Medical comorbid conditions

- Cardiopulmonary diseases
- Parkinson disease
- Restless legs syndrome or periodic limb movements of sleep
- Sleep apnea
- Nocturia (BPH/OAB)
- Chronic pain

Psychiatric disorders

- Mood disorders, PTSD

Drugs

- Caffeine, alcohol
- Glucocorticoids, diuretics, antidepressants, β-agonists

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Insomnia: Diagnosis

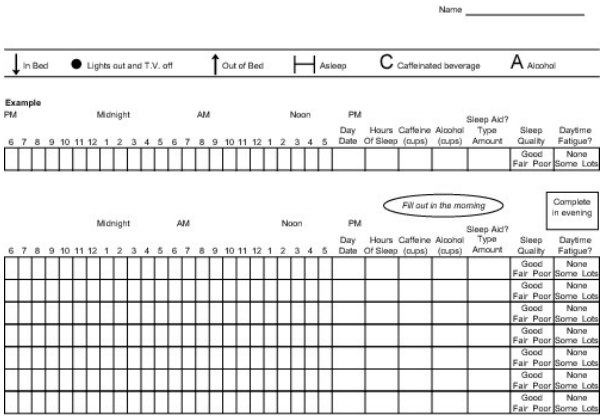
- Poor sleep quality
- Frustration with sleep quantity
- Difficulty initiating sleep
- Inability to return to sleep after awakening
- Short term: <1 month
- Chronic: >3 months

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Insomnia: Testing

- Sleep diary
- Severity Index or Athens Insomnia Scale
- Screen for insomnia-contributing drugs



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Insomnia: Testing

Polysomnography indications

- Suspected sleep apnea
- Suspected periodic leg movement disorder
- Narcolepsy

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Chronic Insomnia: Treatment

Address medical/psychiatric comorbid conditions

Restless legs syndrome

- Iron if ferritin ≤75 ng/mL
- Pramipexole
- Gabapentin, pregabalin

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Chronic Insomnia: Treatment

CBT for insomnia (CBT-I): first-line treatment

- Sleep hygiene plus cognitive behavioral interventions

Sleep hygiene

- Stable bedtimes and rising times
- Limit screen time
- Create a dark environment
- Avoid caffeine, alcohol, and nicotine before bedtime
- Reduce daytime naps
- Limit bedroom activities to intimacy and sleep
- Not effective as standalone treatment

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Chronic Insomnia: Treatment

Pharmacologic therapy

- Can be added if response to CBT-I is incomplete
- Limit to short-term use (4-5 weeks)
  - Nonbenzodiazepine GABA receptor agonists
    - Eszopiclone, zolpidem, zaleplon
  - Doxepin (antidepressant)
  - Melatonin, ramelteon

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Sleep Disorders in Older Adults: Pharmacologic Treatment

Drugs to be avoided in older adults

- Tricyclic antidepressants
- Antihistamines
- Benzodiazepines
- Antipsychotics

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GIM: Common Symptoms

- Answers to Multiple-Choice Questions

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Common Symptoms Q1

A 24-year-old woman is evaluated for a cough of 4 weeks' duration following a typical upper respiratory infection. Her upper respiratory symptoms improved, but she has a severe paroxysmal cough associated with post-tussive emesis. She works in a daycare center. Physical exam is normal.

Which of the following is the most likely diagnosis?

A: Cough-variant asthma

B: GERD-related cough

C: Pertussis infection

D: Postinfectious cough

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Common Symptoms Q2

A 30-year-old man has a 3-month history of cough during the day and night. He feels a need to clear his throat often. He has no postnasal drip, acid reflux symptoms, dyspnea, or wheezing. Physical exam shows cobblestoning of the posterior pharynx.

Which of the following is the most appropriate treatment?

A: Diphenhydramine and pseudoephedrine

B: Inhaled budesonide

C: Loratadine

D: Omeprazole

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Common Symptoms Q3

A 47-year-old woman is evaluated for an 11-day history of cough with purulent sputum. She has no other symptoms. Vital signs, pulmonary exam, and the remainder of the exam are normal. Testing for SARS-CoV-2 is negative.

Which of the following is the most appropriate management?

A: Amoxicillin-clavulanate

B: Chest radiography

C: Sputum culture

D: Supportive care

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Common Symptoms Q4

A 50-year-old man has a 2-year history of insidiously progressive exertional dyspnea. He has no cardiac or pulmonary risk factors or other symptoms. Other than a BMI of 35, physical exam is normal. Oxygen saturation with the patient breathing ambient air is 97%. Chest radiograph, hemoglobin level, ECG, spirometry, and echocardiogram are normal.

Which of the following is the most appropriate next step in evaluating this patient?

A: BNP measurement

B: Cardiopulmonary exercise testing

C: Chest CT

D: Polysomnography

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Common Symptoms Q5

A 67-year-old man is evaluated for syncope occurring shortly after arising from bed. He reports no chest pain or palpitations. He has a 15-year history of diabetes with peripheral neuropathy and was recently diagnosed with BPH. Medications are metformin and tamsulosin. Vital signs, physical exam, and ECG are normal.

Which of the following diagnostic tests should be performed next?

A: CT of the head

B: Orthostatic BP measurements

C: 24-Hour ambulatory ECG

D: Ultrasonography of the carotid arteries

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Common Symptoms Q6

A 22-year-old woman is evaluated after a second episode of syncope. Both episodes occurred while standing in line for a prolonged period in a warm environment. Syncope was preceded by a feeling of warmth, diaphoresis, and tunnel vision. Physical examination, orthostatic BP measurements, and ECG are normal.

Which of the following is the most appropriate treatment?

A: Education and counterpressure maneuvers

B: Fludrocortisone

C: Metoprolol

D: Midodrine

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Common Symptoms Q7

A 58-year-old man reports episodic vertigo lasting 30 to 45 seconds. The most severe episodes occur when arising from bed. The Dix-Hallpike maneuver precipitates horizontal nystagmus after a 3-second latency that resolves after 30 seconds. With repeated maneuvers, the nystagmus is less severe.

Which of the following is the most likely diagnosis?

A: BPPV

B: Brainstem infarction

C: Cerebellar infarction

D: Meniere disease

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Common Symptoms Q8

A 55-year-old woman is evaluated for chronic insomnia. She reports insufficient sleep 5 days/week, on average, during the past 5 months. She has difficulty initiating and maintaining sleep. She reports no nocturnal leg movements or symptoms of depression.

Which of the following is the most appropriate treatment?

A: CBT for insomnia

B: Iron supplementation

C: Trazodone

D: Zolpidem

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Urologic, Obstetric, and Gynecologic Conditions

2025 Virtual/Live Internal Medicine Board Review

Allison L Ruff, MD, MHPE
Clinical Associate Professor, General Medicine
Department of Internal Medicine
University of Michigan
Ann Arbor, MI

ACP Internal Medicine Board Review Course

General Internal Medicine: Urologic, Obstetric, and Gynecologic Conditions

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Table of Contents: Urologic, Obstetric, and Gynecologic Conditions

- Benign prostatic hyperplasia
- Other causes of lower urinary tract symptoms (LUTS) in men
- Erectile dysfunction
- Breast mass
- Vitamin deficiency in pregnancy
- Abnormal uterine bleeding
- Menopause
- Hormonal contraception

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Urologic, Obstetric, and Gynecologic Conditions Q1

A 60-year-old man reports a weak urine stream and sense of incomplete bladder emptying without fever or dysuria.

Vital signs are normal.

There is no palpable bladder distention.

The prostate is diffusely enlarged, firm, and nontender without nodules.

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Urologic, Obstetric, and Gynecologic Conditions Q1

A 60-year-old man reports a weak urine stream and sense of incomplete bladder emptying without fever or dysuria. Vital signs are normal. There is no palpable bladder distention. The prostate is diffusely enlarged, firm, and nontender without nodules.

Which of the following is the most appropriate next step in management?

A: Postvoid residual volume measurement

B: Prostate ultrasonography

C: Urinalysis

D: Urodynamic flow studies

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Benign Prostatic Hyperplasia

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BPH: Diagnosis and Epidemiology

Histologic diagnosis

Proliferation of glandular epithelial, smooth muscle, and connective tissue in prostatic transition zone

Prevalence

- Increases after age 40 years
- 60% of men aged 60 years
- 80% of men aged 80 years

May be asymptomatic or present with LUTS

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BPH: History and Testing

Obstructive symptoms

- Hesitancy
- Weak urine stream
- Straining
- Incomplete voiding, urinary retention
- Overflow incontinence

Digital rectal examination

Urinalysis

Consider prostate-specific antigen (PSA) testing

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BPH: Symptom Severity

American Urological Association (AUA) Symptom Index

International Prostate Symptom Score (IPSS)

- Mild → lifestyle management
- Moderate/severe → medical or surgical treatment

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BPH: Treatment

Lifestyle management

- Weight loss
- Decreased fluid intake in evening
- Timed voiding/double voiding
- Limited caffeine and alcohol intake
- Avoidance of anticholinergic medications

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BPH: Treatment

α-Adrenergic blockers

- Terazosin, tamsulosin, doxazosin, alfuzosin, silodosin
- Most effective pharmacologic therapy
- Therapeutic effects begin in 48 hours
  - Maximal effect: 4 weeks
- Adverse effects
  - Hypotension/orthostasis
  - Sexual dysfunction
- Discontinuation for cataract surgery
  - Risk for floppy iris syndrome

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BPH: Treatment

5α-Reductase inhibitors: second-line therapy

- Finasteride, dutasteride
- Useful if prostate is enlarged
- Therapeutic effects in about 6 months
- May be added to α-adrenergic blockers
- Adverse effects: erectile dysfunction (ED), low libido

Phosphodiesterase-5 (PDE-5) inhibitor

- Tadalafil for BPH + ED

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BPH: Surgical Indications

- Unsuccessful medical therapy
- Acute urinary retention
- Bladder stone
- Persistent gross hematuria
- Recurrent UTIs
- Obstructive nephropathy



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Urologic, Obstetric, and Gynecologic Conditions Q2

A 58-year-old man reports worsening urinary urgency and incontinence despite taking tamsulosin for BPH.

He has no other medical problems and takes no other medications.

Prostate gland is modestly enlarged, smooth, and nontender.

Results of urodynamic studies, PSA testing, and urinalysis are normal.

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Urologic, Obstetric, and Gynecologic Conditions Q2

A 58-year-old man reports worsening urinary urgency and incontinence despite taking tamsulosin for BPH. He has no other medical problems and takes no other medications. Prostate gland is modestly enlarged, smooth, and nontender. Results of urodynamic studies, PSA testing, and urinalysis are normal.

Which of the following is the most appropriate treatment?

A: Sacral neuromodulation

B: Testosterone gel

C: Tolterodine

D: Transurethral resection of the prostate

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Other Causes of Lower Urinary Tract Symptoms (LUTS) in Men

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Lower Urinary Tract Symptoms (LUTS) in Men

Irritative symptoms	Urgency, frequency Nocturia ± Urinary incontinence
Obstructive symptoms	Hesitancy Weak urinary stream Straining Incomplete voiding, urinary retention Overflow incontinence

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LUTS in Men: Diagnosis and Testing

Review of medications

- Antihistamines, antidepressants, diuretics

Bladder palpation

Digital rectal examination (assess prostate size)

Urinalysis

Optional studies

- Bladder ultrasonography/postvoid residual test
- Urodynamic studies

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LUTS in Men: Testing

Indications for cystoscopy/imaging

- Recurrent UTI
- Hematuria
- Renal insufficiency

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Overactive Bladder (OAB): Treatment

First line: behavioral therapies

- Limit caffeine and alcohol intake
- Bladder and pelvic floor muscle training

Second line

- Antimuscarinics
  - Tolterodine, darifenacin, oxybutynin
  - Do not use if ↑ postvoid residual volume
- β_3-Adrenoceptor agonists
  - Mirabegron, vibegron

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Urologic, Obstetric, and Gynecologic Conditions Q3

A 58-year-old man is evaluated for an 8-month history of ED.

He is physically active, has no other medical conditions, and takes no medications.

Physical examination, vital signs, and BMI are normal.

Early-morning serum testosterone level is normal.

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Urologic, Obstetric, and Gynecologic Conditions Q3

A 58-year-old man is evaluated for an 8-month history of ED. He is physically active, has no other medical conditions, and takes no medications. Physical exam, vital signs, and BMI are normal. Early-morning serum testosterone level is normal.

Which of the following is the most appropriate treatment?

A: Intracavernosal alprostadil

B: Sildenafil

C: Testosterone therapy

D: Vacuum erection device

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Erectile Dysfunction

ACP

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Erectile Dysfunction: Causes

- Cardiovascular disease, hypertension, dyslipidemia, diabetes, smoking
- Obesity
- Hypogonadism
- Hypothyroidism
- Depression, anxiety
- Opioids, alcohol
- Antihypertensives (β-blockers, diuretics most common)
- Antidepressants
- Antipsychotics
- Antiandrogens
- Prostate surgery
- Psychogenic

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Erectile Dysfunction: Evaluation

Focused physical exam and testing

Assess for:

- Decreased libido
- Presence of spontaneous morning erections
- Premature ejaculation
- Hypogonadism

Fasting glucose level

Lipid levels

Thyroid-stimulating hormone level

8 AM total testosterone level

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Erectile Dysfunction: Treatment

Lifestyle modification

Weight loss

Increased exercise

Behavioral health counseling

- Underlying mood disorder
- ED-related psychosocial/interpersonal issues

Testosterone therapy for ED + low testosterone



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Erectile Dysfunction: Treatment

PDE-5 inhibitor therapy

- Sildenafil, tadalafil, vardenafil, avanafil
- Absolute contraindication: nitrate use
- Relative contraindications
  - α-Blocker use
  - Recent myocardial infarction, stroke, or life-threatening arrhythmia
  - Resting hypotension or hypertension
- Complications
  - Nonarteritic anterior ischemic optic neuropathy
  - Hearing loss

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Urologic, Obstetric, and Gynecologic Conditions Q4

A 62-year-old woman is evaluated for a breast mass.

Diagnostic mammogram and ultrasound are normal.

On physical exam, there is a firm, 2-cm, nontender mass in the right upper outer quadrant.

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Urologic, Obstetric, and Gynecologic Conditions Q4

A 62-year-old woman is evaluated for a breast mass. Diagnostic mammogram and ultrasound are normal. On physical exam, there is a firm, 2-cm, nontender mass in the right upper outer quadrant.

Which of the following is the most appropriate diagnostic test?

A: Breast MRI

B: Core needle biopsy

C: Repeat mammography in 6 months

D: Repeat mammography in 2 years

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Breast Mass

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Breast Mass: Diagnosis

Palpable breast mass

- Differs from surrounding breast tissue, contralateral breast
- Persists throughout menstrual cycle

Differential diagnosis

- Benign mass (cysts, fibroadenomas, fat necrosis, lipomas)
- Neoplasm

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Breast Mass: Diagnosis

Predictive value of exam is poor

- Well-defined with smooth margins: cyst or fibroadenoma
- Ill-defined: malignancy

Assess for lymphadenopathy

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Breast Mass: Testing

Women aged ≥30 years

- Diagnostic mammography
  - If positive → ultrasonography
    - Biopsy solid or mixed lesions
  - If negative → ultrasonography + biopsy
    - 10% to 20% false-negative rate with mammography

Women aged <30 years and pregnant patients

- Ultrasonography
- Biopsy solid or mixed cystic lesions

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Breast Mass: Treatment

Perform excision if:

- Core needle biopsy is not practical or nondiagnostic
- Core needle biopsy shows atypical hyperplasia
- Discordant pathology report and breast imaging findings

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Urologic, Obstetric, and Gynecologic Conditions Q5

A 22-year-old woman is evaluated following 2 weeks of ongoing nausea and vomiting up to 3 times per day.

She is 8 weeks pregnant.

Her only medication is a multivitamin with folic acid.

She is hypotensive; serum electrolytes are normal.

Fluid replacement is initiated.

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Urologic, Obstetric, and Gynecologic Conditions Q5

A 22-year-old woman is evaluated following 2 weeks of ongoing nausea and vomiting up to 3 times per day. She is 8 weeks pregnant. Her only medication is a multivitamin with folic acid. She is hypotensive; serum electrolyte levels are normal. Fluid replacement is initiated.

Which of the following is the most appropriate management?

A: Intravenous thiamine and folic acid

B: Serum folate measurement

C: Serum vitamin B_{12} measurement

D: No additional management

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Vitamin Deficiency in Pregnancy

ACP

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Vitamin Deficiency in Pregnancy

Recommend prenatal multivitamin to supply pregnancy needs:

Folic acid

- Routine supplementation recommended (0.4-0.8 mg/d)
- Prevents ≥70% of neural tube defects

Vitamin D

- Routine supplementation recommended (600 IU/d)

Thiamine supplementation (1.4 mg/d)

Vitamin B_{12} supplementation (2.6 µg/d)



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Vitamin Deficiency in Pregnancy

Treatment of patients with hyperemesis gravidarum

- IV folic acid
- IV thiamine
- IV fluid and electrolyte repletion

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Urologic, Obstetric, and Gynecologic Conditions Q6

A 46-year-old woman reports irregular vaginal bleeding for 12 months. Her last period was 3 months ago and lasted 3 weeks.

She has never been pregnant.

Medical history is unremarkable; she takes no medications.

Vital signs are normal, as is the pelvic exam.

A urine pregnancy test is negative.

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Urologic, Obstetric, and Gynecologic Conditions Q6

A 46-year-old woman reports irregular vaginal bleeding for 12 months. Her last period was 3 months ago and lasted 3 weeks. She has never been pregnant. Medical history is unremarkable; she takes no medications. Vital signs are normal, as is the pelvic exam. A urine pregnancy test is negative.

Which of the following is the most appropriate diagnostic test?

A: Endometrial biopsy

B: Follicle-stimulating hormone test

C: Serum β-human chorionic gonadotropin test

D: Transvaginal ultrasonography

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Abnormal Uterine Bleeding

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Abnormal Uterine Bleeding (AUB): Diagnosis

- Confirm uterine source of bleeding
- Ovulatory AUB: regular with excessive flow
- Anovulatory AUB: irregular flow and cycle duration

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Abnormal Uterine Bleeding: Diagnosis

Structural causes (PALM):

- Polyp
- Adenomyosis
- Leiomyoma
- Malignancy and hyperplasia

Nonstructural causes (COEIN):

- Coagulopathy
- Ovulation dysfunction
- Endometrial
- Iatrogenic
- Not yet classified

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Abnormal Uterine Bleeding: Risk Assessment

Endometrial cancer risk factors

- Postmenopausal bleeding
- Age ≥45 years
- Age <45 years with:
  - BMI ≥30
  - Chronic anovulation
  - Early menarche
  - Nulliparity
  - Lynch syndrome, Cowden syndrome
  - Tamoxifen use

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Abnormal Uterine Bleeding: Evaluation and Testing

Pelvic exam/cervical cytology

Pregnancy test

CBC (heavy bleeding)

TSH

Consider coagulation studies → von Willebrand disease

- Positive personal or family history of excessive bleeding

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Abnormal Uterine Bleeding: Testing

Ultrasonography

- Consider as alternative to biopsy for only postmenopausal women (no menses >12 months)
- Biopsy if endometrial stripe ≥4 mm

Endometrial biopsy for most

- Postmenopausal (if ultrasonography not performed)
- Premenopausal aged ≥45 years
- Premenopausal aged <45 years with cancer risks

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Urologic, Obstetric, and Gynecologic Conditions Q7

A 54-year-old woman reports a 2-month history of bothersome daily hot flushes, night sweats, and vaginal dryness with dyspareunia.

Her last menstrual period was 13 months ago.

Medical and surgical history is unremarkable.

Mammogram is normal.

Ten-year ASCVD risk is 3%.

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Urologic, Obstetric, and Gynecologic Conditions Q7

A 54-year-old woman reports a 2-month history of bothersome daily hot flushes, night sweats, and vaginal dryness with dyspareunia. Her last menstrual period was 13 months ago. Medical and surgical history is unremarkable. Mammogram is normal. Ten-year ASCVD risk is 3%.

Which of the following is the most appropriate management?

A: Estradiol level measurement

B: Estradiol-progestin replacement

C: Paroxetine

D: Vaginal estradiol cream

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Menopause

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Menopause: Diagnosis

Clinical diagnosis

- FSH/estradiol measurement not necessary

Vasomotor symptoms

- Hot flushes
- Night sweats

Genitourinary syndrome of menopause (vulvovaginal atrophy)

- Vaginal dryness
- Dyspareunia
- Urinary frequency/recurrent cystitis



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Menopause: Hormone Therapy

Moderate/severe symptoms

- ASCVD risk <5%
- Within 10 years of menopause onset
- Low/average risk for breast cancer

Uterus present

- Lowest effective estrogen dose
- Progestin (to avoid endometrial proliferation)

Uterus absent

- Lowest effective estrogen dose

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Menopause: Hormone Therapy

Assess need for hormone therapy annually

Hormone therapy for >5 years increases risk for breast cancer

Contraindications

- Pregnancy
- Undiagnosed abnormal uterine bleeding
- VTE disease
- Stroke/MI
- Breast cancer
- Liver disease

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Menopause: Hormone Therapy

Alternatives to hormone therapy for vasomotor symptoms

- SSRIs/SNRIs
- Gabapentin (night sweats), pregabalin
- Clonidine
- Fezolinetant

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Genitourinary Syndrome of Menopause (Vulvovaginal Atrophy)

- Lubricants/moisturizers (first line)
- Topical estrogen (second line)

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Primary Ovarian Insufficiency (Premature Ovarian Failure)

Hypergonadotropic hypogonadism in women aged <40 years

- Amenorrhea for ≥4 months *or*
- <9 menses per year + symptoms of estrogen deficiency

Ovarian follicle depletion or dysfunction

- Genetic
- Autoimmune
- Idiopathic

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Primary Ovarian Insufficiency (Premature Ovarian Failure): Diagnosis

Serum FSH and estradiol tested twice, one month apart

- FSH >40 mU/mL (40 U/L) and estradiol <50 pg/mL (184 pmol/L) confirms diagnosis

Additional testing to rule out other causes

- TSH
- Prolactin
- Pregnancy test
- Karyotype evaluation

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Hormonal Contraception

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Hormonal Contraception: Methods

Combined estrogen-progestin

- Oral contraceptive pills (OCPs) – daily oral
- Transdermal patch – weekly
- Vaginal ring – monthly or yearlong

Progestin only

- OCPs – daily oral
- Injectable – every 3 months
- Subdermal implant – every 3 years
- Intrauterine device, hormonal – 3 to 8 years

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Hormonal Contraception: Risks and Contraindications

Combined estrogen-progestin

- Decreases risk for endometrial and ovarian cancer
- Treats menorrhagia and dysmenorrhea
- Slightly increases risk for VTE

Contraindications

- VTE
- Breast cancer
- Liver disease
- Migraine with aura
- Women aged >35 years who smoke >15 cigarettes per day

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Hormonal Contraception: Risks and Contraindications

Progestin only

- No increased risk for VTE
- Menstrual changes (spotting, amenorrhea)
- Safe for women with contraindication to estrogen-containing contraception

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Urologic, Obstetric and Gynecologic Conditions

- Answers to Multiple-Choice Questions

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Urologic, Obstetric, and Gynecologic Conditions Q1

A 60-year-old man reports a weak urine stream and sense of incomplete bladder emptying without fever or dysuria. Vital signs are normal. There is no palpable bladder distention. The prostate is diffusely enlarged, firm, and nontender without nodules.

Which of the following is the most appropriate next step in management?

A: Postvoid residual volume measurement

B: Prostate ultrasonography

C: Urinalysis

D: Urodynamic flow studies

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Urologic, Obstetric, and Gynecologic Conditions Q2

A 58-year-old man reports worsening urinary urgency and incontinence despite taking tamsulosin for BPH. He has no other medical problems and takes no other medications. Prostate gland is modestly enlarged, smooth, and nontender. Results of urodynamic studies, PSA testing, and urinalysis are normal.

Which of the following is the most appropriate treatment?

A: Sacral neuromodulation

B: Testosterone gel

C: Tolterodine

D: Transurethral resection of the prostate

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Urologic, Obstetric, and Gynecologic Conditions Q3

A 58-year-old man is evaluated for an 8-month history of ED. He is physically active, has no other medical conditions, and takes no medications. Physical exam, vital signs, and BMI are normal. Early-morning serum testosterone level is normal.

Which of the following is the most appropriate treatment?

A: Intracavernosal alprostadil

B: Sildenafil

C: Testosterone therapy

D: Vacuum erection device

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Urologic, Obstetric, and Gynecologic Conditions Q4

A 62-year-old woman is evaluated for a breast mass. Diagnostic mammogram and ultrasound are normal. On physical exam, there is a firm, 2-cm, nontender mass in the right upper outer quadrant.

Which of the following is the most appropriate diagnostic test?

A: Breast MRI

B: Core needle biopsy

C: Repeat mammography in 6 months

D: Repeat mammography in 2 years

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Urologic, Obstetric, and Gynecologic Conditions Q5

A 22-year-old woman is evaluated following 2 weeks of ongoing nausea and vomiting up to 3 times per day. She is 8 weeks pregnant. Her only medication is a multivitamin with folic acid. She is hypotensive; serum electrolyte levels are normal. Fluid replacement is initiated.

Which of the following is the most appropriate management?

A: Intravenous thiamine and folic acid

B: Serum folate measurement

C: Serum vitamin B_{12} measurement

D: No additional management

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Urologic, Obstetric, and Gynecologic Conditions Q6

A 46-year-old woman reports irregular vaginal bleeding for 12 months. Her last period was 3 months ago and lasted 3 weeks. She has never been pregnant. Medical history is unremarkable; she takes no medications. Vital signs are normal, as is the pelvic exam. A urine pregnancy test is negative.

Which of the following is the most appropriate diagnostic test?

A: Endometrial biopsy

B: Follicle-stimulating hormone test

C: Serum β-human chorionic gonadotropin test

D: Transvaginal ultrasonography

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Urologic, Obstetric, and Gynecologic Conditions Q7

A 54-year-old woman reports a 2-month history of bothersome daily hot flushes, night sweats, and vaginal dryness with dyspareunia. Her last menstrual period was 13 months ago. Medical and surgical history is unremarkable. Mammogram is normal. Ten-year ASCVD risk is 3%.

Which of the following is the most appropriate management?

A: Estradiol level measurement

B: Estradiol-progestin replacement

C: Paroxetine

D: Vaginal estradiol cream

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Geriatric Medicine I

2025 Virtual/Live Internal Medicine Board Review

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ACP Internal Medicine Board Review Course

General Internal Medicine:

Geriatric Medicine I

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Table of Contents: Geriatric Medicine

- Pressure injuries
- Urinary incontinence
- Falls
- Hip fracture in older adults
- Nutrition in older adults
- Depression in older adults
- Clinical pharmacology and aging
- Constipation in older adults

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Geriatric Medicine Q1

A 65-year-old man is evaluated in a nursing home. He is bedbound with multiple sclerosis.

Temperature is 98.4 °F.

Several 1- to 2-cm, indurated, nonblanching, erythematous, shallow ulcers with no purulence or necrosis are noted over the sacrum and bilateral ischial tuberosities.

A pressure redistribution strategy is initiated, and hydrocolloid dressings are applied.

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Geriatric Medicine Q1

A 65-year-old man is evaluated in a nursing home. He is bedbound with multiple sclerosis. Temperature is 98.4 °F. Several 1- to 2-cm, indurated, nonblanching, erythematous, shallow ulcers with no purulence or necrosis are noted over the sacrum and bilateral ischial tuberosities. A pressure redistribution strategy is initiated, and hydrocolloid dressings are applied.

Which of the following is the most appropriate additional treatment?

A: Foam mattress

B: Oral zinc and vitamin C

C: Surgical debridement

D: Vancomycin and piperacillin-tazobactam

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Pressure Injuries

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Pressure Injury: Risk Factors

- Immobility
- Incontinence
- Impaired nutrition
- Diabetes/immunosuppression
- Circulatory impairment

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Pressure Injury: Pathophysiology

- Compression → tissue hypoxia
- Shear forces → stretching, trauma to tissues
- Friction → superficial skin abrasion
- Moisture → skin maceration

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Pressure Injury: Prevention

Positioning and frequent repositioning

- Keep head of bed as flat as possible

Pressure-reducing surfaces

- Advanced static mattresses and overlays
- Chair cushions, device to keep covers off toes, float heels when stationary (pillows/cushion under calves/knees)

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Pressure Injury: Prevention

Manage comorbid conditions

- Diabetes, smoking, immunosuppression, vascular disease

Proper skin care

- Keep skin clean and reduce moisture
- Adequate perfusion
- Avoid pressure and shear forces

Early mobilization

Manage incontinence

Manage malnutrition

- Protein-containing supplements

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Pressure Injury: Diagnosis and Staging

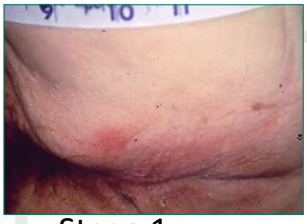
Stage	Description
Stage 1	Nonblanchable erythema of intact skin
Stage 2	Partial-thickness skin loss with exposed dermis
Stage 3	Full-thickness tissue loss extending to subcutaneous fat
Stage 4	Full-thickness tissue loss with exposed bone, muscle, tendon
Unstageable	Full-thickness tissue loss covered with slough and/or eschar
Deep tissue injury	Purple or maroon area of discolored intact or non-intact skin Epidermal separation revealing a dark wound bed or blood-filled blister Represents damage to underlying tissue

Information from Edsberg LE, Black JM, Goldberg M, et al. Revised National Pressure Ulcer Advisory Panel pressure injury staging system: revised pressure injury staging system. J Wound Ostomy Continence Nurs. 2016;43:585-97. [PMID: 27749790]

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Pressure Injury: Diagnosis and Staging



Stage 1



Stage 2



Stage 3



Stage 4

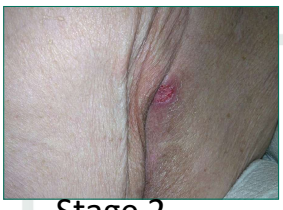
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Pressure Injury: Diagnosis and Staging



Stage 2



Stage 2



Stage ???



Stage 1

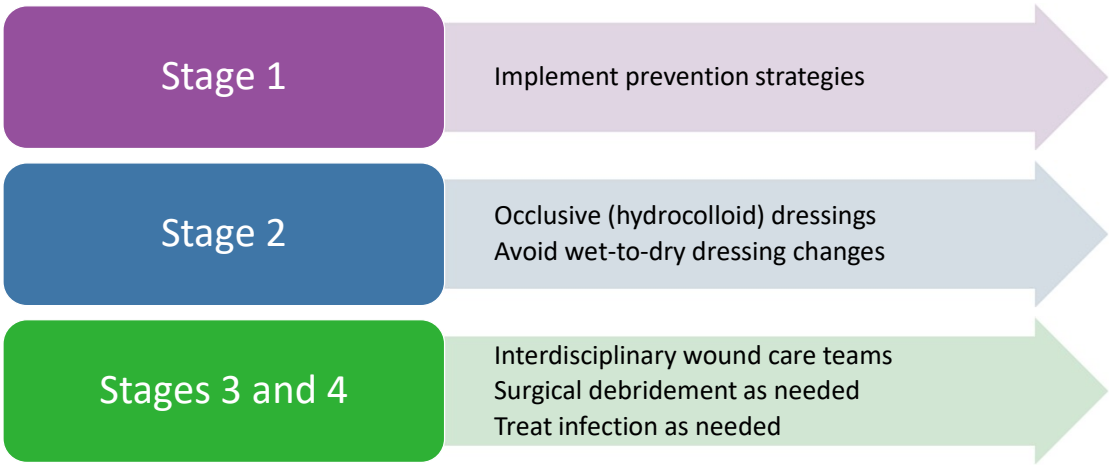


Stage 3

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Pressure Injury: Treatment



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Pressure Injury: Treatment

Avoid swab culture of surface exudate, wound pus, or slough

- Potential for wound contamination

Diagnostic wound culture

- Obtain during surgical debridement (stages 3 & 4) or
- Use Levine technique: Clean wound with normal saline; then obtain swab from expressed exudate from non-necrotic wound tissue beneath wound surface

Consider imaging (radiography, CT, MRI) if osteomyelitis or deep infection is suspected

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Common Types of Ulcers

Ulcer Type	Location	Clinical Presentation	Associated Findings	Risk Factors
Pressure injuries	Over bony prominences	Painful unless impaired sensory function; variable size and shape; bright red to pale pink in color; serous or serosanguinous exudate	Normal surrounding skin; erythema or edema if infected	Immobility, incontinence, impaired nutrition, diabetes mellitus, immunosuppression, circulatory impairment
Venous stasis ulcers	Mid-calf to ankle, often over medial malleolus	Pain variably present; irregularly shaped, shallow, weeping serous fluid; normal arterial pulses	Edema, venous varicosities, eczematous changes, hyperpigmentation, lipodermatosclerosis	Chronic venous insufficiency
Arterial insufficiency ulcers	Distal toes, anterior lower leg	Painful; sharply demarcated borders; dry; pale gray or yellow wound base	Evidence of atherosclerosis, poor pulses, hair loss, shiny skin	Advanced age, smoking, obesity, diabetes mellitus, hyperlipidemia, hypertension
Neuropathic ulcers	Plantar aspect of feet	Painless, occur over pressure points	Decreased sensation, callus formation, neuropathic (Charcot) arthropathy	Diabetes mellitus, peripheral neuropathy

Adapted from Medical Knowledge Self-Assessment Program, 19th edition (MKSAP 19). Philadelphia, PA: American College of Physicians; 2021; selected information from Reuben DB, Herr KA, Paccala JT, et al. Geriatrics at Your Fingertips. New York, NY: American Geriatric Society; 2022.

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Geriatric Medicine Q2

An 86-year-old woman is evaluated for urinary incontinence. She has dementia and osteoarthritis.

She ambulates with a walker.

She cannot make it to the bathroom in time.

Urinalysis is normal.

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Geriatric Medicine Q2

An 86-year-old woman is evaluated for urinary incontinence. She has dementia and osteoarthritis. She ambulates with a walker. She cannot make it to the bathroom in time. Urinalysis is normal.

Which of the following is the most appropriate treatment?

A: Antimuscarinic agent

B: Oral estradiol

C: Pelvic floor muscle training

D: Prompted voiding

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Urinary Incontinence

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Urinary Incontinence: Diagnosis

Type	Incontinence Description
Stress	Associated with increased intra-abdominal pressure (sneezing, laughing, coughing)
Urge	Detrusor overactivity associated with urge to void preceding or accompanied by urine leakage
Overflow	Incomplete bladder emptying, leading to continuous urine leakage or dribbling, weak urinary stream, urinary hesitancy, increased frequency, and nocturia
Functional	Normal bladder/urethral structure and function; physical inability to toilet in a timely manner
Mixed	Combination of stress and urge

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Urinary Incontinence: Testing

Urinalysis

- Exclude UTI in patient with new incontinence or discomfort with voiding

Postvoid residual volume measured by ultrasonography

- Suspected overflow incontinence

Urodynamic studies

- Rarely indicated
- Only for suspected neurologic disease or complex cases

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Urinary Incontinence: Treatment

Stress incontinence

- Pelvic floor muscle training: first line for all patients
- Weight loss: first line for patients with overweight or obesity
- Pessaries, injectable bulking agents, sling cystourethropexy

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Urinary Incontinence: Treatment

Urge incontinence

- Weight loss for patients with overweight or obesity
- Bladder training exercises/timed voiding: first line for all patients
- Antimuscarinic agents: second line
  - Oxybutynin, tolterodine, trospium
  - Darifenacin, solifenacin, fesoterodine
- β-Adrenergic agonist: second line
  - Mirabegron, vibegron

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Urinary Incontinence: Treatment

Mixed incontinence: same as stress and urge, combined

Overflow incontinence

- Stop anticholinergic medications
- Treat BPH
- Intermittent catheterization

Functional incontinence

- Prompted voiding: frequent prompting to use toilet

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Geriatric Medicine Q3

A 72-year-old woman reports having fallen while walking to the bathroom in the dark.

She has had no lightheadedness or previous falls.

Orthostatic vital signs and gait are normal.

Corrected vision is 20/20.

The Timed Up and Go test is completed in 10 seconds.

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A 72-year-old woman reports having fallen while walking to the bathroom in the dark. She has had no lightheadedness or previous falls. Orthostatic vital signs and gait are normal. Corrected vision is 20/20. The Timed Up and Go test is completed in 10 seconds.

Which of the following is the most appropriate management?

A: Education on fall prevention

B: Home safety evaluation

C: Use of a walker

D: Vitamin D supplementation

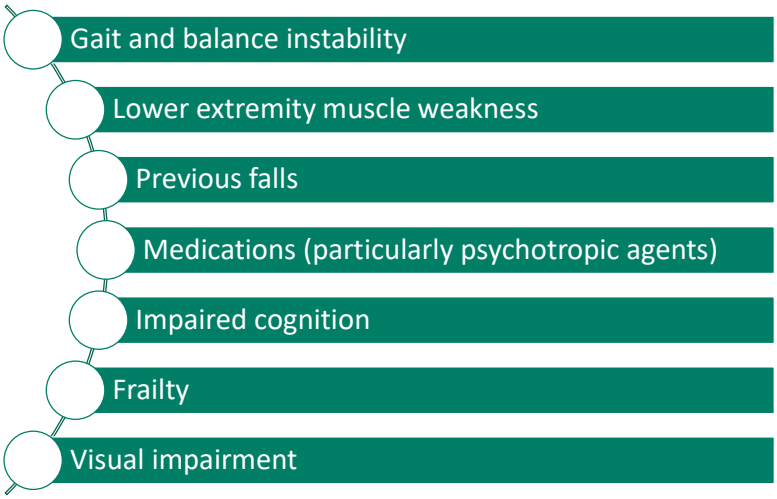
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Falls

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Falls: Risk Factors



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Falls: Testing

Inquire about falls or fear of falling

- Evaluate and refer if positive response

Timed Up and Go test

- Arise from chair, walk 10 feet, turn around, and sit in same chair
- >12 seconds: increased risk for falls
- Identify areas for targeted intervention
  - Rising, gait, turning, balance

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Falls: Prevention and Treatment

- Exercise interventions
- Multidisciplinary fall prevention programs
- Environment modification
- Treatment of contributing conditions
- Interventions for polypharmacy, vision impairment
- Vitamin D replacement not routinely recommended
- Vitamin D supplementation in patients with the following:
  - Osteoporosis
  - Vitamin D deficiency

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Geriatric Medicine Q4

A 68-year-old woman reports experiencing right hip “snapping” and subsequent inability to stand.

She has a 7-year history of alendronate therapy for osteoporosis.

Plain radiograph of the right hip, previously obtained for chronic pain, showed increased cortical width in the femoral shaft.

Significant tenderness to palpation at the proximal thigh is noted.

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Geriatric Medicine Q4

A 68-year-old woman reports experiencing right hip “snapping” and subsequent inability to stand. She has a 7-year history of alendronate therapy for osteoporosis. Plain radiograph of the right hip, previously obtained for chronic pain, showed increased cortical width in the femoral shaft. Significant tenderness to palpation at the proximal thigh is noted.

Which of the following is the most likely cause of this patient's hip pain?

A: Avascular necrosis

B: Bisphosphonate-related femoral fracture

C: Metastatic cancer

D: Multiple myeloma

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Hip Fracture in Older Adults

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Hip Fracture: Risk Factors and Prognosis

Risk factors

- Osteoporosis
- Falls
- Medications
  - Glucocorticoids, PPIs, loop diuretics, thyroid hormone, prolonged bisphosphonate use
  - Sedatives, antidepressants, benzodiazepines, opioids

↑ Risk for death/morbidity following fracture

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Hip Fracture: Diagnosis and Testing

Acute hip pain with inability to bear weight

Displaced fracture

- Increased groin pain
- Shortened and externally rotated leg if femoral neck fracture

Bisphosphonate-related atypical fracture

- Pain may precede fracture
- Subtrochanteric region, along the femoral diaphysis

Hip radiography (AP and lateral)

- MRI if negative radiographic findings

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Hip Fracture: Treatment

Prompt (24-72 hours) fixation or arthroplasty

- Medical therapy alone → four times increased mortality

Pharmacologic or mechanical VTE prophylaxis

- Intermittent pneumatic compression ± LMWH
  - Second line: UFH or fondaparinux
  - DOACs: Insufficient data to recommend use
- Intermittent pneumatic compression alone if high bleeding risk
- Continue for 10-35 days

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Hip Fracture: Treatment

Prevent constipation

- Stimulant laxative (senna or bisacodyl)
- Osmotic laxative (polyethylene glycol)

Prevent pressure injury

- Foam or alternating pressure mattress
- Early mobilization

Prevent urinary retention

- Short-term indwelling catheter
- Early voiding trials
- Intermittent catheterization if voiding trial is unsuccessful

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Hip Fracture: Treatment

Pain management

- Nerve blocks
- Scheduled analgesics

Fall prevention measures/physical therapy

- Early mobilization post-op
- Home modifications
- Prescribed assistive devices to prevent future falls

Treat osteoporosis

- Replete calcium and vitamin D
- Treat same as other cases of osteoporosis

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Nutrition in Older Adults

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Involuntary Weight Loss: Diagnosis

Documented weight loss of >5% within 6 to 12 months

Causes (usually more than one)

- Inadequate dietary intake
  - Chewing, swallowing, malabsorptive disorders
  - Depression, cognitive decline
  - Financial/food access difficulty
  - Dietary restrictions (carbohydrates, sodium)
- Medication effects: dysgeusia
- Endocrine disease (thyroid, adrenal, diabetes)
- Inflammatory effects of disease (cachexia)
  - Chronic diseases, inflammation, cancer

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Involuntary Weight Loss: Testing

Comprehensive history/physical exam

Directed laboratory/radiographic studies

Age-appropriate cancer screening

If indicated:

- Chest radiography
- Abdominal imaging
- Endoscopies

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Involuntary Weight Loss: Treatment

Address identified medical/psychosocial issues

Nutritional supplements

- Unclear effect on morbidity, mortality, or QOL

Appetite stimulants and anabolic agents

- Unclear benefit, adverse effects

Enteral feeding in selected cases

- No benefit in patients with dementia

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Nutritional Deficiencies in Older Adults: Diagnosis and Treatment

Vitamin B_{12}

- Common (10%-20%) → gastric achlorhydria, malabsorption
- Neurologic and hematologic symptoms
- Masked by folate (multivitamin) supplements, enriched foods
  - Vitamin B_{12} deficiency: MMA and homocysteine levels elevated
  - Folate deficiency: MMA level normal, homocysteine level elevated
- Measure vitamin B_{12} (if low, MMA levels)
- Vitamin B_{12} replacement
  - Intake versus absorption issues: absorption issues may require injections

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Nutritional Deficiencies in Older Adults: Diagnosis and Treatment

Vitamin D

- Lack of sunlight, poor diet
- Muscle weakness, functional impairment, depression
- Cholecalciferol supplementation
  - If 25-hydroxyvitamin D level <30 ng/mL (75 nmol/L)
  - 800-1000 U/d

Calcium

- Decreased absorption
- Osteoporosis/bone loss
- Dietary and calcium supplementation, 1200 mg/d

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Geriatric Medicine Q5

An 84-year-old man reports decreased activity, insomnia, and constipation since his wife died 14 months ago.

He also has diabetes, COPD, and BPH.

He lives in an assisted living facility and has no difficulty with ambulation or risk for falls.

PHQ-9 score is 12 (normal range, 0-4).

Mini-Cog assessment is normal.

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Geriatric Medicine Q5

An 84-year-old man reports decreased activity, insomnia, and constipation since his wife died 14 months ago. He also has diabetes, COPD, and BPH. He lives in an assisted living facility and has no difficulty with ambulation or risk for falls. PHQ-9 score is 12 (normal range, 0-4). Mini-Cog assessment is normal.

Which of the following is the most appropriate treatment?

A: Amitriptyline

B: Donepezil

C: Escitalopram

D: Zolpidem

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Depression in Older Adults

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Depression in Older Adults: Diagnosis and Testing

Low energy, somatic symptoms, cognitive dysfunction

PHQ-2, followed by detailed screening if (+)

- PHQ-9
- Geriatric Depression Scale

Same diagnostic criteria as in younger patients

Suicide risk is twice that of younger patients

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Depression in Older Adults: Treatment

Antidepressants

- Selective serotonin reuptake inhibitors (SSRIs) preferred
- Avoid tricyclic antidepressants because of increased adverse effects

Psychotherapy, including cognitive behavioral therapy

- May be used alone or in combination with antidepressants

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Grief: Diagnosis and Treatment

Normal grief

- Adaptation to loss in <12 months
- No feelings of worthlessness, helplessness, guilt
- Supportive care

Pathologic grief

- >12 months
- Intense longing, preoccupation
- Emptiness, inability to live after the loss
- Psychotherapy

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Geriatric Medicine Q6

A 94-year-old woman reports dizziness and confusion 2 weeks after her furosemide dosage was increased.

She has atrial fibrillation and CKD.

Other medications are rivaroxaban, benazepril, gabapentin, metoprolol, omeprazole, and potassium chloride.

Vital signs and physical exam are normal.

Creatinine level has risen from 1.2 mg/dL to 1.8 mg/dL.

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Geriatric Medicine Q6

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Which of the following most likely caused this patient's symptoms?

A: Heart failure

B: Infection

C: Medication effect

D: Stroke

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Clinical Pharmacology and Aging

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Geriatric Prescribing

Discontinue all nonessential medications

Use anticholinergic medications with caution

Avoid the "prescribing cascade"

Consequences of polypharmacy

- ↑ Risk of adverse drug reactions, drug-drug interactions
- ↑ Cognitive impairment, falls, malnutrition, incontinence
- ↓ Functional ability
- ↓ Medication adherence

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Beers Criteria (American Geriatrics Society)

Drugs classified into three categories

- Always avoid
- Potentially inappropriate
- Use with caution

↓ Hospitalizations due to adverse drug reactions

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Geriatric Prescribing

Prescribing medication: Start low, go slow

- Start lower dosages
- Longer periods between dose changes

Adjust dosages for kidney function

Evaluate for drug-drug interactions

Inquire about supplements, OTC meds



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Geriatric Medicine Q7

A 73-year-old man is evaluated for chronic constipation.

He has straining with stooling, hard stools, and longer periods between stools.

Dietary fiber and bulking agents have not been effective.

Screening colonoscopy 3 years ago was normal.

Physical exam is normal.

Plain abdominal radiograph shows stool throughout the colon.

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Geriatric Medicine Q7

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Which of the following is the most appropriate management?

A: Anorectal manometry

B: Docusate sodium

C: Lactulose

D: Polyethylene glycol

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Constipation in Older Adults

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Constipation in Older Adults: Diagnosis

Infrequent, difficult, or incomplete defecation

Primary constipation often due to slowed colonic transit as a physiologic consequence of aging

Medications/polypharmacy: most common secondary cause

- Opioids
- Anticholinergic drugs
- Calcium channel blockers
- Antidiarrheal agents

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Constipation in Older Adults: Diagnosis

Neuropathic

- Autonomic dysfunction, Parkinson disease, spinal cord injury

Endocrine/metabolic

- Diabetes, ↓ thyroid, ↑ calcium level, ↓ potassium level, kidney failure

Depression, immobility

Mechanical obstruction

- Colon cancer, rectocele, stricture, pelvic floor dysfunction

IBS-C

- Typically associated with abdominal pain ± visceral hypersensitivity

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Constipation in Older Adults: Treatment

Diet and lifestyle changes

- Adequate water intake, dietary fiber, exercise

Bulking agent (psyllium)

- With adequate water intake

Osmotic laxatives

- Low-dose polyethylene glycol (PEG) is efficacious, well tolerated
- Lactulose, sorbitol are less effective than PEG; adverse effects

Stimulant laxatives: senna, bisacodyl

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Constipation in Older Adults: Treatment

Recalcitrant constipation

- Combination of agents with different actions

Pharmacologic options

- Lubiprostone, linaclotide (secretagogues)
- Adverse effects, ↑ cost

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Constipation in Older Adults: Treatment

Biofeedback for associated pelvic floor dysfunction

Avoid the following:

- Phosphate-based enemas: may cause electrolyte derangements
- Magnesium-based laxatives in patients with chronic kidney disease
- Docusate sodium (stool softener): ineffective

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Geriatric Medicine I

- Answers to Multiple-Choice Questions

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C: Pelvic floor muscle training

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Geriatric Medicine II

2025 Virtual/Live Internal Medicine Board Review

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ACP Internal Medicine Board Review Course

General Internal Medicine:

Geriatric Medicine II

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- Elder mistreatment
- Home care
- End-of-life and palliative care
- Pain management

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Elder Mistreatment

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Elder Mistreatment: Risk Factors

- Older age
- Functional impairment
- Cognitive impairment
- Social isolation
- External stressors (financial, illness)
- Lower socioeconomic status
- Shared living space with multiple other adults

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Elder Mistreatment: Diagnosis

Physical, sexual, or emotional abuse or neglect; financial exploitation

Indicators include the following:

- Unexplained lacerations
- Bruising
- Fractures
- Malnutrition or dehydration
- Pressure ulcers
- Withdrawn behavior/isolation
- Medication nonadherence
- Fear of caretaker

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Elder Mistreatment: Treatment

Assess for safety

Document carefully and accurately

Refer to appropriate investigative resources

May be a legally reportable diagnosis (most states)

- Adult Protective Services

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Geriatric Medicine Q8

A 74-year-old man has had eight emergency department visits for COPD during the past 12 months.

He becomes fearful and calls an ambulance whenever he has dyspnea.

He lives alone and lacks transportation.

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A 74-year-old man has had eight emergency department visits for COPD during the past 12 months. He becomes fearful and calls an ambulance whenever he has dyspnea. He lives alone and lacks transportation.

Which of the following is the most appropriate management?

A: Home-based care

B: Hospice referral

C: Pulmonary referral

D: Skilled nursing facility placement

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Home-Based Care

9

Home-Based Care

Interdisciplinary patient-centered care model

- Longitudinal primary care through home visits
- Episodic home-based care to supplement or replace office-based care
- Home health services (nursing, social work, other therapies)
- Home hospice services
- Hospital-at-home model for acute disease exacerbations

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Home-Based Care: Benefits

↓ Need for acute care in hospitals/emergency departments

↓ Rates of institutionalization

↓ Rates of readmission

↓ Cost of care

↑ Patient satisfaction

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Home-Based Care: Benefits

Patient populations with evidence for benefit

- Older adults who are frail, homebound
- Patients with complex, chronic, and progressively disabling disease
- Patients with degenerative neuromuscular conditions or spinal cord injury
- Patients with chronic comorbid conditions who are frequent users of emergency department and in-hospital care

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Geriatric Medicine Q9

An 88-year-old woman is evaluated for chronic, progressive severe dyspnea.

She has advanced emphysema.

Medications are tiotropium, mometasone-formoterol, as-needed albuterol, and oxygen.

She wishes to pursue a palliative approach with a focus on symptom control.

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An 88-year-old woman is evaluated for chronic, progressive severe dyspnea. She has advanced emphysema. Medications are tiotropium, mometasone-formoterol, as-needed albuterol, and oxygen. She wishes to pursue a palliative approach with a focus on symptom control.

Which of the following is the most appropriate treatment?

A: Nebulized lidocaine

B: Nebulized morphine

C: Oral lorazepam

D: Oral morphine

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End-of-life and Palliative Care

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Palliative Medicine

Appropriate at any age and any stage of serious disease

Can be provided with curative treatment

Management of pain and other symptoms

Management of affective symptoms resulting from illness

Discussions about:

- Prognosis
- Goals of treatment
- Suffering
- Code status
- Advance directives

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Palliative Medicine

Treat underlying conditions when appropriate

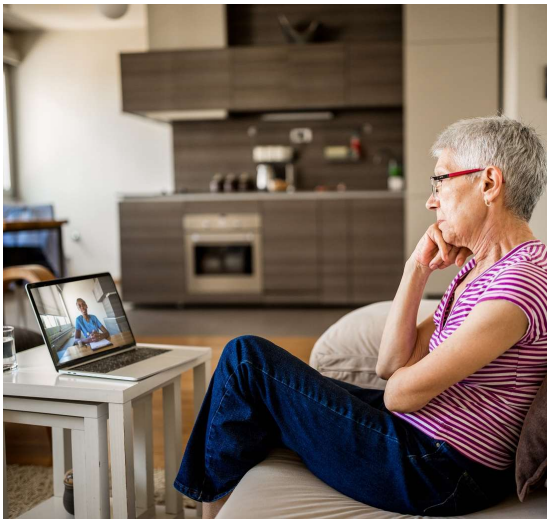
Dyspnea

- Systemic opioids (first line)
  - No role for inhaled/nebulized opioids
- Management of anxiety
- Fan blowing on face
- Supplemental oxygen

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Palliative Medicine



Anxiety

- Social support, relaxation therapy, exercise
- Psychotherapy, especially cognitive behavioral therapy
- Short-term use of benzodiazepines
- SSRI/SNRI depending on life expectancy

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Palliative Medicine

Depression

- Consider comorbid conditions that may be contributing
- Should not be expected; treat aggressively
- SSRI, SNRI, and/or CBT
- Methylphenidate or dextroamphetamine
  - ↓ Symptoms within days
  - Patients with limited life expectancy (<6 weeks)

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Palliative Medicine

Anorexia-cachexia and weight loss

- Treat reversible causes
  - Medications, disease, or treatment-related symptoms
- Family education
- Megestrol acetate (appetite stimulant)
  - No effect on QOL/mortality, associated with adverse events (edema, VTE)
- Cannabinoids (appetite stimulant)
  - Insufficient evidence
- Avoid enteral/parenteral nutrition
  - No effect on morbidity/mortality at end of life
  - Can cause ↑ terminal secretions and edema



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Palliative Medicine: Nausea

Nausea Cause	Treatment
Gut wall stretching or dilatation (constipation, bowel obstruction, ileus)	Antidopaminergic antiemetics (olanzapine, metoclopramide, prochlorperazine, haloperidol) Glucocorticoids for malignant bowel obstruction
Gut mucosal injury (radiation, chemotherapy, infection, inflammation, direct tumor invasion)	Serotonin antagonists (ondansetron, granisetron)
Drugs, metabolic byproducts, bacterial toxins	Antidopaminergic antiemetics, glucocorticoids, serotonin antagonists, and neurokinin-1 receptor blockers (aprepitant, netupitant)
Anticipatory nausea	Behavioral therapy, benzodiazepines, olanzapine
Increased intracranial pressure	Glucocorticoids, palliative radiation if brain metastases

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Palliative Medicine

Constipation

- Consider comorbid conditions that may be contributing
- Common at end of life and among patients receiving palliative care
- Treat underlying conditions
  - Hypothyroidism, low-fiber diet, dehydration
- Limit constipating medications if possible
  - CCBs, anticholinergics, iron, opioids
- Laxatives
  - Stimulant (e.g., sennosides)
  - Osmotic (e.g., PEG)
  - Opioid antagonists for refractory opioid-induced constipation

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Palliative Medicine

Diarrhea

- Consider and treat causes at end of life
  - Overuse of laxatives
  - Partial bowel obstruction or fecal impaction
  - Radiation enteritis
  - Pancreatic insufficiency
- Medications
  - Loperamide: first line
  - Diphenoxylate: effective but has anticholinergic adverse effects
  - Bismuth: reduces number of stools but has slower onset of action
- Avoid milk and lactose-containing products

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Palliative Medicine

Agitation, delirium

- Common at end of life
- Distressing to families
- Nonpharmacologic management strategies first line
- Second-line therapies include haloperidol or benzodiazepines (if sedation is the goal, but they do not reverse delirium)

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Palliative Medicine

Oropharyngeal secretions ("death rattle")

- Patient/caregiver education on normal dying process
- Head of bed raised, lateral positioning
- Deep suctioning only for respiratory distress attributable to significant secretions
- Prophylactic subcutaneous glycopyrrolate or transdermal scopolamine in some cases
  - Reduced death rattle occurrence
  - May marginally prolong dying phase

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Hospice

Specialized interdisciplinary care when

- Life expectancy ≤6 months
- Disease-directed treatment no longer effective or desired

Maximizes quality of life for terminally ill patients

Provides bereavement services for family members

Does not provide 24-hour care

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End-of-Life Planning



Desires for end-of-life care

Specific goals of care

Advance directives

- Guidance on patient wishes if incapacitated (e.g., living will)
- Identification of a surrogate decision maker

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Geriatric Medicine Q10

A 74-year-old man has worsening metastatic cancer–related hip pain.

Despite ibuprofen and immediate-release (IR) morphine every 6 hours, pain recurs 4 hours after dosing.

He has no symptoms of cord compression and has declined radiation therapy.

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Geriatric Medicine Q10

A 74-year-old man has worsening metastatic cancer–related hip pain. Despite ibuprofen and immediate-release (IR) morphine every 6 hours, pain recurs 4 hours after dosing. He has no symptoms of cord compression and has declined radiation therapy.

Which of the following is the most appropriate treatment?

A: Add gabapentin three times daily

B: Increase IR morphine to every 4 hours

C: Switch to IR oxycodone every 4 hours

D: Switch to sustained-release morphine twice daily

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Pain Management

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Pain: Diagnosis

Assess impact of pain on ADLs and quality of life

Review previous pain treatments

Classify pain

- Duration
  - Acute (<6 weeks' duration); chronic (>3 months' duration)
- Type
  - Nociceptive pain
    - Somatic: aching, stabbing, throbbing
    - Visceral: crampy, squeezing, pressure
  - Neuropathic: burning, electric, prickling pain

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Pain: Diagnosis in Patients With Cancer

Look for pain syndromes

- Cauda equina syndrome
- Radiculopathy
- Headache
- Partial bowel obstruction

Assess possible disease-directed treatments

Consider comorbid conditions to guide pain therapy

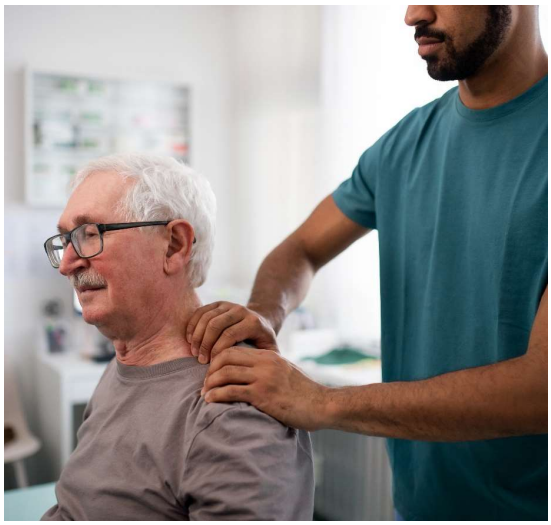


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Pain: Nonpharmacologic therapy

- First-line treatment in chronic pain
- Treat, refer mental health issues
- Physical therapy, exercise programs
- CBT, mindfulness, biofeedback
- Massage, spinal manipulation, acupuncture



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Pain: Non-Opioid Pharmacologic Treatment

Nociceptive Pain	Neuropathic Pain
Acetaminophen	Gabapentinoids (gabapentin, pregabalin)
NSAIDs (oral, topical)	SNRIs (duloxetine)
Topical anesthetics (lidocaine)	TCAs (amitriptyline)
Capsaicin	

Combined nociceptive/neuropathic pain (most common)

- Multimodal therapy

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Pain: Opioid Therapy

No evidence supports long-term use in chronic pain

Lowest effective dose, shortest duration

Avoid opioids + benzodiazepines: may result in respiratory depression

Minimize risk of overdose and opioid use disorder

- Opioid risk assessment
- Opioid overdose protection (naloxone)
- Prescription drug monitoring program review
- Close monitoring

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Pain: Opioid Therapy

Morphine contraindicated in kidney failure

Transdermal fentanyl in opioid-tolerant patients only

Methadone: complex dosing requirement

Buprenorphine

- Greater safety profile but same risks as other opioids

Do not use meperidine or tramadol

- Meperidine has a toxic metabolite
- Tramadol
  - Multiple drug interactions
  - Seizures, orthostatic hypotension, hyponatremia, falls, serotonin syndrome (when combined with SSRIs)

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Pain: Constipation due to Opioid Therapy

Rule out impaction/obstruction

Start laxatives with opioid initiation

- Stimulant laxative
- Add osmotic laxative (PEG)

Add naldemedine, naloxegol, or methylnaltrexone

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Geriatric Medicine II

- Answers to Multiple-Choice Questions

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D: Switch to sustained-release morphine twice daily

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Ethics and Patient Safety

2025 Virtual/Live Internal Medicine Board Review

Kahli Zietlow, MD
Clinical Associate Professor, Geriatric and Palliative Medicine
Program Director, Geriatric Medicine Fellowship Program
Director of Interprofessional Education
University of Michigan Medical School
University of Michigan
Ann Arbor MI

ACP Internal Medicine Board Review Course

General Internal Medicine: Ethics and Patient Safety

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Table of Contents: Ethics and Patient Safety

- Ethics
- Assessment of decisional capacity and competency; surrogate decision making
- Safety and quality improvement

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Ethics and Patient Safety Q1

A colleague appears disengaged, distracted, moody, and forgetful.

He has lapses of judgment and has committed errors.

When asked whether something is wrong and help is needed, the colleague is hostile and reports no problems.

3

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Ethics and Patient Safety Q1

A colleague appears disengaged, distracted, moody, and forgetful. He has lapses of judgment and has committed errors. When asked whether something is wrong and help is needed, the colleague is hostile and reports no problems.

Which of the following is the most appropriate course of action?

A: Ask other physicians if they have concerns

B: Closely observe the colleague

C: Inform the colleague's supervisor

D: Search medical records for evidence of negligent care

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Ethics

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Primacy of Patient Welfare

- Duty to act for the benefit of the patient (beneficence)
- Duty to minimize patient harm (nonmaleficence)
- Duty to provide care regardless of patient characteristics
- Care that is always respectful, competent, and compassionate
- Care that supersedes economic, personal, societal, and administrative forces

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Conflicts of Interest

- Financial, professional, and personal concerns may impair objectivity
- Clinicians have a duty to recognize, disclose, and manage all conflicts of interest
- Accepting gifts, hospitality, and other items may pose conflicts



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Medical Aid in Dying



Photo by michaeljung/Shutterstock.com.

- Physician provides a lethal prescription
- Patient self-administers the drug
- Legal in some states
- Evaluate patients for:
  - Depression
  - Uncontrolled pain
  - Decision-making capacity

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Withholding or Withdrawing Life-Sustaining (Disease-Directed) Treatment

- Patients with decision-making capacity can decline treatment
- No ethical distinction between withholding and withdrawing treatment
- Symptom-focused management and palliative care continue

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Termination of the Physician-Patient Relationship

Patient may terminate the relationship at any time

Physician may terminate the relationship with the following imperatives:

- Patient is in stable health
- Formal, written documentation of termination is provided
- Information on obtaining a new clinician is provided

Patient abandonment is unethical

- Withdrawing without reasonable notice
- Withdrawing without providing a competent replacement

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Confidentiality

Protect patient privacy and confidentiality

Confidentiality not absolute in the following cases:

- Patient at risk for harming self or others
- Suspected child or elder abuse
- Reportable communicable diseases
- Information relating to minors (aged 13 years or younger, at minimum)

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Requests for Inappropriate Treatments



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- No obligation to provide treatments with no clinical benefit
- Laws regarding how to respond to these requests may vary by location of practice

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Disclosure of Medical Errors



Photo by Klaus Tiedge/iStockphoto/Getty Images.

Inform patients of medical errors regardless of outcome

Disclosure

- Optimizes informed decision making
- Promotes trust
- May reduce risk for litigation

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Disclosure of Medical Errors

Disclosure should include the following:

- Facts about the event without assigning blame
- Expression of regret for unanticipated outcome
- Formal apology if outcome was caused by error or system failure
- Assurance of systematic root-cause analysis to help prevent a similar future error

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Physician Impairment

Physicians have an obligation to protect the welfare of patients

Address concerns with the colleague

Report impairment to the physician's supervisor

All states and territories have physician health programs (PHPs)

- PHPs allow for anonymous reporting of impaired physicians

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Ethics and Patient Safety Q2

An 83-year-old man has severe pneumonia. He is unable to make decisions about his care because of his current condition.

The need for mechanical ventilation is imminent.

He does not have an advance directive.

His only living relative is his adult daughter, who is struggling with decision making regarding mechanical ventilation.

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Ethics and Patient Safety Q2

An 83-year-old man has severe pneumonia. He is unable to make decisions about his care because of his current condition. The need for mechanical ventilation is imminent. He does not have an advance directive. His only living relative is his adult daughter, who is struggling with decision making regarding mechanical ventilation.

Which of the following is the most appropriate recommendation?

A: Ask the daughter to decide based on the patient's best interests

B: Ask the daughter to decide based on what she feels is correct

C: Ask the daughter what the patient would do if he were able to make the decision

D: Request a court-appointed guardian

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Assessment of Decisional Capacity and Competency; Surrogate Decision Making

ACP

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Informed Consent and Refusal

Patient understands the proposed intervention

Alternative options presented

Risks and benefits explained

Patient's understanding assessed

Obtaining informed consent requires that the patient:

- Has decision-making capacity
- Makes decisions of their own free will



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Assessment of Competency

- Global incapacity (historically, incompetence) is a legal determination
- Absence of judicial determination → patient is their own legal decision maker
- Clinicians must still assess capacity to make decisions regarding current care plan

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Assessment of Decision-Making Capacity

Criteria for decision-making capacity:

- Understands the relevant information
- Appreciates the situation and consequences
- Reasons about treatment options
- Communicates a choice



Dementia, mental health disorders ≠ absence of capacity

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Advance Directives (Living Wills)

Outline patient's wishes for treatment in the event of lost decision-making capacity

- Appoint a health care power of attorney (HCPOA)
  - Someone identified by the patient to make medical decisions on their behalf in the event of lost decision-making capacity
  - Those without a valid decision maker may be assigned legal guardian
- Establish treatment preferences at end of life
  - May include do-not-attempt-resuscitation (DNAR), do-not-hospitalize (DNH), and do-not-intubate (DNI)

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Advance Directives (Living Wills)

Physician orders for life-sustaining treatment (POLST) or medical orders for life-sustaining treatment (MOLST)

- Standardized forms to outline patient preferences

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Safety and Quality Improvement

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Patient Safety Issues

Common examples:

- Diagnostic errors
- Medication errors
- Communication errors (care transitions)
- Infection

Often best addressed with systems-based interventions

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Diagnostic Errors

Most result from a faulty cognitive approach

Common heuristic diagnostic errors:

- Reasoning influenced by recent diagnoses (availability heuristic)
- Premature closure (anchoring heuristic)
- Pattern recognition (representativeness heuristic)

When evidence does not fit the diagnosis, use diagnostic timeout and switch to systematic approach

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Strategies to Reduce Medication Errors

- Computerized order entry
- Banning of abbreviations
- Bar code implementation in pharmacies
- Medication reconciliation
- Written instructions for patients
- Patients bring medications to office visit



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Strategies to Improve Patient Handovers (Handoffs)

- Standardized process (e.g., I-PASS)
- Written template
- Face-to-face communication
- Environmental optimization (no interruptions)
- Involvement of entire team
- Prioritization of patients with greatest needs

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Strategies to Improve Care Transitions

- Discharge summary available
- Effective physician communication
- Predischarge patient education
- Medication reconciliation
- Timely posthospitalization follow-up

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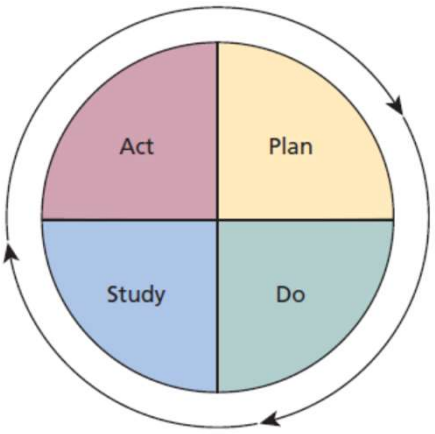
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Quality Improvement

Goal is to improve patient safety and outcomes

Strategy:

- Identify specific goal to address deficiency
- Plan intervention
- Implement/test intervention
- Measure change, evaluate consequence
- Determine necessary modification
- Implement/test modified intervention



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Quality Improvement

Quality measures defined by local health care system and by external stakeholders

- The Joint Commission
- National Committee for Quality Assurance

Quality measures are publicly reported

Quality measures can be tied to reimbursement/penalties

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Ethics and Patient Safety

- Answers to Multiple-Choice Questions

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2025 Greater Chicago Internal Medicine Board Review course
Program Schedule – In-Person and Virtual Live
Tuesday, May 13 – Saturday, May 17, 2025
Central Daylight Time

Friday, May 16, 2025

Time	Topic	Content	Faculty
7:00 a.m. – 8:00 a.m.	**Breakfast**		
8:00 a.m. – 9:00 a.m.	**Cardiology I: Ischemic Heart Disease**	➢ Stable Angina Pectoris ➢ Acute Coronary Syndrome ➢ ACS Complications ➢ Peripheral Artery Disease ➢ Aortic Disease	 *Tanuka Datta Piech, MD*
9:00 a.m. – 10:00 a.m.	**Cardiology II: Pericardial and Valvular Disease**	➢ Acute Pericarditis and Pericardial Effusion ➢ Tamponade ➢ Aortic Stenosis ➢ Aortic Regurgitation ➢ Mitral Regurgitation ➢ Prosthetic Heart Valve	*Tanuka Datta Piech, MD*
10:00 a.m. – 10:15 a.m.	**15-Minute Break**		
10:15 a.m. – 11:15 a.m.	**Cardiology III: Arrhythmias**	➢ Conduction Defects ➢ Bradyarrhythmias ➢ Tachyarrhythmias ➢ Other Dysrhythmias (Cardiac Resuscitation)	*Tanuka Datta Piech, MD*
11:15 a.m. – 12:15 p.m.	**Cardiology IV: Heart Failure and Endocarditis**	➢ Heart Failure With Reduced Ejection Fraction ➢ Dilated Cardiomyopathy ➢ Heart Failure With Preserved Ejection Fraction ➢ Restrictive Cardiomyopathy ➢ Endocarditis ➢ Preoperative Consultation	*Tanuka Datta Piech, MD*

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Friday, May 16, 2025			
12:15 p.m. – 1:15 p.m.	**1-Hour Break**		
1:15 p.m. – 2:30 p.m.	**General Internal Medicine: Musculoskeletal Problems**	➢ Shoulder Syndromes ➢ Elbow Syndromes ➢ Wrist and Hand Syndromes ➢ Hip and Pelvic Pain ➢ Back Pain ➢ Knee Syndromes ➢ Foot and Ankle Syndromes ➢ Sports Injuries and Trauma	 *Rebecca M. Northway, MD*
2:30 p.m. – 3:30 p.m.	**General Internal Medicine: Eye, Ear, Nose, and Throat Disorders**	➢ Bacterial Conjunctivitis ➢ Allergic Conjunctivitis ➢ Uveitis/Iritis ➢ Common Cold ➢ Allergic Rhinitis ➢ Acute and Chronic Sinusitis ➢ Epistaxis ➢ Otitis Media and Externa ➢ Pharyngitis	*Rebecca M. Northway, MD*
3:30 p.m. – 3:45 p.m.	**15-Minute Break**		
3:45 p.m. – 4:45 p.m.	**Hematology I: Erythrocyte Disorders and Transfusions**	➢ Iron Deficiency Anemia ➢ Anemia of Chronic Disease or Organ Failure ➢ Autoimmune Hemolytic Anemia ➢ Microangiopathic Hemolytic Anemia ➢ Megaloblastic Anemia ➢ Polycythemia Vera and Other Erythrocytosis ➢ Indications for Transfusion ➢ Complications of Transfusions	 *Marcus Geer, MD*
4:45 p.m. – 5:45 p.m.	**Hematology II: Leukocyte, Platelet, and Clotting Disorders**	➢ Leukocyte Disorders ➢ Chronic Myeloid Leukemia ➢ Immune Thrombocytopenic Purpura ➢ Drug-Induced Qualitative Platelet Dysfunction	*Marcus Geer, MD*

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Friday, May 16, 2025			
4:45 p.m. – 5:45 p.m.	**Hematology II: Leukocyte, Platelet, and Clotting Disorders (*cont.*)**	➢ Heparin-Induced Thrombocytopenia ➢ Antiphospholipid Syndrome ➢ Venous Thromboembolic Disorders	*Marcus Geer, MD*
5:45 p.m.	**Adjourn**		

Cardiology I

2025 Virtual/Live Internal Medicine Board Review

Tanuka Datta Piech, MD
Assistant Professor, Cardiovascular Disease
University of Michigan
Ann Arbor, MI

ACP Internal Medicine Board Review Course

Cardiology I: Ischemic Heart Disease

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Table of Contents: Ischemic Heart Disease

- Stable angina pectoris
- Acute coronary syndrome
- Complications of acute coronary syndrome
- Peripheral artery disease
- Aortic disease

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Ischemic Heart Disease Q1

A 72-year-old man reports a 3-month history of stable exertional chest pain.

Exercise ECG shows 1.5-mm ST-segment depression in leads II, III, and aVF; the patient develops chest pressure during testing.

Duke treadmill score is −11.5.

3

3

Ischemic Heart Disease Q1

A 72-year-old man reports a 3-month history of stable exertional chest pain. Exercise ECG shows 1.5-mm ST-segment depression in leads II, III, and aVF; the patient develops chest pressure during testing. Duke treadmill score is −11.5.

Which of the following is the most appropriate management?

A: Cardiac catheterization

B: Clopidogrel

C: Stress myocardial perfusion imaging

D: Subcutaneous low-molecular-weight heparin (LMWH)

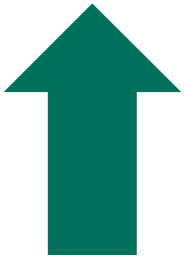
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4

Stable Angina Pectoris

5

Stable Angina: Pathophysiology



Myocardial O_2 demand

- Myocardial wall tension
- Myocardial contractility
- Heart rate



Myocardial O_2 supply

- Coronary artery diameter
- Perfusion pressure
- Hemoglobin

6

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Angina Mimics

- Heart failure
- Aortic stenosis
- Gastroesophageal reflux disease
- Asthma
- Pulmonary hypertension
- Hypertrophic cardiomyopathy

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Stable Angina: Testing

Baseline ECG

Estimate pretest probability of obstructive CAD

Testing for CAD probability of 10% to 90%

- Older and/or more obstructive CAD suspected
  - Stress testing
- Younger and/or less obstructive CAD suspected
  - Coronary CT angiography

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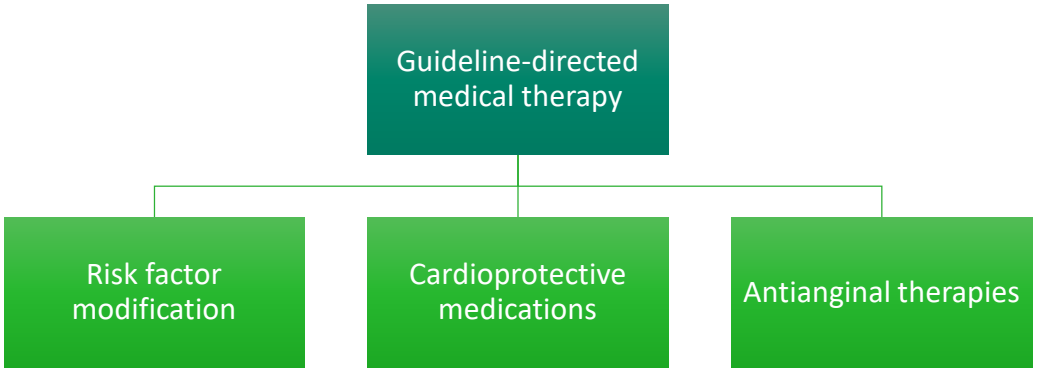
Stable Angina: Stress Testing

Patient Characteristics	Stress Test
Able to exercise with: • Normal or nonspecific changes on baseline ECG (including complete RBBB)	Exercise echocardiography Exercise perfusion imaging Exercise ECG
Able to exercise with: • Previous myocardial revascularization • Preexcitation (e.g., WPW pattern) • Baseline ST depression >1 mm • Taking digoxin • LV hypertrophy	Exercise perfusion imaging Exercise echocardiography
Able to exercise with: • LBBB • Paced ventricular rhythm	Vasodilator perfusion imaging
Unable to exercise	Vasodilator perfusion imaging Dobutamine echocardiography Stress CMR Coronary CT angiography (with or without FFR)

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Stable Angina: Guideline-Directed Medical Therapy



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Stable Angina: Risk Factor Modification

- Tobacco cessation
- Daily aerobic exercise
- BP <130/80 mm Hg
- Glycemic control
- Weight loss if overweight

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Stable Angina: Cardioprotective Medications

Low-dose aspirin (clopidogrel if aspirin intolerant)

High-intensity statin therapy (preferred)

Moderate-intensity statin therapy

- Age >75 years
- Intolerance to high-intensity therapy

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Stable Angina: Other Medical Therapies

SGLT2 inhibitor or GLP-1 agonist

- Patients with diabetes
- ↓ Rates of acute MI, CVA, and CV death
- Benefits independent of glucose reduction

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Stable Angina: Antianginal Therapies

β-Blocker

- Resting heart rate goal of 55-60/min
- Use β_1-selective agent with lung disease

CCB

- β-Blockers not adequate, not tolerated, or contraindicated
- Use nondihydropyridine CCBs (except in patients with LV dysfunction)
- Avoid nifedipine, other short-acting CCBs

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Stable Angina: Antianginal Therapies

Nitrates

- Short-acting nitrates for acute pain relief
- Long-acting nitrates
  - Reduce anginal episodes
  - 12-hour nitrate-free period
- Contraindications
  - PDE-5 inhibitor use
  - Severe aortic stenosis, HCM

Ranolazine

- ↓ Angina and improves exercise capacity

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Ischemic Heart Disease Q2

A 63-year-old man is evaluated for activity-limiting angina, which is being treated with optimal GDMT, including a β-blocker.

He has type 2 diabetes.

BP is 112/72 mm Hg; pulse rate is 60/min.

Angiogram reveals multivessel disease with involvement of the proximal LAD artery.

LVEF is 50%.

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Ischemic Heart Disease Q2

A 63-year-old man is evaluated for activity-limiting angina, which is being treated with optimal GDMT, including a β-blocker. He has type 2 diabetes. BP is 112/72 mm Hg; pulse rate is 60/min. Angiogram reveals multivessel disease with involvement of the proximal LAD artery. LVEF is 50%.

Which of the following is the most appropriate management?

A: CABG

B: Change β-blocker to CCB

C: Multivessel PCI

D: Myocardial viability scan

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Stable Angina: Coronary Revascularization

Indications

- Angina refractory to medical therapy
- Large area of reversible ischemic myocardium
- High-risk criteria on stress testing
- Significant CAD with reduced LV function
- Left main stenosis or equivalent

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Stable Angina: Coronary Revascularization

PCI: no mortality advantage over medical therapy for most stable CAD

CABG primarily indicated for the following:

- Left main stenosis or equivalent (proximal LAD or LCX stenosis)
- Complex or diffuse three-vessel disease
- Multivessel disease (with LAD involvement) and diabetes
- Multivessel disease and LV dysfunction

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Ischemic Heart Disease Q3

A 78-year-old man is evaluated in the emergency department for 13 hours of chest pain.

Troponin I level is elevated.

ECG shows 2-mm ST-segment elevation in leads V_1 through V_4 and 1-mm ST-segment depression in leads II and III.

Emergent cardiac catheterization shows severe stenosis of the proximal LAD artery.

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Ischemic Heart Disease Q3

A 78-year-old man is evaluated in the emergency department for 13 hours of chest pain. Troponin I level is elevated. ECG shows 2-mm ST-segment elevation in leads V_1 through V_4 and 1-mm ST-segment depression in leads II and III. Emergent cardiac catheterization shows severe stenosis of the proximal LAD artery.

Which of the following is the most appropriate treatment?

A: CABG

B: Intracoronary thrombolytic therapy

C: Medical therapy

D: Primary PCI

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Acute Coronary Syndrome

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ACS: Diagnosis

Acute-onset, substernal chest pain

Non–chest pain symptoms (more common in women, patients with diabetes, older adults)

- Dyspnea
- Lightheadedness
- Isolated jaw or left arm pain
- Nausea, epigastric pain
- Diaphoresis
- Weakness

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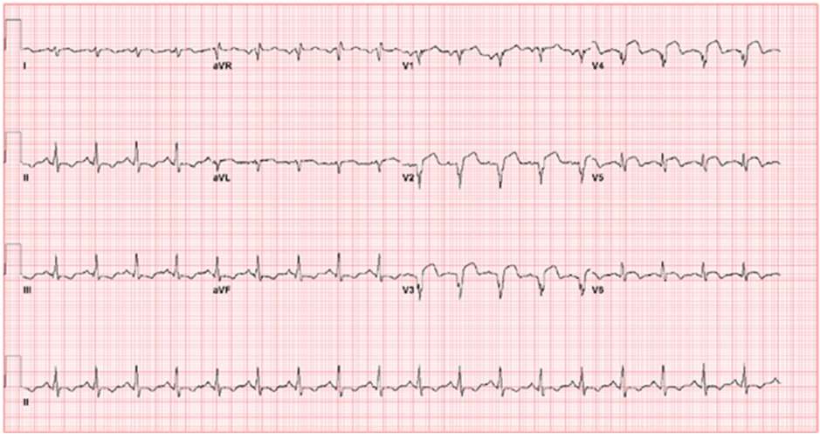
Diagnosis of ACS in Patients With Chest Pain or Ischemic-Equivalent Symptoms

Syndrome	Description
NSTE-ACS	
Unstable angina	**Normal cardiac biomarkers** Possible nonspecific ECG changes (ST-segment depression or T-wave inversion)
NSTEMI	**Positive biomarkers** without ST elevations or ST-elevation equivalents
STEMI	**Positive biomarkers** ST elevation ≥1 mm in ≥2 contiguous leads (except V_2-V_3) ST elevation in leads V_2-V_3 Men aged <40 years: ≥2.5 mm; Men aged ≥40 years: ≥2 mm Women: ≥1.5 mm ST-elevation equivalents New LBBB Posterior MI (tall R waves + ST depression in V_1-V_3)

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Diagnosis of ACS in Patients With Chest Pain



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ACS: Initial Medical Treatment

Aspirin and $P2Y_{12}$ inhibitor

O_2 therapy for O_2 saturation <90%-92%

Anticoagulants

- Unfractionated heparin
- LMWH
- Bivalirudin
- Fondaparinux

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ACS: Initial Medical Treatment

β-Blockade (e.g., metoprolol, atenolol, carvedilol)

- Contraindications
  - Cocaine-induced vasospasm
  - Decompensated HF
  - Shock/hypotension
  - Bradycardia
  - High-grade atrioventricular block
  - Severe bronchospasm

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ACS: Initial Medical Treatment

Nitroglycerin, except in patients with:

- Inferior/posterior infarction
- Aortic stenosis
- Obstructive HCM
- Hypotension
- PDE-5 inhibitor use

High-intensity statin

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STEMI: Reperfusion Therapy

PCI preferred

- Within 12 hours of symptom onset
- Delayed PCI (>12 h) if ongoing ischemia, HF, or cardiogenic shock

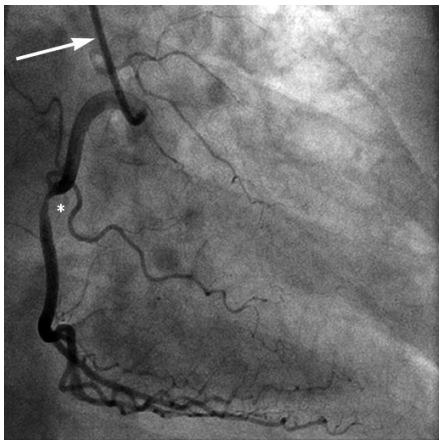
If PCI not available, transfer for PCI if

- Time from first medical contact to PCI ≤120 minutes

Thrombolytic therapy

- Within 12 hours of symptom onset *and*
- Time from first medical contact to PCI >120 minutes

Transfer to PCI-capable facility soon after thrombolysis



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STEMI: Reperfusion Therapy

Thrombolytic therapy

- If PCI not available within time window
- Within 12 hours of symptom onset
- Common absolute contraindications
  - Previous intracerebral hemorrhage
  - Ischemic stroke, head or facial trauma within 3 months
  - Major surgery (within 3 weeks) or recent internal bleeding
  - Known malignant intracranial neoplasm

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NSTEMI: TIMI Risk Score

Estimates risk and guides therapy in NSTE-ACS

- High risk (TIMI score >3) → revascularization
- Low risk (TIMI score 0-2) → ischemia-guided therapy

TIMI Score (1 Point for Each Criterion Met)
Age ≥65 years
≥3 Traditional CAD risk factors (hypertension, family history of CAD, elevated cholesterol level, diabetes, cigarette smoking)
Known history of significant CAD (≥50% stenosis)
Aspirin use in past 7 days
Severe angina in past 24 hours
Elevated cardiac biomarkers
ST deviation >0.5 mm

Information from Antman EM, Cohen M, Bernink PJ, et al. The TIMI risk score for unstable angina/non-ST elevation MI: a method for prognostication and therapeutic decision making. JAMA. 2000;284:835-42. [PMID: 10938172]

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Ischemic Heart Disease Q4

A 58-year-old man is ready for hospital discharge following NSTEMI treated with PCI and stent placement.

Medications are aspirin, ticagrelor, metoprolol, lisinopril, atorvastatin, and sublingual nitroglycerin as needed.

Exam is normal, with pulse rate of 58/min.

LVEF is normal.

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Ischemic Heart Disease Q4

A 58-year-old man is ready for hospital discharge following NSTEMI treated with PCI and stent placement. Medications are aspirin, ticagrelor, metoprolol, lisinopril, atorvastatin, and sublingual nitroglycerin as needed. Exam is normal, with pulse rate of 58/min. LVEF is normal.

Which of the following medication changes is indicated?

A: Add diltiazem

B: Discontinue ticagrelor, start clopidogrel

C: Start eplerenone

D: No medication changes

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ACS: Long-Term Medical Therapy

Begin during hospitalization

- Statin (indefinitely)
- Aspirin (indefinitely)
- Platelet $P2Y_{12}$ receptor inhibitor
  - Ticagrelor, prasugrel (only for PCI), or clopidogrel
  - Continue for 1 year after ACS
- If high bleeding risk, consider:
  - DAPT for 1-3 months with transition to $P2Y_{12}$ inhibitor monotherapy *or*
  - DAPT for 6 months with transition to aspirin monotherapy

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ACS: Long-Term Medical Therapy

Begin at or before discharge

- β-Blocker
- ACE inhibitors (indefinitely) if
  - LVEF ≤40%, diabetes, hypertension, CKD
  - ARB if intolerant to ACE inhibitors
- Spironolactone/eplerenone if
  - Receiving ACE inhibitor + β-blocker *and*
  - LVEF ≤40%, HF, or diabetes

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ACS: ICD Indications

Must meet all the following criteria:

- 40 days since MI or >3 months since PCI/CABG
- Ejection fraction ≤35% if NYHA II/III, ≤30% if NYHA I
- Receiving optimal medical therapy for HF

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ACS: Post-MI Catheterization Indications

- Postinfarction angina
- High-risk post-MI stress test results (among patients initially managed conservatively)

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Ischemic Heart Disease Q5

A 56-year-old man reports 3 hours of chest pain.

BP is 90/60 mm Hg; pulse rate is 110/min.

Physical exam shows JVD, no murmur, and clear lungs.

ECG shows 2-mm ST-segment elevations in leads II, III, and aVF and 0.5-mm ST-segment elevation in lead V_1.

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Ischemic Heart Disease Q5

A 56-year-old man reports 3 hours of chest pain. BP is 90/60 mm Hg; pulse rate is 110/min. Physical exam shows JVD, no murmur, and clear lungs. ECG shows 2-mm ST-segment elevations in leads II, III, and aVF and 0.5-mm ST-segment elevation in lead V_1.

Which of the following is the most likely diagnosis?

A: Acute severe mitral regurgitation

B: LV free wall rupture

C: RV infarction

D: Ventricular septal rupture

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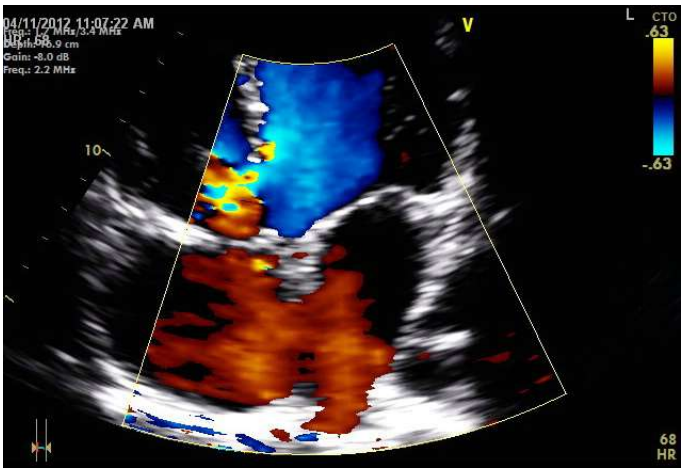
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Complications of Acute Coronary Syndrome

ACP

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Mechanical Complications After STEMI



Ventricular septal rupture

- 1-7 days after MI
- Inferior or anterior MI
- Abrupt pulmonary edema or hypotension
- Loud holosystolic murmur and thrill
- Diagnose with TTE
- Treat with IABP, medical therapy, surgical closure

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Mechanical Complications After STEMI

Papillary muscle rupture

- Inferior or posterior MI
- New holosystolic murmur
- Sudden pulmonary edema
- Diagnose with TTE
- Treat with urgent surgical intervention

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Mechanical Complications After STEMI

Functional ischemic mitral regurgitation

- Ischemic LV dysfunction/dilation
- Diagnose with TTE or cardiac catheterization
- Treat with revascularization

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Mechanical Complications After STEMI

LV free wall rupture

- Anterior MI
- Sudden hypotension or cardiac death
- Pulseless electrical activity
- Ventricular arrhythmias
- Diagnose with TTE (cardiac tamponade)
- Treat with surgery

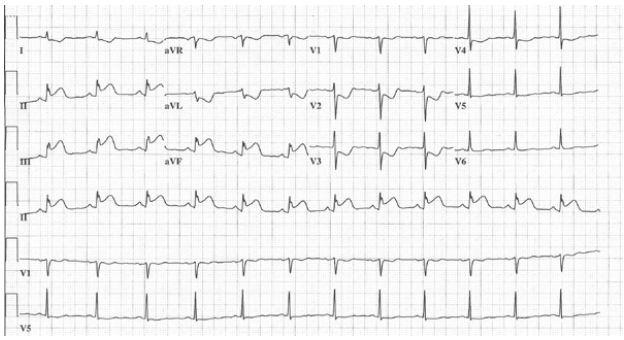
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Complications of Inferior MI

RV infarction

- Hypotension, JVD, clear lungs
- Suspect in inferior MI
- Right-sided ECG leads show ST-segment ↑
- Treatment
  - Volume resuscitation, positive inotropes
  - Revascularization
  - Avoid nitrates (further decrease preload)



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Other Complications of ACS

LV apical thrombus

- 10%-20% of patients with anterior STEMI
- Anticoagulation for ≥3 months

Cardiogenic shock

- Low cardiac output, ↓ BP, end-organ compromise
- Emergent revascularization
- Temporary IABP, LVAD, or ECMO as needed

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Other Complications of ACS: Arrhythmias

Atrial fibrillation

- 10%-20% of patients with STEMI

VT/VF

- Defibrillation

Ventricular ectopy

- Treat ischemia

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Other Complications of ACS: Arrhythmias

Accelerated idioventricular rhythm

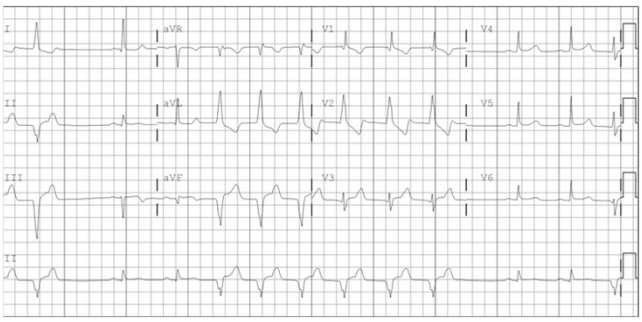
- Benign, no treatment
- Common following reperfusion

Mobitz type 1 block

- Temporary pacemaker if symptomatic

Mobitz type 2 block

Complete heart block



Permanent pacemaker implantation may be required if conduction disturbance is persistent.

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Ischemic Heart Disease Q6

A 57-year-old man reports continuing left calf pain that limits walking.

He recently completed an exercise rehabilitation program for ABI-documented peripheral artery disease.

He no longer smokes.

Medications are aspirin and atorvastatin.

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Ischemic Heart Disease Q6

A 57-year-old man reports continuing left calf pain that limits walking. He recently completed an exercise rehabilitation program for ABI-documented peripheral artery disease. He no longer smokes. Medications are aspirin and atorvastatin.

Which of the following is the most appropriate treatment?

A: Cilostazol

B: Clopidogrel

C: Pentoxifylline

D: Warfarin

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Peripheral Artery Disease (PAD)

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PAD: Risk Factors

- Smoking (current or past)
- Diabetes
- Hypertension
- Dyslipidemia
- Advanced age

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PAD: Diagnosis

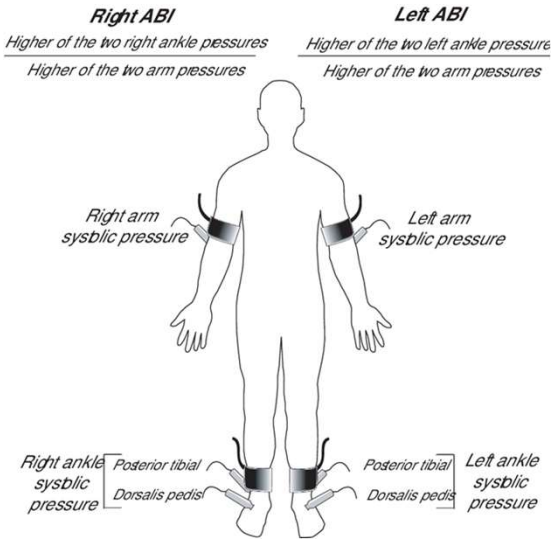
- May be asymptomatic
- Exertional leg pain
- Ischemic rest pain
- Nonhealing wounds
- Ischemic ulcers
- Gangrene



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PAD: Testing



ABI = highest ankle SBP ÷ highest brachial artery SBP in either arm

- ABI ≤0.9 = PAD
- ABI >1.4 = noncompressible calcified arteries

Toe-brachial index (TBI) for ABI >1.4

- TBI <0.7 = PAD

Exercise ABI if normal ABI but high pretest probability

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PAD: Treatment

PAD is CAD equivalent

Cardiovascular risk factor reduction

- Smoking cessation
- Control of hypertension
- High-intensity statin therapy

Aspirin (first choice) or clopidogrel

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PAD: Treatment

Supervised exercise training program

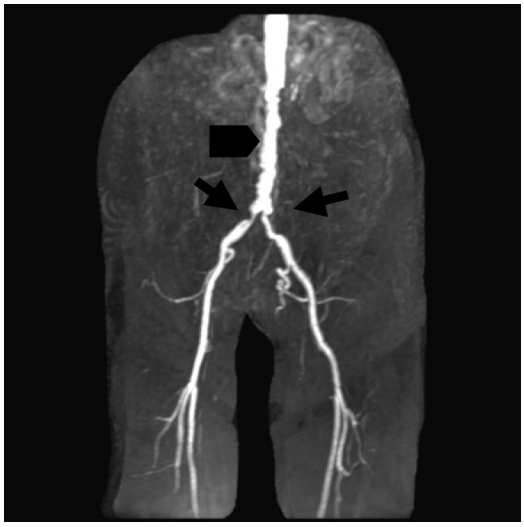
- Best therapy to improve function

Cilostazol for intermittent claudication

- Contraindicated in acute HF

Revascularization

- Symptoms refractory to medical therapy
- Pain at rest or poorly healing ulcers
- CT or MR angiography for revascularization planning



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Acute Limb Ischemia: Diagnosis

Six P's

- Pain
- Paresthesia
- Pallor
- Paralysis
- Pulselessness
- Poikilothermia (coolness)

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Acute Limb Ischemia: Treatment

Initiate heparin

Urgent angiography

- Surgical or endovascular revascularization
- Catheter-directed thrombolysis

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Ischemic Heart Disease Q7

A 67-year-old man is evaluated during a wellness visit.

He has a 30-pack-year smoking history and quit 5 years ago.

Screening abdominal ultrasound shows a 4.5-cm infrarenal abdominal aortic aneurysm.

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Ischemic Heart Disease Q7

A 67-year-old man is evaluated during a wellness visit. He has a 30-pack-year smoking history and quit 5 years ago. A screening abdominal ultrasound shows a 4.5-cm infrarenal abdominal aortic aneurysm.

Which of the following is the most appropriate management?

A: Abdominal CT angiography

B: Endovascular stenting

C: Follow-up ultrasonography in 12 months

D: Open surgical repair

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Aortic Disease

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AAA: Screening and Surveillance

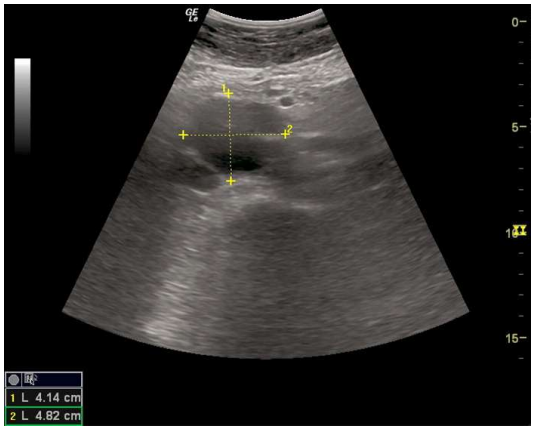
One-time ultrasonography

- Men aged 65-75 years who have ever smoked
- Men or women aged >65 years with first-degree family history of AAA

Do not screen women who have never smoked

Ultrasonography surveillance

- Every 12 months for aneurysms 4.0 to 4.9 cm (men) and 4.0 to 4.4 cm (women)
- Every 6 months for aneurysms >5.0 cm (men) and >4.5 cm (women)



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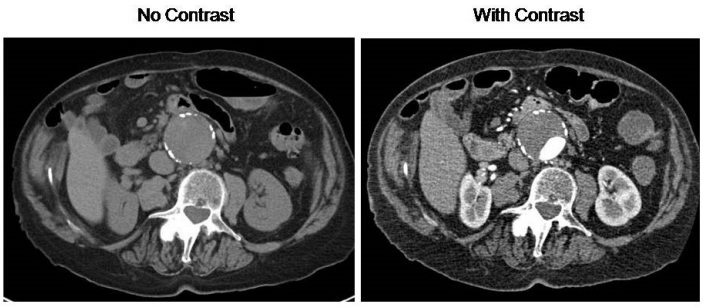
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AAA: Diagnosis and Testing

Most are asymptomatic (75% at diagnosis)

AAA rupture

- New abdominal, flank, back pain
- Syncope, hypotension, shock
- CT or MR angiography



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AAA: Treatment

Risk factor reduction

- Smoking cessation
- BP control

Aortic repair

- AAA diameter ≥5.5 cm in men and ≥5.0 cm in women
- Expansion in AAA size >0.5 cm/6 months
- Symptoms from AAA (abdominal or back pain)

Rupture → emergent surgery

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TAA: Screening and Surveillance

Selective screening

- Bicuspid aortic valve
- Marfan syndrome, Ehlers-Danlos syndrome
- Family history of TAA or aortic dissection

Echocardiographic monitoring

- Follow-up imaging in 6 to 12 months and, if stable, every 6 to 24 months thereafter depending on aortic diameter
- In patients with bicuspid aortic valve and TAA ≥4.0 cm, perform lifelong surveillance imaging
- In Marfan syndrome, perform TTE at initial diagnosis and every 6 to 12 months thereafter

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TAA: Treatment

Goal BP <130/80 mm Hg

- β-Blockers preferred
- ACE inhibitor or ARB as an adjunct to β-blocker therapy if BP goals not met

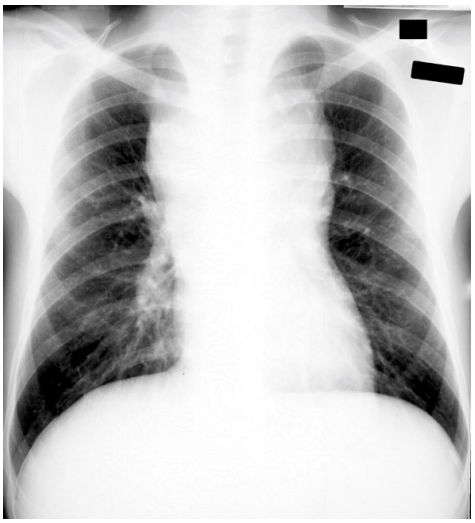
Surgical repair

- Ascending aortic aneurysm >5.5 cm
  - Marfan syndrome >5 cm
- Bicuspid aortic valve and ascending aortic aneurysm >5.5 cm
  - Or >4.5 cm with other criteria (e.g., severe AS, AI)
- Descending aortic aneurysm ≥5.5 cm
- Rapid aneurysm growth (>0.5 cm/year)

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Acute Aortic Dissection: Diagnosis



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Chest, flank, abdominal, and back pain

New aortic regurgitation

Acute HF

Arm BP differential

Other

- Thromboembolism
- Dissection of branch arteries (stroke, MI)
- Cardiac tamponade

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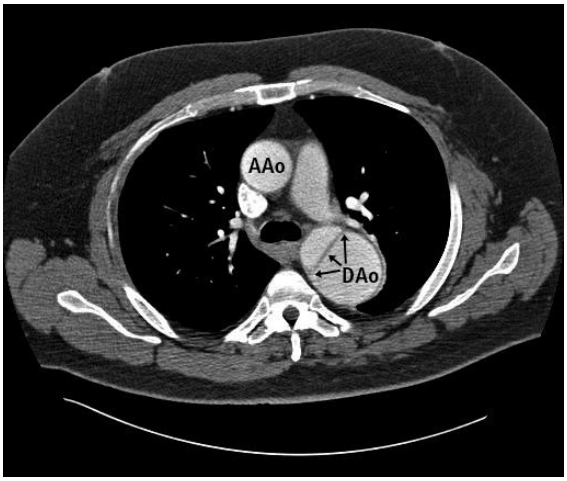
Acute Aortic Dissection: Testing

Chest radiography

- Widened mediastinum

CT/MR angiography, TEE

- Type A dissections: ascending aorta
- Type B dissections: all others



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Acute Aortic Dissection: Treatment

Acute therapy

- SBP to ≤120 mm Hg in the first hour
- Intravenous β-blocker (esmolol) first
  - Target heart rate of 60-80/min is recommended
- ± Nitroprusside

Type A dissection → emergent surgery

Uncomplicated type B dissection → medical therapy

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Cardiology I

- Answers to Multiple-Choice Questions

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Ischemic Heart Disease Q1

A 72-year-old man reports a 3-month history of stable exertional chest pain. Exercise ECG shows 1.5-mm ST-segment depression in leads II, III, and aVF; the patient develops chest pressure during testing. Duke treadmill score is −11.5.

Which of the following is the most appropriate management?

A: Cardiac catheterization

B: Clopidogrel

C: Stress myocardial perfusion imaging

D: Subcutaneous low-molecular-weight heparin (LMWH)

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Ischemic Heart Disease Q2

A 63-year-old man is evaluated for activity-limiting angina, which is being treated with optimal GDMT, including a β-blocker. He has type 2 diabetes. BP is 112/72 mm Hg; pulse rate is 60/min. Angiogram reveals multivessel disease with involvement of the proximal LAD artery. LVEF is 50%.

Which of the following is the most appropriate management?

A: CABG

B: Change β-blocker to CCB

C: Multivessel PCI

D: Myocardial viability scan

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Ischemic Heart Disease Q3

A 78-year-old man is evaluated in the emergency department for 13 hours of chest pain. Troponin I level is elevated. ECG shows 2-mm ST-segment elevation in leads V_1 through V_4 and 1-mm ST-segment depression in leads II and III. Emergent cardiac catheterization shows severe stenosis of the proximal LAD artery.

Which of the following is the most appropriate treatment?

A: CABG

B: Intracoronary thrombolytic therapy

C: Medical therapy

D: Primary PCI

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Ischemic Heart Disease Q4

A 58-year-old man is ready for hospital discharge following NSTEMI treated with PCI and stent placement. Medications are aspirin, ticagrelor, metoprolol, lisinopril, atorvastatin, and sublingual nitroglycerin as needed. Exam is normal, with pulse rate of 58/min. LVEF is normal.

Which of the following medication changes is indicated?

A: Add diltiazem

B: Discontinue ticagrelor, start clopidogrel

C: Start eplerenone

D: No medication changes

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Ischemic Heart Disease Q5

A 56-year-old man reports 3 hours of chest pain. BP is 90/60 mm Hg; pulse rate is 110/min. Physical exam shows JVD, no murmur, and clear lungs. ECG shows 2-mm ST-segment elevations in leads II, III, and aVF and 0.5-mm ST-segment elevation in lead V_1.

Which of the following is the most likely diagnosis?

A: Acute severe mitral regurgitation

B: LV free wall rupture

C: RV infarction

D: Ventricular septal rupture

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Ischemic Heart Disease Q6

A 57-year-old man reports continuing left calf pain that limits walking. He recently completed an exercise rehabilitation program for ABI-documented peripheral artery disease. He no longer smokes. Medications are aspirin and atorvastatin.

Which of the following is the most appropriate treatment?

A: Cilostazol

B: Clopidogrel

C: Pentoxifylline

D: Warfarin

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Ischemic Heart Disease Q7

A 67-year-old man is evaluated during a wellness visit. He has a 30-pack-year smoking history and quit 5 years ago. A screening abdominal ultrasound shows a 4.5-cm infrarenal abdominal aortic aneurysm.

Which of the following is the most appropriate management?

A: Abdominal CT angiography

B: Endovascular stenting

C: Follow-up ultrasonography in 12 months

D: Open surgical repair

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Cardiology II

2025 Virtual Live Internal Medicine Board Review

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ACP Internal Medicine Board Review Course

Cardiology II: Pericardial and Valvular Disease

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Table of Contents: Pericardial and Valvular Disease

- Acute pericarditis and pericardial effusion
- Tamponade
- Aortic stenosis
- Aortic regurgitation
- Mitral regurgitation
- Mitral stenosis
- Prosthetic heart valve

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Pericardial and Valvular Disease Q1

A 67-year-old man is evaluated for a large pericardial effusion of 4 months' duration. He has no symptoms.

No cause has been identified despite extensive evaluation.

Cardiopulmonary exam is normal except for distant heart sounds.

TTE now shows a persistently large pericardial effusion, no tamponade, and normal cardiac function.

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Pericardial and Valvular Disease Q1

A 67-year-old man is evaluated for a large pericardial effusion of 4 months' duration. He has no symptoms. No cause has been identified despite extensive evaluation. Cardiopulmonary exam is normal except for distant heart sounds. TTE now shows a persistently large pericardial effusion, no tamponade, and normal cardiac function.

Which of the following is the most appropriate management?

A: Colchicine

B: Indomethacin

C: Pericardiocentesis

D: Prednisone

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Acute Pericarditis and Pericardial Effusion

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Acute Pericarditis: Diagnosis and Testing

Substernal chest pain

- Pain ↑ with inspiration, supine position

Two- or three-component friction rub

ECG

- Diffuse ST-segment elevation
- PR-segment depression

TTE may be normal or show pericardial effusion

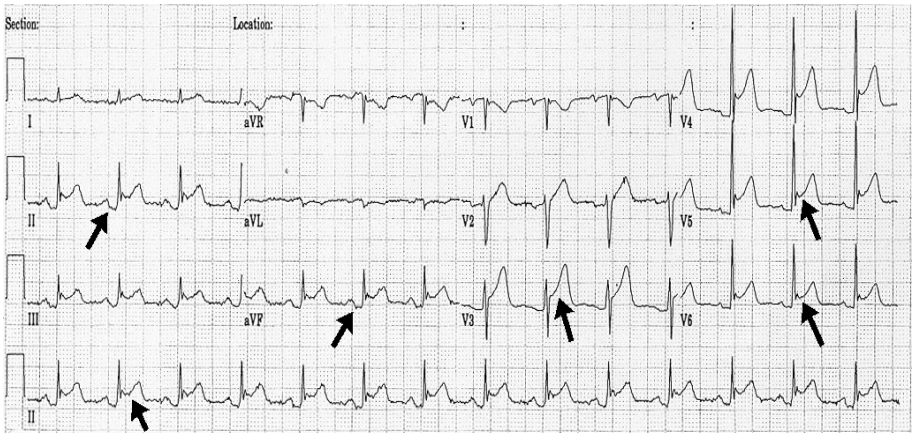
CT scan may show thickened pericardium (chronic)

↑ Inflammatory markers

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Acute Pericarditis: Diagnosis and Testing



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Acute Pericarditis: Treatment

NSAIDs (first line) or aspirin (patients with concomitant CAD)

Adjunctive colchicine

Glucocorticoids reserved for recalcitrant symptoms

- ↑ Risk for recurrent pericarditis

Pericardiocentesis for tamponade

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Pericardial Effusion: Diagnosis

Often discovered incidentally

Most patients asymptomatic: idiopathic

Symptoms/findings of underlying disease

- Malignancy, infection, autoimmune disease
- Recent procedure (e.g., angioplasty, ablation, pacemaker)

Hemodynamic changes: cardiac tamponade

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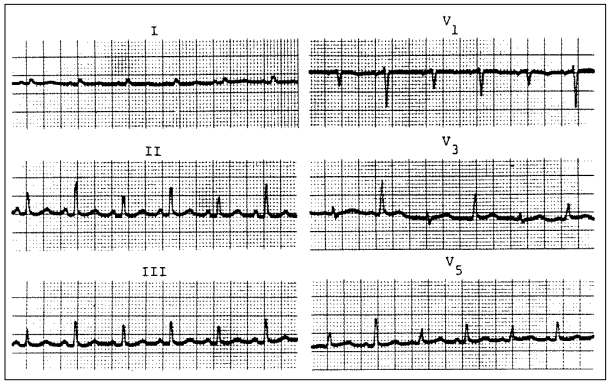
Pericardial Effusion: Testing

Chest radiograph

- May be normal
- Enlarged cardiac silhouette
- Clear lung fields

ECG

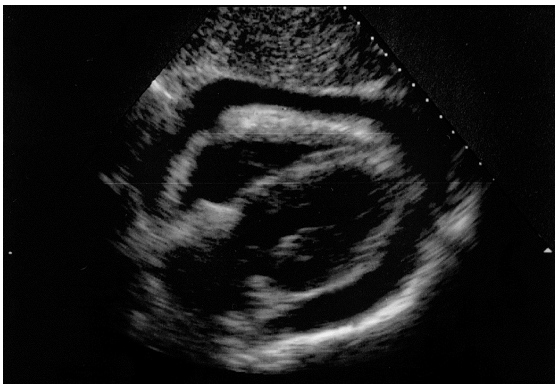
- Low voltage
- Electrical alternans
- Tachycardia



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Pericardial Effusion: Testing



Transthoracic echocardiography

- Sensitive and specific
- Assesses hemodynamic importance

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Pericardial Effusion: Testing

IGRA or TST if concern for tuberculosis

↑ Inflammatory markers

- Support idiopathic pericarditis

Pericardiocentesis

- Consider if unknown cause; often not required
- Gram stain and bacterial and fungal culture
- Cell counts/cytology
- AFB stain, culture, adenosine deaminase
- Viral PCR
- Tamponade physiology

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Pericardial Effusion: Treatment

Pericardial drainage

- Symptomatic: immediate
- Chronic and large, recurrent
  - Rarely, cardiac surgery (stripping)

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Tamponade

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Cardiac Tamponade: Diagnosis

- Dyspnea and fatigue, orthopnea
- Pulsus paradoxus
- JVD
- Clear lungs
- Hypotension (late)
- Reduced heart sounds
- Peripheral edema
- Hepatomegaly, hepatic dysfunction, and ascites

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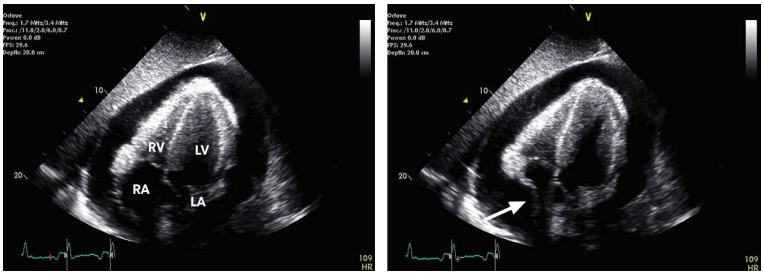
Cardiac Tamponade: Testing and Treatment

Testing

- ECG → electrical alternans
- TTE → RV diastolic or RA systolic collapse

Treatment

- Volume resuscitation/vasopressors
- Pericardiocentesis or surgical drainage



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Pericardial and Valvular Disease Q2

A 60-year-old woman is evaluated for 18 months of progressive exertional dyspnea.

BP is 110/85 mm Hg.

Carotid upstroke is diminished and delayed.

Cardiac exam shows a sustained apical impulse, a grade 3/6 late-peaking systolic murmur, and an S_4.

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Pericardial and Valvular Disease Q2

A 60-year-old woman is evaluated for 18 months of progressive exertional dyspnea. BP is 110/85 mm Hg. Carotid upstroke is diminished and delayed. Cardiac exam shows a sustained apical impulse, a grade 3/6 late-peaking systolic murmur, and an S_4.

Which of the following is the most likely diagnosis?

A: Aortic stenosis

B: Atrial septal defect

C: Pulmonary arterial hypertension

D: Pulmonary valve stenosis

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Aortic Stenosis

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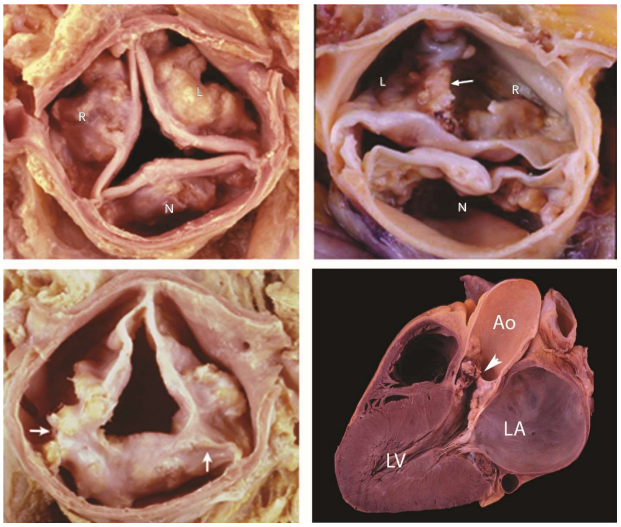
Aortic Stenosis: Diagnosis

Progressive valve calcification

- Most common cause
- Older patients (aged ≥70 years)

Congenital bicuspid aortic valve

- Younger patients (aged <70 years)



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Aortic Stenosis: Diagnosis

Angina, syncope, exertional dyspnea (HF)

Systolic (crescendo-decrescendo) murmur

- Murmur of aortic stenosis peaks early in systole
  - Peaks progressively later in systole as severity increases
- Upper right second intercostal space
- Left sternal border
- Radiation to carotid arteries
- Radiation to right clavicle

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Severe Aortic Stenosis: Diagnosis and Testing

Other physical findings

- Slow and delayed carotid pulse (pulsus parvus et tardus)
- Diminished or absent (critical) aortic component of S_2

May be challenging with reduced LVEF (e.g., low-flow state)

TTE

- Valve area <1 cm^2
- Peak velocity >4 m/s
- Mean transvalvular gradient >40 mm Hg

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Aortic Stenosis: Testing

Lesion Severity	Surveillance Frequency
Mild aortic stenosis	Annual clinical evaluation; echocardiography every 3-5 y
Moderate aortic stenosis	Annual clinical evaluation; echocardiography every 1-2 y
Severe aortic stenosis	Annual clinical evaluation; echocardiography every 6-12 mo

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Aortic Stenosis: Treatment

Aortic valve replacement indications for severe aortic stenosis

- Symptoms
- Asymptomatic with LVEF <50%
- Asymptomatic undergoing other cardiac surgery

Choice between SAVR and TAVR

- Age <65 years and life expectancy >20 years: SAVR
- Age 65-80 years: either SAVR or TAVR
- Age >80 years or life expectancy <10 years: TAVR

Treat coexistent HF with guideline-directed medical therapy

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Pericardial and Valvular Disease Q3

A 43-year-old woman reports 3 months of worsening exertional dyspnea.

She has a remote history of breast cancer treated with radiation therapy.

BP is 155/43 mm Hg, with rapid carotid upstrokes and collapse.

A diminished S_2, grade 2/6 diastolic decrescendo murmur at the left sternal border, and displaced point of maximal impulse are noted.

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Pericardial and Valvular Disease Q3

A 43-year-old woman reports 3 months of worsening exertional dyspnea. She has a remote history of breast cancer treated with radiation therapy. BP is 155/43 mm Hg, with rapid carotid upstrokes and collapse. A diminished S_2, grade 2/6 diastolic decrescendo murmur at the left sternal border, and displaced point of maximal impulse are noted.

Which of the following is the most likely diagnosis?

A: Aortic regurgitation

B: Mitral stenosis

C: Pulmonary regurgitation

D: Tricuspid regurgitation

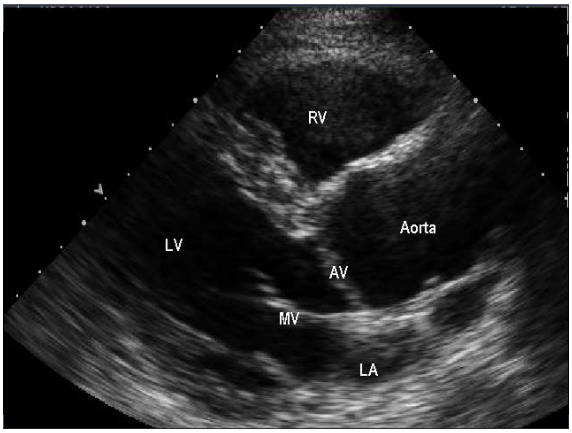
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Aortic Regurgitation

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Chronic Aortic Regurgitation: Diagnosis



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Common causes

- Endocarditis
- Calcific degeneration
- Aortic aneurysm, Marfan syndrome, congenital bicuspid aortopathy
- Chest radiation therapy

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Chronic Aortic Regurgitation: Diagnosis

- Angina, orthopnea, exertional dyspnea
- Early diastolic decrescendo murmur along left sternal border
- Widened pulse pressure
- Displaced point of maximal impulse

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Chronic Aortic Regurgitation: Testing

- TTE to determine severity
- Surveillance to monitor progression

Lesion Severity	Surveillance Frequency
Mild aortic regurgitation	Annual clinical evaluation; echocardiography every 3-5 y
Moderate aortic regurgitation	Annual clinical evaluation; echocardiography every 1-2 y
Severe aortic regurgitation	Annual clinical evaluation; echocardiography every 6-12 mo

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Chronic Aortic Regurgitation: Treatment

Indications for aortic valve replacement in severe aortic regurgitation

- Symptoms
- Asymptomatic with LVEF ≤55%
- Asymptomatic with normal EF and significant LV dilatation
- Asymptomatic undergoing other cardiac surgery

Treat coexistent hypertension and HF with GDMT

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Acute Aortic Regurgitation

Common causes

- Aortic dissection
- Endocarditis
- Traumatic rupture

Acute HF, cardiogenic shock

Short, soft (sometimes inaudible) diastolic murmur

TTE, TEE

CT angiography for aortic dissection

Surgery

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Pericardial and Valvular Disease Q4

A 55-year-old woman reports 3 weeks of progressive exertional dyspnea.

TTE obtained 6 months ago because of palpitations showed normal LV size, LVEF of 65%, and moderate mitral regurgitation.

There is a grade 3/6 holosystolic murmur radiating to the axilla.

ECG shows normal sinus rhythm.

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Pericardial and Valvular Disease Q4

A 55-year-old woman reports 3 weeks of progressive exertional dyspnea. TTE obtained 6 months ago because of palpitations showed normal LV size, LVEF of 65%, and moderate mitral regurgitation. There is a grade 3/6 holosystolic murmur radiating to the axilla. ECG shows normal sinus rhythm.

Which of the following is the most appropriate test?

A: Cardiac catheterization

B: Exercise stress testing

C: Transesophageal echocardiography

D: Transthoracic echocardiography

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Mitral Regurgitation (MR)

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Chronic Mitral Regurgitation: Diagnosis

Primary

- Valve apparatus affected, commonly leaflet dysfunction
  - Mitral valve prolapse (degenerative myxomatous disease)
  - Infective endocarditis
  - Radiation
  - Rheumatic disease

Secondary

- Myocardial disease or dysfunction
  - Ischemic heart disease
  - Dilated cardiomyopathy
  - Hypertrophic cardiomyopathy

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Chronic Mitral Regurgitation: Diagnosis

Exertional dyspnea, orthopnea, paroxysmal nocturnal dyspnea

Apical holosystolic murmur radiating to left axilla

Mitral valve prolapse

- Clicks before murmur
- Valsalva: Clicks/murmur move closer to S_1

S_3 indicates LV dysfunction

Laterally displaced apical impulse indicates LV dilation

Complications: atrial fibrillation, HF

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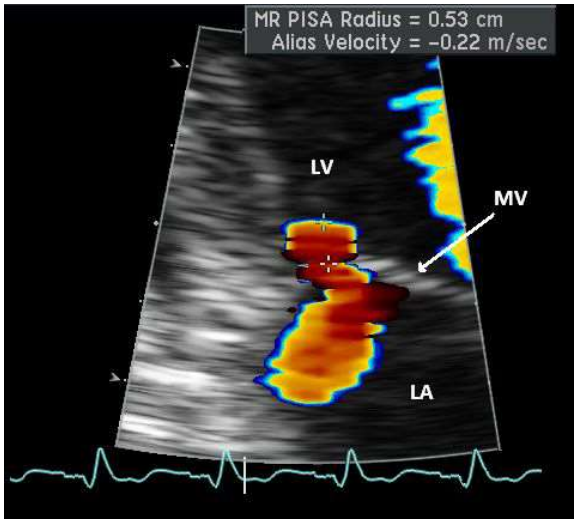
Chronic Mitral Regurgitation: Testing

TTE criteria for severe mitral regurgitation

- Mitral regurgitant orifice area ≥0.4 cm^2
- Regurgitant volume ≥60 mL
- Vena contracta ≥0.7 cm

Other echo findings

- LA/LV dilation
- Flail leaflet



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Chronic Mitral Regurgitation: Testing

Lesion Severity	Surveillance Frequency
Mild mitral regurgitation	Annual clinical evaluation; echocardiography every 3-5 y
Moderate mitral regurgitation	Annual clinical evaluation; echocardiography every 1-2 y
Severe mitral regurgitation	Annual clinical evaluation; echocardiography every 6-12 mo

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Chronic Primary Mitral Regurgitation: Treatment

Severe mitral regurgitation: Indications for surgery

- Symptomatic with LVEF >30%
- Asymptomatic with LVEF 30%-60% and/or LV end-systolic diameter ≥40 mm (pulmonary hypertension may influence)

Mitral valve repair preferred to replacement when possible

Transcatheter edge-to-edge repair

- For selected candidates and scenarios

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Chronic Secondary Mitral Regurgitation: Treatment

Focus on treating underlying condition

Revascularization

- Ischemic papillary muscle dysfunction

Treat HF with GDMT (primary and secondary mitral regurgitation)

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Acute Mitral Regurgitation: Diagnosis

Causes

- Leaflet perforation
- Chordae tendineae/papillary muscle rupture
- Myxomatous valve disease
- Infective endocarditis
- Ischemia/infarction

Acute dyspnea, pulmonary edema, cardiogenic shock

Short decrescendo murmur at apex (absent in 50%)

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Acute Mitral Regurgitation: Testing and Treatment

TTE, TEE

Acute severe mitral regurgitation: surgical intervention

Medical stabilization

- Sodium nitroprusside or nicardipine
- Mechanical circulatory support if unresponsive to medical therapy

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Mitral Stenosis

ACP

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Mitral Stenosis: Diagnosis

Usually caused by rheumatic heart disease

Symptoms

- Fatigue, exertional dyspnea
- Exacerbated by pregnancy

Exam findings

- Diastolic opening snap
- Diastolic rumble at apex
- Right-sided heart failure

TTE diagnostic

- Severe disease with valve area <1.5 cm, gradient >5-10 mm Hg

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Mitral Stenosis (MS): Testing in Asymptomatic Patients

Lesion Severity	Surveillance Frequency
Mild MS Mitral valve area >1.5 cm^2	Annual clinical evaluation; echocardiography every 3-5 y
Moderate MS Mitral valve area 1.0 to 1.5 cm^2	Annual clinical evaluation; echocardiography every 1-2 y
Severe MS Mitral valve area <1.0 cm^2	Annual clinical evaluation; echocardiography every 12 mo

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Mitral Stenosis: Treatment

Percutaneous commissurotomy (if possible) for

- Symptomatic patients
- Asymptomatic patients with pulmonary hypertension

Mitral valve surgery

- Severe stenosis with NYHA III/IV symptoms and not candidate for commissurotomy

Warfarin (not DOAC) for atrial fibrillation

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Pericardial and Valvular Disease Q5

A 35-year-old woman undergoes preconception evaluation.

She has a mechanical mitral valve.

Her only medication is warfarin, 4 mg/d.

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Pericardial and Valvular Disease Q5

A 35-year-old woman undergoes preconception evaluation. She has a mechanical mitral valve. Her only medication is warfarin, 4 mg/d.

Which of the following is the most appropriate anticoagulation strategy?

A: Change warfarin to dabigatran

B: Change warfarin to subcutaneous UFH, twice daily

C: Stop warfarin

D: Continue current therapy

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Prosthetic Heart Valve

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Prosthetic Heart Valves

Mechanical valve: more durable than bioprosthesis

Age	Aortic Valve Type
<50 years	Mechanical
50-65 years	Mechanical or bioprosthetic
>65 years	Bioprosthetic

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Anticoagulation for Mechanical Heart Valves

Lifelong warfarin

- INR goal based on risk

Low-risk patient: INR goal of 2.5

- Bileaflet or current-generation single-tilting disc aortic valve *and*
- No other thromboembolic risk factors

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Anticoagulation for Mechanical Heart Valves

High-risk patient: INR goal of 3.0

- Mechanical mitral valve
- Older-generation mechanical aortic valve
- Current-generation mechanical aortic valve with thromboembolic risk factors
  - Atrial fibrillation
  - LV dysfunction
  - Previous embolism
  - Hypercoagulable disorder

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Anticoagulation for Mechanical Heart Valves

Pregnant patients

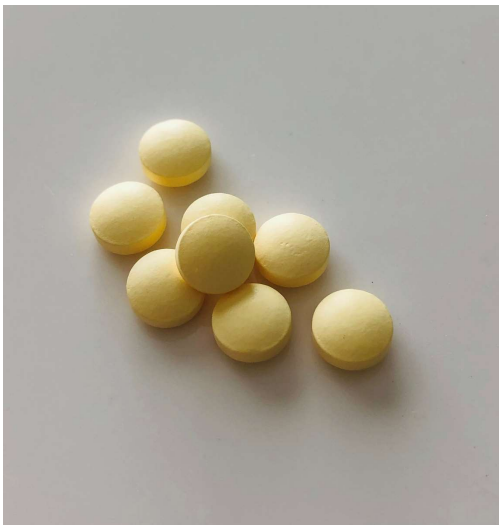
- VKA: lowest thrombotic risk + highest fetal risk
- If on low-dose warfarin (≤5 mg/d), continue warfarin
  - LMWH first trimester, followed by warfarin also reasonable
- If on higher-dose warfarin (>5 mg/d)
  - LMWH first trimester, followed by warfarin

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Antithrombotic Therapy for Bioprosthetic Heart Valves

- Low-dose aspirin in the absence of other indications for oral anticoagulation (e.g., atrial fibrillation)



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Prosthetic Valve Dysfunction: Diagnosis and Testing

TTE for change in clinical symptoms or signs

- HF
- Change in auscultatory findings
- Thromboembolic events
- Hemolytic anemia

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Mechanical Heart Valves: Perioperative Bridging

Anticoagulant therapy should not be stopped for procedures with low risk of bleeding

Common procedures with low bleeding risk include the following:

- Dermatologic surgery
- Dental cleaning or uncomplicated dental caries treatment
- Eye surgery (e.g., cataracts, glaucoma)

Bridging therapy recommended for procedures with a higher risk of bleeding or certain types of mechanical heart valves

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Mechanical Heart Valves: Perioperative Bridging

Patients at high risk for thromboembolism

- Mechanical mitral valve
- Older-generation mechanical aortic valve
- Mechanical aortic valve plus additional risk factor for thromboembolism

If benefit for bridging exceeds risk for bleeding

- Stop warfarin 3-4 days before surgery
- Intravenous heparin or subcutaneous LMWH bridge starts when INR falls below therapeutic threshold
- Restart warfarin after procedure
- Stop heparin when patient fully anticoagulated with warfarin

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Mechanical Heart Valves: Perioperative Bridging

Patients at low risk (current-generation mechanical aortic valve without other thromboembolic risk factors)

- Discontinue warfarin 2-4 days before surgery
- Resume warfarin after surgery
- No bridging heparin required

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Cardiology II

- Answers to Multiple-Choice Questions

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Pericardial and Valvular Disease Q1

A 67-year-old man is evaluated for a large pericardial effusion of 4 months' duration. He has no symptoms. No cause has been identified despite extensive evaluation. Cardiopulmonary exam is normal except for distant heart sounds. TTE now shows a persistently large pericardial effusion, no tamponade, and normal cardiac function.

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Pericardial and Valvular Disease Q2

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Which of the following is the most likely diagnosis?

A: Aortic stenosis

B: Atrial septal defect

C: Pulmonary arterial hypertension

D: Pulmonary valve stenosis

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Pericardial and Valvular Disease Q3

A 43-year-old woman reports 3 months of worsening exertional dyspnea. She has a remote history of breast cancer treated with radiation therapy. BP is 155/43 mm Hg, with rapid carotid upstrokes and collapse. A diminished S_2, grade 2/6 diastolic decrescendo murmur at the left sternal border, and displaced point of maximal impulse are noted.

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B: Mitral stenosis

C: Pulmonary regurgitation

D: Tricuspid regurgitation

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Pericardial and Valvular Disease Q4

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Cardiology III

2025 Virtual/Live Internal Medicine Board Review

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Cardiology III: Arrhythmias

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Table of Contents: Arrhythmias

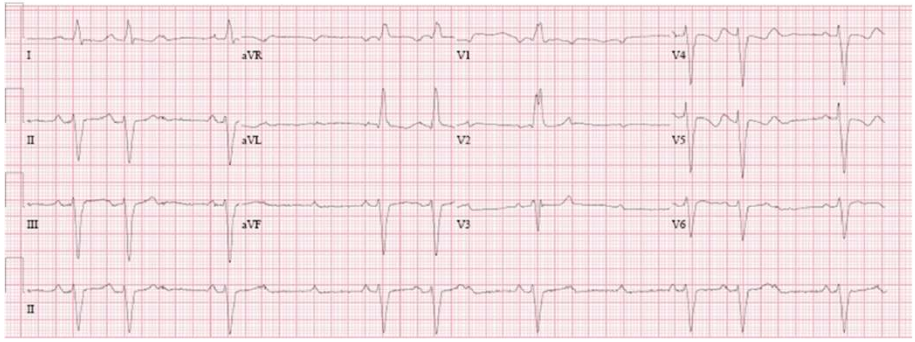
- Conduction defects
- Bradyarrhythmias
- Tachyarrhythmias
- Other dysrhythmias (cardiac resuscitation)

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Arrhythmias Q1

A 67-year-old woman reports an episode of syncope without prodrome. No orthostatic changes are noted. ECG is shown.



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Arrhythmias Q1

A 67-year-old woman reports an episode of syncope without prodrome. No orthostatic changes are noted.

Which of the following is the most likely diagnosis?

A: First-degree AV block

B: Second-degree Mobitz type 1 AV block

C: Second-degree Mobitz type 2 AV block

D: Third-degree heart block

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Conduction Defects

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AV Block: Diagnosis

May be asymptomatic

Symptoms: syncope, presyncope, dyspnea, fatigue

Causes of AV Block
Congenital/genetic
Infectious (e.g., Lyme disease, acute rheumatic fever, endocarditis)
Inflammatory/infiltrative (e.g., sarcoidosis, myocarditis, amyloidosis)
Ischemia
Degenerative
Autonomic
Metabolic/endocrine (e.g., thyroid disease, acid-base disorders)
Iatrogenic (e.g., medication related, cardiac interventions such as ablation, cardiac surgery, TAVR, etc.)

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AV Block: Diagnosis and Testing

First-degree AV block

- All P waves followed by QRS complex
- 1:1 AV conduction
- PR interval >200 ms
- No alterations in heart rate



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AV Block: Diagnosis and Testing

Second-degree AV block

- Intermittent P waves not followed by QRS complex
- Further classified as Mobitz type 1 or type 2
- ECG cannot distinguish Mobitz types if 2:1 AV block

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AV Block: Diagnosis and Testing

Mobitz type 1 second-degree (Wenckebach) AV block

- Progressive PR interval prolongation before dropped beat
- Grouped beats on ECG



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AV Block: Diagnosis and Testing

Mobitz type 2 second-degree AV block

- Unchanging PR intervals
- High-degree AV block: ≥2 nonconducted P waves (shown below)



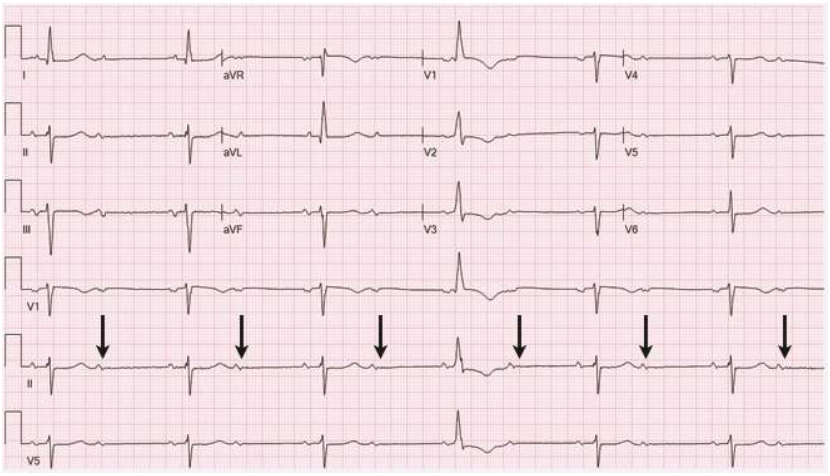
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AV Block: Diagnosis and Testing

Mobitz type 2 second-degree AV block



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AV Block: Diagnosis and Testing

Third-degree (complete heart block)

- No conducted P waves (AV dissociation)
- Atrial rate > ventricular rate



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AV Block: Treatment

Correct reversible causes

- Revascularization for ischemia
- Elimination of contributing drugs
  - β-Blockers, CCBs, digitalis
  - Donepezil
  - Opioids
  - SSRIs, TCAs
- Treatment for infection (Lyme)

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AV Block: Treatment

Hemodynamic compromise

- IV atropine
- Dopamine infusion as temporizing measure
- Transcutaneous or transvenous pacing

Indications for permanent pacemaker in AV block

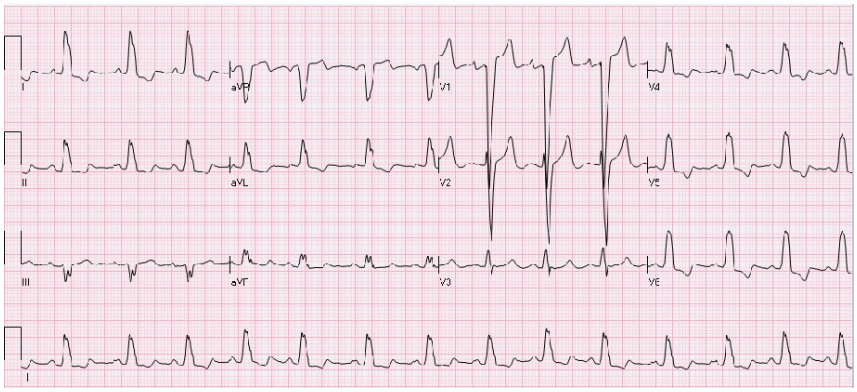
- Alternating bundle branch block
- Complete heart block
- High-degree AV block
- Mobitz type 2 second-degree AV block

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Left Bundle Branch Block

- Absent Q waves in I, aVL, and V_6
- Large, wide, positive R waves in I, aVL, V_6
- QRS ≥120 ms

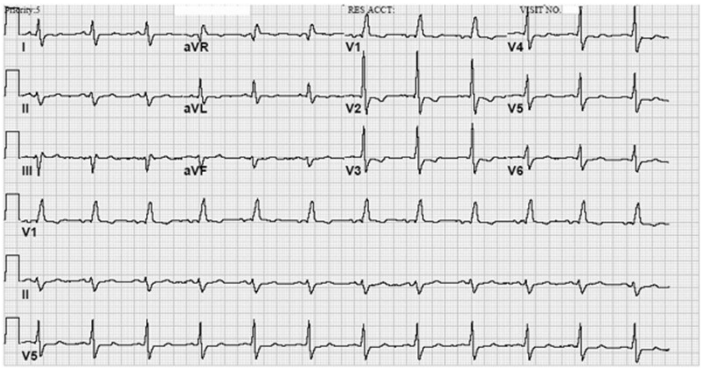


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Right Bundle Branch Block

- RSR' pattern in V_1 or V_2
- Wide negative S wave in V_6
- QRS ≥120 ms



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Arrhythmias Q2

A 77-year-old woman reports a 2-day history of intermittent lightheadedness with rest and activity.

BP is 137/88 mm Hg. ECG is shown.



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Arrhythmias Q2

A 77-year-old woman reports a 2-day history of intermittent lightheadedness with rest and activity. BP is 137/88 mm Hg.

Which of the following is the most likely diagnosis?

A: Carotid sinus hypersensitivity

B: Complete heart block

C: Sinus arrest

D: Sinus node dysfunction

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Bradyarrhythmias

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Bradyarrhythmias: Causes

- Age-related myocardial fibrosis
- Right coronary ischemia
- Sarcoidosis, amyloidosis
- Lyme carditis
- Hypothyroidism
- Electrolyte disturbances
- Cardiothoracic surgery
- Intracranial hypertension
- Medications (most common examples)
  - β-Blockers, CCBs
  - Digoxin
  - Donepezil
  - Opioids
  - SSRIs, TCAs

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Bradyarrhythmias: Diagnosis

- Lightheadedness
- Syncope, near-syncope
- Exertional intolerance, dyspnea, fatigue
- Heart rate <50/min

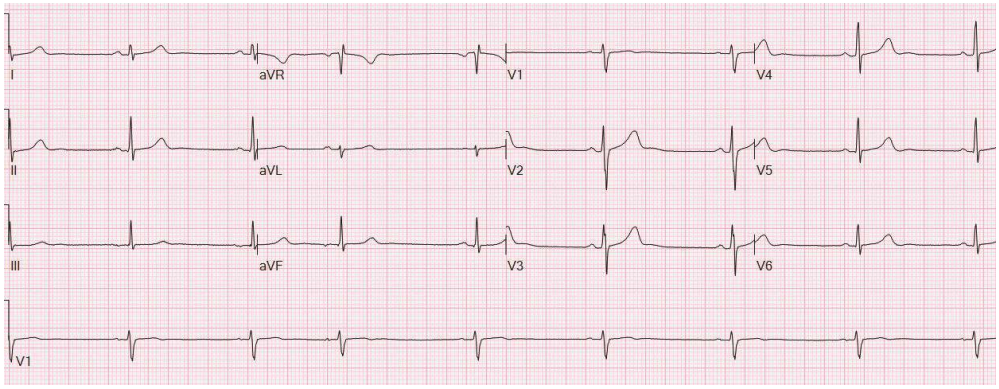
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Bradyarrhythmias: Diagnosis

Sinus bradycardia

- May be appropriate in athletes, during sleep



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Bradyarrhythmias: Diagnosis

Ectopic atrial bradycardia

- Atrial depolarization from source other than sinus node

Sinus pause (>3 s)

Sinus node arrest

- No sinus node depolarization

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Bradyarrhythmias: Testing

- Medication review
- ECG/ambulatory ECG
- Measurement of electrolyte levels
- Thyroid function testing
- Exercise stress testing if chronotropic incompetence is suspected

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Bradyarrhythmias: Treatment

Atropine

- Symptomatic bradycardia with hemodynamic compromise

Pacemaker implantation

- Symptomatic/high-risk bradycardia without reversible cause
- AF and symptomatic bradycardia

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Arrhythmias Q3

A 47-year-old man is diagnosed with AF.

The patient has a history of moderately severe mitral stenosis.

His heart rate is well controlled with metoprolol.

26

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Arrhythmias Q3

A 47-year-old man is diagnosed with AF. The patient has a history of moderately severe mitral stenosis. His heart rate is well controlled with metoprolol.

Which of the following is the most appropriate additional management?

A: Begin aspirin

B: Begin dabigatran

C: Begin warfarin

D: Calculate the CHA_2DS_2-VASc score

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Tachyarrhythmias

28

Tachyarrhythmias: Diagnosis and Testing

- Palpitations, dizziness, syncope
- Heart rate >100/min
- Resting ECG/rhythm strip/long-term ambulatory ECG monitor
- Echocardiography if structural heart disease is suspected
- Exercise stress testing for exercise-induced arrhythmia

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Tachyarrhythmias: Testing

Capture rhythm during clinical event with ambulatory ECG

Noninvasive: 24 hours up to 30 days of data

- Numerous terminologies: Holter, event monitor, loop recorder, mobile telemetry, patch monitor (minor differences)
- Arrhythmias automatically detected, symptoms can be activated by patient
- May be single- or multi-lead
- Can cause skin irritation

Implanted loop recorder

- Long-term continuous monitoring (2-4 years)
- Patient-activated symptoms
- Good choice for very infrequent arrhythmias and/or severe symptoms

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Narrow-Complex Tachyarrhythmias

Regular

- Sinus tachycardia
- AVNRT
- AVRT
- Atrial tachycardia
- Atrial flutter

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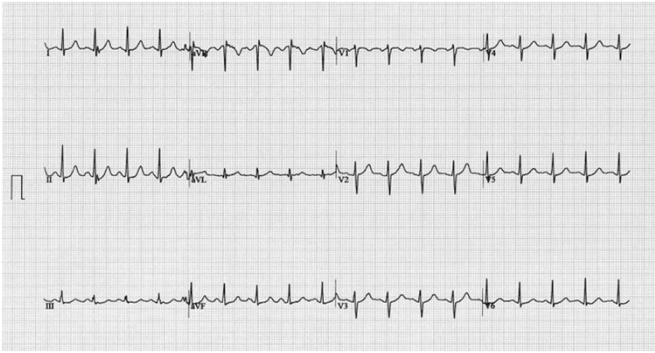
31

Sinus Tachycardia: Diagnosis and Testing

Most common tachycardia

Caused by increased physiologic demand or distress

- Exercise/deconditioning
- Pain
- Fever
- Anemia
- Anxiety
- Hyperthyroidism
- VTE/PE



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AVNRT: Diagnosis and Testing

Most commonly due to ≥2 functionally distinct pathways within AV node:

1. Rapid conduction velocity and a long refractory period
2. Slow conduction velocity and a short refractory period

Re-entry

- Typically occurs with an atrial premature beat
- Conduction down (antegrade) slow pathway (no longer refractory)
- Conduction up (retrograde) fast pathway

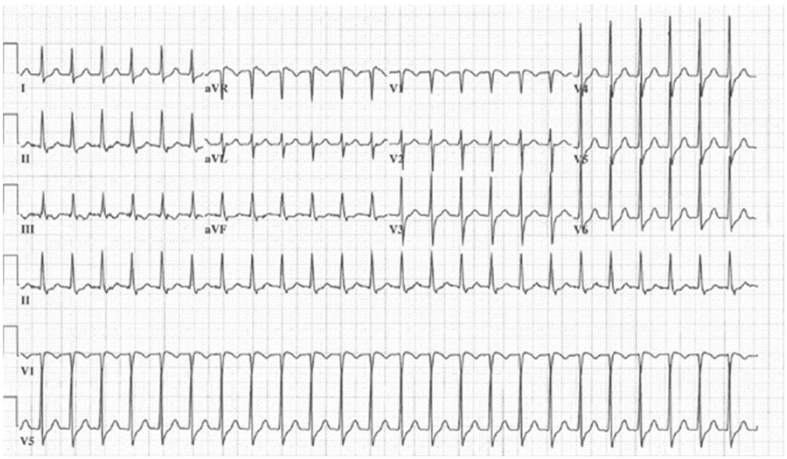
P wave just after QRS or not visible

- Short RP supraventricular tachycardia: RP interval < PR interval

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AVNRT: Diagnosis and Testing

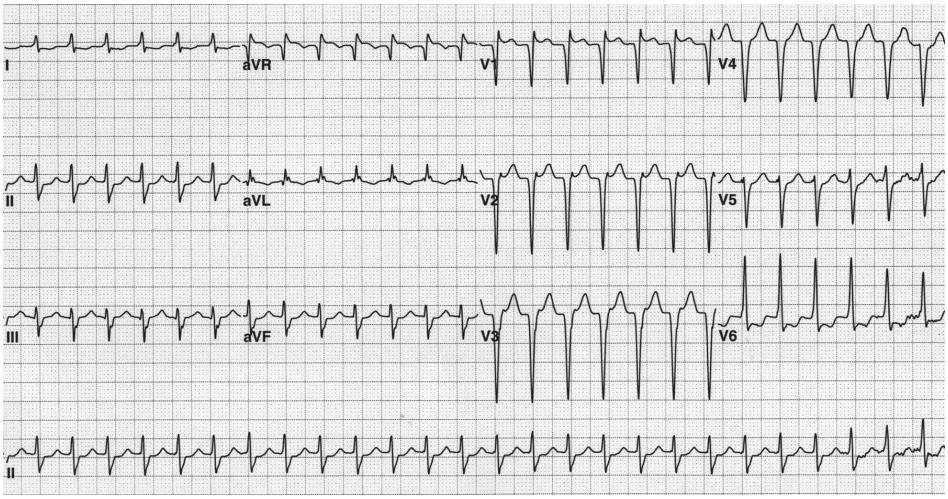


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AVNRT: Diagnosis and Testing



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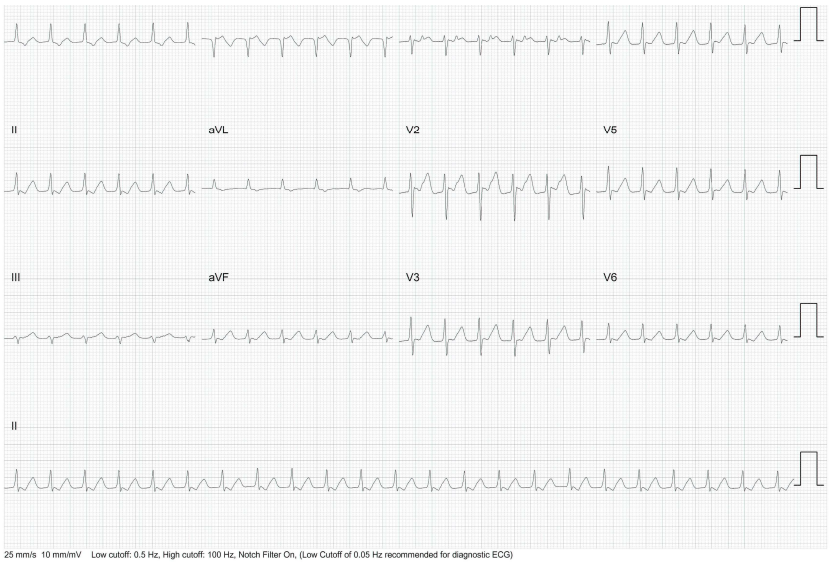
AVNRT: Treatment

- Cardioversion if hemodynamically unstable
- Vagal maneuvers
- IV adenosine
- Ablation is definitive treatment

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AVRT: Diagnosis and Testing



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AVRT: Diagnosis and Testing

Bypass tract connecting atrium and ventricle

Can cause reentry down or up AV node

- Orthodromic (ORT, more common): narrow-complex tachycardia down AV node, up bypass tract
- Antidromic (ART): wide-complex tachycardia down bypass tract, up AV node

Baseline preexcitation

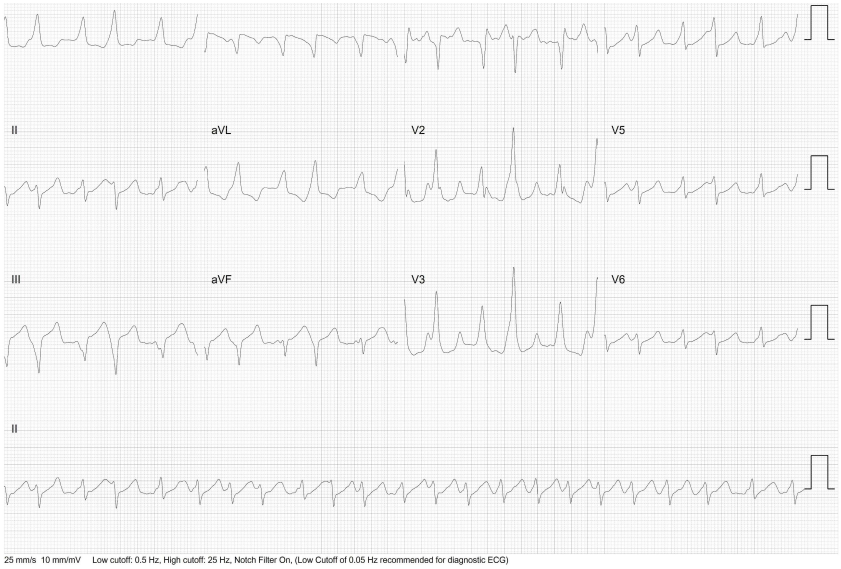
- Short PR interval, delta wave
- May not always manifest on resting ECG



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AVRT: Diagnosis and Testing



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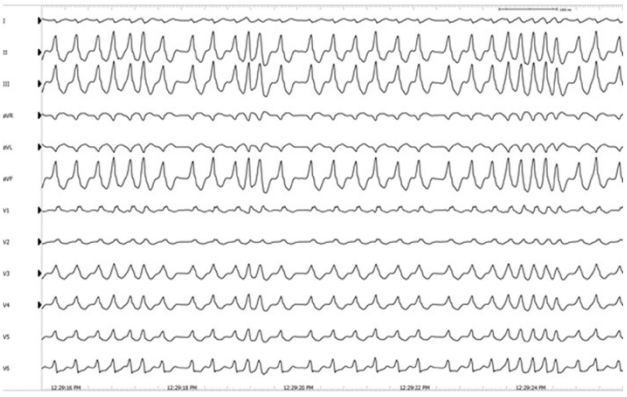
AVRT: Diagnosis and Testing

Wolf-Parkinson-White (WPW) syndrome

- Preexcitation + symptomatic arrhythmias

Preexcited AF

- Life-threatening
- Variable QRS morphology



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AVRT: Treatment

Hemodynamic instability → cardioversion, procainamide

First-line therapy for WPW

- Catheter ablation

Avoid AV nodal blockers acutely

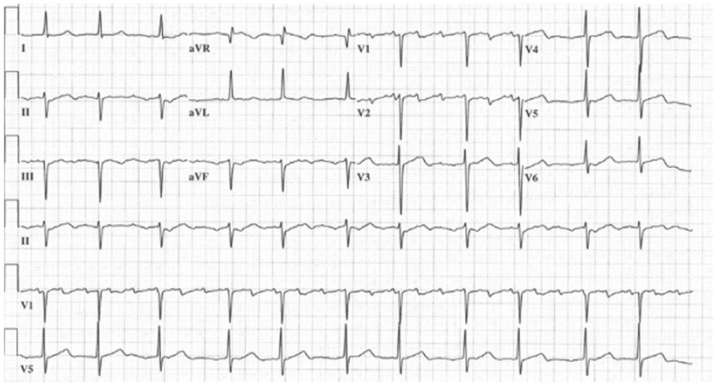
- Risk for ventricular fibrillation

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Atrial Tachycardia: Diagnosis and Testing

- Atrial rate >100/min
- Abnormal P waves and/or P-wave axis (ectopic)

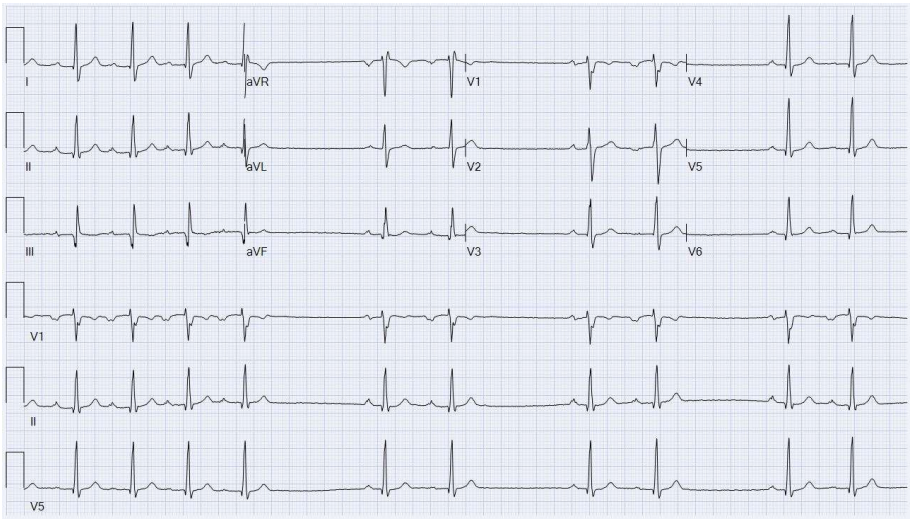


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Atrial Tachycardia: Diagnosis and Testing

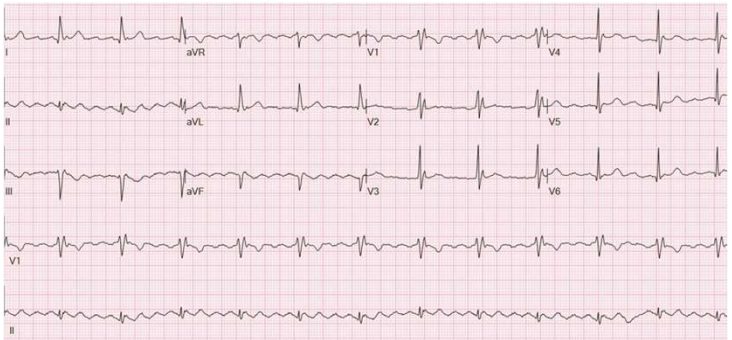


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Atrial Flutter: Diagnosis and Testing

- Atrial rates of 240-350/min
- 2:1 conduction block typical: ventricular rate ~150/min
- ECG: sawtooth pattern in inferior leads

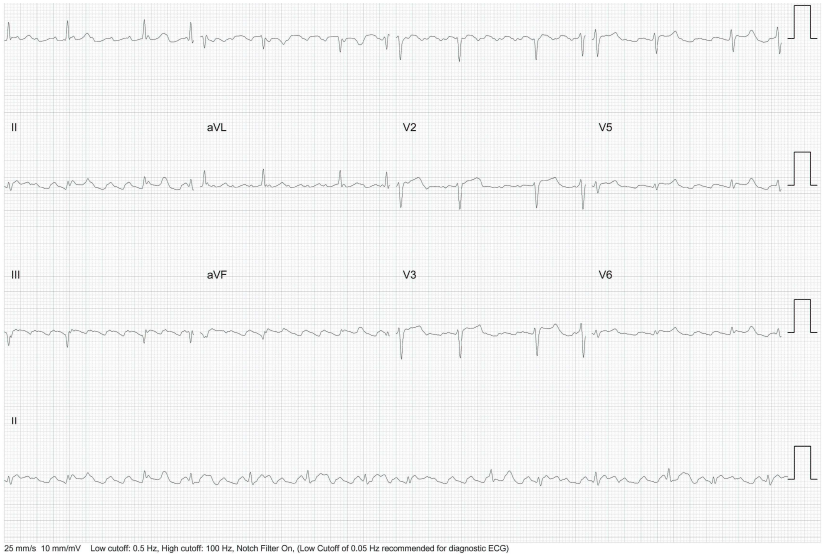


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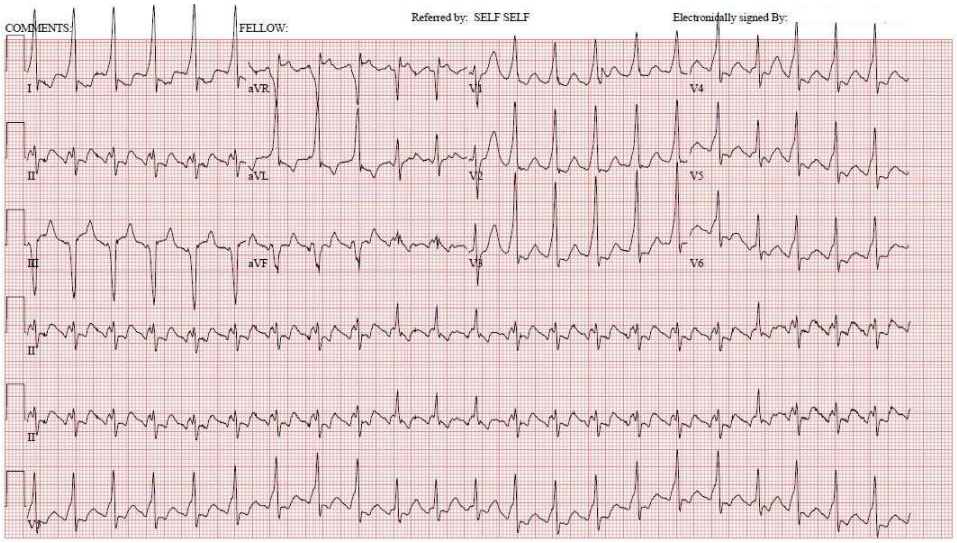
Atrial Flutter: Diagnosis and Testing



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Atrial Flutter: Diagnosis and Testing



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Atrial Flutter: Treatment

Cardioversion if hemodynamically unstable

Anticoagulation if appropriate

- Indications for anticoagulation are the same as for AF

First-line therapy: radiofrequency catheter ablation

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Narrow-Complex Tachyarrhythmia

Irregular

- Atrial fibrillation
- Atrial flutter with variable conduction
- Multifocal atrial tachycardia

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Atrial Fibrillation

- Most common sustained arrhythmia
- Irregularly irregular ventricular rhythm
- Absence of P waves
- Irregular wide-complex tachycardia: bundle branch block or WPW

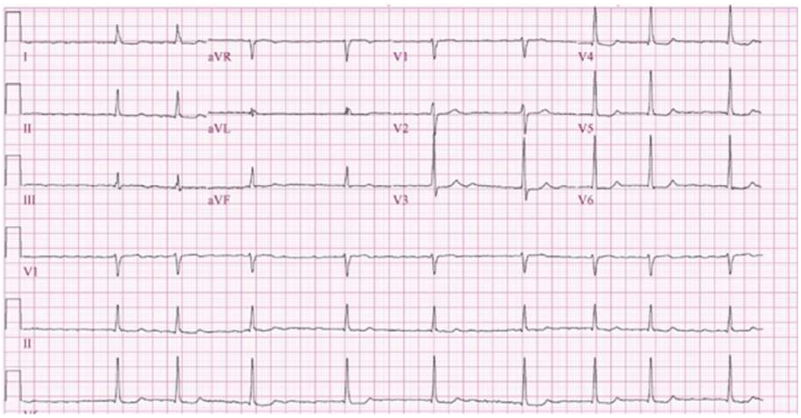


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Atrial Fibrillation



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Atrial Fibrillation: Types

Type	Description
Paroxysmal	Terminates spontaneously or with intervention within 7 days
Persistent	Does not terminate within 7 days
Long-standing, persistent	Lasting >12 months
Permanent	No further attempts to convert to sinus rhythm

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Atrial Fibrillation: Initial Testing

- Risk factor and trigger identification
- CBC, metabolic panel, TSH level
- Echocardiography
- Overnight pulse oximetry (if appropriate)
- Digoxin level (if appropriate)

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Atrial Fibrillation: Cardioversion

Hemodynamic instability → cardioversion

Elective cardioversion

- AF ≥48 h/unknown duration
  - Anticoagulation for 3 weeks before or TEE to exclude thrombus if urgent cardioversion is planned

Anticoagulation ≥4 weeks after cardioversion

"Pill-in-the-pocket" for paroxysmal AF

- Flecainide or propafenone with β-blocker or CCB
  - Contraindication: QRS >120 ms, abnormal cardiac structure or function (including CAD)

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Nonvalvular Atrial Fibrillation: CHA_2DS_2–VASc for Estimating Stroke Risk

1 point each

- Chronic HF
- Hypertension
- Diabetes
- Vascular disease (MI, PAD, aortic plaque)
- Age 65 to 74 years
- Female

2 points each

- Age ≥75 years
- Stroke (or TIA)

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Atrial Fibrillation: Anticoagulation

Generally recommended for CHA_2DS_2–VASc >2 (men) or >3 (women)

Among those with intermediate scores (1 for men, 2 for women), additional considerations (sample):

- AF burden/type (persistent/permanent)
- Obesity
- CKD
- Enlarged LA

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Atrial Fibrillation: Anticoagulation

DOACs generally preferred

- Direct thrombin inhibitor (dabigatran)
- Factor Xa inhibitors (rivaroxaban, apixaban, edoxaban)

Warfarin: therapeutic INR of 2.0 to 3.0

Absolute warfarin indications

- Moderate or severe mitral stenosis
- Mechanical heart valve

Left atrial occlusion an option if anticoagulation contraindicated

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Atrial Fibrillation: Rate Versus Rhythm Control

Increasing clinical benefit of rhythm control, particularly in selected groups

Favors rhythm control (antiarrhythmic drugs, cardioversion, ablation)

- Younger
- More symptomatic
- More comorbidities at risk for CV hospitalization
- Concomitant heart failure

Favors rate-only control

- Older
- Asymptomatic
- Minimal comorbidity

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Multifocal Atrial Tachycardia: Testing and Treatment

- At least three different P-wave morphologies
- Pulmonary/cardiac disease, hypokalemia, hypomagnesemia
- Treat underlying cause



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Ventricular Tachycardia: Diagnosis and Testing

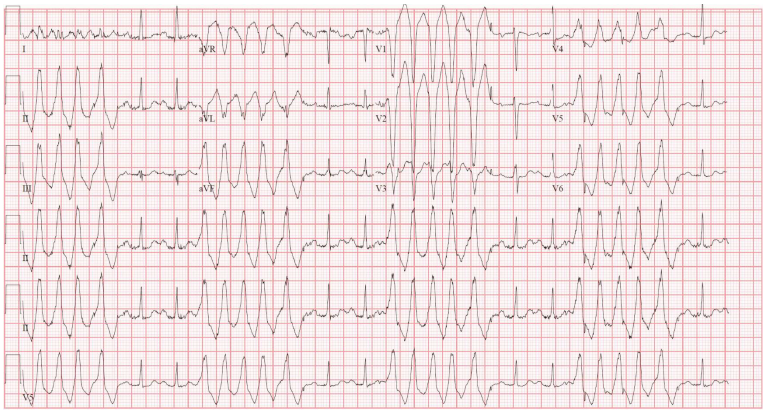
- QRS >120 ms and AV dissociation
- Ventricular rate >100/min
- Nonsustained: <30 s
- Sustained: >30 s or hemodynamic compromise
- Monomorphic: QRS in same leads do not vary in morphology
- Polymorphic: QRS in same leads vary in morphology

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Ventricular Tachycardia: Diagnosis and Testing

- Wide QRS tachycardia: VT until proven otherwise
- Structural heart disease + wide QRS tachycardia = VT



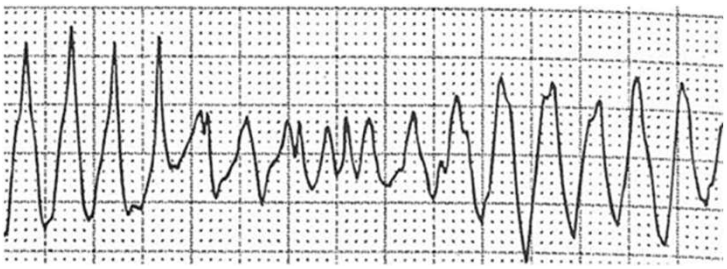
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Torsades de Pointes: Testing

- Due to acquired or congenital QT prolongation
- Polymorphic VT
- Episodes may terminate spontaneously, can cause sudden death due to VF
- Treatment: defibrillation, magnesium, treat underlying cause



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Ventricular Tachycardia: Treatment

Acute hemodynamic instability

- Cardioversion

Nonsustained VT

- β-Blocker or CCB (normal hearts)

Sustained VT

- Antiarrhythmic drug or catheter ablation
- ICD placement (structural disease or syncope/cardiac arrest)

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Arrhythmias Q4

A 74-year-old man has a cardiac arrest.

Cardiopulmonary resuscitation is initiated.

A 200-J shock is given through an automated external defibrillator.

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Arrhythmias Q4

A 74-year-old man has a cardiac arrest. Cardiopulmonary resuscitation is initiated. A 200-J shock is advised and given through an automated external defibrillator.

Which of the following is the next intervention?

A: Administer amiodarone

B: Administer calcium

C: Continue chest compressions

D: Reassess rhythm

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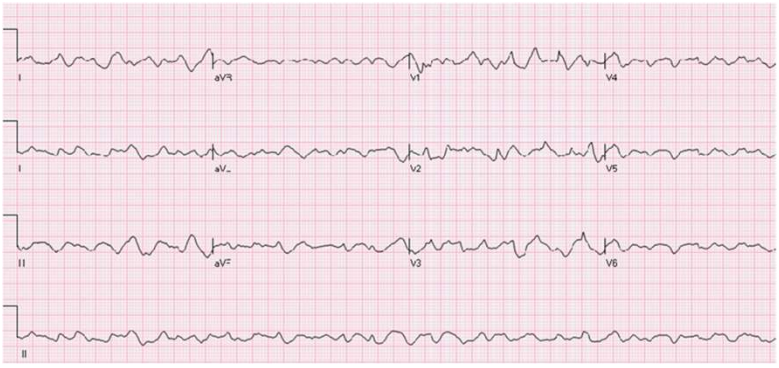
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Other Dysrhythmias (Cardiac Resuscitation)

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Sudden Cardiac Arrest: Diagnosis

- Sudden collapse, pulselessness
- VT and VF are most common causes



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Sudden Cardiac Arrest: Initial Treatment

Activation of EMS, request AED, check pulse

Chest compressions within 10 s

Airway secured: 1 breath/6 s

Shockable rhythm: defibrillation

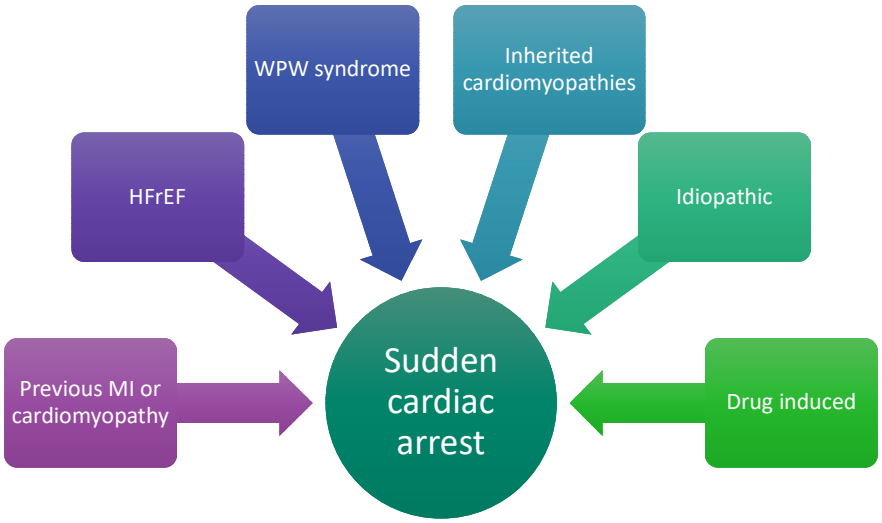
- Resume CPR; reassess rhythm in 2 min
- Epinephrine after the second shock
- Epinephrine every 3 to 5 min
- Amiodarone or lidocaine for VF/VT unresponsive to defibrillation

Nonshockable rhythm: epinephrine as soon as possible

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Sudden Cardiac Arrest: Causes



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Sudden Cardiac Arrest: Testing

ECG

Laboratory studies (e.g., chemistries, toxicology)

Echocardiography

- Anatomic abnormalities
- Impaired ventricular function
- Myopathic processes

In selected patients

- Coronary angiography
- Electrophysiologic studies
- Genetic testing

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QT Prolongation

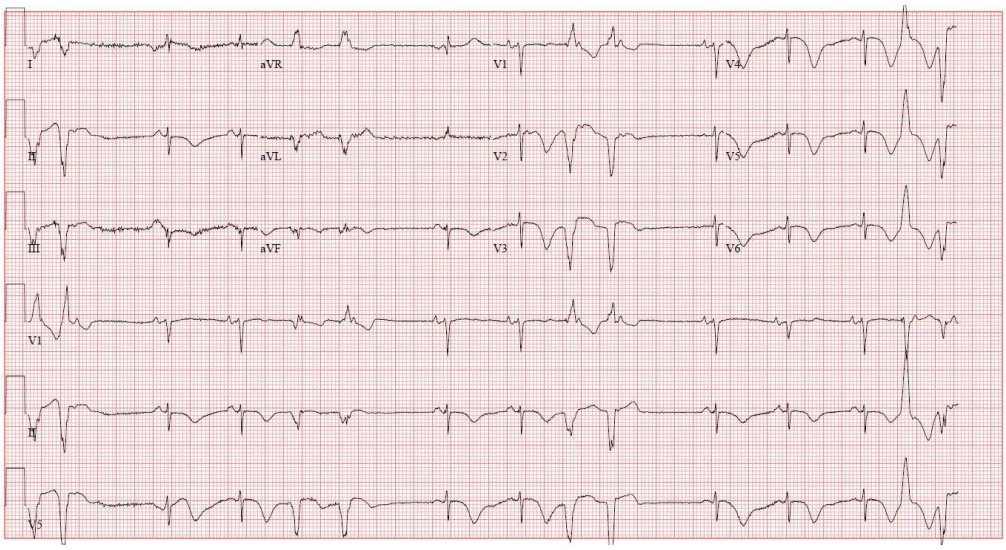
Inherited or acquired

- Greatest risk with QTc >500 ms
- Torsades de pointes
- Syncope or sudden cardiac arrest

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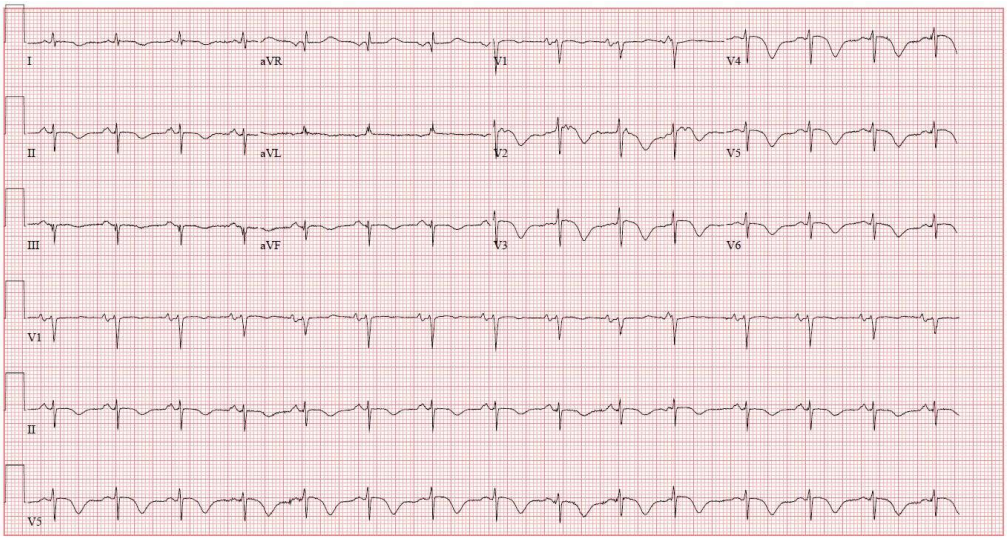
QT Prolongation



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QT Prolongation

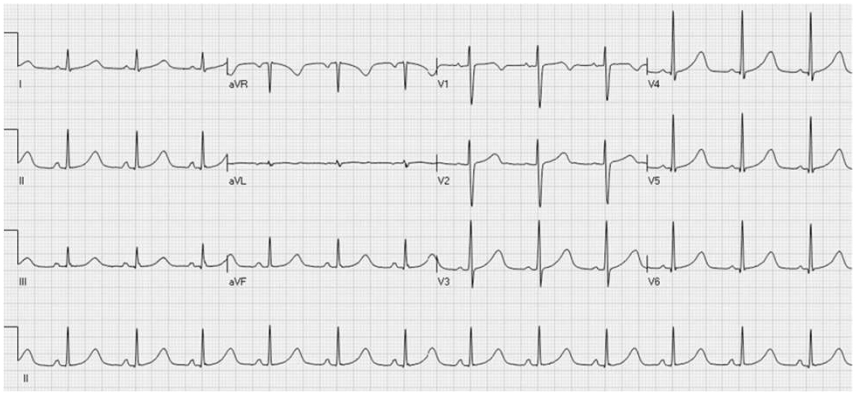


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QT Prolongation

Prolonged QT: QTc of ≥460 ms in women or ≥450 ms in men



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QT Prolongation: Evaluation

Risk factors for acquired long QT syndrome

- Hypokalemia
- Hypomagnesemia
- Structural heart disease
- Medications/drug interactions

Common causative medications:

- Macrolide and fluoroquinolone antibiotics
- Antipsychotic and antidepressant medications
- Methadone
- Antifungal medications
- Class IA and class III antiarrhythmics

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QT Prolongation: Treatment

Acquired long QT syndrome

- Stop culprit medication
- Treat underlying disorder

Congenital long QT syndrome

- β-Blockers
- Surgical sympathectomy
- ICD for patients with SCD or recurrent syncope

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Sudden Cardiac Arrest: Secondary Prevention

Treat underlying coronary artery disease

ICD therapy

- Survivors of cardiac arrest due to VF or VT
- Structural heart disease and sustained VT
- Ischemic or nonischemic cardiomyopathy, NYHA II/III, and LVEF <35%
- Post MI, NYHA I, and LVEF <30% (on optimal HF therapy)
  - After 40 days *or*
  - >3 months after revascularization
- In selected patients with inherited arrhythmogenic diseases

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Cardiology III

- Answers to Multiple-Choice Questions

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Arrhythmias Q1

A 67-year-old woman reports an episode of syncope without prodrome. No orthostatic changes are noted.

Which of the following is the most likely diagnosis?

A: First-degree AV block

B: Second-degree Mobitz type 1 AV block

C: Second-degree Mobitz type 2 AV block

D: Third-degree heart block

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Arrhythmias Q2

A 77-year-old woman reports a 2-day history of intermittent lightheadedness with rest and activity. BP is 137/88 mm Hg.

Which of the following is the most likely diagnosis?

A: Carotid sinus hypersensitivity

B: Complete heart block

C: Sinus arrest

D: Sinus node dysfunction

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Arrhythmias Q3

A 47-year-old man is diagnosed with AF. The patient has a history of moderately severe mitral stenosis. His heart rate is well controlled with metoprolol.

Which of the following is the most appropriate additional management?

A: Begin aspirin

B: Begin dabigatran

C: Begin warfarin

D: Calculate the CHA_2DS_2-VASc score

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Arrhythmias Q4

A 74-year-old man has a cardiac arrest. Cardiopulmonary resuscitation is initiated. A 200-J shock is advised and given through an automated external defibrillator.

Which of the following is the next intervention?

A: Administer amiodarone

B: Administer calcium

C: Continue chest compressions

D: Reassess rhythm

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Cardiology IV

2024 Virtual/Live Internal Medicine Board Review

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ACP Internal Medicine Board Review Course

Cardiology IV: Heart Failure and Endocarditis

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Table of Contents: Heart Failure and Endocarditis

- Heart failure with reduced ejection fraction
- Dilated cardiomyopathy
- Heart failure with preserved ejection fraction
- Restrictive cardiomyopathy
- Endocarditis
- Endocarditis prophylaxis
- Preoperative consultation

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Heart Failure and Endocarditis Q1

A 55-year-old man is evaluated for a 2-month history of exertional dyspnea.

An S_3, crackles, and JVD are present.

Chest radiograph shows vascular congestion.

ECG shows anterior Q waves.

Echocardiogram reveals anterior wall hypokinesis and LVEF of 35%.

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Heart Failure and Endocarditis Q1

A 55-year-old man is evaluated for a 2-month history of exertional dyspnea. An S_3, crackles, and JVD are present. Chest radiograph shows vascular congestion. ECG shows anterior Q waves. Echocardiogram reveals anterior wall hypokinesis and LVEF of 35%.

Which of the following is the most appropriate diagnostic test?

A: Cardiopulmonary exercise test

B: Chest CT

C: Coronary angiography

D: TEE

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Heart Failure With Reduced Ejection Fraction (HFrEF)

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HFrEF: Pathophysiology

Systolic structural or functional impairment

Causes

- Age
- CAD (>50% of HF cases in United States)
- Hypertension
- Obesity
- Diabetes
- Valvular heart disease

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HFrEF: Diagnosis and Testing

Dyspnea, orthopnea, paroxysmal nocturnal dyspnea, bendopnea

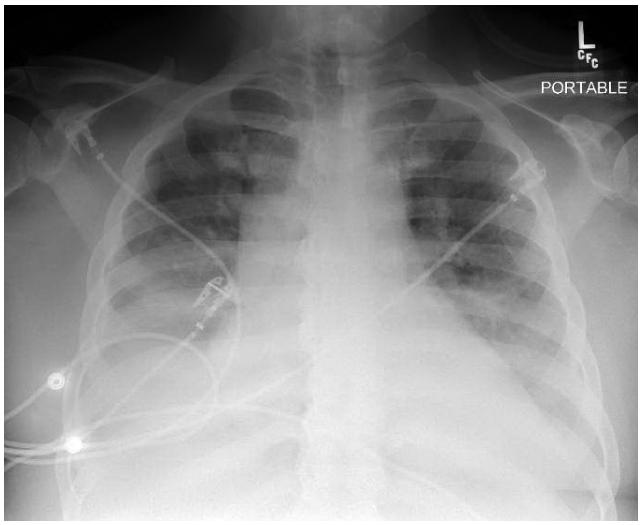
S_3, crackles, JVD, hepatojugular reflux

ECG

- Conduction disease
- Ischemia
- Arrhythmia

Chest radiography

- Pulmonary edema



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HFrEF: Testing

BNP if cause of dyspnea unclear

- Affected by noncardiac factors
  - ↑ BNP level in kidney failure, older age, female sex
  - ↓ BNP level in obesity

	Compatible With HF (Nonspecific)	Excludes HF
BNP level	>400 pg/mL	<100 pg/mL
NT-pro–BNP level	>900 pg/mL	Age dependent: • <450 pg/mL (age <50 y) • <900 pg/mL (age 50-75 y) • <1800 pg/mL (age >75 y)

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HFrEF: Testing

- Complete blood count
- Glucose, electrolytes, blood urea nitrogen, creatinine
- Urinalysis
- Liver chemistry tests
- Lipids
- Thyroid-stimulating hormone
- Toxicology considerations

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HFrEF: Testing

Echocardiography

- LVEF ≤40%
- Regional wall abnormalities suggest CAD
- May reveal valvular heart disease, dilation of LV (late)

Tests for ischemia (most patients)

- Noninvasive testing when low probability of CAD
- Coronary angiography if ischemia suspected

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HFrEF: NYHA Classification

Class	Description
I	No limitations of physical activity
II	Slight limitation of physical activity
III	Marked limitation of physical activity
IV	Unable to carry on any physical activity without symptoms

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HFrEF: Stages of Disease

Stage	Description
A	At risk but no structural disease or symptoms
B	Structural disease without symptoms
C	Structural disease with symptoms
D	Structural disease with refractory symptoms

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Heart Failure and Endocarditis Q2

A 57-year-old woman is evaluated in follow-up for chronic HFrEF due to ischemic cardiomyopathy.

She reports dyspnea with moderate activity.

Echocardiogram shows an LVEF of 30%.

ECG shows normal sinus rhythm, QRS duration of 90 ms, and heart rate of 60/min.

Medications are enalapril, carvedilol, empagliflozin, and spironolactone and are optimally dosed.

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Heart Failure and Endocarditis Q2

A 57-year-old woman is evaluated in follow-up for chronic HFrEF due to ischemic cardiomyopathy. She reports dyspnea with moderate activity. Echocardiogram shows an LVEF of 30%. ECG shows normal sinus rhythm, QRS duration of 90 ms, and heart rate of 60/min. Medications are enalapril, carvedilol, empagliflozin, and spironolactone and are optimally dosed.

Which of the following is the most appropriate next step in treatment?

A: Add digoxin

B: Add ivabradine

C: Switch carvedilol to metoprolol tartrate

D: Switch enalapril to sacubitril-valsartan

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HFrEF: Treatment

ACE inhibitors/ARBs

- Indicated in stages B, C, and D HF (including asymptomatic)
- Reduce morbidity and mortality
- Avoid with eGFR <30 mL/min/1.73 m^2
- Do not combine ACE inhibitor and ARB
- ACE inhibitor–induced cough: Use ARB
- Modest increase in serum creatinine acceptable

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HFrEF: Treatment

Sacubitril-valsartan

- ARB/neprilysin inhibitor (ARNI)
- May be used as first-line therapy instead of ACE inhibitor or ARB **alone** in stage C or D HF
- Use as primary or to replace ACE inhibitor/ARB **alone** in NYHA functional class II-IV HFrEF
- Do not give within 36 hours of ACE inhibitor
- Further reduces morbidity and mortality

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HFrEF: Treatment

β-Blockers

- Indicated in stages B, C, and D HF (including asymptomatic)
- Bisoprolol, carvedilol, and metoprolol succinate only
  - No class effect for all β-blockers
- Improves remodeling, ↑ LVEF, ↓ hospitalization and mortality
- Do not begin or continue in decompensated HF if:
  - Hemodynamically unstable *or*
  - Concern for cardiogenic shock
- Continue during exacerbation of HF if the above clinical issues are absent

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HFrEF: Treatment

Aldosterone antagonists (eplerenone, spironolactone)

- Patients with NYHA functional class II-IV HF
- ↓ Mortality and HF hospitalizations
- Risk for hyperkalemia

SGLT2 inhibitors

- Patients with HFrEF with or without diabetes
- ↓ Risk for worsening HF

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HFrEF: Treatment

Ivabradine

- Reduces HF hospitalizations
- Consider in patients with all of the following:
  - NYHA functional class II or III
  - HFrEF (LVEF ≤35%)
  - Sinus rhythm
  - Resting heart rate ≥70/min
  - Receiving GDMT, including maximal β-blocker therapy

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HFrEF: Treatment

Isosorbide dinitrate–hydralazine

- Patients self-identified as African American with NYHA class III-IV who are receiving optimal therapy
- Patients with ACE inhibitor/ARB intolerance (weak recommendation)

Loop diuretics

- Primary therapy for volume overload

Avoid the following:

- NSAIDs
- Thiazolidinediones
- CCBs

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Acute Decompensated Heart Failure

Identify cause of HF exacerbation

- Nonadherence to sodium restriction, medications
- Recurrent ischemia
- Arrhythmia
- Valvular disease
- Hypertension
- Concurrent medical illness

Assess cardiac function

- Volume overload
- ↓ Peripheral perfusion

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Acute Decompensated Heart Failure

Diuretics

- 2.5 × daily outpatient dose
- IV administration: infusion or bolus
- Add thiazide for resistance
- No “low-dose” dopamine

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Acute Decompensated Heart Failure

GDMT before discharge

- Including β-blocker

Prevent early readmission

- Predischarge BNP level for prognostication
- Follow-up telephone call in 24-48 hours
- Early follow-up appointment

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HFrEF: Device Therapy

Device	Indication (Optimal Medical Therapy Before Device Therapy)
ICD	Ischemic and nonischemic cardiomyopathy: NYHA class II-III, LVEF ≤35% (mortality benefit) Ischemic cardiomyopathy: NYHA I with LVEF ≤30%
CRT (biventricular pacing)	NYHA class II-IV, EF ≤35%, LBBB with QRS ≥120 ms (mortality and functional benefit)

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HFrEF: Advanced Therapies

Cardiac transplant for end-stage HF

Left ventricular assist device

- Bridge to transplant
- Destination therapy

Ambulatory parenteral inotropes (e.g., dobutamine)

- Palliation
- Bridge to other therapies

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Dilated Cardiomyopathy

ACP

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Dilated Cardiomyopathy

Ventricular dilation and decreased function

Common causes

- Idiopathic
- Genetic
- Viral
- Drugs (e.g., anthracyclines)
- Toxins (e.g., alcohol)
- Tachycardia mediated

Treatment

- Treatment of underlying cause
- GDMT

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Peripartum Cardiomyopathy

Commonly occurs 1 month before to 5 months after delivery

Expedite delivery

- Avoid ACE inhibitors/ARBs and aldosterone antagonists

Anticoagulation therapy if EF <35%

Recovery of LV function is common

Risk for recurrence

- Increased risk if LV function does not return to normal
- Avoid subsequent pregnancies if significant LV systolic dysfunction persists

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Arrhythmia-Induced Cardiomyopathy: Types

Tachycardia-induced cardiomyopathy

- Diagnosis of exclusion
- Suspected when cardiomyopathy improves with treatment of tachyarrhythmia

PVC-induced cardiomyopathy

- Caused solely by frequent PVCs with LVEF decreasing at least 10%
- PVC burden ≥10% considered enough to trigger PVC-induced cardiomyopathy
- Treated with anti-arrhythmic drugs or radiofrequency ablation

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Myocarditis

Presentation

- Infection (especially viral), systemic disease
- Chest pain, HF
- Segmental or diffuse ventricular involvement
- Elevated troponin level

Evaluation: CMR imaging, biopsy

Treatment: GDMT, treat underlying cause

Giant cell myocarditis

- Severe disease in young patients
- Treat with immunosuppressives, transplant

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Heart Failure and Endocarditis Q3

A 60-year-old woman receives furosemide for volume overload.

Echocardiogram showed LVEF of 60% without valvular abnormalities.

She has hypertension, HFpEF, and atrial fibrillation.

Medications are metoprolol, hydrochlorothiazide, and rivaroxaban.

On the next day, BP is 130/80 mm Hg and pulse rate is 50/min.

There is no JVD or edema.

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Heart Failure and Endocarditis Q3

A 60-year-old woman receives furosemide for volume overload. Echocardiogram showed LVEF of 60% without valvular abnormalities. She has hypertension, HFpEF, and atrial fibrillation. Medications are metoprolol, hydrochlorothiazide, and rivaroxaban. On the next day, BP is 130/80 mm Hg and pulse rate is 50/min. There is no JVD or edema.

Which of the following is the most appropriate treatment?

A: Add digoxin

B: Add empagliflozin

C: Increase metoprolol dosage

D: Replace hydrochlorothiazide with furosemide

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Heart Failure With Preserved Ejection Fraction (HFpEF)

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HFpEF: Pathophysiology

Diastolic dysfunction

- Impairment in relaxation
- Increased chamber stiffness
- Increase in LV filling pressures → dyspnea

Causative/exacerbating factors

- Hypertension
- Obesity
- Atrial fibrillation
- Infiltrative diseases (e.g., amyloidosis, sarcoidosis)
- Ischemia

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HFpEF: Diagnosis and Testing

Dyspnea, orthopnea, paroxysmal nocturnal dyspnea

S_3, crackles, ↑ JVD

BNP levels are lower than in HFrEF

Echocardiography

- LVEF ≥50%
- Normal LV cavity size
- Increased LV thickness
- Left atrial enlargement
- Diastolic dysfunction

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HFpEF: Treatment

SGLT2 inhibitors for all patients

- ↓ Combined end point of HF hospitalizations and CV death

Consider spironolactone in selected patients: ↓ hospitalizations

- If elevated BNP level or hospitalization within 1 year
- eGFR >30 mL/min/1.73 m^2
- Creatinine level <2.5 mg/dL
- Potassium level <5.0 mEq/L

Consider ARB or ARNI

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HFpEF: Treatment

Diuretics to maintain euvolemia

- Avoid excessive preload reduction

Treat underlying hypertension

- No antihypertensive agent is superior
- β-Blockers, ACE inhibitors, ARBs, ARNI

Revascularization

- Myocardial ischemia despite GDMT

Treat atrial fibrillation according to guidelines

Treat underlying infiltrative disease if present

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Heart Failure and Endocarditis Q4

A 33-year-old woman develops dyspnea.

She has perihilar lymphadenopathy and a history of anterior uveitis.

Increased JVD with inspiration is present. The lungs are clear.

ECG shows Mobitz type 2 heart block.

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Heart Failure and Endocarditis Q4

A 33-year-old woman develops dyspnea. She has perihilar lymphadenopathy and a history of anterior uveitis. Increased JVD with inspiration is present. The lungs are clear. ECG shows Mobitz type 2 heart block.

Which of the following is the most likely cause of this patient's cardiac symptoms?

A: Constrictive pericarditis

B: Ischemic cardiomyopathy

C: Myocarditis

D: Sarcoid cardiomyopathy

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Restrictive Cardiomyopathy

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Restrictive Cardiomyopathy: Diagnosis

Increased myocardial stiffness without dilation → diastolic dysfunction

Presentation

- Heart failure (right-sided HF may predominate)
- ↑ JVD with inspiration (Kussmaul sign)

Infiltrative diseases

- Amyloidosis, sarcoidosis, hemochromatosis

Non-infiltrative diseases

- Scleroderma, radiation therapy

Endomyocardial diseases

- Carcinoid, hypereosinophilic syndrome

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Amyloidosis: Characteristics and Diagnosis

HF signs and symptoms (pulmonary edema is uncommon), low blood pressure

Low-voltage ECG with LV hypertrophy on echocardiogram

Light-chain amyloidosis (AL)

- Autonomic neuropathy, proteinuria, hepatomegaly

Transthyretin amyloidosis (ATTR)

- Polyneuropathy, lumbar spinal stenosis, carpal tunnel, ruptured biceps tendon

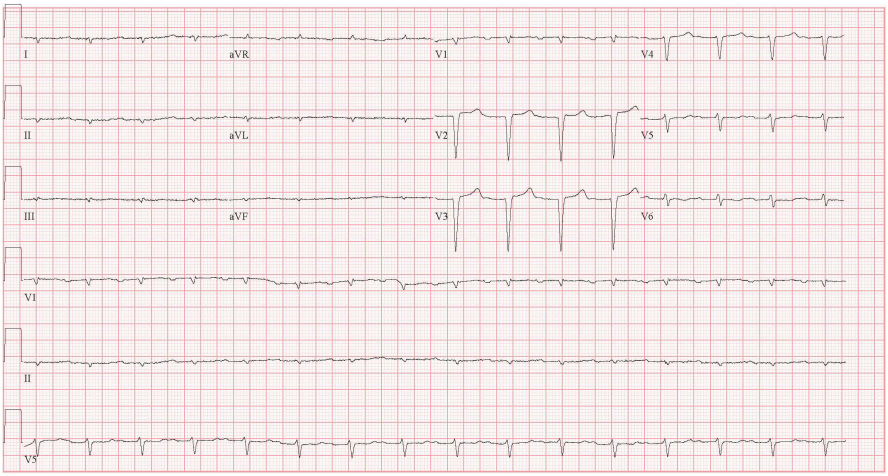
Diagnosis

- AL: CMR imaging, SPEP/UPEP/serum free light chains
- ATTR: CMR imaging, 99m-technetium scan

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Amyloidosis



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Sarcoidosis and Hemochromatosis

	Sarcoidosis	Hemochromatosis
Clinical findings	Lung, skin, joint, ocular involvement Heart failure Conduction block Arrhythmias	Liver disease Osteoarthritis Diabetes
Testing	CMR imaging FDG-PET Consider biopsy	↑ Serum ferritin and transferrin saturation Genetic assay CMR imaging

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Restrictive Cardiomyopathy: Treatment

Treat underlying disease if present

- ATTR amyloidosis: TTR stabilizers (tafamidis), silencers (patisiran, inotersen)
- Sarcoidosis: steroids
- Hemochromatosis: phlebotomy

Avoid volume depletion

Cautious use of AV nodal blocking agents

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Endocarditis

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Infective Endocarditis: Clinical Presentation and Diagnosis

Fever, malaise, fatigue

- Sensitive but not specific symptoms

New valvular regurgitation

Murmur or HF

Vascular phenomena

- Janeway lesions (painless red macular lesions on soles and palms)
- Septic pulmonary infarcts
- Mycotic aneurysms
- Intracranial hemorrhages
- Major arterial emboli

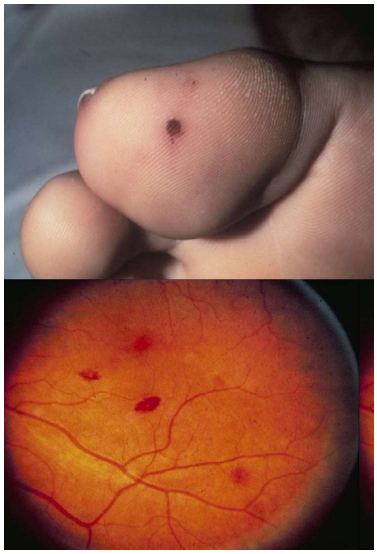


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Infective Endocarditis: Diagnosis



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Immunologic phenomena

- Glomerulonephritis
- Osler nodes (painful purple papulopustules on pulp of fingers/toes)
- Roth spots (hemorrhagic retinal lesions)
- Elevated rheumatoid factor level

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Infective Endocarditis: Testing

Leukocytosis, anemia, hematuria

Blood cultures: ≥2 sets

- At different times, ideally >30 minutes apart
- At peripheral sites

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Infective Endocarditis: Testing

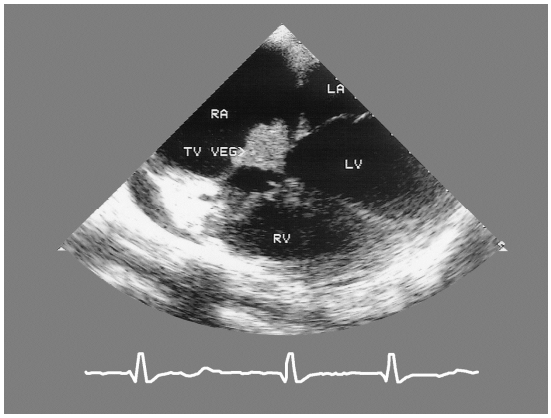
TTE to identify vegetations

TEE if

- Nondiagnostic TTE
- Prosthetic valve, intracardiac device, or abscess

ECG

- Conduction abnormalities suggest perivalvular abscess



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Infective Endocarditis: Modified Duke Clinical Criteria

Major Criteria	Minor Criteria
Blood culture positive for IE (organisms typical for IE × 2 or positive acute serology for *Coxiella burnetii*)	Predisposing heart condition or injection drug use
Positive TTE (TEE recommended for prosthetic valve)	Temperature >100.4 °F
New valvular regurgitation	Embolic vascular phenomena (emboli, infarcts, ICH, conjunctival hemorrhage, Janeway lesions) Immunologic phenomena (glomerulonephritis, Osler nodes, Roth spots, rheumatoid factor)
	Positive blood culture for organisms typical of endocarditis but does not meet major criteria

Information from Li JS, Sexton DJ, Mick N, Nettles R, Fowler VG Jr, Ryan T, et al. Proposed modifications to the Duke criteria for the diagnosis of infective endocarditis. Clin Infect Dis. 2000;30:637. [PMID: 10770721]

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Infective Endocarditis: Modified Duke Criteria

Definite infective endocarditis

- Two major criteria
- One major criterion plus three minor criteria
- Five minor criteria

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Infective Endocarditis: Empiric Therapy

Not always needed; can await culture results

Empiric therapy for sepsis or hemodynamic instability

Antimicrobial agents should focus on common causes

- MRSA/MSSA
- *Streptococcus* spp.
- *Enterococcus* spp.

Vancomycin + ceftriaxone: first choice for most patients

- Differs for critically ill patients and those with prosthetic valve

De-escalate on the basis of culture results

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Infective Endocarditis: Surgery Indications

Valvular dysfunction and symptomatic HF

Left-sided infective endocarditis caused by

- Fungal infections
- Other highly resistant organisms

Annular/aortic abscess, penetrating lesions, heart block

Persistent bacteremia or fever >5-7 days after antimicrobial initiation

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Heart Failure and Endocarditis Q5

A 35-year-old man is scheduled to have dental extractions.

He has a bicuspid aortic valve and a grade 2/6 midsystolic murmur.

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Heart Failure and Endocarditis Q5

A 35-year-old man is scheduled to have dental extractions. He has a bicuspid aortic valve and a grade 2/6 midsystolic murmur.

Which of the following is the most appropriate endocarditis prophylaxis?

A: IV vancomycin

B: Oral amoxicillin

C: Oral TMP-SMX

D: No antibiotic prophylaxis

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Endocarditis Prophylaxis

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Infective Endocarditis Prophylaxis: Risk Assessment

Dental prophylaxis in selected patients

- Prosthetic cardiac valve
- Prosthetic material used for cardiac valve repair
- History of prior IE
- Unrepaired cyanotic congenital heart disease
- Repaired congenital heart disease with residual defects
- Repaired defect that has been repaired with prosthetic material (surgical or catheter based) within the previous 6 months
- Left ventricular assist device
- Cardiac transplantation with valvulopathy with regurgitation

No prophylaxis for nondental procedures

- TEE, upper endoscopy, colonoscopy, cystoscopy
- In absence of ongoing infection

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Infective Endocarditis Prophylaxis: Treatment

Oral amoxicillin

- 30-60 minutes before dental procedure

Inability to take oral drugs

- IM/IV ampicillin, cefazolin, or ceftriaxone

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Infective Endocarditis Prophylaxis: Treatment

Penicillin allergy: oral antibiotics

- Doxycycline, azithromycin, clarithromycin
- Cephalexin for nonsevere, non–IgE-mediated penicillin allergy

Penicillin allergy: parenteral antibiotics

- IV vancomycin
- IM or IV cefazolin, ceftriaxone for nonsevere, non–IgE-mediated penicillin allergy

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Heart Failure and Endocarditis Q6

A 68-year-old man is scheduled to undergo total left knee arthroplasty.

He has no cardiovascular risk factors or symptoms.

Cardiovascular exam is normal.

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Heart Failure and Endocarditis Q6

A 68-year-old man is scheduled to undergo total left knee arthroplasty. He has no cardiovascular risk factors or symptoms. Cardiovascular exam is normal.

Which of the following is the most appropriate preoperative testing?

A: Coronary angiography

B: Noninvasive pharmacologic stress testing

C: Resting echocardiography

D: No testing

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Preoperative Consultation

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Preoperative Consultation: Cardiovascular Preop Consult

Cardiac risk assessment not needed for low-risk surgery

- Endoscopic
- Superficial breast
- Cataract
- Ambulatory

Surgery without testing

- Emergency surgery
- Low cardiovascular risk

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Preoperative Consultation: Medication Considerations

GLP-1 agonists

- Hold 1 week before surgery if possible

DOACs for atrial fibrillation

- Can hold for most patients 1-2 days before surgery and restart 1-2 days after surgery (depending on bleeding risk)

Patients with hypercoagulability with anti-phospholipid antibody or mechanical heart valves

- Bridge with LMWH for surgery

Naloxone

- Stop 1-3 days before surgery and restart 7 days after opioids are discontinued

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Preoperative Consultation: Cardiovascular Preop Consult

Delay surgery if possible

- Myocardial infarction within 30 days
- Unstable/severe angina
- Decompensated HF
- Significant arrhythmia
- Severe valvular heart disease
- Recent coronary stenting (<6 wk)

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Preoperative Consultation: Cardiovascular Preop Consult

Patients with CVD risk factors → calculate risk for MACE

- <1%: no additional evaluation
- ≥1%: evaluate functional capacity (METs) using a validated tool (e.g., Duke Activity Status Index)

METs ≥4 → no additional evaluation

METs <4 or indeterminate → additional evaluation

- Test only if results will change perioperative management
- Pharmacologic stress testing

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Cardiology IV

- Answers to Multiple-Choice Questions

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Heart Failure and Endocarditis Q1

A 55-year-old man is evaluated for a 2-month history of exertional dyspnea. An S_3, crackles, and JVD are present. Chest radiograph shows vascular congestion. ECG shows anterior Q waves. Echocardiogram reveals anterior wall hypokinesis and LVEF of 35%.

Which of the following is the most appropriate diagnostic test?

A: Cardiopulmonary exercise test

B: Chest CT

C: Coronary angiography

D: TEE

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Heart Failure and Endocarditis Q2

A 57-year-old woman is evaluated in follow-up for chronic HFrEF due to ischemic cardiomyopathy. She reports dyspnea with moderate activity. Echocardiogram shows an LVEF of 30%. ECG shows normal sinus rhythm, QRS duration of 90 ms, and heart rate of 60/min. Medications are enalapril, carvedilol, empagliflozin, and spironolactone and are optimally dosed.

Which of the following is the most appropriate next step in treatment?

A: Add digoxin

B: Add ivabradine

C: Switch carvedilol to metoprolol tartrate

D: Switch enalapril to sacubitril-valsartan

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Heart Failure and Endocarditis Q3

A 60-year-old woman receives furosemide for volume overload. Echocardiogram showed LVEF of 60% without valvular abnormalities. She has hypertension, HFpEF, and atrial fibrillation. Medications are metoprolol, hydrochlorothiazide, and rivaroxaban. On the next day, BP is 130/80 mm Hg and pulse rate is 50/min. There is no JVD or edema.

Which of the following is the most appropriate treatment?

A: Add digoxin

B: Add empagliflozin

C: Increase metoprolol dosage

D: Replace hydrochlorothiazide with furosemide

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Heart Failure and Endocarditis Q4

A 33-year-old woman develops dyspnea. She has perihilar lymphadenopathy and a history of anterior uveitis. Increased JVD with inspiration is present. The lungs are clear. ECG shows Mobitz type 2 heart block.

Which of the following is the most likely cause of this patient's cardiac symptoms?

A: Constrictive pericarditis

B: Ischemic cardiomyopathy

C: Myocarditis

D: Sarcoid cardiomyopathy

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Heart Failure and Endocarditis Q5

A 35-year-old man is scheduled to have dental extractions. He has a bicuspid aortic valve and a grade 2/6 midsystolic murmur.

Which of the following is the most appropriate endocarditis prophylaxis?

A: IV vancomycin

B: Oral amoxicillin

C: Oral TMP-SMX

D: No antibiotic prophylaxis

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Heart Failure and Endocarditis Q6

A 68-year-old man is scheduled to undergo total left knee arthroplasty. He has no cardiovascular risk factors or symptoms. Cardiovascular exam is normal.

Which of the following is the most appropriate preoperative testing?

A: Coronary angiography

B: Noninvasive pharmacologic stress testing

C: Resting echocardiography

D: No testing

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Musculoskeletal Problems

2025 Virtual/Live Internal Medicine Board Review

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ACP Internal Medicine Board Review Course

General Internal Medicine: Musculoskeletal Problems

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- Shoulder syndromes
- Elbow syndromes
- Wrist and hand syndromes
- Hip and pelvic pain
- Back pain
- Knee syndromes
- Foot and ankle syndromes
- Sports injuries and trauma

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Musculoskeletal Problems Q1

A 46-year-old man reports 2 weeks of left shoulder pain that worsens with overhead activities.

Pain occurs on active and passive abduction between 60 and 120 degrees. No tenderness to palpation is noted.

Drop arm test is negative. Pain is reproduced with the empty can test.

ROM and strength are normal.

3

3

Musculoskeletal Problems Q1

A 46-year-old man reports 2 weeks of left shoulder pain that worsens with overhead activities. Pain occurs on active and passive abduction between 60 and 120 degrees. No tenderness to palpation is noted. Drop arm test is negative. Pain is reproduced with the empty can test. ROM and strength are normal.

Which of the following is the most appropriate next step in management?

A: Left shoulder MRI

B: Left shoulder radiography

C: Orthopedic surgery referral

D: Physical therapy

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Shoulder Syndromes

5

Rotator Cuff Disease: Diagnosis

Pain localized to upper arm and area of the deltoid insertion

Pain aggravated by

- Overhead activities
- Lying on affected side
- Passive and active abduction (60-120 degrees)

Normal ROM in all directions



Video/article: "Motion is the notion for diagnosing shoulder pain"

I.M. MATTERS from ACP™

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Rotator Cuff Disease: Diagnosis

	Empty Can	Painful Arc	Drop Arm
Uncomplicated rotator cuff injury	Pain	Pain	Negative
Partial tear (supraspinatus)	Pain and weakness	Pain and weakness	Negative (may have weakness)
Full-thickness tear (supraspinatus)	Not able to perform	Not able to perform	Positive

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Rotator Cuff Disease: Testing

Imaging not required for most patients

MRI or ultrasonography indications

- Acute or progressive functional loss
- No response after 3-6 months of conservative measures

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Rotator Cuff Disease: Treatment

Avoidance of aggravating activities

Physical therapy

Acetaminophen, oral/topical NSAIDs

Subacromial glucocorticoid injections → short-term pain relief

Surgery or sports medicine referral

- Complete rotator cuff tear
- Lack of improvement at 3-6 months of conservative therapy

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Adhesive Capsulitis (Frozen Shoulder)

Diagnosis

- Lateral shoulder pain, worse at night
- Shoulder stiffness
- Limited passive and active ROM (all directions)

Treatment (no consensus)

- Intra-articular glucocorticoid injections and physical therapy
- Acetaminophen and NSAIDs
- Surgery or manipulation under anesthesia if conservative therapy fails

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Acromioclavicular Joint Pain

Diagnosis and testing

- Arthritic or traumatic
- Pain at distal end of clavicle
- Plain radiography: acromioclavicular joint degenerative changes
- Pain worse with passive or active adduction of shoulder (hand placed upon the opposite shoulder)

Treatment

- NSAIDs, activity modification: first-line therapy
- Glucocorticoid injections: short-term pain relief



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Proximal Biceps Tendinopathy and Rupture: Diagnosis and Testing



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- Anterior shoulder pain
- Pain aggravated by lifting and resisted wrist supination
- Proximal biceps tendon tenderness to palpation
- Ultrasonography

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Biceps Tendinopathy and Rupture: Treatment

- Avoid aggravating activities
- Topical/oral NSAIDs
- Physical therapy
- Glucocorticoid injection for short-term pain relief
  - Only for tendinopathy
- Surgery for distal biceps tendon rupture

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Labral Tear

Common in individuals who do repetitive overhead activities

Deep pain

- Worsens with abduction and external rotation

Catching sensation with movement

Crepitus

Instability of the joint

Diagnosis is challenging and usually requires orthopedic evaluation

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Elbow Syndromes

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Epicondylitis: Diagnosis and Testing

Lateral epicondylitis (tennis elbow)

- Strain on wrist extensor tendons
- Lateral elbow pain with resisted wrist extension (third-finger extension)

Medial epicondylitis (golfer's elbow)

- Strain on forearm flexor muscles
- Medial elbow pain with resisted wrist flexion

No imaging indicated

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Epicondylitis: Treatment

Conservative treatment

- Activity avoidance
- Ice/NSAIDs
- Physical therapy
- Counterforce bracing

Glucocorticoid injections

- Short-term symptom improvement

Surgery or Tenex procedure for recalcitrant pain or prolonged dysfunction

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Olecranon Bursitis: Diagnosis and Testing



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Caused by repetitive trauma, infection, inflammatory conditions (e.g., gout, rheumatoid arthritis)

Fluid-filled mass, usually minor discomfort

- Erythema, warmth, tenderness

Unrestricted active and passive ROM with pronation and supination

- Flexion and extension may be uncomfortable with full ROM

Can consider aspirating joint to exclude crystals/infection if indicated

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Bursitis: Treatment

Septic bursitis

- Drainage and antibiotics
- Leukocyte count in septic bursitis may be lower than in septic joints

Inflammatory

- Treat underlying disease

Traumatic

- Ice, rest, compression, NSAIDs

Prevention

- Elbow padding

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Musculoskeletal Problems Q2

A 52-year-old woman reports 4 months of worsening tingling and numbness involving the right index finger, thumb, and adjacent palm.

Exam reveals right thumb abductor weakness and thenar eminence atrophy.

Nerve conduction studies show median nerve sensorimotor denervation.

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Musculoskeletal Problems Q2

A 52-year-old woman reports 4 months of worsening tingling and numbness involving the right index finger, thumb, and adjacent palm. Exam reveals right thumb abductor weakness and thenar eminence atrophy. Nerve conduction studies show median nerve sensorimotor denervation.

Which of the following is the most appropriate treatment?

A: Decompression surgery

B: Glucocorticoid injection

C: Nocturnal neutral wrist splinting

D: Occupational therapy

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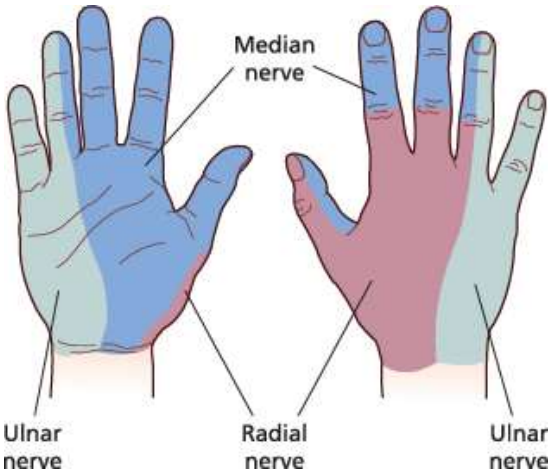
Wrist and Hand Syndromes

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Carpal Tunnel Syndrome: Diagnosis

- Pain and paresthesia (especially nocturnal) in median nerve distribution
- Weak thumb abduction and/or thenar atrophy
- Electromyography (EMG) in equivocal cases and before surgery



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Carpal Tunnel Syndrome: Treatment

First-line therapy

- Wrist splinting
- Glucocorticoid injection → short-term improvement

Carpal tunnel release surgery

- Lack of improvement with conservative therapy
- Weakness, severe pain
- Thenar or hypothenar eminence wasting
- Denervation by EMG

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Ulnar Neuropathy: Diagnosis and Treatment

Nerve entrapment at the wrist or elbow (Tinel sign at Guyon canal or ulnar elbow)

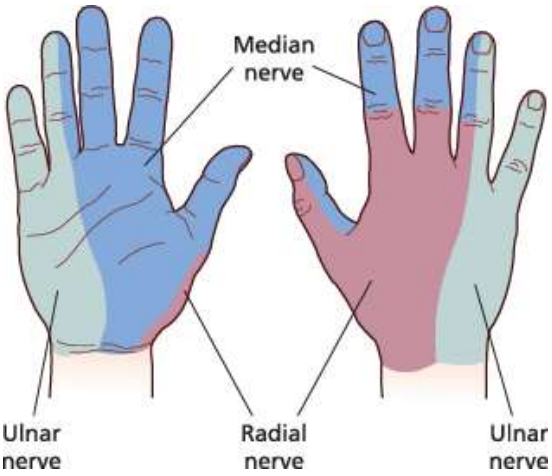
Elbow pain, paresthesia of 4th/5th digits, ulnar hand

Wrist pain, decreased hand strength/sensation

Conservative treatment

- Elbow padding, trigger avoidance

Surgical release for elbow entrapment



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Acute Wrist/Hand Pain After Trauma

Suggests fracture or dislocation, plain film radiography needed

Scaphoid fracture

- Can occur after fall on outstretched hand

Pain in the anatomic snuffbox

- Initial radiographs often normal

Hamate fracture

- Pain over the hypothenar eminence

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Musculoskeletal Problems Q3

A 65-year-old man reports 3 weeks of nonradiating left hip pain.

Symptoms worsen when walking or lying on his left side.

The left hip has full, painless ROM with tenderness to palpation and with figure four PROM stretch over the lateral hip.

Straight leg raise test is negative; reflexes are normal.

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Musculoskeletal Problems Q3

A 65-year-old man reports 3 weeks of nonradiating left hip pain. Symptoms worsen when walking or lying on his left side. The left hip has full, painless ROM with tenderness to palpation and with figure four PROM stretch over the lateral hip. Straight leg raise test is negative; reflexes are normal.

Which of the following is the most likely diagnosis?

A: Greater trochanteric pain syndrome (GTPS)

B: Iliotibial band syndrome

C: Lumbar radiculopathy

D: Osteoarthritis of the hip

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Hip and Pelvic Pain

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Hip and Pelvic Pain: Diagnosis

Anterior	Osteoarthritis Labral tear Avascular necrosis
Lateral	Gluteal tendinopathy/GTPS Iliotibial band syndrome
Posterior/ back pain	Lumbar radiculopathy Sacroiliac joint dysfunction

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Anterior Hip and Pelvic Pain: Diagnosis and Testing

Osteoarthritis

- Insidious onset, anterior groin
- Worsens with standing and activity
- Painful passive and active ROM
- Restricted ROM with internal rotation
- Plain radiography

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Anterior Hip and Pelvic Pain: Diagnosis and Testing

Labral tear

- Often in athletes
- Acute or insidious onset
- Anterior hip or groin pain
- Painful clicking or catching
- May have positive FADIR test, SCOUR test
- MR arthrography

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Anterior Hip and Pelvic Pain: Diagnosis and Testing

Avascular necrosis

- Insidious onset
- Continuous pain
- Difficulty walking
- Risk factors
  - Alcohol use, glucocorticoids, systemic lupus erythematosus, sickle cell anemia
- Hip MRI

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Lateral Hip and Pelvic Pain: Diagnosis and Testing

Gluteal tendinopathy/GTPS

- Insidious onset (usually)
- Pain worse when lying on side
- Point tenderness over the greater trochanter
- Pain with resisted abduction
- Normal ROM
- Imaging not indicated



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Hip and Pelvic Pain: Treatment

Osteoarthritis	Nonpharmacologic therapy (PT) Oral/topical NSAIDs Duloxetine Acetaminophen (add-on therapy) Surgical therapy
Labral tear	Muscle strengthening/activity modification Arthroscopic surgery
Avascular necrosis	Supportive care Core decompression or bone grafting Hip arthroplasty
Gluteal tendinopathy/ GTPS	Activity modification, physical therapy and stretching NSAIDs Glucocorticoid injection

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Musculoskeletal Problems Q4

A 32-year-old man reports 2 weeks of nonradiating low back pain that worsens with activity.

He has had no trauma, morning stiffness, weakness, or paresthesia.

He has limited low back ROM because of pain but no spine or sacroiliac joint tenderness.

Straight leg raise test is negative.

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Musculoskeletal Problems Q4

A 32-year-old man has 2 weeks of nonradiating low back pain that worsens with activity. He reports no trauma, morning stiffness, weakness, or paresthesia. He has limited low back ROM because of pain but no spine or sacroiliac joint tenderness. Straight leg raise test is negative.

Which of the following is the most appropriate diagnostic test to perform next?

A: ESR measurement

B: HLA-B27 testing

C: Lumbar spine radiography

D: No additional testing

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Back Pain

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Low Back Pain

Nonspecific low back pain (90% of all back pain)

- No specific cause identified

Most common identifiable causes (90%)

- Spinal stenosis
- Disk herniation
- Compression fractures

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Lumbar Radiculopathy: Diagnosis and Testing

Diagnosis and testing

- Acute onset
- Pain radiating down leg
- Positive straight leg raise test
- Possible diminished deep tendon reflexes (knee, ankle)
- Lumbar MRI in selected patients

Treatment

- Conservative treatment
- Surgery for severe, progressive, or recalcitrant symptoms

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Sacroiliac Joint Dysfunction

Diagnosis and testing

- Insidious onset
- Pain at night
- Morning stiffness
- Positive inflammatory markers
- Possible other peripheral joint symptoms
- Pain with FABER
- Plain radiography; MRI sensitive to early changes

Treatment

- Physical therapy and NSAIDs



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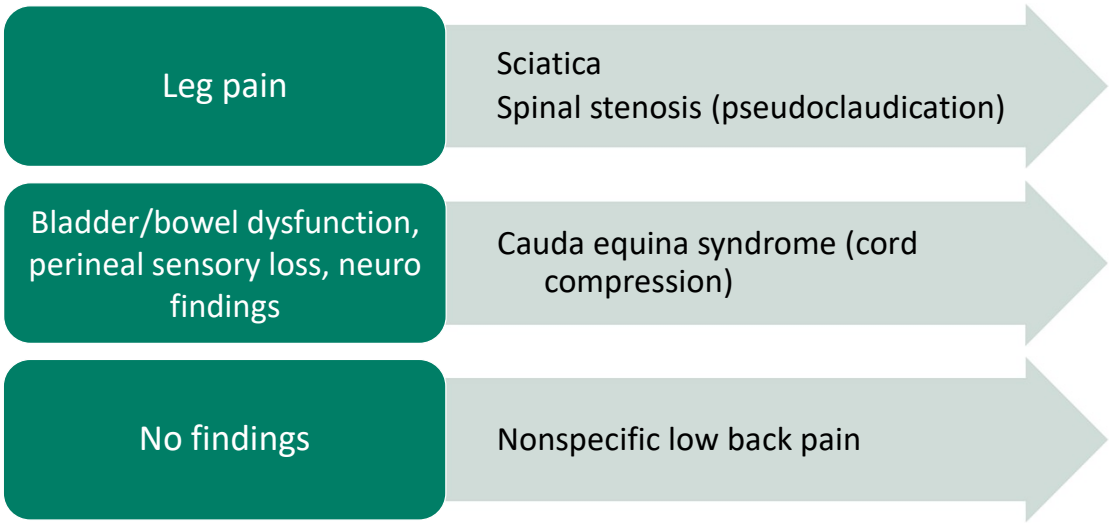
Low Back Pain: Clues to Diagnosis

Fever	Epidural abscess Osteomyelitis/diskitis
Vertebral tenderness	Metastatic cancer Vertebral compression fracture (osteoporosis)
Morning back stiffness	Spondyloarthropathy

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Low Back Pain: Clues to Diagnosis



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Low Back Pain: Testing

No imaging for acute, nonspecific low back pain

Immediate imaging

- Plain radiography
  - Spondyloarthropathy, compression fracture, cancer
- MRI
  - Progressive/new neurologic deficits, bladder dysfunction/saddle anesthesia, bilateral symptoms or signs, neoplasm or epidural abscess likely
- Nonemergent MRI
  - Surgical candidate, not improving, and nonspecific pain for >4 weeks

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Acute Nonspecific Low Back Pain: Treatment

- Most patients improve in ≤3 months
- Activity as tolerated, self-help advice
- Superficial heat, massage
- Acupuncture
- Spinal manipulation
- Yoga
- Physical therapy (core, gluteal strengthening)
- NSAID ± muscle relaxant

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Subacute and Chronic Low Back Pain: Treatment

Nonpharmacologic: first-line therapy

- Exercise
- Multidisciplinary rehabilitation
- Acupuncture
- Mindfulness-based stress reduction
- Yoga
- Physical therapy (core, gluteal strengthening)

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Subacute and Chronic Low Back Pain: Treatment

Pharmacologic: second-line therapy

- NSAIDs: first-line pharmacologic therapy
- Duloxetine or muscle relaxants: second-line pharmacologic therapy
- Avoid opioids

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Subacute and Chronic Low Back Pain: Treatment

Interventions

- Glucocorticoid injections (possible short-term relief)
  - E.g., epidural, branch block, radiofrequency ablation

Surgery

- Pain unresponsive to conservative measures
- Appropriate lesion amenable to surgery

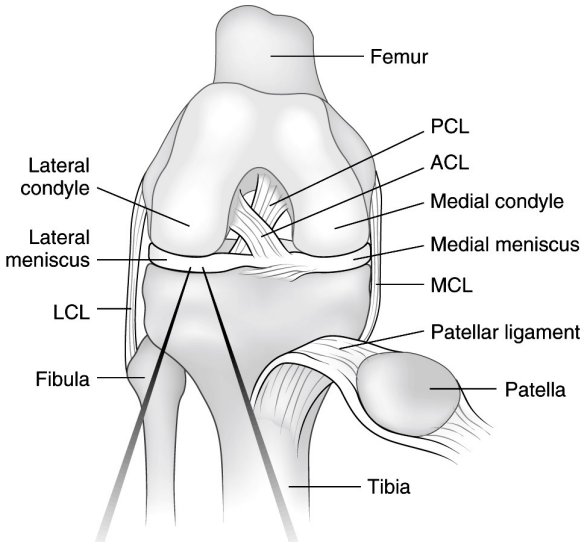
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Knee Syndromes

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Knee Ligament Tear: Anatomy



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Musculoskeletal Problems Q5

A 37-year-old woman has anterior left knee pain that began after training for a marathon.

The pain worsens when she climbs stairs or sits for an extended time.

Exam reveals pain with direct pressure to the patella and while squatting.

No other tenderness or swelling is noted.

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Musculoskeletal Problems Q5

A 37-year-old woman has anterior left knee pain that began after training for a marathon. The pain worsens when she climbs stairs or sits for an extended time. Exam reveals pain with direct pressure to the patella and while squatting. No other tenderness or swelling is noted.

Which of the following is the most likely diagnosis?

A: Iliotibial band syndrome

B: Patellofemoral pain syndrome

C: Pes anserine pain syndrome

D: Prepatellar bursitis

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Patellofemoral Pain Syndrome: Diagnosis

Most common cause of peripatellar knee pain

- Age <45 years
- Women > men

Pain exacerbated by:

- Running
- Descending stairs
- Squatting
- Prolonged sitting

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Patellofemoral Pain Syndrome: Testing

Many examination maneuvers

- Most are poorly studied
- Pain with squatting >90% sensitive
- Pain with compressing patella against the femur

Imaging not needed

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Patellofemoral Pain Syndrome: Treatment

Decrease high-impact activity

Cryotherapy (ice, cold water immersion)

NSAIDs: short course if needed

Hip abductor and quadriceps strengthening exercises, PT

- Vastus medialis oblique (VMO) strengthening

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Pes Anserine Pain Syndrome: Diagnosis and Treatment

Associated with diabetes, OA, and obesity

Possible risk factors: running, racquet sports, basketball

Knee pain

- With activity
- Nocturnal

Pain/swelling: medial tibia 6 cm below joint line

Imaging not needed

Rest, ice, NSAIDs, soft knee brace, quadriceps strengthening, weight reduction

Consider occult fracture, local glucocorticoid injection if persistent



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Prepatellar Bursitis: Diagnosis, Treatment, and Prevention

Swelling in front of patella

May be associated with pain, tenderness, warmth, and erythema

Caused by repetitive trauma by working on knees

- Roofing, flooring, kneeling to bathe animals or children

May or may not be inflamed

- If inflamed, aspiration for urate crystals and infection is indicated

Treatment

- Septic bursitis: drainage and antibiotics
- Inflammatory: Treat underlying disease
- Traumatic: Ice, rest, compression, NSAIDs

Prevention

- Knee padding

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Iliotibial Band Syndrome: Diagnosis

Common running injury

- Repeated flexion/extension

Diffuse lateral knee pain at end of exercise

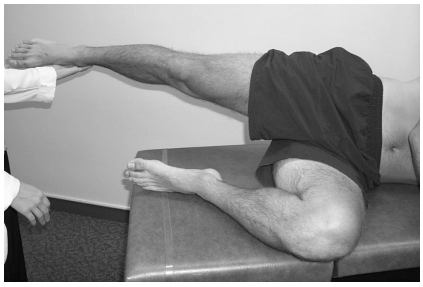
- Worse with running downhill or on uneven ground

Point tenderness 2-3 cm proximal to lateral femoral condyle

- May also have additional tenderness near the greater trochanter

Tightness of tensor fasciae latae (TFL)

- Adduction pain (Ober test)
- Limited ROM and pain and tenderness along the TFL



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Iliotibial Band Syndrome: Testing and Treatment

With patient supine

- Flex and extend knee
- Thumb palpation of lateral femoral epicondyle
- Pain confirms diagnosis

Imaging not needed

Acute phase: rest, ice, NSAIDs

Subacute phase: PT, stretching exercises, graded return to sports

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Meniscal Tear: Diagnosis and Testing

- Acute twisting knee injury or osteoarthritis (degenerative)
- Pain, locking, and clicking mechanical symptoms
- Joint line tenderness
- Slow accumulation of small to moderate knee effusion
- Medial meniscus injury can be associated with medial collateral ligament injury (attached)

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Meniscal Tear: Diagnosis and Testing

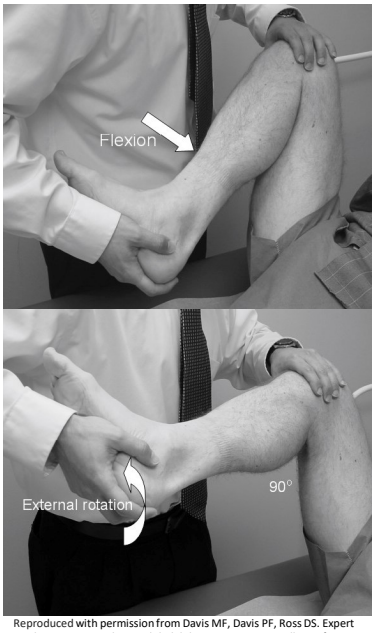
Pain and snapping with McMurray test

- Fully flex knee and rotate tibia externally
- Fully extend knee with hand over medial joint line
- Repeat with tibia internally rotated and examining hand over lateral joint line

Thessaly test

Imaging not needed

MRI if surgery considered



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Meniscal Tear: Treatment

Rest, ice, strengthening of quadriceps and hamstrings

Glucocorticoid injection if mechanical symptoms

Surgery only if symptoms persist after 4 weeks

Osteoarthritis-related meniscal tears

- Physical therapy as effective as meniscectomy

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Knee Ligament Tear: Key Features

- Pain and “popping” at time of injury
- Acute, large knee effusion
- Pain, locking, catching, grinding, and instability

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Knee Ligament Tear: Mechanisms of Injury

ACL tears	Sudden twisting or hyperextension
Collateral ligament tears	Medial or lateral force without twisting
PCL tears	Posteriorly directed force to proximal tibia, knee flexed

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Knee Ligament Tear: Testing

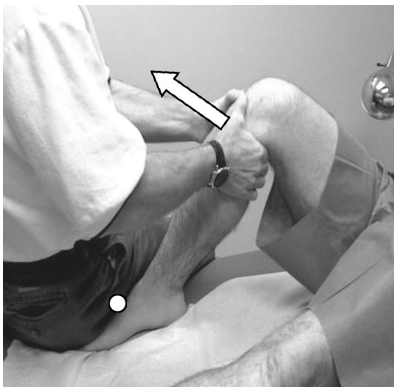
Stressing ligament causes excessive "give"

- ACL: anterior force to proximal calf
- MCL: medial force to knee flexed at 30 degrees
- PCL: posterior force to knee flexed at 90 degrees
- LCL: lateral force to knee flexed at 30 degrees

Plain radiography

- Rule out tibial avulsion fracture

MRI if ligament tear suspected



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Knee Ligament Tear: Treatment

ACL tears

- Surgical reconstruction for active patients/unstable knee

MCL and PCL tears

- Most managed conservatively

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Musculoskeletal Problems Q6

A 46-year-old man has a 3-week history of right foot pain.

The pain is located near the medial inferior heel, is sharp, and occurs with his first few steps in the morning.

Passive dorsiflexion of the toes and palpation of the medial tubercle of the calcaneus reproduce the pain.

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Musculoskeletal Problems Q6

A 46-year-old man has a 3-week history of right foot pain. The pain is located near the medial inferior heel, is sharp, and occurs with his first few steps in the morning. Passive dorsiflexion of the toes and palpation of the medial tubercle of the calcaneus reproduce the pain.

Which of the following is the most likely diagnosis?

A: Achilles tendinopathy

B: Heel pad syndrome

C: Plantar fasciitis

D: Stress fracture of the tarsal navicular bone

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Foot and Ankle Syndromes

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Plantar Fasciitis: Diagnosis

- Most common cause of inferior heel pain
- Pain with first few walking steps
- Palpation tenderness: medial tubercle of the calcaneus
- Toe dorsiflexion: hindfoot pain



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Plantar Fasciitis: Treatment

- Stop aggravating activities
- Stretching exercises
- Avoid flat shoes/walking barefoot
- Heel cups/cushions
- NSAIDs
- Night splints with foot in neutral vs. dorsiflexion/orthotics/immobilization in cushioned walking boot
- Injected glucocorticoid: short-term pain relief (last resort)
- Tenex
- Reserve surgical plantar fascia release for patients with severe symptoms refractory to at least 6-12 months of conservative treatment

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Foot and Ankle Syndromes

Ankle sprains

- Ankle inversion injury, typically
- Use Ottawa Rules for imaging
  - Ankle: malleolar pain, tender at A or B, or NWB
  - Foot: midfoot pain, tender at C or D, or NWB

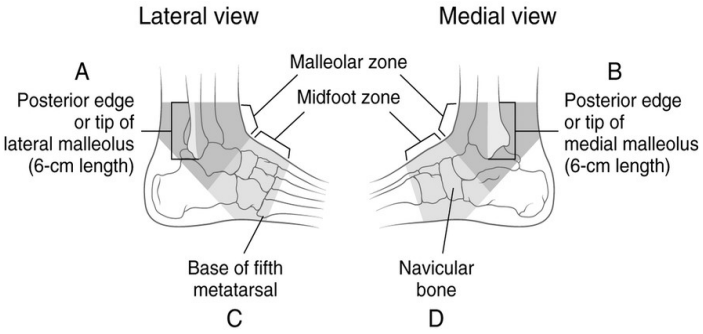


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Foot and Ankle Syndromes

Fractures

- Most common sites: metatarsals, tarsals, and calcaneus
- Radiography
  - First-line diagnostic test
  - Plain radiograph unrevealing but clinical probability high
- MRI
  - Greater sensitivity
  - Information on risk for nonunion

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Musculoskeletal Problems Q7

A 58-year-old woman reports 3 days of left knee pain that worsens with weight bearing.

She recently started jogging for exercise.

Exam reveals medial joint line tenderness.

Plain radiograph is normal; MRI reveals a subchondral hypointensity with adjacent bone marrow edema of the medial femoral condyle.

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Musculoskeletal Problems Q7

A 58-year-old woman reports 3 days of left knee pain that worsens with weight bearing. She recently started jogging for exercise. Exam reveals medial joint line tenderness. Plain radiograph is normal; MRI reveals a subchondral hypointensity with adjacent bone marrow edema of the medial femoral condyle.

Which of the following is the most likely diagnosis?

A: MCL sprain

B: Meniscal tear

C: Osteoarthritis

D: Stress fracture

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Sports Injuries and Trauma (Stress Fracture)

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Stress Fracture: Diagnosis

- Most common in athletes and military recruits
- Insufficiency fracture, osteopenia in older patients
- Sudden increase in physical activity intensity/duration
- Insidious onset of localized pain
- Focal tenderness at the fracture site

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Stress Fracture: Management

Testing	Treatment
Imaging for suspected high-risk stress fractures • Femoral head • Anterior cortex of tibia (tension side) • Patella • Proximal 4th and 5th metatarsals Plain radiography: initial imaging study (often negative) MRI if plain radiograph is negative	High-risk fractures • Immobilization and serial imaging *or* • Surgical fixation Low-risk fractures • Rest, crutches, walking boot and/or padded footwear

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Musculoskeletal Problems

- Answers to Multiple-Choice Questions

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Musculoskeletal Problems Q1

A 46-year-old man reports 2 weeks of left shoulder pain that worsens with overhead activities. Pain occurs on active and passive abduction between 60 and 120 degrees. No tenderness to palpation is noted. Drop arm test is negative. Pain is reproduced with the empty can test. ROM and strength are normal.

Which of the following is the most appropriate next step in management?

A: Left shoulder MRI

B: Left shoulder radiography

C: Orthopedic surgery referral

D: Physical therapy

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Musculoskeletal Problems Q2

A 52-year-old woman reports 4 months of worsening tingling and numbness involving the right index finger, thumb, and adjacent palm. Exam reveals right thumb abductor weakness and thenar eminence atrophy. Nerve conduction studies show median nerve sensorimotor denervation.

Which of the following is the most appropriate treatment?

A: Decompression surgery

B: Glucocorticoid injection

C: Nocturnal neutral wrist splinting

D: Occupational therapy

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Musculoskeletal Problems Q3

A 65-year-old man reports 3 weeks of nonradiating left hip pain. Symptoms worsen when walking or lying on his left side. The left hip has full, painless ROM with tenderness to palpation and with figure four PROM stretch over the lateral hip. Straight leg raise test is negative; reflexes are normal.

Which of the following is the most likely diagnosis?

A: Greater trochanteric pain syndrome (GTPS)

B: Iliotibial band syndrome

C: Lumbar radiculopathy

D: Osteoarthritis of the hip

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Musculoskeletal Problems Q4

A 32-year-old man has 2 weeks of nonradiating low back pain that worsens with activity. He reports no trauma, morning stiffness, weakness, or paresthesia. He has limited low back ROM because of pain but no spine or sacroiliac joint tenderness. Straight leg raise test is negative.

Which of the following is the most appropriate diagnostic test to perform next?

A: ESR measurement

B: HLA-B27 testing

C: Lumbar spine radiography

D: No additional testing

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Musculoskeletal Problems Q5

A 37-year-old woman has anterior left knee pain that began after training for a marathon. The pain worsens when she climbs stairs or sits for an extended time. Exam reveals pain with direct pressure to the patella and while squatting. No other tenderness or swelling is noted.

Which of the following is the most likely diagnosis?

A: Iliotibial band syndrome

B: Patellofemoral pain syndrome

C: Pes anserine pain syndrome

D: Prepatellar bursitis

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Musculoskeletal Problems Q6

A 46-year-old man has a 3-week history of right foot pain. The pain is located near the medial inferior heel, is sharp, and occurs with his first few steps in the morning. Passive dorsiflexion of the toes and palpation of the medial tubercle of the calcaneus reproduce the pain.

Which of the following is the most likely diagnosis?

A: Achilles tendinopathy

B: Heel pad syndrome

C: Plantar fasciitis

D: Stress fracture of the tarsal navicular bone

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Musculoskeletal Problems Q7

A 58-year-old woman reports 3 days of left knee pain that worsens with weight bearing. She recently started jogging for exercise. Exam reveals medial joint line tenderness. Plain radiograph is normal; MRI reveals a subchondral hypointensity with adjacent bone marrow edema of the medial femoral condyle.

Which of the following is the most likely diagnosis?

A: MCL sprain

B: Meniscal tear

C: Osteoarthritis

D: Stress fracture

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Eye, Ear, Nose, and Throat Disorders

2025 Virtual Live Internal Medicine Board Review

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ACP Internal Medicine Board Review Course

General Internal Medicine:
Eye, Ear, Nose, and Throat Disorders

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- Bacterial conjunctivitis
- Allergic conjunctivitis
- Uveitis/iritis
- Common cold
- Allergic rhinitis
- Acute and chronic sinusitis
- Epistaxis
- Otitis media and externa
- Pharyngitis

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Eye, Ear, Nose, and Throat Disorders Q1

A 45-year-old woman has left eye redness and yellow discharge without ocular pain.

She wears contact lenses.

Exam shows mucopurulent discharge at the lid margins and diffuse conjunctival injection of the left eye.

Vision is normal.

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Eye, Ear, Nose, and Throat Disorders Q1

A 45-year-old woman has left eye redness and yellow discharge without ocular pain. She wears contact lenses. Exam shows mucopurulent discharge at the lid margins and diffuse conjunctival injection of the left eye. Vision is normal.

In addition to discontinuing contact lens use, which of the following is the most appropriate treatment?

A: Erythromycin ophthalmic ointment

B: Fluoroquinolone eye drops

C: Lubricating eye drops

D: Topical antihistamine/decongestant eye drops

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Bacterial Conjunctivitis

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Bacterial Conjunctivitis: Diagnosis and Treatment

Diagnosis

- Eye redness with minimal pain
- Mucopurulent discharge
- Morning “glued-shut” eye
- Normal pupil and vision

Treatment

- Topical erythromycin, trimethoprim-polymyxin
- Contact lens wearers: fluoroquinolones



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Eye, Ear, Nose, and Throat Disorders Q2

A 34-year-old man is evaluated for a 3-day history of bilateral itchy red eyes associated with a watery discharge.

He reports eye irritation but no pain.

He has been sneezing and has nasal congestion.

Exam shows bilateral conjunctival injection, normal pupils, and normal vision.

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Eye, Ear, Nose, and Throat Disorders Q2

A 34-year-old man is evaluated for a 3-day history of bilateral itchy red eyes associated with a watery discharge. He reports eye irritation but no pain. He has been sneezing and has nasal congestion. Exam shows bilateral conjunctival injection, normal pupils, and normal vision.

Which of the following is the most appropriate treatment?

A: Ophthalmic antibiotic

B: Ophthalmic antihistamine

C: Ophthalmic glucocorticoid

D: Urgent ophthalmology referral

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Allergic Conjunctivitis

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Allergic Conjunctivitis: Diagnosis

- Recurrent, seasonal conjunctivitis
- Ocular (usually bilateral) itching; also burning, gritty sensation
- No significant eye pain
- Conjunctival edema, “cobblestoning”
- Watery discharge
- Normal pupil and vision



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Allergic Conjunctivitis: Diagnosis

Other allergic symptoms (rhinitis, sneezing) commonly present

History of allergies

Other signs of atopy

- Asthma, urticaria, atopic dermatitis

Symptoms may be identical to those of viral conjunctivitis

- Differentiate by itching and other allergy history

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Allergic Conjunctivitis: Treatment

- Avoid allergens
- Avoid itching and rubbing the eyes
- Discontinue use of contact lenses
- Use cool compresses
- Use saline eye drops liberally

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Allergic Conjunctivitis: Treatment

First-line therapy (OTC or Rx): ocular mast cell stabilizer (e.g., cromolyn), ocular antihistamines (e.g., ketotifen, olopatadine), or dual-action medications

- Consider dual-action medication as initial therapy
- Consider single-action medications if patient is sensitive to components of dual-action medication

Ocular H_1 blocker/vasoconstrictor combination (naphazoline-pheniramine)

Systemic antihistamines

- Not as effective as ophthalmologic antihistamines

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Allergic Conjunctivitis: Treatment

Ophthalmology referral

- Not needed unless symptoms do not improve in 2 weeks
- When considering/requiring ophthalmic glucocorticoids

Consider referral to allergist for severe allergic conjunctivitis if

- No improvement with standard therapy
- Need for ophthalmic glucocorticoids
- Concurrent asthma and allergic rhinitis

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Uveitis/Iritis

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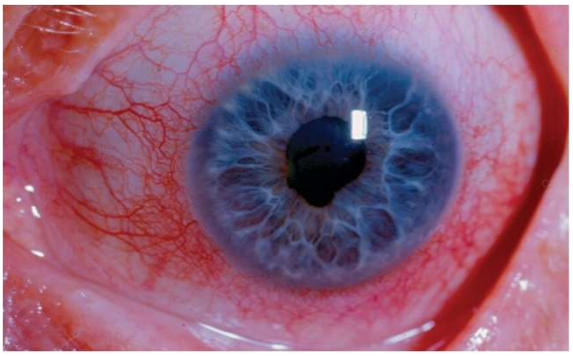
Uveitis/Iritis: Diagnosis

Uveitis: inflammation of the uvea (iris, ciliary body, and sclera)

Iritis: anterior uveitis

Diagnosis

- Eye redness with significant pain
- Photophobia and blurred vision
- New floaters (from vitreous opacities)
- Circumferential redness at junction of cornea and sclera ("ciliary flush")
- Adhesions may distort pupil shape



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Uveitis/Iritis: Causes

Infectious

- Syphilis
- TB
- Viral (CMV, HSV, VZV)

Noninfectious

- Sarcoidosis
- Ankylosing spondylitis
- Reactive arthritis
- Behçet syndrome
- Systemic lupus erythematosus

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Uveitis/Iritis: Treatment

Urgent referral (within 24 h) to ophthalmologist

Goals of care

- Collaborate to identify underlying cause
- Control ocular inflammation
- Preserve/restore vision

Treat underlying cause

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Eye, Ear, Nose, and Throat Disorders Q3

A 32-year-old man reports a 3-day history of cough, sore throat, coryza, rhinorrhea, and nasal congestion.

Temperature is 37.4 °C (99.4 °F).

Bilateral conjunctival injection, boggy nasal mucosa, and erythematous oropharynx without tonsillar exudates are noted.

Testing for SARS-CoV-2 is negative.

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Eye, Ear, Nose, and Throat Disorders Q3

A 32-year-old man reports a 3-day history of cough, sore throat, coryza, rhinorrhea, and nasal congestion. Temperature is 37.4 °C (99.4 °F). Bilateral conjunctival injection, boggy nasal mucosa, and erythematous oropharynx without tonsillar exudates are noted. Testing for SARS-CoV-2 is negative.

Which of the following is the most appropriate treatment?

A: Albuterol

B: Amoxicillin

C: Codeine

D: Reassurance

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Common Cold

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Common Cold: Diagnosis

- Cough, sneezing
- Rhinorrhea, nasal congestion
- Headache
- Sore throat
- Low-grade fever

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Common Cold: Treatment

Reassurance or supportive care

No treatments shorten duration

NSAIDs, acetaminophen

Antihistamine and decongestant combination

Intranasal sprays

- Ipratropium, cromolyn

Intranasal vasoconstrictor (oxymetazoline)

- 3 days only (avoid rebound rhinitis)

Warm compresses

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Common Cold: Treatment

Do not use the following:

- Antibiotics
- Antihistamines alone
- Antivirals
- Vitamins

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Eye, Ear, Nose, and Throat Disorders Q4

A 35-year-old man reports 3 weeks of nasal congestion, sneezing, and rhinorrhea without fever.

His symptoms recur seasonally.

Nose exam reveals pale nasal mucosa and clear mucoid discharge.

Other examination findings are normal.

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Eye, Ear, Nose, and Throat Disorders Q4

A 35-year-old man reports 3 weeks of nasal congestion, sneezing, and rhinorrhea without fever. His symptoms recur seasonally. Nose exam reveals pale nasal mucosa and clear mucoid discharge. Other exam findings are normal.

Which of the following is the most effective initial treatment?

A: Intranasal azelastine

B: Intranasal fluticasone

C: Oral fexofenadine

D: Oral pseudoephedrine

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Allergic Rhinitis

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Allergic Rhinitis: Risk Factors

- Family/personal atopic history
- Early childhood use of antibiotics
- Household smoking
- Indoor allergens

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Allergic Rhinitis: Diagnosis

Clinical diagnosis

Perennial or seasonal symptoms

Sneezing, rhinorrhea, nasal obstruction, nasal/ocular pruritus

Often presents with associated allergic conditions

- Asthma, allergic conjunctivitis, atopic dermatitis

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Allergic Rhinitis: Diagnosis

Pale nasal mucosa, clear rhinorrhea

Cobblestoning

- Posterior pharynx
- Conjunctiva (from hypertrophied lymphoid tissue)

Serous otitis media with eustachian tube dysfunction

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Allergic Rhinitis: Testing

Total IgE level, eosinophil count testing not indicated

Allergy testing is not needed for most people

Consider IgE skin testing if:

- Unclear diagnosis
- Poorly controlled symptoms on treatment
- Coexisting persistent asthma and/or recurrent sinusitis

Rarely perform IgE immunoassays (specific antigen)

- Skin testing most sensitive to inhalant allergens, more cost effective
- Consider if skin testing cannot be performed

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Allergic Rhinitis: Treatment

Allergen avoidance

Intranasal glucocorticoid monotherapy: first line

- ± Intranasal antihistamine

Second-line drug therapy

- Intranasal antihistamine
- Second-generation oral antihistamine
- Intranasal cromolyn sodium
- Immunotherapy if medication treatment fails
- Oral/intranasal decongestants
- Leukotriene inhibitors

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Eye, Ear, Nose, and Throat Disorders Q5

A 48-year-old woman reports a 2-day history of nasal congestion, white nasal discharge, facial fullness, and pain in the upper teeth.

Temperature is 37.8 °C (100.0 °F).

Tenderness to palpation over the maxillary sinuses bilaterally and erythema of the oropharynx are noted.

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Eye, Ear, Nose, and Throat Disorders Q5

A 48-year-old woman reports a 2-day history of nasal congestion, white nasal discharge, facial fullness, and pain in the upper teeth. Temperature is 37.8 °C (100.0 °F). Tenderness to palpation over the maxillary sinuses bilaterally and erythema of the oropharynx are noted.

Which of the following is the most appropriate treatment?

A: Amoxicillin-clavulanate

B: Doxycycline

C: Sinus CT

D: Supportive care

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Acute and Chronic Sinusitis

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Acute Sinusitis: Diagnosis

Viral cause → 90% to 98% of patients

Consider treatment for bacterial cause if

- Symptoms ≥10 days
- Severe symptoms for 3-4 days
- Temperature >39.0 °C (102.2 °F)
- Worsening symptoms after initial improvement

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Acute Sinusitis: Diagnosis and Testing

- Nasal congestion/obstruction
- Head/face pain, pressure, fullness
- Purulent nasal discharge
- Maxillary tooth pain
- Imaging indicated only in suspected orbital/intracranial complications

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Acute Sinusitis: Treatment

Viral → symptomatic treatment

- Analgesics
- Intranasal glucocorticoids
- Nasal saline irrigation
- Consider decongestants for symptomatic relief (oral decongestants for eustachian tube dysfunction)
- Nasal decongestants: evidence lacking
- Antihistamines (oral or nasal): not effective

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Acute Sinusitis: Treatment

Bacterial

- Symptomatic treatment
  - Analgesics
  - Intranasal glucocorticoids
  - Nasal saline
  - May decrease need for antibiotics
- Amoxicillin-clavulanate (preferred) or amoxicillin for 5-7 days
- If penicillin allergy:
  - Doxycycline or levofloxacin

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Chronic Sinusitis: Diagnosis, Testing, Treatment

Diagnosis

- Symptoms ≥12 weeks
- Nasal congestion, purulent drainage
- Anosmia
- Facial pain/pressure
- Nasal polyps

Testing

- Nasal endoscopy or CT

Treatment

- Glucocorticoids and antibiotics
- Nasal irrigation
- Intranasal steroids

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Eye, Ear, Nose, and Throat Disorders Q6

A 75-year-old man reports an acute, persistent nosebleed from the right naris.

He has no history of trauma or other bleeding disorders.

He chronically removes scabs and mucus from his nares with tissues.

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Eye, Ear, Nose, and Throat Disorders Q6

A 75-year-old man reports an acute, persistent nosebleed from the right naris. He has no history of trauma or other bleeding disorders. He chronically removes scabs and mucus from his nares with tissues.

Which of the following is the most appropriate initial treatment?

A: Intranasal fluticasone

B: Nasal compression

C: Oxymetazoline spray

D: Packing both anterior nares

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Epistaxis

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Epistaxis: Treatment

Compression of lower one third of nose for ≥5 min

- Patient should lean forward, directing blood away from posterior pharynx

Persistent bleeding: nasal packing

- Typical duration for packing is 48-72 hours

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Epistaxis: Treatment

Persistent bleeding, source not identified:

- Anterior rhinoscopy to remove clot and identify source of bleeding
- If bleeding source identified on rhinoscopy, use ≥1 of the following:
  - Topical vasoconstrictor (oxymetazoline or phenylephrine)
    - Administered by intranasal spray or cotton pledget
  - Cautery (chemical or thermal)
  - Moisturizer/lubricating agents

Persistent or recurrent bleeding not controlled by packing or cauterization: surgical arterial ligation or endovascular embolization

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Eye, Ear, Nose, and Throat Disorders Q7

A 43-year-old man has a 2-week history of fullness and decreased hearing in the left ear. He also has mild nasal congestion due to seasonal allergies.

Otoscopic image of the left ear is shown.



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Eye, Ear, Nose, and Throat Disorders Q7

A 43-year-old man reports a 2-week history of fullness and decreased hearing in the left ear. He also has mild nasal congestion due to seasonal allergies.

Which of the following is the most appropriate next step in management?

A: Amoxicillin-clavulanate

B: Neomycin, polymyxin B, and hydrocortisone ear drops

C: Tympanostomy tube placement

D: Clinical observation

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Otitis Media and Externa

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Acute Otitis Media: Diagnosis and Treatment



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- Systemic signs of infection
- Fluid/inflammation in middle ear space
- Red, bulging tympanic membrane
- Amoxicillin-clavulanate or amoxicillin

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Otitis Media With Effusion: Diagnosis and Treatment

- Aural fullness, decreased hearing
- Clear/yellow fluid, bubbles in middle ear space
- Clinical observation



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Acute Otitis Externa: Diagnosis



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- Caused by *Pseudomonas aeruginosa*, *Staphylococcus aureus*
- Itching
- Pinna traction causes pain
- Erythema, otorrhea
- Hearing loss

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Acute Otitis Externa: Treatment

Clean out external canal

Mild: topical acidifying agent ± glucocorticoid drops

Moderate: antibiotic/glucocorticoid drops

Severe (occluded ear canal): antibiotic/glucocorticoid + ear wick

Malignant otitis externa: infection beyond auditory canal

- Diabetes, immunosuppression
- *Pseudomonas aeruginosa*
- Hospitalization and systemic fluoroquinolone
- Urgent ENT referral

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Eye, Ear, Nose, and Throat Disorders Q8

A 19-year-old man reports a 2-day history of sore throat, fever, and chills.

Temperature is 102.0 °F.

The pharynx is erythematous with tonsillar enlargement and exudates bilaterally.

No cervical lymphadenopathy is noted.

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Eye, Ear, Nose, and Throat Disorders Q8

A 19-year-old man reports a 2-day history of sore throat, fever, and chills. Temperature is 102.0 °F. The pharynx is erythematous with tonsillar enlargement and exudates bilaterally. No cervical lymphadenopathy is noted.

Which of the following is the most appropriate management?

A: Penicillin therapy

B: Rapid streptococcal antigen detection testing

C: Throat culture

D: Supportive care without further testing

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Pharyngitis

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Pharyngitis: Diagnosis

Most cases are viral

Centor criteria for group A *Streptococcus* infection (1 point each):

- Fever (subjective or measured) >38.0 °C (100.4 °F)
- Absence of cough
- Tender anterior cervical lymphadenopathy
- Tonsillar exudates



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Pharyngitis: Testing and Treatment

Centor score of 0 to 1: no testing/treatment

Centor score of 2: may consider rapid antigen detection test (RADT)

Centor score of 3 to 4: RADT

- If positive, treat
- If negative, do not treat; culture if immunocompromised

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Group A Streptococcal Pharyngitis: Treatment

Penicillin V oral (10 d) or IM penicillin G (1 dose)

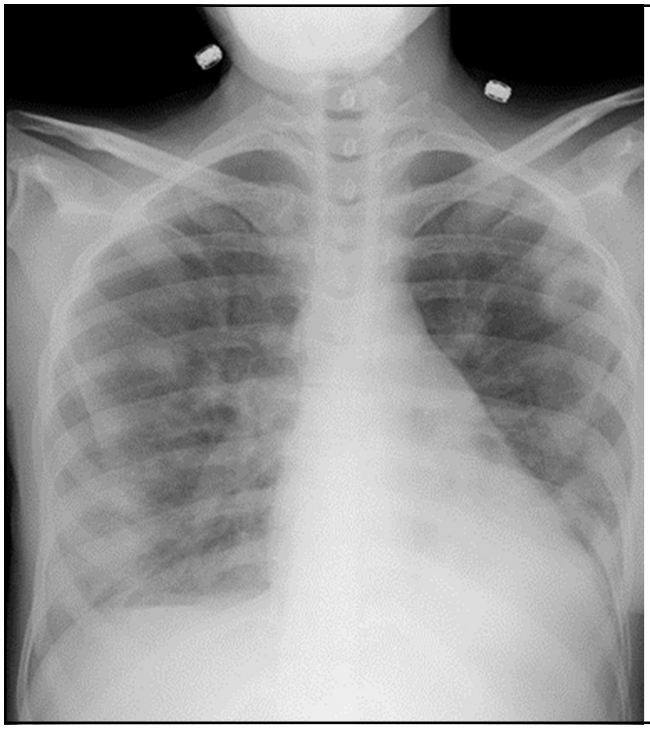
Amoxicillin oral (10 d)

If penicillin allergy:

- Cephalosporins, clindamycin, macrolides

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Fusobacterium necrophorum Pharyngitis

- Lemierre syndrome (septic thrombosis of internal jugular vein)
- Fever, rigor, respiratory distress
- Pain, induration over jugular vein
- Septic pulmonary emboli
- Blood cultures, chest radiography, CT of neck
- Treat with ampicillin-sulbactam or piperacillin-tazobactam

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Eye, Ear, Nose and Throat Disorders

- Answers to Multiple-Choice Questions

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Eye, Ear, Nose, and Throat Disorders Q1

A 45-year-old woman has left eye redness and yellow discharge without ocular pain. She wears contact lenses. Exam shows mucopurulent discharge at the lid margins and diffuse conjunctival injection of the left eye. Vision is normal.

In addition to discontinuing contact lens use, which of the following is the most appropriate treatment?

A: Erythromycin ophthalmic ointment

B: Fluoroquinolone eye drops

C: Lubricating eye drops

D: Topical antihistamine/decongestant eye drops

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Eye, Ear, Nose, and Throat Disorders Q2

A 34-year-old man is evaluated for a 3-day history of bilateral itchy red eyes associated with a watery discharge. He reports eye irritation but no pain. He has been sneezing and has nasal congestion. Exam shows bilateral conjunctival injection, normal pupils, and normal vision.

Which of the following is the most appropriate treatment?

A: Ophthalmic antibiotic

B: Ophthalmic antihistamine

C: Ophthalmic glucocorticoid

D: Urgent ophthalmology referral

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Eye, Ear, Nose, and Throat Disorders Q3

A 32-year-old man reports a 3-day history of cough, sore throat, coryza, rhinorrhea, and nasal congestion. Temperature is 37.4 °C (99.4 °F). Bilateral conjunctival injection, boggy nasal mucosa, and erythematous oropharynx without tonsillar exudates are noted. Testing for SARS-CoV-2 is negative.

Which of the following is the most appropriate treatment?

A: Albuterol

B: Amoxicillin

C: Codeine

D: Reassurance

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Eye, Ear, Nose, and Throat Disorders Q4

A 35-year-old man reports 3 weeks of nasal congestion, sneezing, and rhinorrhea without fever. His symptoms recur seasonally. Nose exam reveals pale nasal mucosa and clear mucoid discharge. Other exam findings are normal.

Which of the following is the most effective initial treatment?

A: Intranasal azelastine

B: Intranasal fluticasone

C: Oral fexofenadine

D: Oral pseudoephedrine

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Eye, Ear, Nose, and Throat Disorders Q5

A 48-year-old woman reports a 2-day history of nasal congestion, white nasal discharge, facial fullness, and pain in the upper teeth. Temperature is 37.8 °C (100.0 °F). Tenderness to palpation over the maxillary sinuses bilaterally and erythema of the oropharynx are noted.

Which of the following is the most appropriate treatment?

A: Amoxicillin-clavulanate

B: Doxycycline

C: Sinus CT

D: Supportive care

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Eye, Ear, Nose, and Throat Disorders Q6

A 75-year-old man reports an acute, persistent nosebleed from the right naris. He has no history of trauma or other bleeding disorders. He chronically removes scabs and mucus from his nares with tissues.

Which of the following is the most appropriate initial treatment?

A: Intranasal fluticasone

B: Nasal compression

C: Oxymetazoline spray

D: Packing both anterior nares

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Eye, Ear, Nose, and Throat Disorders Q7

A 43-year-old man reports a 2-week history of fullness and decreased hearing in the left ear. He also has mild nasal congestion due to seasonal allergies.

Which of the following is the most appropriate next step in management?

A: Amoxicillin-clavulanate

B: Neomycin, polymyxin B, and hydrocortisone ear drops

C: Tympanostomy tube placement

D: Clinical observation

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Eye, Ear, Nose, and Throat Disorders Q8

A 19-year-old man reports a 2-day history of sore throat, fever, and chills. Temperature is 102.0 °F. The pharynx is erythematous with tonsillar enlargement and exudates bilaterally. No cervical lymphadenopathy is noted.

Which of the following is the most appropriate management?

A: Penicillin therapy

B: Rapid streptococcal antigen detection testing

C: Throat culture

D: Supportive care without further testing

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Hematology I – Erythrocyte Disorders and Transfusions

2025 Virtual/Live Internal Medicine Board Review

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ACP Internal Medicine Board Review Course

Hematology I: Erythrocyte Disorders and Transfusions

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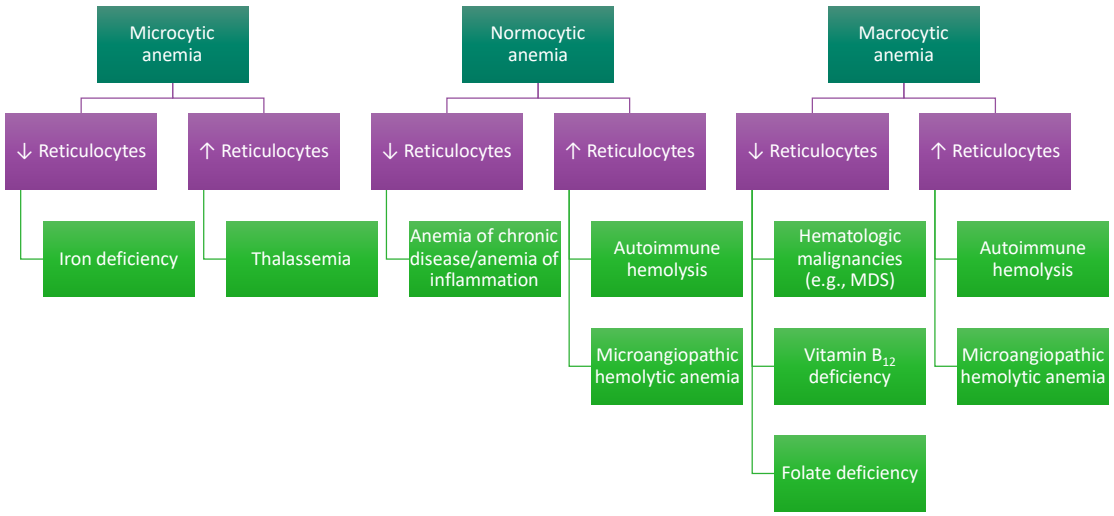
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- Iron deficiency anemia
- Anemia of chronic disease or inflammation
- Autoimmune hemolytic anemia
- Microangiopathic hemolytic anemia
- Megaloblastic anemia
- Polycythemia vera and other erythrocytosis
- Indications for transfusion
- Complications of transfusions

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Anemia: Classification



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Hematology Q1

A 45-year-old man is evaluated for incidentally discovered iron deficiency anemia.

Medical history is unremarkable.

Result of fecal occult blood test is negative.

Iron replacement is initiated.

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Hematology Q1

A 45-year-old man is evaluated for incidentally discovered iron deficiency anemia. Medical history is unremarkable. Result of fecal occult blood test is negative. Iron replacement is initiated.

Which of the following is the most appropriate initial management?

A: Colonoscopy and upper endoscopy

B: Iron studies in 1 month

C: tTG IgA antibody assay

D: Wireless capsule endoscopy

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Iron Deficiency Anemia

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Iron Deficiency Anemia: Signs and Symptoms

- Dyspnea, fatigue, decreased exercise tolerance
- Conjunctival rim pallor
- Koilonychia (spoon nails)
- Restless legs syndrome





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Iron Deficiency Anemia: Causes

Cause	Example
Blood loss	Gastrointestinal bleeding, menstruation
Nutritional	Inadequate intake
Malabsorption	Gastric/duodenal surgery, celiac disease, *Helicobacter pylori* infection, atrophic gastritis
Increased iron requirement	Pregnancy, lactation, erythropoietin-stimulating agent (ESA) therapy
Intravascular hemolysis (urine iron loss)	Athletic training, prosthetic heart valves, paroxysmal nocturnal hemoglobinuria

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Iron Deficiency: Testing

Laboratory Value	Anemia of Inflammation	Iron Deficiency Anemia
Hemoglobin	8-10 g/dL	6-10 g/dL
Reticulocyte count	Low or inappropriately low	Low
Mean corpuscular volume	Normocytic or microcytic	Microcytic
Iron	Low	Low
Total iron-binding capacity (TIBC)	Low	High
Ferritin	High	Low
RBC distribution width	Normal	High

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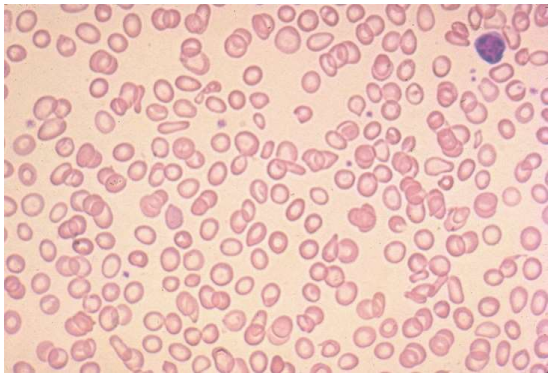
Iron Deficiency: Testing

Peripheral blood smear

- Microcytosis
- Hypochromia
- Poikilocytosis
- Anisocytosis

Upper/lower endoscopy in men and postmenopausal women

Premenopausal with deficiency out of proportion to menses



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Iron Deficiency: Treatment

Oral iron

- Therapy every other day
- Continue 6 months after hemoglobin level normalizes

Parenteral iron preparations

- Celiac disease, inflammatory bowel disease, gastric/small bowel resection
- Chronic hemodialysis
- Intolerant or inadequate response to oral iron

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Hematology Q2

An 87-year-old man is evaluated for chronic asymptomatic anemia. He has hypertension.

Exam is normal. He weighs 140 lb.

Laboratory studies:	
Hemoglobin	11.4 g/dL
Reticulocyte count	0.8%
Creatinine	1.6 mg/dL
Iron studies	Normal

Peripheral blood smear shows normochromic, normocytic erythrocytes.

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Hematology Q2

An 87-year-old man is evaluated for chronic asymptomatic anemia. He has hypertension. Exam is normal. He weighs 140 lb. Laboratory studies: hemoglobin, 11.4 g/dL; reticulocyte count, 0.8%; creatinine, 1.6 mg/dL; iron studies, normal. Peripheral blood smear shows normochromic, normocytic erythrocytes.

Which of the following is the most likely cause of this patient's anemia?

A: Advanced age

B: Inflammatory process

C: Iron deficiency

D: Kidney disease

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Anemia of Chronic Disease or Inflammation

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Anemia of Chronic Disease: Signs and Symptoms

Fatigue, dyspnea, ↓ exercise tolerance

Examples of underlying organ dysfunction

- CKD
- Hypothyroidism
- Hypogonadism
- Liver disease

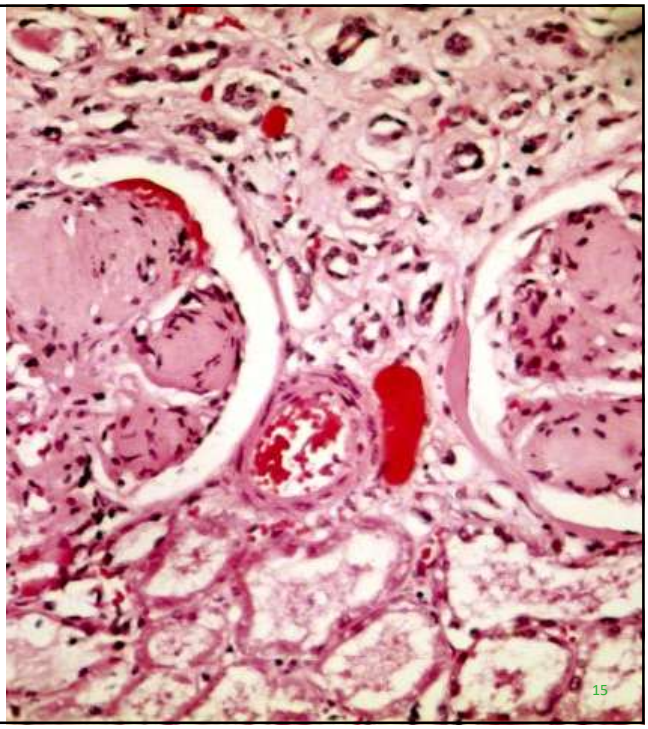
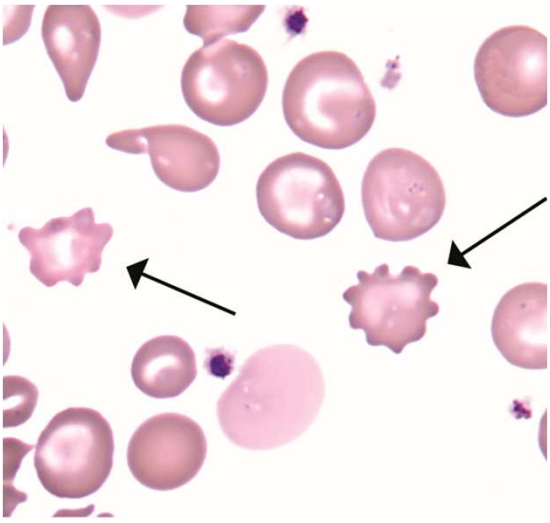


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Anemia of Chronic Disease: Testing



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Normal MCV

Peripheral blood smear

- Normochromic, normocytic
- Echinocytes in patients with uremia, liver disease

Low reticulocyte count

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Anemia of Chronic Disease: Testing

Laboratory evidence of organ dysfunction

- CKD
  - ↑ Serum creatinine level and/or low eGFR
  - Suboptimal erythropoietin level
- Hypothyroidism
  - ↑ Thyroid-stimulating hormone level
- Hypogonadism
  - ↓ Testosterone level
- Liver disease
  - ↑ Bilirubin level and/or low albumin level

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Anemia of Chronic Disease: Treatment

Treat underlying CKD, hypothyroidism, hypogonadism

ESA for CKD

- Indicated in patients with hemoglobin level <10 g/dL
  - Hemoglobin target of 10.0-11.5 g/dL
- Oral iron replacement if deficient (IV if on dialysis, malabsorption, or intolerant to oral iron)
  - Target transferrin saturation >20%-30%, ferritin level >100-200 ng/mL

ESA adverse effects

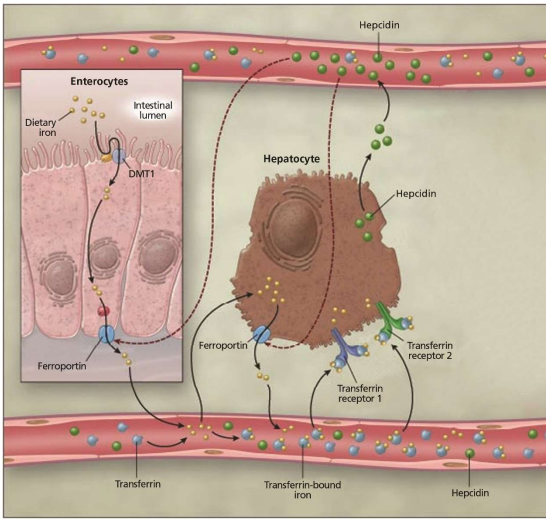
- Hypertension, thrombosis, hypervolemia

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Anemia of Inflammation: Pathophysiology

- ↑ Hepcidin production leads to ↓ ferroportin
  - ↓ Iron absorption/transport
- ↓ Erythrocyte production
- ↑ Ferritin (acute phase reactant)
  - Ferritin level >100-200 ng/mL decreases likelihood of iron deficiency

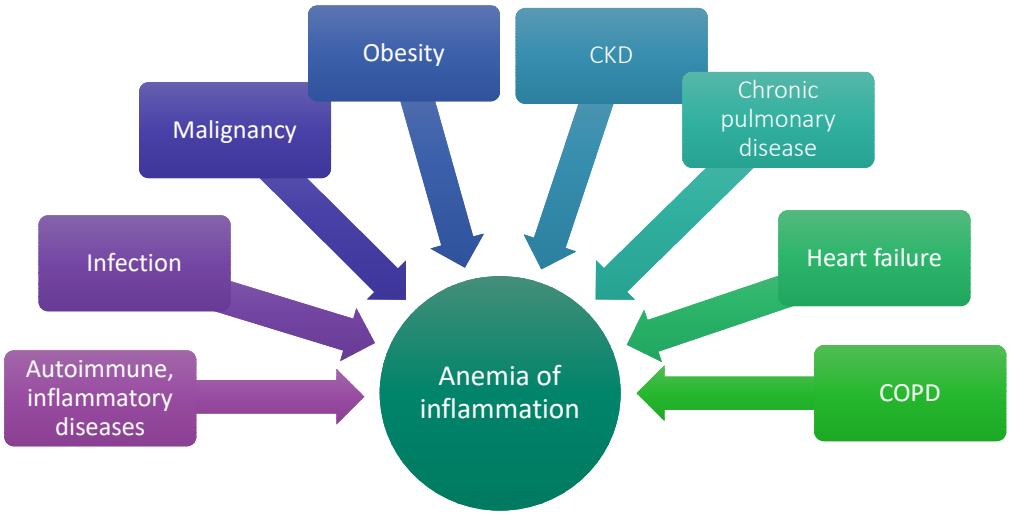


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Anemia of Inflammation: Causes



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Anemia of Inflammation: Testing

Laboratory Value	Anemia of Inflammation	Iron Deficiency Anemia
Hemoglobin	8-10 g/dL	6-10 g/dL
Reticulocyte count	Low or inappropriately low	Low
Mean corpuscular volume	Normocytic or microcytic	Microcytic
Iron	Low	Low
TIBC	Low	High
Ferritin	High	Low
RBC distribution width	Normal	High

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Anemia of Inflammation: Treatment

- Treat the underlying inflammatory cause
- Iron replacement ineffective

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Autoimmune Hemolytic Anemia (AIHA)

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Autoimmune Hemolytic Anemia

Characteristic	Warm AIHA	Cold Agglutinin Disease/Syndrome
Temperature for optimal antibody binding to erythrocytes	37.0 °C (98.6 °F)	<37.0 °C (98.6 °F)
Immunoglobulin class	IgG positive on DAT	IgM positive on DAT
Causes	Primary Idiopathic Secondary Autoimmune (SLE) Lymphoproliferative disorders (CLL, B-cell NHLs) Drug-induced: cephalosporins, penicillin, INH, NSAIDs	Primary (cold agglutinin disease) No associated malignancy or infection Secondary (cold agglutinin syndrome) Infection (*Mycoplasma*, EBV) Lymphoproliferative disorders (IgM MGUS, Waldenström macroglobulinemia, other B-cell NHLs)

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Autoimmune Hemolytic Anemia: Signs and Symptoms

- Anemia symptoms
- Jaundice
- Splenomegaly
- Acrocyanosis (cold agglutinin)
- Increased VTE risk

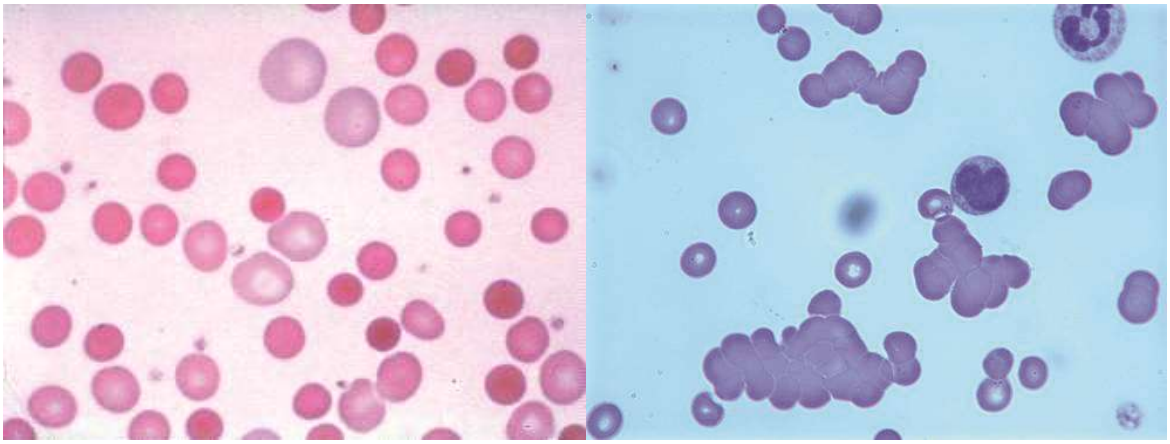
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Autoimmune Hemolytic Anemia: Diagnosis and Testing

Warm AIHA: spherocytes
(erythrocytes with no central pallor)

Cold AIHA: agglutinated erythrocytes
(clumped erythrocytes)



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Autoimmune Hemolytic Anemia: Testing

Reticulocytosis

Normocytic or ↑ MCV (reticulocytes or spherocytes)

↑ LDH, ↑ indirect bilirubin, ↓ haptoglobin levels

Direct antiglobulin test

- Warm AIHA: IgG positive, ± C3 positive
- Cold AIHA: IgG negative, C3 positive

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Autoimmune Hemolytic Anemia: Treatment

Warm AIHA	Cold agglutinin disease/syndrome
• Stop inciting drug • Transfusion • Glucocorticoids • Rituximab	• Cold avoidance • Treat underlying disease • Plasmapheresis, rituximab • Sutimlimab (C1s antibody fixation) • Transfusion using blood warmer

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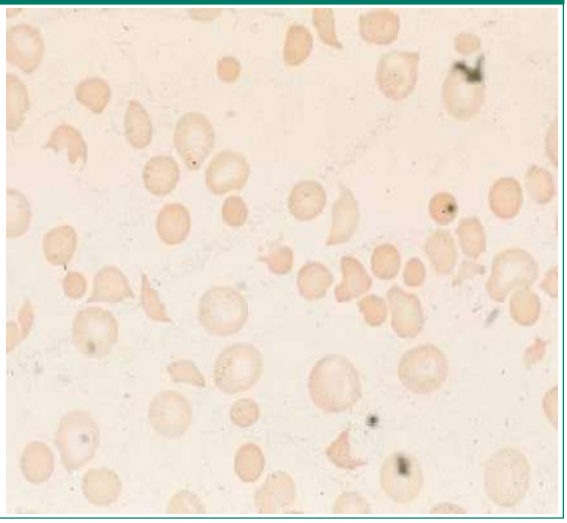
Hematology Q3

A 24-year-old woman reports headache and fever for 48 hours. She is confused.

Temperature is 100.6 °F; BP is 150/92 mm Hg.

Laboratory studies show hemolytic anemia and thrombocytopenia. Coagulation studies are normal.

Peripheral blood smear is shown.



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Hematology Q3

A 24-year-old woman reports headache and fever for 48 hours. She is confused. Temperature is 100.6 °F; BP is 150/92 mm Hg. Laboratory studies show hemolytic anemia and thrombocytopenia. Coagulation studies are normal.

Which of the following is the most likely diagnosis?

A: Aplastic anemia

B: Disseminated intravascular coagulation (DIC)

C: Hemolytic anemia with immune thrombocytopenic purpura (ITP)

D: Thrombotic thrombocytopenic purpura (TTP)

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Microangiopathic Hemolytic Anemia

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Microangiopathic Hemolytic Anemia (MAHA): Causes

TTP

Hemolytic uremic syndrome (HUS)

Malignancy

DIC (MAHA + abnormal coagulation)

Hypertensive crisis/scleroderma renal crisis

Pregnancy related

- HELLP (Hemolysis, Elevated Liver enzyme levels, and Low Platelet levels), acute fatty liver of pregnancy (AFLP), pre-eclampsia/eclampsia

Drugs

- Calcineurin inhibitors (e.g., cyclosporine), mitomycin, gemcitabine

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TTP: Clinical Findings

- Pentad of findings
  1. MAHA (necessary for diagnosis)
  2. Thrombocytopenia
  3. Fever
  4. Fluctuating neurologic findings
  5. Kidney abnormalities
- <5% have all findings of pentad
- Petechiae, easy bruising/bleeding

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TTP: Testing

- ↓ Platelets
- ↑ Reticulocytes
- ↑ LDH level
- ↑ Indirect bilirubin level
- ↓ ADAMTS13 activity assay
- Peripheral blood smear shows schistocytes

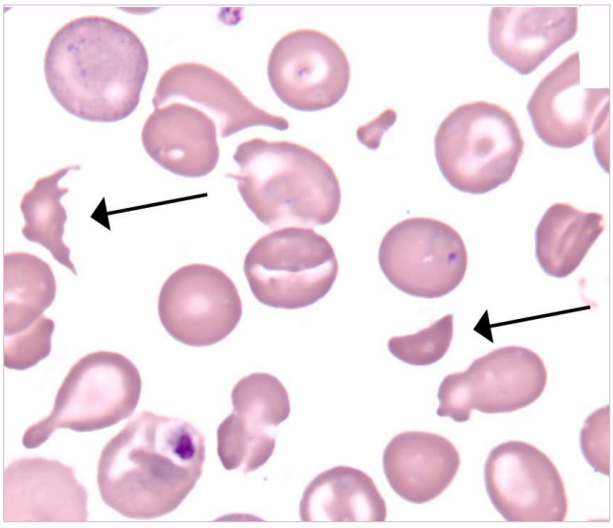


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TTP: Treatment

- Discontinue any culprit drug
- Empiric treatment before ADAMTS13 assay results
- Plasma exchange
- Adjuvant glucocorticoid therapy
- Rituximab
- Consider caplacizumab (anti-vWF monoclonal antibody)

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Hemolytic Uremic Syndrome

- Occurs after *Escherichia coli* O157:H7 or *Shigella* infection (classic HUS)
- Abdominal pain, bloody diarrhea
- ↓ Platelets, MAHA
- AKI possible
- (+) Stool culture
- (+) Shiga toxin PCR, free Shiga toxin, O157:H7 antigen
- Supportive care

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MAHA of Pregnancy

Feature	Pre-eclampsia	HELLP	AFLP
↑ BP	Always	Always	Possible
↓ Platelets	Likely	Always	Possible
Hemolysis	Likely	Always	Possible
DIC	Possible	Possible	Always
Proteinuria	Always	Possible	Possible
↑ Liver enzymes	Possible	Always	Always

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MAHA of Pregnancy: Treatment

HELLP/pre-eclampsia/AFLP

- Treatment is delivery

TTP/HUS

- Treatment same as in nonpregnant patients
- Not affected by delivery

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Hematology Q4

A 30-year-old woman reports difficulty walking and bilateral foot numbness. She follows a vegan diet. She has decreased sensation and vibratory sense in both legs. Peripheral blood smear is shown.

Laboratory studies:	
Hemoglobin	10.4 g/dL
Leukocyte count	2800/µL
MCV	105 fL
Vitamin B_{12}	210 pg/mL

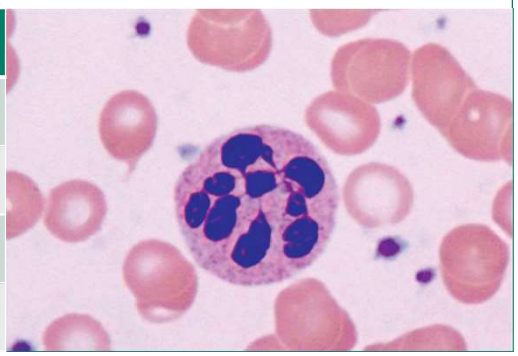


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Hematology Q4

A 30-year-old woman reports difficulty walking and bilateral foot numbness. She follows a vegan diet. She has decreased sensation and vibratory sense in both legs. Laboratory studies: hemoglobin, 10.4 g/dL; leukocyte count, 2800/µL; MCV, 105 fL; vitamin B_{12}, 210 pg/mL.

Which of the following is the most appropriate next diagnostic test?

A: Bone marrow biopsy

B: Folate level measurement

C: Homocysteine level measurement

D: Methylmalonic acid level measurement

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Megaloblastic Anemia

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Megaloblastic Anemia

- Abnormal bone marrow cell growth and nuclear maturation
- Folate deficiency
- Vitamin B_{12} deficiency

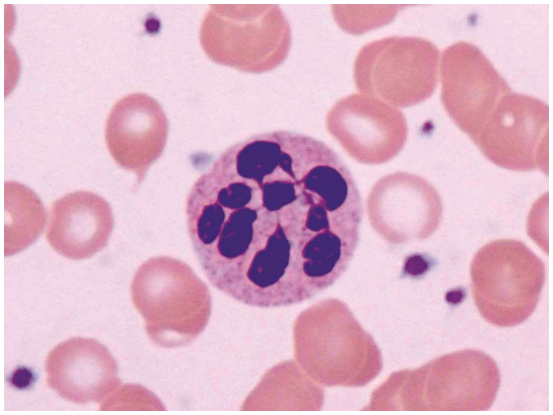
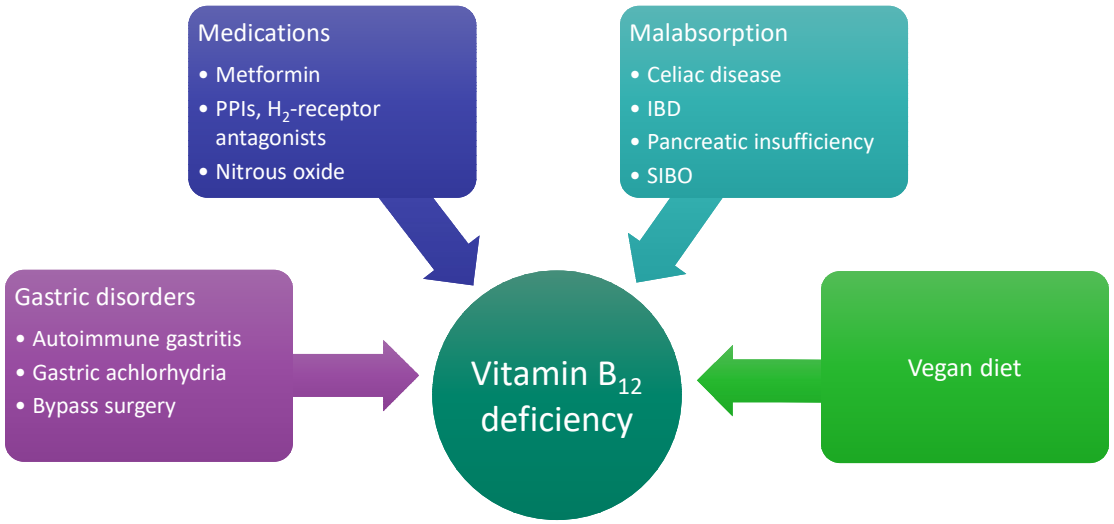


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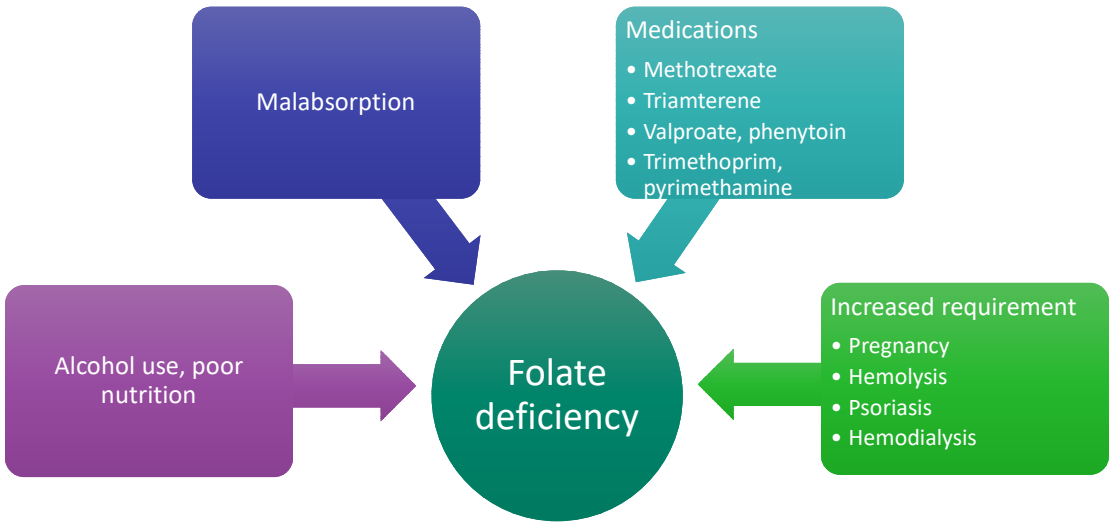
Vitamin B_{12} Deficiency: Causes



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Folate Deficiency: Causes



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Megaloblastic Anemia: Signs and Symptoms

- Fatigue
- Dyspnea
- ↓ Exercise tolerance
- Glossitis

Subacute combined degeneration (↓ vitamin B_{12} only)

- Parasthesias
- ↓ Vibration/position sense
- Ataxia
- Spastic paresis



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Megaloblastic Anemia: Testing

- Macrocytic anemia
- ↓ Reticulocyte count
- ↓ Haptoglobin, ↑ LDH, ↑ indirect bilirubin levels
- ↓ Vitamin B_{12} or ↓ folate level

Peripheral blood smear

- Macro-ovalocytes
- Hypersegmented neutrophils



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Megaloblastic Anemia: Testing

Methylmalonic acid and homocysteine measurement

- Best used if vitamin B_{12} or folate level is borderline low
  - Vitamin B_{12} deficiency: both methylmalonic acid and homocysteine levels elevated
  - Folate deficiency: only homocysteine level elevated

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Vitamin B_{12} Deficiency: Treatment

Oral vitamin B_{12}, 1000-2000 µg/d

Intramuscular vitamin B_{12}

- Malabsorption syndromes
- Severe anemia
- Neurologic dysfunction
- No response to oral replacement

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Folate Deficiency: Treatment

Exclude vitamin B_{12} deficiency

- Anemia may respond to folate
- Neurologic deficiencies are not associated with folate deficiency

Oral folic acid, 1-5 mg/d

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Hematology Q5

A 65-year-old man is evaluated for an elevated hemoglobin level.

He has a 1-year history of pruritus without skin rash. He has never smoked.

Exam shows plethora and splenomegaly.

Laboratory studies show erythrocytosis, leukocytosis, and thrombocytosis.

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Hematology Q5

A 65-year-old man is evaluated for an elevated hemoglobin level. He has a 1-year history of pruritus without skin rash. He has never smoked. Exam shows plethora and splenomegaly. Laboratory studies show erythrocytosis, leukocytosis, and thrombocytosis.

Which of the following is the most appropriate management?

A: Factor V Leiden testing

B: Hydroxyurea

C: *JAK2* V617F testing

D: Peripheral blood flow cytometry

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Polycythemia Vera and Other Erythrocytosis

ACP

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Erythrocytosis: Causes

Polycythemia vera (primary)

Hypoxemia

- COPD/ILD
- Sleep apnea
- Cyanotic heart disease
- Intrapulmonary shunting
- Altitude
- Smoking (multifactorial)

Ectopic/excessive erythropoietin

- Renal cell carcinoma
- Renal artery stenosis
- Hepatocellular carcinoma
- Cerebellar hemangioblastoma
- Uterine fibroids

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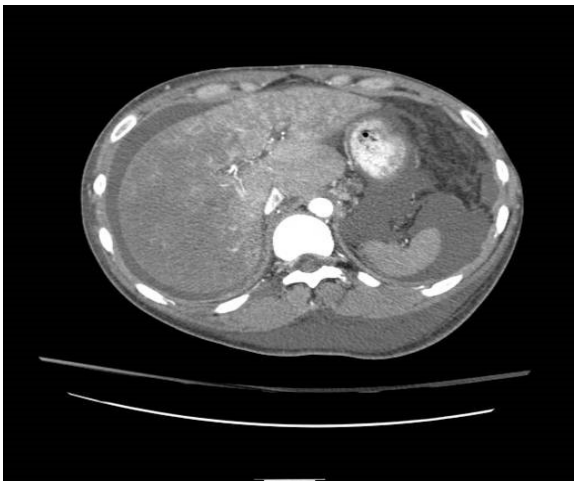
Polycythemia Vera

- Myeloproliferative neoplasm
- ↑ Erythrocyte mass ± ↑ leukocytes, platelets
- Thrombosis or bleeding
- Erythromelalgia
- Pruritus
- Splenomegaly

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Polycythemia Vera: Complications



Thrombosis may be the presenting symptom

Site of thrombosis varies

- Budd-Chiari syndrome (*see image*)
- TIA/CVA
- Myocardial infarction
- VTE

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Polycythemia Vera: Testing

Hemoglobin level >16.5 g/dL in men, >16 g/dL in women

Erythropoietin level

- Decreased erythropoietin level is specific for PV
  - 10% of patients with PV have normal erythropoietin level
- Increased erythropoietin level indicates secondary erythrocytosis

(+) *JAK2* V617F mutation is 97% sensitive for PV

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WHO Criteria for Polycythemia Vera

Major criteria

1. Hemoglobin level >16.5 g/dL in men or >16.0 g/dL in women *or*

   Hematocrit of >49% in men or >48% in women *or*

   Increased red cell mass
2. Bone marrow biopsy showing hypercellularity for age with trilineage growth (panmyelosis) including prominent erythroid, granulocytic, and megakaryocytic proliferation with pleomorphic, mature megakaryocytes (differences in sizes)
3. Presence of *JAK2* V617F or *JAK2* exon 12 mutation

Minor criterion

- Subnormal serum erythropoietin level

Diagnosis of PV requires meeting either all three major criteria *or* the first two major criteria and the minor criterion

Information from Arber DA, Orazi A, Hasserjian R, et al. The 2016 revision to the World Health Organization classification of myeloid neoplasms and acute leukemia. Blood. 2016; 19;127(20):2391-405. [PMID: 27069254] doi: 10.1182/blood-2016-03-643544

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Polycythemia Vera: Treatment

Low risk

- Low-dose aspirin
- Phlebotomy (hematocrit goal of <45%)

High risk (age >60 years and/or prior thrombosis)

- Low-dose aspirin
- Phlebotomy (hematocrit goal of <45%)
- Hydroxyurea

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Hematology Q6

A 65-year-old man was admitted to the ICU 3 days ago for sepsis. He is now stable with no evidence of bleeding. He has no history of CVD.

Laboratory studies (3 days after admission):	
Hemoglobin	7.7 g/dL (10.6 g/dL on admission)
Creatinine	2.8 mg/dL (4.5 mg/dL on admission)
Ferritin	410 ng/mL
Iron	30 µg/dL
TIBC	144 µg/dL

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Hematology Q6

A 65-year-old man was admitted to the ICU 3 days ago for sepsis. He is now stable with no evidence of bleeding. He has no history of CVD. Laboratory studies (3 days after admission): hemoglobin, 7.7 g/dL (10.6 g/dL on admission); creatinine, 2.8 mg/dL (4.5 mg/dL on admission); ferritin, 410 ng/mL; iron, 30 µg/dL; TIBC, 144 µg/dL.

Which of the following is the most appropriate treatment of this patient's anemia?

A: Erythrocyte transfusion

B: Erythropoiesis-stimulating agent

C: IV iron

D: No treatment

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Indications for Transfusion

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Indications for Transfusion: Erythrocytes and Platelets

Hemoglobin transfusion thresholds

- Hemodynamically stable, not bleeding: 7 g/dL
- Orthopedic or cardiac surgery, CVD: 8 g/dL

Platelet transfusion thresholds

- Most patients: 10,000/µL
- Surgery or active bleeding: 50,000/µL
- CNS surgery/procedure or CNS bleeding: 100,000/µL

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Indications for Transfusion: Fresh Frozen Plasma

Warfarin reversal

- Active bleeding
- 4-Factor PCC not available/contraindicated

TTP

Dilutional coagulopathy during massive transfusion

Bleeding with multiple factor deficiencies

- DIC or liver disease

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Indications for Transfusion: Cryoprecipitate

Bleeding with hypofibrinogenemia/dysfibrinogenemia

- Goal fibrinogen level ≥1 g/L
- Goal varies, may be higher in surgical patients

Patients at increased risk for hypofibrinogenemia

- Massive transfusion
- Liver disease, DIC
- Receiving thrombolytic therapy

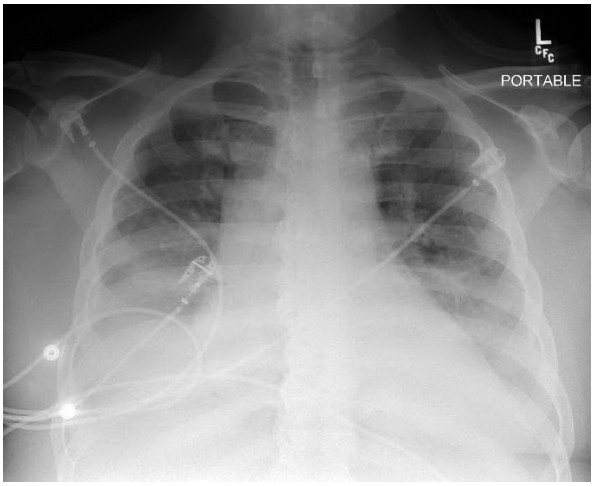
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Complications of Transfusions

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Transfusion-Associated Circulatory Overload (TACO): Diagnosis and Testing



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Diagnosis: ≥3 criteria within 6 hours of transfusion

- Acute respiratory distress
- ↑ BNP level
- ↑ CVP
- Heart failure
- Positive fluid balance
- Radiographic pulmonary edema

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TACO: Treatment

- Stop transfusion
- Diuretic therapy
- Supportive care

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Transfusion-Related Acute Lung Injury

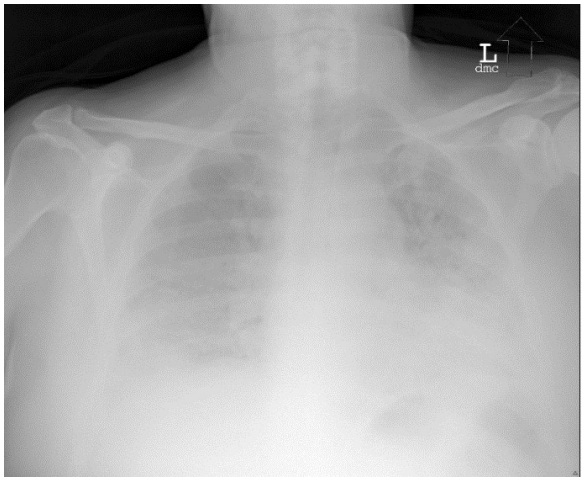
Diagnosis

- Donor antibodies against recipient HLA or neutrophil antigens
- Noncardiac pulmonary edema during transfusion or within 6 hours

Treatment

- Stop transfusion
- Manage as ARDS

Prevention: leukoreduction



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Delayed Hemolytic Transfusion Reaction

Diagnosis

- Anamnestic response to minor erythrocyte antigens
  - 3-14 days after erythrocyte transfusion
- Anemia, jaundice, fever

Testing

- Assess for hemolysis
- Repeat type and screen to identify new alloantibody

Treatment

- Supportive care

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Transfusion-Associated GVHD

- Engraftment of donor lymphocytes in immunosuppressed patients
- Pancytopenia, fever
- Diarrhea, ↑ aminotransferase levels
- Rash
- Usually fatal
- Prevention: gamma irradiation of cellular products

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Febrile Nonhemolytic Transfusion Reaction

Diagnosis

- Cytokines released from donor leukocytes
- Fever and chills within 4 hours of transfusion
- No hemolysis

Treatment

- Stop transfusion
- Provide symptomatic care
- Rule out infection
- Rule out acute hemolytic reaction related to blood mismatch

Prevention: leukoreduction

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Transfusion-Related Infectious Complications

Viral

- Hepatitis B/C, HIV, West Nile

Bacterial

- Especially with platelet transfusion
- Fever, chills, tachycardia, hypotension
- Stop transfusion
- Blood bag Gram stain/culture
- Patient blood cultures
- Empiric broad-spectrum antibiotic

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Hematology I

- Answers to Multiple-Choice Questions

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Hematology Q1

A 45-year-old man is evaluated for incidentally discovered iron deficiency anemia. Medical history is unremarkable. Result of fecal occult blood test is negative. Iron replacement is initiated.

Which of the following is the most appropriate initial management?

A: Colonoscopy and upper endoscopy

B: Iron studies in 1 month

C: tTG IgA antibody assay

D: Wireless capsule endoscopy

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Hematology Q2

An 87-year-old man is evaluated for chronic asymptomatic anemia. He has hypertension. Exam is normal. He weighs 140 lb. Laboratory studies: hemoglobin, 11.4 g/dL; reticulocyte count, 0.8%; creatinine, 1.6 mg/dL; iron studies, normal. Peripheral blood smear shows normochromic, normocytic erythrocytes.

Which of the following is the most likely cause of this patient's anemia?

A: Advanced age

B: Inflammatory process

C: Iron deficiency

D: Kidney disease

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Hematology Q3

A 24-year-old woman reports headache and fever for 48 hours. She is confused. Temperature is 100.6 °F; BP is 150/92 mm Hg. Laboratory studies show hemolytic anemia and thrombocytopenia. Coagulation studies are normal.

Which of the following is the most likely diagnosis?

A: Aplastic anemia

B: Disseminated intravascular coagulation (DIC)

C: Hemolytic anemia with immune thrombocytopenic purpura (ITP)

D: Thrombotic thrombocytopenic purpura (TTP)

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Hematology Q4

A 30-year-old woman reports difficulty walking and bilateral foot numbness. She follows a vegan diet. She has decreased sensation and vibratory sense in both legs. Laboratory studies: hemoglobin, 10.4 g/dL; leukocyte count, 2800/µL; MCV, 105 fL; vitamin B_{12}, 210 pg/mL.

Which of the following is the most appropriate next diagnostic test?

A: Bone marrow biopsy

B: Folate level measurement

C: Homocysteine level measurement

D: Methylmalonic acid level measurement

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Hematology Q5

A 65-year-old man is evaluated for an elevated hemoglobin level. He has a 1-year history of pruritus without skin rash. He has never smoked. Exam shows plethora and splenomegaly. Laboratory studies show erythrocytosis, leukocytosis, and thrombocytosis.

Which of the following is the most appropriate management?

A: Factor V Leiden testing

B: Hydroxyurea

C: *JAK2* V617F testing

D: Peripheral blood flow cytometry

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Hematology Q6

A 65-year-old man was admitted to the ICU 3 days ago for sepsis. He is now stable with no evidence of bleeding. He has no history of CVD. Laboratory studies (3 days after admission): hemoglobin, 7.7 g/dL (10.6 g/dL on admission); creatinine, 2.8 mg/dL (4.5 mg/dL on admission); ferritin, 410 ng/mL; iron, 30 µg/dL; TIBC, 144 µg/dL.

Which of the following is the most appropriate treatment of this patient's anemia?

A: Erythrocyte transfusion

B: Erythropoiesis-stimulating agent

C: IV iron

D: No treatment

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Hematology II – Leukocyte, Platelet, and Clotting Disorders

2025 Virtual/Live Internal Medicine Board Review

Marcus J. Geer, MD
Assistant Professor, Hematology/Oncology
University of Michigan
Ann Arbor, MI

ACP Internal Medicine Board Review Course

Hematology II: Leukocyte, Platelet, and Clotting Disorders

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Hematology Q7

A 52-year-old man is evaluated for recent-onset symptomatic HF, eczema, and diarrhea.

Laboratory studies:	
Hemoglobin	13.5 g/dL
Leukocyte count	18,000/µL (20% lymphocytes, 60% eosinophils, 20% neutrophils)

ECG shows low QRS voltage. Echocardiogram shows restrictive LV filling and increased endomyocardial echogenicity.

Peripheral blood smear demonstrates mature eosinophils.

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Hematology Q7

A 52-year-old man is evaluated for recent-onset symptomatic HF, eczema, and diarrhea. ECG shows low QRS voltage. Laboratory studies: hemoglobin, 13.5 g/dL; leukocyte count, 18,000/µL (20% lymphocytes, 60% eosinophils, 20% neutrophils). ECG shows restrictive LV filling and increased endomyocardial echogenicity. Peripheral blood smear demonstrates mature eosinophils.

Which of the following is the most likely diagnosis?

A: Acute eosinophilic leukemia

B: Chronic myeloid leukemia

C: Hypereosinophilic syndrome

D: Systemic mastocytosis

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Leukocyte Disorders

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Leukopenia: Diagnosis/Definitions

Leukopenia (leukocyte count <4000/µL)

Neutropenia (neutrophil count <1500/µL)

Infection risk increases when ANC <500/µL

Symptoms are diagnosis dependent

Duffy null phenotype

- Patients will have a lower baseline neutrophil count

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Leukopenia: Diagnosis/Causes

Autoimmune

- Felty syndrome: triad of RA + splenomegaly + neutropenia
- SLE includes leukopenia in 50% of patients (lymphopenia or neutropenia)

Hematologic malignancy

- MDS involves variable cytopenias
- Primary myelofibrosis
- Aplastic anemia
- Acute leukemias
- T-cell large granular lymphocytic (LGL) leukemia

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Leukopenia: Diagnosis/Causes

Infection

- Viral, rickettsial, parasitic
- Sepsis

Secondary bone marrow disorders

- Metastatic cancer
- Ineffective erythropoiesis (↓ vitamin B_{12}, ↓ folate levels)
- Myelosuppression (drugs [e.g., hydroxyurea, chemotherapy, antibiotics])

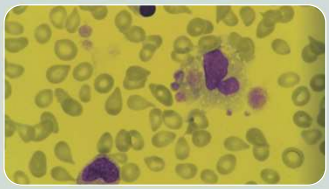
Benign, congenital

- Cyclic neutropenia

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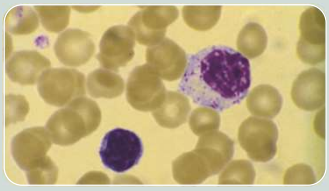
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Leukopenia: Peripheral Blood Smear



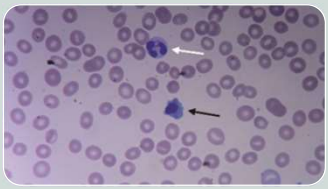
Leukoerythroblastic

- Primary myelofibrosis
- Myelophthisic process (e.g., metastatic carcinoma)



Large granular lymphocytes (LGL)

- Large granular lymphocytic leukemia
- Reactive LGLs may occur in infection, splenectomy, or other lymphomas



Abnormal-appearing leukocytes

- MDS

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Leukopenia: Diagnosis and Testing

Bone marrow disorders

- Bone marrow aspiration and biopsy to evaluate for malignancy

Serum testing for vitamin B_{12}, folic acid, MMA, and homocysteine levels

Viral testing by either serology or PCR

Duffy-null associated neutrophil count

- Test for the Duffy-null genotype

Cyclic neutropenia

- CBC twice weekly for 3-6 weeks to detect a cyclic pattern
- May be associated with *ELANE* variations

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Neutropenia: Treatment

Treat underlying cause (neoplasm, deficiencies)

Monitor mild neutropenia (neutrophil count >500-1000/µL)

Granulocyte colony-stimulating factor (G-CSF)

- Use to prevent recurrent febrile neutropenia
- Do not use in most febrile patients with neutropenia
- Consider in high-risk patients
  - Prolonged (>10 d) and profound (ANC <100/µL) neutropenia, age ≥65 years, uncontrolled primary disease, pneumonia, sepsis syndrome, invasive fungal infection, or hospitalization at the time of fever

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Leukocytosis: Diagnosis

Symptoms are disease dependent

Symptoms from leukostasis depend on leukocyte count and size

- CLL: >600,000-800,000/µL
- CML: >250,000-500,000/µL
- ALL: >200,000/µL
- AML: >100,000/µL

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Leukocytosis: Diagnosis

Leukemoid reaction: elevated leukocyte count due to an inflammatory reaction

- ↑ Mature neutrophils and left shift (immature leukocytes, including bands, myelocytes, and metamyelocytes)
- ≥1% blasts in peripheral blood
  - Not likely a leukemoid reaction
  - Look for a primary bone marrow process

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Leukocytosis: Differential Diagnosis

Infectious syndrome/sepsis

Drugs

- Catecholamines, glucocorticoids, G-CSF

Inflammatory processes

- Hypersensitivity reaction
- Autoimmune disorders, including RA, Kawasaki disease, adult Still disease, IBD

Acute and chronic leukemias

Myeloproliferative neoplasms

- CML most commonly
- Polycythemia vera, essential thrombocytosis

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Leukocytosis: Diagnosis and Treatment

CBC with differential

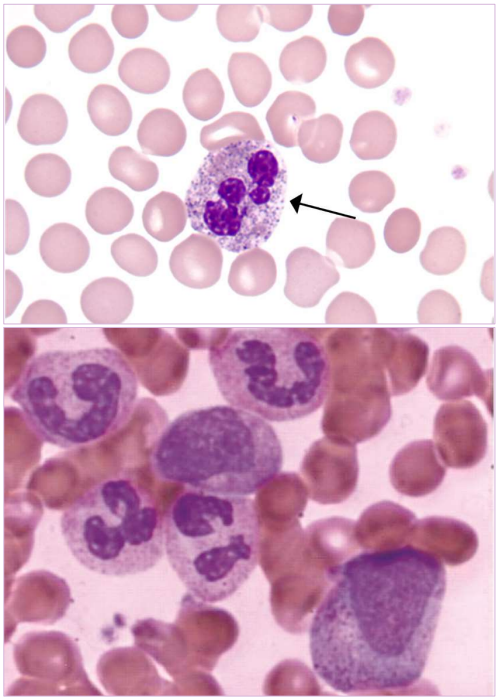
- Type of leukocyte key in diagnosis

Inflammatory markers

Peripheral blood smear

Bone marrow examination

Treat underlying condition



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Hematology Q8

A 40-year-old man reports progressive abdominal pain and weight loss. Exam reveals splenomegaly.

Laboratory studies:	
Hemoglobin	8.3 g/dL
Leukocyte count	85,000/µL
Platelet count	900,000/µL

Testing reveals a t(9;22) translocation.

Peripheral blood smear shows neutrophilia, basophilia, and left-shifted granulopoiesis with no blasts.

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Hematology Q8

A 40-year-old man reports progressive abdominal pain and weight loss. Exam reveals splenomegaly. Laboratory studies: hemoglobin, 8.3 g/dL; leukocyte count, 85,000/µL; platelet count, 900,000/µL. Testing reveals a t(9;22) translocation. Peripheral blood smear shows neutrophilia and left-shifted granulopoiesis with no blasts.

Which of the following is the most likely diagnosis?

A: Chronic lymphocytic leukemia

B: Chronic myeloid leukemia

C: Leukemoid reaction

D: Myelodysplastic syndrome

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Chronic Myeloid Leukemia

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Myeloproliferative Neoplasms

Clonal stem cell disorders

- CML
- Essential thrombocythemia
- Polycythemia vera
- Primary myelofibrosis
- Others

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CML: Phases

Chronic	85% of patients present in this earliest phase Blood and bone marrow blasts are ≤15%
Advanced (Accelerated or Blast Phase)	Terminal phase of evolution with a very poor prognosis Diagnosed when blasts are >15% Blasts may be either a myeloid or lymphoid immunophenotype

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CML: Presenting Symptoms

- Can be asymptomatic, but >90% of patients present with symptoms
- Fatigue, weight loss, splenomegaly, bruising, or bleeding
- Splenomegaly leading to abdominal pain and weight loss
- B symptoms (fever, night sweats, unintentional weight loss)

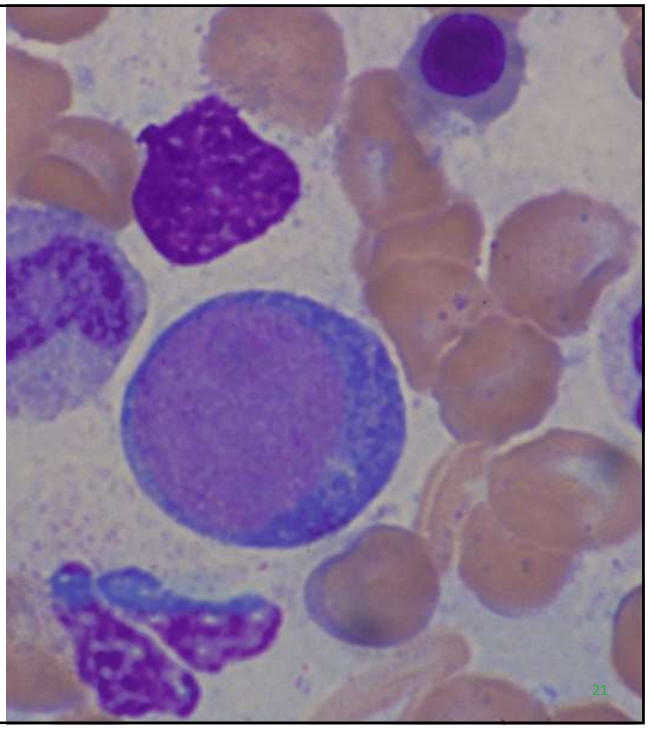


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CML: Diagnosis

Bone marrow aspiration and biopsy to confirm diagnosis

Cytogenetic testing for Philadelphia chromosome

- May be performed on peripheral blood or bone marrow aspirate, but marrow testing must be done to properly phase the disease
- Philadelphia chromosome: balanced chromosomal translocation t(9;22)(q34;q11.2) → *BCR-ABL* gene
- *BCR-ABL* gene leads to a constitutively activated tyrosine kinase

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CML: Treatment

Chronic-phase CML

- Treatment indicated at time of diagnosis to prevent disease progression
- Lifelong treatment in most patients
- TKIs frontline therapy: imatinib, dasatinib, nilotinib, bosutinib, and asciminib

Accelerated and blast crisis disease

- Treatment often involves TKIs ± cytotoxic chemotherapy, followed by allogeneic hematopoietic stem cell transplantation

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Eosinophilia: Causes

C	Collagen vascular disease (eosinophilic granulomatosis with polyangiitis)
H	Helminthic infection (*Strongyloides*)
I	Idiopathic HES (exclude other causes of eosinophilia)
N	Neoplasia (myeloproliferative disorders, AML/ALL, lymphoma)
A	Allergy, atopy, asthma, drugs

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Eosinophilia: Thresholds

Eosinophil count 500-1500/µL

- End-organ damage rare

Eosinophil count >1500/µL

- Possible HES
  - Sustained eosinophil count >1500/µL *and/or*
  - Eosinophil organ infiltration

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Eosinophilia: Treatment

Treat underlying disease

Idiopathic HES

- Glucocorticoids
- Hydroxyurea

PDGFR α or β translocation (primary HES)

- Imatinib

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Immune Thrombocytopenic Purpura (ITP)

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ITP: General Overview

Immune thrombocytopenic purpura (ITP)

- Acquired thrombocytopenia caused by autoantibodies against platelet antigens
- Common cause of thrombocytopenia in otherwise asymptomatic adults

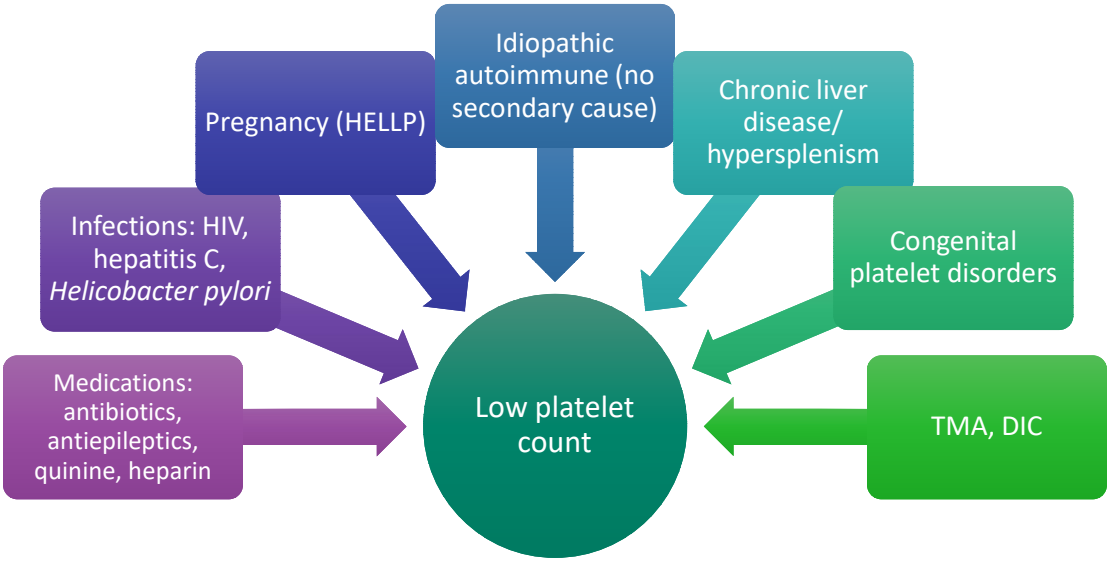
Two major diagnostic concerns in suspected ITP

- Distinguish ITP from other causes of thrombocytopenia
- Determine whether ITP is primary or secondary to an underlying condition that might benefit from treatment

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Thrombocytopenia: Causes

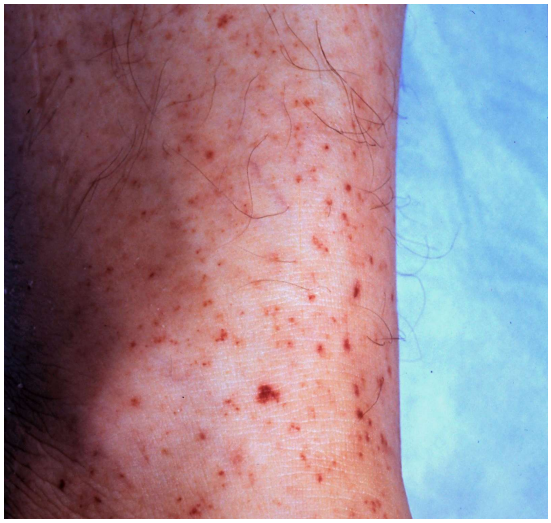


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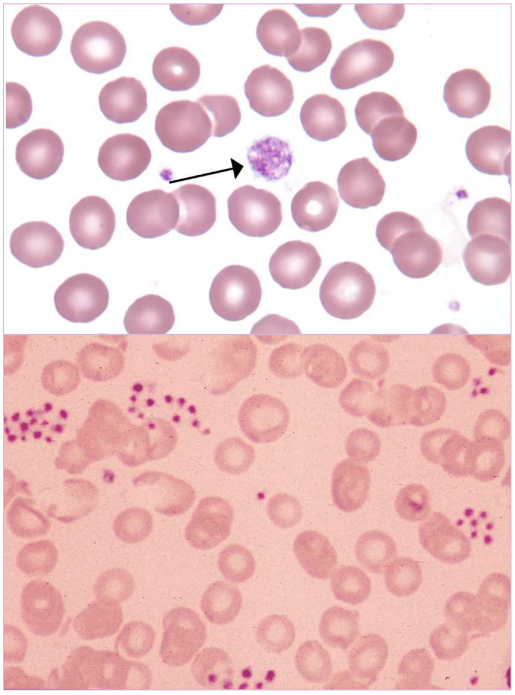
ITP: Signs and Symptoms

- Asymptomatic usually
- Petechiae, ecchymoses
- Mucosal bleeding
- Menorrhagia, GI bleeding
- No lymphadenopathy, splenomegaly, fever



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ITP: Peripheral Blood Findings

Complete blood counts

- Thrombocytopenia
- Normal leukocyte number
- Anemia, if bleeding

Peripheral blood smear

- Thrombocytopenia, large platelets
- Normal erythrocytes, leukocytes
- No platelet clumping (pseudothrombocytopenia)

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ITP: Testing

Bone marrow biopsy/aspiration

- Performed if alternate marrow disorder suspected

Platelet-associated antibody → antiplatelet antibody testing

- Low sensitivity and does not correlate with clinical outcomes
- No role for antiplatelet antibody testing in ITP workup

Ultimately a diagnosis of exclusion

- Start empiric treatment if high on differential
- If patient responds to treatment, diagnosis is confirmed

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Primary ITP: Treatment

Patients with platelet count >30,000/µL and no bleeding

- No treatment required because bleeding is rare

Transfuse only patients with bleeding

- Transfuse platelets to threshold depending on bleeding site and severity
- Patients often will not have meaningful response to platelet transfusion

First-line treatment: glucocorticoids ± IVIG depending on symptom severity

- Combination therapy: severe thrombocytopenia and bleeding
- Single-agent therapy with glucocorticoids: milder bleeding or asymptomatic and severe thrombocytopenia
- Tend to see faster response with IVIG (1-3 d) than glucocorticoids (2-14 d)

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Primary ITP: Treatment

Second-line treatment

- Rituximab
- Fostamatinib
- Thrombopoietin receptor agonists
  - Romiplostim: peptide TPO-RA administered subcutaneously weekly
  - Eltrombopag and avatrombopag: oral, small molecule TPO-RAs given daily
- Anti-RhD immunoglobulin
  - RhD-positive patients with a spleen (boxed warning for hemolytic anemia risk)
- Splenectomy

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Hematology Q9

A 35-year-old woman reports a 3-month history of easy bruising and menorrhagia.

She has occasional migraine but no other problems.

She has had two uneventful vaginal deliveries.

Laboratory studies show a normal CBC, PT, and aPTT.

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Hematology Q9

A 35-year-old woman reports a 3-month history of easy bruising and menorrhagia. She has occasional migraine but no other problems. She has had two uneventful vaginal deliveries. Laboratory studies show a normal CBC, PT, and aPTT.

Which of the following is the most appropriate next step in diagnosis?

A: Fibrinogen level measurement

B: Medication review

C: Platelet aggregation studies

D: von Willebrand factor testing

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Drug-Induced Qualitative Platelet Dysfunction

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Drug-Induced Qualitative Platelet Dysfunction: Diagnosis

- Increased bleeding/bruising
- Normal PT, aPTT, INR, fibrinogen level
- Abnormal platelet function tests
- Irreversible (lasts 7-day platelet lifespan)
- Reversible (limited to duration of drug activity)

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Drug-Induced Qualitative Platelet Dysfunction: Diagnosis

Antiplatelet agents

- Aspirin, clopidogrel, prasugrel (all irreversible)
- Abciximab, eptifibatide, tirofiban (all reversible)

NSAIDs (reversible)

SSRIs, tricyclic antidepressants (reversible)

β-Lactam antibiotics (reversible)

Vitamin E (reversible)

Herbs, such as *Ginkgo biloba*, garlic, turmeric (reversible)

Select tyrosine kinase inhibitors

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Heparin-Induced Thrombocytopenia (HIT)

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HIT: Overview

Life-threatening complication of exposure to heparin

Occurs in a small percentage of patients with any dose, schedule, or route of administration

- Results from an autoantibody directed against endogenous PF4 in complex with heparin
  - Antibody activates platelets and may cause catastrophic arterial and venous thrombosis

Untreated HIT has a mortality rate as high as 20%

- Decreased mortality with improved recognition and early intervention

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HIT: Signs and Timing

Petechiae, ecchymosis

Venous or arterial thrombosis

- Thrombocytopenia and symptoms may occur ≥5 days after heparin exposure if first occurrence
- Symptoms may occur in <1 day after heparin re-exposure within 30 days



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HIT: Suspecting the Diagnosis

New-onset thrombocytopenia (platelet count <150,000/µL)

- ≥50% reduction in platelets, even if platelet count >150,000/ µL
- Venous or arterial thrombosis
- Necrotic skin lesions at heparin injection sites
- Acute systemic reactions (fever/chills, tachycardia, hypertension, dyspnea, cardiopulmonary arrest) after IV heparin administration

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HIT: Testing

Immunoassay is sensitive, not specific

- Heparin platelet factor-4 antibody

Functional assays are specific

- Serotonin-release assay
- Heparin-induced platelet aggregation assay

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HIT: Suspecting the Diagnosis

4T scoring system for predicting HIT and thrombosis

- Degree of thrombocytopenia
- Timing of thrombocytopenia
- Thrombosis or other sequelae
- Absence of other causes of thrombocytopenia

Score: High, medium, or low probability of HIT

- Intermediate/high probability
  - Assume HIT pending results of antibody testing
  - Captures most patients with HIT
- Low probability
  - Do not pursue HIT antibody testing or treat for HIT

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HIT: Immediate Treatment

Empiric treatment is indicated for 4T score ≥4

- Intermediate to high probability of HIT

Discontinue heparin

Initiate a nonheparin anticoagulant while awaiting HIT test results

- Argatroban
- Fondaparinux
- Bivalirudin
- Rivaroxaban

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HIT: Treatment

(+) Immunoassay: Stop heparin and continue HIT treatment

(–) Immunoassay: Continue heparin and stop HIT treatment

Indeterminate immunoassay + high 4T score: Perform functional assay

- (+) Functional assay: Avoid heparin, continue HIT treatment
- (–) Functional assay: Restart heparin if indicated, stop HIT treatment

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Hematology Q10

A 32-year-old woman is evaluated for unprovoked PE.

Family history is negative for VTE.

Physical exam findings show livedo reticularis on both lower extremities.

Laboratory studies show a prolonged aPTT.

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Hematology Q10

A 32-year-old woman is evaluated for unprovoked PE. Family history is negative for VTE. Physical exam findings show livedo reticularis on both lower extremities. Laboratory studies show a prolonged aPTT.

In addition to beginning anticoagulation, which of the following is the most appropriate next diagnostic test?

A: Antithrombin activity assay

B: APLS testing

C: Methylene tetrahydrofolate reductase DNA testing

D: No further testing

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Antiphospholipid Syndrome (APLS)

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APLS: Diagnosis and Testing

Clinical criteria

- Vascular complications may include any of the following:
  - Macrovascular venous thromboembolism
  - Macrovascular arterial thrombosis
  - Microvascular complications
  - Obstetric/pregnancy complications
  - Cardiac valvular lesions
  - Hematologic complications (e.g., thrombocytopenia)

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APLS: Diagnosis

Suspect APLS in a patient with an unexplained venous or arterial thrombotic event

- Especially in a young patient

Diagnosis requires both clinical and laboratory criteria

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APLS: Diagnosis and Testing

Laboratory criteria (≥1 of the following; must be repeated in 12 weeks)

- IgG and/or IgM anticardiolipin antibodies in moderate or high titer (>99% of labs normal)
- IgG and/or IgM anti–β_2-glycoprotein in moderate or high titer (>99% of labs normal)
- Evidence of lupus anticoagulant activity
  - PTT
  - LA-sensitive PTT
  - Dilute Russell viper venom test

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APLS: Management

Management of arterial or venous thrombosis per guidelines

- Warfarin: typically preferred over DOACs, especially for high-risk cases
- Anticoagulation will be lifelong for most patients
- Patients with arterial thrombosis may be managed with warfarin + aspirin or single-agent warfarin using a higher INR

Pregnant patients

- Warfarin is contraindicated, especially in the first trimester
- LMWH used instead of warfarin

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Hematology Q11

A 63-year-old man is evaluated for a 4-hour history of acute dyspnea, pleuritic chest pain, and scant hemoptysis.

He has a history of an unprovoked PE 8 years ago that was treated with 6 months of anticoagulation.

Exam reveals a pulse rate of 110/min; no other abnormalities are noted.

Results of laboratory studies, including creatinine level, are normal.

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Hematology Q11

A 63-year-old man is evaluated for a 4-hour history of acute dyspnea, pleuritic chest pain, and scant hemoptysis. He has a history of an unprovoked PE 8 years ago that was treated with 6 months of anticoagulation. Exam reveals a pulse rate of 110/min; no other abnormalities are noted. Results of laboratory studies, including creatinine level, are normal.

Which of the following is the most appropriate management?

A: CT angiography (CTA)

B: D-dimer measurement

C: Duplex leg ultrasonography

D: Ventilation-perfusion (V/Q) scanning

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Venous Thromboembolic Disorders (VTE)

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VTE: Major Risk Factors

- Surgery
- Immobility
- Previous VTE
- Family history
- Cancer

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VTE: Clinical Presentation

DVT

- Unilateral leg
- Swelling, pain, warmth, erythema

PE

- Acute onset
- Common findings are chest pain, dyspnea, and tachypnea
- Less common findings are cough, fever, syncope, and shock

Use validated prediction rule

- Examples: Wells criteria for DVT and PE

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Wells Criteria for DVT

+1 point (each)

- Calf swelling ≥3 cm
- Swollen unilateral superficial veins (nonvaricose)
- Unilateral pitting edema
- Swelling of the entire leg
- Localized tenderness along the deep venous system
- Active cancer or treatment in previous 6 months
- Paralysis, paresis, recent cast immobilization of legs
- Recently bedridden for ≥3 days; major surgery
- History of DVT

−2 points

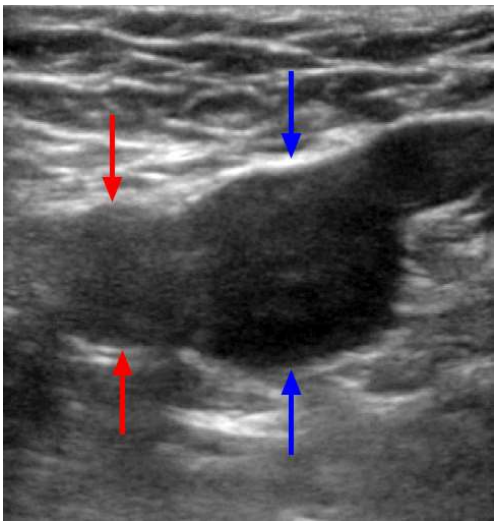
- Alternative explanation for leg symptoms at least as likely

Information from Wells PS, Anderson DR, Rodger M, Forgie M, Kearon C, Dreyer J, et al. Evaluation of D-dimer in the diagnosis of suspected deep-vein thrombosis. N Engl J Med. 2003;349:1227-35. [PMID: 14507948]

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DVT: Diagnosis and Testing



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DVT unlikely (0-1 pts)

- D-dimer assay
  - (+) D-dimer: Doppler ultrasonography
  - (–) D-dimer: no further testing

DVT likely (≥2 pts)

- Doppler ultrasonography without obtaining D-dimer

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Wells Criteria for PE

3 points	• Clinical signs/symptoms of DVT • PE most likely diagnosis
1.5 points	• HR >100/min • Previous documented PE/DVT • Bedridden ≥3 days/major surgery
1 point	• Hemoptysis • Active cancer

Information from Wells PS, Anderson DR, Rodger M, et al. Derivation of a simple clinical model to categorize patients' probability of pulmonary embolism: increasing the model's utility with the SimpliRED D-dimer. Thromb Haemost. 2000;83:416-20. [PMID: 10744147]

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PE: Diagnosis and Testing

≤4 points	≥4 points
PE unlikely; obtain D-dimer	Moderate to high probability of PE
(+) D-dimer: CTA (-) D-dimer: Consider stopping eval	Imaging indicated

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PE: Diagnosis and Testing

PE imaging

- CTA preferred
- V/Q scan
  - If CTA contraindicated (contrast exposure)
  - Normal chest radiograph increases likelihood of definitive result



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VTE: Prognosis

Patients with PE

- Simplified PESI may be used to determine suitability for outpatient management

Mortality risk

- Score = 0: 1.1%
- Score ≥1: 8.9%

Simplified PESI score (high risk = ≥1)

- Age >80 years
- History of cancer
- History of HF or chronic lung disease
- Pulse rate ≥110/min
- SBP <100 mm Hg
- Oxygen saturation <90% (breathing ambient air)

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Hematology Q12

A 44-year-old man undergoes follow-up for an unprovoked proximal left leg DVT 3 months ago.

He has no other medical problems, and his only medication is rivaroxaban.

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Hematology Q12

A 44-year-old man undergoes follow-up for an unprovoked proximal left leg DVT 3 months ago. He has no other medical problems, and his only medication is rivaroxaban.

Which of the following is the most appropriate management?

A: Discontinue rivaroxaban in 3 months

B: Discontinue rivaroxaban now

C: Discontinue rivaroxaban; perform thrombophilia testing

D: Extended anticoagulation

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VTE: Treatment

DOACs

- Rivaroxaban and apixaban as monotherapy
- Edoxaban and dabigatran require initial parenteral therapy

Subcutaneous LMWH or fondaparinux

- Avoid in severe kidney injury
- Followed by oral anticoagulation
- As a bridge to warfarin in patients with APLS

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VTE: Treatment

IV unfractionated heparin

- Patients at high risk for decompensation/thrombolytic therapy or with planned procedure/intervention
- Followed by oral anticoagulation

Outpatient treatment

- For most patients with DVT
- Consider for patients with PE if PESI score = 0

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VTE: Treatment Duration

Provoked VTE	Unprovoked VTE	Cancer-related VTE
• Surgery, trauma, immobility • 3 months if risk factor resolved	• Extended therapy • Periodic assessment of benefit/risk	• As long as cancer is active

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VTE: Reversal of Life-Threatening Bleeding

Stop anticoagulant

Warfarin

- IV vitamin K + 4-factor PCC (factors II, VII, IX, and X)

Rivaroxaban, apixaban, edoxaban

- 4-factor PCC
- Andexanet alfa: reversal "decoy" agent for factor Xa inhibitors

Dabigatran

- Idarucizumab: anti-dabigatran monoclonal antibody fragment
- If not available, may use activated PCC

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Severe VTE: Treatment

Thrombolytic therapy

- Massive iliofemoral DVT + risk of limb loss
- PE + hemodynamic collapse

Device therapy

- Embolectomy
  - Thrombolytic contraindications
  - Thrombolytic failure

Inferior vena cava filter

- Absolute contraindications to anticoagulation in patient with DVT
- Should be removed when contraindication for anticoagulation resolves

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Hematology II

- Answers to Multiple-Choice Questions

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Hematology Q7

A 52-year-old man is evaluated for recent-onset symptomatic HF, eczema, and diarrhea. ECG shows low QRS voltage. Laboratory studies: hemoglobin, 13.5 g/dL; leukocyte count, 18,000/µL (20% lymphocytes, 60% eosinophils, 20% neutrophils). ECG shows restrictive LV filling and increased endomyocardial echogenicity. Peripheral blood smear demonstrates mature eosinophils.

Which of the following is the most likely diagnosis?

A: Acute eosinophilic leukemia

B: Chronic myeloid leukemia

C: Hypereosinophilic syndrome

D: Systemic mastocytosis

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Hematology Q8

A 40-year-old man reports progressive abdominal pain and weight loss. Exam reveals splenomegaly. Laboratory studies: hemoglobin, 8.3 g/dL; leukocyte count, 85,000/µL; platelet count, 900,000/µL. Testing reveals a t(9;22) translocation. Peripheral blood smear shows neutrophilia and left-shifted granulopoiesis with no blasts.

Which of the following is the most likely diagnosis?

A: Chronic lymphocytic leukemia

B: Chronic myeloid leukemia

C: Leukemoid reaction

D: Myelodysplastic syndrome

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Hematology Q9

A 35-year-old woman reports a 3-month history of easy bruising and menorrhagia. She has occasional migraine but no other problems. She has had two uneventful vaginal deliveries. Laboratory studies show a normal CBC, PT, and aPTT.

Which of the following is the most appropriate next step in diagnosis?

A: Fibrinogen level measurement

B: Medication review

C: Platelet aggregation studies

D: von Willebrand factor testing

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Hematology Q10

A 32-year-old woman is evaluated for unprovoked PE. Family history is negative for VTE. Physical exam findings show livedo reticularis on both lower extremities. Laboratory studies show a prolonged aPTT.

In addition to beginning anticoagulation, which of the following is the most appropriate next diagnostic test?

A: Antithrombin activity assay

B: APLS testing

C: Methylene tetrahydrofolate reductase DNA testing

D: No further testing

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Hematology Q11

A 63-year-old man is evaluated for a 4-hour history of acute dyspnea, pleuritic chest pain, and scant hemoptysis. He has a history of an unprovoked PE 8 years ago that was treated with 6 months of anticoagulation. Exam reveals a pulse rate of 110/min; no other abnormalities are noted. Results of laboratory studies, including creatinine level, are normal.

Which of the following is the most appropriate management?

A: CT angiography (CTA)

B: D-dimer measurement

C: Duplex leg ultrasonography

D: Ventilation-perfusion (V/Q) scanning

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Hematology Q12

A 44-year-old man undergoes follow-up for an unprovoked proximal left leg DVT 3 months ago. He has no other medical problems, and his only medication is rivaroxaban.

Which of the following is the most appropriate management?

A: Discontinue rivaroxaban in 3 months

B: Discontinue rivaroxaban now

C: Discontinue rivaroxaban; perform thrombophilia testing

D: Extended anticoagulation

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2025 Greater Chicago Internal Medicine Board Review course
Program Schedule – In-Person and Virtual Live
Tuesday, May 13 – Saturday, May 17, 2025
Central Daylight Time

Saturday, May 17, 2025

Time	Topic	Content	Faculty
7:00 a.m. – 8:00 a.m.	**Breakfast**		
8:00 a.m. – 9:30 a.m.	**Neurology I**	➢ Transient Ischemic Attack ➢ Stroke ➢ Carotid Artery Disease ➢ Head Injury ➢ Dementia ➢ Aphasia ➢ Delirium ➢ Cervical Root Disease ➢ Spinal Stenosis	 *Geeta Verma, MD*
9:30 a.m. – 10:45 a.m.	**Neurology II**	➢ Primary Headache ➢ Secondary Headache ➢ Seizures ➢ Bell Palsy ➢ Parkinson Disease ➢ Essential Tumor ➢ Drug-Induced Myopathy ➢ Multiple Sclerosis and Other Demyelinating Diseases	*Geeta Verma, MD*
10:45 a.m. – 11:00 a.m.	**15-Minute Break**		
11:00 a.m. – 12:00 p.m.	**Endocrinology I: Thyroid Disease and Adrenal Mass**	➢ Hyperthyroidism ➢ Hypothyroidism ➢ Thyroid Nodules and Thyroid Cancer ➢ Thyroid Storm ➢ Myxedemal Coma ➢ Adrenal Mass and Nodules	 *Timothy Bodnar, MD, FACP*
12:00 p.m. – 1:00 p.m.	**1-Hour Break**		
1:00 p.m. – 2:00 p.m. **1:00 p.m. – 2:00 p.m.**	**Endocrinology II: Diabetes Mellitus** **Endocrinology II: Diabetes Mellitus (*cont.*)**	➢ Type 1 Diabetes Mellitus ➢ Type 2 Diabetes Mellitus ➢ Diabetic Neuropathy ➢ Diabetic Retinopathy ➢ Hyperglycemic Crises ➢ Cardiovascular Risk Reduction in Diabetes Mellitus	*Timothy Bodnar, MD, FACP* *Timothy Bodnar, MD, FACP*

2025 Greater Chicago Internal Medicine Board Review course
Program Schedule – In-Person and Virtual Live
Tuesday, May 13 – Saturday, May 17, 2025
Central Daylight Time

Saturday, May 17, 2025			
2:00 p.m. – 3:00 p.m.	**Endocrinology III: Metabolic Bone Disease, Adrenal Disease, and Reproductive Disorders**	➢ Hypercalcemia and Hypercalciuria ➢ Hyperparathyroidism ➢ Osteoporosis ➢ Vitamin D Deficiency and Osteomalacia ➢ Adrenal Insufficiency ➢ Male Hypogonadism ➢ Gynecomastia	*Timothy Bodnar, MD, FACP*
3:00 p.m. – 3:30 p.m.	**Endocrinology IV: Dyslipidemia and Obesity**	➢ Hypercholesterolemia ➢ Hypertriglyceridemia	*Timothy Bodnar, MD, FACP*
3:30 p.m.	**Adjourn**		

Neurology I

2025 Virtual/Live Internal Medicine Board Review

Geeta Verma, MD
Assistant Professor and Health System Clinician, Neurology
Northwestern Medicine
Feinberg School of Medicine
Chicago

ACP Internal Medicine Board Review Course

Neurology I

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- Transient ischemic attack
- Stroke
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- Head injury
- Dementia
- Aphasia
- Delirium
- Cervical root disease
- Spinal stenosis

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Neurology Q1

A 65-year-old woman is evaluated after a 60-minute episode of right-sided weakness.

She has hypertension and diabetes treated with chlorthalidone, metformin, and atorvastatin.

Neurologic exam findings are normal.

Brain imaging is normal.

Neurovascular imaging shows 40% stenosis of the right carotid artery.

ECG and echocardiogram are normal.

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Neurology Q1

A 65-year-old woman is evaluated after a 60-minute episode of right-sided weakness. She has hypertension and diabetes treated with chlorthalidone, metformin, and atorvastatin. Neurologic exam findings are normal. Brain imaging is normal. Neurovascular imaging shows 40% stenosis of the right carotid artery. ECG and echocardiogram are normal.

Which of the following is the most appropriate treatment?

A: Aspirin and clopidogrel

B: Heparin

C: Rivaroxaban

D: Warfarin

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Transient Ischemic Attack

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TIA: Risk Stratification

The ABCD^2 score

- 1 point for Age >60 years
- 1 point for BP >140/90 mm Hg
- 1 point for Clinical symptom of speech deficit, 2 points for hemiparesis
- 1 point for Diabetes
- 1 point for Duration of symptoms of 1-59 min, 2 for ≥60 min

Score of ≥4 indicates higher short-term risk for stroke

Imperfect sensitivity

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TIA/Ischemic Stroke: Diagnosis

Symptoms

- Hemiparesis
- Monocular or hemifield visual loss
- Dysarthria
- Aphasia
- Sensory loss

TIA → similar to stroke but with transient symptoms

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TIA/Ischemic Stroke: Testing

Expedited testing within 24 hours

- Brain imaging (normal in TIA)
  - Immediate MRI (CT if not available)
    - Diffusion-weighted imaging ideal
  - Noninvasive imaging of ICAs
- ECG
  - Atrial fibrillation
  - May be followed by longer-term monitoring
- Echocardiography with bubble study
  - If cardiac cause of stroke suspected
  - TEE not routinely indicated

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Neurology Q2

A 57-year-old man is evaluated in the ED 2 hours after developing acute-onset left arm weakness.

History is unremarkable, and he takes no medications.

BP is 168/98 mm Hg.

Exam reveals left-sided homonymous visual field cut, hemiplegia, and neglect.

Plasma glucose level and head CT scan are normal.

ECG shows AF.

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Neurology Q2

A 57-year-old man is evaluated in the ED 2 hours after developing acute-onset left arm weakness. History is unremarkable, and he takes no medications. BP is 168/98 mm Hg. Exam reveals left-sided homonymous visual field cut, hemiplegia, and neglect. Plasma glucose level and head CT scan are normal. ECG shows AF.

Which of the following is the most appropriate next step in treatment?

A: High-dose aspirin

B: IV heparin

C: IV tPA

D: Mechanical thrombectomy

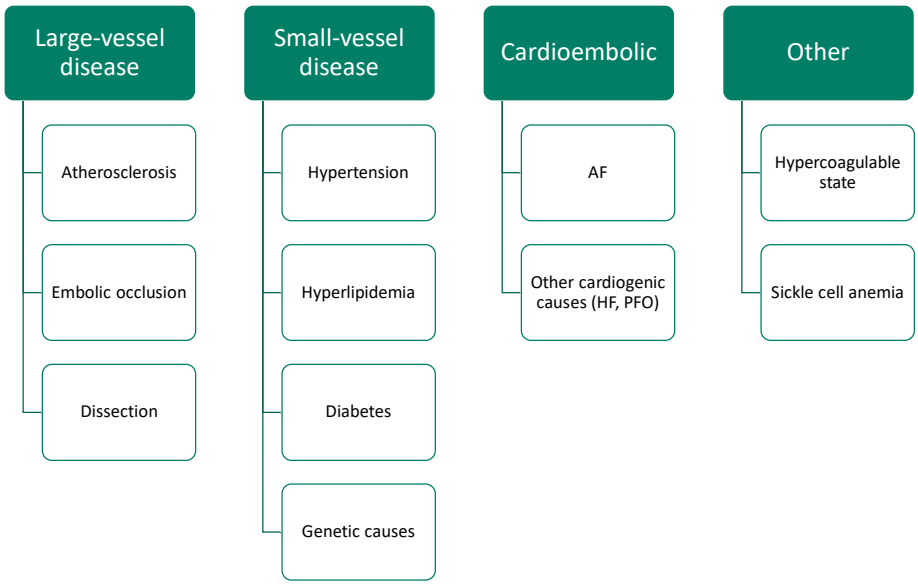
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Stroke

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Ischemic Stroke: Pathophysiology



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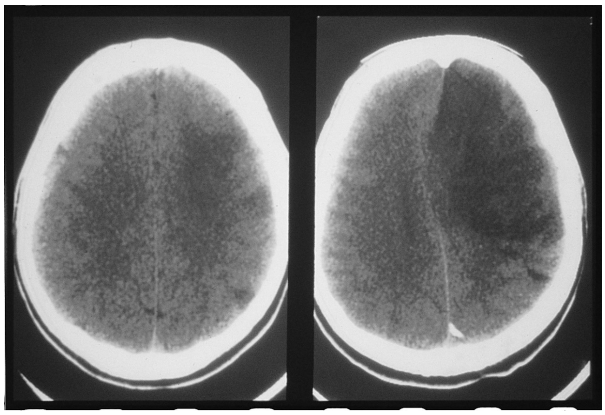
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Ischemic Stroke: Treatment

IV tPA

- Disabling stroke symptoms
- Within 3 to 4.5 hours of onset or from last known normal
- Reduces disability at 3 months
- Exclusionary criteria similar to those for coronary thrombolysis
  - DRAGON score

Thrombectomy in selected patients within 24 hours of onset



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Ischemic Stroke: Treatment

Aspirin/antiplatelet medication

- Unless thrombolysis is planned

Insulin

- Blood glucose level goal of 140-180 mg/dL

Pharmacologic VTE prophylaxis

- Within 24 hours

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Ischemic Stroke: Antihypertensive Treatment

If thrombolytic therapy is not planned, hold antihypertensive treatment unless:

- Systolic BP >220 mm Hg
- Diastolic BP >120 mm Hg

If thrombolytic therapy is planned:

- BP must be <185/110 mm Hg to initiate therapy
- Maintain BP <180/105 mm Hg for >24 h
- IV labetalol or IV nicardipine

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Ischemic Stroke: Secondary Prevention

Antiplatelet therapy

- Aspirin
- Aspirin + dipyridamole superior to aspirin alone
  - Higher incidence of adverse effects
- Clopidogrel equivalent to aspirin + dipyridamole
- Aspirin + clopidogrel
  - For 21 days after high-risk TIA/minor stroke
  - Continue aspirin monotherapy after 21 days

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Ischemic Stroke: Secondary Prevention

Anticoagulation

- Not routine
- AF, left atrial thrombus

Statin therapy

- High intensity
- Regardless of cholesterol level

Antihypertensive therapy

- Long-term BP target <130/80 mm Hg

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Ischemic Stroke: Secondary Prevention

Carotid endarterectomy

- Maximal benefit within 2 weeks
- Minor stroke/TIA
- Ipsilateral stenosis >70%

PFO closure

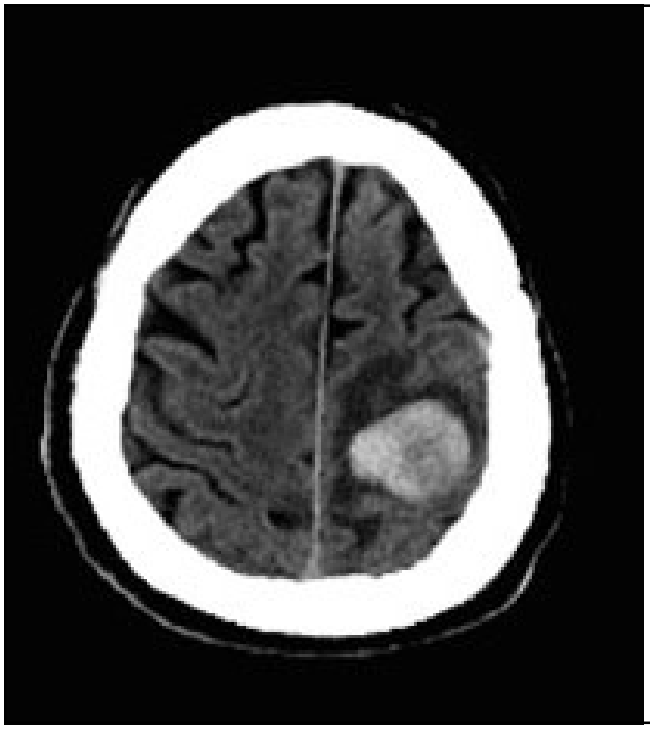
- Patients aged <60 years
- Embolic stroke of unknown origin
- No alternative causes of stroke

Lifestyle modifications

- Healthy diet, exercise, smoking cessation, healthy weight

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ICH: Diagnosis and Testing

- Presentation similar to ischemic stroke
- CT without contrast

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ICH: Acute Treatment

Reverse anticoagulation

Target BP of 140 mm Hg if initial BP >150-180 mm Hg

- IV labetalol or IV nicardipine

Decrease intracranial pressure (ICP)

- Elevation of bed head, analgesia
- Monitor ICP (if clinical exam and neuroimaging suggest it to be high); invasive methods if needed
- Neurosurgical consultation for potential surgery to drain hematoma and decrease ICP
- Mannitol, hypertonic therapy (if still protecting airway)
- Sedation/analgesia, hyperventilation, barbiturate coma, paralytics (once intubated and if ICP remains high)

Mechanical VTE prevention

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Subarachnoid Hemorrhage (SAH): Diagnosis

Abrupt and severe, “worst headache of my life”

Sentinel hemorrhage in 40%

- Severe headache in previous 1-2 weeks

Meningismus common

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SAH: Testing

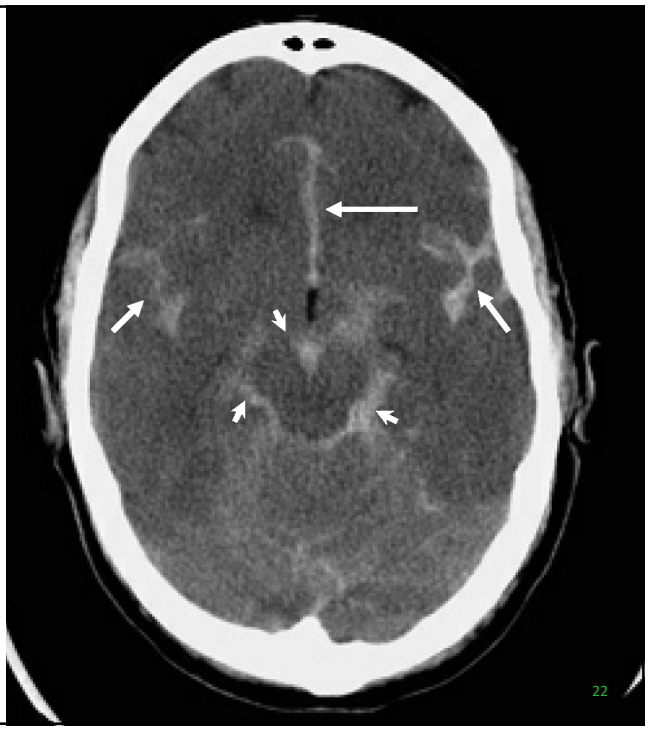
Noncontrast CT

If CT scan nondiagnostic:

- Lumbar puncture → xanthochromia

CT angiography followed by conventional cerebral angiography

- Localize aneurysm and guide therapy



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SAH: Treatment

Reverse anticoagulation

Surgical aneurysm coiling/clipping within 48-72 hours

Maintain systolic BP <130 mm Hg before surgery

Nimodipine for 21 days after surgery

- Decreases risk for vasospasm, stroke

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SAH: Treatment

Repeat CT for worsening mental status

- Rebleeding
- Infarct from vasospasm
- Hydrocephalus

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Neurology Q3

A 76-year-old man reports an episode of aphasia and right-sided weakness that occurred yesterday and lasted 3 hours.

Medical history is unremarkable. His only medication is daily aspirin.

Exam findings are normal.

Head CT is normal.

CT angiogram shows 70% stenosis of the left ICA.

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Neurology Q3

A 76-year-old man reports an episode of aphasia and right-sided weakness that occurred yesterday and lasted 3 hours. Medical history is unremarkable. His only medication is daily aspirin. Exam findings are normal. Head CT is normal. CT angiogram shows 70% stenosis of the left ICA.

Which of the following is the most appropriate next step to reduce this patient's risk for stroke?

A: Carotid endarterectomy

B: Carotid stenting

C: Clopidogrel

D: Warfarin

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Carotid Artery Disease

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Carotid Artery Disease: Risk Factors

- Hypertension
- Smoking
- Hyperlipidemia
- Diabetes
- Obesity
- Lack of exercise
- Family history

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Carotid Artery Disease: Risk Assessment and Prognosis

Stroke mechanism

- Plaque rupture and artery-to-artery embolism
- Low flow due to the stenosis

Scoring systems (e.g., ABCD^2) fail to identify highest-risk patients

- Highest risk: extracranial ICA stenosis >70% plus TIA

Stroke risk highest within 2 weeks of TIA

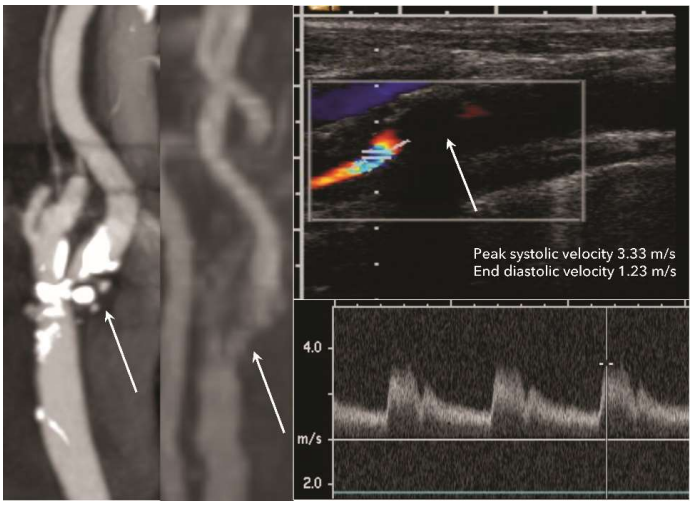


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Carotid Artery Disease: Risk Assessment and Prognosis



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Asymptomatic Carotid Artery Disease

No screening for the general population

Carotid bruit

- Poor predictor of stroke risk
- Predictor of ↑ risk for ischemic cardiac disease

Aggressive treatment for ASCVD

Consider revascularization for primary prevention of stroke if either:

- Stenosis is >70%
- Rapid progression of stenosis

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Symptomatic Carotid Artery Disease

Ipsilateral ocular and cerebral hemisphere ischemic symptoms

Expedited vascular imaging

- Carotid duplex ultrasound
- CT angiography
- MR angiography

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Symptomatic Carotid Artery Disease

Revascularization ≤2 weeks after stroke/TIA with >70% stenosis

- Endarterectomy preferred → lower procedural stroke risk
- Stenting only if endarterectomy is high risk → higher risk for procedural stroke

Medical management for intracranial stenosis

- Stenting not superior to best medical therapy
  - Aspirin monotherapy

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Neurology Q4

A 34-year-old man is evaluated in the ED for worsening headache, nausea, and two episodes of vomiting 2 hours after hitting his head in a fall from the top of a 6-foot ladder.

Vital signs and neurologic exam findings are normal.

GCS score is 15/15.

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Neurology Q4

A 34-year-old man is evaluated in the ED for worsening headache, nausea, and two episodes of vomiting 2 hours after hitting his head in a fall from the top of a 6-foot ladder. Vital signs and neurologic exam findings are normal. GCS score is 15/15.

Which of the following is the most appropriate immediate step in management?

A: Head CT with contrast

B: Head CT without contrast

C: Hospital observation

D: MRI of the brain

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Head Injury

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Traumatic Brain Injury

Mild TBI

- GCS score of 13-15
- No or only brief initial loss of consciousness
- Normal head CT

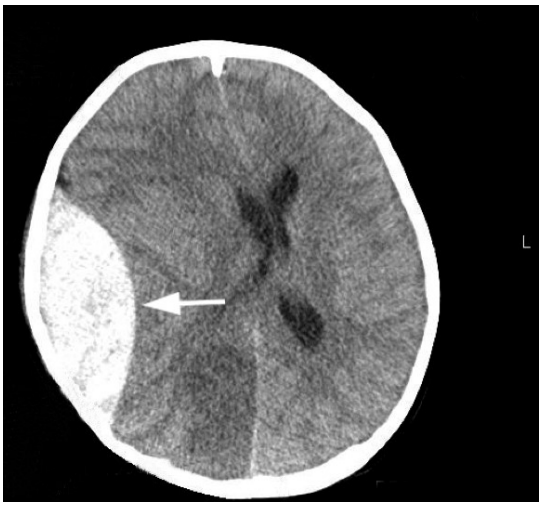
Moderate TBI

- GCS score of 9-12 and/or
- Initial loss of consciousness of 30 min to 24 hours
- Abnormal head CT

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Traumatic Brain Injury



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Severe TBI

- GCS score of 3-8 and/or
- Loss of consciousness >24 hours
- Abnormal head CT

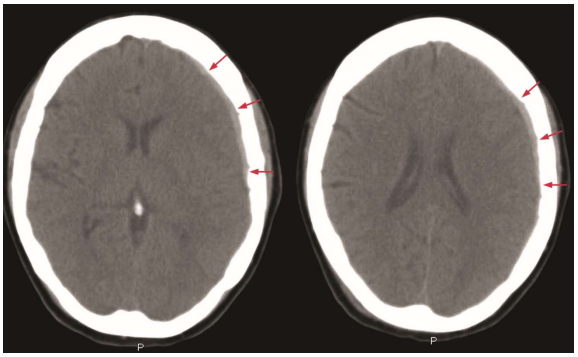
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Traumatic Brain Injury

Indications for noncontrast head CT

- Age >60 years with loss of consciousness
- Age ≥65 years with no loss of consciousness
- Vomiting
- Severe headache
- Posttraumatic seizure
- Drug or alcohol intoxication



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Traumatic Brain Injury

Indications for noncontrast head CT (*cont.*)

- Persistent drowsiness or short-term memory deficit
- "Dangerous" mechanisms of injury
- Glasgow Coma Scale score <15
- Focal neurologic deficit
- Physical evidence of open, depressed, or basilar skull fracture
- Coagulopathy



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Neurology Q5

A 66-year-old man is evaluated for a 1-year history of difficult-to-manage behaviors and slow gait.

He has exhibited intermittent forgetfulness and inattention, gotten lost while driving, and had visual hallucinations.

Exam reveals mild agitation, impaired recall and figure drawing, masked face, muscle rigidity, and a slow gait.

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Neurology Q5

A 66-year-old man is evaluated for a 1-year history of difficult-to-manage behaviors and slow gait. He has exhibited intermittent forgetfulness and inattention, gotten lost while driving, and had visual hallucinations. Exam reveals mild agitation, impaired recall and figure drawing, masked face, muscle rigidity, and a slow gait.

Which of the following is the most likely diagnosis?

A: Alzheimer disease

B: Delirium

C: Dementia with Lewy bodies

D: Frontotemporal dementia

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Dementia

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Dementia: Risk Factors

- Aging
- Diabetes
- Hypertension
- Hyperlipidemia
- Lack of exercise*

*Most important modifiable factor

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Mild Cognitive Impairment

Evidence of cognitive impairment on testing

Preservation of day-to-day functioning

Annual risk for dementia of 10%

No proven pharmacologic treatment

- Lifestyle changes (exercise)
- Cognitive rehabilitation/training may be of benefit

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Neurodegenerative Dementias

Progressive symptoms and loss of independent function

Loss of cognitive function in >1 major domain

- Memory
- Language
- Executive function
- Visuospatial function
- Behavior

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Dementia: Testing

- Cognitive screening
- Medication review
- General neurologic exam
- Evaluation for depression, sleep disorders, alcohol use
- CBC and serum chemistries
- Vitamin B_{12}, TSH, 25-hydroxyvitamin D
- RPR/treponemal and HIV test in populations at high risk
- MRI or CT without contrast
- Reserve specialized tests for uncertain diagnoses or atypical presentations

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Alzheimer Disease: Diagnosis

Early symptoms

- Impaired memory/forgetfulness

Late symptoms

- Diminished executive function
- Calculation errors
- Behavioral/mood symptoms

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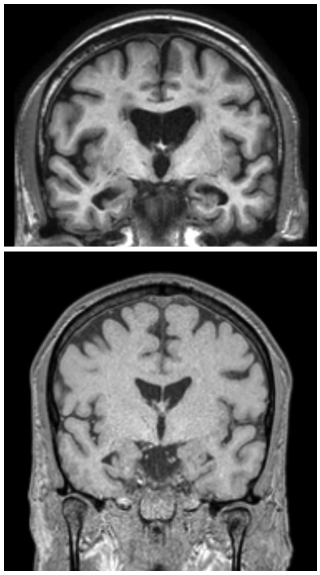
Alzheimer Disease: Testing

MRI shows decreased volume of hippocampi

- Bilateral hippocampal atrophy (*top image*) is typical in Alzheimer disease

More specific testing includes the following:

- CSF biomarkers
- Amyloid PET



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Alzheimer Disease: Treatment

Symptomatic therapy

- Mild to moderate dementia → acetylcholinesterase inhibitors
- Moderate to severe dementia → memantine

Disease-modifying therapy

- Anti-amyloid monoclonal antibodies
- Approved only for mild dementia or mild cognitive impairment (owing to Alzheimer pathology)
- Patients should meet strict criteria
- Need for close monitoring with risk for brain bleed and edema
- Early effects are modest, whereas longer term benefits are under study

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Dementia with Lewy Bodies

Co-occurring symptoms within 1-2 years

- Parkinsonian motor features
- Sensitivity to antipsychotics
- Visual hallucinations
- Frequent, severe fluctuations in attention
- Autonomic symptoms (e.g., orthostatic hypotension)
- Sleep disorders (e.g., REM sleep behavior disorder)
- Early falls

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Dementia with Lewy Bodies

Treatment

- Acetylcholinesterase inhibitors (off-label use)
- Neuroleptic medications contraindicated
- Low-dose levodopa may help with motor symptoms

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Frontotemporal Dementia: Diagnosis

- Positive family history common
- Prominent personality change
- Early sparing of memory
- Disinhibition and impulsivity
- Language and executive impairment

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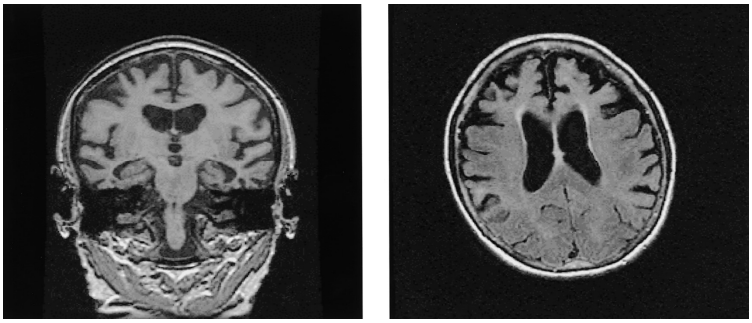
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Frontotemporal Dementia: Testing and Treatment

Diminished frontal and/or temporal lobes on MRI

Treatment

- Supportive care
- SSRIs for compulsive behaviors



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Normal Pressure Hydrocephalus: Diagnosis

- Early mental slowing/diminished executive functioning
- Pronounced gait disorder and falls
- Bladder incontinence

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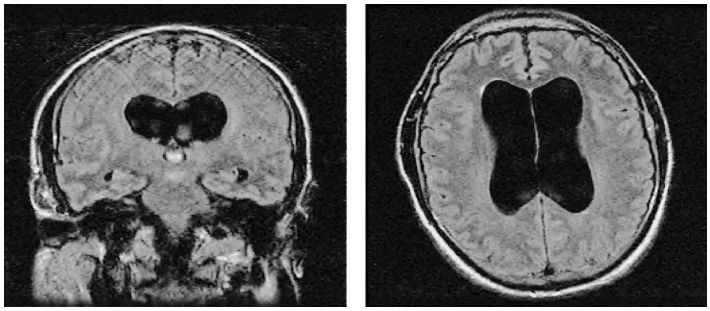
Normal Pressure Hydrocephalus: Testing and Treatment

MRI shows ventriculomegaly

A timed gait evaluation before/after large volume CSF removal

- Predicts response to shunting

Treatment: ventriculoperitoneal shunt



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Neurology Q6

A 54-year-old man is evaluated for acute-onset speech difficulty that has persisted for 1 week.

Speech is spontaneous and without grammatical errors or slurring.

Some of his speech does not make sense, and when confronted, he is unaware of the problem.

He has difficulty repeating sentences and carrying out commands.

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Neurology Q6

A 54-year-old man is evaluated for acute-onset speech difficulty that has persisted for 1 week. Speech is spontaneous and without grammatical errors or slurring. Some of his speech does not make sense, and when confronted, he is unaware of the problem. He has difficulty repeating sentences and carrying out commands.

Which of the following is the most likely diagnosis?

A: Broca (expressive) aphasia

B: Conduction aphasia

C: Primary progressive aphasia

D: Wernicke (receptive) aphasia

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Aphasia

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Aphasia: Causes

Acute transient aphasia

- TIA
- Migraine
- Seizure

Nonacute, persistent aphasia

- Structural brain lesion (e.g., tumor)

Slowly progressive aphasia

- Neurodegenerative disorders (e.g., frontotemporal dementia, Alzheimer disease)

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Acute Aphasia Syndromes: Diagnosis

Broca aphasia (expressive)
- Impaired fluency and grammar
- Preserved comprehension
- Impaired repetition
- Associated dysarthria, right hemiparesis
- Left inferior frontal lobe lesion

Conduction aphasia
- Impaired repetition
- Preserved comprehension and fluency
- Left parietal lobe (arcuate fasciculus) lesion

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Acute Aphasia Syndromes: Diagnosis

Global aphasia
- Impaired fluency, comprehension, and repetition
- Left multifocal lesions

Wernicke aphasia (receptive)
- Impaired comprehension
- Fluent speech with intact grammar
- Nonsensical speech (“word salad”)
- Impaired repetition
- Left posterior temporal lesion

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Aphasia: Testing and Treatment

Testing

- Neurologic exam (identify other deficits)
- Brain MRI (structural brain lesion vs. neurodegeneration)
- Speech and language evaluation
- Neurocognitive testing (if neurodegenerative disorder suspected)

Treatment

- Treat underlying cause
- Speech and language therapy

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Neurology Q7

An 80-year-old woman is hospitalized for pneumonia.

Appropriate antibiotics were initiated, and a urinary catheter was placed in the ED.

She has a history of dementia.

Neurologic exam reveals moderate cognitive impairment without inattention or evidence of focal neurologic deficits.

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Neurology Q7

An 80-year-old woman is hospitalized for pneumonia. Appropriate antibiotics were initiated, and a urinary catheter was placed in the ED. She has a history of dementia. Neurologic exam reveals moderate cognitive impairment without inattention or evidence of focal neurologic deficits.

Which of the following is the most appropriate next step to prevent delirium in this patient?

A: Bedtime benzodiazepine

B: Frequent nighttime safety checks

C: Low-dose haloperidol

D: Urinary catheter removal

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Delirium

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Delirium: Epidemiology and Risk Factors

Common among hospitalized elderly adults

Most common postsurgical complication among elderly adults

Risk higher in patients with the following:

- Baseline cognitive impairment
- Multiple medical problems
- Polypharmacy
- Hypoxia
- Systemic infections (UTI, pneumonia)

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Delirium: Pathophysiology

Diffuse cortical dysfunction

- Toxic, metabolic, hypoxic, or infectious processes
- Impaired function of reticular activating system
- Focal dysfunction of brain regions essential for attention and alertness

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Delirium: Diagnosis

Confusion Assessment Model (CAM)

- Best diagnostic tool
- More accurate than laboratory tests, imaging studies

Diagnosis requires A and B and either C or D of the following:

A. Acute onset and fluctuating course
B. Inattention
C. Disorganized thinking
D. Altered level of consciousness (stupor/coma or hypervigilance)

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Delirium: Evaluation

Complete physical and neurologic exam

Investigate potential underlying cause

- Prioritize life-threatening conditions first

If cause not immediately apparent:

- CBC, metabolic profile, urinalysis, TSH, Vitamin B_{12}
- Drug levels, toxin screen
- ABGs
- Neuroimaging; otherwise prompted by focal symptoms
- Lumbar puncture/CSF analysis
- EEG

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Delirium: Treatment

Treat or eliminate precipitating factors

Employ environmental and social measures

- Cognitive reorientation
- Sleep enhancement (nonpharmacologic)
- Early mobility
- Adaptations for visual and hearing impairment
- Family or bedside sitter
- Avoid physical restraints

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Delirium: Treatment

Avoid antipsychotics

- Use only in life-threatening circumstances
- Associated with ↑ risk of death in patients with dementia

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Neurology Q8

A 47-year-old man reports a 4-week history of progressive neck and left forearm pain and weakness.

Exam reveals 2/5 strength in the left biceps and absent biceps and brachioradialis reflexes.

MRI of the cervical spine shows compression of the left C6 nerve root from a herniated disk.

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Neurology Q8

A 47-year-old man reports a 4-week history of progressive neck and left forearm pain and weakness. Exam reveals 2/5 strength in the left biceps and absent biceps and brachioradialis reflexes. MRI of the cervical spine shows compression of the left C6 nerve root from a herniated disk.

Which of the following is the most appropriate next step in management?

A: Analgesics and rest

B: Epidural glucocorticoid injection

C: Physical therapy strengthening exercises

D: Surgical evaluation

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Cervical Root Disease

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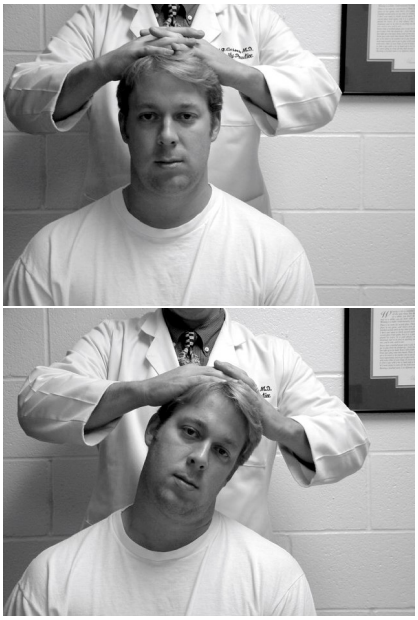
Cervical Radiculopathy: Diagnosis

Neck pain radiating to upper limb

- Dermatomal pattern of pain, paresthesia, or sensory loss
- Worse with spinal axial compression and rotation to affected side

Myotomal pattern of weakness

Impaired deep tendon reflexes



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Cervical Radiculopathy: Testing

Imaging rarely indicated initially

Radiography indications

- Suspected fracture, infection, or malignancy
- Symptoms after 6-8 weeks of conservative therapy

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Cervical Radiculopathy: Testing

MRI indications

- Suspected infection or malignancy/normal radiograph
- Progressive neurologic deficit
- Bilateral symptoms
- Suspected myelopathy
- Surgery

Electromyography (EMG)/nerve conduction velocity (NCV)

- If neuroimaging is inconclusive

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Cervical Radiculopathy: Treatment

Conservative management

- No or mild neurologic deficits
- Rest and analgesics
- Physical therapy

Surgery

- Severe pain/symptoms for 6-12 weeks
- Progressive/significant neurologic deficits
- Corresponding anatomic abnormality on MRI

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Spinal Stenosis

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Cervical Stenosis: Diagnosis

- Neck pain
- Arm and leg weakness
- Gait and coordination disturbances
- Bladder and bowel dysfunction
- Myelopathy (weakness, spasticity, hyperreflexia)

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Lumbar Stenosis: Diagnosis

Neurogenic claudication

- Exertional groin, thigh/buttock pain
- Improves with sitting, lumbar flexion
- Worsens with standing, walking, climbing stairs

Neurologic exam often normal

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Lumbar Stenosis: Diagnosis

Single or multiple lumbosacral radiculopathies

- Focal weakness and/or sensory loss
- Absent deep tendon reflex

Myelopathy (weakness, spasticity, hyperreflexia)

Wide-based gait

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Spinal Stenosis: Testing

MRI indications

- Multilevel lumbosacral radiculopathy
- Myelopathy (weakness, spasticity, hyperreflexia)

MRI findings do not always correlate with symptoms

EMG/NCV not necessary



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Spinal Stenosis: Treatment

Conservative therapy

- Physical therapy
- Nonopioid analgesics
- NSAIDs

Surgical decompression

- Symptoms refractory to conservative therapy
- Myelopathy

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Neurology I

- Answers to Multiple-Choice Questions

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Neurology Q1

A 65-year-old woman is evaluated after a 60-minute episode of right-sided weakness. She has hypertension and diabetes treated with chlorthalidone, metformin, and atorvastatin. Neurologic exam findings are normal. Brain imaging is normal. Neurovascular imaging shows 40% stenosis of the right carotid artery. ECG and echocardiogram are normal.

Which of the following is the most appropriate treatment?

A: Aspirin and clopidogrel

B: Heparin

C: Rivaroxaban

D: Warfarin

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Neurology Q2

A 57-year-old man is evaluated in the ED 2 hours after developing acute-onset left arm weakness. History is unremarkable, and he takes no medications. BP is 168/98 mm Hg. Exam reveals left-sided homonymous visual field cut, hemiplegia, and neglect. Plasma glucose level and head CT scan are normal. ECG shows AF.

Which of the following is the most appropriate next step in treatment?

A: High-dose aspirin

B: IV heparin

C: IV tPA

D: Mechanical thrombectomy

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Neurology Q3

A 76-year-old man reports an episode of aphasia and right-sided weakness that occurred yesterday and lasted 3 hours. Medical history is unremarkable. His only medication is daily aspirin. Exam findings are normal. Head CT is normal. CT angiogram shows 70% stenosis of the left ICA.

Which of the following is the most appropriate next step to reduce this patient's risk for stroke?

A: Carotid endarterectomy

B: Carotid stenting

C: Clopidogrel

D: Warfarin

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Neurology Q4

A 34-year-old man is evaluated in the ED for worsening headache, nausea, and two episodes of vomiting 2 hours after hitting his head in a fall from the top of a 6-foot ladder. Vital signs and neurologic exam findings are normal. GCS score is 15/15.

Which of the following is the most appropriate immediate step in management?

A: Head CT with contrast

B: Head CT without contrast

C: Hospital observation

D: MRI of the brain

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Neurology Q5

A 66-year-old man is evaluated for a 1-year history of difficult-to-manage behaviors and slow gait. He has exhibited intermittent forgetfulness and inattention, gotten lost while driving, and had visual hallucinations. Exam reveals mild agitation, impaired recall and figure drawing, masked face, muscle rigidity, and a slow gait.

Which of the following is the most likely diagnosis?

A: Alzheimer disease

B: Delirium

C: Dementia with Lewy bodies

D: Frontotemporal dementia

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Neurology Q6

A 54-year-old man is evaluated for acute-onset speech difficulty that has persisted for 1 week. Speech is spontaneous and without grammatical errors or slurring. Some of his speech does not make sense, and when confronted, he is unaware of the problem. He has difficulty repeating sentences and carrying out commands.

Which of the following is the most likely diagnosis?

A: Broca (expressive) aphasia

B: Conduction aphasia

C: Primary progressive aphasia

D: Wernicke (receptive) aphasia

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Neurology Q7

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Which of the following is the most appropriate next step in management?

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Neurology II

2025 Virtual/Live Internal Medicine Board Review

Geeta Verma, MD
Assistant Professor and Health System Clinician, Neurology
Northwestern Medicine
Feinberg School of Medicine
Chicago

ACP Internal Medicine Board Review Course

Neurology II

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Table of Contents: Neurology II

- Primary headache
- Secondary headache
- Seizures
- Bell palsy
- Parkinson disease
- Essential tremor
- Drug-induced myopathy
- Multiple sclerosis and other demyelinating diseases

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Neurology Q9

A 39-year-old woman reports a 3-year history of twice-weekly severe hemicranial throbbing headaches associated with nausea and photophobia and milder daily headaches.

She has asthma treated with beclomethasone and albuterol.

Physical exam and brain MRI are normal.

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Neurology Q9

A 39-year-old woman reports a 3-year history of twice-weekly severe hemicranial throbbing headaches associated with nausea and photophobia and milder daily headaches. She has asthma treated with beclomethasone and albuterol. Physical exam and brain MRI are normal.

Which of the following is the most appropriate treatment?

A: Bupropion

B: Propranolol

C: Topiramate

D: Verapamil

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Primary Headache

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Migraine: Risk Factors (Triggers)

- Stress
- Menstruation
- Visual stimuli
- Weather changes
- Nitrates
- Fasting
- Wine

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Episodic Migraine: Diagnosis

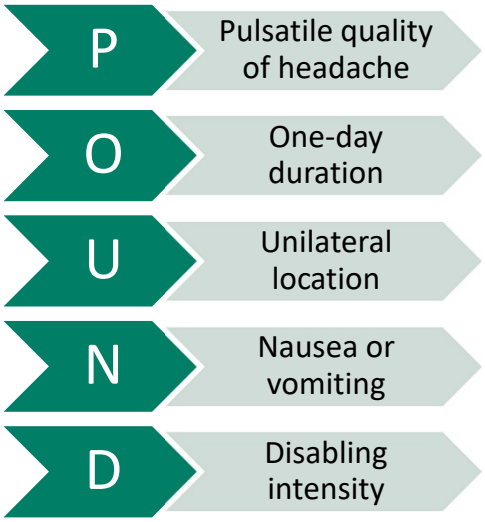
Duration of 4-72 hours

Two of the following:

- Unilateral location
- Pulsatile
- Pain inhibits or prohibits activity
- Moderate or severe pain intensity

Plus one of the following:

- Nausea/vomiting
- Photophobia/phonophobia



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Episodic Migraine: Diagnosis

Aura may occur in 30% of patients with migraine

- Before or during headache
- Evolution over the course of 5-60 minutes
- Resolution is gradual and complete
- Avoid combined oral contraceptives (stroke risk)

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Migraine: Testing

Brain imaging "red flag" indications

- First or worst headache
- Abrupt-onset/thunderclap headache
- Progression/change in headache pattern
- Abnormal exam findings
- New headache in people aged >50 years
- Malignancy, coagulopathy, immunosuppression, pregnancy
- Alteration in or loss of consciousness
- Headache triggered by exertion, sex, Valsalva maneuver

→If classic migraine or no red flags, brain imaging not indicated

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Episodic Migraine: Treatment

Mild to moderate

- NSAIDs
- Aspirin/acetaminophen/caffeine

Moderate to severe

- Triptans
  - Contraindications to triptans
    - Vascular disease (coronary, cerebral, PAD)
    - Uncontrolled hypertension
    - Brainstem or hemiplegic auras

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Episodic Migraine: Treatment

Third-line therapies (no vascular risk)

- Lasmiditan (selective agonist at the 5-hydroxytryptamine 1F receptor)
- Ubrogepant, rimegepant, zavegepant (antagonists at CGRP receptor)

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Episodic Migraine: Prevention

Identify migraine triggers

Initiate pharmacologic prophylaxis with frequency >4 days/month

- Propranolol, timolol, metoprolol
- Divalproex sodium, topiramate
- Atenolol, amitriptyline, venlafaxine, NSAIDs
- CGRP monoclonal antibodies (erenumab, eptinezumab, galcanezumab, fremanezumab)
- CGRP receptor antagonists atogepant and rimegepant

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Chronic Migraine: Diagnosis

- Headache ≥15 days/month × 3 months
- Typical migraine (± aura) ≥8 days/month
- Brain imaging not indicated with stable migraine pattern and normal neurologic exam

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Chronic Migraine: Prevention

- Topiramate
- Onabotulinum toxin A
- CGRP monoclonal antibodies (erenumab, eptinezumab, galcanezumab, fremanezumab)
- CGRP receptor antagonist atogepant

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Neurology Q10

A 56-year-old man is evaluated for a 20-year history of chronic sporadic headaches that recently have increased in frequency without change in quality.

The headache is moderate in intensity, bilateral, nondisabling, associated with neck stiffness, and refractory to acetaminophen, with no photophobia or nausea.

Physical exam findings are normal.

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Neurology Q10

A 56-year-old man is evaluated for a 20-year history of chronic sporadic headaches that recently have increased in frequency without change in quality. The headache is moderate in intensity, bilateral, nondisabling, associated with neck stiffness, and refractory to acetaminophen, with no photophobia or nausea. Physical exam findings are normal.

Which of the following is the most appropriate next step in treatment?

A: Cyclobenzaprine

B: Ibuprofen

C: Physical therapy

D: Propranolol

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Tension-Type Headache: Diagnosis and Testing

Most common type of headache in general population

Duration of 30 minutes to 7 days

Symptoms

- Bilateral nonpulsatile pressure, pain
- No disability (no seeking bed rest)
- No nausea or vomiting
- No photophobia or phonophobia
- Not aggravated by climbing stairs or similar activity

Imaging not indicated for tension-type headache

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Tension-Type Headache: Treatment

Effective abortive therapy

- NSAIDs
- Acetaminophen
- Caffeine-containing compounds

Not effective

- Muscle relaxants
- Benzodiazepines
- Opioids
- Botulinum toxin

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Tension-Type Headache: Treatment

Prophylactic therapy

- Amitriptyline
- Relaxation and biofeedback
- Cognitive behavioral therapy
- Acupuncture

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Secondary Headache

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Thunderclap Headache

Severe headache pain developing abruptly and reaching maximum intensity within 1 minute

Emergent noncontrast head CT

- If nondiagnostic → lumbar puncture
- If normal CT and normal CSF analysis → contrast-enhanced brain MRI and noninvasive vascular imaging (MRA or CTA)

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Thunderclap Headache

Headache Type	Clues	Treatment
Subarachnoid hemorrhage (SAH)	Most common cause Sudden onset of "worst headache of my life" Many patients have warning "sentinel" headaches before SAH	Neurosurgery in selected cases (85% of nontraumatic cases caused by ruptured aneurysm)
Reversible cerebral vasoconstriction syndrome	Recurrent thunderclap headache syndrome, more frequent in women Associated with pregnancy, neurosurgical procedures, exposure to adrenergic or serotonergic drugs, cannabis Imaging shows strokes, hemorrhages, or cerebral edema	Normalization of BP and elimination of any triggering drug or substance Glucocorticoids may worsen outcomes
Carotid or vertebral dissection	Neck pain and ipsilateral headache; neurologic findings in territory of involved vessel Common cause of stroke when age <50 years	Aspirin
Thrombosis of cerebral vein or dural sinus	Exacerbation with Valsalva maneuver, pulsatile tinnitus, and diplopia Consider in hypercoagulable states, pregnancy, use of oral contraceptives	LMWH followed by warfarin, dabigatran, apixaban, or rivaroxaban

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Trigeminal Neuralgia

Diagnosis

- Unilateral lancinating pain
- Triggered by light touch
- Brief paroxysms of pain
- Normal neurologic exam

Imaging

- MRI to rule out extracranial lesions or multiple sclerosis

Prophylactic therapy

- Carbamazepine or oxcarbazepine
- Baclofen

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Medication Overuse Headache

Diagnosis

- Pre-existing headache disorder with exposure to overuse for >3 months
- >10 headaches/month if using triptans, combination analgesics, or ergot alkaloids
- >15 headaches/month if using simple analgesics

Treatment

- Wean overused medication
- Initiate migraine prevention medication
- Provide new acute medications limited to <10 days/month

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Idiopathic Intracranial Hypertension

Diagnosis

- Increased intracranial pressure without identifiable structural pathology
- Patients typically female, have obesity, and are of childbearing age
- Headaches, visual symptoms, pulsatile tinnitus
- Papilledema nearly always present

Testing

- CSF pressure >250 mm H_2O with normal fluid composition
- MRI may be normal or show small ventricles, widened optic nerve sheaths, or a partially empty sella

Treatment

- Weight loss if BMI is elevated
- Acetazolamide
- Treatment of sleep apnea with CPAP
- Lumboperitoneal shunting in severe and refractory cases

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Papilledema

Can cause irreversible vision loss if not identified and treated urgently

Most common cause: idiopathic intracranial hypertension

Other causes

- Brain tumor
- Cerebral venous sinus thrombosis
- CSF inflammation (infectious/noninfectious)

Immediate MRI/MR angiography/MR venography

Lumbar puncture after imaging (if safe)

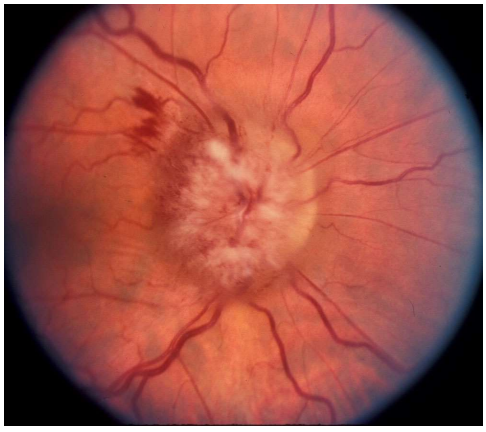


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Neurology Q11

A 30-year-old man has uncontrolled seizures that started 10 years ago, occur weekly, and are characterized by a sense of fear followed by lip smacking and impaired awareness. He currently takes levetiracetam and previously tried valproic acid and gabapentin.

Brain MRI is shown.

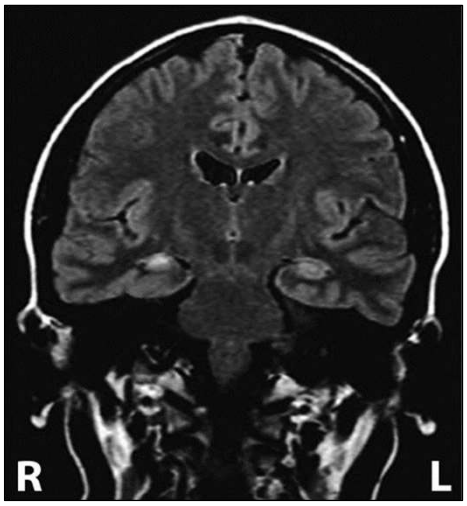


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Neurology Q11

A 30-year-old man has uncontrolled seizures that started 10 years ago, occur weekly, and are characterized by a sense of fear followed by lip smacking and impaired awareness. He currently takes levetiracetam and previously tried valproic acid and gabapentin. Brain MRI is shown.

Which of the following treatments is most likely to lead to seizure remission?

A: Addition of carbamazepine

B: Ketogenic diet

C: Right temporal lobectomy

D: Vagal nerve stimulation

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Seizures

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Focal Seizures: Diagnosis

Focal seizures without altered awareness

- Manifestations based on site of origin in brain
  - Frontal → contralateral clonic jerking
  - Temporal → epigastric rising sensation
  - Parietal → contralateral pain/numbness/paresthesia
  - Occipital → contralateral homonymous visual alteration

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Focal Seizures: Diagnosis

Focal seizures involving impaired awareness

- Memory impairment
- Responsiveness (staring)
- Language impairment
- Cognition impairment

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Generalized Seizures: Diagnosis

Generalized tonic-clonic seizures (GTCS)

- Tonic phase → body stiffening
- Clonic phase → synchronous limb jerking
- Duration of 1-3 minutes
- Postictal confusion, hypersomnolence, fatigue

Myoclonic seizure

- Jerk of limb or body
- Duration of <1 second
- Awareness maintained

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Temporal Lobe Epilepsy: Diagnosis

- Most common focal epilepsy syndrome
- Aura or déjà vu
- Fear or rising sensation in the stomach
- Loss of awareness, staring, behavior arrest
- Automatisms (lip smacking, chewing, repetitive hand motions)
- ± Mesial temporal sclerosis

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Juvenile Myoclonic Epilepsy: Diagnosis

Most common generalized epilepsy syndrome

Onset in teens or twenties; seizures often occur in morning

Triggers

- Sleep deprivation
- Alcohol use
- Stress

Myoclonic seizures → dropping items from hands

GTCS is common comorbidity

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Seizure: Testing

MRI and EEG for all patients with first seizure

Lumbar puncture only if infectious cause suspected

Review of provoking factors

- Medications/drugs/alcohol
- Trauma
- CNS infections
- Metabolic disturbance

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Epilepsy: Treatment

Treat if either of the following:

- Two unprovoked seizures
- One unprovoked seizure with either
  - Significant EEG abnormalities *or*
  - MRI abnormalities

Treatment typically withheld

- One unprovoked seizure with the following:
  - No abnormalities on MRI or EEG *and*
  - No risk factors for epilepsy

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Epilepsy: Treatment

Lamotrigine and levetiracetam

- First-line AED for all seizure types

Teratogenic AEDs (also increase OCP metabolism)

- Carbamazepine
- Phenobarbital
- Phenytoin
- Topiramate
- Valproate

Vagal nerve stimulation

- Used in medication-refractory epilepsy

Temporal lobe resection

- Drug-resistant temporal lobe epilepsy
- Mesial temporal sclerosis

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Convulsive Status Epilepticus

Diagnosis

- GTCS >5 minutes *or*
- Two GTCS within 5 minutes without return to baseline

Treatment

- Secure airway
- IV thiamine and glucose
- Empiric treatment before testing
  1. IV benzodiazepine
  2. IV fosphenytoin, valproic acid, or levetiracetam to prevent seizure recurrence
  3. Sedation

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Neurology Q12

A 29-year-old woman is evaluated 4 hours after she awoke with left facial droop and impaired taste.

She has no history of neurologic symptoms.

Exam reveals weakness of the left upper and lower facial muscles, including inability to close her left eye.

Exam is otherwise unremarkable.

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Neurology Q12

A 29-year-old woman is evaluated 4 hours after she awoke with left facial droop and impaired taste. She has no history of neurologic symptoms. Exam reveals weakness of the left upper and lower facial muscles, including inability to close her left eye. Exam is otherwise unremarkable.

Which of the following is the most appropriate treatment?

A: Acyclovir

B: Aspirin

C: IV methylprednisolone

D: Prednisone

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40

Bell Palsy

41

Bell Palsy: Diagnosis

Upper and lower facial weakness

- Central cause likely with only lower facial weakness

Associated symptoms

- Sensitivity to loud noise
- Impaired taste

Spares muscles of mastication and facial sensory function (trigeminal nerve)



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Bell Palsy: Testing

Initial MRI is not indicated

- Consider imaging with lingering/worsening weakness after 3 months

If additional suggestive findings are present, test for

- Diabetes
- Vasculitis
- Lyme disease (if in endemic area)
- HIV infection
- Sarcoidosis

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Bell Palsy: Treatment

Prednisone within 72 hours of onset

- Improves recovery
- ≤10 days (short term)

Antiviral therapy

- May offer modest benefit in severe palsy

Lubricants/nocturnal taping for incomplete eye closure

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Neurology Q13

A 59-year-old man has a new asymmetric hand tremor.

He also reports difficulty with fine motor movements, smaller handwriting, and softening of his voice.

Exam shows increased tone and resting tremor in the right upper extremity.

Repetitive alternating movements are slow and decrementing.

Gait and cognition are normal.

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Neurology Q13

A 59-year-old man has a new asymmetric hand tremor. He also reports difficulty with fine motor movements, smaller handwriting, and softening of his voice. Exam shows increased tone and resting tremor in the right upper extremity. Repetitive alternating movements are slow and decrementing. Gait and cognition are normal.

Which of the following is the most appropriate next step in confirming the diagnosis?

A: Dopamine transporter scan

B: Lumbar puncture

C: Needle EMG

D: No further testing

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Parkinson Disease

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Parkinsonism

Bradykinesia and ≥1 cardinal feature

Bradykinesia	Rigidity	Resting tremor	Gait/balance disorders
• Slowness • Diminishing amplitude of repetitive movements	• Cogwheeling • Rigidity + tremor • Asymmetric at onset	• Pill rolling • Emerges with a delay in outstretched arms and during ambulation • Asymmetric at onset	• Slow, narrow-based, and shuffling gait • Reduced arm swings • Stooped posture • Imbalance when turning • Gait freezing

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Parkinson Disease

Supporting features for Parkinson disease

- Positive pull test → most reliable predictor of backward fall risk in Parkinson disease
- Levodopa response
- On-off fluctuations
- Levodopa-induced dyskinesias
- Rest tremor

Exclusion criteria

- Lower-limb only symptoms
- Treatment with dopamine receptor–blocking agents
- Lack of response to levodopa
- Normal dopaminergic imaging

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Parkinson Disease: Diagnosis

Red flags for atypical forms of parkinsonism

- Prominent early dysautonomia
- Abnormal eye movements
- Prominent early cognitive impairment
- Visual hallucinations
- Early postural instability/falls
- Cerebellar ataxia
- Symmetric or markedly asymmetric involvement
- Rapid onset and stepwise deterioration
- Lack of response to levodopa

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Parkinson Disease: Initial Treatment

Drug therapy when symptoms interfere with function

Levodopa: preferred initial therapy

- Most effective medication
- Complications in advanced disease
  - Fluctuations ("wearing-off" effect) or dyskinesias

Dopamine agonist (pramipexole, ropinirole)

- Consider in patients aged <60 years with high dyskinesia risk
- Delays early motor fluctuations of levodopa (pramipexole)
- May cause impulsive behaviors (gambling, shopping, hypersexuality)

Deep brain stimulation

- Severe motor fluctuations or refractory tremor

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Neurology Q14

A 64-year-old man is evaluated for tremor that occurs when reading a newspaper or drinking from a cup.

He also reports an up-and-down head tremor.

Tremors improve after drinking wine.

He takes no medications.

Exam is remarkable only for symmetric action tremor in the arms.

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Neurology Q14

A 64-year-old man is evaluated for tremor that occurs when reading a newspaper or drinking from a cup. He also reports an up-and-down head tremor. Tremors improve after drinking wine. He takes no medications. Exam is remarkable only for symmetric action tremor in the arms.

Which of the following is the most likely diagnosis?

A: Dystonic tremor

B: Enhanced physiologic tremor

C: Essential tremor

D: Parkinson disease

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Essential Tremor



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Essential Tremor: Diagnosis

Symmetric postural or action tremor

- Contrasts with asymmetric rest tremor in Parkinson disease
- May include vocal and head tremor

Positive family history of tremor (50%)

Tremor improves with ethanol

Rule out tremor due to

- Medications
- Caffeine
- Hyperthyroidism

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Essential Tremor: Treatment

Treatment is symptomatic

First-line medications

- Propranolol
- Primidone

Other medications

- Topiramate
- Gabapentin

Deep brain stimulation of the VIM thalamic nucleus

- Effective for refractory tremor

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Neurology Q15

A 56-year-old man is evaluated for 2 months of progressive proximal weakness and myalgia.

He has dyslipidemia treated with atorvastatin.

Exam reveals proximal limb weakness and diffuse hyporeflexia.

The remainder of the neurologic exam is normal.

CK level is normal.

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Neurology Q15

A 56-year-old man is evaluated for 2 months of progressive proximal weakness and myalgia. He has dyslipidemia treated with atorvastatin. Exam reveals proximal limb weakness and diffuse hyporeflexia. The remainder of the neurologic exam is normal. CK level is normal.

Which of the following is the most likely diagnosis?

A: Amyotrophic lateral sclerosis

B: Drug-induced myopathy

C: Inflammatory polyneuropathy

D: Myasthenia gravis

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Drug-Induced Myopathy

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Drug-Induced Myopathy: Diagnosis

Can occur acutely or months after exposure

Clinical features

- Proximal muscle weakness
- Hyporeflexia
- Normal sensory function
- Possible myalgia

CK level may be normal or elevated

Myopathic changes on EMG

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Drug-Induced Myopathy: Causes

Toxins and Drugs Associated with Myopathy
Alcohol
Lipid-lowering medications
Amiodarone
Hydroxychloroquine, chloroquine
Cyclosporine
Glucocorticoids
Colchicine
Antiretroviral drugs
Immune checkpoint inhibitors

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Neurology Q16

A 28-year-old woman reports a 5-day history of right leg weakness and blurred vision.

She experienced double vision last year that resolved within 3 weeks.

Physical exam reveals reduced visual acuity and optic disc pallor of the left eye and weakness, hyperreflexia, and plantar extensor response of the right leg.

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Neurology Q16

A 28-year-old woman reports a 5-day history of right leg weakness and blurred vision. She experienced double vision last year that resolved within 3 weeks. Physical exam reveals reduced visual acuity and optic disc pallor of the left eye and weakness, hyperreflexia, and plantar extensor response of the right leg.

Which of the following is the most likely diagnosis?

A: Amyotrophic lateral sclerosis

B: Guillain-Barré syndrome

C: Multiple sclerosis

D: Myasthenia gravis

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Multiple Sclerosis (MS) and Other Demyelinating Diseases

ACP

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MS: Diagnostic Criteria

Symptoms of CNS demyelination separated in space and time

- Series of clinical relapses or progression ("time")
- Signs on physical exam ("space")
- Distribution of lesions on MRI ("space")
- CSF oligoclonal bands (if necessary)

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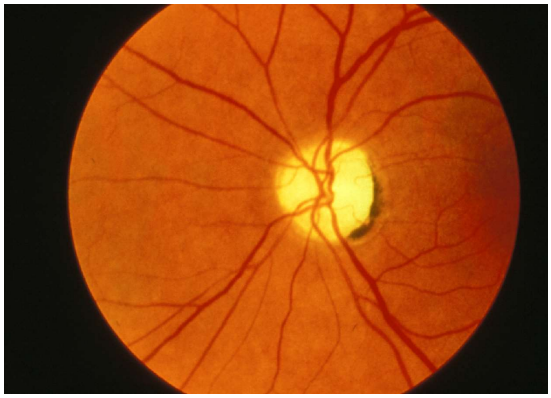
MS: Diagnosis

Optic neuritis

- Unilateral subacute visual deficits
- Afferent pupillary defect
- Optic atrophy (late manifestation)

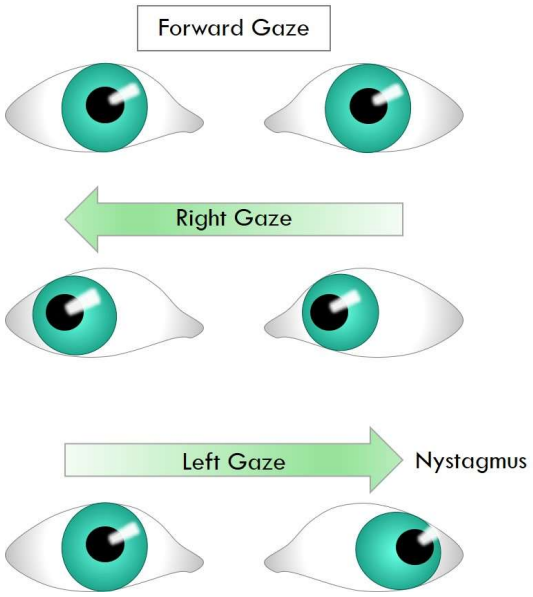
Myelitis

- Focal weakness/hyporeflexia early
- Spasticity/hyperreflexia late
- Neck flexion → shock sensation in spine
- Urinary symptoms



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MS: Diagnosis

Brainstem/cerebellar syndromes

- Diplopia
- Internuclear ophthalmoplegia
- Ataxia and/or vertigo

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MS: Testing

Brain MRI

- Periventricular, juxtacortical, and/or infratentorial white matter lesions

Spine MRI

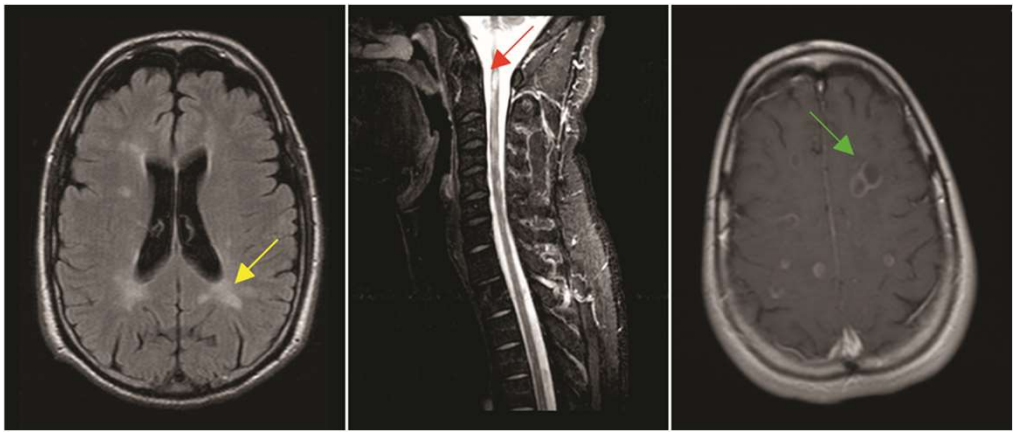
- Obtain if insufficient brain MRI features

CSF oligoclonal bands

- Not routinely required
- Supportive when the MRI criteria are inadequate

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MS: Testing



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MS: Treatment of Acute Exacerbations

Oral/IV glucocorticoids speed recovery

- No impact on disease course

Do not treat pseudorelapse with glucocorticoids

- Worsening symptoms with fever/infection

Observe relapses with no/minimal functional impact

Prevent relapses

- Immunomodulatory/immunosuppressive agents

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Idiopathic Transverse Myelitis: Diagnosis

Monophasic, inflammatory/demyelinating disorder

Affects only one region of the spinal cord

Clinical features

- Subacute weakness
- Sensory changes
  - Hallmark: sensory level
- Bladder/bowel dysfunction

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Idiopathic Transverse Myelitis: Testing and Treatment

Testing

- Evidence of spinal cord inflammation
  - CSF leukocytosis or contrast enhancement on MRI
- Exclusion of other potential causes
  - InfectLongitudinally extensive myelitis, no CSF oligoclonal bands, MRI brain lesions
  - ion excluded (HIV, herpes zoster, West Nile)

Treatment

- IV glucocorticoid
- IV immunoglobulin or plasma exchange in refractory cases

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Neuromyelitis Optica Spectrum Disorders

Diagnosis

- Antibody-mediated inflammation of optic nerves and spinal cord
- Bilateral or rapidly sequential optic neuritis
- Acute transverse myelitis (longitudinally extensive cord disease)

Testing

- Positive AQP4-immunoglobulin G (antibody to aquaporin-4 antibody channels)
- Positive spinal cord imaging

Treatment

- IV glucocorticoid
- IV immunoglobulin or plasma exchange in refractory cases
- Immunomodulatory/immunosuppressive agents for prevention of relapses

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Neurology II

- Answers to Multiple-Choice Questions

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Neurology Q9

A 39-year-old woman reports a 3-year history of twice-weekly severe hemicranial throbbing headaches associated with nausea and photophobia and milder daily headaches. She has asthma treated with beclomethasone and albuterol. Physical exam and brain MRI are normal.

Which of the following is the most appropriate treatment?

A: Bupropion

B: Propranolol

C: Topiramate

D: Verapamil

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Neurology Q10

A 56-year-old man is evaluated for a 20-year history of chronic sporadic headaches that recently have increased in frequency without change in quality. The headache is moderate in intensity, bilateral, nondisabling, associated with neck stiffness, and refractory to acetaminophen, with no photophobia or nausea. Physical exam findings are normal.

Which of the following is the most appropriate next step in treatment?

A: Cyclobenzaprine

B: Ibuprofen

C: Physical therapy

D: Propranolol

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Neurology Q11

A 30-year-old man has uncontrolled seizures that started 10 years ago, occur weekly, and are characterized by a sense of fear followed by lip smacking and impaired awareness. He currently takes levetiracetam and previously tried valproic acid and gabapentin. Brain MRI is shown.

Which of the following treatments is most likely to lead to seizure remission?

A: Addition of carbamazepine

B: Ketogenic diet

C: Right temporal lobectomy

D: Vagal nerve stimulation

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Neurology Q12

A 29-year-old woman is evaluated 4 hours after she awoke with left facial droop and impaired taste. She has no history of neurologic symptoms. Exam reveals weakness of the left upper and lower facial muscles, including inability to close her left eye. Exam is otherwise unremarkable.

Which of the following is the most appropriate treatment?

A: Acyclovir

B: Aspirin

C: IV methylprednisolone

D: Prednisone

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Neurology Q13

A 59-year-old man has a new asymmetric hand tremor. He also reports difficulty with fine motor movements, smaller handwriting, and softening of his voice. Exam shows increased tone and resting tremor in the right upper extremity. Repetitive alternating movements are slow and decrementing. Gait and cognition are normal.

Which of the following is the most appropriate next step in confirming the diagnosis?

A: Dopamine transporter scan

B: Lumbar puncture

C: Needle EMG

D: No further testing

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Neurology Q14

A 64-year-old man is evaluated for tremor that occurs when reading a newspaper or drinking from a cup. He also reports an up-and-down head tremor. Tremors improve after drinking wine. He takes no medications. Exam is remarkable only for symmetric action tremor in the arms.

Which of the following is the most likely diagnosis?

A: Dystonic tremor

B: Enhanced physiologic tremor

C: Essential tremor

D: Parkinson disease

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Neurology Q15

A 56-year-old man is evaluated for 2 months of progressive proximal weakness and myalgia. He has dyslipidemia treated with atorvastatin. Exam reveals proximal limb weakness and diffuse hyporeflexia. The remainder of the neurologic exam is normal. CK level is normal.

Which of the following is the most likely diagnosis?

A: Amyotrophic lateral sclerosis

B: Drug-induced myopathy

C: Inflammatory polyneuropathy

D: Myasthenia gravis

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Neurology Q16

A 28-year-old woman reports a 5-day history of right leg weakness and blurred vision. She experienced double vision last year that resolved within 3 weeks. Physical exam reveals reduced visual acuity and optic disc pallor of the left eye and weakness, hyperreflexia, and plantar extensor response of the right leg.

Which of the following is the most likely diagnosis?

A: Amyotrophic lateral sclerosis

B: Guillain-Barré syndrome

C: Multiple sclerosis

D: Myasthenia gravis

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Endocrinology I

2025 Virtual/Live Internal Medicine Board Review

Timothy W. Bodnar, MD, FACP
Clinical Assistant Professor, Metabolism, Endocrinology, and Diabetes
Assistant Chief, Endocrinology & Metabolism
VA Ann Arbor Healthcare System
University of Michigan
Ann Arbor, MI

ACP Internal Medicine Board Review Course

Endocrinology I: Thyroid Disease and Adrenal Mass

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Leading Internal Medicine, Improving Lives

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Table of Contents: Thyroid Disease and Adrenal Mass

- Hyperthyroidism
- Hypothyroidism
- Thyroid nodules and thyroid cancer
- Thyroid storm
- Myxedema coma
- Adrenal mass and nodules

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Thyroid Disease and Adrenal Mass Q1

A 38-year-old woman is evaluated for palpitations and heat intolerance.

Pulse rate is 110/min.

The patient is restless, with pressured speech, warm and moist skin, and hand tremors.

The thyroid is enlarged without palpable nodules.

Serum TSH level is 0.08 µU/mL; free T_4 level is 1.7 ng/dL.

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Thyroid Disease and Adrenal Mass Q1

A 38-year-old woman is evaluated for palpitations and heat intolerance. Pulse rate is 110/min. The patient is restless, with pressured speech, warm and moist skin, and hand tremors. The thyroid is enlarged without palpable nodules. Serum TSH level is 0.08 µU/mL; free T_4 level is 1.7 ng/dL.

Which of the following is the most appropriate next diagnostic test?

A: Serum total T_3

B: Serum TPO antibody

C: Thyroid function tests repeated in 6 weeks

D: Ultrasonography of the neck

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Hyperthyroidism

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Thyrotoxicosis

Thyrotoxicosis (any cause of excess thyroid hormone)

- Increased hormone production or release by thyroid
- Exogenous hormone administration

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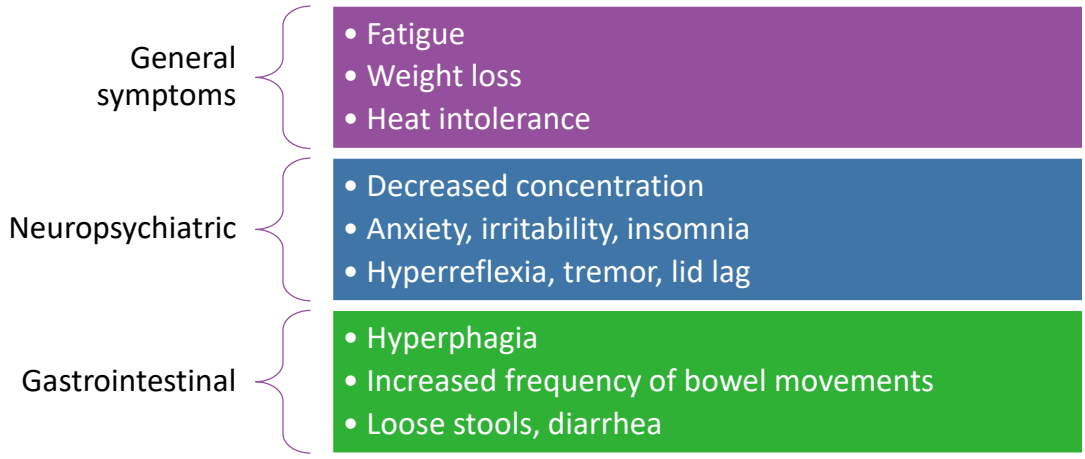
Thyrotoxicosis: Causes

Disorder	Comments
Graves disease	Antibody-mediated activation of the TSH receptor (TSI, TRAb)
Toxic adenoma/toxic multinodular goiter	Autonomously functioning thyroid tissue
Thyroiditis (acute, subacute, painless)	Thyroid inflammation resulting in release of T_3/T_4
Medication induced	Amiodarone, lithium, interferon alfa
Thyrotoxicosis factitia/iatrogenic thyrotoxicosis	Administration of exogenous thyroid hormone
HCG-mediated (pregnancy)	Binding of HCG to TSH receptor

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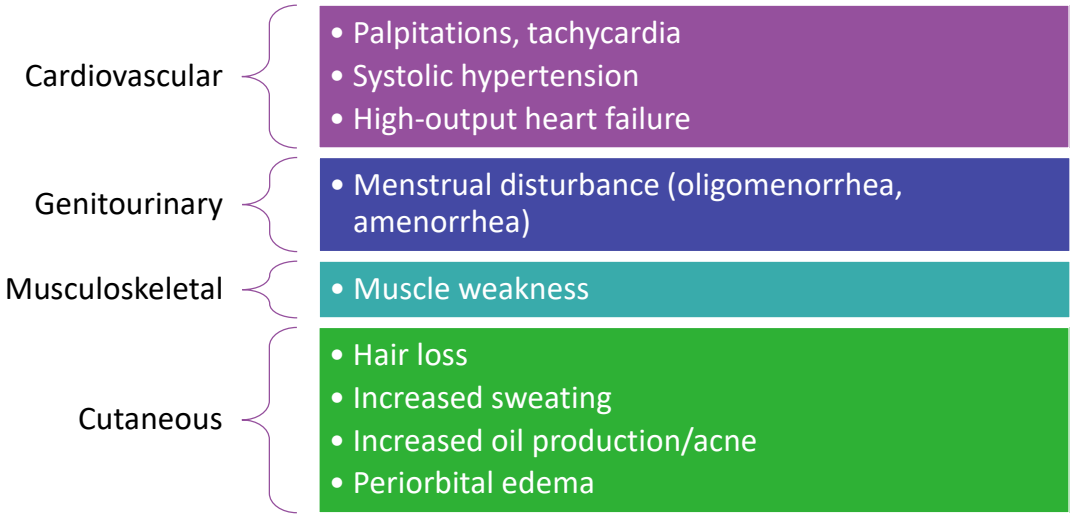
Thyrotoxicosis: Diagnosis



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Thyrotoxicosis: Diagnosis



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Thyrotoxicosis: Initial Testing

Thyroid-stimulating hormone (TSH), free thyroxine (T_4), and triiodothyronine (T_3)

- ↓ TSH and ↑ free T_4 and T_3 → thyrotoxicosis
- ↓ TSH and normal free T_4 and T_3 → subclinical hyperthyroidism
- Normal or ↑ TSH and ↑ free T_4
  - Central hyperthyroidism from TSH-secreting adenoma (extremely rare)

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Thyrotoxicosis: Diagnosing the Cause

Disorder	Comments
Graves disease	Measure TSH receptor antibody (TRAb) or thyroid-stimulating immunoglobulin (TSI) Thyroid scan with diffuse uptake
Toxic adenoma/toxic multinodular goiter	Thyroid scan with focal uptake in toxic nodule or nodules with suppressed uptake elsewhere
Thyroiditis (acute, subacute, painless)	Thyroid scan with very low or no uptake
Medication induced	Amiodarone is most common Uptake scan unreliable because of iodine in amiodarone
Thyrotoxicosis factitia	Low thyroglobulin level Thyroid scan with very low uptake
HCG-mediated (pregnancy)	Measure HCG level Cannot perform thyroid uptake in pregnancy

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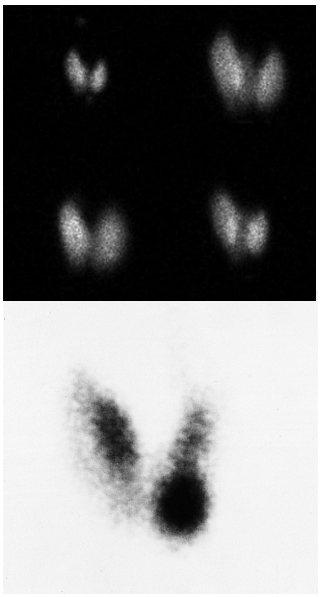
Thyroid Scan and Uptake Tests

Diffuse, elevated uptake

- Graves disease

Focal intense uptake (suppressed elsewhere)

- Autonomously functioning nodule

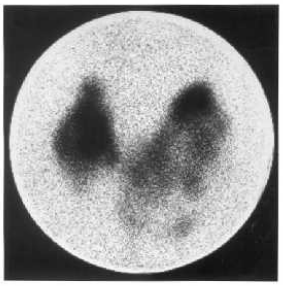


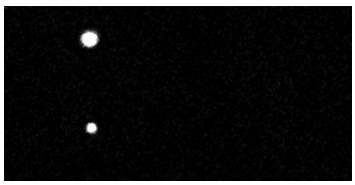
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Thyroid Scan and Uptake Tests





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Multifocal uptake

- Toxic multinodular goiter

No or decreased uptake

- Destructive thyroiditis
- Exogenous T_4 administration

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Graves Disease: Diagnosis

Autoimmune process

- Antibodies bind to/stimulate the TSH receptor
- Increased thyroid hormone production
- Increased gland size and vascularity

Thyroid bruit

Orbitopathy

- Proptosis
- Chemosis
- Extraocular muscle palsy

Pretibial myxedema



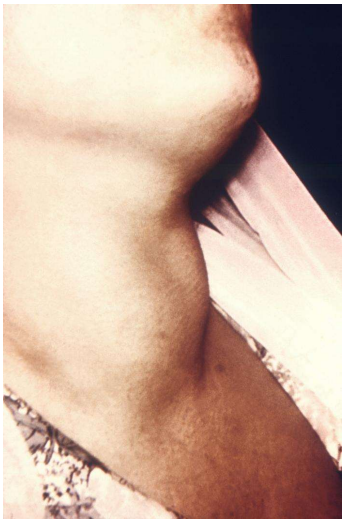


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Graves Disease: Testing



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- Diffuse goiter with diffuse uptake of iodine-131
- TRAb/TSI level

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Hyperthyroidism: Treatment

β-Blockers rapidly reduce adrenergic symptoms

Atenolol and metoprolol are often used because of easiness of dosing

- Once-daily dosing
- Cardioselective

Propranolol

- Two to three times daily
- Noncardioselective; caution advised in patients with asthma and COPD
- Higher doses may decrease T_4 to T_3 conversion

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Graves Disease: Drug Treatment

Methimazole is first line in most patients

Propylthiouracil is used for special circumstances

- First trimester of pregnancy
- Thyroid storm (decreases T_4 to T_3 conversion)
- Minor reactions to methimazole

Remission in 30% to 50% after 12-18 months of treatment

- More common in mild disease
- Can check TSI in 12-18 months to predict remission; if positive, do not attempt to stop drug without other treatment

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Graves Disease: Radioactive Iodine Treatment

- Effective, few adverse effects
- Avoid in pregnancy, breastfeeding, children
- May exacerbate Graves ophthalmopathy
- Most patients eventually develop hypothyroidism
- Indicated for relapse following antithyroid drug therapy
- Also used for toxic adenoma/toxic multinodular goiter

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Graves Disease: Surgical Treatment

- If medical options not viable
- Presence of compressive symptoms
- Moderate/severe ophthalmopathy
- ≥1 nodule without definitive fine-needle aspiration diagnosis
- Known thyroid cancer
- Coexistent hyperparathyroidism

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Subclinical Hyperthyroidism

Suppressed TSH and normal T_4 and T_3

Toxic multinodular goiter is most common cause

Treat if TSH level <0.1 µU/mL and the following are present:

- Age ≥65 years
- Age <65 years with comorbidities (cardiac risk factors, heart disease, hyperthyroid symptoms, osteoporosis, or ↑ risk for osteoporosis)

Consider treatment if TSH level 0.1-0.4 µU/mL and the following are present:

- Age ≥65 years
- Age <65 years with comorbidities (cardiac risk factors, heart disease, hyperthyroid symptoms, osteoporosis, or ↑ risk for osteoporosis)

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Thyroid Disease and Adrenal Mass Q2

A 27-year-old woman is evaluated during the fourth week of pregnancy.

She has primary hypothyroidism treated with levothyroxine, 125 µg/d.

Physical exam is normal.

Serum TSH level is 4.2 µU/mL, and free T_4 level is 1.6 ng/dL.

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Thyroid Disease and Adrenal Mass Q2

A 27-year-old woman is evaluated during the fourth week of pregnancy. She has primary hypothyroidism treated with levothyroxine, 125 µg/d. Physical exam is normal. Serum TSH level is 4.2 µU/mL, and free T_4 level is 1.6 ng/dL.

Which of the following is the most appropriate management?

A: Increase the levothyroxine dosage by 10% now

B: Increase the levothyroxine dosage by 30% now

C: Repeat thyroid function tests in 5 weeks

D: Repeat thyroid function tests in the second trimester

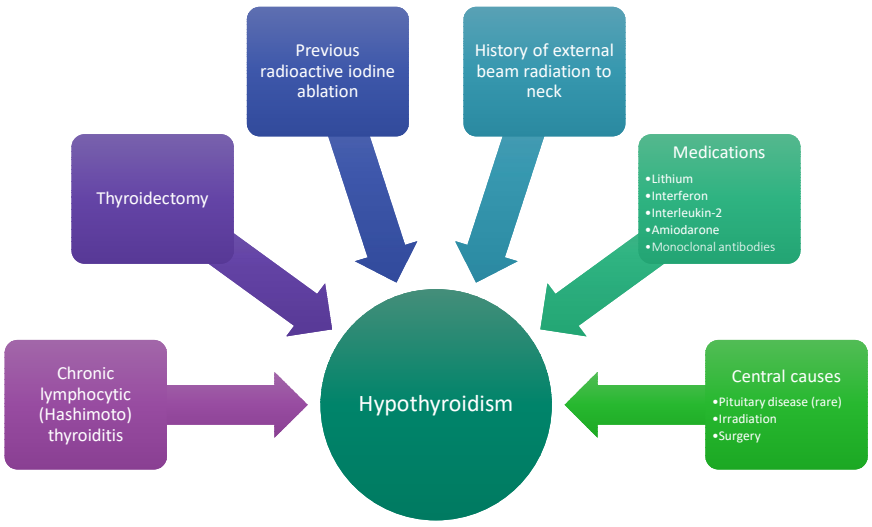
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Hypothyroidism

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Hypothyroidism: Causes



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Hypothyroidism: Diagnosis

General symptoms	• Fatigue • Weight gain • Cold intolerance
Neuropsychiatric	• Decreased concentration • Depression • Psychomotor retardation • Hypersomnolence • Delayed relaxation of deep tendon reflexes
Cardiovascular	• Bradycardia, diastolic hypertension
Gastrointestinal	• Constipation

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Hypothyroidism: Diagnosis

Genitourinary	• Menstrual disturbance (menorrhagia)
Musculoskeletal	• Myalgia • Arthralgia
Cutaneous	• Hair loss • Dry skin • Brittle nails • Periorbital edema • Lateral truncation of the eyebrows • Myxedematous skin changes

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Hypothyroidism: Testing

Thyroid Hormone Deficiency	Laboratory Findings
Primary hypothyroidism	↑ TSH, ↓ free T_4, ↓ T_3
Subclinical hypothyroidism	↑ TSH, normal free T_4, normal T_3
Secondary (central) hypothyroidism	↓ or normal TSH, ↓ free T_4, ↓ T_3
Nonthyroidal illness syndrome	↓ or normal TSH, ↓ or normal or high-normal T_4, ↓ or low-normal T_3, and acute illness

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Hypothyroidism: Treatment

Levothyroxine (T_4)

- Therapeutic goal is normal TSH level
- Aged <60 years
  - Begin at 1.6 µg/kg/d
- Aged >60 years or increased cardiovascular risk
  - Begin at 25-50 µg/d and ↑ by 25 µg every 6 weeks
- Increase dose by 30% to 50% when pregnancy confirmed
  - Monitor TSH and free T_4 levels

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Hypothyroidism: Treatment

T_4 absorption affected by the following:

- Celiac disease (decreased absorption)
- Food (take levothyroxine 60 minutes before eating)
  - Alternatively, can take 4 hours after last meal
- Medications
  - Calcium, iron, PPIs, psyllium
  - Separate levothyroxine administration by several hours

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Thyroid Disease and Adrenal Mass Q3

A 75-year-old woman reports fatigue but no other symptoms.

Physical exam is normal.

Serum TSH level is 6.8 µU/mL (unchanged from 2 months ago); free T_4 level is 1.1 ng/dL.

CBC, complete metabolic profile, and TPO antibody level are normal.

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Thyroid Disease and Adrenal Mass Q3

A 75-year-old woman reports fatigue but no other symptoms. Physical exam is normal. Serum TSH level is 6.8 µU/mL (unchanged from 2 months ago); free T_4 level is 1.1 ng/dL. CBC, complete metabolic profile, and TPO antibody level are normal.

Which of the following is the most appropriate management?

A: Levothyroxine

B: Liothyronine

C: Radioactive iodine uptake study

D: Thyroid function testing in 6 months

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Subclinical Hypothyroidism

↑ TSH, normal free T_4 levels

TSH level >10 µU/mL generally considered to be an indication for treatment

Typically, asymptomatic

Risk for overt hypothyroidism 2% to 4% per year

- TSH level normalizes in 33% of patients

Risk factor for coronary artery disease and heart failure

Treatment is controversial

- Treat symptomatic patients and pregnant patients or those planning pregnancy
- Overtreatment increases risk for arrhythmia and osteoporosis

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Thyroid Disease and Adrenal Mass Q4

A 74-year-old woman has a palpable left-sided thyroid nodule and bilateral fine resting tremor.

Serum levels are TSH, 0.05 µU/mL, and free T_4, 2.9 ng/dL.

Neck ultrasound shows a 1.5-cm solid right thyroid nodule and 2.0-cm solid left thyroid nodule.

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Thyroid Disease and Adrenal Mass Q4

A 74-year-old woman has a palpable left-sided thyroid nodule and bilateral fine resting tremor. Serum levels are TSH, 0.05 µU/mL, and free T_4, 2.9 ng/dL. Neck ultrasound shows a 1.5-cm solid right thyroid nodule and 2.0-cm solid left thyroid nodule.

Which of the following is the most appropriate next step in management?

A: FNAB of both thyroid nodules

B: Initiation of methimazole

C: Radioactive iodine (^{123}I) uptake and scan

D: Total thyroidectomy

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Thyroid Nodules and Thyroid Cancer

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Thyroid Nodule: Diagnosis

- Visible or palpable thyroid nodule(s)
- Possible hyperthyroidism
- Cervical lymphadenopathy (cancer)

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Thyroid Nodule: Testing

Decreased TSH level

- Benign autonomously functioning thyroid adenoma
- Radioisotope uptake scan confirms diagnosis
- Do not order uptake/scan in euthyroid or hypothyroid patients



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Thyroid Nodule: Testing

TSH level normal or elevated

- Thyroid ultrasonography
- Apply American Thyroid Association guidelines for thyroid nodule evaluation (TI-RADS criteria differ)
- FNAB for nodules ≥1 cm of high or intermediate suspicion
- FNAB of lower suspicion nodules if ≥1.5cm
- Do not biopsy purely cystic nodules or “hot” nodules
  - Consider if concerning features



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Thyroid Nodule: Testing

Measure calcitonin if medullary carcinoma suspected

- Thyroid nodule and hypercalcemia
- Family history of medullary cancer
- Family or personal history of MEN2
  - Medullary thyroid cancer
  - Pheochromocytoma
  - Primary hyperparathyroidism

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Thyroid Nodule: Treatment

Follow most benign nodules with repeat ultrasonography

- Biopsy if growth exceeds 50% by volume, 20% increase in 2 or more dimensions (minimum 2 mm) or change in features
- Do not use T_4 suppression

Hyperfunctioning solitary thyroid nodules

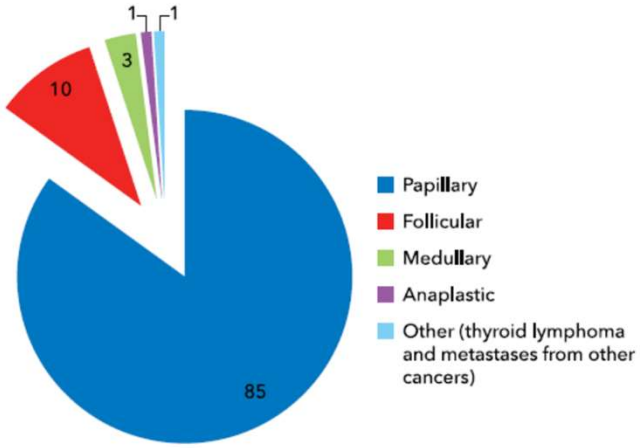
- Radioactive iodine ablation or surgery
- Methimazole if radioactive iodine or surgery contraindicated

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Thyroid Cancer

Well-differentiated in 95% of patients, with good prognosis



Data from Hundahl SA, Fleming ID, Fremgen AM, et al. A National Cancer Data Base report on 53,856 cases of thyroid carcinoma treated in the U.S., 1985-1995. Cancer. 1998;83:2638-48. [PMID: 9874472]

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Non-Medullary Thyroid Cancer: Treatment

Thyroidectomy or thyroid lobectomy

Selective use of radioactive iodine therapy

- Extrathyroidal extension
- Metastatic disease
- Poorly differentiated/more aggressive histology

Levothyroxine suppression of TSH for intermediate or high-risk disease

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Medullary Thyroid Cancer: Treatment

Total thyroidectomy plus central neck dissection

RET proto-oncogene testing before surgery

- Exclude MEN-associated pheochromocytoma

Screening of family members

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Thyroid Disease and Adrenal Mass Q5

A 55-year-old woman is evaluated for fever, cough, nausea, and palpitations. She recently discontinued methimazole for Graves disease.

Temperature is 102.9 °F; BP is 100/50 mm Hg; pulse rate is 138/min.

TSH level is <0.1 µU/mL; free T_4 level is 4.4 ng/dL.

Chest radiograph shows a left lower lobe infiltrate.

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Thyroid Disease and Adrenal Mass Q5

A 55-year-old woman is evaluated for fever, cough, nausea, and palpitations. She recently discontinued methimazole for Graves disease. Temperature is 102.9 °F; BP is 100/50 mm Hg; pulse rate is 138/min. TSH level is <0.1 µU/mL; free T_4 level is 4.4 ng/dL. Chest radiograph shows a left lower lobe infiltrate.

In addition to initiation of ceftriaxone and azithromycin, which of the following is the most appropriate next step in management?

A: Atenolol

B: Propranolol, propylthiouracil, and hydrocortisone

C: Thyroid ablation with radioactive iodine

D: Thyroid scan with a radioactive iodine uptake test

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Thyroid Storm

ACP

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Thyroid Storm

High mortality (up to 30%)

Increased risk in patients with Graves disease

Untreated thyrotoxicosis

- Discontinuation of antithyroid drug therapy

Precipitated by surgery, infection, trauma, or acute iodine load

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Thyroid Storm: Diagnosis

Life-threatening or severe symptoms

- Cardiac decompensation (tachycardia, arrhythmia, heart failure, shock)
- Hyperpyrexia
- Mental status changes
- GI and hepatic dysfunction

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Thyroid Storm: Testing

- Hyperthyroidism (low TSH, high T_4 and T_3 levels)
- No level of thyroid hormone is diagnostic
- Scoring systems are sensitive but not specific

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Thyroid Storm: Treatment

Intensive care unit admission

Treat precipitant illness

Thyrotoxicosis-directed therapy

- β-Blockers
- Antithyroidal medications
  - Iodine must be given after antithyroidal medications are initiated
- IV high-dose glucocorticoids
- Potassium iodide
- Bile acid sequestrants

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Myxedema Coma

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Myxedema Coma

Rare, life-threatening clinical condition

- Mortality is 20% to 50%

Occurs in patients with long-standing, severe untreated hypothyroidism

Often precipitating event

- Patients previously compensating until precipitating event occurs

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Myxedema Coma: Diagnosis

Altered mental status

Hypothermia

Precipitating event

- Cold exposure
- Infection
- Drug use
- Trauma
- Stroke
- Heart failure
- GI bleed

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Myxedema Coma: Diagnosis

Physical exam findings

- Hypothermia
- Hypoventilation
- Hypotension
- Bradycardia
- Dry/coarse skin
- Periorbital edema
- Macroglossia
- Delayed reflexes
- Altered mental status

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Myxedema Coma: Diagnosis

Laboratory abnormalities

- Anemia
- Hyponatremia
- Hypoglycemia
- Hyperlipidemia
- Elevated creatinine kinase level
- Elevated TSH and low free T_4 levels if primary hypothyroidism
- If central hypothyroidism, expect low TSH and low free T_4 levels

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Myxedema Coma: Treatment

Supportive measures: ventilatory support, warming, fluid expansion, glucose, treat precipitating event

Thyroid hormone

- IV dose of levothyroxine, 200-400 µg, followed by 75% of weight-based dosing administered IV (1.6 µg/kg/d)
- Differing opinions on additional use of T_3, 2.5-10 µg, every 8 hours after a loading dose of 5-20 µg
  - Evidence is weak
  - IV often not available
- Change to oral dosing when patient is fully awake

Treatment of pituitary-adrenal dysfunction

- IV hydrocortisone, 100 mg, every 8 hours

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Thyroid Disease and Adrenal Mass Q6

A 55-year-old woman is evaluated for an incidentally discovered adrenal mass.

Physical exam, including vital signs, is unremarkable.

Serum electrolyte levels are normal.

Testing for cortisol excess is negative.

Abdominal CT scan shows a 2.5-cm right adrenal mass with an attenuation value of 25 Hounsfield units.

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Thyroid Disease and Adrenal Mass Q6

A 55-year-old woman is evaluated for an incidentally discovered adrenal mass. Physical exam, including vital signs, is unremarkable. Serum electrolyte levels are normal. Testing for cortisol excess is negative. Abdominal CT scan shows a 2.5-cm right adrenal mass with an attenuation value of 25 Hounsfield units (HU).

Which of the following is the most appropriate next step in management?

A: Measurement of plasma metanephrine level

B: Measurement of serum aldosterone/plasma renin activity

C: Repeat imaging at 12 months

D: No additional testing

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Adrenal Mass

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Adrenal Mass: Diagnosis

Incidentaloma: >1-cm mass detected incidentally

- Prevalence increases with age
- 10% to 15% secrete hormones
- Most are benign

Metastases

Cysts

Myelolipoma

Adrenocortical carcinoma

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Adrenal Mass: Testing

All patients

- 1-mg overnight dexamethasone suppression

Unenhanced CT attenuation ≥10 HU

- Plasma metanephrines or 24-hour urine metanephrines and catecholamines

Hypertension or hypokalemia

- Plasma aldosterone concentration/plasma renin activity

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Adrenal Mass: Treatment

Consider adrenalectomy*

- Functioning tumors
- >4 cm
- Suspicious radiographic features on CT scan
  - Attenuation >10 HU
  - Contrast washout ≤50% at 10 minutes

*Must rule out pheochromocytoma before any adrenal procedure

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Endocrinology I: Thyroid Disease and Adrenal Mass

- Answers to Multiple-Choice Questions

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Thyroid Disease and Adrenal Mass Q1

A 38-year-old woman is evaluated for palpitations and heat intolerance. Pulse rate is 110/min. The patient is restless, with pressured speech, warm and moist skin, and hand tremors. The thyroid is enlarged without palpable nodules. Serum TSH level is 0.08 µU/mL; free T_4 level is 1.7 ng/dL.

Which of the following is the most appropriate next diagnostic test?

A: Serum total T_3

B: Serum TPO antibody

C: Thyroid function tests repeated in 6 weeks

D: Ultrasonography of the neck

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Thyroid Disease and Adrenal Mass Q2

A 27-year-old woman is evaluated during the fourth week of pregnancy. She has primary hypothyroidism treated with levothyroxine, 125 µg/d. Physical exam is normal. Serum TSH level is 4.2 µU/mL, and free T_4 level is 1.6 ng/dL.

Which of the following is the most appropriate management?

A: Increase the levothyroxine dosage by 10% now

B: Increase the levothyroxine dosage by 30% now

C: Repeat thyroid function tests in 5 weeks

D: Repeat thyroid function tests in the second trimester

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Thyroid Disease and Adrenal Mass Q3

A 75-year-old woman reports fatigue but no other symptoms. Physical exam is normal. Serum TSH level is 6.8 µU/mL (unchanged from 2 months ago); free T_4 level is 1.1 ng/dL. CBC, complete metabolic profile, and TPO antibody level are normal.

Which of the following is the most appropriate management?

A: Levothyroxine

B: Liothyronine

C: Radioactive iodine uptake study

D: Thyroid function testing in 6 months

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Thyroid Disease and Adrenal Mass Q4

A 74-year-old woman has a palpable left-sided thyroid nodule and bilateral fine resting tremor. Serum levels are TSH, 0.05 µU/mL, and free T_4, 2.9 ng/dL. Neck ultrasound shows a 1.5-cm solid right thyroid nodule and 2.0-cm solid left thyroid nodule.

Which of the following is the most appropriate next step in management?

A: FNAB of both thyroid nodules

B: Initiation of methimazole

C: Radioactive iodine (^{123}I) uptake and scan

D: Total thyroidectomy

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Thyroid Disease and Adrenal Mass Q5

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Thyroid Disease and Adrenal Mass Q6

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Which of the following is the most appropriate next step in management?

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Endocrinology II

2025 Virtual/Live Internal Medicine Board Review

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ACP Internal Medicine Board Review Course

Endocrinology II: Diabetes Mellitus

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Table of Contents: Diabetes Mellitus

- Type 1 diabetes mellitus
- Type 2 diabetes mellitus
- Diabetic neuropathy
- Diabetic retinopathy
- Hyperglycemic crises
- Cardiovascular risk reduction in diabetes mellitus

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Diabetes Mellitus Q1

An 18-year-old woman is evaluated for excessive urination and thirst.

Her mother has type 2 diabetes mellitus.

BMI is 35. Physical exam, including vital signs, is otherwise normal.

Random glucose level is 324 mg/dL; electrolytes and urine ketones are normal.

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Diabetes Mellitus Q1

An 18-year-old woman is evaluated for excessive urination and thirst. Her mother has type 2 diabetes mellitus. BMI is 35. Physical exam, including vital signs, is otherwise normal. Random glucose level is 324 mg/dL; electrolytes and urine ketones are normal.

In addition to treating the patient's hyperglycemia, which of the following is the most appropriate next step in management?

A: Measure fasting plasma C-peptide level

B: Measure fasting plasma insulin level

C: Measure stimulated plasma C-peptide level

D: Obtain islet cell, insulin, and glutamic acid decarboxylase antibody titers

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Type 1 Diabetes Mellitus

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Type 1 Diabetes: Pathophysiology and Epidemiology

Immune mediated (90%): Cell-mediated autoimmune destruction of β-cells

- Antibody positive
  - Antibodies are immune markers
  - Children, adolescents
- Latent autoimmune diabetes of adulthood
  - Older, lean adults
- Additional autoimmune endocrinopathies are common
  - Hashimoto hypothyroidism
  - Celiac disease
  - Primary adrenal insufficiency

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Type 1 Diabetes: Pathophysiology and Epidemiology

Idiopathic (10%)

- Antibody negative: no autoantibodies to β-cells
- Strongly inherited

Acquired

- β-Cell destruction from conditions affecting the pancreas

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Type 1 Diabetes: Diagnosis and Testing

Children and adolescents

- Polyuria/polydipsia
- Diabetic ketoacidosis

Adults

- Variable presentation
- Temporary remissions

Initial screening

- Insulin antibodies
- GAD65, IA-2, ZnT8 autoantibodies
- Treatment implications (insulin requiring)

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Diabetes: Testing

Test	Diagnostic Criteria for Diabetes (Any Form)*
Random plasma glucose	Classic hyperglycemic symptoms or hyperglycemic crisis plus a random glucose level ≥200 mg/dL
Fasting plasma glucose	≥126 mg/dL
2-Hour plasma glucose during an OGTT	≥200 mg/dL
HbA_{1c}	≥6.5%

*In the absence of unequivocal hyperglycemia, diagnosis requires two abnormal test results from the same sample or in two separate test samples.

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Type 1 Diabetes: Treatment

Basal and prandial insulin coverage

- Dosage range, 0.4-1 U/kg/d; typical starting dose, 0.3-0.4 U/kg/d
- 50% basal and 50% prandial insulin

Insulin correction dose

- 1 U for each 50 mg/dL above target

Delivery methods

- Subcutaneous (SC) insulin
- Continuous SC infusions (insulin pump)
- Inhaled insulin (prandial)

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Hypoglycemia Unawareness

Low plasma glucose levels without warning symptoms

- May cause loss of consciousness

Treat with rapid-acting carbohydrates or glucagon

Decrease insulin dose

- Increase glucose levels for 1-2 months
- Restore sensitivity to hypoglycemia

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Diabetes Mellitus Q2

A 55-year-old man has a fasting plasma glucose level of 128 mg/dL and an HbA_{1c} level of 5.6%.

He is asymptomatic.

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Diabetes Mellitus Q2

A 55-year-old man has a fasting plasma glucose level of 128 mg/dL and an HbA_{1c} level of 5.6%. He is asymptomatic.

Which of the following is the most appropriate diagnostic test to perform next?

A: Oral glucose tolerance test

B: Random blood glucose

C: Repeat fasting plasma glucose

D: Repeat HbA_{1c}

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Type 2 Diabetes Mellitus

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Type 2 Diabetes

90% to 95% of all diabetes

Screening recommendations

- American Diabetes Association (ADA)
  - BMI ≥25 (≥23, Asian Americans) and ≥1 additional risk factor
  - Age ≥35 years, regardless of risk factors
  - Persons with history of gestational diabetes: Screen every 1-3 years
- United States Preventive Services Task Force
  - Age 35-70 years with overweight or obesity

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Type 2 Diabetes: Testing

Test	Prediabetes	Diagnostic Criteria for Diabetes*
Random plasma glucose	—	Classic hyperglycemic symptoms or hyperglycemic crisis plus a random glucose level ≥200 mg/dL
Fasting plasma glucose	100-125 mg/dL	≥126 mg/dL
2-Hour plasma glucose during an OGTT	140-199 mg/dL	≥200 mg/dL
HbA_{1c}	5.7%-6.4%	≥6.5%

*In the absence of unequivocal hyperglycemia, diagnosis requires two abnormal test results from the same sample or in two separate test samples.

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Prediabetes: Treatment

Lifestyle modification (weight loss, exercise, diet)

Metformin* for prevention: Consider if high risk for T2DM

- Age 25-59 years with BMI ≥35 (*and other age/BMI groups, pre-DM*)
- Fasting glucose level 110-125 mg/dL
- Hemoglobin A_{1c} value ≥6%
- Patients with previous gestational diabetes

*Long-term metformin use can be associated with vitamin B_{12} deficiency; periodically monitor vitamin B_{12} levels.

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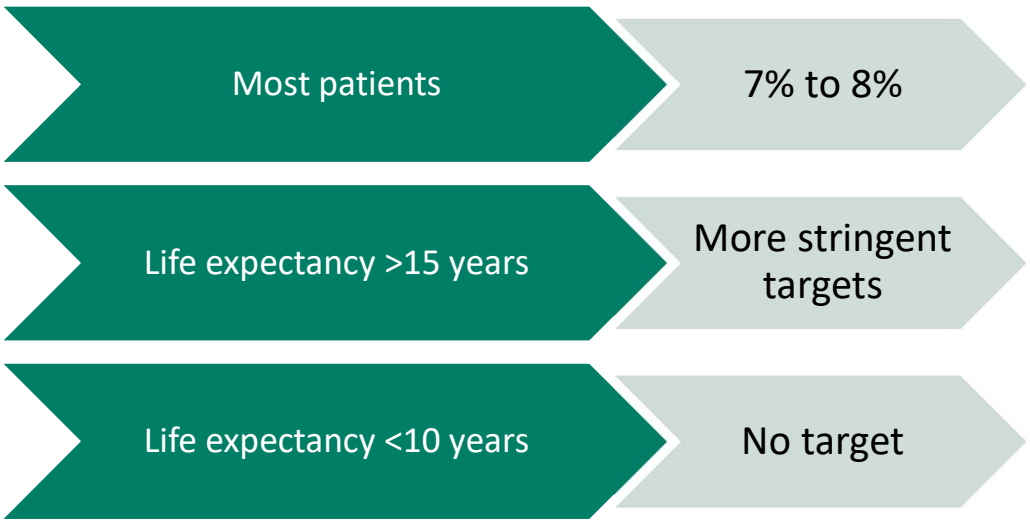
ADA HbA_{1c} Targets

Healthy, nonpregnant adults	<7%
Healthy older adults	<7.5%
Older adults with significant comorbidities, life expectancy <10 y, frequent hypoglycemia	<8%
Very complex health issues/limited life expectancy	No HbA_{1c} goal

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ACP HbA_{1c} Targets



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Type 2 Diabetes: Nonpharmacologic Therapy

Lifestyle modification

- Exercise
- Weight loss
- Diet

Metabolic surgery (ADA recommendations)

- BMI ≥30 (≥27.5 in Asian Americans)

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Diabetes Mellitus Q3

A 68-year-old woman is evaluated during follow-up of type 2 diabetes.

FBG levels were 110 to 140 mg/dL during the past 6 months; HbA_{1c} values have exceeded 8.5%.

She has had two early-morning hypoglycemic episodes.

Medications are metformin and insulin glargine.

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Diabetes Mellitus Q3

A 68-year-old woman is evaluated during follow-up of type 2 diabetes. FBG levels were 110 to 140 mg/dL during the past 6 months; HbA_{1c} values have exceeded 8.5%. She has had two early-morning hypoglycemic episodes. Medications are metformin and insulin glargine.

Which of the following is the most appropriate next step in management?

A: Add liraglutide to her regimen

B: Assess serum fructosamine level

C: Increase the insulin glargine dosage

D: Measure 2-hour postprandial glucose levels

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Type 2 Diabetes: Pharmacologic Therapy

Initial therapy: metformin

- eGFR >45 mL/min/1.73 m^2

Dual therapy if HbA_{1c} remains above target

Multiple ASCVD risk factors, ASCVD, or CKD

- SGLT2 inhibitor or GLP-1 RA with known cardiovascular benefit

HFrEF

- SGLT2 inhibitor

Diabetic kidney disease

- SGLT2 inhibitor or GLP-1 RA with known CKD benefit

MASLD

- GLP-1 RA, dual GLP-1 RA and GIP, pioglitazone

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Type 2 Diabetes: Pharmacologic Therapy

Triple and combination therapy if HbA_{1c} above target after 3 months

- Triple oral therapy + injectable therapy
  - GLP-1 RA is often second option after metformin
  - GLP-1 RA is preferred injectable over insulin

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Pharmacologic Agents and Effect on Weight

Weight loss	Weight neutral	Weight gain
• GLP-1 RA + GIP (very high) (tirzepatide) • GLP-1 RA (high) (greater in semaglutide than liraglutide/dulaglutide) • SGLT2 inhibitors (intermediate)	• Metformin • α-Glucosidase inhibitors • DPP-4 inhibitors	• Insulin • Sulfonylureas • Thiazolidinediones • Meglitinides

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Diabetes Mellitus Q4

A 57-year-old man reports bilateral burning sensations in his feet.

He has CAD, first-degree AV block, and type 2 diabetes.

He began metformin 18 months ago.

Physical exam reveals distal sensory polyneuropathy.

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Diabetes Mellitus Q4

A 57-year-old man reports bilateral burning sensations in his feet. He has CAD, first-degree AV block, and type 2 diabetes. He began metformin 18 months ago. Physical exam reveals distal sensory polyneuropathy.

Which of the following is the most appropriate management of this patient's neuropathy?

A: Amitriptyline

B: Duloxetine

C: Nerve conduction study

D: Vitamin B_{12} measurement

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Type 2 Diabetes: Complications

Acute complications

- Hyperglycemic emergency-HHS

Chronic complications

- Diabetic retinopathy
- Peripheral sensory neuropathy
- Autonomic neuropathy
- Cardiovascular and kidney disease
- Diabetic foot changes

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Diabetic Neuropathy

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Diabetic Neuropathy

Damage to nerves/nerve roots due to hyperglycemia

Glycemic control may prevent or delay progression

Multiple presentations

- Mononeuropathy
- Polyneuropathy
- Plexopathy
- Autonomic

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Diabetic Peripheral Neuropathy: Diagnosis

Asymptomatic (50%)

Ascending neuropathy

"Stocking-glove" distribution

Small nerve fiber

- Pain, burning, and tingling

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Diabetic Peripheral Neuropathy: Diagnosis

Large nerve fiber (position sense, vibration, light touch)

- Decreased pain and pressure sensation
- Anatomic deformities (hammer toes, rocker bottom feet)
- Abnormal callus formation (from foot deformity)
- Foot ulcer/amputation

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Diabetic Peripheral Neuropathy: Testing



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Small nerve fiber

- Pinprick and temperature

Large nerve fiber

- Ankle reflexes
- 128-Hz tuning fork testing
- 10-g monofilament testing

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Diabetic Peripheral Neuropathy: Screening

Type 1 diabetes

- After 5 years, then annually

Type 2 diabetes

- At diagnosis, then annually

Screening technique

- Skin assessment
- Foot deformity evaluation
- Lower extremity pulse assessment
- 10-g monofilament testing
- Vibration, ankle reflexes, pinprick, or temperature



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Diabetic Peripheral Neuropathy: Treatment

Optimize glucose, blood pressure, and lipid control

ADA recommends the following for neuropathic pain:

- Gabapentinoids: pregabalin, gabapentin
- SNRIs: duloxetine
- Tricyclic antidepressants
  - Use should be avoided in patients aged >65 years
- Sodium channel blockers: oxcarbazepine, carbamazepine, lamotrigine, valproic acid, lacosamide
- Topical capsaicin

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Diabetic Autonomic Neuropathy: Diagnosis

- Hypoglycemia unawareness
- Gastroparesis
- Diarrhea/constipation
- Erectile dysfunction
- Bladder dysfunction
- Orthostatic hypotension
- Sudden cardiac death

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Diabetic Autonomic Neuropathy: Testing and Treatment

Testing

- Resting tachycardia (>100/min)
- Orthostatic hypotension
- No heart rate variation with respiration

Treatment

- Optimization of glucose control
- Dependent on organ system involved
- Largely symptomatic relief

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Diabetes Mellitus Q5

A 48-year-old man has macular edema and retinal neovascularization manifesting as blurring of his central vision bilaterally.

He has had type 1 diabetes for 24 years that has been well controlled with insulin.

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Diabetes Mellitus Q5

A 48-year-old man has macular edema and retinal neovascularization manifesting as blurring of his central vision bilaterally. He has had type 1 diabetes for 24 years that has been well controlled with insulin.

Which of the following is the most appropriate next step in management?

A: Add aspirin

B: Administer anti-VEGF intravitreal injections

C: Begin infliximab therapy

D: Decrease insulin dosage

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Diabetic Retinopathy

ACP

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Diabetic Retinopathy: Risk Factors

- Long duration of diabetes
- Poorly controlled diabetes
- Hypertension
- Albuminuria
- Dyslipidemia

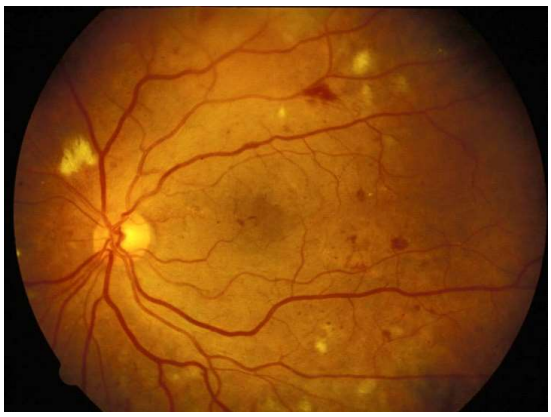
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Diabetic Retinopathy: Diagnosis

Nonproliferative

- Microaneurysms
- Dot-and-blot hemorrhages
- Hard exudates (lipid deposition)
- Soft exudates or cotton-wool spots (ischemic superficial nerve fibers)
- Venous bleeding
- Intraretinal microvascular abnormalities



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Diabetic Retinopathy: Diagnosis



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Proliferative

- Neovascularization due to chronic ischemia with potential for intraocular hemorrhage
- Retinal detachment
- Vision loss

Macular edema may occur with both types

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Diabetic Retinopathy: Testing

Dilated and comprehensive eye examination by eye specialist

Type 1 diabetes

- Within 5 years of diagnosis
- Follow-up should be every 1-2 years if no retinopathy and diabetes is well controlled
- Any evidence of retinopathy, even if stable, requires at least yearly exam

Type 2 diabetes

- At time of diagnosis
- Follow-up should be every 1-2 years if no retinopathy and diabetes is well controlled
- Any evidence of retinopathy, even if stable, requires at least yearly exam

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Diabetic Retinopathy: Treatment

Proliferative diabetic retinopathy

- Laser photocoagulation *or*
- Intraocular injections of anti-VEGF agent

Diabetic central macular edema

- Intraocular injections of anti-VEGF agent



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Diabetes Mellitus Q6

A 20-year-old woman has abdominal pain and vomiting after 3 days of cough and fever.

She has type 1 diabetes and has not taken insulin in 24 hours.

Temperature is 95.9 °F, BP is 90/68 mm Hg, pulse rate is 120/min, and respiration rate is 28/min. She is lethargic.

Abdominal exam shows generalized tenderness.

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Diabetes Mellitus Q6

A 20-year-old woman has abdominal pain and vomiting after 3 days of cough and fever. She has type 1 diabetes and has not taken insulin in 24 hours. Temperature is 95.9 °F, BP is 90/68 mm Hg, pulse rate is 120/min, and respiration rate is 28/min. She is lethargic. Abdominal exam shows generalized tenderness.

Which of the following laboratory tests will establish the diagnosis?

A: Serum glucose, electrolytes, ketones, and ABGs

B: Serum glucose, phosphate, potassium, and ABGs

C: Serum glucose, potassium, CBC

D: Serum ketones, bicarbonate, CBC

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Hyperglycemic Crises

ACP

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Diabetic Ketoacidosis: Diagnosis

- Rapid progression of symptoms over 24 hours
- Polyuria, polydipsia
- Deep respirations
- Fruity breath odor
- Abdominal pain, nausea, vomiting
- Hypotension, tachycardia, shock
- Lethargy, obtundation, coma

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Diabetic Ketoacidosis: Testing

Initial testing

- Serum glucose, electrolytes, ketones, creatinine/BUN
- Plasma osmolality
- CBC
- ABG
- Urinalysis, urine ketones
- ECG
- Cultures, chest radiography if infection possible

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Diabetic Ketoacidosis: Testing

Typical findings

- Glucose 250-600 mg/dL
- pH ≤7.30
- Increased anion gap
- Positive serum/urine ketone levels

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Diabetic Ketoacidosis: Treatment

Identify and address precipitant

IV 0.9% saline initially

- Add 5% glucose when glucose level is <250 mg/dL

Insulin infusion

- Delay if potassium level is <3.3 mEq/L
- Initiate when potassium level is ≥3.3 mEq/L

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Diabetic Ketoacidosis: Treatment

- Potassium replacement if 3.3-5.2 mEq/L
- Routine phosphate replacement not indicated
- Bicarbonate replacement if pH <6.9
- Continue insulin/glucose until AG normalizes

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Hyperglycemic Hyperosmolar Syndrome: Diagnosis

Progression over several days

Older adults with hypovolemia and mental status changes

- Precipitated by poor adherence, infection, or MI

Young adults and teens

- Undiagnosed and untreated diabetes

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Hyperglycemic Hyperosmolar Syndrome: Testing

Initial testing

- Similar to DKA testing

Typical findings

- Plasma osmolality >320 mOsm/kg H_2O
- Glucose >600 mg/dL
- Arterial pH >7.3
- Serum bicarbonate >20 mEq/L
- Ketones normal

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Hyperglycemic Hyperosmolar Syndrome: Treatment

Identify and treat precipitant

IV 0.9% saline initially

- Switch to 0.45% saline when corrected sodium is normal
- Add 5% glucose when glucose level is <250 mg/dL

IV insulin if serum potassium level is ≥3.3 mEq/L

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Cardiovascular Risk Reduction in Diabetes Mellitus

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Cardiovascular Risk Reduction in Diabetes

Lifestyle intervention

- Weight loss if overweight or obese
- Smoking cessation
- Mediterranean or plant-based diet
- Moderation of alcohol intake
- Increased physical activity

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Cardiovascular Risk Reduction in Diabetes

Lipids

- Lipid profile every 5 years for risk estimation if aged <40 years
- Moderate-intensity statin therapy (aged 40-75 years)
- High-intensity statin therapy if increased risk

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Cardiovascular Risk Reduction in Diabetes

Blood pressure

- Treatment target: BP <130/80 mm Hg (ADA, ACC/AHA)
- ACE inhibitors, ARBs, thiazides, or dihydropyridine CCBs
- ACE inhibitor or ARB if albumin-creatinine ratio >30 mg/g

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Cardiovascular Risk Reduction in Diabetes

SGLT2 inhibitors and GLP-1 RA with known CV benefit

- Established ASCVD
- Established kidney disease
- Multiple risk factors for ASCVD
- Independent of HbA_{1c} level

Aspirin

- Primary prevention: may consider if increased CV risk (discuss benefits vs. bleeding risk)
- Secondary prevention: routinely recommended

Finerenone: add to ACE inhibitor or ARB in CKD

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Endocrinology II – Diabetes Mellitus

- Answers to Multiple-Choice Questions

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Diabetes Mellitus Q1

An 18-year-old woman is evaluated for excessive urination and thirst. Her mother has type 2 diabetes mellitus. BMI is 35. Physical exam, including vital signs, is otherwise normal. Random glucose level is 324 mg/dL; electrolytes and urine ketones are normal.

In addition to treating the patient's hyperglycemia, which of the following is the most appropriate next step in management?

A: Measure fasting plasma C-peptide level

B: Measure fasting plasma insulin level

C: Measure stimulated plasma C-peptide level

D: Obtain islet cell, insulin, and glutamic acid decarboxylase antibody titers

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Diabetes Mellitus Q2

A 55-year-old man has a fasting plasma glucose level of 128 mg/dL and an HbA_{1c} level of 5.6%. He is asymptomatic.

Which of the following is the most appropriate diagnostic test to perform next?

A: Oral glucose tolerance test

B: Random blood glucose

C: Repeat fasting plasma glucose

D: Repeat HbA_{1c}

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Diabetes Mellitus Q3

A 68-year-old woman is evaluated during follow-up of type 2 diabetes. FBG levels were 110 to 140 mg/dL during the past 6 months; HbA_{1c} values have exceeded 8.5%. She has had two early-morning hypoglycemic episodes. Medications are metformin and insulin glargine.

Which of the following is the most appropriate next step in management?

A: Add liraglutide to her regimen

B: Assess serum fructosamine level

C: Increase the insulin glargine dosage

D: Measure 2-hour postprandial glucose levels

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Diabetes Mellitus Q4

A 57-year-old man reports bilateral burning sensations in his feet. He has CAD, first-degree AV block, and type 2 diabetes. He began metformin 18 months ago. Physical exam reveals distal sensory polyneuropathy.

Which of the following is the most appropriate management of this patient's neuropathy?

A: Amitriptyline

B: Duloxetine

C: Nerve conduction study

D: Vitamin B_{12} measurement

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Diabetes Mellitus Q5

A 48-year-old man has macular edema and retinal neovascularization manifesting as blurring of his central vision bilaterally. He has had type 1 diabetes for 24 years that has been well controlled with insulin.

Which of the following is the most appropriate next step in management?

A: Add aspirin

B: Administer anti-VEGF intravitreal injections

C: Begin infliximab therapy

D: Decrease insulin dosage

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Diabetes Mellitus Q6

A 20-year-old woman has abdominal pain and vomiting after 3 days of cough and fever. She has type 1 diabetes and has not taken insulin in 24 hours. Temperature is 95.9 °F, BP is 90/68 mm Hg, pulse rate is 120/min, and respiration rate is 28/min. She is lethargic. Abdominal exam shows generalized tenderness.

Which of the following laboratory tests will establish the diagnosis?

A: Serum glucose, electrolytes, ketones, and ABGs

B: Serum glucose, phosphate, potassium, and ABGs

C: Serum glucose, potassium, CBC

D: Serum ketones, bicarbonate, CBC

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Endocrinology III

2025 Virtual/Live Internal Medicine Board Review

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ACP Internal Medicine Board Review Course

Endocrinology III: Metabolic Bone Disease, Adrenal Disease, and Reproductive Disorders

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- Hyperparathyroidism
- Osteoporosis
- Vitamin D deficiency and osteomalacia
- Adrenal insufficiency
- Male hypogonadism
- Gynecomastia

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Metabolic Bone Disease Q1

A 59-year-old man is evaluated for hypercalcemia. He reports no symptoms.

He has recently diagnosed multiple myeloma and takes no medications.

Physical exam, including vital signs, is normal.

Serum calcium level is 10.8 mg/dL.

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Metabolic Bone Disease Q1

A 59-year-old man is evaluated for hypercalcemia. He reports no symptoms. He has recently diagnosed multiple myeloma and takes no medications. Physical exam, including vital signs, is normal. Serum calcium level is 10.8 mg/dL.

Which of the following levels should be measured next?

A: 1,25-Dihydroxyvitamin D

B: Ionized calcium

C: Parathyroid hormone (PTH)

D: PTH-related peptide

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Hypercalcemia and Hypercalciuria

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Hypercalcemia: Causes

Primary hyperparathyroidism

- Most common cause in outpatients
- Usually asymptomatic and chronic

Humoral hypercalcemia of malignancy (PTH-related peptide)

Osteolytic bone lesions

Ectopic PTH secretion

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Hypercalcemia: Causes

Granulomatous disease

- Increased production of 1,25-vitamin D

Drug induced

- Lithium (PTH mediated)
- Thiazide diuretics (non-PTH mediated)
- Excess vitamin D
- Excess calcium (milk-alkali syndrome)

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Hypercalcemia: Causes

Familial hypocalciuric hypercalcemia (FHH)

- Family history of hypercalcemia
- Mild hypercalcemia since childhood
- No hypercalcemia complications
- Very low 24-hour urine calcium excretion

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Hypercalcemia: Diagnosis

Clinical features

- Anorexia, nausea, vomiting
- Polyuria, polydipsia, and nocturia
- Acute kidney injury
- Mental status changes

Medication review

ROS for cancer symptoms, granulomatous disease

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Hypercalcemia: Testing

Confirm hypercalcemia, measure PTH

Measure ionized calcium level

- High albumin can alter total calcium

↑ PTH level (or inappropriately normal)

- Primary hyperparathyroidism
- Ectopic PTH secretion (if PTH secreting)
- Tertiary hyperparathyroidism
- Rule out FHH

↓ PTH level

- PTHrP mediated
- Osteolytic bone lesions
- Excess 1-α hydroxylase (granulomatous disease, lymphomas)
- Excessive calcium carbonate ingestion

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Acute Severe Hypercalcemia: Treatment

Volume resuscitation with 0.9% saline

Furosemide only for specific indications (volume overload, CKD)

Calcitonin

- Second-line therapy
- During first 48 hours in highly symptomatic patients
- Tachyphylaxis

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Acute Severe Hypercalcemia: Treatment

IV bisphosphonate: zoledronic acid superior to pamidronate

- May take >48 hours for effect
- Can be repeated after a few days for hypercalcemia of malignancy

Glucocorticoid therapy

- Excess 1-α hydroxylase (granulomatous disease, lymphomas)

Denosumab

- Refractory hypercalcemia or kidney failure

Hemodialysis

- Severe hypercalcemia in oliguric patients

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Metabolic Bone Disease Q2

A 45-year-old man is evaluated for a 3-month history of fatigue, constipation, polydipsia, and polyuria.

He has hypertension.

Medications are losartan and diltiazem.

Exam findings, including vital signs, are normal.

Serum calcium level is 11.4 mg/dL, phosphorus level is 2.2 mg/dL, and serum creatinine level is 1.1 mg/dL.

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Metabolic Bone Disease Q2

A 45-year-old man is evaluated for a 3-month history of fatigue, constipation, polydipsia, and polyuria. He has hypertension. Medications are losartan and diltiazem. Exam findings, including vital signs, are normal. Serum calcium level is 11.4 mg/dL, phosphorus level is 2.2 mg/dL, and serum creatinine level is 1.1 mg/dL.

Which of the following levels should be measured next?

A: 25-Hydroxyvitamin D

B: Calcitonin

C: PTH

D: PTHrP

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Hyperparathyroidism

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Hyperparathyroidism: Diagnosis

- Asymptomatic (80% found incidentally)
- Anorexia, nausea, constipation
- Polyuria, polydipsia
- Nephrolithiasis/nephrocalcinosis
- Osteoporosis/osteopenia
- Subclinical kidney disease

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Hyperparathyroidism: Testing

Simultaneous calcium and PTH

- PTH elevated or inappropriately normal

Serum 25-hydroxyvitamin D

- Deficiency may obscure diagnosis

24-Hour urine calcium

- Estimate risk for stone formation
- Exclude familial hypocalciuric hypocalcemia

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Hyperparathyroidism: Testing

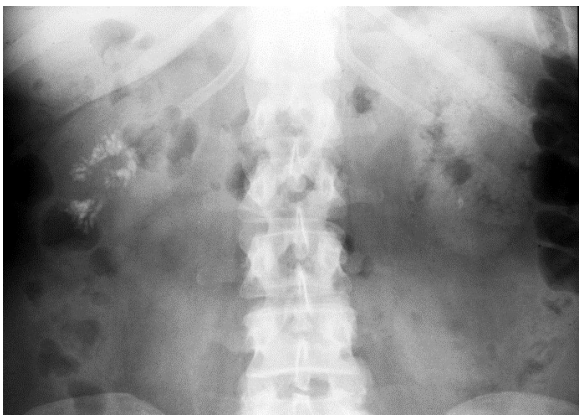


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Serum phosphorus (low or low normal)

DXA measurements

- Hip
- Spine
- Distal forearm
- Vertebral fracture assessment

Kidney imaging

- Ultrasonography, abdominal radiography, or CT to look for kidney stones

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Hyperparathyroidism: Treatment

Calcium-sufficient diet (limit to 1000 mg/d)

Measure and replenish vitamin D

- May alter management

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Hyperparathyroidism: Treatment

Indications for parathyroidectomy (any of the following)

- Hypercalcemia
  - Serum calcium level ≥1 mg/dL above ULN
- Skeletal involvement
  - Osteoporosis or vertebral compression fracture
- Kidney involvement
  - eGFR <60 mL/min/1.73 m^2
  - Hypercalciuria: 24-hour urine calcium >250 mg/d (female), >300 mg/d (male)
  - Nephrolithiasis/nephrocalcinosis on imaging
- Age <50 years
- Symptomatic patients

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Metabolic Bone Disease Q3

A 54-year-old woman is evaluated for a bone health assessment. She is postmenopausal.

FRAX shows 22% risk for major osteoporotic fracture and 2.4% risk for hip fracture over 10 years.

T-scores are lumbar spine, −2.1; femoral neck, −2.3; and total hip, −1.9.

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Metabolic Bone Disease Q3

A 54-year-old woman is evaluated for a bone health assessment. She is postmenopausal. FRAX shows 22% risk for major osteoporotic fracture and 2.4% risk for hip fracture over 10 years. T-scores are lumbar spine, −2.1; femoral neck, −2.3; and total hip, −1.9.

Which of the following is the most appropriate pharmacologic treatment?

A: Alendronate

B: Estrogen

C: Raloxifene

D: Teriparatide

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Osteoporosis

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Osteoporosis: Important Causes

- Estrogen deficiency (most common)
- Low BMI, alcohol use disorder, smoking
- Hypogonadism
- Hyperthyroidism
- Hyperparathyroidism
- Malabsorption (celiac disease, IBD)
- Multiple myeloma
- Inflammatory joint disease
- HIV
- Glucocorticoids, anticonvulsants, GnRH agonists

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Osteoporosis: Bone Mineral Density (BMD) Screening

Women aged ≥65 years

Women aged <65 years with one or more clinical risk factors

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Osteoporosis: Diagnosis

Clinical diagnosis by fracture (DXA not needed)

- Fragility fracture (fracture after falling from standing height)
- Hip fracture
- Vertebral compression fracture

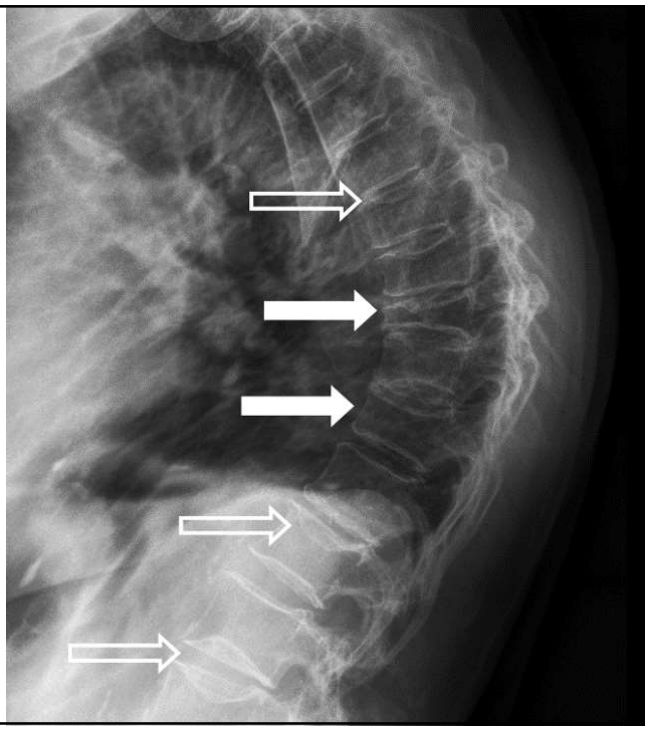


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Osteopenia and Osteoporosis: Testing

Osteopenia

- DXA T-score of −1.0 to −2.4

Osteoporosis

- DXA T-score of −2.5 or below

Premenopausal women and men aged <50 years

- Z-score below −2 (low bone mass for age)

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Osteoporosis: Nonpharmacologic Management

- Weight-bearing/muscle-strengthening exercise
- Smoking cessation
- Dietary calcium
- Vitamin D

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Osteoporosis: Bisphosphonate Therapy

First-line therapy

- Oral alendronate, risedronate
- IV zoledronic acid (annual)

Contraindications and complications

- Advanced CKD (eGFR <35 mL/min/1.73 m^2)
- For oral agents: esophageal disease (Barrett esophagus, strictures, varices, bariatric surgery)
- Osteonecrosis of jaw (more often seen in cancer treatment)
- Atypical femoral fracture

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Osteoporosis: Other Therapies

Denosumab

- Antibody to RANKL
- Second-line therapy
- Effects not sustained if stopped
  - Lifelong or followed by bisphosphonate therapy to prevent rebound fracture
- May be preferred in patients with either of the following:
  - Stage 4 CKD (but with caution because patients with kidney disease have increased risk for hypocalcemia with denosumab)
  - Intolerance or incomplete response to bisphosphonate

PTH/PTHrp analogues: teriparatide and abaloparatide

Romosozumab: sclerostin inhibitor

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Glucocorticoid-Induced Osteoporosis

BMD testing as soon as possible (within 6 months) after initiation of glucocorticoids

- Patients aged ≥40 years: DXA, Fracture Risk Assessment Tool, and vertebral fracture assessment (VFA)
- Patients aged <40 years: DXA and VFA

Treatment

- Moderate risk for fracture (or high risk and age <40 years): bisphosphonate, denosumab, or PTH/PTHrp analogue
- High risk for fracture and >40 years: denosumab or PTH/PTHrp analogue preferred
- Very high risk for fracture: PTH/PTHrp analogue

Other options if intolerance to other agents

- Raloxifene, romosozumab

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Metabolic Bone Disease Q4

A 78-year-old woman is evaluated for progressive weakness, fatigue, and myalgia over the past 6 months. Physical exam is noncontributory.

Laboratory studies:	
Albumin	3.9 g/dL
Alkaline phosphatase	190 U/L
Calcium	8.5 mg/dL
Phosphorus	2.4 mg/dL
PTH	100 pg/mL

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Metabolic Bone Disease Q4

A 78-year-old woman is evaluated for progressive weakness, fatigue, and myalgia over the past 6 months. Physical exam is noncontributory. Laboratory studies: albumin, 3.9 g/dL; alkaline phosphatase, 190 U/L; calcium, 8.5 mg/dL; phosphorus, 2.4 mg/dL; PTH, 100 pg/mL.

Which of the following levels is most appropriate to measure next?

A: Alkaline phosphatase isoenzymes

B: 1,25-Dihydroxyvitamin D

C: 25-Hydroxyvitamin D

D: Osteocalcin

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Vitamin D Deficiency and Osteomalacia

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Vitamin D Deficiency: Diagnosis

Mild deficiency is typically asymptomatic

Severe, prolonged deficiency (osteomalacia)

- Bone pain and tenderness
- Muscle weakness
- Difficulty walking/falls
- Low bone mass

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Vitamin D Deficiency: Testing

Screening not recommended

Test high-risk groups

- Low bone mass
- Bone fractures
- Hypocalcemia
- Hyperparathyroidism

Measure 25-hydroxyvitamin D [25(OH)D]

- Reflects dietary and skin-derived vitamin D

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Vitamin D Deficiency: Treatment

Population	Treatment
Most adults	Cholecalciferol (D_3) or ergocalciferol (D_2)
Patients with kidney disease	
eGFR ≥30 mL/min/1.73 m^2	Vitamin D_3 or D_2
eGFR <30 mL/min/1.73 m^2	Calcitriol (1,25-dihydroxyvitamin D [1,25(OH)2 D])
Patients with liver disease	Calcidiol [25(OH)D]
Patients with hypoparathyroidism	Calcitriol [1,25(OH)2 D]

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Osteomalacia

Failure of organic matrix of bone to mineralize

Low bone mass on DXA scan

- Indistinguishable from osteoporosis

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Osteomalacia: Causes

High-risk environmental conditions

- Nursing home residence
- "Tea and toast" diet
- Lack of sunlight exposure

Malabsorption of vitamin D

- Celiac disease, gastric bypass

Impaired production of active vitamin D

- Liver disease (particularly cholestatic)
- Kidney disease

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Osteomalacia: Testing

Low vitamin D level

Hypocalcemia

Hypophosphatemia

Elevated serum alkaline phosphatase level

Radiography

- Low BMD
- Cortex thinning
- Pseudofractures

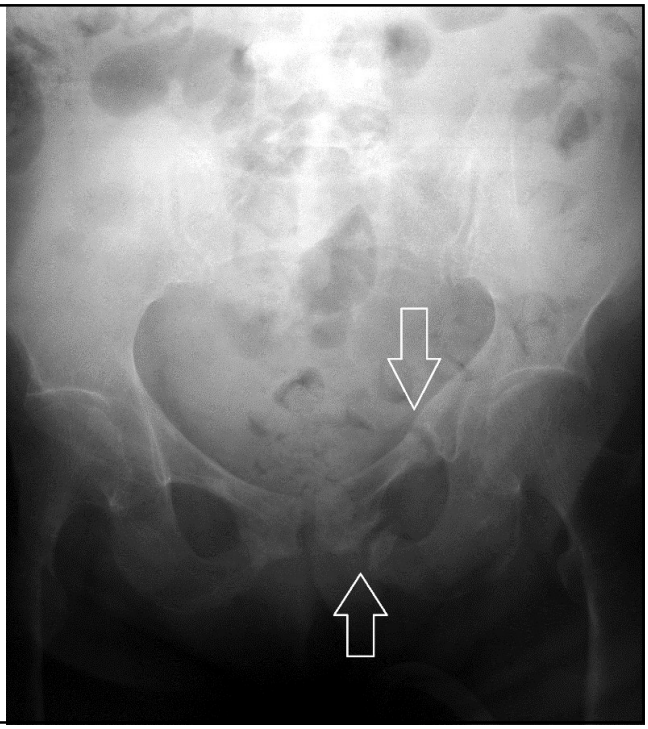


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Osteomalacia: Treatment

Vitamin D and calcium supplements

Targets

- Normal serum 25(OH)D level
- Normal calcium level
- Normal phosphorus level

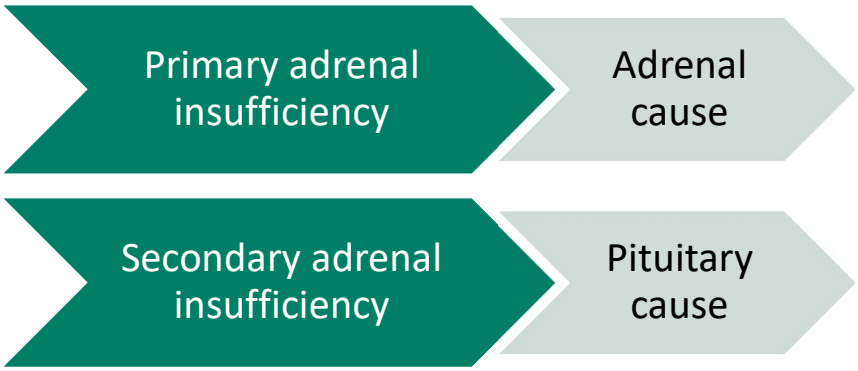
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Adrenal Insufficiency

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Adrenal Insufficiency: Diagnosis



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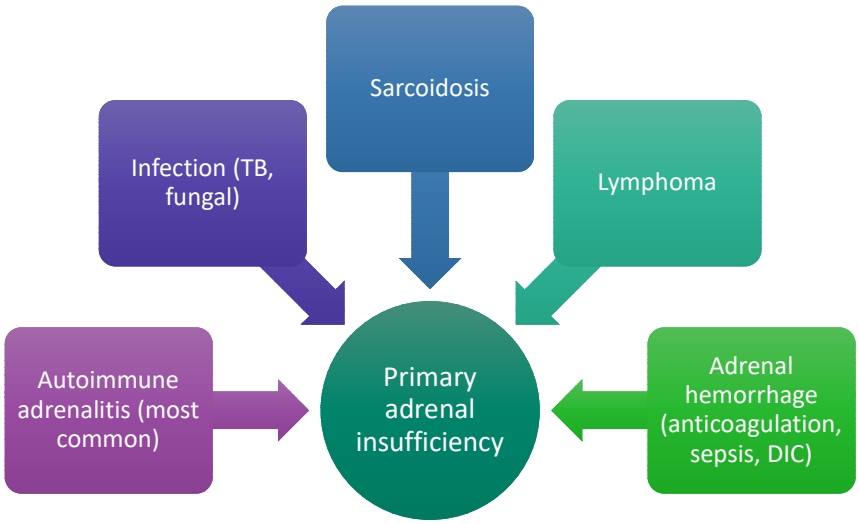
Adrenal Insufficiency: Diagnosis

- Orthostatic hypotension
- Weight loss
- Nausea/vomiting
- Hyperpigmentation (primary disease only)
- Hypoglycemia
- Hyponatremia
- Hyperkalemia (primary disease only)

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Primary Adrenal Insufficiency: Causes



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Primary Adrenal Insufficiency: Diagnosis

Biochemical findings

- ↓ Cortisol level
- ↓ Adrenal androgens
- ↓ Aldosterone level
- ↑ ACTH level

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Secondary Adrenal Insufficiency: Diagnosis

Hypothalamic-pituitary suppression

- Most commonly from glucocorticoid use
- Chronic opioid use

Pituitary damage

- Tumor, infarction, hemorrhage, trauma
- Checkpoint inhibitor–induced hypophysitis

Biochemical findings

- Hypopituitarism frequent
- ↓ Cortisol level
- Normal aldosterone and renin levels
- Low or inappropriately normal ACTH level

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Adrenal Insufficiency: Testing

Measure morning serum total cortisol level

<3 µg/dL	3-15 µg/dL	>15-18 µg/dL
Adrenal insufficiency	Indeterminate	Adrenal insufficiency ruled out
Measure ACTH level	Perform ACTH (cosyntropin) stimulation test	No further testing

ACTH (cosyntropin) stimulation test

- If morning serum cortisol level fails to ↑ after stimulation, use baseline ACTH level to determine primary versus secondary

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Adrenal Insufficiency: Testing

↑ ACTH level

- Primary adrenal insufficiency
- Measure 21-hydroxylase antibody
- Evaluate with CT of the adrenal glands if 21-hydroxylase antibody is negative
- Consider adrenoleukodystrophy in young males

Normal or ↓ ACTH level

- Secondary adrenal insufficiency
- Evaluate with pituitary MRI

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Adrenal Insufficiency: Treatment

Acute adrenal insufficiency therapy

- High-dose hydrocortisone and IV saline

Chronic adrenal insufficiency therapy

- Hydrocortisone (glucocorticoid)
- Fludrocortisone (mineralocorticoid)
  - Primary adrenal insufficiency only

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Stress Dose Replacement Strategy

Minor physiologic stress

- ↑ Glucocorticoid replacement dose 2-3 times baseline for 2-3 days

Major physiologic stress

- Higher-dose glucocorticoid replacement for longer periods of time
- Fludrocortisone not required if replacement hydrocortisone dose >50 mg/d

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Metabolic Bone Disease Q5

A 35-year-old man reports a 2-month history of low libido.

Puberty was normal.

He drinks two beers weekly and takes no medications.

Physical exam findings, including testicular size and BMI, are normal.

Total testosterone level (4 PM) is 200 ng/dL.

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Metabolic Bone Disease Q5

A 35-year-old man reports a 2-month history of low libido. Puberty was normal. He drinks two beers weekly and takes no medications. Physical exam findings, including testicular size and BMI, are normal. Total testosterone level (4 PM) is 200 ng/dL.

Which of the following is the most appropriate next diagnostic test?

A: Morning serum free testosterone

B: Morning serum total testosterone

C: Serum ferritin and transferrin saturation

D: Testicular ultrasonography

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Male Hypogonadism

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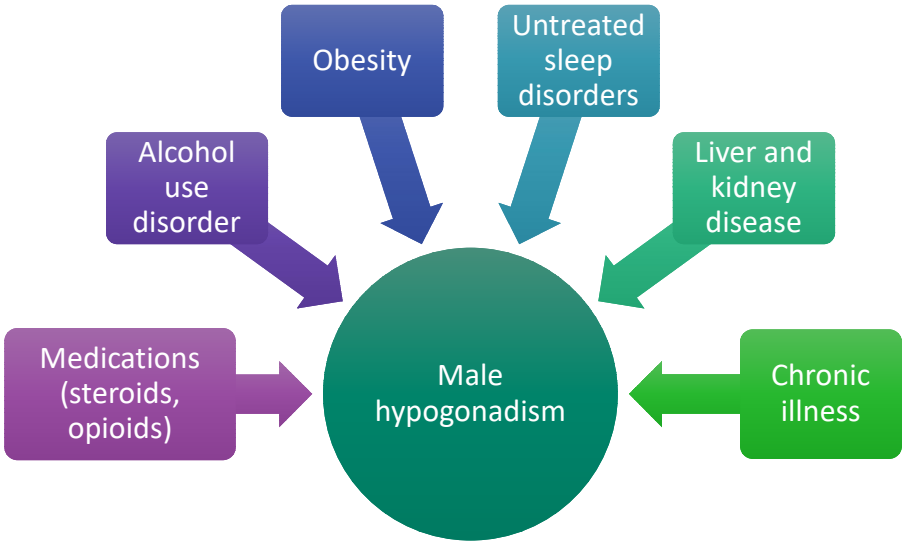
Male Hypogonadism: Diagnosis

- Decreased/absent morning erections
- Decreased libido
- Gynecomastia
- Hot flashes
- Fragility fractures (osteoporosis)
- Infertility

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Male Hypogonadism: Contributing Conditions



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Male Hypogonadism: Testing

Measure 8 AM serum total testosterone

- <200 ng/dL on two occasions supports diagnosis
- 200-350 ng/dL (measure free or bioavailable testosterone)

Measure free or bioavailable testosterone in persons with obesity

- Lower sex hormone–binding globulin in obesity

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Male Hypogonadism: Testing

If testosterone level is low

- Measure serum luteinizing hormone (LH) and follicle-stimulating hormone (FSH)
- ↑ LH or FSH → primary testicular failure
- Normal or ↓ LH or FSH → secondary hypogonadism

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Male Hypogonadism: Testing

Evaluation of secondary hypogonadism

- Prolactin level (prolactinoma)
- Pituitary MRI (pituitary adenoma) when total testosterone is <150 ng/dL, other pituitary deficiencies, or elevated prolactin
- Iron studies (hemochromatosis)
- Medication review (chronic opioid therapy)
- Sleep apnea screening

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Male Hypogonadism: Treatment

Treat underlying disorder

Testosterone replacement therapy

- Transdermal (preferred)
- Intramuscular testosterone (least expensive)
- Oral and subcutaneous formulations also available
- Contraindicated in patients with prostate cancer, severe LUTS, erythrocytosis, untreated sleep apnea, recent MI or CVA

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Metabolic Bone Disease Q6

A 42-year-old man has a 6-month history of painful, enlarged breasts.

He had normal puberty, and he takes no medications.

Symmetric tender gynecomastia is present, with normal testicular volume and masses.

Serum levels are hCG, 2 mU/mL; LH, 5 mU/mL; and total morning testosterone, 400 ng/dL.

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Metabolic Bone Disease Q6

A 42-year-old man has a 6-month history of painful, enlarged breasts. He had normal puberty, and he takes no medications. Symmetric tender gynecomastia is present, with normal testicular volume and masses. Serum levels are hCG, 2 mU/mL; LH, 5 mU/mL; and total morning testosterone, 400 ng/dL.

Which of the following is the most appropriate next diagnostic test?

A: Adrenal CT

B: Estradiol level measurement

C: Karyotype

D: Testicular ultrasonography

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Gynecomastia

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Gynecomastia: Causes

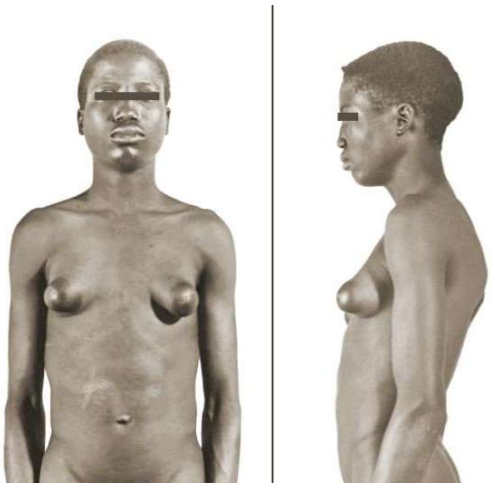
Physiologic	Pathologic	Pharmacologic
• Puberty • Aging	• Hypogonadism • Hyperprolactinemia • Adrenal tumors • Testicular germ cell tumors • Thyroid disorders • Obesity/malnutrition • Cirrhosis • CKD • Substance use disorder	• Estrogens • Spironolactone • Cimetidine • Ketoconazole • Growth hormone • Gonadotropins • 5α-Reductase inhibitors

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Gynecomastia: Diagnosis

- Evidence of predisposing pathologic condition
- Rubbery, concentric, subareolar mass
- Typically bilateral; possible breast cancer if unilateral



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Gynecomastia: Testing

Asymptomatic and long-standing

- Testosterone
- If testosterone low → measure FSH, LH

Acute, painful, or large

- Testosterone
- Estradiol
- LH, FSH
- hCG
- Thyroid-stimulating hormone (TSH), free T_4

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Gynecomastia: Testing

Unilateral or fixed mass

- Breast ultrasonography or mammography

Elevated estradiol and low or normal LH

- Testicular ultrasonography
- Adrenal CT (if testicular ultrasound negative)

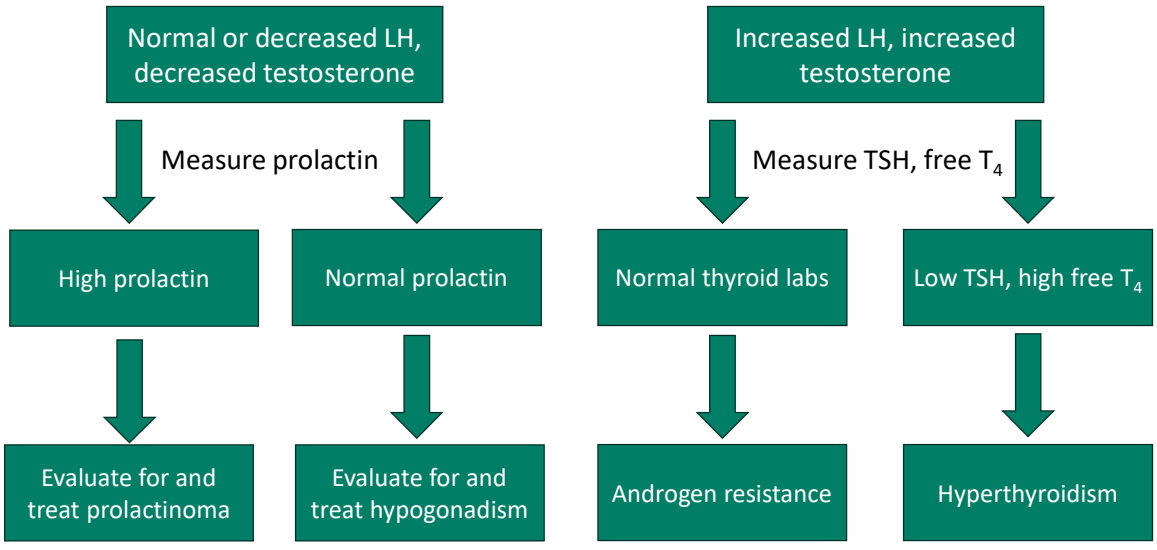
Elevated hCG

- Testicular ultrasonography
- CT of chest and abdomen (if testicular ultrasound negative)

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Gynecomastia: Testing



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Endocrinology III - Metabolic Bone Disease, Adrenal Disease, and Reproductive Disorders

- Answers to Multiple-Choice Questions

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Metabolic Bone Disease Q1

A 59-year-old man is evaluated for hypercalcemia. He reports no symptoms. He has recently diagnosed multiple myeloma and takes no medications. Physical exam, including vital signs, is normal. Serum calcium level is 10.8 mg/dL.

Which of the following levels should be measured next?

A: 1,25-Dihydroxyvitamin D

B: Ionized calcium

C: Parathyroid hormone (PTH)

D: PTH-related peptide

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Metabolic Bone Disease Q2

A 45-year-old man is evaluated for a 3-month history of fatigue, constipation, polydipsia, and polyuria. He has hypertension. Medications are losartan and diltiazem. Exam findings, including vital signs, are normal. Serum calcium level is 11.4 mg/dL, phosphorus level is 2.2 mg/dL, and serum creatinine level is 1.1 mg/dL.

Which of the following levels should be measured next?

A: 25-Hydroxyvitamin D

B: Calcitonin

C: PTH

D: PTHrP

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Metabolic Bone Disease Q3

A 54-year-old woman is evaluated for a bone health assessment. She is postmenopausal. FRAX shows 22% risk for major osteoporotic fracture and 2.4% risk for hip fracture over 10 years. T-scores are lumbar spine, −2.1; femoral neck, −2.3; and total hip, −1.9.

Which of the following is the most appropriate pharmacologic treatment?

A: Alendronate

B: Estrogen

C: Raloxifene

D: Teriparatide

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Metabolic Bone Disease Q4

A 78-year-old woman is evaluated for progressive weakness, fatigue, and myalgia over the past 6 months. Physical exam is noncontributory. Laboratory studies: albumin, 3.9 g/dL; alkaline phosphatase, 190 U/L; calcium, 8.5 mg/dL; phosphorus, 2.4 mg/dL; PTH, 100 pg/mL.

Which of the following levels is most appropriate to measure next?

A: Alkaline phosphatase isoenzymes

B: 1,25-Dihydroxyvitamin D

C: 25-Hydroxyvitamin D

D: Osteocalcin

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Metabolic Bone Disease Q5

A 35-year-old man reports a 2-month history of low libido. Puberty was normal. He drinks two beers weekly and takes no medications. Physical exam findings, including testicular size and BMI, are normal. Total testosterone level (4 PM) is 200 ng/dL.

Which of the following is the most appropriate next diagnostic test?

A: Morning serum free testosterone

B: Morning serum total testosterone

C: Serum ferritin and transferrin saturation

D: Testicular ultrasonography

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Metabolic Bone Disease Q6

A 42-year-old man has a 6-month history of painful, enlarged breasts. He had normal puberty, and he takes no medications. Symmetric tender gynecomastia is present, with normal testicular volume and masses. Serum levels are hCG, 2 mU/mL; LH, 5 mU/mL; and total morning testosterone, 400 ng/dL.

Which of the following is the most appropriate next diagnostic test?

A: Adrenal CT

B: Estradiol level measurement

C: Karyotype

D: Testicular ultrasonography

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Endocrinology IV

2025 Virtual/Live Internal Medicine Board Review

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ACP Internal Medicine Board Review Course

Endocrinology IV: Dyslipidemia and Obesity

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Table of Contents: Dyslipidemia and Obesity

- Hypercholesterolemia
- Hypertriglyceridemia
- Obesity

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Hypercholesterolemia

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Dyslipidemia

A range of lipid abnormalities that may include the following:

- Elevated total cholesterol
- Elevated LDL cholesterol
- Elevated triglycerides
- Low HDL cholesterol

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Hyperlipidemia: Pathophysiology

LDL cholesterol

- Most atherogenic lipoprotein
- Associated with ↑ ASCVD risk

HDL cholesterol

- Protects against ASCVD
- Low HDL not linked to ↑ ASCVD risk

Triglycerides

- Independently associated with ↑ ASCVD risk
- Associated with pancreatitis

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Hyperlipidemia: Lipid Level Evaluation

USPSTF recommendations

- Universal screening in patients aged 40-75 years for ASCVD risk calculation
- Screening in patients aged 21-39 years: Use clinical judgment
- Measuring lipid levels every 5 years is reasonable

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Hyperlipidemia: Lipid Level Evaluation

AHA/ACC recommendations

- Screen all patients aged 40-75 years for ASCVD risk calculation
- Measurement reasonable in patients aged 20-39 years to assess traditional risk factors
- Screen patients with family history of familial hypercholesterolemia or premature ASCVD/genetic hyperlipidemia





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Atherosclerotic Cardiovascular Disease (ASCVD) Risk Estimation

10-year ASCVD risk is estimated using Pooled Cohort Equations

Evaluate cardiovascular risk in patients:

- Aged 40-75 years;
- With LDL cholesterol 70-189 mg/dL (1.8-4.9 mmol/L); and
- With no diabetes or clinical ASCVD

Helps predict benefit of statin therapy for primary prevention

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Hypercholesterolemia: Diagnosis

Consider familial hypercholesterolemia if either:

- LDL cholesterol level ≥190 mg/dL (4.9 mmol/L)
- Family history of premature ASCVD/genetic hyperlipidemia

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Hypercholesterolemia: Treatment

Therapeutic lifestyle changes for all patients

- Dietary modification
  - Plant-based diet
  - Mediterranean diet
- Moderate to vigorous physical activity (150 min/wk)
- Weight loss
- Smoking cessation



Photo by Jaimie Duplass.

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Dyslipidemia and Obesity Q1

A 47-year-old man has a 2-year history of type 2 diabetes.

Aside from diabetes, he has no other traditional risk factors for ASCVD.

Triglyceride level is 201 mg/dL.

His 10-year ASCVD risk is estimated at 6.9%.

Lifestyle counseling is provided.

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Dyslipidemia and Obesity Q1

A 47-year-old man has a 2-year history of type 2 diabetes. Aside from diabetes, he has no other traditional risk factors for ASCVD. Triglyceride level is 201 mg/dL. His 10-year ASCVD risk is estimated at 6.9%. Lifestyle counseling is provided.

Which of the following is the most appropriate treatment?

A: Gemfibrozil

B: High-intensity statin

C: Moderate-intensity statin

D: No additional treatment

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Hypercholesterolemia: Statin Therapy

Statin Intensity	Drug and Dosage
High intensity	Atorvastatin, 40-80 mg/d Rosuvastatin, 20-40 mg/d
Moderate intensity	Atorvastatin, 10-20 mg/d Rosuvastatin, 5-10 mg/d Simvastatin, 20-40 mg/d Pravastatin, 40-80 mg/d Lovastatin, 40 mg/d Fluvastatin, 40 mg twice daily

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Hypercholesterolemia: Primary Prevention Statin Therapy

ACC/AHA	USPSTF	VA/DoD
Moderate-intensity statin (any): • Diabetes and age 40-75 y • Intermediate 10-y ASCVD risk[a] with risk enhancers **High-intensity statin** (any): • LDL cholesterol level ≥190 mg/dL • High 10-y ASCVD risk[b] • Diabetes with multiple ASCVD risk factors	**Low- to moderate-intensity statin**: • ≥1 ASCVD risk factor (dyslipidemia, diabetes, hypertension, or smoking) with 10-y ASCVD risk of 10% or higher • Selective consideration if risk 7.5%-10%	**Moderate-intensity statin** (any): • 10-y ASCVD risk ≥12% • LDL cholesterol level ≥190 mg/dL • Diabetes

[a]Intermediate 10-y ASCVD risk = ≥7.5% to <20%
[b]High 10-y ASCVD risk = ≥20%.

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Hypercholesterolemia: Primary Prevention Adjuvant Therapy

Ezetimibe if both:

- Initial LDL cholesterol level ≥190 mg/dL (4.9 mmol/L)
- <50% reduction in LDL cholesterol and level >100 mg/dL (2.6 mmol/L) on maximum-tolerated statin therapy

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Dyslipidemia and Obesity Q2

A 70-year-old woman is hospitalized for acute ischemic stroke.

MRI shows multiple previous strokes.

Laboratory studies:	
Total cholesterol	243 mg/dL
LDL cholesterol	145 mg/dL
HDL cholesterol	38 mg/dL
Triglycerides	302 mg/dL

Aspirin is initiated, and lifestyle counseling is ongoing.

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Dyslipidemia and Obesity Q2

A 70-year-old woman is hospitalized for acute ischemic stroke. MRI shows multiple previous strokes. Aspirin is initiated, and lifestyle counseling is ongoing.

Which of the following is the most appropriate additional treatment?

A: Ezetimibe

B: High-intensity statin

C: Moderate-intensity statin

D: PCSK9 inhibitor

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Hypercholesterolemia: Secondary Prevention of Clinical ASCVD[a]

Treatment	ACC/AHA Recommendations
High-intensity statin	Patients aged ≤75 years with clinical ASCVD
Moderate-intensity statin	Patients aged >75 years with clinical ASCVD Patients in whom high-intensity statin is contraindicated or not tolerated
Add ezetimibe	Patients at very high risk[b] with LDL cholesterol level ≥70 mg/dL despite statin
Add PCSK9 inhibitor	Patients at very high risk[b] with LDL cholesterol level ≥70 mg/dL despite statin + ezetimibe

[a]ACS, history of MI, angina, revascularization, stroke, TIA, or PAD.
[b]Very high risk = multiple major ASCVD events (MI within 12 months; history of MI, CVA, PAD) or one major ASCVD event plus multiple high-risk conditions.

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Hypercholesterolemia: Statin Monitoring

Before initiating statin treatment

- Fasting lipid panel
- Aminotransferase levels

During statin treatment

- Lipid panel in 1 to 3 months to assess adherence/response
- Repeat lipid panel every 3 to 12 months
- CK level only if severe muscle symptoms or muscle weakness
- Liver panel only if symptoms suggesting hepatotoxicity

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Hyperlipidemia: Statin Interactions and Adverse Effects

Drugs that ↑ statin levels

- Fibrates (primarily gemfibrozil)
- Cyclosporine, macrolides, antifungals
- CCBs, amiodarone

Adverse effects

- Statin-associated muscle symptoms
- Rhabdomyolysis
  - Lowest risk: pravastatin, fluvastatin
- Liver failure (rare)

Contraindicated in pregnancy

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Hyperlipidemia: Statin-Associated Muscle Symptoms

Reassess and rechallenge

- Modified dosing regimen
  - E.g., lower dose, dose three times a week
- Alternate statin
- Statin + nonstatin therapy

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Dyslipidemia and Obesity Q3

A 43-year-old woman has a history of acute pancreatitis due to hypertriglyceridemia.

She follows a very-low-fat diet and avoids refined carbohydrates and alcohol.

Medications are simvastatin, 40 mg/d, and an omega-3 fatty acid supplement.

Fasting triglyceride level is 530 mg/dL.

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Dyslipidemia and Obesity Q3

A 43-year-old woman has a history of acute pancreatitis due to hypertriglyceridemia. She follows a very-low-fat diet and avoids refined carbohydrates and alcohol. Medications are simvastatin, 40 mg/d, and an omega-3 fatty acid supplement. Fasting triglyceride level is 530 mg/dL.

Which of the following is the most appropriate treatment?

A: Colestipol

B: Ezetimibe

C: Fenofibrate

D: PCSK9 inhibitor

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Hypertriglyceridemia

ACP

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Hypertriglyceridemia: Causes

Diabetes and metabolic syndrome

Excessive alcohol intake

Hypothyroidism

Nephrotic syndrome

CKD or liver disease

Medications

- Glucocorticoids, protease inhibitors, estrogens, tamoxifen

Obesity

Concentrated sugar intake

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Hypertriglyceridemia: Testing



Photo by fmajor/iStockphoto/Getty Images.

Lipid panel (for ASCVD risk calculation)

- Repeat fasting measurement if triglyceride level >400 mg/dL

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Hypertriglyceridemia: Treatment

Triglyceride level 175-499 mg/dL (2.0-5.6 mmol/L)

- Lifestyle interventions (up to 70% reduction)
- Treat reversible causes
- Avoid contributing medications
- Add statin if 10-year ASCVD risk ≥7.5%
- If level remains high on statin and patient has ASCVD or diabetes, is older than age 50 years, and has one other ASCVD risk factor, consider icosapent ethyl

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Hypertriglyceridemia: Treatment

Triglyceride level ≥500 mg/dL (5.65 mmol/L)

- Very-low-fat diet
- Omega-3 fatty acid consumption
- Avoidance of refined carbohydrates, alcohol
- Add statin if 10-year ASCVD risk ≥7.5%
  - Add icosapent ethyl if triglycerides remain high
- Fibrate therapy
  - Prevents pancreatitis
  - Fenofibrate preferred to gemfibrozil
  - 50% to 70% triglyceride reduction



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Dyslipidemia and Obesity Q4

A 38-year-old man is evaluated for obesity.

He has never received weight loss treatment.

He is otherwise healthy.

BP is 122/70 mm Hg.

BMI is 36, and waist circumference is 42 inches.

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Dyslipidemia and Obesity Q4

A 38-year-old man is evaluated for obesity. He has never received weight loss treatment. He is otherwise healthy. BP is 122/70 mm Hg. BMI is 36, and waist circumference is 42 in.

Which of the following is the most appropriate treatment?

A: Bariatric surgery

B: Lifestyle interventions

C: Orlistat

D: Phentermine-topiramate

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Obesity

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Obesity: Pathophysiology

Multifactorial

- Hormonal/metabolic
- Immunologic
- Genetic
- Behavioral
- Environmental
- Social/cultural

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Obesity: Pathophysiology

Endocrine and immune response

- Prediabetes and diabetes
- Hypertension
- Dyslipidemia
- ASCVD
- Cerebrovascular accident
- Metabolic dysfunction–associated steatotic liver disease

Pathologic physical forces

- Osteoarthritis
- Obstructive sleep apnea
- Obesity hypoventilation syndrome
- Gastroesophageal reflux disease
- Immobility
- Intertrigo

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Obesity: Screening and Diagnosis

USPSTF

- Calculate BMI for all patients
- Measure waist circumference

Weight		Disease Risk (Waist Circumference)	
Category*	**BMI**	**Men (≤40 in [102 cm]) Women (≤35 in [88 cm])**	**Men (>40 in [102 cm]) Women (>35 in [88 cm])**
Overweight	25 to 29.9	Increased	High
Obesity, class I	30 to 34.9	High	Very high
Obesity, class II	35 to 39.9	Very high	Very high
Obesity, class III	≥40	Extremely high	Extremely high

*Criteria for stratification of obesity varies by ethnicity. In Asian populations, BMI for overweight is 23-27.5, and BMI for obesity is >27.5.

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Obesity: Treatment

Loss of 3% to 5% of initial weight

- ↓Triglyceride level
- ↓ Glucose level

Greater weight loss

- ↓ BP
- Improved LDL and HDL cholesterol levels

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Obesity: Nonpharmacologic Therapy

Lifestyle interventions for all patients

Behavioral counseling

- Food monitoring, step counting, weighing

Moderate-intensity exercise (150-300 min/wk)

- Any exercise desirable

Calorie deficit ≥500 kcal/d

- All calorie-restricted diets work
- Prescribe a diet to which the patient will likely adhere

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Obesity: Pharmacologic Therapy

Indications

- BMI ≥30 without comorbidities
- BMI ≥27 plus weight-related comorbidities

All FDA-approved antiobesity agents contraindicated in pregnancy

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Obesity: Pharmacologic Therapy

Orlistat

- Alters fat absorption
- Oily stools, stool incontinence, severe liver injury

Liraglutide, semaglutide, tirzepatide

- Inhibits gastric emptying
- Anorexic effect
- Risk for thyroid C-cell tumors (animal studies)
- Contraindicated with history of pancreatitis or personal or family history of MEN2

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Obesity: Pharmacologic Therapy

Bupropion/naltrexone

- Anorexic effect
- Contraindications: epilepsy, uncontrolled BP, opioid use

Phentermine-topiramate

- Anorexic effect
- Kidney stones

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Antiobesity Medications: Adverse Effects

Medication	Common Adverse Effects
Orlistat	Oily stools, stool incontinence, liver injury
Phentermine	Dry mouth, constipation, headache, insomnia
Topiramate	Drowsiness, impaired cognition
Bupropion	Nausea, headache, insomnia, increase in blood pressure
Naltrexone	Dizziness, insomnia, nausea, vomiting
GLP-1 RAs (liraglutide, semaglutide) and GLP-1/GIP (tirzepatide)	Nausea, diarrhea, constipation, pancreatitis Thyroid C-cell tumors*

*Adverse effect of GLP-1 RAs noted in animal studies.

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Antiobesity Medications: Contraindications

Clinical Situation	Do NOT Use
History of acute-angle closure glaucoma	Phentermine, topiramate, bupropion, naltrexone
History of kidney stones	Phentermine, topiramate, orlistat
Gallstones	Orlistat, caution with GLP-1 RAs
History of thyroid C-cell tumor	GLP-1 RAs
History of pancreatitis	GLP-1 RAs
Epilepsy	Bupropion
Uncontrolled blood pressure	Bupropion
Opioid use	Naltrexone

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Obesity: Metabolic and Bariatric Surgery

Indications

- BMI ≥35
- BMI of 30 to 34.9 with type 2 diabetes mellitus

Long-term postsurgical care

- Preventing nutritional deficiencies
- Managing adherence to lifestyle modifications
- Monitoring for behaviors that lead to weight regain

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Obesity: Metabolic and Bariatric Surgery

- Sleeve gastrectomy: most common procedure, less malabsorption
- Roux-en-Y gastric bypass
- Biliopancreatic diversion with duodenal switch
  - Most malabsorption-associated procedure

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Obesity: Metabolic and Bariatric Surgery Postoperative Care

Anastomotic leak

- Usually in the first week
- Nonspecific findings, fever, tachycardia, respiratory symptoms, pain
- CT or barium swallow

Closely monitor chronic medical conditions

Hypoglycemia in patients with diabetes

- Preemptively discontinue medications such as sulfonylureas, adjust insulin

Most common nutritional deficiencies

- Iron, vitamin B_{12}, folate, calcium, vitamin D

Marginal ulcers (avoid NSAIDs)

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Endocrinology IV - Dyslipidemia and Obesity

- Answers to Multiple-Choice Questions

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Dyslipidemia and Obesity Q1

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