

ANTICOAGULATION

can start as soon as 48-72 hrs after surgery w/out increased risk of bleeding

When treating DVT, use unfractionated or LMWH, bridge to warfarin ≥ 3 mo w goal INR 2-3. heparin prevents extension of the clot and devpt of future clots, does not lyse current clot.

	mechanism	labs	complications
unfractionated heparin		Platelet count $\downarrow \geq 50\%$ from baseline (nadir of 30,000-60,000) follow aPTT: goal aPTT > 1.5-2 times normal, at which point warfarin is initiated ("heparin bridge")	Type 1 HIT — <ul style="list-style-type: none"> Nonimmune direct effect of heparin on platelet activation usually presents within first 2 days of heparin exposure. Then platelet count normalizes with continued heparin therapy. No clinical consequences. Type 2 HIT — <ul style="list-style-type: none"> Immune-mediated disorder due to antibodies to platelet factor 4 (PF4) complexed with heparin -> platelet aggregation, thrombocytopenia, thrombosis *arterial and venous) Presents 5-10 days after initiation of heparin therapy Severe, may lead to life-threatening consequences *limb ischemia, stroke)
low molecular weight heparin (LMWH) = enoxaparin		normal aPTT	cannot be used in patients with severe renal insufficiency (estGFR < 30 mL/min/1.73m ² – reduced renal clearance increases anti-Xa activity levels and bleeding risk —> use unfx heparin
Factor Xa inhibitors (fondaparinux(injection), rivaroxaban (oral))	immediate onset of action		cannot be used in patients with severe renal insufficiency (estGFR < 30 mL/min/1.73m ² – reduced renal clearance increases anti-Xa activity levels and bleeding risk —> use unfx heparin
Warfarin	Co-administered with IV unfractionated or LMWH. Do not use alone due to initial hypercoagulable state from transient protein C depletion and risk of thrombosis and skin necrosis	takes up to 5-7 days to reach therapeutic levels can stop heparin bridge when INR is therapeutic	



COAGULATION DISORDERS

Warfarin mechanism:

Inhibits production of vitamin K-**dependent** clotting factors II, VII, IX, and X.

& Inhibits production of natural anticoagulants protein C and S

Prothrombotic					Bleeding
Warfarin-induced skin necrosis	Heparin-induced thrombocytopenia (HIT)	Antithrombin III deficiency	Factor V Leiden mutation	Antiphospholipid antibody syndrome (APS)	Factor VII deficiency
<p>Protein C production decreases faster (50% within first day) while levels of procoagulant factors (II, IX and X) decline more slowly = transient hypercoagulable state</p> <p>Increase the risk for venous thromboembolism and skin necrosis, esp in patients with underlying hereditary protein C deficiency</p> <p>Typically within first few days of warfarin therapy, esp at large loading doses</p>	<p>Caused by autoantibodies to platelet factor 4 (PF4) complexed with heparin</p> <p>Thrombocytopenia, arterial or venous thrombosis, and necrotic skin lesions at heparin injection sites within 5-10 days of therapy.</p>	<p>Antithrombin III = vitamin K-independent inhibitor of the clotting cascade</p> <p>Predisposes to thrombus formation</p>	<p>Increases risk for venous thromboembolis (DVT or PE)</p> <p>Inc risk for cerebral mesenteric portal vein thrombosis</p>	<p>False positive VDRL</p> <p>Prolonged PTT</p> <p>Thrombocytopenia</p> <p>Inc risk for recurrent pregnancy losses/spontaneous abortions, arterial and venous thrombosis</p> <p>Dx:</p> <ul style="list-style-type: none"> • VDRL (false positive) • Prolonged PTT • Thrombocytopenia 	<p>Bleeding diathesis characterized by bruising and hemorrhage</p>
			<p>Anticoagulants</p> <p>Initiation of warfarin should not cause unusual hypercoagulability</p>	<p>Low dose aspirin and LMWH to avoid pregnancy loss</p>	

BACK PAIN

vertebral osteomyelitis	Tenderness to gentle percussion on spinal processes pain not relieved with rest	IVDU, sickle cell anemia, immunosuppressed are at highest risk	Dx by MRI (most sensitive) ESR sig elevated > 100mm/hg Platelet count high as marker of inflammation/stress Rx = longterm IV abx +/- surgery
Ankylosing spondylitis	Pain and progressive limitation of back motion Sx worst in the morning, improve as day progresses		
Lumbar disk herniation	Acute onset pain +/- radiation down a leg Usually 2/2 an inciting event Pain worse with activity and improves with rest		
Lumbar spinal stenosis = arrowing of spinal canal with compression of 1 or more spinal roots	Pain radiating to buttocks and thighs Sx worsen with walking and lumbar extension (walking down hill), better w lumbar flexion (shopping cart) +/- Numbness and paresthesias	Usually patients > 60yo	Dx by MRI
Vertebral compression fracture	Local tenderness to palpation	Elderly patients with history of osteoporosis	

BREAST CANCER (V INFECTIOUS)

Nipple discharge in a non-lactating woman – esp if spontaneous, unilateral, localized to a single duct, pt is >40yo, bloody, or assd with mass

	Breast cancer		Infectious	
	inflammatory breast carcinoma		Cellulitis/abscess	mastitis
appearance	Peau d'orange = brawny edematous cutaneous plaque, overlying a breast mass.		Erythematous and edematous cutaneous plaque	
Prognosis				
Dx	Most present with axillary lymphadenopathy,			
Rx	¼ are found to have subsequent metastatic dz		Abx that covers Staphylococci Should be encouraged to continue breastfeeding or breast pumping from the affected breast	

ACUTE BACTERIAL RHINOSINUSITIS

Pathogen	<ul style="list-style-type: none">Usually preceded by viral URIStreptococcus pneumoniaeHaemophilus influenzae
Sx	<ul style="list-style-type: none">Purulent nasal dischargeFacial painFever
	Complicated: <ul style="list-style-type: none">Periorbital edemaVision abnormalitiesAltered mental status
Dx	A clinical diagnosis <ul style="list-style-type: none">Persistent symptoms \geq 10 days without improvementSevere symptoms, fever \geq 39 C, purulent nasal discharge, or face pain \geq 3 days,Worsening symptoms \geq 5 days after initially improving viral URI
Rx	Oral amoxicillin-clavulanic acid + intranasal corticosteroids if hx of allergic rhinitis

ENT - PATHOLOGY

		Cause	Sx
Serious otitis media	Most common middle ear pathology in pts w AIDS	Presence of middle ear effusion without evidence of an acute infection	Conductive hearing loss Dull tympanic membrane that is hypomobile on pneumatic otoscopy
Otosclerosis		Bony overgrowth of stapes	Conductive hearing loss

DYSPHAGIA - ENT

		organism	Signs/sx	Rx
Pts without HIV	Ludwig anginaÂ (rapidly progressive bilateral cellulitis of submandibular and sublingual spacs)	Classically streptococcus and anaerobes from infected second or third mandibular molar.	Fever Dysphagia Odynophagia Drooling (from swelling of submandibular space and posterior displacement of tongue) Induration of submandibular space, +/- crepitus from anaerobes. Can die of asphyxiation	Intubation if necessary. Abx and removal of infected tooth.
	[diffl dx — Cervical actinomycosis	Actinomyces -- anaerobic, gram +, filamentous branching bacteria colonizes the oral cavity	Risk factors: malnutrition, poor oral hygiene, diabetes mellitus, immunosuppression, local tissue damage (eg irradiation) Presentation: Chronic slowly progressive, nontender indurated mass Extends through tissue planes to form abscess, fistula, and draining sinus tract Mandible isth most commonly involved site	Penicillin for prolonged (12 hrs) + surgical excision for more severe cases (extensive abscesses, persistent sinus tracts)

Patients with HIV	+ Oral thrush, mild sx	Candida likely		Empiric treatment (eg, fluconazole) Endoscopy if no improvement with treatment
	- Oral thrust, severe sx	Dx: endoscopy for likely viral (eg HSV, CMV) etiology:		
		White plaques = candida		Fluconazole Resistant voriconazole, echinocandins (caspofungin), or amphotericin
		Large linear ulcers = CMV likely,		Ganciclovir Acyclovir — not useful bc the virus does not encode the thymidine kinase enzyme to convert acyclovir to its active form
		Vesicles & round/ovoid ulcers (usually multiple, small, well circumscribed) = HSV likely	Cells w ballooning degeneration and eosinophilic intranuclear inclusions	Acyclovir
		Aphthous ulcers (noninfectious)		Symptomatic therapy -- topical corticosteroids. Recurrent - prednisone

HIV - IMMUNIZATIONS

Vaccine	Indications
HAV	Chronic liver disease (including hepatitis B and C) Men who have sex with men IV drug users
HBV	All patients without documented immunity to HBV
HPV	Men and women age 9-26
Influenza	Annually for all patients
Meningococcus	All patients age 11-18 Large groups living in close proximity (college students, military recruits, incarcerated patients) Asplenia or complement deficiency
Pneumococcus	PCV13 once PPSV23 8 weeks later, then every 5 years
Tetanus, diphtheria & pertussis	Tdap once Repeat Tdap for women during each pregnancy Td every 10 years following Tdap
Live vaccines -- MMR, varicella, zoster, live-attenuated influenza	Contraindicated if CD4+ cell count <200/uL

PCV13 = 13-valent pneumococcal conjugate vaccine

PPSV23 = 23-valent pneumococcal polysaccharide vaccine

PCP

Defn	Fungal organism called pneumocystis jiroveci AIDS defining illness, CD4 count < 200/mL
S/sx	Hypoxia out of proportion to the radiographic findings is suggestive. nonproductive cough, progressive dyspnea, weight loss, tachypnea
Labs/Imaging	CXR = bilateral interstitial infiltrates and/or alveolar infiltrates, or normal Serum LDH levels are frequently elevated.Â Dx confirmed by organism in sputum (induced by hypertonic saline - specific but only 50% sensitive) or BAL aspirate (>90% sensitive and specific)

BONE MARROW TRANSPLANT

	CMV
timing	~45 days (2wks-4mo) post BMT
S/sx	fever, dyspnea, dry cough (2/2 pneumonitis) + abd pain, diarrhea (2/2 upper and lower GI ulcers) bone marrow suppression, arthralgias, myalgias, esophagitis
Labs/Imaging	CXR - multifocal diffuse patchy infiltrates HiresCT - parenchymal opacification or multiple small nodules
Dx	Bronchoalveolar lavage dx in most cases.

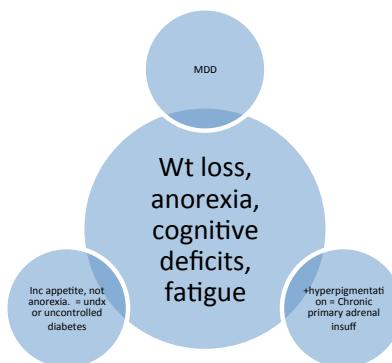
HIV ASSD...ESOPHAGITIS

				Common esp when CD4 < 100/uL
Painful swallowing and substernal burning.				
Candida albicans (most common) = white plaque, oral thrush	HSV = herpetic vesicles and round/ ovoid ulcers , concurrent perioral/ oral HSV	CMV = linear ulcers , distal esophagus	Idiopathic/ aphthous = concurrent oral aphthous ulcers	Other causes (medications -- potassium supplements, tetracyclines, bisphosphonates) have direct chemical effect on mucosa (pill esophagitis). AR drugs usually do not.
Rx empirically w 3-5 days of oral fluconazole If no thrush or fail to respond to empiric rx: Esophagoscopy w bx, cytology, and culture to determine the specific etiology.	Rx: valacyclovir and acyclovir			

Wt loss, anorexia, cognitive deficits, fatigue

+hyperpigmentation = Chronic primary adrenal insuff

Inc appetite, not anorexia. = undx or uncontrolled diabetes



INFECTIONS IN IMMUNOCOMPROMISED PATIENTS

	Histoplasmosis (disseminated)	Blastomycosis (uncommon in immunocomp hosts)	Coccidiomycosis	Aspergillosis	Sporotrichosis
	Dimorphic fungi Mold in soil, bird and bat droppings -- exploring caves, spelunking, cleaning bird cages or coops	Contact with soil or rotting wood..			
Endemic region	Mississippi and Ohio River basins (central and southern)	great lakes, Mississippi and Ohio River basins (Wisconsin)	Southwestern US		
Pathophys	Fungus targets histiocytes and reticuloendothelial system.				
Sx	Immunocompromised: Lymphadenopathy, pancytopenia , hepatosplenomegaly Palatal ulcers Disseminated can have fever, fatigue, wt loss	fever, cough, night sweats, wt loss Pulm -- multiple nodules or dense consolidation on CXR Spreads hematogenously to cause skin ulcerative or verrucous skin lesions, plaque-like lesions on the mucous membranes, osteolytic bone lesions and prostate involvement	fever, cough, night sweats Pulm -- localized pulmonary infiltrate Disseminated disease -- more likely in advanced HIV infection. Presents w/ fever, maculopapular skin lesions, bone, lesions, and primary lung complaints may be absent	Fever, cough, dyspnea	Subq infection characterized by papule at the site of inoculation followed by development of subsequent papules along route of lymphatic flow Pulmonary sporotrichosis: chronic upper lobe, cavitory lesion.
Labs/ Imaging	CXR: hilar lymphadenopathy with or without areas of pneumonitis Diffuse reticulonodular or cavitary Pancytopenia Elevated serum LDH and ferritin, liver enzymes		CXR: localized pulmonary infiltrate, hilar adenopathy, and/or pleural effusion.	CD4 count < 50/ microL	
Dx	Urine or serum antigen (rapid, very sensitive and specific) Fungal blood cultures are confirmatory but lower sensitivity and takes days to weeks	broad-based budding yeast from sputum confirms dx			
Rx	Mild/immunocompetent: no rx, or oral itraconazole Severe, or disseminated, or immunocompromised: Amphotericin B	if symptomatic, itraconazole or amphotericin B			

IMMUNOSUPPRESSANT DRUGS

	Cyclosporine	tacrolimus	Azathioprine	Mycophenolate
Mechanism	<p>Inhibits transcription of IL-2 and several other cytokines (mainly T helper lymphocytes)</p> <p>Aka is a calcineurin-inhibitor</p>	<p>Macrolide produced by fungi.</p> <p>Same as cyclosporine</p> <p>also a calcineurin-inhibitor</p>	<p>Purine analog</p> <p>Inhibits purine synthesis</p>	<p>Reversible inhibitor of IMPDH (inosine monophosphate dehydrogenase), the rate-limiting enzyme in de novo purine synthesis</p>
Side effects:	<p>Nephrotoxicity:</p> <ul style="list-style-type: none"> • Reversible acute azotemia or irreversible progressive renal disease • Hyperuricemia with accelerated gout, hyperK, hypoP, hypoMg. • Rarerly HUS <p>Hypertension:</p> <ul style="list-style-type: none"> • 2/2 Renal vasoconstriction and Na retention • First few weeks of therapy • Rx: CaChblockers <p>Neurotoxicity</p> <ul style="list-style-type: none"> • Reversible • Headaches, visual disturbances, seizure, mild tremors, akinetic mutism <p>Glucose intolerance, esp pts taking steroids concurrently</p> <p>Infection</p> <p>Malignancy:</p> <ul style="list-style-type: none"> • Inc risk of squamous cell carcinoma of skin and lymphoproliferative diseases <p>Gingival hypertrophy and hirsutism</p> <p>GI manifestations:</p> <ul style="list-style-type: none"> • Anorexia, nausea, vomiting, diarrhea • common but mild 	<p>Similar to cyclosporine, but: NO gingival hypertrophy nor hirsutism.</p> <p>Higher incidence of neurotoxicity, diarrhea, and glucose intolerance.</p>	<p>Dose-related diarrhea, leukopenia, and hepatotoxicity</p>	<p>Bone marrow suppression</p>

BLOOD TRANSFUSION REACTIONS (IMMUNOLOGIC)

Type	
Febrile nonhemolytic (most common reaction)	Fever and chill Within 1-6 hrs of transfusion Caused by cytokine accumulation during blood storage
Acute hemolytic	Fever, flank pain, hemoglobinuria, renal failure and disseminated intravascular coagulation Within 1 hour of transfusion Positive direct Coombs test, pink plasma. Caused by ABO incompatibility
Delayed hemolytic	Mild fever and hemolytic anemia Within 2-10 days after transfusion Positive direct Coombs test, positive new antibody screen Caused by anamnestic antibody response
Anaphylactic	Rapid onset of shock, angioedema/urticaria and respiratory distress Within a few seconds to minutes of transfusion Caused by recipient anti-IgA antibodies
Urticular/allergic	Urticaria, flushing, angioedema and pruritis Within 2-3 hours of transfusion Caused by recipient IgE antibodies and mast cell activation
Transfusion-related acute lung injury	Respiratory distress and signs of noncardiogenic pulmonary edema Within 6 hours of transfusion Caused by donor anti-leukocyte antibodies

FOOD BORNE DISEASE

By symptom:	
Vomiting predominant	Staph aureus Bacillus cereus Norovirus (eg Norwalk)
Watery diarrhea predominant	Clostridium perfringens Enterotoxic escherichia coli Enteric viruses Cryptosporidium Cyclospora Intestinal tapeworms
Inflammatory diarrhea predominant	Salmonella (both typhi and non0typhi) Campylobacter Siga toxin producing escherichia coli Shigella Enterobacter Vibrio (usually parahaemolyticus) Yersinia
Non-GI symptoms	Botulism (descending paralysis) Ciguatera toxin (paresthesia) Scombrotoxin (flushing, urticaria) Listeria (meningitis) Vibrio vulnificus (cellulitis, sepsis) Hepatitis A (jaundice) Brucellosis (fever, arthralgias)

DIARRHEA

no diarrhea = mycoplasma, aspergillus, PCP (immediate posttxpt)
 + diarrhea - lung = cryptosporidium

HIV patients			
Non-opportunistic	Opportunistic infections	Non-infectious	
Salmonella Campylobacter Entamoeba Chlamydia Shigella Giardia lamblia	CMV Cryptosporidium Isopora belli Blastocystis MAC HSV Adenovirus HIV	Kaposi sarcoma Lymphoma of GIT tract	
Sx: Hematochezia and lower abdominal cramps usually 2/2 colonic infection with: Cdiff, CMV, Shigella, E.histolytica, or campylobacter	HSV usually assd w painful esophagitis in HIV pts Bloody diarrhea and normal stool exam is highly suspicious for CMV colitis -> colonoscopy w bx	Kaposi is assd w nonbloody diarrhea, no colonic ulcerations.	
Disseminated MAC	CMV colitis	Crypto	E histolytica
Chronic non-bloody diarrhea and weight loss	Sx: Chronic bloody diarrhea, abdominal pain, CD4 <50 cells/uL, normal stool exam W/u: Colonoscopy = mucosal erosions and colonic ulceration. + Bx = large cells with eosinophilic intranuclear and basophilic intracytoplasmic inclusions ("owl's eye effect") Rx: Ganciclovir. If failure/intolerance, Foscarnet.	Profuse, watery nonbloody diarrhea	Bloody diarrhea Trophozoites on stool exam. Colonoscopy = flask-shaped colonic ulcers.
Involves small intestine			
Bx + culture for dx			

OSTEOMYELITIS

	Vertebral osteomyelitis
S/Sx	Fever, back pain, focal spinal tenderness
Organism	Staph aureus >50% of cases of pyogenic spinal osteomyelitis. Gram-neg bacilli -- can be 2/2 to hematogenous spread of UTI
Workup	1. Blood cultures Â Inflammatory marker -- ESR, CRP markedly elevated. (leukocyte count may be normal) Plain spinal xrays -- may be normal in first 2-3 wks 2. MRI for dx -- can detect abscess and cord compression 3.then CT-guided bone bx

SKIN: ERYTHEMA AND SWELLING

	Thrombophlebitis	Toxic shock syndrome	Bacillary angiomatosis	Ludwig angina (rapidly progressive bilateral cellulitis of submandibular and sublingual spaces)
Organisms			Bartonella henselae and bartonella quintana Generally affects immunosuppressed patients (AIDS, hematologic malignancies, undergoing chemotherapy, organ transplant recipients)	Classically streptococcus and anaerobes from infected second or third mandibular molar.
Pathogenesis				
Signs/sx	Erythema, tenderness, and swelling of distal extremity along with palpable "cord-like" vein.	Diffuse erythematous skin rash that is not localized nor painful. Hypotension followed by multi-organ dysfunction.	Fever, weight loss, malaise, and abdominal pain Classic cutaneous lesion is a large pedunculated exophytic papule with a collarette of scale -- resembles large pyogenic granuloma or cherry angioma	Fever Dysphagia Odynophagia Drooling (from swelling of submandibular space and posterior displacement of tongue) Induration of submandibular space, +/- crepitus from anaerobes. Can die of asphyxiation.
Dx			Tissue biopsy and microscopic identification of organisms and the characteristic angiomatic histology -- biopsy with caution, prone to hemorrhage.	
Rx			Abx can lead to involution/regression	Intubation if necessary. Abx and removal of infected tooth.

skin:erythema and swelling continued....

	Necrotizing fasciitis	Abscess	Cellulitis	Pyomyositis (muscle abscess)
Organisms	Streptococcus pyogenes (group A streptococci) Staphylococcus aureus Clostridium perfringens Polymicrobial			
Pathogenesis	Bacteria spreads aggressively and rapidly through subq tissue and deep fascia, undermining the skin	Skin and soft tissue infections that have been successfully limited by immune system and tissue barriers.	Acute skin infection	(usually) limited to one muscle group and does not spread rapidly.
Signs/sx	Pain out of proportion to exam Systemic sx (fever and hypotension) Crepitus in 50% Tissue necrosis Most commonly involves extremities and perineal region	Systemic signs not likely Localized to a tender, fluctuant area and do not spread aggressively.	Warmth, erythema, edema, and tenderness	Fever, erythema, swelling, pain
Dx	CT: air in the tissue planes			
Rx	Surgical debridement and broad spectrum abx			

MISC

RESTLESS LEG SYNDROME

Clinical features of restless legs syndrome	
Diagnostic criteria	<p>Urge to move the legs and</p> <ul style="list-style-type: none"> Unpleasant sensations in the legs (or other body parts [eg, arms]) that begin/worsen during inactivity (eg, lying down, sitting) Unpleasant sensations in the legs relieved by movement (eg, walking, stretching) Unpleasant sensations in the legs that worsen or occur only in the evening/night Symptoms not explained by another disorder
Secondary causes	<ul style="list-style-type: none"> Iron-deficiency anemia Uremia (end-stage renal disease, chronic kidney disease) Diabetes mellitus Multiple sclerosis, Parkinson disease Pregnancy Drugs (eg, antidepressants, metoclopramide)
Treatment	<p>Mild/intermittent symptoms</p> <ul style="list-style-type: none"> Iron supplementation for serum ferritin <75 µg/L Supportive measures (eg, leg massage, heating pads, exercise) Avoid aggravating factors (eg, sleep deprivation, medications) <p>Persistent/moderate to severe symptoms</p> <ul style="list-style-type: none"> 1st-line: Dopamine-agonists (eg, pramipexole) Alternate: Alpha-2-delta calcium channel ligands (eg, gabapentin enacarbil)

REPRODUCTIVE/GERM CELL TUMORS

		origin	
leydig cell tumors	most common type of testicular sex cord stromal tumors	principal source of testosterone + capable of estrogen production via aromatase	
seminomas			betaHCG somewhat elevated if contain syncytiotrophoblastic giant cells
yolk sac tumor		endodermal sinus tumor	
choriocarcinoma		germ cell tumor	inc beta-HCG
teratoma			inc serum AFP or beta-hCG (may indicate coexistent germ cell tumor)

Stage	Clinical manifestations of Lyme disease
Early localized (days-1 month after tick bite)	<ul style="list-style-type: none"> Erythema migrans (80% of patients) Fatigue, malaise, lethargy Mild headache & neck stiffness Myalgias & arthralgias
Early disseminated (weeks-months after tick bite)	<ul style="list-style-type: none"> Carditis (5% untreated patients) <ul style="list-style-type: none"> Atrioventricular block, cardiomyopathy Neurologic (15% untreated patients) <ul style="list-style-type: none"> Unilateral or bilateral cranial nerve defects (usually VII), meningitis, encephalitis Muscular (60% untreated patients): Migratory arthralgias Conjunctivitis (10% untreated patients) Skin: Multiple erythema migrans Regional or generalized lymphadenopathy
Late or chronic (months-years after tick bite)	<ul style="list-style-type: none"> Muscular (60% untreated patients): Arthritis Neurologic: Encephalomyelitis, peripheral neuropathy

Endo

SCREENING FOR ADRENAL INSUFFICIENCY

		Diagnostic Screening Tests for Adrenal Insufficiency			
	<u>Symptoms of Adrenal Insufficiency</u>	Basal Cortisol Level (early morning)	ACTH	Cortisol Response to cosyntropic	Origin of disease
Result of screening test	Primary Adrenal Insufficiency	LOW (<5ug/dL)	HIGH	Minimal Response	Adrenal gland disease/ Addison's Disease
	Secondary or tertiary adrenal insufficiency	LOW (<5ug/dL)	LOW	Minimal or suboptimal response	Pituitary or hypothalamic disease
	Unlikely to be adrenal insufficiency	>15ug/dL		Normal response >20 ug/dL	
	Indeterminate	5-15 ug/dL			

What is cosyntropic?	Cosyntropin is an ACTH synthetic analogue.
What does this test show?	Cortisol level is measured 30-60 min to help distinguish primary AI (adrenal disease/Addison's Disease) vs. central AI (pituitary/hypothalamic)
Why do this test?	Could make the diagnosis with cortisol and ACTH but the results of ACTH take

AMENORRHEA

1° = woman who has never menstruated. Normal up to age 16 if has secondary sexual characteristics. If absent secondary sexual characteristics, evaluate at age 14.

2° = menstrual-age woman who has not menstruated in 6 mo

(absent breast development indicates estrogen deficiency)

Most common cause = pregnancy. Exclude before further workup.

Most common anatomic cause of 2°amenorrhea = Asherman's Syndrome: scarring of **uterine** cavity after D&C

Uterus present:
Check Serum FSH

Uterus absent:
Check Karyotype
and Serum testosterone

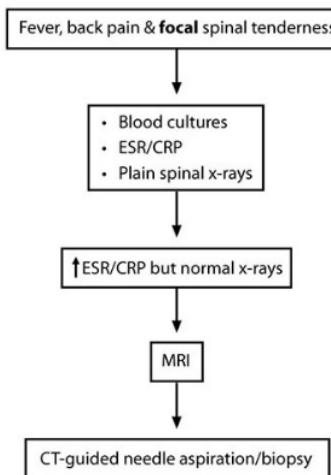
↑FSH	↓FSH	46, XX Normal female testosterone levels	46XY Normal male testosterone levels
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	Peripheral	Central	Abnormal Mullerian Development	Androgen insensitivity syndrome
Workup:	Karyotype	Pituitary MRI		
Causes:	<ul style="list-style-type: none">• Ovarian dysfunction: Turner's syndrome, premature menopause. Sx of estrogen deficiency (hot flashes, mood swings, vaginal dryness, dyspareunia, sleep disturbances, skin thinning)	<ul style="list-style-type: none">• Pituitary dysfunction: either ↓ hypothalamic pulsatile release of GnRH or ↓ pituitary release of FSH or LH• Hypothalamic deficiency 2/2 weight loss, excessive exercise, obesity, prolactinoma/ craniopharyngioma, anorexia	Genital outflow tract alteration: imperforate hymen or agenesis of uterus/vagina	

DIABETES PHARMACOLOGY

	Hypoglycemia	Weight gain/ Weight loss	Important Side Effects/ Toxicities
Metformin	No	Loss	GI upset Lactic acidosis
Sulfonylureas	Yes	Gain	
Pioglitazone (TZDs)	No	Gain	Hepatotoxicity CHF Bone Fractures Bladder Cancer
Insulin	Yes	Gain	
DPP-IV inhibitors	No	Neutral	
GLP-1 receptor agonist (exenatide)	No	Loss	Pancreatitis

Evaluation of vertebral osteomyelitis



SECONDARY HYPERTENSION

	hi renin hi aldo	lo renin hi aldo (plasma aldo:renin >20)	lo renin lo aldo
	2ndary hyperaldo	primary hyperaldo (Conn's syndrome)	non-aldosterone causes
	renovascular hypertension <ul style="list-style-type: none"> • (ex: 2/2 • fibromuscular dysplasia - noninflamm and nonatherosclerotic • unilateral renal artery stenosis - abd bruits and episodes of flash pulm edema malignant hypertension renin-secreting tumor diuretic use	aldosterone-producing tumor bilateral adrenal hyperplasia	congenital adrenal hyperplasia deoxycorticosterone-producing adrenal tumor cushing syndrome exogenous mineralocorticoids pheochromocytoma (classic triad - ha, sweating, palpitations w tachycardia)
clinical presentations	metabolic alkalosis	htn mild hypernatremia +/-hypokalemia - muscle weakness metabolic alkalosis	
etiology	aldosterone saves sodium (inc Na reabsorption), K secretion, and H secretion in distal renal tubules. Na reabsorption increases water absorption, but in a few days spontaneous diuresis (aldosterone escape) makes volume status ~normal and only mild hyperNa (143-147) without sig peripheral edema. alkalosis 2/2: <ul style="list-style-type: none"> • hypoK directly increases renal bicarb resorption. • inc H secretion 		
other dx criteria/ supporting	fibromuscular dysplasia - severe/resistant htn women<50yo, acei or ARB doesn't affect BP but inc creatinine >0.5-1mg/dL. sx of brain ischemia (amaurosis fugax, horner's, tia, stroke), carotid/vertebral artery involvement (ha, pulsatile tinnitus, dizziness). dx - ctangio, u/s, if inconclusive, arteriography, f/u w BP and creatinine and renal u/s.	confirmatory = oral saline load —> adrenal suppression testing abd CT and adrenal venous sampling —> distinguish b/w unilateral adenoma and bilat hyperplasia	
rx		unilat adrenal adenoma = surgery. if poor candidates/refuse, aldosterone antagonists (spironolactone, eplerenone)** bilat adrenal hyperplasia = aldosterone antagonists	

**spironolactone - progesterone and androgen receptor antagonist cause sfx like gynecomastia/menstrual irreg)
 thiazides - hypoK, hypoNa, hyperUricemia, hyperglycemia
 ace-i's - sfx- hyperK 2/2 dec angiotensin II, elevated cr 2/2 reduced GFR
 eplerenone - selective mineralocorticoid antagonist)

fibromuscular dysplasia - renal, carotid, vertebral arteries, non inflammatory and nonatherosclerotic.

ELECTROLYTE ABNORMALITIES

	hx/etiology	sx		rx
hypocalcemia	post surgical (thyroidectomy) autoimmune parathyroid destruction	asx, or nonspecific - fatigue, anxiety, depression involuntary contractions/tetany - lips, face, extremities severe - seizures	ekg - QT prolongation	
hypercalcemia	can be 2/2 overprod of calcitriol aka vit D 2/2 granulomatous diseases or lymphoma	"moans groans psychic overtones" kidney stones abd pain anorexia constipation malaise, back pain polyuria, polydipsia —> severe>14: weakness, confusion, lethargy, stupor, coma	shortened QT interval	<u>if mod-severe, >12-14 mg/dL or sx:</u> immediate= IV NS + calcitonin (acts w/in 4-6hrs) Long-term = bisphosphonate (zoledronate) if mild, avoid thiazides, lithium, adequate volume.
hypoK	Cushing's syndrome - cortisol w mineralocorticoid activity causing potassium wasting. also hyperNa			

Work up for Hypercalcemia

		Causes of hypercalcemia			
Elevated calcium	Corrected Calcium= Ca+ 0.8 (4-albumin)	Primary Hyperparathyroidism	Familial hypercalcemic hypocalciuria	Cortisol Response to cosyntropic	Origin of disease
Causes of hypercalcemia		LOW (<5ug/dL)	HIGH	Minimal Response	Adrenal gland disease/ Addison's Disease
		LOW (<5ug/dL)	LOW	Minimal or suboptimal response	Pituitary or hypothalamic disease
	Solid Tumor malignancy	>15ug/dL		Normal response >20 ug/dL	
	Lymphoma/ Sarcoid	5-15 ug/dL			

What is cosyntropic?	Cosyntropin is an ACTH synthetic analogue.
What does this test show?	Cortisol level is measured 30-60 min to help distinguish primary AI (adrenal disease/Addison's Disease) vs. central AI (pituitary/hypothalamic)
Why do this test?	Could make the diagnosis with cortisol and ACTH but the results of ACTH take

ADRENAL INSUFFICIENCY

	hx/etiology	sx		rx
primary adrenal insufficiency	TB most common cause in developing countries	hypotn pigmentation hypoNa hyperK eosinophilia	TB - adrenal calcification	glucocorticoids and mineralocorticoids
	fungal infxn (and sometimes meds to treat like ketoconazole - inh steroid synthesis)			
	CMV			
	autoimmune (Addison's) - Abs ag adrenal enzymes responsible for steroid synthesis 80% in developed countries		markedly elevated ACTH low serum cortisol	
	assd with autoimmune conditions - thyroid, parathyroid, ovaries, pernicious anemia, vitiligo			
	adrenal hemorrhage (esp pts on warfarin and acute stress like sepsis)	acute onset	imaging shows blood in acute stage	
acute adrenal crisis	adrenoleukodystrophy - young males, 2/2 accumulation of very long chain fatty acids w/in adrenal glands		enlarged adrenal glands without any calcifications	
	central insuff due to chronic glucocorticoid use (>20mg pred or equivalent for >3wks) —> HPA axis suppression	unexplained n/v/abd pain hypoNa, hyperK hypoglycemia hypotension cushingoid features - buffalo hump, central obesity, moon face, wt gain		may not respond appropriately to stress (surgery, infection, bleeding, MI) and require higher doses ("stress doses") of short-term glucocorticoids during acute condition

MULTIPLE ENDOCRINE NEOPLASIA

1	Pituitary	Parathyroid	Pancreatic
2A	Medullary thyroid	Parathyroid	Pheochromocytoma
2B	Medullary thyroid	Mucosal & intestinal neuromas Marfans Syndrome	Pheochromocytoma

1: pancreatic endocrine tumor - ex: zollinger ellison = gastrinoma. MEN1 tumor suppressor gene on chromosome 11

2A and 2B: 2/2 germline mutations in RET proto-oncogene

think suspicious for MEN if:

2A = htn, palpitations, HA, diaphoresis

dx pheo: 24hr urine metanephhrines and free catecholamines or plasma free metanephhrines

MISC

phosphodiesterase inhibitors (e.g. sildenafil) = 1st line for erectile dysfunction in DM

1. contraindicated in patients treated with nitrates
2. use with caution in conditions predisposing to priapism
3. may have adverse reactions with concurrent use of drugs which interfere with metabolism of sildenafil (e.g. erythromycin, cimetidine)
4. give at least 4 hr interval if combining with an alpha-blocker (doxazosin for BPH) to reduce risk of hypotension

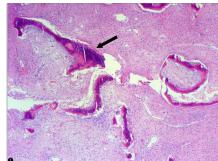
OSTEOPOROSIS, OSTEOPENIA, OSTEOMALACIA

	hx/etiology	dx	
osteoporosis/osteopenia	<p>osteoblast dysfunction tiny frail white woman advanced age post menopausal medical hx of fracture w minimal trauma (fragility fracture) low body wt fam hx of hip fx current smoking Excessive ETOH meds - steroids, anticonvulsants</p> <p>2ndary causes: premature menopause, hypogonadism, malabsorption, inflammatory dz o's - ibd, RA, hyperthyroid, hyperparathyroid, cushing, vit D def, chronic liver or renal dz</p>	<p>screen w 1x dexa >65yo. osteoporosis = t score < -2.5 (means 2.5 std devs below the mean). osteopenia = -2.5 < tsscore < -1</p> <p>nl ca, nl phos, nl PTH</p>	
osteomalacia	<p>hx: vit D def 2/2:</p> <ul style="list-style-type: none"> • malabsorption • intestinal bypass surgery • celiac sprue • chronic liver disease • chronic kidney disease <p>sx: • asx • bone pain and muscle weakness • muscle cramps • difficulty walking, waddling gait</p>	<p>↓25-OH vit D ↓serum ca and more ↓ phos (dec intestinal absorption) so ↑PTH (which worsens hypophos by further loss in urine) ↓urinary ca ↑alk phos,</p> <p>Xray - thinning of cortex w reduced bone density, poorly mineralized osteoid</p> <p>bilat and symmetric pseudofractures</p>	

Paget's disease	osteoclast dysfunction = inc bone turnover/osteoclast bone breakdown -> compensatory inc in bone formation but aberrant/disorganized osteoid formation. <ul style="list-style-type: none"> • bone and joint pain • skeletal/skull deformities • hearing loss 2/2 CN8 entrapment from enlarged cranial bones • spine bone pain/stenosis/ nerve compression, • long bone bowing deformities • osteosarcoma, giant cell tumors 	nl ca, nl phos, nl PTH markedly ↑ alk phos (may be incidental finding) (nl ggt = not liver) xray - femoral bowing, osteolytic or mixed lytic/sclerotic lesions. Bone scan is more sensitive, used for extent/locating skeletal involvements. results in " mosaic " pattern of lamellar bone - irreg lamellar bone w woven bone	Rx bisphosphonates.
primary hyperPTH	2/2: <ul style="list-style-type: none"> • parathyroid adenoma 90% • hyperplasia • carcinoma assd w: MEN1, 2A 80% are asx nonspecific sx - fatigue, weakness, mild depression hyperca sx: abd pain, renal stones, bone pain/fx, psych manifestations	inc or inappropriately nl PTH, inc ca, lo phos 24hr urinary ca >250mg urine ca:creat >0.02 (distinguish from familial hypocalciuric hyperca) loss of cortical bone mass	parathyroidectomy for sx patients
hypoPTH		low PTH, lo ca, inc phos	

Notes:

multiple myeloma may cause diffuse osteopenia due to osteoclastic activation



Fibrous dysplasia causes fibrous replacement of bone

hypervitaminosis A causes abundant mineralization of periosteum

PROLACTIN & THYROID

	hx/etiology	sx	labs, imaging	rx
prolactinoma	<p>supression of gonadotropin-releasing hormone secretion from hypothalamus by prolactin</p> <p>TSH may also be normal or low depending on compressive effect on thyrotroph cells</p>	<p>premenopausal women - oligo/ amenorrhea, infertility, galactorrhea, hot flashes, dec bone density</p> <p>post menopausal women 0 mass effect (ha, visual field defects)</p> <p>men: infertility, dec libido, impotence, gynecomastia</p>	<p>serum prolactin often >200 ng/mL</p> <p>rule out renal insuff (cr) and hypothyroidism (TSH, t4)</p> <p>MRI of pituitary</p>	dopamine agonist - cabergoline trans-sphenoidal surgery
pituitary adenoma	usually adenoma is nonfunctioning arising from gonadotrophs in pituitary gland - just secrete alpha subunit.	<p>when large enough:</p> <ul style="list-style-type: none"> • headache • visual field defects • disrupt pituitary fxn 	<p>hypopituitarism = central hypogonadism (low LH and low testosterone) + central hypothyroidism (low TSH and T4)</p> <p>prolactin mild-mod inc (2/2 anatomic disruption of dopaminergic pathways that normally suppress prolactin secretion)</p> <p>if >200 ng/mL, suggests prolactinoma</p>	trans-sphenoidal surgery
hyperthyroid	subacute lymphocytic (painless) thyroiditis = inflammatory damage of thyroid follicles -> leakage of thyroid hormones into circulation -> thyrotoxicosis.	painless	enlarged thyroid/ swelling	
thyrotoxicosis: CV:	often in post-partum period		<p>lid retraction</p> <p>tremor</p> <p>wt loss</p>	
• angina 2/2 coronary vasospasm			inc total and free T4	
• sinus tach, PAC/ PVC's, afib/aflutter			dec TSH	
• HTN, inc pulse pressure				
• inc contractility and cardiac output				
• dec SVR				
• inc myocard o2 demand				
• new onset exac heart failure				
• mitral valve prolapse				
	subacute granulomatous thyroiditis		thyroid scan - very low radioactive iodine uptake	
	levothyroxine overdose			
	iodine-induced thyrotoxicosis			

• MR, TR	very rare - struma ovarii = ovarian teratoma that produces thyroid hormones		
	subacute granulomatous (De Quervain's thyroiditis)	intense pain in thyroid region	
	Grave's disease		inc radioactive iodine uptake diffusely
	toxic multinodular goiter		"hot nodules" - inc uptake of iodine in toxic nodules with no uptake in rest of gland. heterogenous uptake of radioactive iodine.
hypothyroid	primary - autoimmune most common	fatigue dec appetite wt gain constipation cold intolerance	lo T3, T4 TSH >10 IU/L
	secondary - pituitary gland dysfxn		lo T3 ,T4 low or iappr nl TSH
	tertiary - hypothalamus	phys ex: cool pale skin coarse hair brittle nails delayed relaxation of deep tendon reflexes	
	generalized peripheral resistance to thyroid hormones		elevated circulating T3, T4 nl to elevated TSH
	subclinical hypothyroidism	no sxs	nl T3,T4 mild elevated TSH

primary hypothyroidism can cause mild-mod hyperprolactinemia (due to TRH-induced stimulation of lactotrophs)

antipsychotic meds (eg risperidone) can block normal dopamine-dependent regulation of prolactin secretion -> cause hyperprolactinemia

rx for hyperthyroidism = propylthiouracil (PTU) and methimazole - sfx - agranulocytosis. us within 90 days of treatment, if fever and sore throat, check wbc, if <1,000, stop drug!

rx for hypothyroidism = levothyroxine.

interactions with levothyroxine:

- bile acid binding agents (cholestyramine), iron, ca, PPI = decreases absorption.
- phenobarb, rifampicin, phenytoin, carbamaz = increases hepatic clearance
- oral estrogen, tamoxifen, raloxifene, heroin, methadone = increases TBG concentration (and thus patient would require higher doses of L-thyroxine. same during pregnancy)
- androgens, glucocorticoids, anabolic steroids, slow-release nicotinic acid = decreases TBG concentration

WORKUP OF THYROID NODULE

single nodule
check TSH, T3, T4

hyper:

u/s of thyroid
radioactive iodide scan

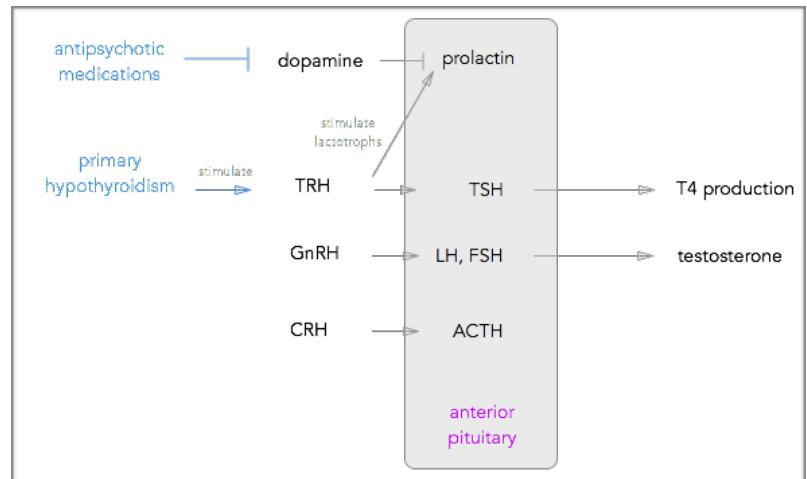
- if single hot nodule -> toxic nodule
- if diffuse uptake -> graves
- if nothing -> acute thyroiditis (hashimoto's),
or cancer -> fine needle aspiration biopsy. if follicular cells, to distinguish bw adenoma and cancer, look for invasion of tumor capsule and blood vessels

hypo:

u/s of thyroid
radioactive iodide scan

—

papillary	follicular	medullary
<ul style="list-style-type: none"> • most common • slow infiltrative local spread - local lymph node involvement • unencapsulated • psammoma bodies • Hurthle cells • excellent prognosis 	<ul style="list-style-type: none"> • rarely have lymph node involvement • encapsulated - invasion of tumor capsule and blood vessels • Hurthle cells • mets to distal organs 	calcitonin secretion



TYPE 2 DIABETES MEDS

Screen pts who:

have BP > 135/80

>45yo

or addl risk factors for diabetes:

- HTN, prior CV disease
- Dyslipidemia (low HDL, hi TG)
- hx glucose intolerance
- physical inactivity
- 2st degree relative w diabetes
- hi risk race/ethnicity (AA, latino, Native American, Asian, Pacific Islander)
- Women w children's birth wt \geq 9lbs
- hx gestational DM
- hx PCOS

dx:

A1c \geq 6.5%

FBG \geq 126mg/dl

random glucose >200 w sx of hyperglycemia

OGT - 75g load 2hrs, \geq 200 (more sensitive test for insulin resistance/dm in PCOS)

rx:

Medication	\downarrow A1C	Points to remember
Metformin (biguanide)	1-2%	<ul style="list-style-type: none">• Initial therapeutic agent for most type 2 diabetics• Weight neutral, low risk of hypoglycemia• Lactic acidosis is a life threatening complication
Sulfonylureas	1-2%	<ul style="list-style-type: none">• Generally added to patients with metformin failure• Weight gain and hypoglycemia are main side effects
Pioglitazone (TZDs)	1-1.5%	<ul style="list-style-type: none">• Used if unable to tolerate metformin or sulfonylureas• Side effects: weight gain, edema, CHF, bone fracture, bladder cancer• Low risk of hypoglycemia when used alone or with metformin• Can be used in renal insufficiency
Insulin	1.5-3.5%	<ul style="list-style-type: none">• Basal insulin added as second agent in metformin failure with A1C > 8.5%• Prandial short acting insulin added for inadequate glycemic control with combination of oral antidiabetic drugs and basal insulin• Weight gain and hypoglycemia are main concerns
DPP-IV inhibitors (e.g., sitagliptin)	0.5-0.8%	<ul style="list-style-type: none">• Low risk of hypoglycemia• Weight neutral• Can be used in renal insufficiency
GLP-1 receptor agonist (e.g., exenatide)	0.5-1.0%	<ul style="list-style-type: none">• Possible second agent for metformin failure, especially if weight loss is desired• Low hypoglycemia risk when used alone or with metformin

if inadequate control on metformin, add second drug.

add insulin if HbA1c >8.5% (risk of wt gain and hypoglyc)

GLP-1 agonist (exanatide or liraglutide) - r/o acute pancreatitis

thiazolidinediones (pioglitazone) - r/o inducing CHF in pt with heart disease

TYPE 1 DIABETES

Consider if sx - wt loss, polydipsia, polyuria. patient is stuporous, rapid Kussmaul breathing. get finger stick glucose, then cbc/ABG if in DKA.

POLYCYSTIC OVARIAN SYNDROME (PCOS)

hx/sx	labs	rx
irreg menstrual periods hirsutism = acne	<ul style="list-style-type: none"> • elevated testosterone • inc LH/FSH ratio • type 2 DM or insulin resistance (OGT >200) 	<ul style="list-style-type: none"> • OCP or clomiphene citrate - induces ovulation • metformin - for dm, helps correct hirsutism 2/2 slight suppression of androgen production, wt loss.

D/O OF SEXUAL DEVELOPMENT

DISORDERS OF SEXUAL DEVELOPMENT					
Diagnosis	Cause	Breast development	Reproductive organs	Axillary & pubic hair	Karyotype
Complete androgen insensitivity syndrome	X-linked mutation of androgen receptor	Yes	Cryptorchid testes, absent uterus & upper vagina	Minimal to absent	46,XY
Müllerian agenesis (Mayer-Rokitansky-Küster-Hauser syndrome)	Hypoplastic or absent Müllerian ductal system	Yes	Absent or rudimentary uterus & upper vagina	Normal	46,XX
Transverse vaginal septum	Malformation of urogenital sinus and Müllerian ducts	Yes	Normal uterus, abnormal vagina	Normal	46,XX
Turner syndrome	Complete/partial absence of 1 X chromosome	Variable (depending on ovarian function)	Normal uterus & vagina, streak gonads	Normal	45,X
Complete XY gonadal agenesis (Swyer syndrome)	SRY gene mutation on Y chromosome	No	Normal uterus & vagina, streak gonads	Minimal to absent	46,XY

MYOPATHY

causes	sx	dx
<p>connective tissue disease:</p> <ul style="list-style-type: none"> • polymyositis, dermatomyositis • inclusion body myositis • vasculitis • mixed connective tissue disease <p>endo/metabolic:</p> <ul style="list-style-type: none"> • hypothyroidism, thyrotoxicosis • cushing's syndrome • electrolytes (hypok, ca, phos) <p>drugs:</p> <ul style="list-style-type: none"> • corticosteroids, statins • zidovudine, colchicine • alcohol, cocaine, heroin <p>infxn, trauma, hyperthermia</p>	<p>fatigue myalgias prox muscle weakness sluggish ankle reflexes nl esr, elevated ck</p> <p>hypothyroid: always consider with unexplained elevation of CK</p> <p>polymyositis: DTR usually nl. assd w other findings (raynauds, interstitial lung dz). ANA Abs +</p>	<ol style="list-style-type: none"> 1. TSH and T4 2. if nl, ANA abs, further w/u —> polymyositis

EPIGASTRIC PAIN/ABD PAIN

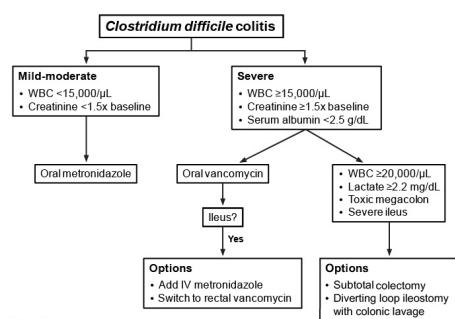
	hx	s/sx	dx	rx
peptic ulcer		sudden onset n/v/hematemesis peritoneal signs - guarding, rigidity, rebound tenderness	sx CXR - free air under diaphragm	
esophageal perforation	<ul style="list-style-type: none"> • spontaneous - boerhaave • instrumentation (endoscopy) • esophagitis (infectious, pills, caustic) • esophageal ulcer 	sudden onset, severe pain - retrosternal, neck, back, abdomen, chest, and/or epigastric fever Hamman sign - subcut emphysema in neck - crunching sound on chest auscultation 2/2 mediastinal emphysema CXR - widened mediastinum (2/2 air = pneumomediastinum)	gastrografin-contrast (water soluble. NOT barium) esophagram, or CT esophagogram	Abx and supportive surgical repair for sig leakage with sirs
acute pancreatitis	<ul style="list-style-type: none"> • chronic etoh use • gallstones • hyperlipidemia (types I, IV, V) • drugs - didanosine, azathioprine, valproic acid, thiazide diuretics • infxn - cmv, legionella, aspergillus • trauma • iatrogenic (post-ERCP) 	dx = 2 of following: <ul style="list-style-type: none"> • acute constant epigastric abd pain +/- radiating to back • ↑amylase/lipase >3x normal limit (ex: amylase 2066, lipase 1800) • abd imaging: CT w contrast - focal or diffuse pancreatic enlargement w heterogenous enhancement. U/S - diffusely enlarged and hypoechoic pancreas <p>other:</p> <ul style="list-style-type: none"> • n/vomiting • improved pain with sitting up or leaning forward, worse with walking and lying supine <p>vitals/labs</p> <ul style="list-style-type: none"> • fever, tachypnea, hypoxemia, hypotension • ↑WBC • ALT > 150 - biliary pancreatitis <p>complications:</p> <ul style="list-style-type: none"> • +/-CXR - left-sided pleural effusion • ileus • ARDS • renal failure <ul style="list-style-type: none"> • necrotic pancreatic tissue can form abscess - persistent fever and leukocytosis. rx = drain. • 1-2wks after episode, can have infection of necrotic pancreas. gravely ill - spiking fevers, leukocytosis, shock....rx surgical debridement • hemorrhagic pancreatitis - severe, lifethreatening retroperitoneal hemorrhage and pancreatic necrosis. bluish discoloration of flanks (Grey Turner sign), periumbilical (Cullen sign) 	supportive for episode, usually self-limited 4-7d - IV fluids, NPO, analgesics (eg meperidine, fentanyl) if severe biliary pancreatitis, ERCP for sphincterotomy/stone removal treat underlying cause (ex gallstones/cholecystectomy) Px: <ul style="list-style-type: none"> • Can subsequently develop pseudocyst - fibrous capsule of inflamm fluid (amylase, lipase, enterokinase), can leak and elevate amylase in serum. dx by u/s. resolves spontaneously or drain if >6wks, >5cm, or infected. • chronic pancreatitis = recurrent bouts of epigastric abd pain fat malabsorption with steatorrhea, diarrhea dm, wt loss, nl LFTs. calcifications on CT or xray is dx. can lead to fibrosis -> stricture of intrapancreatic portion of bile duct -> inc bili and alk phos 	

pancreatic ca	can present with obstructive jaundice or vague abd pain inc risk if: hereditary - 1st deg relative smoking obesity chronic pancreatitis	wt loss, abd pain (usually epigastric - more chronic and worse in supine position and at night) and jaundice Courvoisier's sign - head of panc - steatorrhea, wt loss, jaundice body or tail - pain and wt loss ct scan w contrast dx - sens 85-90%, spec 90-95% if nondx, ERCP	surgical resection. mortality <1yr otherwise can monitor response to chemo with CA19-9
mesenteric ischemia	older risk factors: diffuse atherosclerosis, valvular abnormality, cardiac arrhythmias or recent MI hypercoagulable d/o's	severe acute periumbilical abd pain out of proportion to phys exam hematochezia (late) leukocytosis inc lactate, amylase, phosphate metabolic acidosis (not often true in peptic ulcer perf)	resuscitative rx broad spectrum abx NG tube - decompression Surgery for bowel infarct/perf
other	ACS, aortic dissection		

prefer abd ct w contrast over u/s for epigastric pain + wt loss without jaundice

LOWER QUADRANT ABD PAIN

		hx	s/sx	dx	rx
	appendicitis		guarding rigidity or rebound tenderness initial vague periumbilical pain that localizes to right lower quadrant		
	psoas abscess	2/2 contiguous spread (ex: bone, bowel, spinal tb/potts, hematogenous spread). s.aureus is most common.	pain on deep abd palpation, or lower abd pain or back pain. leukocytosis	CT if neg, and suspicion is high, exploratory laparoscopy or percutaneous drainage tube	
colon	diverticulitis				
	crohn disease				
	perforation carcinoma of cecum				
	yersiniosis				
	c diff colitis	fluoroquin, penicillin, cephalosporins, clindamycin have suspicion with unexplained leukocytosis even without diarrhea	mild-modL wbc <15,000/uL, creat <1.5x baseline severe: wbc ?>15,000/uL, creat >1.5x baseline serum albumin <2.5 g/dL	send stool studies (PCR for c.diff toxin)	empiric metronidazole severe: oral vancomycin +/- IV metronidazole



GALLBLADDER/RUQ/ABNORMAL BILI

	hx/etiology	s/sx	dx	rx
acute ascending cholangitis	infection of common bile duct, commonly 2/2 obstruction of common bile duct by stone or stricture	Charcot's triad: fever severe jaundice RUQ abd pain very ill/acute distress leukocytosis		supportive care broad spectrum abx if persistent sx, high fever, hypotension, abd pain, confusion → urgent biliary decompression/drainage by ERCP - sphincterotomy w/ stone removal and/or stent insertion
cholelithiasis	"fat, fertile, female, forty" also predisposed: <ul style="list-style-type: none">• Native American• DM• Obesity• rapid wt loss• OCPs/pregnancy (estrogen inc cholesterol secretion and progesterone dec bile acid secretion -> bile has inc chol saturation)• on TPN or prolonged fasting (CCK stimulus is absent -> biliary stasis)• clofibrate, octreotide, ceftriaxone	+/- occasional RUQ abd pain bloating and dyspepsia after eating fatty foods	abd u/s - 95% sensitive cholesterol or mixed = radiolucent. majority. calcium-bilirubinate = least common.	if symptomatic, laparoscopic cholecystectomy medical rx: reduce cholesterol content of bile by dec hepatic secretion nad intestinal reabsorption of cholesterol - usodeoxycholic acid. 50% recur
acute cholecystitis	' above + fever can be precipitated by ingestion of fatty foods	RUQ abd pain that radiates to right shoulder - Murphy's sign n/v/fever/leukocytosis	abd u/s - thickened gallbladder wall with edema if u/s unclear, HIDA (better and esp for acalculous cholecystitis) alk phos might be nl	can manage conservatively w cholecystectomy within 72 hrs
acalculous cholecystitis	critically ill patients, need high degree of clinical suspicion		clinical suspicion and confirm w imaging - gallbladder wall thickening and distension and pericholecystic fluid.	abx and percutaneous cholecystostomy once medical condition improves, cholecystectomy w/ drainage of any associated abscesses is definitive therapy

chronic cholecystitis	2/2 chronic inflammation/irritation from gallstones complication: can cause ileus if gallstone enters intesting 2/2 fistubla bw gallbladder and sm intestine (see air in biliary tract)		CT - "porcelain gallbladder" - intramural calcium rim	11-33% eventually develop gallbladder (adeno)carcinoma, so surgical resection
acute choledochal lithiasis		acute onset RUQ or epigastric pain labs: ↑conj bili ↑alk phos		
malignant biliary obstruction	2/2: <ul style="list-style-type: none">• cholangiocarcinoma• pancreatic adenocarcinoma• hepatocellular carcinoma• metastatic (colon, gastric)	painless jaundice fatigue, wt loss pruritis, acholic stools w dark urine RUQ mass, tenderness, or hepatomegaly labs: ↑direct(conj) bili ↑alk phos & ggt nl or ↑AST, ALT	abd u/s or CT if nondx, MRcholangiopancreatogram or ERCP	
stricture of pancreatic portion of bile duct	chronic pancreatitis -> fibrosis -> stricture	↑conj bili ↑alk phos		

JAUNDICE

diff dx for jaundice:

normally 95% of circulating bilirubin is in unconjugated form.

predom elevated: (from looking at urine dipstick)	can be due to:	examples	LFTs
indirect/unconjugated bili <i>(water insoluble, tightly bound to albumin)</i>	inc bili production	hemolysis - 2/2 <ul style="list-style-type: none"> • rbc membrane defects • hemoglobinopathies • thalassemias • erythrocyte enzymatic defects • immune destruction (paroxysmal nocturnal hemoglobinuria) • mechanical injury • hypersplenism 	
	dec bili uptake by liver	portosystemic shunt	
	abnormal bili conjugation	Crigler-Najjar = absent UDP-glucuronyl transferase - early death Gilbert's syndrome = mild def (usually asx)	
direct/conjugated bili <i>(water soluble, loosely bound to albumin, excreted in urine)</i>	hepatocellular injury/intrinsic liver dz	viral hepatitis, hemochromatosis, sarcoidosis, hepatic malignancy	predom elevated transaminases with normal alk phos
	dec bili excretion in bile canaliculi	Dubin-Johnson syndrome,	normal AST, ALT, and Alk Phos
	defect of hepatic storage of conj bili	Rotor syndrome	
	intrahepatic cholestasis	primary biliary cirrhosis	elevated alk phos out of proportion to transminases
	extrahepatic cholestasis from biliary obstruction	malignancy - cholangiocarcinoma, pancreatic, hepatocellular, metastatic (colon, gastric)	

start with doing u/s?

ABNORMAL LFT SYNDROMES

	hx/etiology	s/sx	dx	rx	prognosis	LFTs
Wilson's disease aka hepatole nticular degenera tion	rare autosomal recessive age 5-40yo = dec formation and secretion of ceruloplasmin —> dec copper secretion into biliary system —> copper causes oxidative/free radicals and accumulates in liver —> injures hepatocytes —> into blood and basal ganglia and cornea	• liver involvement: asx, chronic hepatitis, fulminant hepatitis, macronodular cirrhosis , or portal htn • neuropsych sx (hepatolenticular degeneration) • Kayser-Flesicher rings (brownish/ gray-green rings of fine granular copper deposits in cornea)	low serum ceruloplasmin <20 mg/dL, with inc urine copper excretion gold std = liver bx —> hepatic cu level >250 mcg/gram	d-penicillamine or trientine (copper chelators) +oral zinc (prevents cu absorption)	liver txpt for fulminant hepatic failure or decompensated liver disease that doesn't respond to meds	Liver studies: Total bilirubin: 4.5 mg/dL Direct bilirubin: 3.2 mg/dL Alkaline phosphatase: 441 U/L Aspartate aminotransferase (AST): 500 U/L Prothrombin time: 12.5 sec
hemochromatosis	autosomal recessive iron overload 2/2 abnormally high iron absorption —> oxidative damage to liver, panc, lung, pit	liver dz "bronze diabetes" - DM, hyperpigmentation impotence arthropathy cardiac enlargement hypothyroid	first iron studies, then genetic confirmation nl or mildly ↑ bili and alk phos	long term serial phlebotomy	inc r/o cirrhosis and hepatocellular carcinoma	signif elevations of transaminases

primary biliary cirrhosis	autoimmune destruction of intrahepatic bile ducts and cholestasis	<ul style="list-style-type: none"> pruritis is often earliest sx - severe, nighttime fatigue 	cholestasis (alk phos and cholesterol)	ursodeoxycholic acid - slows disease progression and relieves sx	inc r/o hepatobiliary malignancy	
	middle-aged women, insidious onset	<ul style="list-style-type: none"> hepatosplenomegaly xanthomas - eyelids, skin, tendons <p>—>—></p> <ul style="list-style-type: none"> jaundice steatorhea portal htn osteopenia wt loss 	serum AMA (anti-mitochondrial Abs)	lengthens transplant-free survival time	severe liver damage or cirrhosis —> liver txpt with 1yr survival 85-90% = definitive treatment	
	assoc with autoimmune:					
viral hepatitis			inc bili and alk phos following inc in alt/ast		much higher, >25x normal AST and ALT (toxin induced - acetaminophen, ischemic, also this high) ALT>AST	

drug-induced	<p>direct toxic effect (dose dependent and short latent periods)</p> <ul style="list-style-type: none"> • carbon • tetrachloride, • acetaminophen, • tetracycline, • amanita phalloides mushroom <p>vs</p> <p>idiosyncratic rxn (not dose dependent, variable latent periods)</p> <ul style="list-style-type: none"> • isoniazid • chlorpromazine, • halothane, • antiretroviral therapy 	<p>or group by morphology:</p> <p>cholestasis -</p> <ul style="list-style-type: none"> • chlorpromazine, • nitrofurantoin, • erythromycin, • anabolic steroids <p>fatty liver -</p> <ul style="list-style-type: none"> • tetracycline, • valproate, • anti-retrovirals <p>hepatitis -</p> <ul style="list-style-type: none"> • halothane, • phenytoin, • isoniazid, • alpha-methyldopa <p>toxic/fulminant liver failure -</p> <ul style="list-style-type: none"> • carbon • tetrachloride, • acetaminophen <p>granulomatous -</p> <ul style="list-style-type: none"> • allopurinol, • phenylbutazone 				similar to viral hepatitis
alcoholic hepatitis	<p>heavy drinking history</p> <p>steatosis -> alcoholic hepatitis -> alcoholic fibrosis/cirrhosis</p>	<ul style="list-style-type: none"> • jaundice, anorexia, fever • RUQ +/- epigastric pain • abd distention 2/2 ascites • tender hepatomegaly • +/- hepatic encephalopathy 	<p>↑ ggt ↑ bili (↑ INR)</p> <p>leukocytosis (neutrophils) ↑ ferritin (acute phase reactant)</p> <p>dec albumin 2/2 malnutrition</p>	<p>+/- fatty liver on abd imaging</p> <p>Mallory bodies, infiltration by neutrophils, liver cell necrosis, perivenular distribution of inflammation</p>	<p>fatty liver, alcohol hepatitis, and early fibrosis are potentially reversible with cessation of etoh</p>	<p>AST:ALT ratio ≥ 2:1 usually < 300U/L, always <500 U/L</p> 
chronic autoimmune hepatitis	<p>young-to-middle age women</p> <p>if viral and drug induced ruled out</p>	<p>presents as acute or chronic hepatitis</p>				<p>very very ↑conj bili very ↑aminotransferases >1000 U/L</p>
sarcoidosis or TB (granulomas)						<p>don't often cause massive transaminase</p>

nonalcoholic fatty liver disease	middle-aged, obese, metabolic syndrome (central obesity, dm, hyperlipidemia, htn) histology: fatty liver disease vs nonalcoholic steatohepatitis	asymptomatic or fatigue, malaise, RUQ abd discomfort (etiologic: periph insulin resistance -> inc peripheral lipolysis and TG synth -> hepatic uptake of fatty acids -> oxidation -> proinflammation -> inc fat accumulation and fibrosis/ cirrhosis)		u/s liver shows hyperechoic texture with diffuse fatty infiltration		AST/ALT ratio <1
ischemic hepatic injury/ shock liver	hypotension (septic shock, heart failure)				acute, massive increases in AST and ALT >1000 with milder asdd inc in total bilirubin and alk phos <p style="text-align: right;"> Bilirubin, total 1.2 mg/dL AST 2,200 u/mL ALT 2,250 u/mL Alkaline phosphatase 162 mEq/L </p>	typically return to normal within 1-2 wks if hypotension resolved

evidence of cirrhosis = spider angiomas, gynecomastia, asterixis. bx has regenerative nodules

VIRAL HEPATITIS - A,B,C,D,E

	hx	s/sx	dx	rx	prognosis
hep A					
hep B	infected blood, sexual contact			rx if: <ul style="list-style-type: none"> • acute liver failure • clinical complications of cirrhosis • advanced cirrhosis with high serum HBV DNA • no cirrhosis but HBeAg +, HBV DNA >20,000IU/mL and serum ALT > 2x upper limit of normal • Prevent HBV reactivation during chemo or immunosuppression • Interferon - short-term • lamivudine - drug resistance is increasing • entecavir - decompensated cirrhosis • tenofovir - most potent 	risk of chronic infection, cirrhosis, inc risk of hepatic cancer treatment of chronic HBV can reduce disease progression to chronic liver disease, prevent complications (cirrhosis/cancer) and decrease transmission to others
hep C	exposure to infected blood IV drug use tattoos blood transfusions hi occurrence in pts w mixed cryoglobulinemia			pegylated interferon + ribavirin + telaprevir if genotype 1	
hep D					
hep E	fecally-contam water in endemic areas - India, Asia, Africa, Central America (unusual in U.S.)	sudden onset - jaundice, malaise, anorexia, nausea, vomiting, abd pain, fever, hepatomegaly histo - focal necrosis, ballooned hepatocytes, acidophilic hepatocytic degen	detect HEV RNA by PCR of serum or feces or IgM Ab's to HEV	prevent: exposure	self-limited. no chronic carrier state, no cirrhosis, no hepatocellular carcinoma high rate of progression to fulminant hepatitis in pregnant female (esp 3rd trimester)

The serological markers of hepatitis B develop over a specific time course, as outlined below.

HBsAg: The first virological marker detected in the serum after inoculation, it precedes both the elevation of serum aminotransferases and the onset of clinical symptoms. It remains detectable during the entire symptomatic phase of acute hepatitis B and suggests infectivity.

Anti-HBs: Appearing in the serum after either successful HBV vaccination or the clearance of HBsAg, this marker remains detectable for life. It serves as an indicator of noninfectivity and immunity. However, there is a time lag between the disappearance of HBsAg and the appearance of anti-HBs in the serum, which is termed the "window period."

HBcAg: This marker is not detectable in serum as it is normally sequestered within the HBsAg coat.

Anti-HBc: Appearing in the serum shortly after the appearance of HBsAg, this marker remains detectable long after the patient recovers. The IgM fraction signals the acute phase of disease, whereas the IgG fraction signals recovery from the disease. Because IgM anti-HBc is present in the "window period," it is an important tool for diagnosis when HBsAg has been cleared and anti-HBs is not yet detectable. Thus IgM anti-HBc is the most specific marker for diagnosis of acute hepatitis B.

HBeAg: This antigen is detectable shortly after the appearance of HBsAg and indicates active viral replication and infectivity. It is associated with the presence of HBV DNA. HBeAg tends to disappear shortly after aminotransferase levels peak and before HBsAg is eliminated, and is followed by the appearance of anti-HBe. Should it persist for more than three months, there is an increased likelihood of chronic hepatitis B.

Anti-HBe: This marker suggests the cessation of active viral replication and low infectivity.

Therefore, testing for both HBsAg and anti-HBc offers the best screening for acute hepatitis B infection, as it won't miss the window period when HBsAg has disappeared but anti-HBs has not yet appeared in the serum.

PURPURA

	hx	s/sx	dx	rx	prognosis
mixed cryoglobulinemia		palpable purpura proteinuria hematuria (glomerulonephritis) arthralgias peripheral neuropathy hepatosplenomegaly hypocomplementemia	circulating cryoglobulins	test for HCV Abs	
henoch-schonlein purpura		palpable purpura on buttocks abd pain arthralgias proteinuria hematuria - rbc casts on UA			
SLE	young adult females	skin - malar/discoid rash	Anti-nuclear Abs very specific: Anti-DNA & Anti-Sm Ab's	renal involvement	
microscopic polyangiitis		fever, malaise abd pain hematuria purpura	ANCA + otherwise normal serology		

SMALL BOWEL OBSTRUCTION (SBO)

proximal vs. mid/distal. simple (luminal occlusion) vs. strangulated (loss of blood supply)

	s/sx	dx	rx
complete proximal	early vomiting abd discomfort/bloating	xray - abnormal contrast filling	
mid/distal	delayed vomiting colicky abd pain prominent abd distention constipation hyperactive bowel sounds	xray - dilated loops	
strangulated	peritoneal signs - rigidity rebound signs of shock (late findings)- fever, tachycardia, leukocytosis		
causes:	<ul style="list-style-type: none"> • adhesions - most common 2/2 abd operations inflammation • children - congenital Ladd's bands • Crohn's chronic fibrosis • rare - peptic ulcer disease. (proximal SBO) 		

CONSTIPATION

	hx	s/sx	dx	rx
vit D toxicity —> hyperCa by inc GI absorption in Ca	>4000 IU daily - meds for treating hypoPTH, or 2ndary hyperPTH from renal failure, or psoriasis topical vit D	+ abd pain + polydipsia		
hypothyroidism		+ cold intolerance + fatigue + wt gain		
diverticulitis	RUQ pain, tenderness and guarding, low grade fever,	complications - if not resolve with IV abx, suspect abscess, fistula, frank perforation - by CT		

DIARRHEA

	hx/etiology	s/sx	dx	rx
adrenal insuff		wt loss fatigue muscle weakness orthostatic hypotension headache		
malabsorption		wt loss edema vit def		
watery diarrhea	cdiff			
inflammatory diarrhea	salmonella			

VOMITING

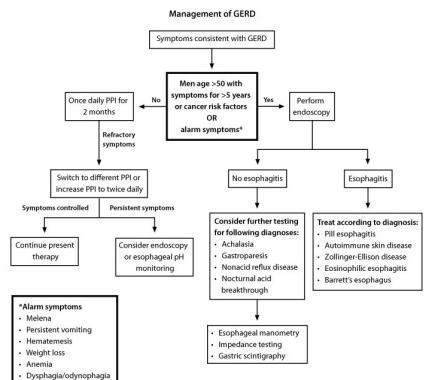
	hx/etiology	s/sx	dx	rx	prognosis
foodborne	staphylococcus				

GI BLEED

	hx	s/sx	dx	rx
mallory-weiss tears (10% of upper GI bleeds)	2/2 vomiting (inc intragastric pressure)	tears in submucosal arteries of distal esophagus and prox stomach		90% stops spontaneously if not, vasopressin, endoscopic injection, electrocautery
esophageal varices	2/2 portal hypertension	ruptured dilated submucosal veins at gastroesophageal junction		
iatrogenic	2/2 endoscopy	immed after procedure		
stress ulcers	ICU or burn unit setting			
peptic ulcer dz				
gastritis				
esophagitis				
angiodysplasia	dilated, ectatic, thin-walled vessels lined by endothelium. chronic painless bleeding often underlying aortic stenosis (disrupts vonwillebrand multimers) or ESRD (uremic platelet dysfxn) that makes prone to bleeding age >60yo	anemia, painless GI bleeding aortic stenosis murmur	colonoscopy, upper endoscopy, small-bowel enteroscopy, or capsule endoscopy	
diverticulosis	most common cause of painless lower GI bleeding		colonoscopy - multiple outpouchings of mucosa through hypertrophied muscle layers	
hemorrhoids		blood on surface, not mixed with, stools	detected on rectal exam	
colon cancer	painless chronic bleeding		colonoscopy - (hyperplastic polyps are non-neoplastic)	

Inflammatory bowel dz: Crohn's vs Ulcerative colitis	bimodal age distribution 20yo, 60yo		neutrophilic cryptitis: <ul style="list-style-type: none"> • Crohn's = extends transmurally through entire bowel wall, skip lesions, cobblestone appearance, creeping fatty appearance of mesentery, fistulas, fissures, perianal disease. non-caseating granulomas are pathognomonic. • UC = superficial in mucosal surface, crypt abscesses 	conservative - bowel rest, ng tube, steroids or abx
	Crohns - two patterns <ul style="list-style-type: none"> • fibrostenotic obstructing pattern • penetrating fistulous pattern UC (and Crohns involving colon)- subacute presentation of abd pain with bloody stool	Crohn's - most commonly terminal ileum but anywhere mouth to anus, rectum generally spared UC - limited to colon, always involves rectum , may involve terminal ileum. complications: acutely worse - toxic megacolon : dx = <u>radiographic distension</u> <u>≥6cm</u> + <u>at least 3 of:</u> <ul style="list-style-type: none"> • fever >38 C, • HR >120 • neutrophilic leukocytosis > 10,500, • anemia + <u>at least 1 of:</u> <ul style="list-style-type: none"> • volume depletion • altered sensorium • electrolyte disturbances • hypotension 	severe - emergent surgery w subtotal colectomy and end-ileostomy	

melena = black or tarry stool = GI bleed above the ligament of Treitz



ESOPHAGUS

	etiology	sx	dx	complications/rx	rx
GERD			do upper GI endoscopy if have alarm symptoms (dysphagia, odynophagia, wt loss, anemia, gi bleeding, recurrent vomiting) or men >50yo w >5yr (chronic) sx and cancer risk factors (tobacco)	predisposes to: <ul style="list-style-type: none">• erosive esophagitis• peptic strictures and/or• Barrett's esophagus (intestinal metaplasia of lower esophagus)	initial trial of PPI (daily for 2 mo) if refractory, switch PPI or use BID
esophageal (peptic) stricture	2/2 GERD, radiation, systemic sclerosis, caustic ingestion	dysphagia for solids not liquids no wt loss	barium swallow - symmetric lower esoph narrowing		
adenocarcinoma	typically in pts who have had GERD sx >20 yrs.	subtle sx retrosternal discomfort mild dysphagia to solid foods burning sensation	barium swallow: asymmetric narrowing of esoph lumen		
achalasia	esophageal motility d/o	presents w dysphagia of both solids and liquids food regurgitation	barium swallow - <ul style="list-style-type: none">• aperistalsis• poor emptying of barium• dilation of proximal esophagus• bird beak narrowing at GE junction		
vascular rings	aortic arch vessels encircle trachea +/- esophagus	dysphagia is usually the presenting complaint			
zenker diverticulum	posterior lower cervical esophagus near cricopharyngeus muscle, most common in elderly	dysphagia and regurg, foul-smelling breath, at risk for aspiration pneumonia	contrast esophagram	surgical	

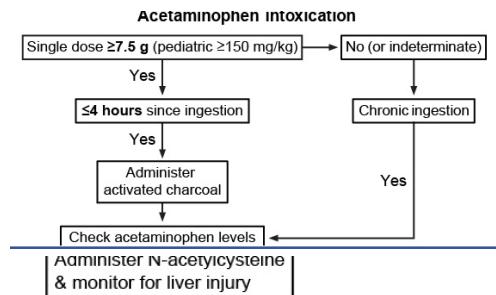
DYSPHAGIA

	sx	dx	complicatios/rx	rx
oropharyngeal	difficulty initiating swallowing assd with coughing, choking, or nasal regurgitation	videofluoroscopic modified barium swallow		
esophageal	<p>can initiate swallowing but has difficulty passing food down the esophagus</p> <p>dysphagia with solids then liquids = mechanical obstrxn</p> <p>dysphagia with solids and liquids both at onset, or intermittent dysphagia = motility disorder</p> <p>progressive dysphagia = achalasia or systemic sclerosis aka scleroderma</p> <p>progressive dysphagia = stricture or cancer</p> <p>nonprogressive = esophageal rings</p>	<p>barium swallow before endoscopy if hx of prior radiation, caustic injury complex stricture, or surgery for esoph/laryng cancer (risk of perf)</p> <p>barium swallow is more effective in evaluating motility d/o's. further eval with motility studies/ manometry to confirm dx.</p> <p>o/w endoscopy and if neg, barium swallow</p>		

MISCELLANEOUS

normal liver span is 6-12 cm in midclavicular line

statins - inhibit HMG-CoA reductase. Can cause hepatic dysfunction. Myalgias/myopathy-



>7.5g single dose. may be ask for first 24 hrs, or n/v/anorexia. then severe liver injury.
if within 4 hrs, give activated charcoal. get acetaminophen level, and dose N-acetylcysteine accordingly

symmetric prox muscle weakness or tenderness (2/2 decreasing coenzyme Q10 synthesis)

metastasis:

colon -> liver most common

lung cancer -> liver, bone, brain, adrenal glands

liver <- (mets most common - GI, lung, breast, skin (melanoma))

signs of portal htn: esophageal varices, spider nevi, palmar erythema, caput medusa. thrombocytopenia and coagulopathy often seen.

FFP has all clotting factors.

liver synthesizes all factors except factor VIII. Vit K dependent factors are II, VII, IX, and X.

for hi volume bleeds - 2 large bore IVs, T&S, platelets if <50,000/mm³, if hematemesis w/r/o aspiration - endotracheal intubation to secure airway.

celiac disease - "malabsorption and iron def anemia"

= small bowel malabsorption -> bulky, foul-smelling stools, def of vit A (hyperkeratosis), D and calcium (bone pain 2/2

osteomalacia, fx 2/2 osteoporosis), K (easy bruising), iron (pallor/anemia, fatigue)

gold std = villous atrophy small bowel bx. serum IgA antiendomysial and antiTTG Abs + (but might be negative because of assd IgA deficiency). would see low serum and urine excretion of Dxylose test.

pernicious anemia - autoimmune d/o where body makes anti-intrinsic factor Abs. leading cause of B12 def

etiology: anti-intrinsic factor Abs decrease amt of functional IF to facilitate B12 absorption. Also develop a chronic atrophic gastritis with decreased production of intrinsic factor by gastric parietal cells —> inc 2-3x r/o intestinal-type gastric cancer and gastric cardinoid tumors.

spontaneous bacterial peritonitis - intestinal bacterial direct translocation, or hematogenous spread to liver and ascites - us gram neg (ecoli, klebsi)

ascitic fluid PMN ≥250 cells/uL, +cx and exclusion of 2ndary causes of peritonitis

SAAG ≥1.1g/dL = portal htn caused the ascites

Ascites protein <1g/dL & glucose >50 mg/dL

rx - empiric abx like 3rd gen cephalosporins (cefotaxime).

ASCITES

cause	SAAG	total ascites protein	ascitic amylase	other
alcohol hepatitis				
pancreatic ascites 2/2 chronic pancreatitis (2/2 chronic etoh)	<1.1 g/dL	>3 g/dL	>1000 IU/L	
malignancy-related (eg hepatocellular carcinoma)	<1.1 g/dL			
secondary bacterial peritonitis (2/2 perf peptic ulcer or bowel)	>1.1 g/dL	< 1g/dL glucose >50 mg/dL		PMN > 250 cells/uL free air under diaphragm on cxr
spontaneous bacterial peritonitis	>1.1 g/dL	< 1g/dL glucose >50 mg/dL		

splenomegaly - malaria, lymphoma (hodgkin), infectious mononucleosis 2/2 ebstein-barr virus

liver (amebic) abscess - echinococcus. endemic area, occasionally jaundice.

"anchovy paste". dx w u/s, CT scan, MRI. confirm = serum Ab for amebiasis. supporting = leuk>10,000 or elevated alk phos.

rx empiric oral metronidazole. do not aspirate unless no impvt.

hepatic adenoma - benign epithelial tumors as solitary mass in right hepatic lobe. young and middle aged women w hx of OCP usage. palpable abd mass, hepatomegally, or jaundice.

gastroparesis - rx with metoclopramide (prokinetic and antiemetic) - sfx risk of extrapyramidal side effects (eg tardive dyskinesia). or IV erythromycin (acute rx)

antiemetics - antihistamines (promethazine, diphenhydramine) or 5HT3 antagonists (ondansetron, granisetron)

granulomas = GI TB, sarcoid, yersinia, crohns

cirrhosis:

sx = nonspecific - anorexia, wt loss, weakness, fatigue, muscle cramps

jaundice, pruritis, GI bleed (melena, hematemesis), encephalopathy (confusion, sleep disturbances), amenorrhea/ anovulation, hypogonadism in men.

phys ex =

skin - telangiectasias, caput medusae,

Chest - gynecomastia

Abd - ascites, hepatomegaly, splenomegaly

GU - testicular atrophy

Ext - palmar erythema, Dupuytren's contracture, clubbing

Hepatic encephalopathy -

rx:

1. supportive (volume repletion), give adequate nutrition, and lower serum ammonia (oral or enema lactulose, if refractory after 48 hrs, rifamixin)

2. treat precipitating cause:

- medications - sedatives
- hypovolemia
- infection
- excess nitrogen load - ex: GI bleed
- electrolyte abnormalities - ex: hypokalemia (met alkalosis converts ammonium to ammonia (which can cross BBB))

Colonoscopy findings:

- hundreds of colonic polyps - familial colonic polyposis (FAP) - autosomal dominant, 2/2 mutations in adenomatous polyposis coli (APC) gene. 100% risk of cancer. Rx protocolectomy.
- melanosis coli - dark brown discoloration of colon with pale patches of lymph follicles shining through.

Lynch syndrome - high risk of extracolonic tumors, most common is endometrial carcinoma

Neuro/ Cards

CARDIAC

cardiac tamponade = Beck's triad = jugular venous distention, muffled/distant heart sounds, hypotension
+/- pulsus paradoxus >10mm Hg drop in systolic bp during inspiration
positive hepatojugular reflux
clear lungs (not vol o/l)
compensatory tachycardia and inc contractility 2/2 sympathetic stimulation to maintain cardiac output

(etiology: fluid accumulation (eg from viral pericarditis/pericardial effusion) in pericardial cavity so intrapericardial pressure > diastolic vent pressure —> dec venous return to heart/both ventricles —> dec preload, stroke volume, cardiac output.
etiology of pulsus paradoxus: inspiration —> filling of right ventricle —> interventricular septum shifts towards left ventricle cavity —> further dec left vent filling).

rx - pericardiocentesis, pericardectomy

NOTE:

inspiration = lowers intrathoracic pressure and increase venous return to right ventricle

HEART FAILURE

COR PULMONALE

Common etiologies	COPD (most common) PE (also common) Interstitial lung disease Pulmonary vascular disease (thromboembolic) OSA
Symptoms	Dyspnea on exertion, fatigue, lethargy Exertional syncope (due to ↑ cardiac output) Exertional angina (due to ↑ myocardial demand)
Examination	Peripheral edema inc JVP with prominent a wave Widely split and loud (pulmonic component of) S2 Right sided heave Pulsatile liver from congestion Tricuspid regurgitation murmur
Imaging	ECG: partial or complete RBBB, right axis deviation, RVH, right atrial enlargement ECHO: pulmonary HTN, dilated right ventricle, tricuspid regurg R heart catheterization: right ventricular dysfunction, pulmonary HTN, no left heart disease

Etiology	Systemic hypertension is the classic cause (chronic high left ventricular diastolic pressures -> atrial dilatation, can -> afib)
Symptoms	Can lead to decompensated heart failure
Examination	
Imaging	
Treatment	Diuretics Blood pressure control

DIURETICS/ANTIHYPERTENSIVES

Non pharmacologic:

Treatment of hypertension		
Modification	Recommended plan	Approximate ↓ systolic BP (mm Hg)
Weight loss	Reduce BMI <25 kg/m ²	5-20 per 10-kg loss
DASH diet	Diet high in fruits & vegetables & low in saturated fat & total fat	8-14
Exercise	30 min/day for 5-6 days/week	4-9
Dietary sodium	<3 g/day	2-8
Alcohol intake	2 drinks/day in men & 1 drink/day in women	2-4

<u>Class of Drug</u>	<u>Examples</u>	<u>How it works?</u>	<u>Mortality Benefit?</u>
ACE/ARB	Ie. Captopril, losartan	Limits ventricular remodeling	Improves mortality
B-blockers	Ie. Metoprolol, carvedilol, bisoprolol	Blocks the neurohormonal cascade that leads to disease progression	Improves mortality
COX inhibitors	Aspirin	Prevents platelet aggregation	Improves mortality in patient w/ underlying CAD
Loop Diuretics	Furosemide	Diuretic	Symptomatic relief
Aldosterone antagonist	Spironolactone, eplerenone	K+ sparing diuretic	Improves mortality
Cardiac Glycoside	Digoxin	Increases heartâ€™s contractility	Symptomatic relief

Renin is produced in the juxtaglomerular cells of the kidney in response to hypoperfusion. Renin cleaves angiotensinogen into angiotensin I, which is converted into angiotensin II by angiotensin-converting enzyme (ACE) in the lung. Aldosterone acts on the collecting ducts to increase renal sodium and water reabsorption. The net result of RAAS activation is increased blood pressure, total body sodium and water, and blood volume. As a result, any drug that blocks the effect of angiotensin II or aldosterone enhances natriuresis.

HEART FAILURE MEDICATIONS

	Mechanism	Affect on RAAS (renin, angiotensin II, aldo)
Loop diuretics		Decreased blood volume stimulates renin release that in turn increases angiotensin II and aldosterone concentrations hRenin hAng-II hAldosterone
Hydrochlorothiazide		
K-Sparing		
ACE inhibitors	Prevent conversion of angiotensin I to angiotensin II	
Direct renin inhibitors (eg, aliskiren)		iAng-II iAldosterone
Angiotensin receptor blockers	Prevent angiotensin II from acting on angiotensin receptors. Unlike ACE inhibitors, angiotensin receptor blockers do not decrease angiotensin II levels but decrease aldosterone production.	-- Ang-II iAldosterone
Aldosterone receptor antagonists		-- Ang-II hAldosterone (by blocking the mineralocorticoid receptors)

Cardiorenal syndrome - ex in heart failure patients with volume overload but low cardiac output → poor renal perfusion. Rx with IV loop diuretics to improve renal perfusion

ENDOCARDITIS

	in IVDU (++ risk in HIV) Tricuspid/Right-sided > aortic valve	left-sided/mitral
Signs/Sx	Fevers, chills Septic emboli common (occur in up to 75% of pts): Lung -- pleuritic chest pain, dyspnea, and/or cough Fewer peripheral manifestations splinter hemorrhages Janeway lesions Often lacks audible tricuspid valve murmur (due to relatively low pressure gradient across the valve) [tricuspid regurg - holosystolic murmur of lower sternum, increases in intensity with inspiration)	Intermittent fever fatigue new holosystolic murmur
Dx	Requires high degree of suspicion CT may show pulm septic emboli, usually at periphery: Pulmonary infiltrates Abscesses Infarction Gangrene Cavities	+ bl cx
Organism	Most common -- Staph aureus in IVDU >=50% cases	<ul style="list-style-type: none"> • staph aureus - prosthetic valves, intravascular catheters, implanted devices (pacemakers, defibrillators), IV drug users. most common hosp-assd • streptococci - most common community acqd • viridans group strep (strep sanguinis, mitis, oralis, mutans, sobrinus, milleri)- dental procedures, bx/incision of resp tract. • coag neg staph - IV catheters, prosthetic valves, pacemakers or defibrillators • enterococci - nosocomial UTI • strep bovis - colon ca, IBD • fungi - immunocomp host, chronic indwelling catheters, prolonged abx
Complications	Septic emboli - to lungs	splenic abscess 2/2 hematogenous spread or septic emboli — presents with classic triad: fever/chills, leukocytosis, & LUQ pain. left-sided pleural effusion with left-sided pleuritic chest pain, splenomegaly. 2/2 staph, strep, salmonella. dx by abd CT Rx abx & splenectomy, +/- percutaneous drainage if poor surg candidate
Rx (empiric)	Native valve: Cover methicillin-susceptible and resistant staphylococci, streptococci, and enterococci Ex: Vanc	vancomycin to cover: staphylococci (methicillin-susceptible and -resistant) streptococci enterococci
Post-culture sensitivity results	<ul style="list-style-type: none"> • Amp-sulbactam for penicillin-resistant enterococcus and HACEK organisms • Penicillin G for penicillin-susceptible viridans streptococci. • Aminoglycosides (gentamycin) • Clindamycin for ppx for high risk patients undergoing invasive dental procedures. 	viridans group streptococci (ex strep mutans) - very susceptible to pcn with MIC of <0.12 ug/ml <ul style="list-style-type: none"> • = IV aqueous penicillin G q4-6 hrs of 24hrs continuous infusion or IV ceftriaxone once daily for 4 wks (easier for home administration) • if pcn allergy, IV vanc

Syncope

Abrupt and transient loss of consciousness with loss of postural tone, followed by spontaneous and complete recovery

Caused by:	Assd sx:	Assd labs/EKG findings:
Orthostatic Hypotension		
Impaired baroreceptor sensitivity/ autonomic failure	<ul style="list-style-type: none">• In elderly• Presyncope sx	
Volume depletion:	<ul style="list-style-type: none">• 2/2 diarrhea, decreased fluid intake, diuretic therapy, blood loss• Dry mucous membranes, postural drop in BP (≥ 20 mmHg drop in systolic blood pressure with position change)	<ul style="list-style-type: none">• >20:1 BUN:Cr ratio• Lactic acidosis if late stages/severe vol depletion/ hypovolemic shock)• Inc hematocrit (hemoconcentration) in pts with volume depletion fr diarrhea or vomiting• Dec hematocrit if overt significant blood loss
Cardiac		
Structural		
<ul style="list-style-type: none">• Aortic stenosis,• Hypertrophic cardiomyopathy• Anomalous coronary arteries	Syncope with exertion or during exercise	
Conduction		
<ul style="list-style-type: none">• Ventricular arrhythmias• Sick sinus syndrome• Bradyarrhythmias• AV block	<ul style="list-style-type: none">• Prior history of coronary artery disease , myocardial infarction, cardiomyopathy, or reduced ejection fraction• Sinus pauses on monitor• Can be intermittent	Prolonged PR interval or QRS duration
<ul style="list-style-type: none">• Torsades de pointes (acquired long QT syndrome)• Congenital long QT syndrome	<ul style="list-style-type: none">• Medications causing prolonged QT interval• Triggers – exercise, swimming, sudden noise, during sleep• Family history of sudden death	<ul style="list-style-type: none">• HypoK, hypoMg• Prolonged QT interval
Neurologic		
Vasovagal or neurally mediated syncope	<ul style="list-style-type: none">• Triggers – prolonged standing or emotional distress, painful stimuli• Prodromal sx – nausea, warmth, diaphoresis	
Seizure	<ul style="list-style-type: none">• Tonic-clonic movements, loss of bowel or bladder control, post-ictal phase	

SYNCOPE

	hx	s/sx	dx	rx
AAA rupture	involves all aortal layers, does not create an intimal flap or false lumen. >3cm at level of renal arteries typically >60yo, men hx smoking, CAD	profound hypotn acute onset abd or back pain followed by syncope +/- pulsatile mass on exam complication: can create aortocaval fistula with inferior vena cava —> venous conestion in retroperitoneal structures (eg bladder —> distends veins in bladder that rupture —> gross hematuria)	————>	immediate emergent surgical repair

in patients with syncope (or exertional syncope) due to suspected structural heart disease (AS, hypertrophic cardiomyopathy, LV dysfunction, vtach, cardiac tamponade) = get TTE
 —> can follow w exercise stress testing

if suspicion for coronary disease, cardiomyopathy, or valvular heart disease —> exercise stress test

if suspicion for arrhythmia (sinus pauses, advanced AV block, vtach, vfib) as cause —> holter monitor

MENINGITIS & ENCEPHALITIS

	Signs/Sx	CSF findings
Bacterial meningitis	Sudden onset fever, stiff neck, headache, nausea, severe myalgias in otherwise healthy patient	Elevated wbc Elevated protein Decreased glucose
--Meningococcal meningitis (meningococcemia)	+ hypotension, tachycardia, intense myalgias, purpuric skin lesions, petechiae Within several hours of initial meningitis	
--Pneumococcal meningitis	Not assd with acute onset of pupura or skin lesions	Elevated wbc Elevated protein Decreased glucose
--Later in course of Lyme disease	Erythema chronicum migrans	
Syphilitic meningitis	Not as sudden onset Assd with peripheral rash of secondary syphilis -- palms of hands and soles of feet, and generalized lymphadenopathy	
Arboviruses -- eastern equine, western equine, St Louis and West Nile virus	Encephalitis presents with altered mental status, fever, and focal neurologic deficits without nuchal rigidity or signs of meningitis	
Other red rashes		
--Rocky Mountain spotted fever	Rash begins from ankles and wrists and spreads both centrally and to the palms and soles	Viral mengingitis-like findings

ONC/NEURO SX WEAKNESS

	Myasthenia gravis	Lambert-Eaton	Polymyositis	Amyotrophic lateral sclerosis
		Occurs in association with small cell carcinoma of the lung		
Mechanism	Autoantibodies ag postsynaptic receptors	Autoantibodies directed ag voltage-gated calcium channels in the presynaptic motor nerve terminal -> Leads to defective release of Ach -> proximal muscle weakness		
Sx	Weakness in proximal muscles Deep tendon reflexes preserved, somewhat brisk in clinically weak muscles	Weakness in proximal muscles Loss of deep tendon reflexes h/o smoking, wt loss, lung mass, malaise		
Dx		Electrophysiological studies confirm: Muscle response to motor nerve stimulation should increase with repetitive stimulation		
Rx		Plasmapheresis Immunosuppressive drug therapy		

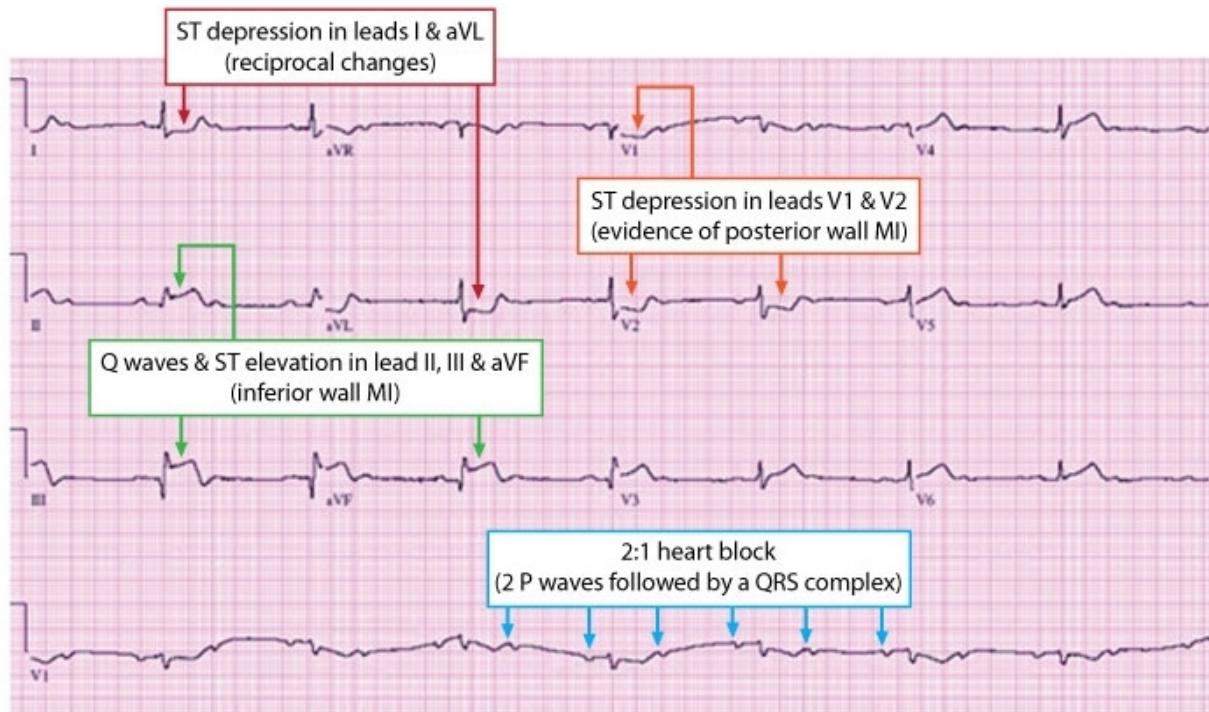
Plasma Cell Disorders

	MGUS	Multiple myeloma	Waldenstrom's Macroglobulinemia	Amyloidosis (1° or 2°)
		excessive production of kappa/ lambda light chain	IgM monoclonal gammopathy	AL –monoclonal light-chain fragments AA – serum amyloid A. Assd with chronic inflammatory diseases (eg RA), infections, neoplasms
Sx	Mild sx or Asymptomatic	<ul style="list-style-type: none"> • Anemia + bone pain with mvt • Lethargy, wt loss • Hypercalcemia (polyuria, constipation, confusion/ lethargy) • Renal failure - Bence-Jones • Lytic bone lesions • Dec anion gap • Infxns by encapsulated bacteria • >40yo • African American 2x incidence 	<ul style="list-style-type: none"> • Anemia + bone pain • Lethargy, wt loss • Hyperviscosity syndrome = stroke, retinopathy, CHF, sensorimotor peripheral neuropathy • Splenomegaly • Coagulation abnormalities • Cold agglutinin (AIHA) 	
Labs		<ul style="list-style-type: none"> • Urine – Bence Jones • ESR >55 • Rouleaux RBCs 		
Dx		<p>+ M spike (IgG or IgA) on SPEP or + UPEP</p> <p>AND</p> <p>↑plasma cells in bone marrow OR Osteolytic bone lesions OR Bence-jones proteinuria</p>	<p>M spike (IgM) on SPEP</p>	Congo red staining (apple green birefringence under polarized light) on tissue bx
Rx		<p>Chemo – Metastatic Radiation - Isolated lesions BMT to prolong survival</p>	<p>Chemo Plasmaphoresis</p>	Chemo
BOTTOM LINE:		Back pain, anemia, renal dysfunction, elevated ESR		

MI'S AND EKG'S

where	vessel	EKG leads involved	other notes
anterior MI	LAD	some or all V1-V6 (esp V1-V4)	can also cause second degree AV block
inferior MI	RCA or LCX	ST elevation II, III & aVF	commonly assd with sinus bradycardia due to increased vagal tone in first 24 hours after infarction and dec RCA blood supply to SA node also assd with hypotension, bradycardia, av block 1/3 involve right ventricle (esp if ST changes in I and aVL l- leftmost leads)
posterior MI	LCX or RCA	ST depression V1-V3 ST elevation I & aVL (LCX) ST depression I & aVL (RCA)	
lateral MI	LCX, diagonal	ST elevation in leads I, aVL, V5 & V6	
right ventricle MI (occurs in 1/2 of inferior MI)	RCA	ST elevation leads V4-V6R	

Posterior and inferior wall MI



RCA supplies AV node too — occlusion can cause AV block.

LAD supplies anterior walls of left ventricle, and anterior 2/3 of septum — occlusion can also cause second degree AV block.

LCX supplies posterolateral wall of left ventricle

Left main coronary — occlusion (both LCX and LAD) usually causes sudden death. ST elevations in anterior and lateral leads (I, aVL, V1-V6)

POST-MI - COMPLICATIONS

	sx	img	rx	px
acute mitral regurgitation 2/2 papillary muscle ischemia or rupture	<p>classically 2/2 posteroseptal MI's (solitary blood supply of posterior medial papillary muscle) but can occur with anterior MIs as well</p> <p>inc LA pressure -> pulm edema: orthopnea, babasilar crackles</p> <p>blowing systolic murmur at cardiac apex</p> <p>no sig chg in LVEF (which decreases with chronic MR, 2/2 LV weakness and inc compliance)</p>		<p>reversible w reperfusion if papillary muscle ischemia.</p> <p>rupture requires emergent surgery</p>	
interventricular septum rupture	<p>pansystolic murmur</p> <p>can lead to left-to-right shunt</p>			
ventricular arrhythmias (not common cause of sudden death in immediate post MI period)	<p>common in immediate post MI period:</p> <ul style="list-style-type: none"> • w/in 10 min = immediate/phase 1a (2/2 reentry) • 10-60 min post MI = delayed/phase 1b arrhythmia (2/2 abnormal automaticity) <p>vfib, vtach (sustained or nonsustained), vent premature beats</p>			
cardiac catheterization complications	<p>at catheter insertion site -</p> <ul style="list-style-type: none"> • w/in 12 hrs: bleeding, hematoma (localized/ retroperitoneal extension) • arterial dissection, thrombosis, pseudoaneurysm, av fistula. <p>cholesterol embolism (atheroembolism) —> tissue or organ ischemia.</p> <ul style="list-style-type: none"> • immed - ≥30 days after • intestinal ischemia, GI bleed, pancreatitis, aki • skin most common = blue toe syndrome, livedo reticularis, gangrene, ulcers • Hollenhorst plaques in retinal artery 2/2 internal carotid artery 		<p>supportive statins</p>	
post-myocardial pericarditis - Dressler's syndrome	1-6wks after MI sharp and pleuritic cp, pericardial friction rub			

post MI CHF:

LV systolic dysfxn —> LV dilation/remodeling/papillary muscle displacement —> MR 2/2 mitral annulus enlargement

impaired myocardial contractility —> dec Cardiac output —> inc norpi, renin, ADH —> inc SVR —> inc blood volume, inc preload, and short-term improves stroke volume but —> inc afterload —> inc left-sided pressures —> 2ndary right heart failure = pulm congestion —> pulm edema

HIGH OUTPUT CARDIAC FAILURES

	types	sx	dx	rx
AV fistula (AVF) -> dec systemic vascular resistance -> inc cardiac preload ->	<p>congenital -</p> <ul style="list-style-type: none"> • PDA • angiomas • pulm AVF • CNS AVF <p>acquired -</p> <ul style="list-style-type: none"> • trauma • iatrogenic (femoral cath) • atherosclerosis (aortocaval fistula) • cancer 	<p>w sig AV shunting, compensatory inc HR + SV</p> <p>when decompensates -> high output cardiac failure bc cannot meet O₂ demand</p>	doppler u/s	surgery for large AVF

HEART FAILURE

Signs/sx:

left sided	<p>elevated pro-brain natriuretic peptide (proBNP) = secreted in response to ventricular stretch and wall tension when cardiac filling pressures are elevated. = secreted by cardiac myocytes</p> <p>low BNP rules out acute heart failure w very high NPV</p>	<p>S3 = soft diastolic sound produced by tensing of the papillary chordal apparatus when there is rapid influx of blood into the ventricle in early diastole. aka blood sloshing into "big baggy heart"/ ventricle</p>	<p>+/- wheezing - 2/2 bronchial wall edema crackles on lung exam CXR - pulm vascular congestion and interstitial edema</p>	
right sided	JVP distension Kussmaul's sign - inc in JVD with inspiration	peripheral edema	hepatomeg	clear lungs

		causes		sx	rx
right ventricular		pulm htn 2/2 inc pulm arterial pressure (primary) or inc pulm venous pressure (left ventricular failure) • COPD (most common) • PE (also common) • Interstitial lung disease (eg idiopathic pulmonary fibrosis)	ECG: partial or complete RBBB, right axis deviation, RVH, right atrial enlargement ECHO: pulmonary HTN, dilated right ventricle, tricuspid regurg	• Dyspnea on exertion, • weakness, fatigue, lethargy • Exertional syncope (due to cardiac output) • Exertional angina (due to myocardial demand) exam: • Peripheral edema • inc JVP with prominent a wave, reduced carotid upstroke • Widely split and loud (pulmonic component of) S2	doesn't present as right heart failure until late in the disease requires high preload to maintain BP — so IV fluids NOT nitroglycerin and diuretics supplemental O2 diuretics treatment of underlying etiology IV inotropes for severe decompensation
		OSA	R heart catheterization: gold std. right ventricular dysfunction, pulmonary HTN, no left heart disease	• Right sided heave • Pulsatile liver from congestion +/- ascites • Tricuspid regurgitation murmur	
left ventricular	primarily diastolic dysfxn aka preserved left ventricular ejection fraction (HFPEF) • Impaired filling of left or right ventricle 2/2 impaired myocardial relaxation or stiff, non-compliant ventricle. • Contractility (i.e. ejection fraction) may remain normal but diastolic pressures are elevated -> reduced cardiac output	restrictive cardiomyopathy - 2/2: • infiltrative - sarcoid, amyloid • storage dz - hemochromatosis • endomyocardial fibrosis • idiopathic constrictive pericarditis hypertrophic cardiomyopathy diastolic - dec ventricular filling systolic - dec cardiac output	echo - symmetric echo - interventricular septum is thickest	sx of right sided heart failure predominate - prominent jvd, bilat ankle edema, tender hepatomegaly left sided heart failure sx too - bibasilar rales, pleural effusion syncope in 15-25% pts presyncope or cp with exertion fam hx of sudden death crescendo-decrescendo murmur at apex and LL sternal border: • softer with squatting/ handgrip (inc preload and venous return and inc LV cavity size) • louder with straining/ valsalva/abrupt standing (dec preload and ventricular size)	only hemochromatosis is reversible. rx with phlebotomy (remove iron from bloodstream) sarcoid or scleroderma - steroids can slow progression and prolong survival but not reversible. beta blockers - • slows heart and prolongs diastole -> more filling -> less outflow obstrxn • also antianginal effect if can't tolerate bblockers, ca ch blockers/diltiazem
	primarily systolic dysfxn	• ischemic heart disease • hypertension • cardiomyopathy		normal or decreased pulse pressure, weak carotid upstroke, cold pale extremities	cardioselective beta blockers (carvedilol, sustained-release metoprolol succinate, atenolol, bisoprolol)
both	dec cardiac contractility				

Notes:

for borderline/low EF < 55%, inc risk of cardiotoxicity 2/2 trastuzumab (aka herceptin) with chemo.

Acute decompensated heart failure —

2/2: <ul style="list-style-type: none">• (most commonly) left ventricular, systolic or diatolic dysfunction. +/- additional cardiac disease (MI, arrhythmia, MR or AR)• uncontrolled severe HTN• renal artery stenosis• severe renal disease with fluid overload	sx: <ul style="list-style-type: none">• acute dyspnea• orthopnea• paroxysmal nocturnal dyspnea• htn or hypotn if severe• tachycardia• tachypnea• diffuse crackles w possible wheezes/ cardiac asthma• possible S3, JVD, peripheral edema	rx: <ul style="list-style-type: none">• supplemental O2• IV furosemide (+/- if hypotension/ shock)• +/- vasopressor (norepi) if hypotension/shock• +/- IV nitroglycerin
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Indications for carotid endarterectomy	
Men	Asymptomatic: <ul style="list-style-type: none"> • 60%-99% stenosis Symptomatic: <ul style="list-style-type: none"> • 50%-69% stenosis (Grade IIA) • 70%-99% stenosis (Grade IA)
Women	Symptomatic & asymptomatic: <ul style="list-style-type: none"> • 70%-99% stenosis

carotid bruit

MURMURS/HEART SOUNDS/RUBS

type	cause	etiology	where heard?	sx	ekg
systolic murmur	aortic stenosis	<ul style="list-style-type: none"> • age-related sclerocalcific changes • bicuspid aortic valve • HOCM 	<ul style="list-style-type: none"> • harsh ejection (cresc-decresc) murmur • right 2nd intercostal space, radiation to carotid arteries • (HOCM - best at apex and LLsternal border) • pulsus parvus et tardus = delayed and diminished carotid pulse • point of maximal impulse inc in intensity 	<p>cp, dyspnea, dizziness, syncope</p> <p>HOCM at younger age - murmur:</p> <ul style="list-style-type: none"> • softer with squatting/ handgrip (inc preload and venous return and inc LV cavity size) • louder with straining/ valsalva/abrupt standing (dec preload and ventricular size) 	echo - for structural heart disease pts with symptomatic severe AS should be referred for aortic valve replacement
	tricuspid regurg	<ul style="list-style-type: none"> • endocarditis • chagas dz (trypanosoma cruzi) • thyrotoxicosis 	holosystolic accentuated with inspiration		conduction abnormalities are UNcommon
	mitral regurg (MR)	<ul style="list-style-type: none"> • mitral valve perf as complication of mitral valve endocarditis • chagas dz • thyrotoxicosis 		acute CHF	
	Atrial septal defect (ASD)		ejection systolic murmur over left second intercostal space 2/2 inc blood flow across pulm valve +/- mid-diastolic murmur for large ASDs 2/2 inc flow across tricuspid valve		

diastolic murmur	aortic regurgitation (AR)	<p>valvular disease (leaflet)</p> <ul style="list-style-type: none"> • congenital (most common in developed countries) • rheumatic heart dz (developing countries) • endocarditis • bicuspid ao valve • trauma • myxomatous degen • ankylosing spondylitis • acromegaly • meds (fenphen) 	<ul style="list-style-type: none"> • decresc early diastolic murmur • left sternal border (3rd and 4th intercostal spaces) • patient sitting up, leaning forward, holding breath in full expiration 		
		<p>aortic root disease</p> <ul style="list-style-type: none"> • ex: perivalvular abscess 2/2 infective endocarditis +/- IV drug use • htn • aortitis 2/2 syphilis • ankylosing spondylitis • dissecting aneurysm • ehlers-danlos • marfan syndrome • IBD, RA 	right sternal border	syncope	<p>endocarditis + perivalvular abscess can —> conduction abnormality 2:1 2nd degree AV block — iv drug use inc risk of periannular extension</p>
	mitral stenosis (MS)		late diastolic murmur opening snap	pulm edema afib	
pericardial friction rub	acute pericarditis	<ul style="list-style-type: none"> • viral most common • bacterial • connective tissue dz (eg SLE) • uremia 		<p>sharp and pleuritic CP - improves by sitting up and leaning forward</p> <p>uremic pericarditis - BUN > 60mg/dL</p>	<p>diffuse concave upward ST-elevations across precordial and limb leads, PR elevation in aVR (except in uremic pericarditis)</p> <p>rx nsails hemodialysis for uremic pericarditis</p>
	constrictive pericarditis	<ul style="list-style-type: none"> • idiopathic • viral • cardiac surgery/ radiation therapy • TB 		<p>fatigue and DOE periph edema and ascites</p> <p>inc JVP</p> <p>+/- pericardial knock</p> <p>pulsus paradoxus</p> <p>kussmaul's sign</p>	<p>nonspecific, afib, or low voltage QRS</p> <p>jvp tracing has prominent x&y descents</p>

Midsystolic soft murmurs in asx young patient - usually benign. no futher w/u needed.

Diastolic and continuous murmurs - always investigate.

ARRHYTHMIAS

			causes	ekg	sx	rx	px										
SVT - supraventricular tachycardia = any tachycardia originating above His-bundle ekg - mostly narrow complex tachycardia QRS <120ms [figure 0]	afib		most common foci location @ pulmonary veins classification:  <table border="1"> <tr><th>First detected</th><td>Initial diagnosis, independent of duration</td></tr> <tr><th>Persistent</th><td>Persistent (> 7 days) episode or terminates spontaneously in < 7 days, usually within 24 hours</td></tr> <tr><th>Transient</th><td>Episodes longer > 7 days</td></tr> <tr><th>Longstanding persistent</th><td>Persistent > 1 year duration</td></tr> <tr><th>Permanent</th><td>Persistent with no further plans for rhythm control</td></tr> </table>	First detected	Initial diagnosis, independent of duration	Persistent	Persistent (> 7 days) episode or terminates spontaneously in < 7 days, usually within 24 hours	Transient	Episodes longer > 7 days	Longstanding persistent	Persistent > 1 year duration	Permanent	Persistent with no further plans for rhythm control	absent p waves - replaced by tiny chaotic fibrillatory waves, irregularly irregular R-R intervals , narrow QRS complexes	all: palpitations +/- dizziness, lightheadedness, SOB, diaphoresis, CP, presyncope, syncope	for all: if hemodynamically stable: • 1. vagal maneuvers (eg carotid sinus massage, valsalva, eyeball pressure) OR IV adenosine • = helps identify type of SVT bc temporarily slows conduction via AV node and may unmask 'hidden' p-waves in a flutter or atrial tach. • can terminate pSVT medical mgmt: av nodal blockers (NOT for WPW): • beta blockers • ca ch blockers • digoxin • adenosine if hemodynamically unstable afib with rvt: immediate synchronized cardioversion	if rate or rhythm control not possible with medical rx, can get catheter-based radiofreq ablation of myocardial tissue surrounding PVs amiodarone
First detected	Initial diagnosis, independent of duration																
Persistent	Persistent (> 7 days) episode or terminates spontaneously in < 7 days, usually within 24 hours																
Transient	Episodes longer > 7 days																
Longstanding persistent	Persistent > 1 year duration																
Permanent	Persistent with no further plans for rhythm control																
thyrotoxicosis (esp in older patients)																	
paroxysmal SVT sx - abrupt onset and offset	AVRT - atrioventricular reentrant tachycardia	wolff-parkinson-white (WPW) preexcitation syndrome = accessory atrioventricular bypass tract	slurred upsloping R-waves (delta waves)		WPW - drugs that inc refractoriness of AV node increases conduction across accessory pathway —> vfib! so rx is cardioversion or procainamide to return to sinus rhythm												
	AVNRT - atrioventricular nodal reentry tachycardia	reentrant circuit formed by 2 separate conducting pathways (one fast, one slow) within AV node.		sudden onset and termination rapid (140-250/min) regular rhythm narrow QRS complexes, absence of definite P waves (may be buried right after QRS complex)		' = can lead to tachycardia-mediated cardiomyopathy											
	atrial tachycardia	+ AV block = dig tox		HR 150-250 bpm (slower than aflutter)													
aflutter	junctional tachycardia																
	aflutter	reentrant circuit around tricuspid annulus , with slowing of impulse through cavotricuspid isthmus region	rapid "sawtooth" flutter waves	HR 250-350 bpm		' = can lead to tachycardia-mediated cardiomyopathy											
	AV block	perivalvular abscess from endocarditis +/- iv drug use lyme dz MI inc vagal tone (sleep, pain) metabolic (hyperK) meds (beta blockers, ca ch blockers)	P-QRS dissociation constant R-R interval T wave inversions suggest MI [figure 2]		if symptomatic, temporary pacemaker, rx underlying cause if irreversible cause, permanent pacemaker												
	sinus tachycardia	panic attacks			alprazolam												
ventricular tachycardia	monomorphic			wide QRS complex		if hemodynamically stable, amiodarone or lidocaine if hemodynamically unstable, immediate defibrillation	' = can lead to tachycardia-mediated cardiomyopathy										

polymorphic	torsades de pointes		cyclic/sinusoidal alteration of QRS	prolonged QT interval predisposes - fluc/moxiflox, HIV, electrolyte imbalances	if hemodynamically unstable, immediate defibrillation if conscious and stable, IV magnesium	
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figure 0* SVT

- Usually there are no regular P waves as they are buried within the QRS complexes, but retrograde P wave can occur.
- Retrograde P waves: seen in the beginning or end of a QRS complex when the atria & ventricles are not simultaneous. Can appear as spikes on QRS complexes or as inverted P waves.

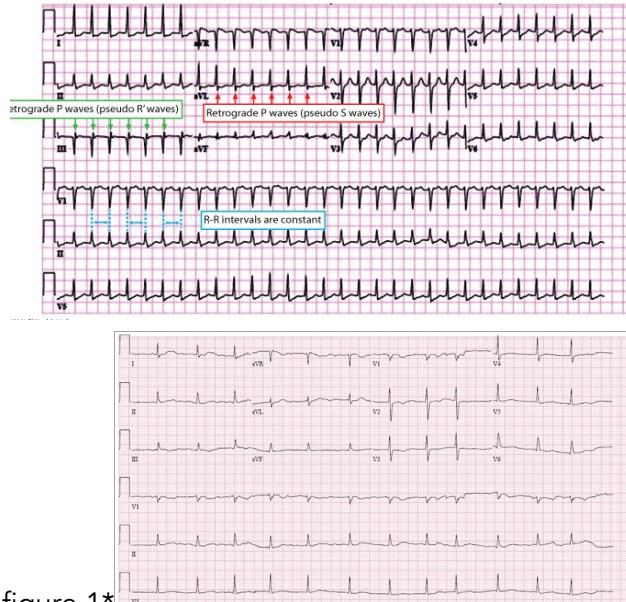
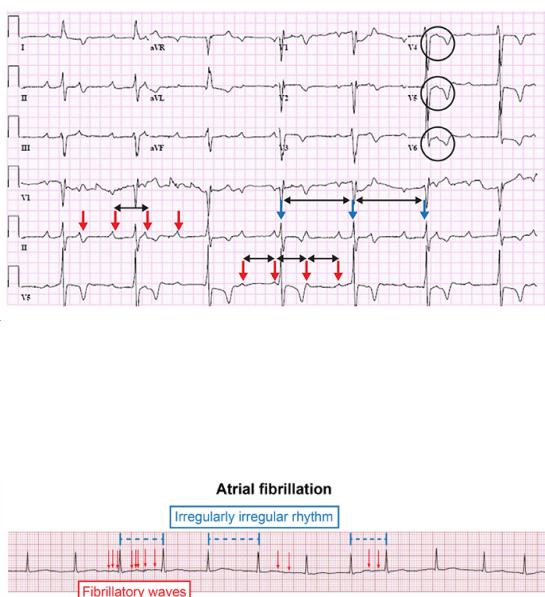


figure 1*

Figure 2* More on complete AV block (3rd degree):



Causes of acquired long QT syndrome	
Medications	<ul style="list-style-type: none"> Diuretics (due to electrolyte imbalances) Antiemetics (eg, ondansetron) Antipsychotics (eg, haloperidol, quetiapine, risperidone) Tricyclic antidepressants Selective serotonin reuptake inhibitors (eg, citalopram) Antiarrhythmics (eg, amiodarone, sotalol, flecainide) Antiangular drugs (eg, ranolazine) Anti-infective drugs (eg, macrolides, fluoroquinolones, antifungals)
Metabolic disorders	<ul style="list-style-type: none"> Electrolyte imbalances ($\downarrow K$, $\downarrow Mg$, $\downarrow Ca$) Starvation Hypothyroidism
Bradyarrhythmias	<ul style="list-style-type: none"> Sinus node dysfunction Atrioventricular block (2nd or 3rd degree)
Others	<ul style="list-style-type: none"> Hypothermia Myocardial ischemia/infarction Intracranial disease HIV infection

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More on Afib management. two concerns to manage:

rate vs rhythm control	anticoagulation
antiarrhythmic drugs for those w recurrent symptomatic episodes, or LV systolic dysfxn due to uncontrolled AFib.	risk of stroke or systemic embolism = CHA2DS2-VASc (essentially weighs benefit of anticoagulation/whether worth the risk) <ul style="list-style-type: none"> CHADS2 = 0 = no anticoag indicated. CHADS2 = 1 = oral anticoag, or aspirin if cannot. CHADS2 ≥ 2 = oral anticoag strongly recommended. (for nonvalvular afib, rivaroxaban Xa inhib)

More on tachycardia-mediated cardiomyopathy:

sx: progressive dyspnea, dec exercise tolerance, tachyarrhythmia/palpitations, s/sx of CHF. may have murmur 2/2 LV dilation

→ dx by ekg, echo, assessment for CAD as alternate cause for LV dysfunction

→ rx by aggressive rate control or restore to sinus rhythm = av node blocking agents, antiarrhythmic drugs, catheter ablation

ANTIARRHYTHMIC DRUGS - 1

	Lidocaine (class I B antiarrhythmic)	Amiodarone (class III)	Metoprolol
Function	Ventricular arrhythmias, not atrial arrhythmias	Rhythm control for Afib or underlying left ventricular systolic dysfunction Ventricular arrhythmias/tach	
Side effects	<p>do not use prophylactically in acs because could increase risk of asystole.</p> <p>Cardiac: <ul style="list-style-type: none"> • Sinus bradycardia, heart block • Risk of proarrythmia - QT prolongation and risk of torsades de pointes </p> <p>Pulmonary: <ul style="list-style-type: none"> • Chronic interstitial pneumonitis (cough, fever, dyspnea, pulmonary infiltrates) most common </p> <p>Endocrine: <ul style="list-style-type: none"> • Hypothyroidism • Hyperthyroidism </p> <p>Gastrointestinal/Hepatic <ul style="list-style-type: none"> • Elevated transaminases, hepatitis </p> <p>Ocular visual disturbances: <ul style="list-style-type: none"> • Corneal microdeposits • Optic neuropathy </p> <p>Dermatologic: <ul style="list-style-type: none"> • Blue-gray skin discoloration </p> <p>Neurologic: <ul style="list-style-type: none"> • Peripheral neuropathy </p> <p>50% of pts on long-term treatment develop significant side effects, should monitor with period thyroid and haptic fxn markers.</p>	<p>Bradyarrhythmias Acute worsening of heart failure</p> <p>Bronchoconstriction</p> <p>Fatigue, weight gain</p>	

ANTIARRHYTHMIC DRUGS - 2 (CONTD)

	Class III antiarrhythmic (Dofetilide)	Digoxin	Verapamil
Function		<p>Systolic dysfunction - Positive inotropic effect</p> <p>RVR 2/2 flutter or afib - Negative dromotropic (increases AV refractoriness)</p>	
Side effects	<p>Risk of torsades de pointes in 3% of patients</p>	<p>Cardiac arrhythmias</p> <p>Thyroid and hepatic effects significantly less common than with amiodarone</p> <p>Nausea, vomiting, diarrhea</p> <p>Anorexia</p> <p>Visual disturbances</p> <p>Confusion</p>	<p>Impaired cardiac conduction and contractility</p> <p>Potential worsening bradyarrhythmias</p> <p>CHF</p> <p>Constipation</p>

Atropine for symptomatic sinus brady, or AVnodal block

MI MEDS

acute rx: PCI < 90 min of first medical contact to balloon time. and <12 hr of sx onset.

	aspirin + P2Y12R blocker (plavix)	nitrates	O2	heparin - unfxn, lmwh, or bivalirudin	beta blockers	ACEinhibitors	statins
Function	inhibits platelet aggregation and prevents recurrence of coronary artery blockage	vasodilators - dilate systemic veins + arterioles > coronary arteries by relaxing sm muscle cells —> lowers preload and LV end diastolic volume —> dec wall stress —> dec myocardial O2 demand arterial/arteriolar vasodilation —> dec systemic vasc resistance and BP —> dec wall stress —> dec myocardial O2 demand	for arterial sat <90%			limits ventricular remodeling in wks to mo's following MI should be started within 24hrs of MI	
Side effects		can induce reflex tachycardia with inc myocardial O2 demand and worsening angina. so use concomitant beta blockers also be careful in pts with hypotension, RV infarct, severe aortic stenosis			contraindicated in heart failure. bradycardia or cardiogenic shock		

for cocaine: IV benzos first for bp and anxiety, then aspirin, nitroglycerin & ca ch blockers for pain, cardiac cath.

Contraindicated: beta blockers (leaves unopposed alpha stim) and fibrinolytics (risk of intracranial hemorrhage).

post MI:

	aspirin 75-325 mg/day	plavix	beta blockers	ACEinhibitors	statins
Function		for pts with UA, NSTEMI and post PCI for 12 mo (mortality benefit) for STEMI: if stent = 1 mo if drug eluting stent = 12 mo class of drugs called thienopyridines. antagonize ADP —> antiplatelet effect		limits ventricular remodeling in wks to mo's following MI should be started within 24hrs of MI	
Side effects					

for chronic stable angina:

anti-anginal:			preventative:		
nitrates (long: isosorbide dinitrate, isosorbide mononitrate)	beta blockers (+/- ca ch blocker (diltiazem, felodipine)	aspirin	statin	behavior mod
use short-acting form for acute relief long-acting for persistent angina	1st line. improves exercise tolerance decreases myocardial contractility and HR —> dec angina mortality benefit for pts w MI	peripheral and coronary vasodilation —> dec angina			<ul style="list-style-type: none"> smoking cessation regular exercise and wt loss control bp and diabetes

CHEST PAIN EVALUATION

patient is:	pretest probability of CAD —>	able to exercise?	result?	
• men <40 • women <50 • atypical cp • no sig cardiac risk factors (nonsmoker, no fam hx of premature CAD)	low	—> —> —>		no addl testing
	intermediate	y - exercise EKG/ imaging test	positive =	coronary angiography
		n - pharmacologic stress imaging test		
	high	—> —> —>		possible CT coronary angio, start meds to treat CAD

CARDIAC ARREST MANAGEMENT

start CPR, O₂, attach defibrillator	• vfib • pulseless vtach	shock then CPR q2min and IV access	if shockable rhythm, shock otherwise: CPRx2 min Epi 1 mg q3-5 min ?advanced airway ?rx reversible causes	if shockable rhythm, shock then CPRx2 min amiodarone otherwise: CPRx2 min Epi 1 mg q3-5 min ?advanced airway ?rx reversible causes
	• asystole • PEA	CPR x 2min IV access Epi 1 mg q3-5m advanced airway		
			^— (repeat) —I	

reversible causes of PEA: 5 H's and T's

sx or sustained monomorphic VT or hemodyn unstable afib = immed synchronized electrical cardioversion

DRUG O/D TOXICITY

	hx/ s/sx	dx	rx
TCA overdose	<ul style="list-style-type: none"> cns - drowsiness, delirium, coma, sz (2/2 gaba inhibition), resp depression cv - sinus tach, hypotension, prolonged pr/qrs/qt intervals -> vtach, vfib anticholinergic - dry mouth, blurry vision, dilated pupils, flushing, hyperthermia, urinary retention 		<p>if QRS > 100 ms, sodium bicarb (alleviates inhibitory action of TCAs on fast sodium channels -> improve hypoten and dec risk risk of ventricular arrhythmias). also give if vtach or vfib.</p> <p>within 2 hrs, activated charcoal</p> <p>if sz, give benzo (gaba agonist)</p> <p>supportive - supplemental o2, intubation, iv fluids</p>
beta blocker overdose	wheezing 2/2 bronchospasm bradycardia 2/2 AV block + hypotension —> cardiogenic shock (cold clammy) delirium, sz hypoglycemia		atropine and IV fluids first. if no impvt of BP -> glucagon (increases cAMP and higher intracell ca -> augment cardiac contractility) if still no impvt —> calcium, glucose/insulin, epi.
ca ch blockers	similar to bblocker tox without wheezing		
cholinergi c agents			
digoxin tox	bradycardia normal BP blurred vision, abn color perception fatigue, ha abd pain atrial tachycardia w AV block (inc ectopy in atria or ventricles, and inc vagal tone)		digoxin specific antibody

HEMODYNAMICS OF SHOCK

	RA pressure (preload) (normal value:)	PCWP (preload) ~ LA pressure or LEDP mean 9mm Hg	SVR (afterload) mean 1150 dynes sec/cm ⁵	Cardiac index (pump function) 2.8-4.2 L/min/m ²	mixed venous O ₂ sat 60=80%
hypovolemic shock	dec	dec	—> inc	dec	dec
cardiogenic shock	inc	inc	—> inc	v dec	dec
septic/distributive shock	nl or slightly dec	nl or slightly dec	dec —> inc with progression to hypodynamic phase	inc	inc

—> means compensatory

bold is primary/cause

WEAKNESS:

MYASTHENIA GRAVIS V LAMBERT EATON

	s/sx	dx	rx
myasthenia gravis	ptosis double vision sob, difficulty swallowing = autoantibodies ag post-synaptic receptors —> dec receptors avail —> weakness weaker with repetition. DTR usually preserved	AchR Ab CT to screen for thymoma	if thymoma, thymectomy
lambert eaton	assd with small cell carcinoma of lung —> autoantibodies ag voltage-gated ca channels in presynaptic motor nerve terminal —> defective Ach release —> prox muscle weakness muscle strength improves with repetition		
polymyositis	proximal weakness (difficulty ascending and descending stairs, combing hair) nl reflexes	high CPK	

MULTIPLE MYELOMA

s/sx	dx	rx	px
back pain anemia renal dysfunction elevated ESR hypercalcemia 2/2 bone lysis (polyuria, constipation, confusion, anorexia, vomiting, weakness)		Epo indicated if Hct <30% or Hg <10 <u>replete iron before starting</u> epo — or else will cause iron def, particularly in chronic dz patients who already have low iron stores	<ul style="list-style-type: none"> • worse HTN (20-50% pts): 10mmHg rise in dBP (unknown mechanism) —> rx by dialysis fluid removal or antihtnsives: beta blockers/vasodilators • Headaches (15% pts) • flu-like sx (5% pts) • red cell aplasia (rare)

RHEUMATOID ARTHRITIS

			rx
			methotrexate hydroxychloroquine TNF-inhibitors (infliximab, etanercept) +/-epo for anemia

|| Anemia in 65yo

GENERAL WORKUP:

sx	phys ex/ROS:	diff dx	tests	further tests
SOB, DOE palpitations fatigue dizziness	conj pallor, guiac + stool epigastric/LUQ pain —> ulcer esp if on nsails ?colonoscopy	GI bleed	EGD (upper and lower) coags (PT/PTT)	if pt/ptt abnormal —> GI bleed from coagulopathy/liver dz • +wt loss, lymphad —> malignancies like leuk/lymph • +young —> sickle cell, thalassemias, g6pd def
		new onset angina (* post menopausal s/sx of angina/ami can be atypical)	ECG + trops	
		CHF		
		Afib	ECG	
			chem7	if low Hg/Hct - anemia w/u: • CBC with peripheral smear, retic count • iron studies • vit b12/folate

NOTES:

reduced o2 carrying capacity of blood 2/2 anemia exacerbates dyspnea from CHF

conj pallor is reliable as sign of anemia in elderly.

glossitis, dec vib/posist sense, ataxia, paresthesia, confusion, dementia, pearly gray hair at early age —> B12 def

jaundice —> hemolysis

splenomeg —> thalassemia or neoplasm

microcytic =

iron def: lo iron, lo ferritin, hi tIBC

thalassemia:

anemia of chronic dz:

macrocytic =

folate def: assd w alcoholics

B12 def: elevated methylmalonic acid (MMA). assd with pernicious anemia, hx of gastrectomy, malabsorption dz (bacterial infection, crohns, celiac)

normocytic =

chronic inflammation (anemia of chronic dz): normal iron stores but def capacity of using stored iron (dist from iron def by TIBC being low)

renal insuff: low epo production

Rx:

transfusion Hg < 7.0

iron def: oral ferrous sulfite 325 mg three times a day

b12 def: IM B12 1000 ug daily for 7 days, then weekly 4 wks, then monthly for rest of life

folate def: 1mg daily until corrected

CAGE: cut back, annoyed, guilty, eye-opener

	Macrocytic anemia
	B12 (cobalamin) def
Iron studies	
	MCV > 100 fL
peripheral smear	
Pathophysiology	pernicious anemia, or short-bowel syndrome, or vegan, or ETOH

Microcytic anemia				
	Iron deficiency	Thalassemia (minor)	Anemia of chronic disease (inflammation)	hereditary spherocytosis
Iron studies	Low iron Low ferritin Inc TIBC Low transferrin saturation (iron/TIBC) Low MCV hct can go below 30%	Hi iron Hi ferritin Low TIBC V hi transferrin saturation V. Low MCV <75 fL hct rarely below 30%	Low iron Normal/hi ferritin Low TIBC Normal/Low transferrin saturation Normal/low MCV	Hi MCHC
peripheral smear	Normochromic normocytic RBC	target cells, tear drop cells beta thal will have hemoglobin A2 on electrophoresis (alpha thal = normal hg)	Low retic count relative to anemia severity (= impaired RBC production)	spherocytes (diff dx: g6pd def, AIHA) Coombs neg (pos in AIHA) dx - eosin5maleimide binding test
hx/sx			Commonly assd with chronic inflammatory disease (eg, infections, cnacer, atuimmune disorders) Can also be observed in heart disease, diabetes mellitus, acute inflammation Rx the underlying inflammatory d/o often improves anemia	hemolytic anemia, jaundice, splenomegaly r/o pigment gallstones, aplastic crisis from parvo b19 Rx - folic acid, transfusions, splenectomy

hx/sx			<p>Commonly assd with chronic inflammatory disease (eg, infections, cancer, autoimmune disorders)</p> <p>Can also be observed in heart disease, diabetes mellitus, acute inflammation</p> <p>Rx the underlying inflammatory d/o often improves anemia</p>	<p>hemolytic anemia, jaundice, splenomegaly</p> <p>r/o pigment gallstones, aplastic crisis from parvo b19</p> <p>Rx - folic acid, transfusions, splenectomy</p>
Pathophysiology			<p>impaired iron utilization = Iron trapping within macrophages -> reduced serum iron concentrations and poor iron availability for hemoglobin synthesis</p> <p>Low transferrin (TIBC) bc trying to be under the radar (aka not help pathogens use iron)</p> <p>Also may have dec erythropoietin production and poor marrow response to erythropoietin</p>	<p>most 2/2 autosomal dominant mutation of ankyrin gene —> abnormal rbc membrane scaffolding proteins —> less deformable —> splenic sequestration</p>

Iron studies in microcytic anemia					
Cause	Mean corpuscular volume	Iron	TIBC	Ferritin	Transferrin saturation (Iron/TIBC)
Iron deficiency	↓	↓	↑	↓	↓
Thalassemia	↓↓	↑	↓	↑	↑↑
Anemia of chronic disease (inflammation)	Normal/↓	↓	↓	Normal/↑	Normal/↓

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		causes	Rx	Sfx of Rx:
normocytic, normochromic, hypoproliferative anemia		2/2 low epo 2/2 CKD	Epo indicated if Hct <30% or Hg <10 <u>replete iron</u> before starting epo — or else will cause iron def, particularly in chronic dz patients who already have low iron stores	<ul style="list-style-type: none"> worse HTN (20-50% pts): 10mmHg rise in dBp (unknown mechanism) —> rx by dialysis fluid removal or antihtnsives: beta blockers/vasodilators Headaches (15% pts) flu-like sx (5% pts) red cell aplasia (rare)

IMMUNE THROMBOCYTOPENIA

s/sx	labs	rx	
preceded by viral infxn purpura, petechiae, ecchymoses mucosal/cutaneous bleeding - epistaxis, hematuria, gi bleed	isolated thrombocytopenia < 100,000 uL megakaryocytes on peripheral smear	if platelets \geq 30,000/uL without bleeding - observe (usually self-limited w spontaneous recovery <6mo) if plt <30,000/uL or bleeding - IVIg or glucocorticoids	

LEUKEMIAS

	s/sx	labs	rx
CLL (chronic lymphocytic leukemia)	elderly often asx lymphadenopathy splenomegaly	lymphocytosis later anemia, thrombocytopenia on peripheral smear: • hypercondensed nuclear chromatin, • smudge cells	
Hodgkin's disease		normal peripheral smears dx = LN bx pathognomonic = Reed Sternberg cells	
CML (chronic myeloid leukemia)	splenomegaly	no lymphocytosis left shift (more myelomonocytes, neutrophils), basophilia	

SYSTEMIC LUPUS ERYTHEMATOSIS

etiology	s/sx	labs	rx
+/- hypersplenism, MAHA, AIHA, TTP, bone marrow dysfxn, aplastic anemia,		<p>pancytopenia</p> <ul style="list-style-type: none"> • anemia: 2/2 renal insuff SLE nephritis, iron def, anemia chronic disease, AIHA • leukopenia: 2/2 autoimmune-mediated destruction • thrombocytopenia: 2/2 immune-mediated destruction 	

leukocytosis = EBV, CLL

OTHER HEME D/O'S

	etiology	s/sx	labs	rx
TTP	dec AdamTS13 protease	<p>hemolytic anemia and thrombocytopenia low grade fever, AMS dx usually clinical</p>	<p>hemolytic anemia = inc indirect bili, normocytic anemia, inc reticulocytes renal failure - elevated BUN and Cr peripheral smear: schistocytes</p>	
sickle cell	<p>usually chronic well-compensated hemolytic anemia w appropriate reticulocytosis</p> <p><u>complications:</u> vasoocclusive crisis</p> <p>hyperhemolytic crisis/ aplastic crisis = 2/2 infxn/parvo b19,</p> <p>auto-splenectomy 2/2 vasoocclusion and pooling of rbc's in spleen. can → hypotensive shock</p> <p>acute chest syndrome</p>	<p>acute pain triggered by change in weather, dehydration, infxn</p> <p>pallor, sudden severe anemia</p> <p>rapidly enlarging spleen</p> <p>fever, cp, infiltrate on CXR. usually 2/2 pulm infarction nad infxn.</p>	<p>dec Hg, absence of reticulocytosis < 1%</p>	<p>splenectomy, hi chance of recurrence and risk of mortality</p>
aplastic anemia			pancytopenia	

Pulm

CF (VERSUS)

	CF	primary ciliary dyskinesia (immotile cilia syndrome)	acute lymphoblastic leukemia	
	autosomal recessive	autosomal recessive d/o of mucociliary clearance		
dx	gold std = quantitative pilocarpine iontophoresis + measurement of sweat chloride concentration	much more rare than CF		
etiology of recurrent pulm infxn	accumulation of inspissated mucus allow bacteria to proliferate -> rec rhinosinusitis	same <-		
clinical features by organ system	<p>respiratory:</p> <ul style="list-style-type: none"> • obxt lung dz - bronchiectasis • recurrent pna • chronic rhinosinusitis <p>GI:</p> <ul style="list-style-type: none"> • obxtn - meconium ileus, distal obxtn • pancreatic - exocrine insuff, CF-related diabetes <p>repro:</p> <ul style="list-style-type: none"> • infertility <p>msk:</p> <ul style="list-style-type: none"> • osteopenia - fractures • kyphoscoliosis • digital clubbing 			
sx, PhyEx	<p>nasal polyps - further obstruct and exacerbate sinusitis</p> <p>bilat diffuse rales</p> <p>digital clubbing</p>	<p>also has nasal polyps</p> <p>also digital clubbing</p>	<p>wt loss, recurr infections</p> <p>hepatosplenomeg</p> <p>lyphadenopathy</p> <p>petechiae</p>	

rx	intranasal glucocorticoids can provide sx relief +/- surgical resection of polyps			
----	---	--	--	--

IMMUNODEF SYNDROMES

			dx	risk of:
humoral immunity deficiency	igA		all - quantitative measurement of serum immunoglobulin levels	encapsulated bacteria (recurrent, severe, upper and lower resp tract infections)
	igG			
	igG3 alone	adult females, assd with recurrent sinopulm and GI infections		
	CVID	suppressed cell immunity and inc risk of malignancy		
cell-mediated				infections from viruses, pathogens, fungi (intracellular replication)

Alveolar O₂ pressure derived from = PAO₂ = (FiO₂ x [Patm - PH₂O]) - (PaCO₂ + R)

Arterial O₂ measured directly by blood gas

A-a gradient is elevated by anything that results in impaired gas exchange
interstitial dz, processes that cause V/Q mismatch (ex PE)

Other causes of recurrent sinopulm infections:

+GI obstruction/panc dz, +infertility, +msk -> CF

+ dependent/lower lobes 2/2 aspiration while upright, or posterior segment of upper lobes-> aspiration pneumonia

- altered consciousness - sz, alcoholism, drug OD

- neuro dysphagia - dementia, parkinsonian, cva, myasthenia),

- GEjunction - esoph dz, gerd),

- disruption of glottic closure - endotracheal intub, bronchoscopy, endoscopy),

- sedation for procedures

PULMONARY- DYSPNEA AND LUNG CAVITIES

	H.Flu is a colonizer of URtract	Legionella pneumophila	Primary TB	Pnemocystis pneumonia (CD4 <200 /uL)	Pnemococcus -- community acquired pneumonia (streptococcus pneumoniae)	Embolization 2/2 tricustpid endocarditis
	Typically causes upper respiratory tract infections, bronchitis (primarily in pts with COPD), and PNA Usually presents with noncavitating infiltrates	Via contaminated aerosolized water (cooling systems) Pts with chronic lung disease, cigarette smokers, and immunosuppressed pts are more predisposed	Slowly progressive sx of malaise, anorexia, wt loss, fever, and night sweats along with pulmonary findings. Chronic cough, not dyspnea, usually the most common pulm sx	Subacute respiratory sx	lobar	Fragments of vegetation embolies to the lungs
Dx				Increased alveolar-arterial gradient		
Organism						Staphylococcus aureus
CXR		Cavities more often found in immunosuppressed patients receiving corticosteroids		Diffuse infiltrates	Rarely causes cavitation	Characteristic nodular infiltrate w cavitation
Complications						

PNEUMONIA

Curb65 for CAP empiric treatment based on what level treatment they need =

confusion

Uremia – bun>20

Tachypnea (rr >30/min)

Hypotension (BP <90/60)

Age > 65

2+ = inpatient

4+ = icu

2ndary bacterial superinfection/pna common in elderly most common strep pnemo, staph aureus, or hflu

Staph aureus can cause necrotizing broncopna with multiple nodular infiltrates

“pnematocoeles” (cavitate to make small abscesses)

	Hx	Sx	Phys Exam/imaging	Dx	Rx
Community acquired pneumonias					
Strep pnemo (most common - adults)	Nursing home				Preventative -- vaccination with pneumovax Risk assessment using CURB65 -> outpatient, inpatient, icu: Empic therapy: Outpt = macrolide/doxy Fluoroquin or beta lactam +macrolide if comorbid condition, inpatient, or icu Icu could also do beta lactam + macrolide
Staph aureus (relatively uncommon cause of CAP)	most often affects hospitalized patients, nursing home residents, IVDU, CF patients, or recent influenza infection		Can be assd w/ necrotizing bronchopna resulting in pneumatoceles (small abscesses cavities)	Gram + cocci in clusters on gram stain	
H flu					
Legionella 2-10% (gram -- rod, primarily intracellular)	Travel associated, linked to cruise ship and hotel water supplies	<ul style="list-style-type: none">• High-grade fever >39.0 C• GI• Neuro	Rales CXR = focal lobar consolidation Sputum gram stain shows many neutrophils but no organisms (stains poorly bc primarily intracellular)	Bacterial Cx on charcoal agar +/- urinary antigen testing	Macrolides (azithromycin) Or Newer generation fluoroquinolones (levofloxacin)
mycoplasma pneumoniae (leading cause of 'atypical' pna)		nonproductive cough Headache rash	CXR = may have interstitial pattern	no organism on gram stain. +/- cold agglutinins present in blood	
Nosocomial pneumonia					
MRSA very likely					Vancomycin
Klebsiella pneumoniae	diabetics, alcoholics	currant jelly sputum	cavitation empyema	gram - encapsulated rods	
pseudomonas aeruginosa	CF patients, bronchiectasis			gram - rod	
Aspiration pneumonia					
Anaerobic organisms	Neuro disorders (advanced dementia, parkinsons dz, stroke), poor dentition	subacute	leading cause of abscesses -> CXR fluid filled cavity		Clindamycin
Cryptococcal infection					Fluconazole

T B - P P D

PPD/TST Induration	Patients to treat
>= 5 mm	HIV-positive patients Recent contacts of known TB case Nodular or fibrotic changes on chest x-ray consistent with previously healed TB Organ transplant recipients and other immunosuppressed patients
>= 10 mm	Recent immigrants (<5 years) from TB-endemic areas Injection drug user Residents and employees of high-risk settings (eg prisons, nursing homes, hospitals, homeless shelters) Mycobacteriology lab personnel Higher risk for reactivation TB (eg, diabetes, prolonged corticosteroid therapy, leukemia, end-stage renal disease, chronic malabsorption syndromes) Children <4 years of age, or those exposed to adults in high-risk categories
>= 15 mm	All of the above plus healthy individuals
If -- PPD: Does not have latent TB, no rx.	
If +PPD: Hx, PhysEx, CXR to rule out active TB Å	
If CXR is neg, treat for latent TB: 9 mo isoniazid (INH) + pyridoxine to prevent possible neuropathy or 3 mo once weekly INH and rifapentine by direct observed therapy	If CXR is pos, treat for active TB: Isoniazid, rifampin, ethambutol, pyrazinamide for 8 weeks (2 mo). Then (continuation phase) INH + rifampin for additional 4 mo.

Tuberculin skin test (TST) is used to identify asymptomatic patients with prior exposure to mycobacterium tuberculosis and latent tuberculosis infection.

= intradermal injection of purified protein derivative PPD from *M. TB*.

= delayed hypersensitivity response measured by **size of induration** not erythema 48-72 hrs after administration

TB/HEMOPTYSIS

pmh:	<ul style="list-style-type: none"> • endemic area (mexico, philippines, china, vietnam, india, Dominican Republic, Haiti), lived in US <5 yrs, esp first year • immunocompromised (HIV, on immunosuppression) • hx of hematologic malignancy or head/neck cancer • homeless, alcoholism, work in healthcare field
Sx	<p>chronic low grade fever, night sweats, weight loss, cough productive of blood tinged sputum</p> <p>wt loss</p> <p>extrapulmonary sites - liver, spleen, kidney, bone, adrenal gland</p>
labs	acid-fast bacilli smear, cx
Imaging	<p>reactivation of latent TB = cavitary lesion on cxr</p> <p>pathy/nodular opacity, multiple nodules, cavity... involving apical-posterior segments of upper lobes of the lungs</p>
Rx	if suspicion for tb, respiratory isolation is first step. until dx confirmed or refuted

Causes of hemoptysis (most common - chronic bronchitis, bronchogenic carcinoma, bronchiectasis)

Common causes of hemoptysis	
Pulmonary	<ul style="list-style-type: none"> • Bronchitis • Pulmonary embolism • Bronchiectasis • Lung cancer
Cardiac	• Mitral stenosis/acute pulmonary edema
Infectious	<ul style="list-style-type: none"> • Tuberculosis • Lung abscess
Hematologic	• Coagulopathy
Vascular	• Arteriovenous malformations
Systemic diseases	<ul style="list-style-type: none"> • Wegener's granulomatosis • Goodpasture's syndrome • Systemic lupus erythematosus, vasculitis

+malaise and throat pain and yellow sputum = acute bronchitis

+chronic prod cough for 3 mo in 2 successiv yrs = chronic bronchitis

+fever = pna, lung abscess

+chest pain = pulm infarct

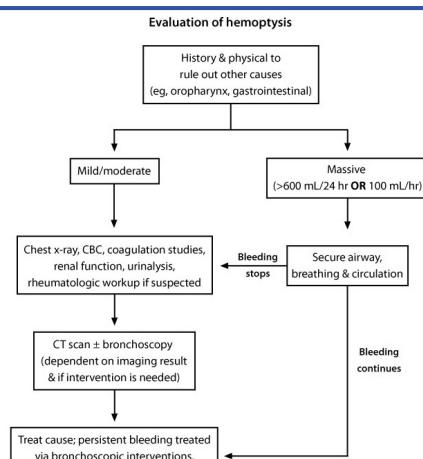
+constitutional signs (wt loss, significant hemopt) = malignancy or tb

+ hx recurrent resp tract infections, copious mucopurulent sputum + crackles/rhonchi/wheezing = bronchiectasis

CT indicated if suspect PE, mass lesions, bronchiectasis, or vascular malformations

if hi res ct doesn't give clear dx, or has recurrent episodes of hemoptysis, or want to assess mass lesions = bronchoscopy

In case of massive hemoptysis, establish adequate patent airway, place bleeding lung in dependent position, and bronchoscopy (can localize site and also intervene)



PE/DYSPIEA

>90% acute PE's from proximal deep veins (above knee) = iliac, femoral, popliteal

10% venous thromboemboli originate in deep veins of upper extremities (inc risk if indwelling catheters)

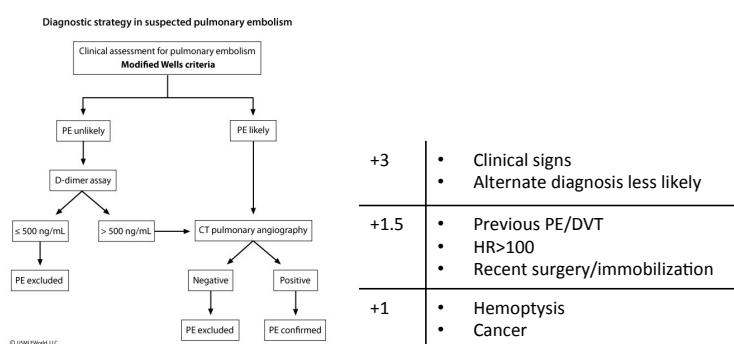
Diffl dx:

+risk factors DM, fam hx of MI, smoking = MI

same dyspnea/tachypnea/tachycardia +triad (jvd, hypotn,distant heart sounds) = cardiac tamponade

same dyspnea/tachypneatachycardia/lowO₂sat +wheezing -pleuritic cp = bronchoconstriction

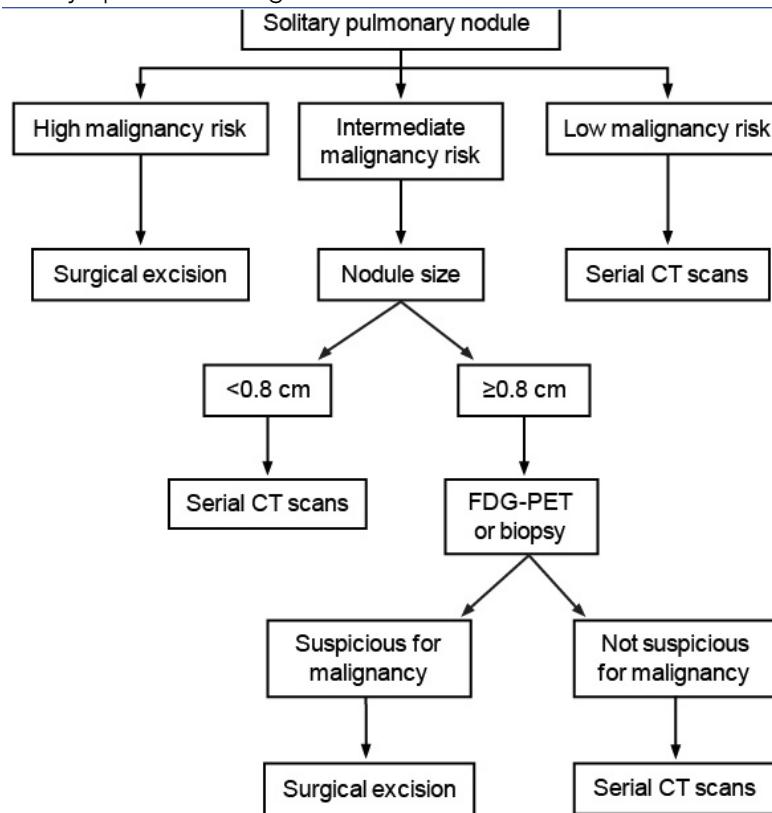
same acute SOB/pleuritic chest pain, + tracheal dev, hypotn, unilat absence of breath sounds = TensPTX



	PE
dx	<p>modified wells criteria: +3 pts = clinical signs of dvt alternate dx is less likely than PE</p> <p>+1.5pts = previous PE or DVT — total =</p> <p>likely PE -> [start anticoagulation LMWH or unfractionated heparin, unless contraindicated] -> CTA to look for filling defect = dx</p> <p>unlikely PE -> Ddimer >500 = ctA <500 excluded.</p> <p>if anticoag is contraindicated, if dx testing finds +PE, consider IVC filter</p>
factors making more likely PE	OCP use, sickle cell trait, tachycardia
Sx (non diagnostic)	<p>(from most common): acute onset SOB - 73% pts with PE tachypnea - 70% pleuritic chest pain - 66% tachycardia - 30% leg sx <30% hemoptysis <20% low grade fever 15%</p> <p>calf swelling, virchow's triad (stasis, endothelial injury, hypercoagulable state) not always present</p>
labs/imaging (non dx)	classic: ECG S1Q3T3 (or new onset RBBB) CXR - Hampton's hump, Westermark's sign
Rx/Px	massive PE can lead to right-sided heart failure and hypotension
poor prognostic factors	low O2 sat, afib

LUNG MASS ON RADIOLOGY

solitary pulm nodule = rounded opacity < 3 cm, completely surrounded by pulm parenchyma, without assd lymph node enlargement



Type of tumor	Incidence	Location	Clinical associations
Adenocarcinoma	40%-50%	• Peripheral	<ul style="list-style-type: none"> Clubbing Hypertrophic osteoarthropathy
Squamous cell carcinoma	20%-25%	<ul style="list-style-type: none"> Central Necrosis & cavitation 	<ul style="list-style-type: none"> Hypercalcemia
Small cell carcinoma	10%-15%	• Central	<ul style="list-style-type: none"> Cushing syndrome SIADH Lambert-Eaton syndrome
Large cell carcinoma	5%-10%	• Peripheral	<ul style="list-style-type: none"> Gynecomastia Galactorrhea

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Secondary malignancies most commonly in:

lung (esp smokers)

breast

thyroid

bone

GI (colorectal, esophageal, gastric tumors)

primary lung malignancy by distribution:

adenocarcinoma most common in smokers and non smokers

Other tumors/masses:

sarcoid = bilateral hilar adenopathy

aspergilloma = mobile mass that moves w/ position

carcinoid tumors = centrally located

apical lung/SVC syndrome = sm cell lung cancer, NHL

can include sinus imaging, pft's, hi res ct, or empiric sequential therapy for gerd, cough-variant asthma, chronic sinusitis

1st gen antihistamine = chlorpheniramine

combined antihist-decongestant = brompheniramine and pseudoephedrine

	imaging shows:	what it is	sx
fungus ball (aspergilloma)	mobile, intracavitory mass with air crescent in periphery	is fungal hyphae, inflammatory cells, fibrin, tissue debris collecting in preexisting cavity 2/2 cavity (ex from tb, sarcoid, bronchial cysts, neoplasm)	
pulm TB	apical cavitary lesions		prod fever/night sweats, cough, hemoptysis, wt loss
radiation fibrosis	volume loss with coarse opacities	2/2 lung field radiation	dyspnea, nonproductive cough, chest pain 4-24 mo after therapy
secondary malignancy		2/2 radiation/chemo therapy for Hodgkin lymphoma.	

ASTHMA

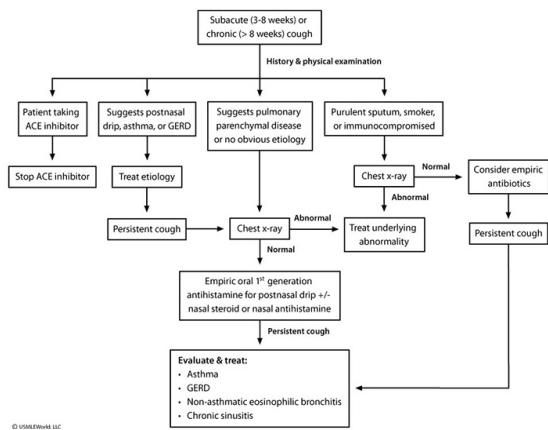
		rx	alternative/adjunctive rx
intermittent	<2 episodes / week ≤ 2 nighttime no limitation on daily activities	short-acting bronchodilator (eg albuterol) PRN	
mild persistent	2+ episodes / week 3-4 nighttime / month minor limitation on activities normal PFTs	+ daily low-dose inhaled corticosteroid (as controller medication)	daily oral theophylline
moderate persistent	daily sx weekly nighttime awakenings FEV1 60-80% predicted	+ long-acting inhaled beta 2 agonist	daily oral theophylline
severe persistent	continuous daytime sx frequent nighttime sx extremely limited activity FEV1 <60% predicted	albuterol inhaler PRN high-dose inhaled corticosteroid long-acting inhaled beta 2 agonist +/- daily oral steroids (pred)	daily oral theophylline

bronchoconstriction can be triggered by aspirin or beta blocker therapy in patients with asthma (esp if concurrent chronic rhinitis and nasal polyps). = sudden worsening of asthma and nasal congestion 30m to 3hr after ingestion of nsaid's

SUBACUTE/CHRONIC COUGH

subacute 3-8wks	chronic >8wks
	<p>post nasal drip + gerd + asthma = 90%</p>

Evaluation of subacute & chronic cough



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ARDS

	ards	periop MI
defn	<ul style="list-style-type: none"> 1. new/worsening resp sx during past 1 or within 1wk of known clinical insult 2. bilat lung opacities (pulm edema) 3. no cardiac failure or fluid overload 4. echo to definitely exclude hydrostatic pulm edema 5. PaO₂/FiO₂ ratio < 300 mmHg with peep >5 cm H₂O <ul style="list-style-type: none"> - mild = 200-300 - moderate = 100-200 - severe <100mm 	
etiology	2/2 pancreatitis (leak of pancreatic enzymes from serum across capillaries and damage surfactant in alveoli)	
sx	diffuse crackles, respiratory distress	new S3 gallop, peripheral edema, JVD
dx	dx of exclusion	

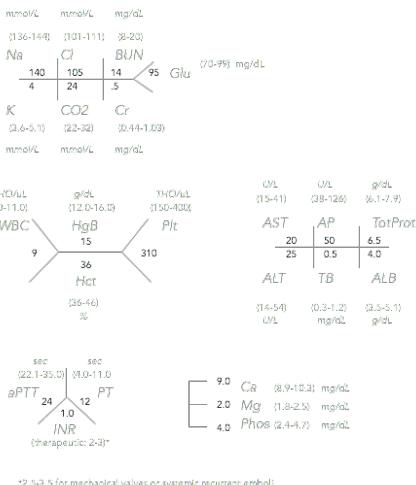
CAUSES OF POST-OP FEVER (5W'S)

Wind	Pulmonary embolus PNA Aspiration
Wound	Surgical site infection
Water	UTI
Walk	DVT
Wonder drugs/products	Drug fever Blood products IV lines

COPD - RX

	Stage/intensity of management		notes
acute exacerbation of COPD (cardinal sx = • increased dyspnea • increased cough (freq and more severe) • increased sputum production (chg in color & volume) cxr = hyperinflation ABG = hypoxia, CO2 retention, resp acidosis w compensatory met alkalosis)	1. acute medical management	<ul style="list-style-type: none"> oxygen with target sat 88-92% inhaled short-acting bronchodilators (eg albuterol) inhaled anticholinergics (eg ipratropium) systemic glucocorticoids and antibiotics (eg levofloxacin) for patients with 2/3 cardinal sx, mod-to-severe exacerbation, or mech ventilation <p>failure = continued sx -> noninvasive vent support</p>	<ul style="list-style-type: none"> combo of short-acting anticholinergic (ipratropium bromide) + beta adrenergic agonist (albuterol) is better than either alone. mild to mod = oral glucocorticoids (pred 40mg daily)// severe exacerb = IV glucocorticoids (methylpred) 5 days rx
	2. NPPV = noninvasive positive pressure ventilation (ventilatory support) (2 hr trial)	decreases work of breathing, improves alveolar ventilation = dec PaCO ₂ inc PaO ₂ inc tidal volume inc minute ventilation dec RR failure = hypoxemia, severe respiratory distress, and/or acidosis -> invasive mechanical ventilation	shown to decrease mortality, rate of intubation, hospital length of stay, and incidence of nosocomial infections
	3. invasive mechanical ventilation	req'd in <ul style="list-style-type: none"> hypercapnic patients with poor mental status (eg somnolence, lack of cooperation, inability to clear secretions), hemodynamic instability, profound acidemia (ph<7.1) 	
chronic	maintenance Rx	long acting beta2 agonists (eg salmeterol) long-term supplemental O ₂ indicated if PaO ₂ ≤55, SaO ₂ ≤88%, hct >55, or evidence of cor pulmonale	proven to prolong survival and improve QOL

ACID-BASE DISORDERS



- O₂ in hypercapnic and hypoxic patients should be titrated gradually with goal of arterial O₂ saturation of 90-94%, or PaO₂ of 60-70mmHg (to avoid oxygen toxicity)
- Remember that increasing oxygen flow may improve oxygenation but not address impaired ventilation or elevated PaCO₂
- COPD airway obstruction 2/2 infectious/inflammatory mucosal edema, bronchial smooth muscle hypertrophy, and bronchial submucosal gland hyperplasia. largest risk factor = smoking.
- COPD can cause secondary pneumothorax (alveolar blebs rupture into pleural space)

pH <7.4 is low
 serum bicarb <24mEq/L is low
 PaCO₂ > 40mmHg is high
 (50-80mmHg = alveolar hypoventilation)

DKA:
 1° acidosis = pH < 7.35
 HCO₃⁻ < 24 w respiratory compensatory dec in PaCO₂ (kussmaul breathing)
 inc anion gap from ketones = Na⁺ — (Cl⁻ + HCO₃⁻)

Inc anion gap metabolic acidosis 2/2:

- ketoacidosis (alcoholic, diabetic, starvation)
- intoxications (methanol, salicylate, ethylene glycol, isoniazide, metformin)
- tissue hypoxia (ischemia, CO, cyanide)
- renal failure

Winter's formula if 1° metabolic acidosis:

$$\text{Expected pCO}_2 = 1.5 [\text{HCO}_3] + 8 (+/-2)$$

Non-gap acidosis 2/2: primary adrenal insufficiency (addison's).

(calculate urine anion gap to disting bw renal — RTA or CAhydrlnhib use. or intestinal bicarb loss — diarrhea)

Metabolic alkalosis 2/2 vomiting (hypokalemia, hypochloremic), hyperaldosteronism, cushing's syndrome, severe hypoK <2 mEq/L, excessive volume contraction (eg thiazides, loops).

vomiting/diuretics = generation phase: H⁺ vomited/lost in urine, so w no gastric acid, HCO₃⁻ is not excreted by pancreas and instead retained in blood. maintenance phase: 2/2 volume loss in vomited volume -> dec ECV -> dec renal perfusion pressure -> RAAS activated -> aldosterone -> hypoK and contraction alkalosis. Rx then is IV NS and K.

urine chloride < 20 mEq/L (excess mineralocorticoid with H and K loss and inc Na retention causing inc extracellular volume)= saline responsive. >20 mEq/L (hypovolemia and hypochl) = saline resistant

Respiratory acidosis 2/2 impaired ventilation

Respiratory alkalosis 2/2 hyperventilation

PE = respiratory alkalosis 2/2 hyperventilation to overcome hypoxia and V/Q mismatch

post-ictal = apnea/hypopnea

lactic acidosis = metabolic acidosis

renal failure = metabolic acidosis 2/2 inadequate excretion of sulfates, phosphates

vomiting = metabolic alkalosis 2/2 loss of gastric acid

respiratory acidosis/alveolar hypoventilation =

Pulm/Thoracic dz: copd, OSA, obesity hypoventilation, scoliosis

Neuromusc dz: myasthenia gravis, lambert-eaton syndrome, guillain-barre syndrome

drug-induced hypoventilation: anesthetics, narcotics, sedatives

primary CNS dysfxn: brain stem lesion, infection, stroke

—> see next page 'hypoxemia and rx' to calculate A-a gradient

HYPOXEMIA AND RX

Hypoxemia = measured via arterial blood gas, pulse ox, or hematocrit.

Alveolar O₂ = PAO₂ = (FiO₂ x [Patm - PH₂O]) - (PaCO₂ / R), R = 0.8

A-a gradient = PAO₂ - PaO₂, [Normal A-a gradient < 15, increases with age. >30 is abnormal regardless of age.]

Effect of arterial oxygenation & ventilation in various environments				
	Example	A-a gradient	P _a CO ₂	Corrects with supplemental O ₂ ?
Reduced inspired oxygen tension	High altitude	Normal	Normal	Yes
Hypoventilation	CNS depression	Normal	↑	Yes
Diffusion limitation	Interstitial lung disease	↑	Normal	Yes
Shunt	Intracardiac shunt, extensive ARDS	↑	Normal	No
V/Q mismatch	Obstructive lung disease, atelectasis, pulmonary edema & pneumonia	↑	Normal or ↑	Yes

V/Q mismatch is due to worsened imbalance of blood flow and ventilation resulting in depressed PaO₂.

Ventilation is obstructed and blood flow is unchanged - ex: emphysema
—> O₂↓, CO₂↑

When blood flow is excessive relative to ventilation - ex: pulmonary edema, effusion, pna, atelectasis, PE

—> O₂↓ may have dec PaCO₂ 2/2 compensatory tachypnea.

Shunt: bypasses blood flow around ventilated alveoli to prevent gas exchange in the blood

ex: extensive ARDS (lung is poorly aerated, lung is stiff and less compliant)

ex: large left-to-right intracardiac shunt (eg ventricular septal defect) lowers compliance by increasing pulmonary blood flow, elevating pulmonary arterial and/or venous pressures, and causing fluid leakage into the interstitium and alveoli

causes of pleuritic chest pain (from irritation and inflammation of visceral and parietal pleurae): pulm embolism w subsequent minor or massive pulm infarct, pna (with or without parapneumonic effusion or empyema), ptx, collagen vascular disease, viral pleuritis, radiation pneumonitis

INTERSTITIAL LUNG DISEASE

Common etiologies	<ul style="list-style-type: none"> Sarcoidosis, amyloidosis, alveolar proteinosis Vasculitis (eg, granulomatosis with polyangiitis) Infections (eg, fungal, tuberculosis, viral pneumonia) Occupational & environmental agents (eg, silicosis, hypersensitivity pneumonitis) Connective tissue disease (eg, systemic lupus erythematosus, scleroderma) Idiopathic pulmonary fibrosis, interstitial pneumonia Cryptogenic organizing pneumonia
Clinical presentation	<ul style="list-style-type: none"> Progressive exertional dyspnea or persistent dry cough Pulmonary findings due to other underlying conditions (eg, silicosis, connective tissue disease) >50% of patients with significant smoking history Lung examination with fine crackles during mid-late inspiration, possible digital clubbing
Laboratory/ Imaging	<ul style="list-style-type: none"> Chest x-ray can show reticular or nodular opacities High-resolution chest computed tomography usually shows fibrosis, honeycombing, or traction bronchiectasis Pulmonary function tests: Normal or ↓ FEV1/FVC ratio, ↑ DLCO, ↑ TLC, ↑ RV* Resting arterial blood gas can be normal or show mild hypoxemia Exertion usually causes significant hypoxemia due to V/Q mismatch

defn - excessive collagen deposition in extracellular matrix around alveoli -> scarring -> reduced total lung capacity, functional residual capacity, and residual volume. Restrictive lung pattern on PFTs

sx - progressively worsening exertional dyspnea +/- persistent dry cough.

labs/pfts: (FEV1 and FVC decreased, FEV1/FVC normal or increased). reduced diffusion capacity and inc A-a gradient

etiologies: infectious, connective tissues,...etc.... or idiopathic

CXR - reticular or nodular opacities

hi res chest CT - fibrosis, honeycombing, or traction bronchiectasis

Dx - clinical features, pft, and radiographic +/- lung biopsy if unclear

Pulm Fibrosis

2/2

Hypersensitivity pneumonitis (alveolar inflammation 2/2 inhaled antigen - ex aerosolized bird droppings 'bird fancier's lung' or molds 'farmer's lung')

acute episodes = 4-6 hrs after exposure, cough, breathlessness, fever, malaise

restrictive pattern on pft, haziness/groundglass opacities of lower lung fields on cxr

rx - avoid exposure -> remission

PULM INFECTIONS IN IMMUNOSUPP

- + late complication in post-BMT presenting with pneumonitis and colitis = CMV
- + immediate post-transplant period but no diarrhea = PCP
- + diarrhea but no lung involvement = cryptosporium
- + lung but no diarrhea = mycoplasma and aspergillus
- + skin rash +/- intestine, liver +/- lung involvement (bronchiolitis obliterans) in chronic = GVHD

BRONCHOGENIC CARCINOMA

+cough, sputum production, progressive dyspnea

+bilateral pleural thickening + bibasilar reticulonodular infiltrates, honeycombing (cystic areas surrounded by interstitial infiltrates) +hi res CT - subpleural linear densities, parenchymal fibrosis, 50% have **pleural plaques** = asbestosis

asbestosis —> bronchogenic carcinoma most common malignancy even than malignant pleural mesothelioma
(unilateral w large pleural effusion on CXR)

Conditions commonly associated with digital clubbing	
Intrathoracic neoplasms	<ul style="list-style-type: none">• Bronchogenic carcinoma• Metastatic cancers• Malignant mesothelioma• Lymphoma
Intrathoracic suppurative diseases	<ul style="list-style-type: none">• Lung abscess• Empyema• Bronchiectasis• Cystic fibrosis• Chronic cavitary infections (eg, fungal, mycobacterial)
Lung disease	<ul style="list-style-type: none">• Idiopathic pulmonary fibrosis• Asbestosis• Pulmonary arterio-venous malformations
Cardiovascular disease	<ul style="list-style-type: none">• Cyanotic congenital heart disease

Pancoast tumor -> (small cell lung cancer or NHL are common etiologies)
compression of brachial plexus ulnar distribution (C8 and T1 nerve invasion) = Pancoast syndrome
compression of sympathetic trunk = Horner syndrome
compression of right recurrent laryngeal nerve = hoarse voice, and
compression of superior vena cava = SVC syndrome.

clubbing = megakaryocytes not fragmented in pulm circulation -> get stuck in distal fingertips -> release PDGF and VEGF -> connective tissue hypertrophy and permeability and inc vascularity

most common = lung malignancy, cf, and right-to-left cardiac shunts
COPD alone does not

PTX 2/2 COPD (VERSUS)

= acute onset chest pain, SOB, reduced breath sounds, hyperresonant, catastrophic worsening of resp sx

+elevated PaCO₂ w diffuse rhonchi and wheezing = diffuse sputum obstruction

+coarse crackles bilaterally (not wheezes) = acute pulm edema 2/2 acute CHF

+chest pain, SOB, cough w sputum, fever, dullness to percussion, crackles, bronchia breath sounds, slower onset = PNA

ACUTE DYSPNEA IN HOSPITALIZED PT

Acute dyspnea in the hospitalized patient		
Mechanism	Risk factors	Clinical features
Arrhythmia	<ul style="list-style-type: none">Cardiac diseaseElectrolyte abnormalities	<ul style="list-style-type: none">Dizziness, palpitationsTachycardia or bradycardia
Bronchoconstriction	<ul style="list-style-type: none">AsthmaMedications (eg, aspirin, beta blockers)	<ul style="list-style-type: none">WheezingProlonged expiration
Congestive heart failure/hypervolemia	<ul style="list-style-type: none">Cardiac diseaseChronic kidney diseaseIatrogenic (fluids, blood products)	<ul style="list-style-type: none">CracklesElevated jugular venous pressure (>8 cm H₂O)Lower-extremity edema
Infection/pneumonia/aspiration	<ul style="list-style-type: none">Chronic lung diseaseImmunosuppressionImpaired mental statusStroke/dysphagia	<ul style="list-style-type: none">FeverLeukocytosis
Anxiety	<ul style="list-style-type: none">DementiaChronic mental illnessSleep deprivation	<ul style="list-style-type: none">Tachycardia, tachypneaNormal oxygenation/lung examination
Pulmonary embolism	<ul style="list-style-type: none">Prolonged immobilitySurgery (eg, hip/knee replacements)	<ul style="list-style-type: none">Tachycardia, tachypneaHypoxemiaSigns of deep venous thrombosis

bronchoconstriction can be triggered by aspirin or beta blocker therapy in patients with asthma (esp if concurrent chronic rhinitis and nasal polyps). nonselective beta 1 and beta 2 - propanolol, nadolol, sotalol, timolol. less likely with cardioselective beta blockers (beta 1) - metoprolol, atenolol, bisoprolol, nebivolol

acute bronchitis = fever, SOB, productive cough

TRAUMA

diaphragmatic rupture = more common on left side bc right side is protected by liver. risk of mortality 2/2 injury and strangulation of bowel. sx = n/v, or resp distress if larger rupture

PULMONARY EFFUSION

Light's criteria = (exudate has ≥ 1 of the following):

- >0.5 Pleural fluid protein/serum protein ratio
- >0.6 Pleural fluid LDH/serum LDH ratio
- Pleural fluid LDH = $>2/3$ upper limit of normal serum LDH

Causes of exudative (2/2 inflammation and inc capillary and pleural membrane permeability or impaired lymphatic draining of pleural space)

- infection - pna, tb
- malignancy - +/- hemorrhagic effusions, insidious accumulation, 30% have $<60\text{mg/dL}$ low glucose
- PE - hemorrhagic effusion is common (suggests pulm tissue infarction), can occasionally cause transudative pleural effusion
- connective tissues disease
- iatrogenic

Renal

ANEMIA

	causes	Rx	Sfx of Rx:
normocytic, normochromic, hypoproliferative anemia	2/2 low epo 2/2 CKD	Epo indicated if Hct <30% or Hg <10 <u>replete iron</u> before starting epo — or else will cause iron def, particularly in chronic dz patients who already have low iron stores	<ul style="list-style-type: none">• worse HTN (20-50% pts): 10mmHg rise in dBP (unknown mechanism) —> rx by dialysis fluid removal or antihtnsives: beta blockers/vasodilators• Headaches (15% pts)• flu-like sx (5% pts)• red cell aplasia (rare)

ACUTE RENAL FAILURE/AKI

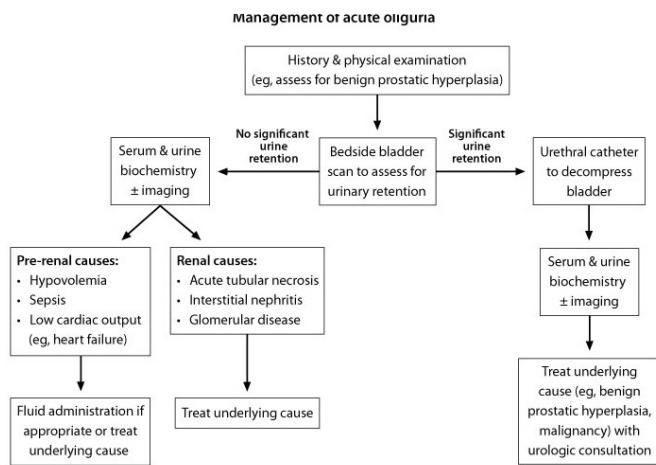
	causes	mechanism	s/sx	Rx
intrinsic	contrast-induced nephropathy	vasoconstriction and tubular injury inc risk for pts with hx of DM or chronic renal insuff	spike in Cr within 24 hrs of contrast administration with return to nl renal fxn within 5 days	pre-CT IV hydration to prevent. (prior to and few hours after procedure) +/- acetylcysteine is also protective: vasodilation and antioxidant properties also helps to discontinue NSAIDS (cause renal vasoconstriction) prior to contrast administration
	crystal-induced (direct renal tubular toxicity)	IV acyclovir (rarely oral) -- less often causes ATN or AIN sulfonamides methotrexate ethylene glycol protease inhibitors inc risk if underlying vol depletion, CKD	usually asx, or nonspec n/v, flank/abd pain elevated Cr 24-48hrs (up to 1-7days) after starting drug UA - hematuria, pyuria, crystals	concurrent vol repletion can prevent AKI discontinue drug, volume repletion
	Acute interstitial nephritis	meds like beta lactams, PPI, aminoglycosides	7-10 days after drug exposure. skin rash, eosinophilia, eosinophiluria, pyuria	
	Glomerular injury	glomerulonephritis 2/2 post-strep	UA: proteinuria, hematuria, rbc casts	
post-renal	post-renal AKI	obstruction at bladder neck (BPH, prostate cancer)	obstructive voiding sx (post void dribbling, dec urinary stream, hesitancy, urgency, nocturia, urinary retention) signs - hi post-void urinary resid volume when foley catheter inserted	
pre-renal	prerenal azotemia	volume depletion --> hypoperfusion to kidneys	BUN:Cr > 20:1 FeNa < 2%	avoid nephrotoxic meds to prevent further injury (ex metformin can cause lactic acidosis in AKI, liver failure, and sepsis) check foley, then fluid challenge - iv NS

Notes: renally dosed meds - nafcillin, vancomycin, levoflox. azithromycin is renally cleared.

OLIGURIA

oliguria < 400cc or <6cc/kg per day

oliguria + AKI is due to [prerenal], [intrinsic] and [postrenal] causes



NEPHROTIC/NEPHRITIC SYNDROME

		s/sx	dx/labs/imaging	Rx
nephrotic syndrome basic path: altered permeability of glom membrane for proteins	FSGS (most common) - AA/hispanic, HIV pts, heroin use, obesity, heavy proteinuria with rapid renal failure	hypercoagulability (art and ven - most often renal vein thrombosis) 2/2: <ul style="list-style-type: none">• inc urinary loss of antithrombin 3• altered levels of prot C & S• inc platelet aggregation• hyperfibrinogenemia (inc hepatic synthesis)• impaired fibrinolysis + accelerated atherosclerosis —> risk of MI	<ul style="list-style-type: none">• proteinuria >3.5g/day• hypoalbuminemia• edema• hyperlipidemia and lipiduria• fatty casts normal Cr does not exclude	aggressive management to prevent MI or stroke - statins may lose vit D in urine
	membranous nephropathy - hepB, adenocarcinoma (breast, lung, colon, prostate), NSAIDs, SLE			
	mesangioproliferative glomerulonephritis			
	diffuse(membrano) proliferative glomerulonephritis - hep B and C, chronic infx (eg endocarditis)	complications: <ul style="list-style-type: none">• protein malnutrition• transferrin loss > iron-resistant microcytic hypochromic anemia• cholecalciferol-binding protein -> vit D def• thyroxine binding globulin -> dec thyroxin levels• Ab loss -> inc suspect to infxn		
	minimal change (children) - NSAIDs, lymphoma (ex hodgkin)			
	igA nephropathy - URI			
nephritic syndrome	Goodpasture's dz			
	Granulomatosis with polyangiitis (GPA, Wegener's)			
	glomerulonephritis crescentic - autoimmune		<ul style="list-style-type: none">• hematuria - rbc casts• edema• hypertension• proteinuria	

SIADH -

causes: meds, bronchogenic carcinoma

labs: marked hyponatremia, low plasma osmolality with inappropriately elevated urine osmolality and urine sodium concentration.

rx: remove cause, fluid restriction <800ml/day. if severe and sx or resistant, give hypertonic saline. if fail, demeclocycline acts at renal collecting tubule to dec responsiveness to ADH (but can be nephrotoxic).

HEMATURIA

	type	causes:	etiology (2/2)	sx	urine studies
glomerular cause	microscopic hematuria proteinuria dysmorphic rbc or rbc casts nephritic syndrome - HTN, oliguria, inc Cr	glomerulonephritis basement membrane disease (eg Alport syndrome)	igA nephropathy (most common GN)	hematuria and proteinuria within 5 days of URI or pharyngeal illness	proteinuria dysmorphic rbc or rbc casts
non-glomerular hematuria (more common)	gross hematuria no proteinuria normal RBC morphology dysuria or obstxn sx - flank pain, renal/ureteral colic, anuria	renal tumor/ malignancies	ex: renal cell ca of interstitium	<ul style="list-style-type: none"> classic triad: hematuria, flank pain, palpable abd renal mass scrotal varicoceles (usually left-sided) night sweats, fatigue, wt loss <p>paraneoplastic symptoms:</p> <ul style="list-style-type: none"> anemia or erythrocytosis thrombocytosis fever hypercalcemia cachexia 	no proteinuria CT abd is most sensitive and specific
	nephrolithiasis				
	papillary necrosis	"NSAID" <ul style="list-style-type: none"> 1/1 long-term acetaminophen abuse (NSAID) Sickle cell disease Analgesic abuse Infection (pyelonephritis) Diabetes mellitus 			
	ATN	hypotensive or nephrotoxic injury (acute azotemia)	dark or cola-colored urine		muddy brown granular casts (sens not spec) Urine Na > 20 mEq/L FeNa 2%

	tubulointerstitial nephritis	certain abx (cephalosporins, pcn, sulfonamides) NSAIDs diuretics rifampin phenytoin allopurinol	fever, rash, arthralgias peripheral eosinophilia	variable proteinuria (even up to nephrotic range proteinuria in severe cases) WBC casts early polyuria, sterile pyuria +/- wbc casts and eosinophiluria -> renal papilla sloughing -> microscopic hematuria and renal colic
	bladder tumor/ cancer, or cystitis	smoking is risk factor		
	PCKD			

(Choice A) Broad casts are seen in patients with chronic renal failure (CRF). These arise in the dilated tubules of enlarged nephrons that have undergone compensatory hypertrophy in response to the reduced renal mass. Waxy casts, which are shiny and translucent, are also generally seen in chronic renal disease.

(Choice C) RBC casts are indicative of glomerular disease or vasculitis.

(Choice D) WBC casts are definitive evidence that urinary WBCs originate in the kidney. These are seen in cases of interstitial nephritis, pyelonephritis, etc.

(Choice E) Fatty casts are seen in conditions causing nephrotic syndrome. Hyaline casts are composed almost entirely of protein and pass unchanged along the urinary tract; these may be seen in asymptomatic individuals and in patients with pre-renal azotemia.

Educational Objective:

Muddy brown granular cast - Acute tubular necrosis
RBC casts - Glomerulonephritis
WBC casts - Interstitial nephritis and pyelonephritis
Fatty casts - Nephrotic syndrome
Broad and waxy casts - Chronic renal failure

*Extremely high yield question for the USMLE!!!

ESRD/DIALYSIS PATIENTS

Anemia

hyperPhos (from dec GFR and dec renal P excretion. also binds to circulating Ca and interferes with renal production of 1,25 dihydroxyvitamin D (calcitriol))

Inc PTH

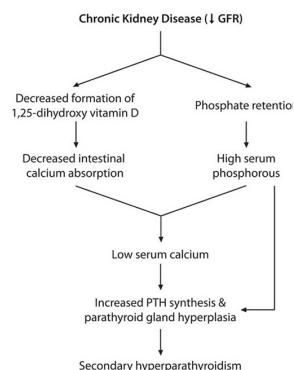
inc homocysteine levels (impaired metabolism and decreased removal)

accelerated atherogenesis - more oxidant stress due to uremia

replacement therapies

supplemental ca to correct hyperphos —> enhances coronary artery calcification

inhibition of NO -> vasoconstriction and hypertension



indications for dialysis:

AEIOU

A - acidosis (refractory met acidosis pH < 7.2)

E - electrolytes (refractory hyperK)

I - coagulopathy, i?

O - volume Overload or pulm edema not responding to diuretics

U - uremia (pericarditis, encephalopathy, or neuropathy)

URINARY RETENTION/INCONTINENCE

Diffl dx retention:

- obstruction (BPH, prostate ca)
- neurogenic bladder (can lead to overflow incontinence. 2/2 Multiple sclerosis, anesthetic blocks, drugs like anticholinergics)
- detrusor muscle underactivity

Diffl dx incontinence:

+dec rectal tone, lower extremity weakness, inc lower extremity DTR: spinal cord lesion with compression in lumbar region

NEPHROLITHIASIS

Based on sx and referred pain/presentation (abd pain radiation to perineum +/- n/v) —> Dx with noncontrast spiral CT abd/pelvis - very sens and spec for small/non-calcium stones
 U/S if pregnant (hard to see distal ureter and uretovesical junctio small hard to see)

if + dysuria or fever —> c/f infection

type of stone	etiology	mechanism
oxalate	Crohn's disease patients (or other small intestinal fat malabsorption) are predisposed to hyperoxaluria .	2/2 inc oxalate absorption in gut (bc normally ca binds oxalate in gut and prevents its absorption...but if fat malabsorption, fat preferentially binds ca and oxalate is free to be absorbed. also bc inadequate bile salt reabsorption damages colonic mucosa and increases oxalate absorption).
calcium	hypercalciuria: idiopathic hyperpTH excessive ca/vitD ingestion dehydration or prolonged immobilization	r
struvite	recurrent UTI, particularly by <i>Proteus</i> species	
uric acid stones	radiolucent. dx by CT abdomen can cause secondary ileus due to vagal reaction to ureteral colic.	

UTI, CYSTITIS +/- PYELONEPHRITIS

Leuk esterase +. (nitrites + is more specific, released by bacteria)
 pyuria = wbc > 10/hpf

	sx	dx	rx
uncomplicated cystitis	dysuria, urgency	UA	oral nitrofurantoin 5 days
complicated cystitis: <ul style="list-style-type: none"> • DM, CKD, pregnancy, immunocompromised • urinary tract obstruction • hospital-acquired infection • asdd with procedure (eg cystoscopy) • indwelling foreign body (eg catheter, stent) 			
uncomplicated pyelonephritis	UTI + fever and flank pain/tenderness	UCx	oral cipro (fluoroq) or trimeth-sulfamx severe: IV ceftriaxone, fluoroq cipro/levo, TMP-SMX, ampicillin + gentamicin
complicated pyelo	indwelling urinary cathetier, obstruction, or retention, recent urol procedure, hosp-aq infxn, underlying renal impairment, immuonsupp and comorbid diabetes		total 10-14days treatment mild mod: IV ceftriaxone, cefepime, fluoroq (cipro, levo) severe: amp-sulb, pip-tazo, mreopenem, aztreonam +/- gent pregnant: IV ceftriaxone +/- gentamicin, aztreonam can usually switch to oral abx within 48-72hrs

+mucopurulent urethral discharge, ur freq —> gonococcal or chlamydial urethritis (dx cx of discharge and urine, or first catch urine nucleic acid amplification testing for chlamyd). Rx ceftriaxone for gonocc. azithromycin or doxy for chlamyd

gentamicin added for patients with severe infection or risk of drug-resistant organisms (hospital acquired infections)

Treatment of acute cystitis & pyelonephritis in nonpregnant women	
Uncomplicated cystitis	<ul style="list-style-type: none"> Nitrofurantoin for 5 days (avoid in suspected pyelonephritis or creatinine clearance <60 mL/min) Trimethoprim/sulfamethoxazole for 3 days (avoid if local resistance rate >20%) Fosfomycin single dose Fluoroquinolones only if above options cannot be used Urine culture needed only if initial treatment fails
Complicated cystitis*	<ul style="list-style-type: none"> Fluoroquinolones** (5-14 days), extended-spectrum antibiotic (eg, ampicillin/gentamicin) for more severe cases Obtain urine culture prior to initiating therapy & adjust antibiotic as needed
Pyelonephritis	<ul style="list-style-type: none"> Outpatient: Fluoroquinolones (eg, ciprofloxacin, levofloxacin) Inpatient: Intravenous antibiotics (eg, fluoroquinolone, ceftriaxone) Obtain urine culture prior to initiating therapy & adjust antibiotic as needed

*Associated with diabetes, pregnancy, renal failure, urinary tract obstruction, indwelling catheter, urinary procedure (eg, cystoscopy), immunosuppression & hospital-acquired.

**Do not use fluoroquinolones in pregnancy. Consider nitrofurantoin, amoxicillin & cephalixin.

DIABETES INSIPIDUS VS POLYDIPSIA

All have polyuria and dilute urine
primary polydipsia (inc water intake)

urine osmolality < 1/2 serum osmolality, or <100 mOsm/kg
hyponatremia < 137 mEq/L

central DI (dec ADH secretion from pituitary) = impaired thirst mechanism.
significant **hypernatremia >150 mEq/L**

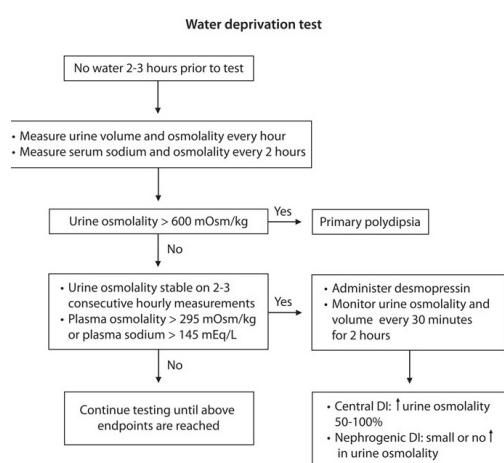
rx: intranasal (or oral) desmopressin

nephrogenic DI (renal ADH resistance, ex 2/2 lithium; normal ADH levels) = intact thirst mechanism and usually compensate for renal water loss. sodium ~145.

rx: HCTZ - causes mild volume depletion that increases proximal water and Na resorption

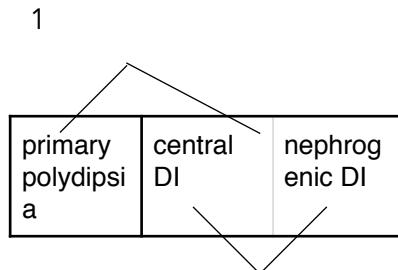
	Primary polydipsia	Central diabetes insipidus	Nephrogenic diabetes insipidus
Defect	↑ Water intake	↓ ADH release from pituitary	ADH resistance in kidney
Etiology	<ul style="list-style-type: none"> Antipsychotics Anxious, middle-aged women Central hypothalamic lesion 	<ul style="list-style-type: none"> Idiopathic Trauma Pituitary surgery Ischemic encephalopathy 	<ul style="list-style-type: none"> Chronic lithium use Hypercalcemia Hereditary (AVPR2 mutations)
Clinical features	<ul style="list-style-type: none"> Polyuria & low urine osmolality Serum Na <137 mEq/L 	<ul style="list-style-type: none"> Polyuria & low urine osmolality Serum Na may be >150 mEq/L due to significant thirst impairment 	<ul style="list-style-type: none"> Polyuria & low urine osmolality Serum Na 142-150 mEq/L due to intact thirst mechanism

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Dx algorithm to distinguish b/w them.

(1. water deprivation test, 2. administer desmopressin. compare changes in urine and serum osmolality):



2

PRIMARY ADRENAL INSUFFICIENCY

Diff'l Dx:

HCTZ (acts on distal kidney) - can cause hypokalemia, hyperglycemia, hyperuricemia
aldosterone acts to increase sodium resorption in distal renal tubules

mechanism:

causes	mechanism	s/sx	Rx
extrapulmonary TB in adrenal gland	↓cortisol	gradual fatigue, weakness, borderline hypotension, electrolyte abnormalities (hyperK, hypoglyc), eosinophilia	
granulomatous disease (eg histoplasmosis, coccidioidomycosis, cryptococcosis, sarcoidosis)	↓adrenal sex hormone and ↓aldosterone secretion —> kidney inappropriately loses Na while retaining K and H at distal tubule —> normal anion gap, hyperK and hypoNa metabolic acidosis		
other			

Clinical features of primary adrenal insufficiency	
Etiology	<ul style="list-style-type: none"> Autoimmune Infections (eg, tuberculosis, HIV, disseminated fungal) Hemorrhagic infarction (eg, meningococcemia, anticoagulants) Metastatic cancer (eg, lung)
Clinical presentation	<p>Acute</p> <ul style="list-style-type: none"> Most commonly with shock Abdominal tenderness with deep palpation (unclear etiology) Unexplained fever Nausea, vomiting, weight loss & anorexia Hyponatremia, hyperkalemia, hypercalcemia & eosinophilia <p>Chronic</p> <ul style="list-style-type: none"> Fatigue, weakness & anorexia Gastrointestinal (eg, nausea, vomiting, abdominal pain) Weight loss Hyperpigmentation or vitiligo Hypotension, hyponatremia, hyperkalemia & hypercalcemia Anemia & eosinophilia
Diagnosis	<ul style="list-style-type: none"> Measure ACTH and serum cortisol with high-dose (250 µg) ACTH stimulation test Primary adrenal insufficiency: Low cortisol, high ACTH Secondary/tertiary adrenal insufficiency: Low cortisol, low ACTH

PHEOCHROMOCYTOMA

sx	Rx		
high bp palpitations pounding headaches abd pain tremor excessive sweating (in paroxysms) varying intervals and inc in severity over time	alpha blockers first! giving only beta blockers leaves unopposed alpha —> ↑↑BP!	urine vanillylmandelic acid and metanephhrines	

CONGENITAL KIDNEY DISEASE

	sx	complications	dx	rx
ADPKD - autosomal dominant polycystic kidney disease	<p>most asx hematuria intermittent bilat flank pain nocturia HTN palpable kidney/abd mass on exam (right is lower than left and easier to palpate)s</p>	<p>pain 2/2: multiple renal cysts/ rupture UTIs nephroithiasis hemorrhage</p> <p>rupture of brain aneurysm and abd aortic aneurysms</p>	abd u/s (or CT) - enlarged kidneys w multiple cysts	htn: ACEis
horseshoe kidney	complications: uretopelvic junction obstrxn renal stones vesicoureteric reflux chronic urinary tract infection			

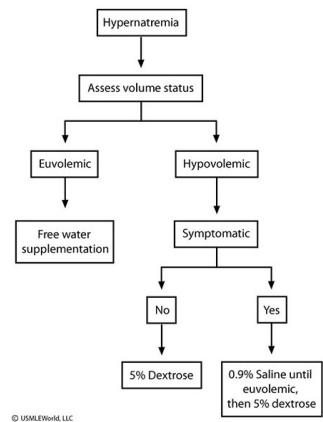
Autosomal dominant polycystic kidney disease	
Symptoms	<ul style="list-style-type: none"> Most patients are asymptomatic Hematuria Flank pain (nephrolithiasis, infection, cyst rupture, hemorrhage)
Clinical signs	<ul style="list-style-type: none"> Hypertension Palpable abdominal masses (usually bilateral) Proteinuria Chronic kidney disease
Extrarenal features	<ul style="list-style-type: none"> Cerebral aneurysms Hepatic & pancreatic cysts Cardiac valve disorders (mitral valve prolapse, aortic regurgitation) Colonic diverticulosis Ventral & inguinal hernias
Diagnosis	<ul style="list-style-type: none"> Ultrasonography (alternate: computed tomography, magnetic resonance imaging) shows multiple renal cysts
Management	<ul style="list-style-type: none"> Follow blood pressure & renal function Aggressive control of cardiovascular risk factors, including hypertension ACE inhibitors preferred for high blood pressure End-stage renal disease: dialysis, renal transplant

Characteristics of renal cysts	
Simple renal cyst	Malignant cystic mass
• Thin, smooth, regular wall	• Thick, irregular wall
• Unilocular	• Multilocular
• No septae	• Multiple septae , occasionally thick & calcified
• Homogenous content	• Heterogenous content (solid & cystic)
• Absence of contrast enhancement on CT/MRI	• Presence of contrast enhancement on CT/MRI
• Usually asymptomatic	• May cause pain, hematuria, or hypertension
• No follow-up needed	• Requires follow-up imaging & urological evaluation for malignancy

HYPERNATREMIA

hypernatremia + hypovolemic + sx —> rx with NS (0.9%) == basically restoring isotonic volume depletion
 hypernatremia + hypovolemia - sx —> rx with 5% dextrose (or 0.45% half normal saline) == basically restoring free water loss/
 dehydration
 hypernatremia + euvolemic —> free water supplementation. can test for central v nephrotic DI with water deprivation test.

goal to correct serum sodium by 0.5 mEq/dL/hr without exceeding 12 mEq/dL/24hr



OTHER ELECTROLYTES

hypoMag causes hypoCalcemia by inducing PTH resistance and decreasing PTH secretion (so = variable PTH levels).
 serum phosphate levels are normal or low

