

# **2016 In-Service Review**

**Presented on behalf of the  
American Academy of Emergency Medicine**

## The Actual “Qualifying Examination”...

The qualifying examination is a criterion-referenced examination. All candidates achieving 75% or more correct answers on those questions that are designated for scoring for certification will pass the examination.

The qualifying examination is a comprehensive examination that covers the breadth of Emergency Medicine. Each examination appointment is approximately 8 hours in length, with approximately 6.5 hours devoted to actual testing time. The examination contains approximately 305 single-best answer multiple-choice questions. Between 10% and 15% of the questions will have a pictorial stimulus. The qualifying examination is administered at approximately 200 PearsonVUE professional computer-based testing centers throughout the United States.

Preparing: Practice lots and lots of questions; get good sleep; arrive early; have photo ID

Taking It: 73 seconds per question; fill in answer sheet as you go; mark difficult questions you wish to later reconsider; write in the booklet → cross out or line thru incorrect choices

- If you anticipate an answer as you read the question, you are probably right
- 1/3 of test not scored (questions being “trialed”); don’t worry about poorly worded or confusing question
- There are 3 types of questions
  - You know the answer
  - You know part of the answer
  - You have no idea what they’re talking about
- Answers which state “always” or “never” are usually not correct
- If two answers are close, one is probably correct
- If two answers are direct opposites, one is usually correct
- For stimulus questions, you frequently won’t need the EKG / x-ray / picture to answer the question
- Relax – you’ll do fine

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## 2.0 Abdominal and Gastrointestinal – 9% / 27 questions

Sudden Pain: mesenteric embolus leading to ischemia / infarction; ruptured abdominal aortic aneurysm; perforated viscus; renal colic; cecal volvulus (sigmoid volvulus more gradual)

Lethal Causes of Pain: mesenteric ischemia / infarction; ruptured or leaking abdominal aortic aneurysm; perforated viscus; acute pancreatitis; bowel obstruction

Abdominal Pain That Is...

...diffuse, severe, and colicky suggests bowel obstruction

...out of proportion to examination suggests mesenteric ischemia

...associated with atrial fibrillation, hypercoagulable state, atherosclerotic PVD, severe CHF, severe cardiomyopathy, digoxin use, or vasopressor use suggests mesenteric ischemia

...associated with lower GI bleed suggests mesenteric infarction or AAA with aortoenteric fistula (worst-case scenarios)

...associated with chest pain suggests a thoracic aortic dissection extending below the diaphragm

...radiating from epigastrium straight through to midback suggests pancreatitis (1° or 2° to penetrating posterior ulcer)

...in the left mid- or low abdomen with radiation through to the back suggests ruptured AAA

Gastrointestinal Bleed: hematemesis: bright red or coffee-ground; melena: black tarry stool, requires 150 – 200 cc blood in GI tract for minimum 8 hours to turn black; hematochezia: bloody maroon stools; ~5cc of hemorrhoid blood can turn toilet water bright red; octreotide and antibiotics if variceal bleeding

Nausea and Vomiting: most common cause in adults: medications; most common GI disease in US: acute gastroenteritis

### **Vomiting...**

...of bile rules out gastric outlet obstruction  
...of feculent material suggests distal obstruction  
...in morning suggests pregnancy, uremia, or ↑ICP  
...of food >12 hrs old pathognomonic for outlet obstruction

### **Diarrhea...**

...which is mucoid bloody + high fever + febrile seizure in infant → shigella  
...in patient with pet turtle or iguana → salmonella  
...in patient without spleen or with sickle cell → salmonella  
...and pseudoappendicitis presentation → yersinia  
...& fecal WBCs after poultry or eggs → salmonella, campylobacter  
...after poultry or meat, no fecal WBCs → *Clostridium perfringes*  
...profuse and watery after antibiotic or chronic "community acquired" → *Clostridium difficile*  
...after potato salad or mayonnaise → *Staphylococcus aureus*  
...after fried rice → *Bacillus cereus*  
...after raw oysters → *Vibrio cholera*  
...after drinking from mountain stream → *Giardia lamblia*  
...in AIDS patient → isospora or cryptosporidium  
...persistent, chronic with RUQ pain after trip to South America → *amebic dysentery*  
...and hemolytic-uremic syndrome or TTP → *E. coli* 0157:H7

Foreign Bodies: 80% in kids; most common object → coin(CXR-en face-esophagus; on edge-trachea); most common in adults: food, especially meat, bones; "Cafe coronary": unchewed meat lodged in upper esophagus → airway obstruction → sudden cyanosis → collapse → death; "Steakhouse syndrome": distal esophageal obstruction; glucagon + effervescent agent relieves acute lower esophageal obstruction ~75% of patients; proteolytic enzymes contraindicated; suspected perforation: water-soluble contrast material (Gastrograffin®); **newer Lithium button batteries-remove ASAP within 2-2.5 hours due to rapid erosion**

Swallowing Dysfunction: most common upper: neuromuscular (e.g. stroke); most common lower: intrinsic motility disorder (e.g., achalasia, spasm)

Tear vs. Rupture: Mallory-Weiss: vomiting → partial thickness esophageal tear and bleeding; Boerhaave syndrome: vomiting → full thickness esophageal rupture → mediastinitis; consider in alcoholic with vomiting + chest pain or chest pain + large left pleural effusion (94%)

Upper GI Bleed: pain between meals; most common causes UGI bleed: peptic ulcer disease > erosive gastritis > varices > Mallory-Weiss > esophagitis

Biliary Disease: bilirubin 2.0 – 2.5 → jaundice; pre-hepatic: hemolytic; hepatic: hepatocellular; post-hepatic: obstructive; cholecystitis = cholelithiasis; acalculous in ~5 to 10%; Murphy's sign 97% sensitive: ↑ pain during subcostal palpation on inspiration

Gallstones: ultrasound 94% sensitive, 78% specific; radioisotope study (HIDA) 97% sensitive, 90% specific; Charcot triad: fever + jaundice + right upper quadrant pain → ascending cholangitis (Reynolds pentad-add AMS and hypotension, most common in DM)

Liver Disease: hepatitis A: short incubation, usually benign; hepatitis B: percutaneous, STD; carrier, chronic, fulminant disease; hepatitis C: potential for carrier, chronic, fulminant disease; most common US blood borne infection → hepatitis C (not HIV)

Pancreatitis: gallstones – 45%; alcohol – 35%; followed by medications and , hypertriglyceridemia; lipase most useful, mild elevations not specific; very specific if levels >5 x normal; 2 or more of Ranson's criteria → ICU (also consider medications, uremia, tumor, post-traumatic, post-ERCP)

Small Bowel Obstruction: most common cause: adhesions from prior surgery >50%; if no prior surgery: hernias and neoplasms - ~15% each; diagnosis: air-fluid levels on x-ray or markedly dilated air-filled loops of small bowel are suggestive

Intestinal Ischemia: most common: arterial embolus >50%; arterial thrombosis ~15%; venous thrombosis ~15%; nonocclusive vascular disease ~20%

Mesenteric Ischemia: pain out of proportion to exam; heme-positive stool; serum lactate not sensitive nor specific, serial lactates may be useful; ↑ phosphate may be found; study of choice: angiography or CT angio

Appendicitis: most common surgical emergency; classic appendicitis still a clinical diagnosis; CBC, fever, C-reactive protein, plain x-rays: no help; if equivocal: helical CT with dilated appendix >5-6mm and fat stranding; kids need PO contrast because of no peritoneal fat; compression graded US is useful alternative in kids but is highly operator dependant

Gastroenteritides: symptoms within 2 to 4 hours of eating → staphylococcus (mostly vomiting) or Bacillus cereus; others take longer; enterotoxigenic *E. coli*: ~50% of traveler's diarrhea; daily prophylaxis prevents ~90%; ciprofloxacin is drug of choice for invasive diarrhea.

Diverticular Disease: usually in elderly, but becoming more common in patients <40 years; diverticulitis → LLQ tenderness, distention, normal bowel sounds; CT equivalent to barium enema for diagnostic accuracy; most frequent cause of significant lower GI bleed – diverticulosis (usually painless); most common cause of large bowel obstruction – diverticular disease and carcinoma; Crohn's disease – all layers of bowel wall, spares rectum, fistulas and abscesses, "skip" lesions, can involve any are of the GI tract; ulcerative colitis – mucosal disease, involves rectum, continuous involvement, usually limited to colon

### Pediatric – Abdominal / Gastrointestinal

Appendicitis: most common cause surgical abdomen in children; perforation rate 15 – 40% due to delayed diagnosis; barium enema: appendix does not fill in 10 – 30% of normal patients; helical CT: inflamed appendix, fecalith, abscess, stranding of peri-appendiceal fat

Colic: unexplained paroxysmal crying for >3 hours on >3 days for >3 weeks in otherwise healthy infant; diagnosis of exclusion! consider formula changes, simethicone

Pyloric Stenosis: hypertrophy and hyperplasia of pyloric musculature; presents at 2 weeks to 2 months; non-bilious vomiting, may be projectile; hungry child; "old man" appearance; peristaltic waves from left to right; palpable mass (olive) in right upper abdomen lateral to right rectus muscle in 70 – 90%

Meckel's Diverticulum: ectopic gastric mucosa → ileal ulceration and bleeding; painless, sometimes massive rectal bleeding in age <2 years; most common location: 40 – 100 cm from ileocolic junction

Hirschsprung Disease: absent intramural ganglion cells in rectum; may involve sigmoid or entire colon; neonate who fails to pass meconium; older infant or child with constipation and obstipation

Intussusception: prolapse of one part of the intestine into lumen of adjacent distal part; most common location: ileo-colic; intermittent, colicky abdominal pain; currant jelly stools → late finding; diagnosis and often treatment: air or barium contrast enema

Henoch-Schönlein Purpura (HSP): A – abdominal pain + / - bloody stools; R – purpuric rash; E – edema; N – nephritis; A – arthralgias/ arthritis

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### 3.0 Cardiovascular – 10% / 30 questions

Hypertrophic Cardiomyopathy: most common symptom: dyspnea; syncope in 20 – 30%; harsh crescendo – decrescendo murmur <> at left sternal border; ↑ with Valsalva or squat to standing (maneuvers that decrease LV filling); ↓ with squatting, hand grip (isometric exercises), or trendelenberg position (maneuvers that increase LV filling)-avoid nitro, cardiac echo ASAP

Mitral Stenosis: most common symptoms: exertional dyspnea, hemoptysis; most common cause: rheumatic heart disease; most patients develop atrial fibrillation; mid-diastolic rumble, into S2  
Mitral Incompetence: acute: endocarditis or acute myocardial infarction → dyspnea, tachycardia, pulmonary edema; chronic: rheumatic heart disease; systolic murmur radiates to axilla

Aortic Stenosis: dyspnea, chest pain, syncope; #1 cause congenital; #2 rheumatic heart disease; harsh systolic ejection murmur radiating to carotids; sudden arrhythmic death in ~25%; EKG → LVH; murmur get more quiet with severity then disappears

Aortic Incompetence: dyspnea, pulmonary edema; high-pitched blowing diastolic murmur immediately after S2; acute: endocarditis, dissection; chronic: congenital, rheumatic disease → wide pulse pressure, water hammer pulse, head bobbing; acute aortic regurgitation with aortic dissection-may also be associated with STEMI as coronary ostia are also compromised

Treating Acute Valvular Disease: aortic and mitral regurgitation: combination of vasopressors to maintain blood pressure (dopamine, norepinephrine) plus afterload reducers to "unload" the heart and promote forward flow (nitroglycerin, nitroprusside); control rate of atrial fibrillation; balloon pump contraindicated in wide-open aortic regurgitation

### Infective Endocarditis

Most common: left-sided → *Streptococcus viridans*, staphylococcus, enterococcus

Right sided: intravenous drug use → *Staphylococcus aureus*, *Streptococcus pneumoniae*

Left-sided: sepsis ± heart failure; neurologic symptoms in 1/3; subacute: murmur of AI, MR;  
Roth spots: retinal hemorrhage with central clearing; Osler nodes: tender nodules on fingers and toes; oxacillin and aminoglycoside

Right-sided: usually acute: fever, cough, chest pain, dyspnea, hemoptysis; murmur much less common; diagnosis: echocardiogram, blood cultures; penicillinase-resistant penicillin or vancomycin + aminoglycoside; possible emergent surgery

Prosthetic valves: some sources recommend addition of rifampin for treatment

PTCA >>Thrombolysis / Fibrinolysis: goal is 90 minutes; symptoms of myocardial infarction within prior 12 hours + >1 mm ST↑ in 2 contiguous leads or isolated in aVR (new LBBB maybe-newer evidence suggests this is +/-) and no contraindications

Chest pain risk stratification – HEART, TIMI, ADAPT scoring systems with 3-8 hour 2-set troponins +/- stress test

Cocaine Chest Pain: 6% rule-in rate; all usual treatments plus benzodiazepines; avoid beta-blockers → unopposed alpha; cocaine causes accelerated development of atherosclerosis, increased platelet aggregation, contraction band necrosis eventually leading to cardiomyopathies, tachydysrhythmias → ischemia

Pericardial Tamponade: electrical alternans + tachycardia + low voltage + narrow pulse pressure

Atrial Fibrillation: rate control with diltiazem bolus/drip >>amiodarone/betablockers; consider cardioversion if < 24 hours otherwise must also consider anticoagulation; check CHADS2 or CHA2DS2 score for risk of stroke

Wolff – Parkinson – White: short PR; delta wave; PSVT: 40 – 80%; atrial fibrillation: 10 – 20%; atrial flutter: ~5% - procainamide is preferred antiarrhythmic versus electricity

Torsade de Pointes: treat unstable patient with electricity; intermittent runs of TdP or “stable” patients can be treated with magnesium 2 gm IVP or overdrive pacing

### Hypertensive Emergency (evidence of end-organ damage)

- Hypertensive encephalopathy: nitroprusside, labetalol
- Stroke: nitroprusside, labetalol
- Pulmonary edema: nitroglycerin, nitroprusside
- Myocardial ischemia: nitroglycerin
- Thoracic dissection: begin with beta-blocker (goal HR 60s), then add nitroprusside (goal SBP 100-110)
- Pheochromocytoma: phentolamine (Regitine®); avoid beta-blockers due to unopposed alpha
- Eclampsia: hydralazine, labetalol

CHF: nitroglycerine + ACE-I + BiPAP/CPAP if acute decompensation **before** diuresis

Abdominal Aortic Aneurysm: beware the elderly man with hematuria and sudden back pain (it's *not* a kidney stone!)

Brugada Syndrome: common cause of sudden death → Incomplete RBBB with ST elevation in V1 and or "saddle deformity" of the ST-T segment – admit for AICD

Aortic Dissection: >50 years, hypertension; younger: connective tissue disease, pregnancy; ~90% abrupt tearing mid-scapular back pain or chest pain; concurrent MI in 1-4% (usually inferior wall), stroke, aortic regurgitation, spinal cord symptoms all possible presentations; nitroprusside, beta-blocker; Type A: ascending, needs surgery; Type B: descending, medical treatment, but surgery needed if a major branch vessel occluded (e.g. a mesenteric artery)

### **Pediatric – Cardiovascular**

**Blue baby**: right to left shunting (terrible t's: tetralogy of Fallot, transposition of great arteries; total anomalous pulmonary venous return, tricuspid atresia, truncus arteriosus, single ventricle, pulmonary atresia,

**Mottled or gray baby**: systemic outflow tract obstruction (coarctation, aortic stenosis)

**Pink baby**: CHF with left to right shunting (ventricular septal defect, patent ductus arteriosus, endocardial cushion defect)

- Presentation: poor feeding, sweating with feeds, sudden pallor or cyanosis
- Treatment: prostaglandin infusion; no PEEP (↓ pulmonary blood flow)
- Shock and cyanosis during the first 2 weeks of life – ductal dependant congenital heart lesion → give PGE<sub>1</sub> 0.05-0.1 µg/kg/min IV, beware of apnea/hypotension/fever as S/E

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## **4.0 Cutaneous – 2% / 6 questions**

Nikolsky's Sign: Minor rubbing → desquamation of underlying skin, including pigment; positive in Toxic epidermal necrolysis (medications especially sulfa); Staph scalded skin syndrome: Tintinalli – yes, Rosen – no; Pemphigus vulgaris (but not bullous pemphigoid)

**Be able to recognize and treat:**

Pemphigus Vulgaris

Staphylococcal Scalded Skin Syndrome

Erythema Multiforme  
Stevens-Johnson / toxic epidermal necrolysis

Erythema migrans (Lyme)  
Erysipelas

Herpes Simplex

Herpes Zoster

Henoch-Schönlein Purpura

Purpura Fulminans

Extremity "pain out of proportion" with few findings initially- rapidly progressive necrotizing infections +/- hemorrhagic blebs and subcutaneous gas; emergent surgical debridement, broad spectrum antibiotics including anaerobic coverage, +/- HBO

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## **5.0 Endocrine and Metabolic – 3% / 9 questions**

Acid – Base

- Respiratory alkalosis → hyperventilation
- Respiratory acidosis → hypoventilation
- Metabolic alkalosis → volume and potassium depletion

- Respiratory compensation immediate, metabolic lags 24 hrs
- Anion gap:  $[Na^+] - ([Cl^-] + [HCO_3^-])$ ; normal  $12 \pm 3$  mEq/L
- Base deficit: valuable indicator of shock and efficacy of resuscitation
- In acute alkalosis, plasma  $HCO_3^-$  ↓ ~2 mEq/L for each 10 mmHg decrease in PaCO<sub>2</sub>
- Acidemia has 4 buffering systems: extracellular  $HCO_3^-$ -COOH; intracellular blood protein; renal compensation; respiratory compensation
- Winter's Formula:  $pCO_2 = 1.5 [HCO_3^-] + 8 \pm 2$  – if pCO<sub>2</sub> not in this range → superimposed primary respiratory process

Metabolic acidosis caused by: ↑ acid production; ↓ acid excretion (renal); loss of alkali  
Most common mixed disturbance: primary metabolic acidosis + primary respiratory alkalosis

Anion Gap Acidosis: CAT MUD PILES

Carbon monoxide / Cyanide exposure

Alcoholic ketoacidosis

Toluene exposure

Methanol intoxication

Uremia

Diabetic ketoacidosis

Paraldehyde ingestion

Isoniazid (INH) / Iron intoxication

Lactic acidosis

Ethylene glycol/Ethanol intoxication

Salicylate intoxication

Non-Anion Gap Acidosis Implies loss of HCO<sub>3</sub>: GI loss → diarrhea, enterostomy; renal loss → renal tubular acidosis, acetazolamide; hyperalimentation

Electrolytes: consider laboratory error as part of differential; primary responsibility: restore intravascular volume and tissue perfusion; correct electrolyte abnormalities at rate they occurred

Sodium – Too High: excess free water loss = diabetes insipidus, hyperglycemia; inadequate free water intake = poor oral intake; excess sodium gain → iatrogenic, hyperaldosteronism, Cushing's syndrome; if volume depleted, give IV NSS which is hypotonic in comparison; correct too fast → brain edema, seizures

Water deficit (L) =  $[0.6 \times (\text{weight kg}) \times \{(\text{serum sodium}) - 140\}] / 140$

Example: weight = 80 kg, Na<sup>+</sup> = 178

$[0.6 \times 80 \times \{178 - 140\}] / 140 = 13$  L

Sodium – Too Low: hypovolemic: renal loss, vomiting, burns → IV NSS ~500 cc/hr; euvolemic: SIADH, glucocorticoid deficiency → furosemide + IV NSS, correct <0.5 mEq/hr; hypervolemic: CHF, renal failure, excessive water intake with psychiatric disease and Ecstasy/methamphetamine → water restriction + furosemide, consider Na<sup>+</sup> replacement with 3% NaCl if seizures

Potassium – Too High: renal failure, acidosis, tissue necrosis, hemolysis, transfusions, GI bleed, drugs; EKG findings: peaked T waves, "sine wave," ventricular fibrillation, asystole; protect heart: calcium chloride or gluconate; shift K<sup>+</sup> into cell: bicarbonate, insulin, albuterol; block K<sup>+</sup> reabsorption: furosemide; bind K<sup>+</sup> for excretion: sodium polystyrene (Kayexalate®)-no evidence that this actually works; prevent hypoglycemia: dextrose

Potassium – Too Low: ↑ pH 0.10 → ↓ serum K<sup>+</sup> 0.5 ± 0.2 mEq/L; redistribution: alkalosis, insulin, beta-agonists; renal loss: diuretic, excess glucocorticoid; GI loss: vomiting, diarrhea; oral better absorbed, safer than IV; limit peripheral IV dose 2° side effects; maximum daily replacement → 3 mEq / kg / day



Calcium – Too High: most common outpatient cause: 1° hyperparathyroidism; inpatient cause: malignancy; most common paraneoplastic syndrome: hypercalcemia; signs and symptoms: variable and nonspecific; most important treatment is to restore intravascular volume (vigorous IVF):  $\text{Ca}^{+2}$  ↓ 1.6 – 2.4 mg/dl; once adequately hydrated enhance renal elimination: loop diuretic, thiazides can make worse; reduce osteoclastic activity

Calcium – Too Low: neuromuscular hyperexcitability; perioral paresthesias, muscle cramps, tetany; Chvostek's sign: tap facial nerve → ipsilateral facial muscles twitch; Trousseau's sign: inflate arm blood pressure cuff → carpal spasm

Sugar – Too High DKA: lack of insulin, the only anabolic hormone; half-life IV regular insulin 3 – 10 minutes → continuous drip; most important treatment: IV NS; ↓ glucose by 100 mg/dl/hr; start replacing  $\text{K}^{+}$  once the patient begins to urinate; phosphate not needed; bicarbonate controversial, generally not needed; magnesium may be needed; note that the patient is always total-body hypokalemic, but the initial serum potassium may be elevated due to the acidosis (shift of potassium out of cells → serum) therefore always check the ECG early

Sugar – Too High HHNC: hyperglycemic hyperosmolar nonketotic coma; prodrome longer than DKA; infection common: higher glucose, deeper coma, greater volume loss; **focal neurologic findings common**; 85% with underlying renal or cardiac impairment; rapid IV fluid most important, partially corrects glucose; low-dose insulin helpful; seizures: phenytoin (Dilantin®) contraindicated, impairs endogenous insulin release; usually associated with a higher mortality rate than DKA due to underlying illnesses, degree of dehydration, and duration of the illness prior to presentation (DKA patients tend to present early in course because the ketones induce vomiting, prompting patient to seek medical attention)

Sugar – Too Low: symptoms at 40 to 50 mg/dl; bedside tests essential, accurate; 1 amp  $\text{D}_{50\%}$  raises 40 to 350 mg/dl; glucagon 1 mg IM similar, takes 10 to 20 minutes (not in alcoholics → no glycogen); if refractory, consider cortisone

Alcoholic Ketoacidosis: binge drinking followed by poor intake, vomiting; blood glucose usually <200 mg/dl; beta-hydroxybutyrate >> acetoacetate: may dip negative for ketones; use  $\text{D}_5\text{NS}$  (dextrose is critical in order to reverse the ketosis), replace  $\text{K}^{+}$ ; avoid  $\text{NaHCO}_3^{-}$

Thyroid – Too High: most common cause of storm: Graves' disease; amiodarone → ~25% of patients develop thyrotoxicosis; signs: ↑T, ↑HR, goiter, heart failure, ophthalmopathy; symptoms: agitation, weight loss, nervousness, palpitations; thyroid storm often misdiagnosed as sepsis since inciting event is concomitant infection → high mortality if not treated in first 24 hours

- Block peripheral effects: beta-blockade (propranolol)
- Prevent peripheral conversion of T4 to T3: dexamethasone
- Inhibit hormone synthesis: PTU (propylthiouracil), methimazole
- Block hormone release: iodine, lithium (only AFTER PTU is given)

Thyroid – Too Low: women >> men; winter disease; hypothermia in ~80%; altered sensorium:  $\text{CO}_2$  narcosis; ~5% of people with carpal tunnel are hypothyroid; most sensitive test: TSH; CXR: pleural, pericardial effusion; replace thyroid immediately especially if also septic: thyroxine (T4) is cornerstone; treat precipitating factors: most common → CHF, pneumonia; reverse metabolic abnormalities: most serious → ↑ $\text{CO}_2$ , ↓glucose

Adrenal – Too Low: inadequate glucocorticoids, primarily cortisol; most common cause: exogenous steroid therapy with adrenal suppression; primary → adrenals; compensatory ↑ACTH, ↑MSH → pigmentation; Secondary → hypothalamic-pituitary axis; unconfirmed diagnosis → dexamethasone phosphate does not interfere with ACTH stimulation test; known adrenal failure → hydrocortisone hemisuccinate; no IV access → cortisone acetate; can always draw a random cortisol then administer hydrocortisone-consider in any septic patient with refractory hypotension; Waterhouse-Friderickson Syndrome-adrenal infarction

**Pediatric** – Endocrine and metabolic

Congenital adrenal hyperplasia: ↑ ACTH → ↑ steroid precursors → androgens → ambiguous genitalia; vomiting/ dehydration → circulatory collapse within first 2 weeks of life, dysrhythmias due to hyperkalemia and acidosis, hypoglycemia → seizures; treat with IV fluid, glucose, hydrocortisone, fix hyperkalemia

Hypoglycemia: normal if >30mg/dl in infants, >40mg/dl in older children

Newborns: give 10% dextrose; infants and young children: 25% dextrose 2 – 4 cc/kg

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## 6.0 Environmental – 3% / 9 questions

Brown Recluse Spider (rare): painless bite, often not recognized; necrotic lesion; treat with good wound care –no evidence for use of dapsone or HBO, avoid extensive surgical debridement; loxoscelism: fever, vomiting, myalgias, hemolysis, DIC

Black Widow: painful bite → severe muscle cramps; analgesics, benzodiazepines; antivenin if severe, very young or old

Marine Envenomations: most common marine vertebrate envenomation: stingray; Tx for jellyfish, man-o'-war: vinegar; Tx for starfish, sea urchin, lionfish: remove spines, hot water (45°C); ocean infections can be caused by *Vibrio* species: Tx TMP/SMZ, doxycycline, fluoroquinolone

Rattlesnake: crotalid bite; Tx -Crotaline Fab antivenom

Coral Snakes: Red on Yellow, Kill a Fellow; admit for 24 – 48 hour observation for respiratory failure, antivenom stocks are low or non-existent, new formulation due out in 2016-17

High-Altitude

HACE (cerebral edema): O<sub>2</sub>, dexamethasone

HAPE (pulmonary edema): O<sub>2</sub>, nifedipine

**Best: descent**

Acute Hypothermia → Osborne or J-wave; ignore dysrhythmias except ventricular fibrillation: rewarm internally if patient has temp < 30 degrees C or if hemodynamically unstable/VFib  
Coma: if severe: active core rewarming-best is cardiac by-pass- with 42degrees C fluids (peritoneal, bladder, pleural lavage); avoid CPR if electrical activity; avoid excessive use of medications due to build-up and release with recirculation;

Heat Stroke: consider in any patient with altered mental status and fever (even at low temps), especially athlete who collapses; rapid cooling with spray water and fans

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## 7.0 H.E.E.N.T. – 5% / 15 questions

**Eye:** Primary Complaints: My eye hurts. My eye is red. I can't see.

Trauma: blunt trauma: orbital floor weakest point, medial wall 2<sup>nd</sup> weakest; x-ray → teardrop sign; best x-ray → CT; retrobulbar hemorrhage → consider lateral canthotomy; alkali burn: irrigate copiously until pH is normal; acid burn: less destructive

Cornea: abrasion: no eye patch, do not prescribe topical anesthetic drops; foreign body: rust ring; ulcer from contact lens: *Pseudomonas*-treat with ciprofloxacin eye drops; perforation: teardrop-shaped pupil, positive Seidel test (fluorescein flow)

### Conjunctivitis vs. Iritis

Conjunctivitis: palpebral erythema; itch better with topical anesthetic; hyperpurulent: think GC  
Iritis: central erythema (ciliary flush), debris in anterior chamber (cell and flare), consensual photophobia, no relief from topical anesthetic-tx is dilation (red top) and tx of underlying cause

Preseptal = Periorbital: eye not involved: full EOM, normal acuity; usually staphylococcus; H. flu in uninoculated

Septal = Orbital: pain with EOM; proptosis; staphylococcus most common; mucormycosis: diabetes, immuno-compromised

Herpes Keratitis: can be primary or assoc with herpes zoster - Hutchinson's Sign (involvement of the tip of the nose)

### Sudden Vision Loss

- Glaucoma: haloes
- Retinal detachment: curtain
- Amaurosis fugax: transient
- CRAO: sudden, painless
- Vitreous hemorrhage: floaters
- Temporal arteritis: women >60 with headache +/- visual complaints, jaw claudication; physical exam unreliable, get ESR; if significantly elevated start steroids, biopsy later

Glaucoma: optic neuropathy 2° increased intraocular pressure; acute angle closure can mimic acute abdomen; begins abruptly, dark room; steamy cornea, midposition fixed pupil; haloes around lights

- Suppress aqueous production: topical beta-blockers (timolol-yellow top) + topical alpha-adrenergic (apraclonidine) + carbonic anhydrase inhibitor (acetazolamide)
- Dehydrate eyeball: mannitol
- Open the angle: pilocarpine (green top)

### Nose

Trauma: Most common facial fracture; septal hematoma → drain

Nosebleed: anterior vs. posterior

**Ear**

Ear – External: otitis externa = swimmer's ear: *Staphylococcus* or *Pseudomonas*: malignant otitis externa (MOE) = necrotizing otitis externa (NOE) = skull-base osteomyelitis (SBO):

*Pseudomonas aeruginosa* → admission, systemic antibiotic

Ear – Middle: otitis media, acute: *Streptococcus pneumoniae*, *Haemophilus influenzae*: otalgia ± fever; first Tx: still amoxicillin, complication-mastoiditis

**Mouth**: most common nontraumatic dental emergency: pain from caries and abscesses; most important concern: airway compromise; implant avulsed teeth ASAP or preserve in Hank's solution, milk, saliva; fractured teeth managed depending upon structures involved: enamel, dentin, or pulp exposure; Ludwig's –sublingual cellulitis/abscess secondary to tooth infection or recent dental procedure presents with submandibular swelling and tongue elevation

→clindamycin, CT scan, admission +/- OR-can lead to mediastinitis

Acute Necrotizing Ulcerative Gingivostomatitis (ANUG): trench-mouth; fusobacteria and spirochetes;Tx local compresses and systemic antibiotics

**Airway Obstruction**

Child with drooling or stridor: don't do x-ray, prepare to control airway

Epiglottitis → much less common in kids after H. flu vaccine but assoc with rapid airway loss

X-ray: find hyoid bone; normal retropharyngeal space width <twice diameter of vertebral body

LeFort I: transverse fracture separates body of maxilla from lower portion of pterygoid plate and nasal septum; with stress of maxilla, only hard palate and upper teeth move

LeFort II: pyramidal fracture of central maxilla and palate; facial tugging moves nose, not eyes

LeFort III: cranial-facial disjunction, complete facial skeleton separates from skull; entire face, including most of both orbits, shifts with mobilization

LeFort IV: midface plus frontal bone

Tripod Fracture: infraorbital rim fracture, diastasis of zygomatic-frontal suture, and disruption of zygomatic-temporal junction at the arch

**Pediatric: HEENT**

Epiglottitis: newborn to adults; ↓ H. flu; ↑ staph and strep; average pediatric range 2 to 7 years; fever, progressive sore throat; "sniffing" position; lateral neck x-ray → "thumb" sign

Retropharyngeal abscess: opposite presentation from epiglottitis, toxic 18-24 month child with stridor when sitting up (prefer to lie down to reduce the obstruction) and a stiff neck-lateral xray of neck or CT shows increased prevertebral STS-ENT emergency

Airway Foreign Bodies: most in mainstem bronchus; paroxysmal cough, wheezing and ↓ breath sounds; x-ray → hyperinflation, mediastinal shift away from affected side

Croup: racemic epinephrine → observe for 2-3 hours after administration; steroids:

dexamethasone 0.6mg/kg IM/PO/IV versus inhaled budesonide

Gingivostomatitis: anterior mouth: herpes simplex; posterior pharynx: coxsackievirus

Bacterial Tracheitis: Age 1 – 5 years; initial croup-like symptoms; high fever, toxic appearance; emergent intubation usually necessary

IV antibiotics: nafcillin plus ceftriaxone

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## 8.0 Hematology – 2% / 6 questions

### Blood Products

- 1 U PRBC ↑ hemoglobin ~1 gm%
- Hematocrit ~3 x hemoglobin
- 1 U platelets ↑ count 5000 – 10,000
- Autotransfusion: no functional platelets, fibrinogen
- Universal donor: O-negative
- Treat symptoms, not numbers
- Fresh Frozen Plasma: each cc contains 1 U each clotting factor
- Most common reaction: febrile
- Most serious reaction: hemolytic
- Disease transmission virtually zero

### Coagulopathy – iatrogenic

Warfarin: inhibits vitamin K Factors X, IX, VII, II (1-9-7-2); FFP: immediate reversal, short-lived; vitamin K: reverse over 4 to 24 hrs

Heparin: binds antithrombin III; discontinuing usually enough (short half-life); protamine 1 mg / heparin 100 U

Hemophilia: classic (Type A): normal amount Factor VIII, abnormal function; normal PT, prolonged aPTT; morbidity: joint bleeds; mortality: head bleeds, AIDS; drug of choice: DDAVP; recombinant Factor VIII → 1 unit = 2% activity (avoid cryoprecipitate if possible due to hepatitis and HIV risk, 10-15cc/kg of FFP will give ~ 100% activity type of hemophilia is unknown)

- Minor bleed (joint): 15 – 25 U/kg
- Moderate bleed (GI): 25 – 50 U/kg
- Major bleed (CNS): 50 U/kg = 100% activity

Disseminated Intravascular Coagulation (DIC): simultaneous deregulation of coagulation and fibrinolytic pathways (“consumptive coagulopathy”); everything abnormal: PT, aPTT, platelets, fibrinogen, D-dimer; Tx RBCs, platelets, FFP, may need heparin

Immune Thrombocytopenic Purpura (ITP): old name: Idiopathic...; ↑ platelet clearance by reticuloendothelial system; adults: steroids; kids: intravenous immunoglobulin

Thrombotic Thrombocytopenic Purpura (TTP): classic pentad in 40% - 1. thrombocytopenia; 2. hemolytic anemia; 3. fluctuating neurologic exam; 4. renal disease (mild); 5. fever (infrequent); Tx plasma exchange, plasmapheresis (DO NOT GIVE Platelets)

Von Willebrand’s Disease: most common genetic bleeding disorder; prolonged bleeding time, normal PT, prolonged aPTT ~25%, platelet count normal, ↓ function; Tx DDAVP, FFP; for nosebleed: pork-fat nasal pack

Anemia: most common human enzyme defect: G6PD deficiency → hemolysis with oxidants; hemolytic-uremia syndrome: renal failure, hemolysis, fever, low platelets; diarrhea precursor: most common *E.coli* 0157:H7

Sickle Cell Disease: **vaso-occlusive** (painful): labs not helpful, avoid repeated doses of meperidine (buildup of metabolite can induce seizures); **hemolytic**: precipitous fall in hematocrit, ↑ reticulocytes; **aplastic**: bone marrow failure, ↓ hematocrit, ↓ reticulocytes; think parvovirus; **sequestration**: large spleen in kids; **chest**: hypoxia, diffuse infiltrates, CP; **sepsis** especially with encapsulated organisms; also CVAs and **osteomyelitis**

Leukemia: blast crisis: flu-like symptoms with ↑ immature cells; leukemoid reaction: ↑ WBC due to infection, resembles leukemia; neutropenia (<1000 /ml): death in days

Multiple Myeloma: plasma cell malignancy; pain in back, ribs; ↑ calcium ~30%; neutropenia, hypo-gamma-globulinemia → infections (esp. pneumococcus); hyperviscosity

Tumor Compressions: spinal cord: Tx steroids, radiation; upper airway: Tx establish definitive airway; pericardial tamponade: if unstable, pericardiocentesis; superior vena cava syndrome: diuretics, steroids, radiation

Biochemical Derangement: hypercalcemia: Tx IVF, furosemide; SIADH: Tx NS, diuretics; hyperviscosity → fatigue, strokes, blindness, seizures: Tx NS, phlebotomy; adrenocortical insufficiency with shock: Tx hydrocortisone

Cancer plus...

...constipation = hypercalcemia

...fever = neutropenia / sepsis

...hypotension / JVD / shortness of breath = tamponade / SVC syndrome

...hypoglycemia = ↓ adrenal

...hyponatremia = ↓ adrenal or SIADH (euvolemic)

...back pain = cord compression

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## 9.0 Immunology – 2% / 6 questions

Reiter's Syndrome – classic triad: arthritis, conjunctivitis, non-GC urethritis; trigger: chlamydia or GI bug; asymmetric joint stiffness, low back pain; worse with inactivity

Rheumatoid Arthritis: Felty syndrome: rheumatoid arthritis + neutropenia + splenomegaly → serious bacterial infection; cervical spine instability: C1-C2 degeneration → minor trauma → neurologic damage

Vasculitis: Henoch-Schönlein purpura (HSP): hypersensitivity vasculitis with purpuric rash commonly on the buttocks and LE, abdominal pain, arthritis and potentially renal involvement-treat with steroids ;

Giant cell arteritis: temporal, other carotid branches: headaches, fatigue, fever, anemia, ↑ sedimentation rate and CRP; high-dose steroids; complications include blindness

HIV: most new cases are in heterosexuals; presentation: anything and everything; opportunistic infections if **CD4 <200 cells/ml (assoc with thrush)**

Kawasaki Disease (mucocutaneous lymph node syndrome): fever ≥five days **and** four of following five: bilateral conjunctival injection, oral mucosal changes, rash (not vesicles); extremity changes; cervical adenopathy; **complication-coronary artery aneurysms**  
Aspirin + gamma globulin therapy

Anaphylaxis / Allergies: most common cause of death: airway obstruction; classic: IgE mediated; anaphylactoid: non-IgE mediated; ↓BP: vasodilatation, capillary leakage

- 1° Tx: epinephrine
- Bronchospasm: inhaled β-agonists
- H1-blocker: diphenhydramine

- H2-blocker: cimetidine, famotidine, ranitidine
- Systemic corticosteroids
- Refractory ↓BP: pressors with alpha-adrenergic activity (levarterenol or dopamine)

Resistant to epinephrine if taking β-blocker → glucagon; corticosteroids and H<sub>2</sub> blockers may help prevent rebound

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## 10.0 Systemic Infectious Disease – 5% / 15 questions

Gonococcus : urethritis, epididymitis, prostatitis, cervicitis, PID; disseminated disease: fever, tender pustules, oligoarticular arthritis (1 – 3 joints); septic arthritis in young Tx ceftriaxone (Rocephin®), fluoroquinolone

Botulism :  descending  paralysis: starts with bulbar palsies, diplopia, ptosis, dysarthria, reflexes preserved: contrast with Guillain-Barré → ascending paralysis with lost reflexes  
Tx respiratory support, trivalent antitoxin; cathartic to speed toxin transit

Toxic Shock Syndrome : colonization or infection with *Staphylococcus aureus*; exotoxin causes symptoms: fever, hypotension/orthostasis, rash-erythroderma/sunburn; multisystem disease, desquamation late; Tx fluids, anti-staphylococcal antibiotic, pressor

Lyme Disease :  Erythema chronicum migrans  (*Borrelia burgdorferi* → *Ixodes scapularis*)

- Stage I: ECM (60 – 80%), viral symptoms, lymphadenopathy, erythema chronicum migrans
- Stage II: neurologic (neuritis,  **bilateral Bell’s palsy** ), cardiac (nodal heart block)
- Stage III: chronic arthritis, myocarditis, encephalopathy

Tx- doxycycline, azithromycin

Rocky Mountain Spotted Fever : fever, rash, tick exposure (~50% don’t recall) → malaise,  headache , fever, myalgias, abdominal pain, gastrointestinal symptoms; petechial rash starts on ankles and wrists, spreads inwards; must treat based on presentation with doxycycline, chloramphenicol-cannot wait for titers

Tetanus : intact sensorium, trismus (lockjaw); risus sardonicus; spasms and contractions, autonomic dysfunction: ↑BP, ↑P, ↑T (↑catecholamine). Differential: strychnine  
Tx tetanus immune globulin (TIG) + tetanus toxoid; benzodiazepines for spasms; airway management +/- neuromuscular blockade; surgical debridement of wound; parenteral metronidazole – avoid penicillin

Rabies : human rabies immune globulin (HRIG) 20 IU per kg, inject as much as possible (at least half if possible) into and around wound, remainder in gluteal region; Vaccine: 1 mL human diploid cell vaccine (HDCV) or rabies vaccine absorbed (RVA), or purified chick embryo cell culture (PCEC) in deltoid days 0, 3, 7, 14, and 28 (never give in gluteal area, as it is not absorbed from fatty tissue); CDC recommends to tx for ANY bat exposure in an enclosed space

### **Viral Exanthems**

Erythema Infectiosum : Fifth Disease → parvovirus; sickle cell → aplastic crisis; “slapped cheek”

Roseola : Sixth Disease → human herpes virus 6; high fever 3 – 5 days, then sudden rash after defervescence

Varicella: macules, papules, vesicles; trunk, face to extremities; contagious until crusted; encephalitis: seizures, coma; salicylates → Reye syndrome

Neonatal Sepsis: group B streptococcus, *Listeria monocytogenes*, *E. coli*, et al.

Presentation: "not acting right" – lethargy, irritability, poor feeding, tachycardia, bradycardia, mottled skin, poor perfusion

- Neonate: septic work-up, admit if <28 days old; Tx ampicillin + cefotaxime (avoid ceftriaxone in neonates)
- 28 – 60 days: full work-up with possible outpatient management; if negative, next-day follow-up, with or without ceftriaxone
- Sick cell: think salmonella

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## 11.0 Musculoskeletal, Nontraumatic – 3% / 9 questions

Osteomyelitis: most common organism: *Staphylococcus aureus* (even in sickle-cell patients); if sickle-cell: think salmonella; if foot puncture: pseudomonas; after dog / cat bite: pasteurilla; MRI is best diagnostic tool early-positive at 48-72 hours, plain radiographs positive after ~30 days

Osteonecrosis / AVN: o Boney infarction caused by disruption of the blood supply; may be idiopathic (20%) or associated with trauma, steroid use, alcoholism, sickle cell disease, dysbarism, chronic pancreatitis, collagen vascular disease and renal transplantation; hip after traumatic dislocation, scaphoid fx, lunate (Kienbock's Dz), Legg-Calve-Perthes Dz, humerus (sickle cell dz)

Arthritis: most common organism if septic: *Staphylococcus aureus*; migratory: gonorrhea

- Monoarticular: septic until proven otherwise
- Oligoarthritis: GC, rheumatoid, Lyme, Reiter's
- Polyarthrits (>3 joints): lupus, virus, rheumatoid

Rhabdomyolysis: total CPK is most sensitive test -more than 5x normal; myoglobinuria (urine positive for hemoglobin, no red cells on microscopy) is specific but insensitive so cannot be used to rule the disease out; Tx fluids, fluids, ...and more fluids, bicarbonate (controversial), mannitol +/- furosemide

**Deep Space Infections: Necrotizing Fasciitis** – Spectrum of disease, beginning with cellulitis (see Dermatology section) and eventually involving the skin, SQ tissue and fascia. Causes include penetrating trauma, extension from deep soft tissue infection (i.e. perirectal abscess), recent surgery. Predisposing factors include diabetes, poor circulation, immuno-compromise, trauma. Clinically, patients present with red, moderately tender skin (pain out of proportion without history of trauma or injury is an early finding plus unexplained tachycardia and lactic acidosis), +/- blisters and areas of necrosis, severe swelling, +/- palpable gas. Systemic toxicity is moderate to severe. Etiology is mixed anaerobe and aerobes (non-group A streptococci plus anaerobes versus group A beta-hemolytic streptococci). Treatment includes emergent wide excision, antibiotics and possibly HBO. Antibiotic choice is guided by gram stain findings or location, thus likely organism. Start with penicillin, an aminoglycoside, and clindamycin. If gram positives found or expected, use penicillinase-resistant penicillin. Despite treatment, mortality is 35%.

**Clostridial Cellulitis** – Gas producing, anaerobic suprainfection of previously traumatized or necrotic tissue that spreads along intrafascial planes treated with penicillin or tetracycline.



**Fournier's syndrome** – Insidious necrotizing subcutaneous infection of the perineum resulting in acute dermal gangrene commonly seen in men ages 20-50; caused by aerobic (*E. coli*) and anaerobic (*B. fragilis*) bacteria (commonly of the distal colon), management consists of resuscitation, broad spectrum antimicrobials and surgical debridement. Mortality is as high as 35%.

Cellulitis: periorbital / preseptal vs. orbital – think *Staphylococcus aureus* / MRA

Abscesses-most are MRSA, all need I&D, antibiotics only if significant associated cellulitis-TMP/SMX, clindamycin, vancomycin

Impetigo: group A streptococcus, but *Staphylococcus aureus* also possible: honey-crusted rash (not specific), topical mupirocin (Bactroban®), oral penicillin, cephalosporin

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## 12.0 Nervous System – 5% / 15 questions

Multiple Sclerosis: if distribution of neurologic deficits doesn't make sense – think MS (DDx when neuro deficits doesn't make sense: aortic/carotid/vertebral artery dissection, vasculitis, psychogenic); get MRI; most common initial symptom: optic neuritis

Headaches: migraine: young woman, aura, nausea / vomiting; cluster: young man, orbital, periodic; tension: worse through day; subarachnoid hemorrhage: sudden, syncope, nausea / vomiting, severe, occipitotuchal; hypertensive: throbbing, occipital; meningitis: fever, meningismus; tumor: early morning awaking HA's, Valsalva; pseudotumor: obese young woman, papilledema; glaucoma: vomiting, orbital pain, cloudy cornea, midposition/non-reactive pupil

Subarachnoid: head CT only if completed less than 6 hours after onset; if high pretest probability and CT is >6 hours after onset and is negative, must do LP for xanthochromia  
Only medicine: oral nimodipine to both lower BP and prevent spasm

Stroke: general Tx; supplemental O<sub>2</sub>; avoid IV's with glucose: ↑ risk neuronal damage if hyperglycemic; Tx only severe hypertension with goal to decrease MAP by no more than 20-30%  
If fibrinolytic: total dose rt-PA 0.9 mg/kg, with maximum dose 90 mg; 10% given as bolus, remainder over 60 min.; fibrinolytic must be given within 3-4.5 hours of the *known onset* of deficits versus interventional cerebral intra-arterial tPA up to 6 hours

Epidural Abscess: IV drug users: hematogenous spread; fever, back pain, percussive tenderness  
Diagnosis: CT or MRI; Tx antibiotics, neurosurgery

Meningitis: pneumococcus #1 in all but neonates

**Neonates**: group B streptococcus, *Listeria monocytogenes*, Gram negatives – ampicillin + ceftriaxone

**Infants 1 – 3 months**: – group B streptococcus, *Listeria monocytogenes*, pneumococcus, *H. flu*, *N. meningitidis* - ampicillin + ceftriaxone + vancomycin

**3 months – 18 years**: *H. flu*, pneumococcus, *N. meningitidis* – ceftriaxone + vancomycin

**Adults**: pneumococcus, *N. meningitidis* – ceftriaxone + vancomycin or rifampin; if >50 years, add ampicillin

**Immunocompromised**: “adults” plus *Listeria*, aerobic gram negatives – vancomycin + ampicillin + ceftazidime

Myasthenia Gravis: muscle weakness, improves with rest; EOM: ptosis, diplopia; generalized MG → proximal muscle weakness; rarely presents with respiratory insufficiency; edrophonium (Tensilon®) inhibits acetylcholinesterase and will improve MG crisis (but if the patient has weakness due to excess of the cholinergic medications, edrophonium may cause abrupt worsening, including respiratory arrest); 1 – 2 mg IV; have atropine and ET tube at bedside!

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### 13.0 Obstetrics and Gynecology – 4% / 12 questions

Infections: cervicitis, salpingitis (PID): gonorrhea, chlamydia; PID + RUQ pain + jaundice = Fitz-Hugh-Curtis syndrome; vulvovaginitis: *Trichomonas vaginalis*, *Gardnerella vaginalis*, and *Candida albicans*

Ultrasound: gestational sac: double deciduum; IUP 5 weeks – yolk sac; 6 – 7 weeks – fetal pole; discriminatory zone: transvaginal IUP at >1500 mIU/mL; trans-abdominal: >5000 mIU/mL

Ultrasound: Ectopic

Tubal ring = ectopic; identify ectopic pregnancy → work-up over; identify intrauterine pregnancy → work-up over; beta-hCG ≥2000 mIU/mL without sonographic evidence of IUP → ectopic until proven otherwise

Ectopic: amenorrhea ~70%; vaginal bleeding ~80%; pain >90%; “classic” pain: lateralized, sudden, sharp, severe; serum beta-hCG that fails to double in 48 hours suggests ectopic or abnormal pregnancy; adnexal mass + free fluid + empty uterus = ectopic;

Lethal Complications in...

...mother → hemorrhage, infection, preeclampsia

...full-term infant → hemorrhage (abruptio), pregnancy-induced hypertension, pulmonary embolism (esp. amniotic fluid)

...fetus → chromosome abnormalities (~60%)

Miscarriage: if Rh-negative and bleeding → RhoGam 300 mcg within 72 hours (can use 50 mcg in first trimester); profuse bleeding → add oxytocin 20U to IV fluids

Late-term Complications

HELLP: Hemolysis + Elevated Liver enzymes + Low Platelets

Hypertension: >140/90 mmHg; preeclampsia: ↑BP + headache, visual disturbances, edema, or abdominal pain; eclampsia: preeclampsia + seizure

Tx magnesium sulfate, antihypertensive, emergent delivery

Abruptio Placentae: ~30% of 3<sup>rd</sup> trimester bleeding; risks: hypertension, ↑maternal age, ↑parity, smoking, cocaine; painful vaginal bleeding (but blood may be hidden); 3<sup>rd</sup> trimester + trauma + bleeding → abruptio

Placenta Previa: ~20% of 3<sup>rd</sup> trimester bleeding; **painless** bleeding; **DO NOT** perform digital or speculum exam → ultrasound

Preterm Labor: prior to 37 weeks gestation; ~85% neonatal deaths not due to congenital abnormalities; premature rupture of membranes (PROM): prior to onset of labor; fetal viability at 23 weeks, with ↑ mortality / morbidity

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## 14.0 Psychobehavioral – 3% / 9 questions

Delirium Tremens: chronic (>5 years) drinker; gross tremor, confusion, fever, incontinence, visual hallucinations, seizures ("rum fits"); hyperadrenergic: tachycardia, hypertension; mortality up to 10%; treat with *large* dosages of benzodiazepines

Related Illnesses: alcohol amnestic disorder → Korsakoff's psychosis; withdrawal seizures → rum fits; Wernicke's encephalopathy → ophthalmoplegia, ataxia, delirium; Tx thiamine

Major Depression: Classic triad: dysphoric mood + distorted perceptions of self and environment + vegetative symptoms

Suicide: ↑ risk with age; ↑ risk if single, divorced, widowed, separated, unemployed; women try more, men succeed more; involuntary commitment as last resort only when in best interests of the patient

Homicide: breach of confidentiality vs. safety of others; case law requires reporting threats of violence against third parties to police; legal precedent of "duty to warn"; Tarasoff v. Regents of the University of California (1976)

Child Abuse: History: unexplained / poorly explained injuries; injuries incompatible with stated history; changing history; significant delay in seeking treatment

Child Abuse: Physical: various stages of healing; multiplanar: back and front, right and left side together; obvious pattern: hand, belt; injuries in usually well-protected areas: trunk, upper arms, upper legs, neck, face, perineal area

Domestic Abuse: ~2000 deaths yearly; 2 - 3% ED visits; barriers to ED diagnosis: lack of training, fear of offending, time, nihilism; let victim know help available; some states with mandatory reporting laws

Elder Abuse: battery: physical, psychological, verbal; neglect; financial abuse; confusion, disorientation risk factor

Hysterical Conversion: loss of function, usually neurologic: paralysis, numbness, blindness; ED diagnosis one of exclusion

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## 15.0 Renal and Urogenital – 3% / 9 questions

Acute Renal Failure: pre-renal (↓ renal flow) - 40 – 80%; renal (intrinsic, ATN, etc.) - 25%; post-renal (prostate, fibroid) - <5%; 50% ↓ creatinine clearance or 50% ↑ serum creatinine

Chronic Renal Failure: months → years; no symptoms until function <10%; cause: diabetes, hypertension, glomerulonephropathies; hyperkalemia: life-threatening; cardiac arrest: Tx ↑K+ empirically

Access Problems: most common problems: stenosis / thrombosis; infection: *Staphylococcus aureus* and Gram-negatives; Tx vancomycin: t½ 5 – 7 days

Peritoneal Dialysis: most common problem: infection; Tx 1<sup>st</sup> generation cephalosporin or vancomycin

Glomerulonephritis: most common sign: periorbital edema; teenage boys; hypertension in ~80%; gross hematuria; consider post-streptococcal infection

Pyelonephritis: fever + flank pain + CVA tenderness; leukocyte esterase highly sensitive for pyuria; Tx fluoroquinolone; admit if toxic, pregnant, comorbid factors

Testes: Pain and Swelling: most common (for boards): epididymitis, testicular torsion, torsion of testicular appendage; hydrocele: transilluminates; varicocele: “bag of worms”; hernia: acute, painful

Epididymitis: <40 years old: STD organisms; >40 years: E. coli, klebsiella, proteus, etc.; Prehn’s sign: “pain improves with elevation of the scrotum” - NOT RELIABLE

Testicular Torsion: peak incidence puberty, occurs at all ages; acute unilateral pain, swelling; cremasteric usually absent; Prehn’s unreliable; time critical – consult first, obtain color-flow Doppler US; manual detorsion: “open a book”

Fournier’s Gangrene: life-threatening necrotizing infection; mixed flora: streptococcus, *B. fragilis*, *E. coli*, clostridium; antibiotics, surgery, consider HBO

Urethritis: most common urologic infection; sexually active male, dysuria = urethritis, not UTI

Paraphimosis: can’t reduce retracted foreskin; edema and venous engorgement → arterial compromise, gangrene; Tx manual reduction with “push-pull” method, if unsuccessful and no immediate urologic assistance place penile ring block and perform dorsal incision

Phimosis: inability to retract foreskin proximally beyond glans; if meatal tip involved → retention; Tx if able to urinate can wait for formal circumcision; may try to dilate ostium; consider suprapubic catheter rather than dorsal slit as formal circumcision has the best outcome

Priapism: **low flow**: impaired venous outflow is assoc with ischemia, commonly seen in sickle cell patients; **high flow**: increased arterial flow typically due to trauma and A-V fistula; Tx trial sub-Q terbutaline; persistent: corpora aspiration, irrigation with phenylephrine

Hemolytic Uremic Syndrome: infancy & early childhood; following diarrheal illness, esp. *E. coli* 0157:H7, shigella, yersinia, campylobacter, salmonella; ARF + hemolytic anemia + thrombocytopenia; Tx early dialysis → good results

#### Nephrolithiasis

Associated with urea-splitting bacteria: Proteus – causes rise in urine pH

Probability of passage: <4 mm diameter ~90% will pass; 4 – 6 mm ~50% pass; >6 mm ~10% will pass

Diagnosis: sudden debilitating flank pain; first choice: abdominal aortic aneurysm; plain film: poor reliability; IVP: lower sensitivity / specificity than CT; ultrasound 98% sensitive for hydronephrosis; non-contrast Helical CT ~96% sensitive / specific; noninvasive; evaluate other potential causes

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## 16.0 Thoracic – Respiratory – 8% / 24 questions

P(A-a)O<sub>2</sub>

Alveolar – arterial gradient: short form:  $150 - p\text{CO}_2 / 0.8$

Normally <10 mmHg

Sample:  $p\text{O}_2 = 78$ ,  $p\text{CO}_2 = 32$

Calculated alveolar oxygen =

$150 - 36 / 0.8 = 150 - 40 = 110$

$110 - 78 = \underline{32}$

Hypoxemia → Five causes: 1. hypoventilation; 2. right-to-left shunt; 3. ventilation-perfusion mismatch; 4. diffusion impairment; 5. low inspired oxygen

Epiglottitis: median age now much higher; most common pathogens: *Streptococcus pyogenes* and *Staphylococcus aureus*; presentation in kids: tripod position, drooling, stridor, toxic appearance; adults: subtle, stridor may not be present, severe sore throat but normal exam, often have significant tenderness with palpation of anterior neck at level of epiglottis

Tracheostomy: most common complications: accidental decannulation; tube obstruction; infection; bleeding tracheoinnominate fistula; tracheal stenosis

Transudate vs. Exudate

Transudate = plasma = two a's; ultrafiltrate of plasma with ↓ protein; from ↑ hydrostatic pressure or ↓ oncotic pressure; most common cause: CHF

Exudate → high protein, pleural inflammation; most common cause: infection

Pneumomediastinum: spontaneous: Valsalva, drugs; mediastinal crepitation = Hamman's crunch in 50 – 80%

Pneumothorax: tall, thin male smoker; acute pleuritic chest pain – 95%; shortness of breath – 85%; decreased breath sounds – 85%; 1¼% intrapleural air absorbed/day; catheter aspiration: 37 – 75% successful

Tension Pneumothorax: large-bore needle, 2<sup>nd</sup> intercostal space; on boards, if question involves suspected tension pneumothorax, chest x-ray is NEVER the right answer

Non-cardiogenic pulmonary edema: rapid labored breathing; chest x-ray → diffuse infiltrates with normal-size heart; cause: sepsis, pancreatitis, opiates, HAPE, aspirin OD, inhaled toxins, near drowning

Asthma: reversible airway obstruction, hyper-responsiveness, inflammation; Peak Expiratory Flow: best bedside test; ABG and chest x-ray rarely needed

Primary therapy: oral prednisone burst x 5 days or decadron or IV methylprednisolone +/- steroid inhaler if frequent attacks

Rescue Tx- beta-adrenergics (e.g. albuterol): mainstay of therapy for acute bronchospasm; act in <5 minutes; MDI with spacer vs. "wet neb"; levalbuterol: no advantage;

Epinephrine SQ: alpha- and beta-adrenergic; IV in life-threatening disease if not moving any air; consider BiPAP also before intubation; if intubation-"permissive hypercapnia" with long expiratory phase and low pressures as the goal

Other Treatments: Xanthines: theophylline no longer used; rug interactions / toxicities

Bronchitis: acute cough (less than 1 week); normal O<sub>2</sub> oxygenation; no auscultatory abnormalities; majority caused by virus; color of sputum not predictive

COPD: smoking causes ~90%; hallmark: exertional dyspnea, chronic productive cough; mainstay of management: bronchodilators; low-dose oxygen → avoid CO<sub>2</sub> narcosis; always assume CO<sub>2</sub> narcosis in the COPD patient with mental status change

Inhaled Toxins: large or highly water soluble particles → deposit in upper airway → cough, wheeze; small or lower water soluble particles → reach lower tracts → possible delayed symptoms; intermediate → early irritation, then delayed pulmonary edema

### Pulmonary Embolism

Virchow’s Triad: venous stasis + trauma to vascular endothelium + hypercoagulable state  
Symptoms: dyspnea > chest pain; signs: tachypnea far more than others

Initial Evaluation: PERC Rule to avoid all testing; D-dimer for low pretest probability patients; high-resolution multidetector computed tomographic angiography (MDCTA) has sensitivity and specificity comparable to that of contrast pulmonary angiography, 99% NPV.;

Electrocardiogram: classic S1 – Q3 – T3 only present in 10-15%; only 30-50% have tachycardia; new onset RBBB or atrial fibrillation is worrisome

Other tests: positive troponin and BNP in the face of a PE should prompt cardiac echo for RV compromise and consideration of tPA administration.

Tx : consider out-patient treatment with LMWH: 1 mg / kg subcutaneously BID OR 1.5 mg / kg subcutaneously daily or the newer anticoagulants such as rivaroxaban; no PTT monitoring necessary Unfractionated Weight Based: bolus: 80 – 100 units / kg, continuous infusion: 18 U / kg / hr Hull Method: bolus: 5000 units, continuous infusion: 1200 – 1300 units / hour  
Warfarin has no place in acute management of DVT or PE

Lung abscess: suppuration and necrosis → cavity formation → air-fluid level; risk factors: alcohol abuse; 90% have periodontal disease; direct ] at anaerobes → clindamycin

Pneumonia: top infectious disease cause of death in US; “classic” x-ray findings are myths  
Most common cause in HIV-positive: pneumococcus (unless ↓CD4); after influenza: staphylococcus; in pregnancy: think varicella

Empiric OP Management: <60 years: macrolide or doxycycline or pulmonary specific fluoroquinolone; >60 years and/or comorbid disease: pulmonary specific fluoroquinolone or macrolide + 2<sup>nd</sup> / 3<sup>rd</sup> generation cephalosporin

In-Patient Community Acquired: macrolide + 3<sup>rd</sup> generation cephalosporin

In-Patient Hospital Acquired: pip/tazo, imepenum, meropenum, cefipime plus vancomycin

In-Patient Hospital Acquired with Pseudomonas risk-add ticarcillin to above regimen

- *Legionella pneumophila*: high fever, dry cough, abdominal pain, vomiting, diarrhea, elevated LFTs, hyponatremia
- Chlamydia: mild, subacute
- Mycoplasma: “walking” pneumonia
- Pneumonia + bullous myringitis + rash + arthralgia

Pneumococcus: most serious cause of pneumonia requiring hospitalization; fever, rigors, rusty sputum, pleurisy; lobar infiltrate; ↑ penicillin-resistant *Streptococcus pneumoniae* (PRSP) (4 – 5% of US isolates); use 3<sup>rd</sup> generation fluoroquinolone

Mycobacterium: aerobic rod; multiple drug-resistance frequent; health care workers at risk  
Most common symptom: fever, not cough or hemoptysis  
Presentation: night sweats, mild cough, fever, malaise  
Classic: cavitory lesions in upper lobes  
Contemporary: parenchymal infiltrates, hilar and mediastinal nodes, pleural effusion  
Tx: four drug therapy – isoniazid (INH) + rifampin + pyrazinamide + streptomycin or ethambutol

Lung Cancer: small cell → paraneoplastic syndromes; SIADH → low sodium; excess ACTH → low potassium; Eaton-Lambert syndrome: myasthenic symptoms

### **Pediatric – Thoracic and Respiratory**

Bronchiolitis: 90% due to RSV: wheezing, retractions, rales; apnea if <3 months; Tx trial of beta-agonist, new emphasis on racemic epinephrine

Pneumonia: neonate – group B streptococcus, *E. coli*, *H. influenzae* B; young child - *Streptococcus pneumoniae*, *H. flu*

Pertussis (Whooping Cough): severe cough spasms, then “whoop;” post-tussive emesis, subconjunctival hemorrhage, petechiae; Tx erythromycin limits communicability, does not shorten course

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## **17.0 Toxicology – 4% / 12 questions**

Know Your Toxidromes!

Opioids: ↓CNS, ↓pupils (miosis), ↓HR, ↓respirations; Tx ventilate, naloxone

Sympathomimetics: agitation, mydriasis, diaphoresis, ↑HR, ↑T, ↑BP, rhabdomyolysis, seizures, myocardial ischemia; cocaine, amphetamines; Tx cooling, sedation

Cholinergic: salivation, lacrimation, diaphoresis, N/V, fasciculations, bronchorrhea, bradycardia  
Insecticides; Tx airway, atropine, pralidoxime

Anticholinergic: altered mental status, mydriasis, dry flushed skin, urinary retention, ↑T, seizures, rhabdomyolysis; atropine, jimsonweed; Tx sedation, cooling; consider physostigmine

Salicylates: altered mental status, tachypnea, ↑HR, diaphoresis, tinnitus, ↑T, anion gap metabolic acidosis; ASA, oil of wintergreen; Tx multi-dose activated charcoal, alkalize urine, consider hemodialysis

Hypoglycemia: altered MS, diaphoresis, tachycardia, hypertension, bizarre behavior, seizures  
Insulin, sulfonylureas; Tx D50, glucagon

Serotonin: altered mental status, ↑muscle tone, ↑reflexes, ↑T, “wet dog shakes”; meperidine / dextromethorphan + MAOI or SSRI; SSRI + TCA; SSRI/TCA/MAOI + amphetamine; Tx cool, sedate, cyproheptadine

### EKG

Tachycardic EKG + drug overdose = digoxin or tricyclic

TCA: large S in I, wide QRS, long QT, tall R in aVR

Digoxin: PAT with block, slow regular atrial fibrillation, high-grade atrioventricular block

Tricyclic Antidepressant: CNS, cardiac; life threatening: 10 mg / kg; Tx NaHCO<sub>3</sub> for wide QRS, ↓BP, ventricular dysrhythmias; no flumazenil – beware co-ingestions

If no symptoms after 6 hours, can safely “clear”

Activated charcoal does not absorb lithium, alkali / acid, heavy metals, iron

Consider Dialysis for...I STUMBLE: Isopropyl alcohol, Salicylates, Theophylline, Uremia, Methanol, Barbiturates, Lithium, Ethylene glycol

Whole Bowel Irrigation for...SLIM: Sustained release, stuffers, Lithium, Iron, Metals (heavy)

Acetaminophen (APAP, Tylenol®): N-acetylcysteine (NAC) – 140 mg/kg toxic ingestion; 140 mg/kg loading dose of NAC; 140 mcg/ml 4-hour toxic level

#### Antidotes

Arsenic: chelation with BAL

Lead: BAL, CaNa<sub>2</sub>-EDTA

Cyanide: amyl nitrite pearl → sodium nitrite → sodium thiosulfate

Methanol: ethanol, fomepizole, folate, dialysis

Ethylene glycol: ethanol, fomepizole, calcium, dialysis

Iron: deferoxamine

Organophosphates: pralidoxime (2PAM), atropine

INH → intractable seizures + metabolic acidosis: pyridoxine (vitamin B<sub>6</sub>)

Digoxin: Fab fragments (Digibind®, DigiFab®)

Carbon monoxide: high-flow O<sub>2</sub>, hyperbaric oxygen

Calcium-channel blocker: calcium, glucagon

Beta-blockers: glucagon

Ethylene Glycol: calcium oxalate crystals; anion gap, osmolar gap, acidotic; CNS symptoms (drunk) + cardiac failure (CHF, ↓BP) + renal; hypocalcemia may be severe; Tx ethanol, fomepizole

Methanol: formaldehyde and formic acid; anion gap, osmolar gap, acidotic; ↓CNS, visual disturbance, retinal edema, optic disc hyperemia, abdominal pain; Tx ethanol, fomepizole, folate: converts formic acid to CO<sub>2</sub>

Alkalinize serum for tricyclic antidepressants, urine for salicylates, barbiturates, chlorpropamide

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## 18.0 Trauma – 11% / 33 questions

### Head Injury

- Most common bleed: traumatic subarachnoid
- Most common cause of post-traumatic coma: diffuse axonal injury
- Epidural: middle meningeal artery, blood outside of dura (periosteal), rapid CNS deterioration, little brain damage so excellent recovery if aggressively treated; CT: lens-shaped = biconvex = football-shaped
- Subdural: bridging vessels, slow bleed pressing on brain → damage, subacute and chronic presentations, poor prognosis. Old and young have ↑ risk; CT: crescent-shape
- CT if GCS <15, intubate if GCS ≤8
- Cerebral perfusion pressure = mean arterial pressure – intracerebral pressure (CPP = MAP – ICP): maintain ICP at 20 – 25 mmHg



- Most common site herniation: uncus of temporal lobe displaced inferiorly through medial edge of tentorium → compression of third (oculomotor) nerve, ipsilateral fixed and dilated pupil

#### Neck Injury

- Zone I – clavicles to cricoid cartilage, includes vertebral and proximal carotid arteries, major thoracic vessels, superior mediastinum, lungs, esophagus, trachea, thoracic duct, spinal cord
- Zone II – inferior margin of cricoid cartilage cephalad to angle of mandible, includes carotid and vertebral arteries, jugular veins, esophagus, trachea, larynx, spinal cord
- Zone III – angle of the mandible to base of skull, includes distal carotid and vertebral arteries, pharynx, spinal cord

Cervical spine: Lateral x-ray → identifies ~80% of fractures; ~10% at cervico-thoracic junction; normal prevertebral tissue: 6 mm at C2 / 22 mm at C6

- Flexion: anterior subluxation, bilateral facet dislocation, simple wedge, Clay-shoveler, flexion teardrop fracture
- Flexion-rotation: unilateral facet dislocation
- Vertical compression (axial load): Jefferson, burst fracture of C1
- Hyperextension: anterior atlas arch avulsion, extension teardrop, laminar
- "Hangman's fracture": posterior elements of C2, associated with severe hyperextension

#### Spinal Cord:

- Anterior cord: loss of motor function and pain and temperature sensation distal to lesion, preservation of vibration, position, and crude touch
- Central cord: decreased strength, pain and temperature sensation, more in upper than lower extremities
- Brown-Séquard: ipsilateral loss of motor function, proprioception, and vibratory sensation, and contralateral loss of pain and temperature sensation
- Spinal shock: complete loss of reflexes + paralysis
- Neurogenic shock: acute spinal cord injury → disrupts sympathetic outflow → unopposed vagal → hypotension and bradycardia

#### Chest

Hemothorax: can see on upright chest x-ray with 200 – 300 cc of blood; large chest tube (34 – 40F); auto-transfusion if available; thoracotomy for unstable vital signs, >300 – 400 cc/hr for 4 hours, >1500 cc in 12 to 24 hours

Aortic Rupture: most common location: between ligamentum arteriosum and left subclavian artery; high level of suspicion; x-ray findings (many)

Diaphragm: most common: penetrating; left > right (liver is protective on right side)

Extended Focused Assessment with Sonography for Trauma (eFAST) Exam: assesses for fluid in (1) pericardium, (2) hepatorenal recess of Morrison (a common location for blood in patients with hemoperitoneum), (3) pelvis around the bladder, and (4) perisplenic region; rapidly replacing DPL as procedure of choice to detect hemoperitoneum in unstable trauma patient (5) assess for PTX with loss of lung-sliding and comet tails and for fluid in the pleural space

Trauma in Pregnancy: fundal height, uterine irritability, fetal heart tones part of 2<sup>o</sup> survey; most common cause of traumatic fetal death: abruptio placentae; place patient in left lateral decubitus position; perimortem cesarean section – within 5 minutes if possible

**Orthopedics:**

Scaphoid Fracture: most commonly fractured carpal bone

Carpal Dislocations: scapholunate (>3mm gap) vs. lunate (“spilled teacup,” “piece of pie”) vs. perilunate

Galeazzi ---- Radius ---- Ulna ---- Monteggia (GRUM)

Fat Pads

- Small anterior: may be normal; sail sign → large anterior fat pad
- Posterior: never normal; adults: radial head fracture; pediatrics: supracondylar fracture

Posterior Shoulder Dislocation: fall, seizure, electric shock

Jones Fracture: Transverse fracture base 5th metatarsal

Lisfranc: most common midfoot fracture; disrupted tarsal-metatarsal joint; expect fracture base 2<sup>nd</sup> metatarsal

Radial Head Subluxation: “nursemaid’s elbow,” annular ligament pulled from radial head due to distraction force

Legg-Calvé-Perthes Disease: avascular necrosis of femoral head; prepubertal, boys > girls

Slipped Capital Femoral Epiphysis: boys > girls; obesity, puberty

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SIDS / Apnea: Sudden Infant Death Syndrome: leading cause of death 1 month to 1 year; 30 – 50% with URI, especially RSV; ↑ risk with prone sleep

Pediatric Resuscitation: respiratory arrest is most common cause of cardiac arrest

Intubation: straight blade: preferred, uncuffed tube if <8 years old

ET tube size: little finger, nostril diameter, or (16 + age in years)/ 4

Shock: earliest sign tachycardia, then poor perfusion; hypotension late sign

Resuscitation: crystalloid 20 cc/kg, RBCs 10cc/kg

Epinephrine: 0.01 mg/kg

Atropine: 0.02mg/kg with minimum dose 0.1mg/kg, maximum dose 0.5 mg for a child and 1 mg for an adolescent

SVT: infant with heart rate >220/minute, child >180/minute; stable: adenosine 0.1 mg/kg rapid IV push; unstable: cardiovert 0.5 – 1 J/Kg

Ventricular Tachycardia: rare in kids; lidocaine 1 mg/kg IV; synchronized cardioversion (if pulse present): 0.5 – 1J/kg

Sinus Bradycardia: usually due to inadequate ventilation and oxygenation

Asystole: CPR plus epinephrine plus atropine

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## **Appendix 1: Procedures and Skills – 6% / 20 questions**

Techniques: airway adjuncts, cricothyrotomy, Heimlich maneuver, intubation: nasotracheal, orotracheal, rapid sequence, mechanical ventilation, percutaneous transtracheal

Anesthesia: local, regional nerve block, sedation – analgesia for procedures (“conscious sedation”)

Diagnostic procedures: anoscopy, arthrocentesis, bedside ultrasonography, lumbar puncture, nasogastric tube, paracentesis, pericardiocentesis, peritoneal lavage, slit lamp examination, thoracentesis, tonometry

Genitourinary procedures: bladder catheterization (Foley catheter and suprapubic), cystourethrogram , testicular detorsion

Head and neck: control of epistaxis (anterior packing, cautery, posterior pack), laryngoscopy, aspiration peritonsillar abscess, rust ring removal, tooth replacement

Hemodynamic techniques: arterial catheter insertion, central venous access (femoral, jugular, subclavian, umbilical, venous cutdown, intraosseous

Other techniques: thrombosed hemorrhoid excision, foreign body removal, gastric lavage, gastrostomy tube replacement, incision and drainage, pain management, physical restraints, sexual assault exam, nail trephination, wound closure techniques, wound management

Resuscitation: cardiopulmonary resuscitation, neonatal resuscitation

Skeletal procedures: fracture / dislocation immobilization techniques, fracture / dislocation reduction techniques, spine immobilization techniques

Thoracic procedures: cardiac pacing (cutaneous, transvenous), defibrillation / cardioversion, thoracostomy, thoracotomy

The presenters would like to thank Joe Lex, MD, FAAEM for his tremendous contributions to this handout and accompanying slide set.

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