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# 1 Chest Pain

Look at the chart, vitals, EKG

Rapid EKG interpretation

- Is this a STEMI? (1mm elevation in 2 contiguous leads)
- Look in anatomical locations
  - o I and AVL (lateral)
  - o II, III, AVF (inferior)
  - o V1-V3 (anterior/septal)
  - o V4-V6 (lateral)
  - o AVR (isolation)
- Rate- look at machine or divide 300 by number of boxes between two R waves or 300, 150, 100, 75, 60, 50, etc...
- Rhythm- P before every QRS (sinus) or not?
- Axis- if upright in I and AVF, normal
- Ischemia
  - o Flipped T waves- can be ischemia
  - o ST Elevations= infarction
  - o ST Depression= infarction opposite of that lead
- Look at computer interpretation and reconcile with your own reading

## Chest pain history

### OPQRST

- **Onset**- When did the symptoms start AND what were you doing?
- **Provocation/Provoking**- What makes you pain better or worse?
- **Quality**- What does your pain feel like (sharp, dull, pressure, burning)?
- **Relieving/Radiation**- Where does your pain radiate to (neck, jaw, arm, back?)
- **Severity**- 1 to 10 scale
- **Time**- When did your pain start?

**PEARL**- Make sure this isn't syncope (much different workup)

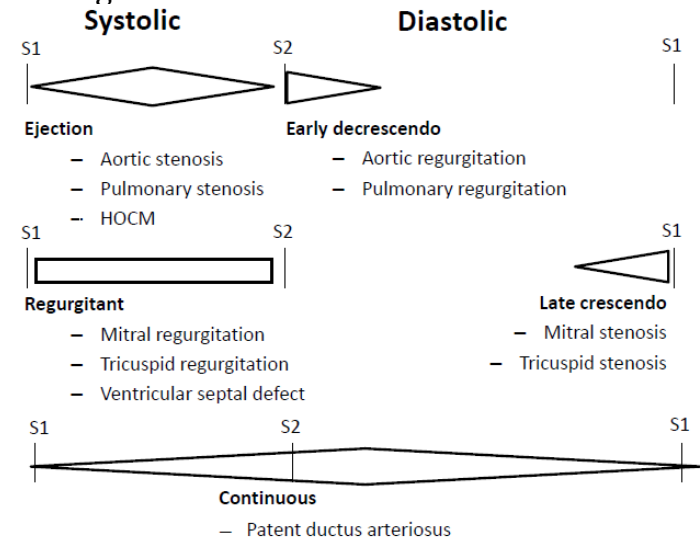
- **Associated signs and symptoms**- nausea, vomiting, diaphoresis, abdominal pain or back pain, syncope
- **Similarity to previous pain or MI?**
- **Past history**- HTN, hyperlipidemia, MI, CHF, echo with EF in chart?
- **History of stress tests or cath**- confirm if possible

**PEARL**: a "negative cath" can still have 30% occlusions- that is heart disease!

- **Medications**- BP meds, statins, aspirin, Plavix (clopidogrel), coumadin (warfarin), pradaxa (dabigatran)

## Physical exam key points

- **Volume status**- volume up, down, or euvolemic (wet or dry?)
- **Heart and lung sounds**- Murmurs? Wet lungs or wheezing?



- **Abdominal and back exam**- palpable AAA?
- **Legs**- edema or swelling? Pitting edema = compressible, indentation. Non-pitting seen with DVT
- **Pulses**- asymmetric deficits suggest a dissection

## Differential

Take your **PET MAC** for a walk- the 6 deadly causes of chest pain

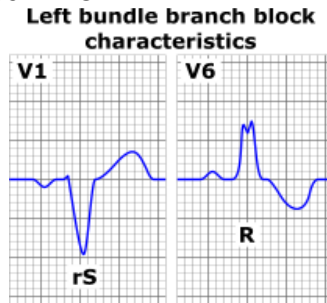
**PE** Esophageal rupture **T**ension pneumothorax

**MI** Aortic Dissection **C**ardiac Tamponade

## Workup

### Every patient- Chest x-ray and EKG

Chest pain + EKG with 1mm elevation in 2 contiguous leads or new left bundle branch block = CATH LAB



**Chest x-ray-** Pneumothorax, screen for dissection (widened mediastinum is 60-70% sensitive), esophageal rupture

**PEARL:** Be liberal with your EKGs and stingy with your enzymes

### If you are suspecting cardiac chest pain:

#### - Labs

- Cardiac set- (major reasons for labs in parentheses)
- CBC (anemia)
- Chem 10 (electrolyte abnormalities)
- Coags (baseline)
- Cardiac Enzymes (Troponin, CK, CK-MB)

**PEARL:** One set of enzymes USUALLY means admission for rule out ACS

#### - Treatments

- Aspirin 325mg PO
- Nitroglycerin (0.4mg sublingual q5 minutes x3 total doses, hold systolic BP <100 or pain free, contraindicated with Viagra (sildenafil), Cialis (tadalafil), Levitra (vardenafil) etc.

**PEARL:** have an IV in place before giving nitro, if hypotensive usually fluid responsive to 500cc NS bolus, avoid nitro in posterior MIs (R. ventricular dysfunction are preload dependent!)

- **If not pain free after aspirin and nitro-** can give morphine, Zofran (ondansetron)

**PEARL:** Get a pain free EKG and make sure there are no changes! (always have 2)

**If patient has persistent pain despite interventions-** consider unstable angina and admission to CCU instead of telemetry floor

### **Sample conversation with cardiologist regarding a low risk chest pain admission in the “cardiology format”:**

Hi, this is Dr. Turn in the ED, I have a 40 year old male with a history of HTN with no known coronary artery disease who comes in with 3 hours of chest pain at home. It started at rest and persisted for 3 hours. It wasn't exertional or positional. He described a sharp in his chest, 5 out of 10 severity. No other associated signs or symptoms. Exam is normal, EKG is normal and non-ischemic, Chest x-ray normal, and cardiac enzymes are normal as well. He got a 325mg ASA and one sublingual nitro with total relief of his pain. Repeat EKG has no changes. I would like to admit him for a low-risk rule out.

### If you are suspecting Pulmonary Embolism

- **Symptoms-** pleuritic chest pain, SOB, tachycardia, tachypnea, hypoxia
- **Risk factors-** OCPs, pregnancy, trauma, recent surgery, malignancy

**PEARL-** Therapeutic INR (2-3) is NOT 100% protective against PE

#### - Workup

- EKG and CXR
- CBC (low yield but consultants want it)
- Chem 10 (creatinine for a CT)
- Coags (baseline)

**PEARL-** DON'T indiscriminately order D-dimers

### **Decision making in PE**

- First step- Gestalt (“gut feeling”)
  - Low probability- no workup or proceed to PERC criteria below
  - Moderate or high probability- CT pulmonary angiogram (CTPA)

**PERC criteria**- low risk gestalt PLUS all of the following-

**BREATHS**

- **B**lood in sputum (hemoptysis)
- **R**oom air sat <95%
- **E**strogen or OCP use
- **A**ge >50 years old
- **T**hrombosis (in past or current suspicion of DVT)
- **H**ear rate >100 documented at ANY time
- **S**urgery in last 4 weeks

**If negative**- no testing (risk of PE 1.8%, risk of anti-coagulation 2%)

**If positive**- if negative D-dimer- no further testing, if positive- CTPA

- **Treatment**

- o If you diagnose a PE- get **cardiac enzymes and BNP** for risk stratification
- o **Regular PE** (vitals stable, no elevation in cardiac enzymes or BNP)- **lovenox (enoxaparin)** 1mg/kg SQ, or **heparin drip**, admit
- o **Submassive PE** (vitals stable with elevation in CEs or BNP, right heart strain on echo)- **lovenox (enoxaparin)** 1 mg/kg SQ, strongly *consider ICU admit for thrombolytics*
- o **Massive PE** (unstable vitals, systolic BP less than 90 at any time) - **thrombolytics** and ICU admit, **?interventional radiology intervention**

**Other diagnoses**

- **Esophageal rupture (Boerhaave's syndrome)**
  - o **History**- recent forceful vomiting, recent endoscopy, alcoholic, sick and toxic looking patient
  - o **Chest x-ray**- Free air under diaphragm, rigid abdomen on exam
  - o **Treatment**- resuscitation, surgical intervention
- **Aortic dissection** - ripping or tearing chest that goes into the back or shoulder area

**PEARL**- Chest pain + motor or neuro deficit **OR** chest pain but a seemingly unrelated complaint elsewhere in the body - think about dissection- aorta connects them both

- o **Risk factors**- **HTN (#1)**, pregnancy, connective tissue diseases (Marfan's and Ehlers-Danlos)
- o **Exam**- unequal BPs (more than 20 mmHg, 60-70% sensitive), pulse deficits (20% sensitive)
- o **Chest x-ray**- widened mediastinum (60-70% sensitive)
- o **Testing**- CT Aorta with contrast, TEE if dye allergy or creatinine elevated, cardiac MRI

## 2 Abdominal Pain

### History

- Look at the triage note and vitals and address them
- Before talking the patient- look at them as they sit on the stretcher
  - o Appendicitis- usually want to remain very still
  - o Kidney stones- usually writhing, can't get comfortable
- OPQRST questions about pain
  - o Onset, Provocation, Quality, Radiation, Severity, and Time
- Associated signs and symptoms
  - o Nausea/vomiting/diarrhea, chest pain, back pain, urinary symptoms
- Female patients
  - o Missed periods, vaginal bleeding, discharge
- PO intake
  - o Relation of pain to food intake, worse pain with movement?
- Medical history
  - o Special attention to surgical history, previous colonoscopy

### Exam

- Don't dive for the abdomen - do an HEENT exam, heart/lung exam
- Uncover the abdomen and ask patient to point where it hurts the most ("*with one finger*")
- Check bowel sounds first
  - o Can press down with stethoscope to see if they are tender
- Start pressing opposite of where they have pain
  - o Start lightly and presser harder
  - o If they have trouble relaxing, bend knees to 45 degrees
- **Peritoneal signs**- usually indicate appendicitis or other surgical pathology
  - o Lightly shake stretcher- for kids- have them jump up and down
  - o All of these signs are positive if increased pain in RLQ

- o **Psoas sign**- roll onto left side, extend leg back
- o **Obturator sign**- flex and externally rotate right leg
- o **Rovsing's sign**- push in LLQ, pain in RLQ
- o **Reverse Rovsing's**- push in RLQ, pain in LLQ (diverticulitis)
- o Murphy's sign- patient takes a deep breath, push in RUQ, positive if patient stops inhaling due to pain

**PEARL**- Do a testicular exam in all males- don't miss a torsion!

- Summary: Check mucus membranes and eyes → heart exam → sit up for lung exam, also check for CVA tenderness → totally flat: point to pain, bowel sounds, palpation, rebound, guarding, peritoneal signs → if male, testicular exam

**Labs** - not everyone needs them but if you think it's surgical abdominal pain, get them (reasons for getting them in parentheses)

- UA/HCG for females (no cx unless you admit or treat for UTI)
- CBC (consultants want them, up to 30% of appys have normal WBC)
- Chem 10 (hypokalemia can cause an ileus, low bicarb= acidosis, creatinine for a CT)
- Coags (standard pre-op lab, liver disease elevates coags before LFTs)
- LFTs (cholecystitis workups, may not need them for an appy)
- Lipase (pancreatitis, amylase is unnecessary - not sensitive or specific)
- VBG with lactate (for older patients screen for mesenteric ischemia, high lactate = bad disease)

**Pain control**- don't withhold it!

- **Morphine** 0.1mg/kg IV, most start with 4-6mg IV though. Write PRNs if you can "Morphine 4mg IV, may repeat q15 min for 3 total doses, prn pain. Hold for somnolence, hypoxia, or SBP <100".
- Give **Zofran** (ondansetron) 8mg IV to counteract nausea/vomiting.
- **Benadryl** (diphenhydramine) 25mg IV PRN for itching

**PEARL**- Demerol (meperidine) is a poor choice of opiate to use. It has lots of side effects and causes lots of euphoria. It doesn't cause clinically significant sphincter of oddi spasm- that is a myth, there's really no reason to use it all. Morphine, fentanyl and dilaudid (hydromorphone) are all excellent painkillers

**Give IV fluids**- younger people 1-2 liters, older patients- 500cc at a time

**Differential Diagnosis**

- Appendicitis
- Cholecystitis
- Pancreatitis
- Diverticulitis
- Bowel obstruction
- Bowel perforation
- Mesenteric ischemia
- Kidney stone
- Gastritis
- Gastroenteritis
- AAA

**How to image the abdomen effectively by quadrants** (female specific causes excluded!) (CT A/P= CT abdomen and pelvis)

<p><b>Epigastric</b></p> <ul style="list-style-type: none"> <li>- Rarely require imaging</li> <li>- May get it for pancreatitis to check for pseudocyst but probably doesn't need it in the ED.</li> <li>- If you find pancreatitis, check a RUQ US for gallstone pancreatitis</li> </ul>	
<p><b>RUQ</b></p> <ul style="list-style-type: none"> <li>- US is the best test for cholecystitis</li> <li>- Also get US to search for gallstone for pancreatitis</li> </ul>	<p><b>LUQ</b></p> <ul style="list-style-type: none"> <li>- Rarely requires imaging unless rigid abdomen or suspect bowel obstruction</li> </ul>
<p><b>RLQ</b></p> <ul style="list-style-type: none"> <li>- CT A/P for appendicitis. Can be done without contrast with same results, some institutions require PO and/or IV contrast</li> </ul>	<p><b>LLQ</b></p> <ul style="list-style-type: none"> <li>- CT A/P for diverticulitis, once again +/- IV and or PO contrast</li> </ul>
<p><b>Suprapubic</b></p> <ul style="list-style-type: none"> <li>- in isolation- usually a UTI</li> </ul>	

- **Flank pain**- CT A/P without contrast for kidney stones, CVA tenderness

**PEARL**: 20-30% of patients with stones have NO hematuria on UA (Kidney Stones - CVA tenderness, colicky pain, can't find comfortable position)

**BIG PEARL**: Don't write gastritis or gastroenteritis on a chart, better to say "abdominal pain" or "vomiting/diarrhea" as a diagnosis instead.

**BIG PEARL**: For gastroenteritis- you need vomiting AND diarrhea. It can't be gastroenteritis unless you have both



## Other serious diagnoses:

- **Mesenteric ischemia** - clot thrown into mesentery or low flow state. **VBG with lactate as screening**. Classically an older patient with a-fib with pain out of proportion (patient in lots of pain but not tender on exam). Low flow mesenteric ischemia is usually a hypotensive patient on pressors in the ICU. **Diagnosed with CT angiogram A/P. Need emergent surgery and/or interventional radiology**
- **Bowel obstruction** - patient with multiple abdominal surgeries, diffuse abdominal pain and vomiting as their chief complaint. Diagnosed with **CT A/P, PO contrast is helpful**
- **Bowel perforation** - usually from a perforated ulcer or recent colonoscopy - be concerned if they have a rigid abdomen. **Upright Chest x-ray** can be helpful if you see free air, need the **OR emergently**
- **AAA** - back pain, abdominal pain, syncope, hematuria among other presentations, elderly patient with HTN, use **ultrasound** to diagnose at bedside
  - o over 5cm needs the OR immediately
  - o 2-5cm needs follow-up

**PEARL** - mortality for STEMI? - 8% mortality for elderly patient with abdominal pain? 10%

**PEARL** - if your CT or US is negative but the patient still has a concerning abdominal exam, get a surgical consult - nothing is 100%

## Discharge instructions for abdominal pain

- Document a repeat abdominal exam before discharge
- Sample discharge conversation with the patient:
  - o "I think you have a GI bug. These usually get better on their own but we can make you feel better with zofran so that you can keep fluids down. However, I have been fooled before and sometimes early appendicitis presents like a GI bug. So if you go home and have increased pain, if you are vomiting constantly despite the zofran, if you develop new pain or it moves to your right lower abdomen, or if anything else is concerning you, please come back into the ER. Also, if you don't feel better in 12-24 hours, you should come back in as well."

**PEARL** - don't discharge your patients with an excessive number of anti-emetics. If they are taking zofran or Phenergan every 6 hours and they aren't better they need to come back to the ED, 5 tablets or ODTs is usually sufficient

### 3 Female Specific Abdominal Pain

#### History

- First question- is the patient pregnant?
  - o Urine HCG and UA often done from triage
  - o If delay in getting urine, get an IV and check a serum qualitative HCG
- OPQRST questions about pain
  - o Onset, Provocation, Quality, Radiation, Severity, and Time
- Associated signs and symptoms
  - o Nausea/vomiting/diarrhea, back pain, urinary symptoms, fevers, chills
- Female specific questions
  - o Missed periods, vaginal bleeding, discharge
- Gs and Ps
  - o G= Pregnancies P= Live births- know them for OB consultation

#### Medical history

- Special attention to surgical history, history of ectopic pregnancies or spontaneous/elective abortions
- Sexual history
  - o Is the patient sexually active currently or in the past?
  - o (Kick parents out of room for younger patient)
  - o Monogamous relationship?
  - o History or concern for STDs?

#### Exam

- Don't dive for the abdomen- do an HEENT exam, heart/lung exam
- Uncover the abdomen and ask patient to point where it hurts the most
  - o Top of iliac crest- more often abdominal cause of pain
  - o Lower towards inguinal ligament- pelvic pathology
  - o Not absolute but can help you guide your workup

#### Differential Diagnosis

- Ectopic Pregnancy
- Threatened abortion/miscarriage
- Normal pregnancy
- STDs- Gonorrhea, Chlamydia, Trichomonas
- Pelvic Inflammatory Disease
- Tubo-Ovarian abscess
- Ovarian Torsion
- Ovarian Cyst
- Bacterial Vaginosis
- Vaginal Candidiasis (BV and Candidiasis *don't cause pain* but are frequently encountered in the workup)

#### Workup

- UA and HCG (looking for UTI, pregnancy status)
- CBC (check for WBC- low yield and anemia)
- Chem 10 (standard part of abdominal pain workup)
- LFTs
- Lipase
- Coags
- Pelvic Exam
  - o GC/Chlamydia
  - o Wet Prep/KOH
- Quantitative HCG (if the patient is pregnant)

#### Pelvic Exam tips

- Do an external exam to look for lesions or obvious discharge
- As you insert the speculum, examine for lesions or discharge
- GC and Chlamydia swab- insert in cervix and twist 360 degrees
- Wet Prep/KOH- swab vaginal walls
- Bimanual exam
  - o Touching the cervix is uncomfortable- do this slowly
  - o Say "I know this is uncomfortable but does this hurt when I move my fingers" look for reaction.
  - o If the patient seems comfortable this is NOT cervical motion tenderness
  - o If the patient is in a lot of distress, then this is CMT
  - o Check the adnexa
  - o Palpate the abdomen while checking adnexa to see where the patient has the most pain



## Imaging

**PEARL**- HUGE overlap between pelvic and abdominal pathology - keep your differential open

- **Transvaginal Pelvic ultrasound**- helpful in suspected ectopic pregnancy (Should see IUP at HCG of approximately 1,500) or ovarian torsion.

## Ovarian Torsion

- “Classic”- Sudden onset of sharp stabbing pain in lower abdomen with nausea or vomiting → often a clinical diagnosis

**PEARL**- A negative pelvic ultrasound DOES NOT rule out torsion

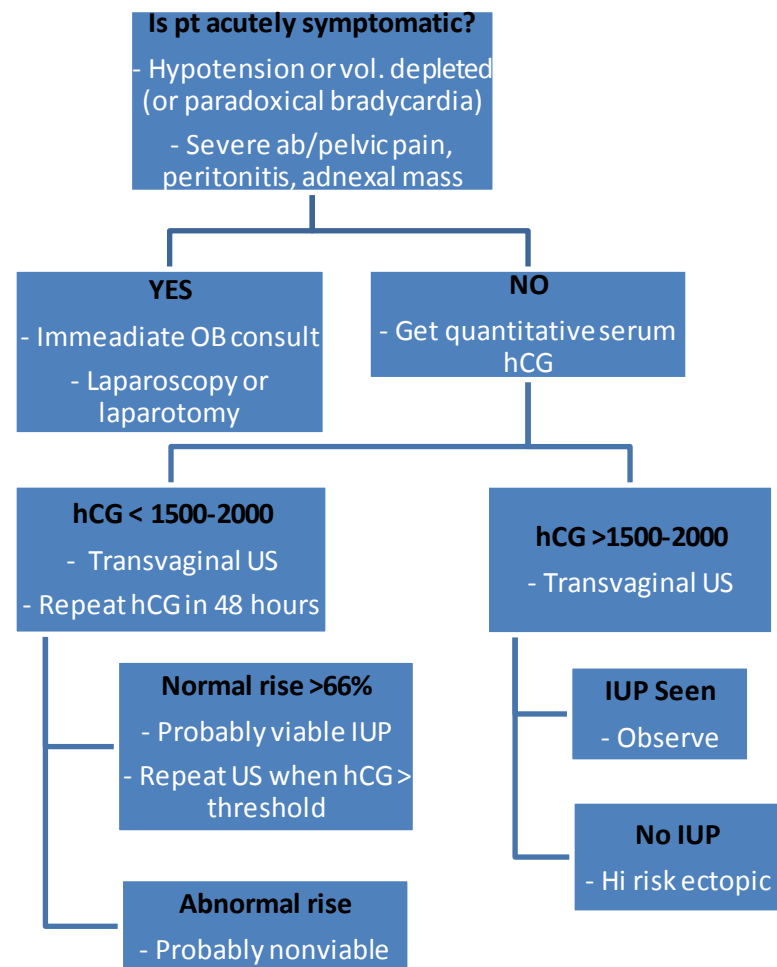
- Intermittent torsion is possible
- Time sensitive diagnosis- ovary salvage rate greatly declines after 4 hours
- High suspicion= OB/GYN consult and admission for observation
- Most torsions have large cysts but not all

**PEARL**- If radiologist doesn't want to do TVUS after hours because “an ultrasound doesn't rule out torsion”, say you are concerned for tubo-ovarian abscess or large hemorrhagic cyst

## Ovarian Cyst

- Cyst on same side as pain with good blood flow to ovary
- Can be **discharged with pain control, OB/GYN followup**

## Ectopic Pregnancy



## STDs

- Treatment depends on how fast your GC/Chlamydia test is
  - o Send-out = Empirically treat all patients with discharge and/or CMT

**PEARL**- ALWAYS treat for gonorrhea and chlamydia (Often co-exist and missing it can have long term fertility consequences)

## Cervicitis treatment (no CMT but positive swab)

- Ceftriaxone 125mg IM
- 1 gram of azithromycin PO x1 dose (can give with Zofran for N/V)
- (PCN or cephalosporin allergic- 2 grams azithromycin PO x1)

## PID treatment (CMT and/or discharge)

- Ceftriaxone 250mg IM
- Doxycycline 100mg PO BID for 14 days

**PEARL**- Admit patients who are ill appearing, pregnant, unresponsive to outpatient treatment, PO intolerant

- Caution patient to not have sex for seven days after treatment stopped and to get partner tested to avoid re-infection

**Fitz-Hugh Curtis**- PID infection that has spread to the liver capsule and causes perihepatitis- may have RUQ pain and tenderness, right shoulder pain. LFTs may be elevated but not always. Treatment is to treat for PID

## Tubo-Ovarian Abscess

- Non-specific symptoms- abdominal/pelvic pain, history of STDs, severe or recurrent PID.
  - o If suspicious for torsion, should also be suspicious of TOA
- Usually untreated PID that has formed an abscess.
- Diagnosed with TVUS, admitted, treated with IV abx, surgical drainage

## Trichomonas

- Motile organisms on Wet Prep. Sxs- *itching, discharge, dysuria dyspareunia*
- Tx- Flagyl (metronidazole) 2 grams PO x1 or 500mg PO BID for 7 days
- Treat partner as well- men are often asymptomatic
- No alcohol while on flagyl (disulfaram reaction = vomiting)

## Bacterial Vaginosis

- Not an STD but frequently diagnosed- overgrowth of Gardnerella Vaginalis.
- Sxs- *malodorous discharge*. Clue cells on Wet Prep  
Treat all symptomatic patients AND pregnant patients
- Tx- Flagyl (metronidazole) 2 grams PO or 500mg PO BID for 7 days

## Candidiasis

- “yeast infection” usually after abx. Fungal elements on Wet Prep.
- Treatment- Fluconazole- 150mg PO x1 or topical treatments
- Topical treatments can control sxs better, can use with fluconazole

**PEARL**- with pelvic swabs- false negatives occur so treat clinically for what you think is the most serious cause

## How to approach positive STD tests

- Have a frank discussion of what you found and what it means. Talk to the patient alone.
- Make sure the patient knows that they have an STD but let them know that they could have been asymptomatic for a long time and that you aren't pointing fingers. Express importance of completing the full course of treatment and following up with their OB/GYN or primary care doctor. Stress importance of getting their partner tested and treated as well.
- If you are treating PID empirically (send-out GC/Chlamydia) make sure that the patient knows this and they understand that you are treating them for an STD without knowing whether or not they have one. Have a good phone number to call the patient back with a positive test result.

## 4 First Trimester Vaginal Bleeding

### History

- Look at triage note, take note of Gs and Ps
  - o Gs- number of pregnancies Ps- Number of living children; (P → FPAL: Full, Preterm, Abortions, Living children)
- Quantify how much bleeding- spotting vs pads
- History of spontaneous or elective abortions, pre-term birth

**PEARL**- Pregnancy does not mean your patient can't have an appy or a chole or something else- don't turn your brain off and ignore everything else!

- Associated signs and symptoms
  - o Abdominal pain, nausea/vomiting, discharge
  - o Chest pain, SOB, dizziness, near syncope or syncope

### Exam

- Standard physical exam- HEENT, heart/lungs, back
- Good abdominal exam
- Pay attention to rebound, guarding, peritonitis
- Miscarriages can have abdominal pain and tenderness, usually diffuse

**PEARL**- If a pregnant patient is unstable or has a concerning abdominal exam, they need an immediate OB/GYN consultation and the OR.

**PEARL**- Some women with ruptured ectopic will have bradycardia instead of tachycardia (blood irritates peritoneum and causes vagal response). Don't let a lack of tachycardia sway you or your consultant away from the diagnosis.

### Differential Diagnosis

- Ectopic pregnancy
- Spontaneous abortion (miscarriage)
- Threatened abortion
- Abnormal pregnancy
- Normal early pregnancy

### Workup

- UA (check for UTI)
- Quantitative HCG (quantify how far along the pregnancy is and for trending)
- CBC (not absolutely necessary unless you think severe blood loss)
- Type and Rh or Type and screen (if the patient is Rh negative, they need Rhogam, type and screen gets you an antibody match that is one step closer to crossmatched blood)
- Pelvic setup
- GC/Chlamydia
- Wet Prep/KOH- (may be overkill to get on all patients but asymptomatic pregnant patients with BV should be treated, you are doing the pelvic exam anyway so there isn't any harm in checking this box)
- Transvaginal ultrasound (done by yourself or radiology)

### Pelvic exam

- Quantify the amount of bleeding during the exam- scant amount vs. active bleeding
- Look for any tissue and have a ring forceps available to remove any products of conception that you may see (and send to pathology)
- Check to see whether the os is open or closed
- Perform a bimanual exam and check the ovaries

### Transvaginal ultrasound

- Answer one clinical question- is there an IUP or not?
- All in context of quantitative HCG
  - o 1,500- HCG cutoff for seeing an IUP
  - o 5,000- HCG cutoff for cardiac activity
- Progression of US findings
  - o Double decidual sign (two rings)
  - o Early gestational sac (large empty sac of fluid)
  - o Yolk sac (little round ring inside of sac)
  - o Fetal pole (little body attached to yolk sac)
- If you find a mass outside the uterus or free fluid in the cul de sac- get a formal TVUS from radiology

**PEARL**- Ectopic pregnancies can give a pseudogestational sac inside the uterus while there is an ectopic pregnancy elsewhere

**PEARL**- If the quant is below 1500 and the radiologist says “there’s no point in doing an US- we won’t see anything” tell them you are looking for evidence of an ectopic or a large amount of free fluid.

### **Disposition**

- Quant below 1,500- could be early ectopic vs. early normal pregnancy- **OB-GYN follow up in 2-3 days for repeat quant and TVUS**
- Quant above 1,500 and evidence of an IUP- if stable and non-concerning abdominal exam, discharge with **OB/GYN follow up in 2-3 days for repeat quant and TVUS**

### **Ectopic pregnancy management**

- Don’t forget the ABCs, resuscitate as appropriate
- Usually taken to the OR by OB/GYN
- Methotrexate is an option in consultation with OB/GYN

**PEARL**: Don’t give methotrexate without having OB/GYN look at ultrasound scans and having examined and consented the patient themselves and arranged for close follow-up

Other concerns

**UTIs**- be aggressive about treating UTI in pregnancy. Even the slightest hint of a UTI like small or moderate leukocyte esterase should get treated

**PEARL**- send a **urine culture** if you decide to treat for UTI

- **Macrobid (nitrofurantoin)** 100mg PO BID for 7 days
- **Keflex (cephalexin)** 500mg PO TID for 7 days

### **Bacterial Vaginosis**

- **Flagyl (metronidazole)** 500mg PO BID for 7 days

### **Vaginal Candidiasis**

- **Fluconazole** 150mg PO x1 dose

**PEARL**- Don’t treat asymptomatic trichomonas in pregnancy

**PID**- rare in pregnancy but should be **admitted for IV antibiotics**

Rh negative patient- give **rhogram** (Rho (D) immune globulin) in consultation with OB/GYN to prevent alloimmunization

### **Talking with patients about miscarriages**

#### **During the initial H and P**

Let the patient know up front that you may not know for sure whether or not this is a miscarriage. This helps keep

expectations reasonable. Let them know that no matter what happens, they will need to follow-up with their OB/GYN doctor in 2-3 days to see how the pregnancy is progressing. Make sure they know that you may not have all the answers today.

### **Discharging a patient with a threatened abortion (miscarriage)**

Every patient with 1st trimester vaginal bleeding gets this diagnosis regardless of their workup. Stress the importance of followup in 2-3 days. Classically, discharge instructions advise pelvic rest (no sex or anything in the vagina) until seen by OB/GYN. However, studies have not shown any increase in the rate of miscarriages in patients who have sex in these situations. That being said, I tell my patients about this but I also tell them that it may be better for them psychologically in case they do miscarry. That way they don’t blame themselves and wonder “what if” down the road. Tell the patient that “threatened abortion” is the medical term for a possible miscarriage because the word “abortion” can have negative connotations.

### **Breaking bad news**

You will have to tell some women that they are having a miscarriage. Some women know or are strongly suspecting it. This can be devastating news especially if the patient has tried for a long time to get pregnant. Make sure to sit down next to the patient on their level. In a calm voice explain that you’ve got the test results back and you are sorry to say that they are having a miscarriage. Let the patient react to the news. Have tissues handy. Once they have collected themselves a little bit, let them know that nothing they did or didn’t do that caused the miscarriage. Let them know that that most miscarriages have abnormalities that could not have resulted in the birth of a child. Let them know that this wasn’t their fault and that it doesn’t affect chances of future fertility.

### **Miscarriage management options**

- Expectant- discharge the patient with an OB/GYN followup in 2-3 days. Let them know that they will continue to pass tissue. Prescribe vicodin (hydrocodone/acetaminophen) or Percocet (oxycodone/acetaminophen) and encourage round the clock motrin (ibuprofen) for cramping. Good **return**

precautions for increased pain, persistent vomiting, or passing out

- Cytotec (misoprosotol)- cervical ripening medication- to be done in consultation with OB/GYN only
- D and C- some women prefer this go this route to take care of everything at one time. Talk with your OB/GYN consultant- will most likely be discharging these patients with close followup and outpatient surgery.

## 5 Airway/Intubation

### Why we intubate

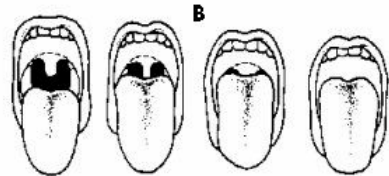
- 1) Can't protect the airway (GCS <8, obtunded)
- 2) Can't maintain oxygenation/ventilation
  - O2 sat <90 with non-rebreather mask
  - Patients who are tiring from increased work of breathing
  - Severe asthma/COPD (airway obstruction)
- 1) Expected Clinical Course
  - Drunk and rowdy trauma patient (can't cooperate)
  - Going to CT scanner with a tenuous airway
  - Pain control- patient with multiple long bone fractures going to the OR anyway
- 2) Airway obstruction
  - Deep space neck infection/mechanical obstruction

### Predicting a difficulty airway

ED airways = difficult airways automatically

EVALUATE **LEMON LAW** – positive = airway is more difficult

- **L**ook- incisors or buck teeth, dentures, obese?, beard
- **E**valuate 3-3-2
  - 3 finger breadths- open mouth
  - 2 finger breadths- mandible to neck
  - 2 finger breadths- neck to thyroid
- **M**allampati Score- look inside mouth



Class 1 Class 2 Class 3 Class 4

- **O**bstuction- foreign body or abscess, tumor, epiglottitis, stridor?
- **N**eck mobility- in c-collar?, any limitation in neck movement?

### PREPARATION FOR INTUBATION- most important step

**PEARL**- Get the patient on 100% oxygen (O<sub>2</sub>) via non-rebreather (NRBM) ASAP, use Bi-PAP/CPAP to get oxygenation as high as possible if needed

**PEARL** - BVM with self-refilling reservoir doesn't provide oxygen unless you are squeezing it (don't just place it on the patient's face)

### **SOAP-ME**

- **S**uction- at least one working suction, place it between mattress and bed
- **O**xygen- NRBM and BVM attached to 15 LPM of O<sub>2</sub>
- **A**irways- 7.5 ET tube with stylet fits most adults, 7.0 for smaller females, 8.0 for larger males, test balloon by filling with 10 cc of air with a syringe
  - Stylet- placed inside ET tube for rigidity, bend it 30 degrees starting at proximal end of cuff
  - Blade - Mac 3 or 4 for adults- curved blade
  - Miller 3 or 4 for adults- straight blade
  - Handle - attach blade and make sure light source works, DON'T keep it attached until you are ready to intubate
  - Backups - ALWAYS have a surgical cric kit available!
  - Have glidescope, LMA and bougie at bedside
- **P**re-oxygenate- 15 LPM NRBM (should probably be first thing)
- **M**onitoring equipment/Medications
  - Cardiac monitor, pulse ox, BP cuff opposite arm with IV
  - Medications drawn up and ready to be given
- **E**nd Tidal CO<sub>2</sub>- out of the package, keep sticker in place until the patient is intubated

**Premedication**- not used frequently except for some situations

- Head injury- **Lidocaine** 1.5 mg/kg IV 3-5 minutes prior to intubation
  - Theoretically decreases ICP but not great evidence
- Children <10 years old- **Atropine**- 0.02 mg/kg IV, minimum 0.1 mg
  - Prevents reflex bradycardia from intubation



## **RAPID SEQUENCE INTUBATION** - how we intubate in the ED

#1 point is that you DO NOT bag the patient once they go apneic

**Overall**- rapid administration of sedative followed by paralytic to produce unconsciousness and reduce aspiration risk

**PEARL**- Don't need RSI in patients in cardiac arrest

**PEARL**- Dose medications off patient's actual body weight- 20 of etomidate and 100 of suxs won't be enough for everyone

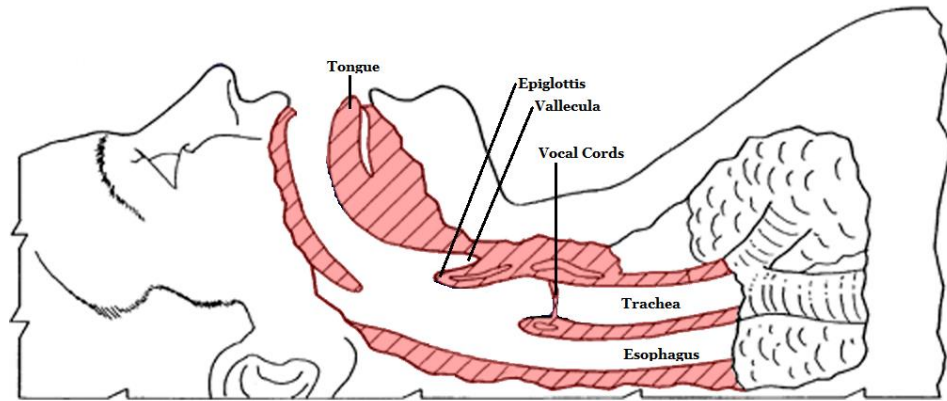
## **Sedative medications**

- **Etomidate** - ultra short active sedative
  - o Most favored for ED RSI
  - o Dose- 0.3 mg/kg IV
  - o Onset- 30-45 seconds
  - o Duration- 10 minutes
  - o Considerations- single dose with cause adrenal suppression but probably not clinically significant, biggest concern is in sepsis (can use ketamine)
- **Ketamine** - PCP derivative- analgesia and sedation- dissociative agent
  - o Patient maintains airway reflexes, good for asthmatics (bronchodilator)
  - o Dose- 1-2 mg/kg IV or 3-4 mg/kg IM
  - o Onset- 30-45 seconds
  - o Duration- 30 minutes
  - o Considerations- concern that it causes ICP rise but this is being debunked, some won't use it in head injured patients
- **Propofol** (aka **Diprivan**)- ultra short acting hypnotic with NO analgesic properties
  - o Very rapid onset and very short duration of action
  - o Dose- 1mg/kg IV rapid push
  - o Duration- 3-4 minutes
  - o Considerations- causes hypotension so use caution in patients who are already hypotensive, excellent to use for post intubation sedation

## **Paralytics** - IV push rapidly after sedative meds

- **Succinylcholine** ("suxs")- depolarizing paralytic (initially binds to motor endplate and causes depolarization then relaxation
  - o Most favored paralytic for ED RSI
  - o Dose- 1.5 – 2 mg/kg IV, 3-4 mg/kg IM
  - o Onset- 60 seconds
  - o Duration- 4-5 minutes
  - o Considerations - causes transient rise in potassium, use with caution in those on dialysis, crush injuries or burns more than 24 hours old, patients with a history of malignant hyperthermia or muscular dystrophy
- **Rocuronium** - non-depolarizing paralytic (competitive inhibitor that competes for motor end plate sites with acetylcholine)
  - o Dose- 1.2 – 1.5 mg/kg IV
  - o Onset- 60 seconds
  - o Duration- 30-45 minutes
  - o Considerations- causes long paralysis, some prefer suxs so that the patient recovers from the paralysis if ET tube can't be placed
- **Vecuronium** - non-depolarizing paralytic- not used frequently for RSI but can be used for long term paralysis if needed
  - o Dose- 0.1 mg/kg IV but 10 mg IV is a common dose across the board
  - o Onset- 2-3 minutes
  - o Duration- 45 – 60 minutes
  - o Considerations- don't use it routinely, titrate sedation aggressively to ensure patient is awake but paralyzed

## Relevant Anatomy



**Intubation**- make sure your SOAP-ME is complete, quiet the room, check with your RT, medication nurse, and assistant to make sure they are ready, have an assistant to your right who does nothing but assist you

1. Give medications- 20 of etomidate, 100 of suxs is a common dose for the “average” 70 kilogram adult
2. Keep NRBM on until you intubate- although you don't want to bag the patient a lot, your supervisor may ask for one or two breaths to ensure that bagging the patient is possible
3. Hold the blade in your LEFT hand (even if you are left handed)
4. Open the patient's mouth
  - Use 1st and 3rd fingers to scissor open the mouth
  - \*\*\*\*NEVER ROCK BACKWARDS WITH THE BLADE\*\*\*\*
5. Slowly advance the tip of the blade down the right side of the tongue
6. Use a sweeping motion to move tongue upwards
7. Look for your structures
8. Identify the epiglottis
9. For Mac blade- place blade tip anterior to epiglottis
  - a. For miller blade- directly lift up the epiglottis
  - b. Best reference for this - [airwaycam.com](http://airwaycam.com) on YouTube
10. Once you see cords- ask for the tube without looking away
11. Use bimanual laryngoscopy

- a. Have assistant place fingers on thyroid cartilage and you move their fingers until you get the best view, whatever direction you need to get the best view

12. Insert the tube
13. Pass through the right side of the mouth, place balloon just past the cords and have your assistant inflate it
14. Tube depth- 3 times the tube length- (7.0 ET tube = 21 cm)
15. Confirm placement - Use end-tidal CO<sub>2</sub> detector- yellow= YES, check the stomach for breath sounds then bilateral breath sounds on the chest and look for equal chest rise and fall
16. Order a post-intubation chest x-ray

## Adjuncts

- Bougie- if you can't see cords but you can see arytenoid cartilages, insert the bougie and then insert the ET tube over the bougie

## Failure to intubate

- Misplacement of the tube isn't deadly but not recognizing it is
- If patient desats, bag the patient
- Prep the neck for a surgical cric
- \*\*IF YOU CAN'T BAG PATIENT, NEED A SURGICAL CRIC\*\*
- If you can bag the patient, make a 2nd attempt, have the cric tray and an LMA available
- How to do a cric- search YouTube for “[bougie assisted cric](#)”

## Initial vent settings

- A/C mode (assist/control)
- Tidal volume- 6-8 cc/kg of IDEAL body weight (lung volumes in a 5 foot patient the same if they are 100 pounds or 500 pounds)
  - o “Average” 70 kg adult= 500 cc
- FiO<sub>2</sub>- 100 percent initially, work to titrate down as you can
- PEEP- 5 initially, 0 PEEP for asthmatic
- Initial settings- A/C tidal volume 500, 100 percent FiO<sub>2</sub>, 5 of PEEP

## Post-intubation sedation and analgesia

- Try to have this prepared BEFORE you intubate so your patient doesn't wake up (etomidate only lasts 10 minutes)
- **Propofol**- easy on/easy off- caution in hypotensive patients
  - o Give bolus 0.5 – 1 mg/kg IV then 20 mcg/kg/min and titrate upwards
- **Versed (midazolam)**- longer acting, harder to titrate
  - o Give bolus 5mg IV then drip at 5 mg/hr
- **Fentanyl**- provides analgesia- having a tube in your throat hurts!
  - o Titrate 50-100 mcg IV (1 mcg/kg), less hypotension than morphine

### References:

The Manual of Emergency Airway Management- Dr Ron Walls, et. al.  
Airway Cam Pocket Guide to Intubation- Dr. Richard Levitan

## 6 Headache

Triage note- be sure that the patient isn't here for weakness or syncope which is a different workup

**History**- OPQRST questions

Headache **red flags** (concerning for subarachnoid hemorrhage (SAH))

- Sudden or gradual in onset
- Worst of life? (Ask patient "how does this compare to your other headaches?")
- Maximal at onset (worst when it started or did it gradually get worse?)
- Associated symptoms- sensitivity to light/sound, nausea/vomiting, vision changes, slurred speech, weakness, syncope, ataxia, dizziness, fever, neck pain
- Previous headaches/workups- previous CT/MRIs?
- Rest of history: any fever, neck pain, chest pain, SOB, ab pain?

DOCUMENTATION- on every headache whom I am not suspecting a SAH I write "I doubt SAH/ICH given headache is not worst of life, not maximal or sudden in onset with multiple normal neuro exams"

### Neuro Exam

- Cranial nerves
  - Pupil response, papilledema
  - Extraocular movements (any nystagmus?)
  - Facial sensation
  - Puff out cheeks
  - Smile symmetry
  - Shrug shoulders
  - Turn head left and right, flex and extend
- Upper extremity Motor strength
  - Grip strength
  - Push towards/away while still holding grip
  - Pronator drift- palms up, arms at shoulders, close eyes
    - Positive if asymmetry or if one arm falls
- Fine motor and cerebellar exam

- Nose to finger- have patient touch their nose then your finger
- Rapid alternating movements- hands in lap, rapidly pronate/supinate
- Finger movements- touch 2nd finger to thumb, move to 3rd-5th fingers
- Gross sensation- check upper extremities on both sides for differences
- Lower extremity motor strength
  - Hip flexors- place hand above knee, have patient push upwards
  - Hip extensors- place hand under thigh, have patient push downwards
  - Leg extension- hold knee up, extend lower leg
  - Leg flexion- hold knee up, flex lower leg
  - Foot flexion- push "down on the gas pedal" with foot
  - Foot extension- push "up towards your head" with foot
- Gross sensation lower extremities
- Gait- very important to test
  - Walk towards and away from you- look for instability
  - Walk on heels and then toes
  - Romberg- face away from you with palms and arms up, closes eyes, stand behind patient, swaying is ok, falling backwards is positive
- Reflexes- low yield in headaches but part of a full neuro exam

### Headache differential

- **Subarachnoid hemorrhage (SAH)**- sudden onset of worst headache of life that is maximal at onset, headache with syncope, ruptured aneurysm or trauma
- **Bacterial meningitis/encephalitis**- fever and headache, stiff neck, toxic appearing
- **Temporal arteritis**- "Classic" presentation- 60 year old female with unilateral throbbing temporal or frontal headache with tenderness on temporal area
- **Carbon monoxide poisoning**- cold climate with a furnace at home
- **Tumor or mass**- neuro deficit with insidious onset

- **Subdural hematoma**- spontaneous bleed in a patient on anticoagulation or an alcoholic patient without trauma, or a patient with major trauma
- **Epidural hematoma**- trauma to temporal area (middle meningeal artery), **lucid interval with decompensation**, blown pupil
- **Acute angle glaucoma**- older patient in a dark area then has their pupil dilated (movie theatre), non-reactive pupil
- **Hypertensive emergency**- very elevated blood pressure in the setting of end organ damage (renal failure, stroke, intracranial bleeding, MI, aortic dissection; > 180/120 should be concerned)
- **Tension headache**- most common discharge diagnosis, band-like pain that is non-pulsating and dull
- **Migraine headache**- unilateral pulsating or throbbing pain, increases with activity, nausea/vomiting, photo/phonophobia, visual changes/aura
- **Cluster headache**- younger male with unilateral sharp stabbing pain to the eye, associated injection and tearing, responds well to high flow oxygen

## Labs

- Low yield- get a pregnancy test on females (some meds class C and D)
- If doing an LP- CBC (platelets), Chem 10 (electrolytes), Coags (coagulopathy)
- LP labs- cell count tubes 1 and 4, glucose/protein, gram stain/culture (if suspecting meningitis)

## Imaging

- CT head without contrast- detects acute bleeds, sensitivity about 90%, current practice is that a negative head CT is followed by an LP (CT can miss 5-10% of SAH)

## Lumbar Puncture (LP) (How to do an LP)

- Looking for xanthochromia (yellowish tinge of fluid from RBC breakdown) or elevated RBC count
  - o Usually in the 1,000s- 10,000s with SAH but no cutoffs have ever been defined
  - o No cutoff below which SAH can be excluded (reported as low at 800 RBCs), "clearing" of RBCs between tubes 1 and 4 does not rule out SAH

- o Best if you can get RBC counts <100 but if story is concerning, may need CTA brain (with contrast) or MRI to rule out SAH

## Special populations

- Pediatrics- persistent vomiting, vomiting first thing in the morning may be a tumor
- Elderly- low threshold to CT, be aware of temporal arteritis- elevated **ESR and/or CRP** need **high dose steroids** and urgent temporal artery biopsy to confirm diagnosis (by ophthalmology/general surgery), don't delay steroids

## Treatment

- **IV Fluids 1-2L NS**
- **Compazine (prochlorperazine)**- 10mg IV; anti-nausea, antipsychotic, anxiolytic
  - o (Compazine/prochlorperazine is Class C in pregnancy)
  - o Run this slowly to prevent akathisia from Compazine
- **Benadryl (diphenhydramine)** 25mg IV, can run in 1 liter of normal saline; antihistamine

**PEARL**- Compazine/Benadryl proven more effective in ED patients than triptans

- **Reglan (metoclopramide)**- 10mg IV; prokinetic, antiN/V
  - o instead of Compazine/benadryl, class B in pregnancy

## Adjuncts

- **Toradol (ketorolac)**- 30mg IV; NSAID
  - o Caution in older patients, those with renal failure or insufficiency (check creatinine)
  - o Class C in third trimester only but generally not given to any pregnant patient
  - o Don't use if suspecting subarachnoid without doing CT first (anti-platelet medication)
- **Decadon (dexamethasone)**- 10mg IV- shown to reduce return rates in patients with migraine

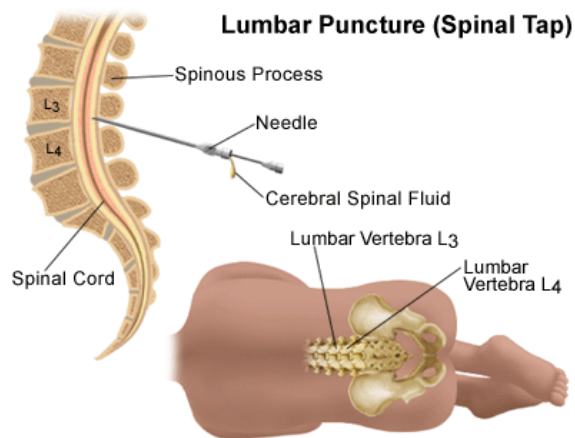
## **Big points**

- 1) Get a good headache history - was headache sudden or maximal at onset or worst of life?**
- 2) Do a thorough neuro exam and walk the patient**
- 3) If suspecting SAH, do CT and LP**
- 4) Treatment- IV fluids, Compazine/Benadryl, toradol and decadron- adjuncts**



## How to do a LP

- Consent the patient prior to meds- explain risk of bleeding, infection, worsening headache (post LP headache), nerve damage (exceedingly rare)
- Lying down vs. sitting up- lying down can get an opening pressure (often not necessary in the ED), sitting up easier for the patient to hold position
  - o If suspecting benign intracranial hypertension (formerly pseudotumor cerebri) then get opening pressure (needs to be lying down) - usually obese young white female
- Find the L4/L5 interspace- level with the top of the iliac crests on the midline



- Can use a retracted ballpoint pen to make an indentation
- Give **premedication**- **fentanyl** 75mcg IV / **zofran** 8mg IV
- Use non-cutting needle (whitacre)- decreased incidence of post-LP headache
- Put betadine inside LP kit, put on sterile gloves, prep patient with betadine
- Drape the patient- tuck one sheet into underwear, one sheet on back
- Repalpate landmarks
- Inject lidocaine- inject from the side superficially, angle deeper
  - o Give minute or two to work
  - o Can check anesthesia by using needle from lidocaine and lightly poking – should feel only pressure, not sharp
- Prep tubes- put them in order and place them open

- With bevel up and stylet inserted, insert needle pointing towards umbilicus
- Take stylet out after first few millimeters of skin
- Advance slowly and feel for pops, stop if you hit bone, get clear fluid or blood
  - o If you get clear fluid- collect 1 cc in each tube (1/2 cc for kids)
  - o If you get blood- let some drops fall and see if it clears
  - o If you hit bone- retract the needle until you are almost at the skin surface, redirect either towards the head or the sacrum by 5 or 10 degrees, try again
- When done, replace the stylet, turn the needle 90 degrees and remove it (can help prevent post LP HA)
- Put a bandaid on the puncture site, clean off betadine with damp cloth
- **TIGHTEN EACH TUBE, LABEL THEM, AND WALK THEM TO THE LAB!**

## 7 Febrile Infants

**Triage note-** fever at home?, exact age of patient, temp >100.4 is a fever, parental concerns, wet diapers in past 24 hours (at least 3 indicate good hydration, vomiting?, fussiness?, how are they feeding)

**Pediatric Assessment Triangle- ABC-** from foot of the bed

- **A**ppearance- Active vs. lethargic, good muscle tone vs. poor tone
- **W**ork of **B**reathing- comfortable breathing vs. working hard to breathe
- **C**olor- Pink vs. mottled, cyanosis, pallor

If any one of these is abnormal, it demands immediate intervention

**Temperature-** under 28 days fever is rectal temp 100.4 F or 38 C

**PEARL-** most guidelines give same weight to a tactile fever by parents

Bundling with clothes does not significantly affect rectal temperature

**Birth history** - premature? Gestational age at birth, any birth complications? Vaccines up to date (2, 4, 6 months old), Growing or developing normally? Maternal STD history or GBS positive? (antibiotics during labor?)

**Physical exam-** beyond the pediatric assessment triangle- low yield in patients <28 days old, be sure to fully undress the patient and look for rashes/petechiae/vesicles, anterior fontanelle bulging, count respiratory rate (can use stethoscope), murmurs, abdominal tenderness, circumcised?

## Workup

Age	Workup
≤ 28 days old	<p>“slam dunk”</p> <ul style="list-style-type: none"> <li>- CBC- WBC and platelet count</li> <li>- Chem 10- low bicarb = acidosis = sicker patient</li> <li>- Cath UA and urine culture- white cells in the urine, nitrite</li> <li>- Blood culture x1</li> <li>- Chest x-ray</li> <li>- LP- cell count, glucose and protein, gram stain, culture</li> </ul> <p><b>PEARL-</b> even if obvious UTI or pneumonia, still need full workup (meninges can be seeded from those sources)</p> <p><b>Antibiotics,</b> admit</p>
29 days - 3 mo	<p>A lot of clinicians LP all children under 60 days old - there are criteria to avoid LP and/or admission (Rochester, Philadelphia, Boston)</p> <ul style="list-style-type: none"> <li>- Selective workup + or - LP</li> </ul>
> 3 m.o.	<p>UA/UC, can let immunization status and exam be your guide</p> <p>If toxic then full septic workup</p> <ul style="list-style-type: none"> <li>- Must get catheterized UA and UC               <ul style="list-style-type: none"> <li>- All females under 24 months</li> <li>- All uncircumcised males under 12 months</li> <li>- All circumcised males under 6 months (some guidelines test all boys under 12 months)</li> </ul> </li> </ul>

**Empiric antibiotics**- don't delay for LP (have at least 2 hours before LP results are affected by antibiotics)

Age	Antibiotics
≤ 28 days old	<ul style="list-style-type: none"> <li>- Ampicillin- 50 mg/kg IV</li> <li>- Gentamicin- 2.5 mg/kg IV               <ul style="list-style-type: none"> <li>- Cefotaxime (alternative to Gentamicin)- 50 mg/kg IV</li> </ul> </li> <li>- Acyclovir- 10mg/kg IV- given if patient has vesicles, neuro changes, seizure, thrombocytopenia, high CSF WBC count (pleocytosis), no clear guidelines on empiric dosing, talk with your peds consultant</li> </ul> <p><b>PEARL</b>- Don't use ceftriaxone under 28 days or if born prematurely (immature bilirubin conjugation can cause kernicterus)</p>
> 1 month old	<ul style="list-style-type: none"> <li>- Ceftriaxone- 50 mg/kg IV               <ul style="list-style-type: none"> <li>- Cefotaxime (alternative to Ceftriaxone)- 50 mg/kg IV</li> </ul> </li> <li>- Vancomycin- 20 mg/kg IV</li> <li>- Over 6 weeks old- consider Decadron (dexamethasone) 0.15 mg/kg IV- used to prevent deafness from H Flu meningitis, must be given within 1 hour of antibiotics, no firm guidelines on empiric treatment- talk with your peds consultant</li> </ul>

**Tips on getting an LP on an infant**

- Consent parents- bleeding, infection, nerve damage (exceedingly rare)
- Ask parents to leave the room, if they want to stay, have them sit down and explain what you are doing ahead of time and during procedure
- Most important thing is the person holding the patient
  - o Must use extreme flexion of neck and hips
  - o Place patient on pulse ox to prevent desaturation
- Give the patient oral sucrose (sweet-eeze) to help patient
  - o Injected lidocaine does little to reduce pain and leads to increased attempts at LP
- Same landmarks as adults- level with iliac crests at midline (L4/L5)
- Can use retracted ballpoint pen to make a skin indentation
- Prep with betadine, put on sterile gloves, drape and curl patient
- Place thumb of left hand on superior vertebral body
- Be sure patient is perpendicular to bed
- Insert needle, remove stylet after first few millimeters of skin
- Insert slowly, feel for pops
- If you get fluid- get 1/2 cc per tube
- If you get blood- let a few drops fall and see if it clears and collect it
- If you hit bone, pull back until at skin surface and re-direct 5-10 degrees towards head or towards sacrum
- TIGHTEN THE TUBES, LABEL THEM, WALK THEM TO THE LAB

## 8 Back Pain

Triage note- incontinence/urinary retention? Leg weakness? Fever?

### History

- OPQRST about pain
- Pain worse at night or wakes the patient up from sleep (red flag) vs. gets worse gradually as the day goes on. Numbness or tingling to groin (saddle) area?
- Urinary/stool retention (*early sign*) or incontinence (*late sign*)
- Does it feel different when you wipe yourself when you go to the bathroom?
- Fever, night sweats, or unintended weight loss?
- IV drug use?

**Complete medical history**- hypertension, diabetes, known AAA, cancer?

### Exam

- Complete HEENT exam, heart and lungs
- Ask patient to point where it hurts- CVA vs. midline?
- Abdominal exam- tenderness? (different workup if abdominal + back pain)
- In males- testicular exam
- Sensory exam of saddle area
- Rectal exam- can use selectively (20 year old lifting a box probably doesn't need it, 60 year old with incontinence does)
  - o Check perianal sensation as well as tone
- Lower extremity motor exam
  - o Hip flexor - hand on knee, push up
  - o Hip Extensor - hand on posterior thigh, push down
  - o Leg flexor - hold knee up, hand on lower leg, push up
  - o Leg Extensor - hold knee up, hand on calf, push down
  - o Ankle extensor - hand on bottom of foot, "push down on the gas"
  - o Ankle flexor- hand on the top of foot, push up towards the head

- Lower extremity sensory exam- check sensation on both sides
- Straight leg raise test- patient on their back, with straight leg, raise it to 30 to 70 degrees, if pain in sciatic distribution from buttocks to knees **suggests a herniated disc**

### Differential Diagnosis

- **Abdominal Aortic Aneurysm** - older patient with hypertension and new onset back pain, possibly hematuria. **Use bedside ultrasound**- symptomatic AAA 5cm or larger needs the OR immediately, 2 to 5 cm needs referral for follow-up
- **Aortic Dissection**- can be chest and/or back pain, ripping and tearing quality to pain, most have history of hypertension, may have pulse or motor deficits
  - o **Tx** = aggressive BP control w/ IV Rx and sometimes surgery
- **Renal colic/urolithiasis (kidney stone)** - usually younger patients with sudden onset unilateral back pain with CVA tenderness, microscopic hematuria in 70-80%, usually writhing on stretcher, can't get comfortable
- **Cauda Equina Syndrome** - bowel or bladder retention/incontinence, sudden onset of ripping or tearing back pain, saddle anesthesia, represents an acutely herniated disc, needs an **emergent MRI for diagnosis**, managed emergently in the OR
- **Epidural abscess** - IV drug user with fever and back pain, also in diabetics or patients with recent epidural injections, **needs an emergent MRI for diagnosis**
- **Tumor or mass** - patients with weight loss, night sweats, back pain at night or wakes up from sleep, history of cancer, needs **emergent MRI**, may need emergent radiation therapy to shrink tumor burden to preserve function
- **Fracture** - direct trauma, pathologic fractures, pain in the middle of the back
- **Pyelonephritis** - back pain and a fever with/without urinary symptoms
- **Abdominal pathology** - a reminder that this can present with pure back pain
- **Zoster** - older patient with dermatome distribution of pain, pain can precede vesicles by several days

- **Musculoskeletal sprain/strain**- diagnosis of exclusion once the above have been addressed, most common discharge diagnosis

**PEARL**- Major serious causes of back pain- CRAFTI

- Cauda Equina
- Renal
- Aorta (aneurysm or dissection)
- Fracture
- Tumor
- Infection

**Labs**- usually low yield

- UA- low threshold especially in female patients (UTI)
- CBC/Chem 10/ type and cross for 8 units/emergency release blood- if suspecting AAA
- ESR/CRP- elevated in epidural abscess

**Imaging**

- **Bedside ultrasound**- for AAA- if larger than 5 cm and symptomatic = OR STAT
- **CT Aorta with contrast** - if suspecting aortic dissection
- **CT Abdomen/Pelvis without contrast** - if suspecting kidney stone
- **Plain films** - generally low yield

**American College of Radiology guidelines for plain films**

- o Recent significant trauma or milder trauma age >50
- o Unexplained weight loss
- o Unexplained fever
- o Immunosuppression
- o History of cancer
- o IV drug use
- o Osteoporosis
- o Prolonged use of steroids
- o Age >70
- o Focal neuro deficit or disabling symptoms
- o Duration greater than 6 weeks
- **Emergent MRI - needed for diagnosis of cauda equina, epidural abscess, tumor**

- **Post-void residual**- useful in diagnosis of cauda equina- ask the patient to urinate then insert urinary catheter, normal is less than 100 cc
- **Bedside ultrasound post void residual**- ultrasound the bladder in transverse plane (indicator to the right), use the calculation function (sonosite) for volume, get maximal horizontal and vertical measurements, hit “save calc”, turn the probe 90 degrees (indicator towards the head) and measure largest depth, hit “save calc”, sonosite will calculate volume

Diagnostic philosophy- assume a serious cause, do a good history, physical, and exam and check for red flags, if not concerning, try to talk yourself into a serious cause, if you can't then end workup

**Treatment of back pain**

- **Toradol (ketorolac)**- 30mg IV (60mg IM), NSAID, caution in older patients and those with renal failure/insufficiency
  - o If works well d/c w. **Ibuprofen 400mg** PO t.i.d with food
- **Morphine** - 0.1 mg/kg IV is a good starting dose, **zofran (ondansetron)** IV as needed for nausea/vomiting, be sure the patient has a ride
  - o **Vicodin (hydrocodone/acetaminophen)** - discharge medication, 1-2 tabs q4-6 hours PRN, no more than 15 tablets
- **Flexeril (cyclobenzaprine)** - analgesia and sedation 5- 10mg PO three times per day
- **Valium (diazepam)** - 5mg PO three times per day, don't take within 4 hours of vicodin, can use at night for sleep

**PEARL**- If you are prescribing sedating medications or opiates, tell the patient not to drive or drink alcohol while using these medications, document on their chart (sedation warnings given)

**Return Precautions**

- Tell pt to come back (no pun intended) if:
  - o Increased pain
  - o New numbness/tingling or weakness in legs
  - o Changes in bowel or bladder

## 9 MI and ACS

### **Acute Coronary Syndrome-** a spectrum of disease

- Does NOT include low-risk chest pain (we admit low-risk chest pain to RULE OUT ACS – Patient's with chest pain, but nonconcerning story, normal EKG, normal CE, normal CXR, and pain that goes away with some intervention we are admitting to rule out ACS → get serial CE and serial EKG and most likely a stress test next day)
- Rule *into* ACS by: bumping CE, EKG changes, persistent pain.

### **Unstable Angina**

- Pathophysiology
  - o Fixed coronary stenosis that causes symptoms only when under stress – w/o leak of cardiac enzymes
  - o Can represent a patient with a “normal cath” with 30% stenosis
- Definition
  - o Chest pain that is new or different, occurs at rest, or is different in intensity, character, or exertion level required to give chest pain
  - o Pneumonic- **Random UA or RND-UA** Rest, New, or Different
  - o + or – EKG changes but NO evidence of STEMI
- **Treatment**
  - o **Aspirin**- 325mg PO (Plavix (clopidogrel) 75mg PO if aspirin allergic)
  - o **Anticoagulation**- talk to cardiologist regarding choice of agent (doesn't reduce mortality, but does reduce rate of reinfarction)
    - **Heparin** drip- 60-70 units/kg bolus then 12-15 units/kg per hour
      - MAX dose- 5,000 unit bolus and 1,000 units per hour
      - Advantage- easy on, easy off
      - Disadvantage- some studies show lovenox to be superior
    - **Lovenox** (enoxaparin, LMWH)- 1 mg/kg subcutaneous

- Advantage- may be superior in UA/NSTEMI
- Disadvantage- difficult to reverse if patient has bleeding
- o **Nitroglycerin** (decrease preload and afterload to decrease work of heart, also coronary vasodilation)
  - Dosing- Sublingual tablets are 400 micrograms, work over 5 minutes (80 mcg/minute)
  - Nitro Drip- start at 80 – 100 mcg/minute and titrate to relief of chest pain or systolic above 100
  - CAUTION- Patients with posterior MI (preload dependent) or SBP <100
  - CONTRAINDICATED- Cialis (tadalafil) in past 72 hours, Levitra (vardenafil) or Viagra (sildenafil) in past 24 hours
- o After pt stabilized in ED, most likely admitted to cardiac ICU → cardiac catheterization on urgent basis

### **Non- ST elevation MI (NSTEMI)**

- Pathophysiology
  - o Supply/demand mismatch- stenosis large enough to cause cardiac enzyme leak
- Definition
  - o Type 1 NSTEMI- Chest pain + or – EKG changes with cardiac enzyme elevation
  - o Type 2 NSTEMI- Above definition in the setting of a non-cardiac stressor (sepsis, trauma, surgical abdomen, etc.)- usually from prolonged tachycardia
- **Treatment**
  - o Type 1- Same as Unstable Angina (ASA, heparin/lovenox, nitro) → cardiac ICU, urgent catheterization
  - o Type 2- Treat the underlying cause, trend enzymes as an inpatient and if really hi troponin or chest pain then taken to cath lab



**PEARL**- Depressions can signal infarction opposite of that lead

**Pneumonic for reciprocal changes**

**PAILS**- Posterior Anterior Inferior Lateral Septal

### **ST elevation MI (STEMI)**

- Pathophysiology
  - o Coronary plaque that has ruptured, causing platelet aggregation and acute clot that compromises blood flow
    - Presents with severe chest pain pressure, diaphoresis, nausea, radiation to left arm and jaw, etc
- Definition
  - o 1 mm or more of ST elevation in 2 or more contiguous leads OR new LBBB



II

### **Treatment**

- o Immediate cath lab activation or transfer to cath capable facility (90 min door to balloon time)
- o **Aspirin**- 325mg PO
- o **Plavix** 600mg PO with **zofran** (ondansetron) 4-8mg IV
- o **Heparin** drip- 60-70 units/kg bolus, 12-15 units/kg/hr, max 5,000/1,000

**PEARL**- be sure to do a good H and P and check a chest x-ray to evaluate for other causes of STEMI (aortic dissection [can present as MI if involves coronary arteries, widened mediastinum on CXR 70% sensitive], AAA, pericarditis, intracranial hemorrhage)

## 10 Altered Mental Status (AMS)

### History

- Vitals- temperature is most important (fever or hypothermia)
- How is the patient altered?- talk with family, EMS, nursing home
- Recent trauma or illness?
- Onset of AMS?
- Psychiatric history- don't attribute it automatically to this
- Ingestions- legal or illegal
- Talk to the patient- oriented to person, place, time, situation/president? Check recent memory of events

\*\*\*\*\***BIG PEARL**\*\*\*\*\* ALL PATIENTS WITH AMS ARE HYPOGLYCEMIC UNTIL PROVEN OTHERWISE

- Check a d-stick, if below 80 give 1 amp D50 IV

### Exam

- Neuro exam- **Cincinnati Pre-hospital Stroke scale**- high yield exam
  - o **Face**- facial droop- ask patient to smile, positive if asymmetric
  - o **Arms**- lift arms to shoulder level with palms up, close eyes, positive if asymmetry or one side falls to the stretcher
  - o **Speech**- slurred speech? "You can't teach an old dog new tricks"
  - o **Time**- what was exact time of onset?
- Pupils- check size and reactivity, evidence of nystagmus
- Axilla- if suspecting a tox cause, if axilla are dry- suggest anticholinergic exposure/ingestion (e.g. atropine tox)
- Lungs- focal lung sounds suggesting pneumonia
- Abdomen- tenderness or pain especially in elderly
- Skin- GU area for infected decubitus ulcers, any rashes or petechiae?

### Differential Diagnosis (Big list- AEIOUTIPS)

- |                     |  |
|---------------------|--|
| A- Alcohol/Acidosis | T- Toxidromes / Trauma / Temperature   |
| E- Electrolytes     | I- Infection                           |
| I- Insulin/Ischemia | P- Psych / Polypharmacy                |
| O- Oxygen           | S- Stroke/Space occupying lesion / SAH |
| U- Uremia           |  |

### Condensed differential- TINE (or NETTI?)

- T- Trauma / Tox
- I- Infection
- N- Neurologic
- E- Electrolytes

### Tox

- Opiates- vicodin (hydrocodone/acetaminophen), percocet (oxycodone/acetaminophen), oxycontin (oxycodone), heroin-
  - o *somnolent, lethargic, respiratory depression, pinpoint pupils*
  - o treatment with **Narcan (naloxone)**
- Benzodiazepines- valium (diazepam), Ativan (lorazepam)-
  - o somnolent, lethargic, not as much respiratory depression.
  - o **supportive** care, support ABCs
- Sympathomimetics (uppers)- cocaine, PCP, meth
  - o agitated, hyper, dilated pupils
  - o supportive care, use **benzos to sedate (2mg Ativan IV), RSI for uncontrolled agitation**

### Workup

- D-stick, EKG, CBC, Chem 10
- Serum Tylenol (acetaminophen), Serum ETOH, Serum Salicylate, +/- urine drug screen (lots of false positives, doesn't tell current intoxication)

**PEARL** - Unlike salicylate and ETOH use, Tylenol (acetaminophen) overdose don't have a specific toxidrome and will likely be asymptomatic, important to get this level given it is easily missed and mortality is high

## Trauma

- Any history of falls either recent or remotely.
- **Non-contrast head CT** is test of choice upfront

**PEARL**- Have a low threshold to get a head CT in AMS, especially in patients with what appears to be new onset psychiatric disease even if they don't have neuro deficits

## Infection

- look for fever, hypotension, tachycardia, try to ID a source, make sure to do a thorough skin and GU exam

**PEARL** -The elderly and those on immunosuppression or steroids may not mount a fever in response to infection

- UTIs cause lots of AMS in the elderly
- Hypothermia in the setting of infection is especially concerning

**Workup** - CBC, Chem 10, blood cultures x2, UA and urine culture, chest x-ray, LP if suspecting meningitis

## **Broad spectrum antibiotics**

- **Zosyn (piperacillin/tazobactam)**- 3.375 or 4.5 grams IV
- **Vancomycin**- 15-20 mg/kg, usual dose 1 gram IV (many guidelines suggest 1st dose be 2 grams IV for faster therapeutic levels)
- **Ceftriaxone**- (in some areas better than Zosyn for urinary pathogens), 1 gram IV, 2 grams IV if suspecting meningitis (along with Vancomycin)

**PEARL**- You have several hours before antibiotics will affect culture results so give antibiotics early, especially if you suspect meningitis

## Neurologic

### **Seizures**

- Make sure they aren't from hypoglycemia first!
- Must have some sort of post-ictal state afterwards with AMS that slowly or quickly improves
- May be intermittently agitated and then somnolent
- If they have a seizure history and they didn't hit head, support ABCs and you can allow to wake up and try to find cause (usually missed medication doses)
- If new onset seizure, trauma, or other concerns, do appropriate workup

## **Stroke**

- New onset focal neuro deficits
- D-stick first, hypoglycemia can mimic a stroke
- Address ABCs then **immediately get a non-contrast head CT**
  - o Don't delay on the head CT, activate ED stroke protocol
- If no intracranial bleed and **within 3 hours of onset**, can give **TPA** if no contraindications
  - o Get a checklist of all contraindications and go through each one
  - o Certain patients qualify for 4.5 hour time window for TPA

## Electrolytes

### **Glucose**

- if below 80, give **1 amp D50 IV** and monitor response

**PEARL**- If you can't get d-stick quickly, just give D50, benefits >>>> risks

### **Hyponatremia**

- *Asymptomatic*- **water restrict**
- Below 120 and seizing- **hypertonic saline 3%, 2-3 cc/kg over 10 minutes and repeat until seizures stop**
- Below 120 but not seizing- consult appropriate reference for slow replacement with hypertonic saline

### **Hyperkalemia**

- EKG changes (peaked T waves, QRS widening)- immediately give **1 amp Calcium gluconate IV** to stabilize cardiac membrane and prevent arrhythmias
- Other treatments- insulin/glucose, furosemide, albuterol, dialysis
- **C (A) BIG K, DIE! - Calcium, (Albuterol), Bicarb, Insulin/Glucose, Kayexylate, Dialysis**

## General AMS workup

(add or subtract testing as appropriate for clinical situation)

1. \*\*\*D-STICK\*\*\*
2. EKG
3. Labs
  - a. CBC
  - b. Chem 10
  - c. UA/Urine Cx
  - d. Blood Cx x 2
  - e. VBG w. Lactate
  - f. Urine drug screen
  - g. Serum acetaminophen level
  - h. Serum EtOH level
  - i. Serum salicylate level
4. LP if suspecting meningitis
5. CXR
6. Non-contrast head CT

## MAJOR POINTS:

- 1) All patients with AMS are hypoglycemic until proven otherwise
- 2) Broad categories of AMS- **TINE- Trauma/Tox, Infection, Neuro/Electrolytes**
- 3) Have a low threshold for non-contrast head CT
- 4) Get a good neuro exam- quickest is Cincinnati Prehospital Stroke Scale- Face, Arms, Speech, Time

## 11 DKA

**Diabetic Ketoacidosis (DKA)**- mostly a disease of Type 1 Diabetics

**Hyperglycemia Hyperosmolar State**- mostly a disease of Type 2 Diabetics

**HOWEVER**- either condition can happen in Type 1 or Type 2 Diabetics

### DKA

**Definition**- Use the abbreviation- DKA

- **Diabetic**- blood sugar over 250
- **Keto**- ketones in the urine or blood
- **Acidosis**- pH of 7.3 or lower

**Pathophys**- lack of insulin leads to body to burn fat for fuel -> ketone production -> acidosis (ketones disassociate H<sup>+</sup> ions at body's normal pH)

**PEARL**- A high blood sugar alone doesn't make the diagnosis of DKA- they need the ketosis and acidosis as well- process that evolves over hours to days

### HHS

**Definition**- also use the abbreviation- HHS

- **Hyperglycemic**- blood sugar over 800- much higher than DKA
- **Hyperosmolar**- serum osmolarity over 320
- **State**- it's a state (so maybe this one doesn't totally work like DKA does)

No ketones produced in HHS since patient has some circulating insulin

(May have small ketones from vomiting but not large ketones like in DKA)

**PEARL**- Major difference

DKA- 4 to 6 liters volume down

HHS- 9 to 10 liters volume down, often with altered mental status

## Physical exam

- Kussmaul respirations- rapid deep breathing without respiratory distress- compensation for acidosis by blowing off CO<sub>2</sub>
- Fruity odor on breath- only in 20-30% of patients, some people are unable to smell this- don't hang your hat on it

## History

- look for precipitating cause to DKA and treat appropriately- any stressor can cause DKA
- **7 I's mnemonic**
  - o Infection- signs/symptoms of pneumonia, UTI, appendicitis/cholecystitis?
  - o Infarction- CVA or MI
  - o Iatrogenic- change in insulin dose by provider
  - o Incision- surgery can be a precipitating cause
  - o Intoxication- ETOH or illegal drugs
  - o Initial- initial diagnosis of Type 1 DM
  - o Insulin- too little or no insulin being taken by the patient

**PEARL**- Many patients with DKA will have nausea, vomiting, and abdominal pain (thought to be from ileus 2/2 electrolyte abnormalities). If the abdominal exam is concerning or the pain *persists* after you have corrected the acidosis, image appropriately for underlying surgical pathology

## INITIAL MANGEMENT

- Fingerstick glucose, 2 large bore IVs, blood draw for labs and stat VBG
- Labs
  - o CBC- high H and H = dehydration
  - o Chem 10- electrolytes are very important in DKA management
  - o VBG- serum pH, CO<sub>2</sub>, and bicarb measurements are necessary for management
  - o UA- urine ketones and signs of UTI
  - o Serum Ketones- +/-, if urine ketones are absent and you suspect DKA
  - o Serum or urine HCG for females- females = pregnant until proven otherwise

- Chest x-ray- + or – if respiratory symptoms suggesting pneumonia

**PEARL**- Patients may produce both acetoacetate and beta-hydroxybuterate as ketones but only acetoacetate is detected by urine dipstick, order a serum beta-hydroxybuterate if necessary

## Management

- **IV Fluid management**- initially much more important than insulin

- o Patient WITH signs of shock- (tachy, low BP, poor perfusion, altered mental status)- bolus 2-3 liters of normal saline as fast as possible
- o Patient WITHOUT signs of shock- One liter of normal saline over 1 hour

**PEARL**- DKA = hypovolemia and hypokalemia who just happens to have a high blood sugar

- **Potassium management**- total body stores of potassium are depleted in DKA- insulin is needed to drive potassium into the cells, without insulin lots of potassium is lost in the urine

**PEARL**- even if the potassium is normal, in DKA these patients are total body potassium depleted

- o Potassium replacement- depends on initial K+ level
- o K+ Below 3.3- add 20-30 meq of K+ per liter of IV fluids
- o \*\*\*\*DON'T START INSULIN UNTIL K+ IS ABOVE 3.3!\*\*\*\*
  - (This will push too much potassium into the cells and cause fatal arrhythmia)
- o K+ 3.3 - 5- add 20-30 meq of K+ per liter of IV fluids, start insulin
- o K above 5- NO extra K+ to IV fluids, start insulin

- **Insulin**- after K+ level is addressed- next question= to bolus or not to bolus?

- o (Bolusing not proven to add benefit and theorized- but not proven- to increase rate of cerebral edema)
- o Bolus- 0.1 units/kg regular insulin IV
- o Drip- 0.1 units/kg/hr regular insulin IV
- o (Some texts recommend 0.14 units/kg/hr if you don't use a bolus)

- **Bicarb**- controversial and not done by every clinician

- o Only give bicarb drip if initial pH < 6.9
- o Bicarb drip- 3 amps of sodium bicarb in one liter of D5W (NOT NORMAL SALINE!) (NS + bicarb = precipitation and a very hypertonic solution)
- o Drip rate- Give 400cc over 2 hours

## ONGOING MANAGEMENT

- **Fluids**

- o After initial IV fluid bolus- recheck serum sodium and correct it for blood sugar
- o Corrected serum sodium = Measured serum sodium +  $\frac{((\text{Glucose} - 100) * 1.6)}{100}$ 
  - Example- if Na 125, Glucose 500
  - $125 + \frac{(500-100) * 1.6}{100}$
  - $125 + 6.4 = 131.4$
- o If corrected sodium low
  - Normal saline at 250 – 500 cc/hr
- o If corrected sodium normal or high
  - 1/2 normal saline (0.45%) at 250-500 cc/hr
- o Once serum glucose <200
  - switch to D5 1/2 normal saline- prevent hypoglycemia

- **Insulin**- once blood sugar <200

- o reduce insulin drip by 1/2 to 0.05 units/kg/hr

**PEARL**- DO NOT STOP INSULIN UNTIL ANION GAP IS NORMAL (CLOSES)

- Anion Gap =  $[\text{Na}^+] - ([\text{Cl}^-] + [\text{HCO}_3^-])$

Doing so will send the patient back into DKA

Increase rate of D5 1/2 normal saline or give D50 IV if hypoglycemic

## Ongoing labs

- While in ED- at a minimum- VBG, chem 10, and fingerstick every hour
  - o (If your VBG panel includes sodium, potassium, bicarb, and glucose use that)
- Sicker patients may need VBGs every 30 minutes



## Pediatric DKA PEARLS

- Limit fluid boluses- limit to one 20 cc/kg bolus in ED, more than 45 cc/kg in first 4 hours increases risk of cerebral edema, shock is rare in pediatric DKA
- If the patient was transferred to you- find out exactly how much fluid and how many boluses they got at the transferring hospital
- Consult pediatric endocrinology early- they follow these patients closely and want to be involved early

## **BIG POINTS**

- DKA- blood sugar >250, ketones in blood or urine, pH 7.3 or less
- HHS- blood sugar >800, serum osmolarity over 320
- IV fluids- normal saline rapid bolus if in shock, otherwise one liter in first hour
- DON'T START INSULIN UNTIL YOU KNOW THE POTASSIUM
- Potassium- add K+ to IV fluids as appropriate (see above)
- Insulin- + or - bolus 0.1 units/kg regular insulin IV, drip 0.1 units/kg/hr
- When blood sugar <200- add dextrose to fluids, reduce insulin drip by 1/2
- DON'T STOP INSULIN DRIP UNTIL THE ANION GAP IS NORMAL (CLOSES)
- Pediatric DKA- limit fluid boluses to one 20 cc/kg bolus, consult peds endocrine early

## 12 Syncope

Definition of syncope- a rapid loss of consciousness followed by a rapid return to baseline

- Pure syncope- usually cardiac in nature- rapid loss of blood flow to the brain
- Vasovagal syncope- stressor causes increased vagal tone that causes bradycardia and hypotension -> syncope

(if the patient has other symptoms like chest pain or headache, is confused after awakening or is unconscious for an extended period of time- that is not pure syncope and demands a different workup)

**History**- it's all about the history for this chief complaint

**PEARL**- Dizzy does not equal syncope!

- Dizziness- sense of the room spinning or loss of balance (disequilibrium)= [different workup than syncope workup](#)
- Ask the patient: "Was the room spinning or did you feel like you were going to pass out?" (Spinning= dizziness, pass out= syncope)

**PEARL**- Near syncope (or lightheadedness) is the same as Syncope (in regards to the workup)

- Stressors- try to identify preceding stressors- dehydration, emotional distress, rapid temperature changes, painful condition, insufficient food or water intake
- Symptoms- prodrome of feeling flushed and hot, tingling in extremities, nausea = more suggestive of vasovagal syncope
- Activity- what was the patient doing? Were they exercising at the time of collapse (VERY IMPORTANT! – arrhythmia or hypertrophic cardiomyopathy)
- Witnesses- ask them if the patient hit their head, any seizure activity (more than a few muscle jerks?), how long until the patient woke up, any confusion after waking up?

**PEARL**- to diagnose a seizure there has to be sustained generalized tonic/clonic movements followed by a period of post-ictal confusion

### Preceding symptoms and red flags

- Syncope + headache= subarachnoid or intracranial hemorrhage
- Syncope + neuro deficit= stroke/TIA or intracranial bleed

- Syncope + confusion= seizure
- Syncope + chest pain= MI, PE, or aortic dissection
- Syncope + back/abdominal pain in older patient= abdominal aortic aneurysm (AAA)
- Syncope + positive HCG= ectopic pregnancy

**Past medical history**- is this recurrent syncope or is this new? Ask for history of seizures, MI, stroke/TIA, known AAA, family history of heart disease

**PEARL**- In younger patients say "I'm not saying this is going to happen to you but did anyone in your family die suddenly and they couldn't find out why?" (Screen for inherited arrhythmias/cardiomyopathy)

**Physical exam**- check for head trauma, do a good neuro exam, listen for murmurs (both with valsalva and with standing and squatting in younger patients), abdominal/back tenderness

### Differential diagnosis (with triggers)

- Seizure- sustained generalized tonic/clonic movements with eyes open with post-ictal confusion
- Subarachnoid/intracranial hemorrhage- syncope plus a headache or a neuro deficit
- Ruptured AAA- older patient with hypertension with back/abdominal pain or hematuria +/- unstable vital signs- stat bedside ultrasound
- Stroke/TIA- syncope with neuro deficit
- GI Bleed- syncope plus black or bloody stools
- MI/ACS- chest pain and syncope
- Aortic dissection- sudden onset of ripping or tearing chest/back pain +/- pulse or neuro deficit
- Aortic stenosis- older patient with a systolic ejection murmur that radiates into the carotids
- Pulmonary embolism- sudden onset of dyspnea/pleuritic chest pain +/- risk factors for PE
- Arrhythmia- see below- WPW/HOCM/Long QT/Brugada
- Carotid sinus sensitivity- syncope with activities that put pressure on carotid sinus (tying a necktie, shaving, checking carotid pulse)

- Orthostatic hypotension- medications such as alpha and beta blockers, dehydration
- Hypoglycemia- diabetic patient or ingestion of diabetic medications
- Tox- drugs, ETOH, environmental (carbon monoxide)- look for a toxidrome
- Sepsis- fever and signs of infection

## Syncope Workup

- EKG and an HCG in females are a **MUST**- other testing guided by clinical picture

**PEARL** - Troponins and head CTs are positive only 0.5% of the time and in all cases were suggested by the history (chest pain, neuro deficit, etc.)

**PEARL**- In general- young patients with a normal EKG/negative HCG and no red flags go home; older patients- admitted for tele monitoring

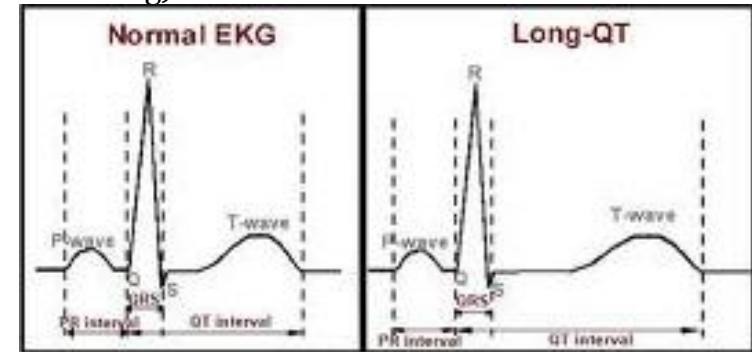
**Labs** (if necessary, usually for older patients who are being admitted)

- D-stick (some clinicians do this in all patients)
- CBC- (severe anemia can cause syncope)
- Chem 10 - (electrolyte abnormalities can cause arrhythmias)
- UA- UTIs can cause a wide variety of symptoms in older patients
- Non-contrast head CT- if there is head trauma +/- C-spine CT as needed

EKG findings in syncope- look for these 4 findings on EVERY EKG on a patient with syncope- Long QT, Brugada, WPW, HOCM/LVH  
**Pneumonic- BLOW Hard- (Brugada, Long QT, WPW, HOCM)**

Long QT syndrome- congenital disorder causing prolonging of refractory period = greater chance of R on T phenomenon (PVC on downslope of T wave causing v-fib).

- EKG- Long QT defined as >440 milliseconds in males, >460 ms in females (some experts say QTs >500 are most concerning)

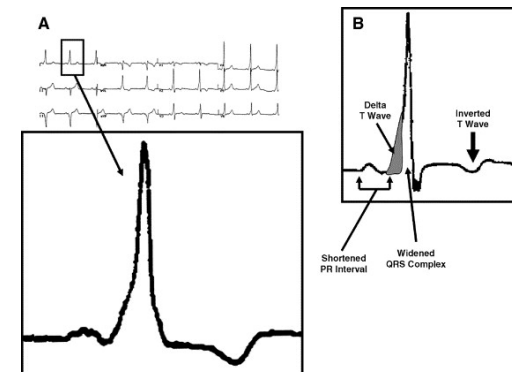


**PEARL**- to eyeball a normal QT- T wave is within the first half of the R to R interval, look for U wave that may cause EKG machine to overcall the QT interval

- **Dispo**- no exercise until evaluated and cleared by cardiology, give seizure precautions (no driving, no swimming, shower with a chair or with someone nearby)

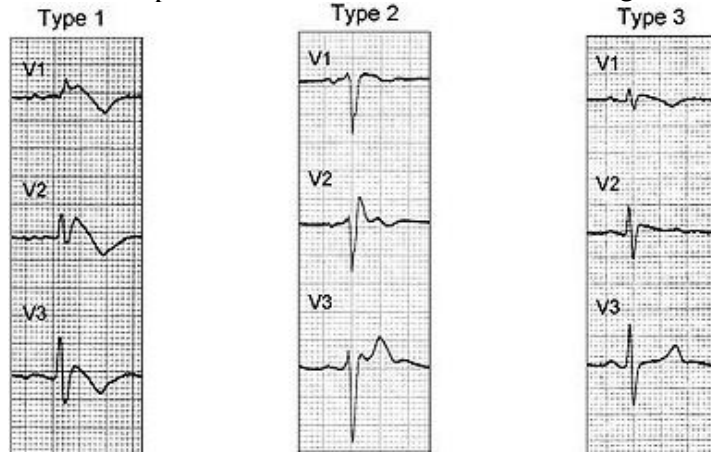
Wolf Parkinson White (WPW)- accessory pathway that bypasses AV node and can cause V-tach

- EKG- shortened PR and delta wave (slurring of Q to R transition)



- **Dispo**- needs Cardiology/EP followup, no exercise until cleared by cardiology

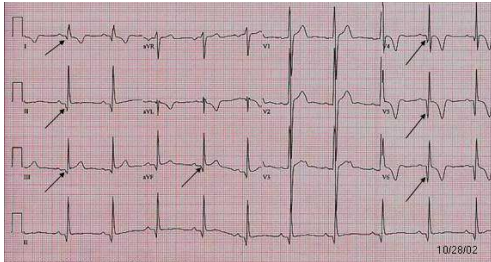
**Brugada syndrome**- sodium channel disorder- frequent syncope in a young and otherwise healthy patient without heart disease with a right bundle block pattern and ST elevation in V1-V3



- **Dispo**- admit for immediate implanted defibrillator placement (high risk for sudden death)

**Hypertrophic cardiomyopathy/LVH**- thickened LV wall that causes outflow obstruction with exercise, classically a young athlete that collapses during exercise

- EKG- LVH (tall R waves in V4-V6 or AVL and deep Q waves in V4-V6)



- **Dispo**- confirm with echo + no exercise until cleared by cardiology

### Overall dispo for syncope

- Young patients- normal EKG/negative HCG, no red flags, and normal EKG= discharge
- Older patients (50 or over- my opinion, definitely over 65)- admitted for telemetry monitoring and further workup

**San Francisco Syncope rule**- insufficient sensitivity to rule out need for admission (52-92% sensitivity for serious outcomes in validation studies) if positive, more reason to admit

- **Pneumonic = CHES**
  - o CHF- History of CHF or current suspicion
  - o Hematocrit <30%
  - o EKG abnormalities (non-sinus rhythm or change in EKG)\*
  - o Shortness of breath (with syncope episode)
  - o Systolic BP less than 90 after arrival to the ED

\*Although this was excluded in the original study, most clinicians also include any T wave abnormalities in the “abnormal EKG” criteria

### Big points

- 1) Syncope= rapid loss of consciousness followed by rapid return to baseline- period, anything else demands a bigger workup
- 2) Syncope workup must include EKG and HCG in females, everything else dictated by clinical scenario
- 3) Syncope with exercise= red flag- look for WPW, Long QT, Brugada, and HOCM in young patients
- 4) Young patients with syncope with no red flags and negative EKG/HCG go home, older patients get admitted for further workup

## 13 Sepsis

A stepwise approach to classifying sepsis:

### Systemic Inflammatory Response Syndrome (SIRS)

#### Criteria

A screening tool to identify patients who are having a systemic response to a stressor (usually an infection)

- WBC count <4 or >12 (or >10% bands)
- Temperature <36 C or >38C (<96.8 F or >100.4 F)
- Respiratory rate >22 or PaCO<sub>2</sub> <30
- Heart rate >90

**PEARL**- just because someone meets SIRS doesn't mean it's sepsis or worse. A patient with a broken ankle could have most of those SIRS criteria but they don't have an infection- it's a screening tool

**Sepsis** = 2 out of 4 SIRS criteria + known or suspected source of infection

**PEARL**- Again, just because you meet criteria for sepsis doesn't mean you get a central line and get admitted to the MICU.

Technically if you are febrile and tachycardic from strep pharyngitis then you are septic

**Severe Sepsis**- Sepsis + signs of end organ damage

- Systolic BP <90 after 2 liters of normal saline bolus (OR more than 40 points below the patient's established outpatient baseline)
- Lactate >4 (byproduct of anaerobic metabolism and a marker of global hypoperfusion)
- Altered mental status
- New onset (or worsening) renal failure
- Hyperglycemia in a patient who is not diabetic

**Septic Shock**- Severe sepsis requiring vasopressors

Severe sepsis/Septic Shock= **initiate early goal directed therapy (EGDT)**

### Sepsis workup

- CBC
- Chem 10
- VBG with lactate
- UA/UC
- Blood cultures x2
- Chest x-ray
- Noncontrast head CT and LP if suspecting meningitis
  
- Consider other less common causes of sepsis- skin infections (check for decubitus ulcers), perirectal abscesses, surgical abdomen (appy, chole, perforation), intra-abdominal abscess, in females- PID or infected IUD.
  - o Image as needed and get surgeon involved for source control

Early Goal Directed Therapy for Severe Sepsis and Septic Shock  
Rivers, et al. New England Journal of Medicine. 2001; 345:1368-137

(<http://www.nejm.org/doi/full/10.1056/NEJMoa010307>)

Criteria: Patients with severe sepsis or septic shock

Main points of protocol- **very aggressive fluid resuscitation**- intubate if necessary, **early initiation of antibiotics**

**Step 1: Early antibiotics**- broad spectrum/tailored for source (if known)

- Popular broad spectrum combo:
- **Zosyn** (piperacillin/tazobactam)- 3.375 or 4.5 grams IV – good gram neg and gram pos coverage + pseudomonas
- **Vancomycin**- 15-20 mg/kg IV (usually capped at 1 gram per dose but latest guidelines recommend giving full weight based dose up to 2 grams IV for the first dose) – works well for MRSA and gram pos

Antibiotics for other clinical situations

- Healthcare associated pneumonia aka HCAP (patients at risk for *drug resistant organisms*- long term care facility resident, admitted to the hospital for 2 or more days in the past 3 months, dialysis patient, outpatient IV antibiotics or chemo in the past month)- **add levaquin to zosyn/vanc**



- Levaquin (levofloxacin)- 750mg IV “double covers pseudomonas”
- **Rocephin (ceftriaxone)**- preferred for urosepsis and meningitis
  - Dose: 1 gram IV (urosepsis) or 2 grams IV (meningitis in combination with vancomycin)

### Step 2: Aggressive fluid resuscitation

- Start with a **2 liter normal saline bolus**
- Insert a central line above the diaphragm (subclavian, supraclavicular, internal jugular)
- Measure central venous pressure (CVP)
- If CVP <8 (or less than 12 in a ventilated patient)= more fluids

**PEARL**- septic patients can get 13-14 liters in their first 24 hours!

- Give fluids until CVP goal is met, even if it means intubating the patient for pulmonary edema

**PEARL**- the actual act of breathing can take up to 30% of a critically ill patient’s metabolism so by intubating early you will improve their hemodynamics and their response to therapy

### Step 3: Vasopressors

- Once CVP above 8 or 12, if MAP is less than 65, start vasopressors
- Will probably require an arterial line at this point
  - **Levophed (norepinephrine)**- 2-20 mcg/min- strong alpha and beta agonist (increased myocardial squeeze and increased vasoconstriction) central line, most clinician’s preferred 1st line pressor
  - **Dopamine**- 2-20 mcg/kg/min- can be given through a peripheral IV- gives more tachycardia than levophed

**PEARL**- you can start peripheral dopamine while you are putting the central line in

- Other treatments- vasopressin/steroids (not covered in the podcast)
- Goal: get MAP above 65

### Step 4: Assess SCVO<sub>2</sub>

- **SCVO<sub>2</sub>**- a measurement of oxygen saturation of the blood in the superior vena cava (as it returns to the heart)
- Need a central line above the diaphragm to measure this
- Two methods- Edwards catheter provides continuous SCVO<sub>2</sub> readings (expensive) or draw serial VBGs from central line and look at O<sub>2</sub> sat
- If SCVO<sub>2</sub> <70%- **check hemoglobin/hematocrit**
  - If H and H less than 10 and 30 - **transfuse pRBCs** until its above 10/30
  - Once H and H is >10/30- if SCVO<sub>2</sub> still <70% - start **dobutamine**
    - **Dobutamine**- strong B<sub>1</sub> agonist
    - Dose- 5-20 mcg/kg/min

### Step 5: Reassess response to therapy (also continuously)

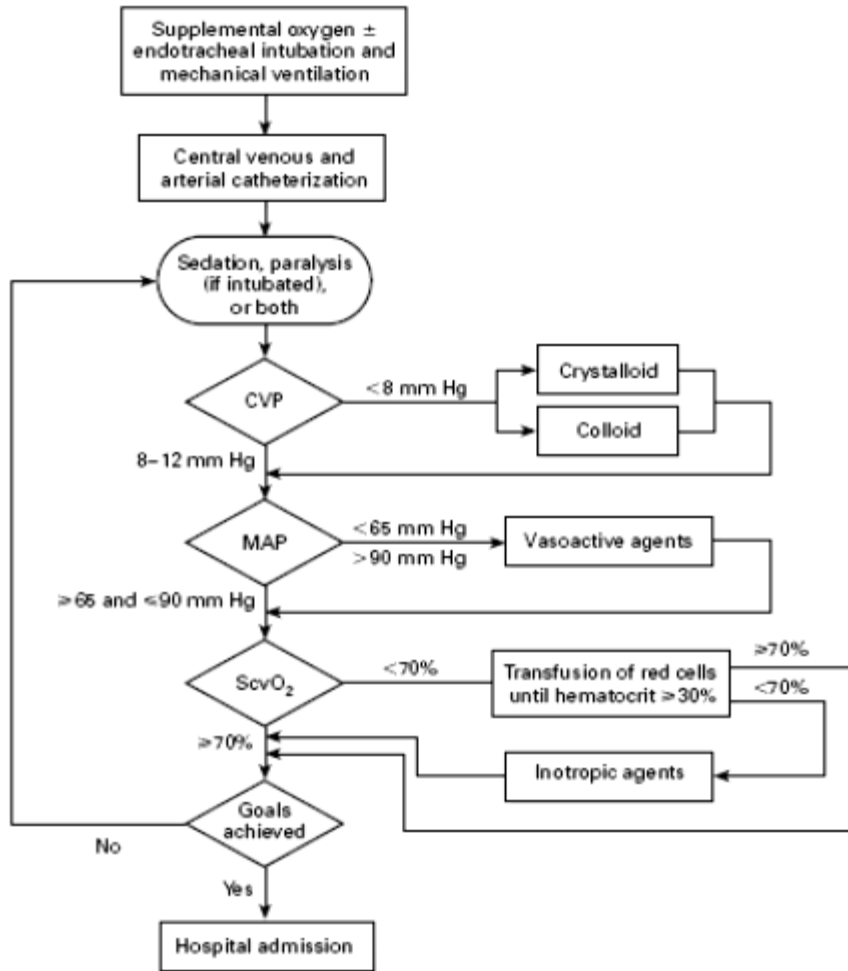
- It may take 6-12 hours or longer to reach this step. Once you are here, go back and reassess each step and make sure you have optimized each one.
- Follow serial lactates
  - if they are decreasing then you are doing something right.
  - if they are staying the same or increasing- try something different

### **BIG POINTS:**

- 1) Know the definitions of SIRS, sepsis, severe sepsis, and septic shock
- 2) Early broad spectrum antibiotics- Zosyn/Vanc, Levaquin, Rocephin
- 3) **FLUIDS FLUIDS AND MORE FLUIDS!**- these patients can get 13-14 liters in the first 24 hours- be aggressive even if you have to intubate
- 4) CVP <8 or <12- pressors to MAP >65 (norepinephrine, dopamine)
- 5) MAP >65- check SCVO<sub>2</sub>- less than 70%, transfuse to H and H >10/30
- 6) H/H >10/30- add dobutamine



## Rivers EGDT Flowchart



Rivers E, Nguyen B, Havstad S, et al. Early goal-directed therapy in the treatment of severe sepsis and septic shock. *N Engl J Med.* 2001;345: 1368–1377.

## 14 Shortness of Breath (SOB)

Vitals- special attention to respiratory rate and pulse ox

**PEARL**- A respiratory rate of 16, 18, or 20 in an adult probably means that it wasn't counted accurately- it says "I think the respiratory rate is normal"- think of anything over 20 as tachypenic

Rapid assessment- look at the patient's work of breathing and make a decision as to whether they have increased work of breathing

**PEARL**- The decision to intubate is based on clinical situation- not numbers- a severe COPD patient may live at a pCO<sub>2</sub> of 70 and a pulse ox of 92- if they are talking without distress they probably don't need a tube. **It's about mental status and work of breathing- not numbers**

**History**- ask standard OPQRST questions about when the SOB started

- **Important associated symptoms**
  - o Chest pain (PE or MI)
  - o Fever (pneumonia)
  - o Lower extremity edema (CHF)
  - o Increased sputum (COPD)
- Aggravating factors- dyspnea on exertion or orthopnea (SOB with rest)

**PEARL**- bad bronchitis or COPD can cause some blood tinged sputum- clarify the amount- blood tinged or dime sized is not as worrisome- "nothing but blood" is worrisome

### Medical history

- Focus on asthma, COPD, cardiovascular history.
- Hx of MI, strokes, CABG, catheterizations
- Ever intubated for COPD or asthma?

**Medications**- recently on antibiotics or steroids? Recent med changes?

**Social history**- most important is tobacco use

### Exam

- Work of breathing- may have to take down the patient's gown. Look for accessory muscle use (clavicles) or retractions (usually).
  - o Retractions- paradoxical contraction of muscles with inspiration (for children check subcostal)
- HEENT- assess the upper airway for foreign bodies and for predictors of difficult intubation (poor mouth opening, visibility of soft palate, etc.)
- Heart- Listen to it first before lungs (better exam that way), listen for valve disorders (aortic stenosis most common in older patients – avoid meds that ↓ preload!)
- Lungs- Assess both sides all of the way up, full lung sounds vs. quiet chest?, listen for crackles, rhonchi, and wheezing

**PEARL**- In young children- count out respiratory rate while you listen to lung sounds- easier than counting by watching- do it for a full minute!

- Abdomen- assess for tenderness- don't miss a peritonitis
- Extremities- lower extremity edema, calf tenderness (DVT?)

### Differential Diagnosis

- Tubes- upper airways- airway obstruction or burns, dental or neck abscess, foreign body, croup, epiglottitis
- Lower airways- bronchitis, asthma, COPD, bronchiolitis (kids <2 y.o.)
- Lungs- Pneumonia
- Pipes- Pulmonary embolism
- Pump- Congestive heart failure, valve disorders
- Outside the lungs- pneumo/hemothorax, pleural effusion, abdominal process

### Tubes/Upper Airway

- Dental or neck abscess- most worrisome is Ludwig's angina- deep space neck infection- classically in diabetics with poor dentition, look toxic, have brawny edema of floor of the mouth, drooling- need **broad spectrum antibiotics** and **OR emergently with ENT to drain infection and secure airway**
- Foreign Body- most common in kids- sudden onset of stridor without a cough and no other viral symptoms

- Croup- Viral infection in kids caused by parainfluenza, causes upper airway swelling and “barking seal” cough, worse at night, stridor at rest is more severe (see below)
- Epiglottitis/tracheitis- upper airway infections, usually in children but today is more seen in adults (waning vaccine immunity), toxic appearing, drooling, hoarse voice. Don’t agitate- **get immediately to the OR**

### Lower airway

- Asthma- usually a younger patient with wheezing and shortness of breath, on outpatient inhalers
- COPD- usually an older patient with a history of smoking, wheezing, and on outpatient inhalers
- Bronchiolitis- viral syndrome, wheezing, respiratory difficulty, *bilateral runny nose* in a child <2 years old

### Lungs

- Pneumonia- cough, fever, SOB, +/- hypoxia, chest x-ray with an infiltrate
- Pipes (blood vessels)
- Pulmonary embolism- sudden onset of pleuritic chest pain, shortness of breath, risk factors include OCPs, immobilization, recent surgery, etc.

### Pump (heart)

- Congestive heart failure- dyspnea on exertion with lower extremity edema, orthopnea, crackles on lung exam, “wet” chest x-ray
- MI- chest pain, diaphoresis, nausea, EKG changes

### Outside the lung (space occupying)

- Pneumothorax- spontaneous (thin tall young patient or bad COPD/asthma) or traumatic, air in chest cavity on CXR
- Hemothorax- traumatic- seen as a white out on the CXR
- Pleural effusion- layering fluid at bases on CXR
- Abdominal process- peritonitis, free air under diaphragm

### **Workup- EKG and Imaging**

- EKG- low threshold especially on older patients and in anyone with CHF or MI as a consideration (**most patients over 40 should get one**)

- Chest x-ray- Low threshold but can withhold it if it seems like an obvious asthma exacerbation or clear cut bronchiolitis (PNA, Pulm edema, Pleural effusion, PTX)
- **PEARL**- If patient is in distress or has chest pain, get a 1 view portable CXR at the bedside, otherwise send for a 2 view PA and lateral, 2 view is better, can’t tell cardiomegaly from 1 view
- CT Pulmonary Angiogram- if considering PE

### **Workup- Labs**

- In general- if you are going to send the patient home, don’t get labs (or at least don’t order them and send them), if you admit, get labs
- Venous blood gas- can be helpful in cases of severe SOB but don’t base airway interventions on those numbers alone
- CBC/Chem 10- in COPD and pneumonia patients that you are going to admit
- Blood cultures x2- Only in pneumonia patients, ? quality measure but this seems to change everyday, don’t order them unless you are admitting the patient to avoid culture callbacks. Can tell your nurse/tech to draw and hold if you are unsure whether the patient will be admitted
- CBC, chem 10, coags- PE workup patients (check creatinine for IV contrast, platelets and coags for possible anticoagulation)
- Cardiac Enzymes- Cardiac workup- CK, CK-MB, Troponin, +/- myoglobin
- BNP- secreted by the heart in response to increased ventricular stretch, <100- *probably not CHF*, >400- probably CHF 100-400 indeterminate

### **Treatment**

- Non-invasive Ventilation (CPAP and BiPAP)- can use to avoid intubation and reduce work of breathing, start at 10/5 and titrate upwards

### **Asthma and COPD**

- **Beta Agonists- albuterol**- 2.5 mg unit dose or 5mg continuous (child) or 10mg continuous (adult)
- **Anticholinergic- ipratropium (atrovent)**- 1 dose during ED stay (1 dose lasts 4-6 hours, no benefit from higher dosing)
  - o *1 duoneb followed by 2 albuterol is adequate*

- Steroids- for both asthma and COPD
  - o **Prednisone**- 50mg PO for adults (5 day total course)
  - o **Orapred (oral prednisolone)**- 1 mg/kg PO BID for kids (5 day course)
  - o **Solumedrol (IV prednisolone)**-125 mg IV or 2mg/kg for kids

**PEARL**- Bioavailability is the same PO vs. IV- only reason to give IV is if the patient is too tachypenic to take PO; solumedrol may also be considered if patient has liver failure

COPD flares- add antibiotics (anti-inflammatory effects)

- Outpatient- **Azithromycin** (Z-pack)- 500mg on day 1, 250 for days 2-5
- Inpatient- **Azithromycin** or **Levaquin (levofloxacin)**- 500mg IV

### **Bronchiolitis treatment- mostly supportive**

- Treatment- **nasal suctioning and oxygen as needed**

**PEARL**- Beta agonists don't help bronchiolitis

**PEARL**- High risk bronchiolitis patients (need admission for apnea monitoring) - **12 bed PICU**- <12 weeks old, Premature, Immunodeficient, Cardiac anomaly (congenital)

### **Croup- mostly supportive**

- **Decadron (dexamethasone)**- 0.6 mg/kg PO, max 10mg
- **Racemic Epi neb**- only for kids with stridor at rest (i.e. when NOT agitated or crying)- 0.5cc; requires 4 hour observation period after neb

**Pneumonia**- most common cause is strep pneumonia

- Treatment- **antibiotics, oxygen as needed**
  - o Adults- Community Acquired- outpatient- **Azithromycin** (covers Strep pneumo + atypicals)
  - o Adults- Community Acquired- inpatient- **Ceftriaxone** 1 gram IV and **Azithromycin** 500mg initial dose in ED
  - o Children- Community Acquired- outpatient- **Amoxicillin** 45 mg/kg BID

**PEARL**- Amoxicillin 400mg/5ml= 1 teaspoon for every 10 kg (like children's acetaminophen/ibuprofen)

- o Children- Community Acquired- inpatient- **Ceftriaxone** 50 mg/kg IV and **azithromycin** 10 mg/kg

Hospital Acquired- see sepsis podcast

### **The Pipes (blood vessels)**

- Pulmonary embolism- **heparin/enoxaparin** - see chest pain podcast

### **The Pump (heart)**

- Congestive Heart Failure (CHF)- **nitrates, Lasix**
  - o Nitroglycerin- start with sublinguals (0.4 mg q 5 minutes= 80 mcg per minute), can do IV drip for more severe cases
  - o Lasix- loop diuretic- takes 4-6 hours for diuresis but is a weak venodilator (nitro much better)- 20mg IV or usual outpatient PO dose given IV.

### **Outside the lungs**

- Pneumo/hemothorax- drain using a chest tube
- Pleural effusion- consider draining but most will resolve if you treat the underlying condition

## 15 How to give a good ED patient presentation

- Chief complaint
- History of present illness with pertinent positive and negatives
- Brief review of systems
- Focused Past medical and surgical history
- Focused pertinent medications and allergies
- Very focused social history and family history if required
- Vitals- highlight any abnormal vital signs
- Focused and pertinent physical exam
- Differential diagnosis- 3 life threatening things followed by what you think it is
- Plan- what you want to do
- Disposition- Patient being discharged, needs more testing before a decision, or is being admitted no matter what the testing shows

### Example presentation

- **Chief complaint**- I have a 50 year old male with chest pain
  - o If pt has multiple complaints: I have a 50 yo male with multiple complaints, most concerned about \_\_\_x\_\_\_
- **History of present illness with pertinent positive and negatives** - The pain started at rest 3 hours ago while he was watching TV. He describes it as a pressure like sensation in his chest with no radiation. The pain came on gradually over 30 minutes and peaked at an 8 out of 10 intensity. Nothing made it better or worse, and the pain went away on his way into the ED.
- **Brief review of systems** - He denies shortness of breath, diaphoresis, nausea, vomiting, abdominal pain, or recent illnesses. He has no DVT or PE risk factors.
- **Focused Past medical and surgical history**- The patient has hypertension and his only surgeries are a remote appendectomy and knee surgery
  - o For children ask if vaccinations UTD, any problems at birth, are they growing and developing normally?

- **Focused pertinent medications and allergies**- His only medication is lisinopril and he has no allergies
- **Very focused social history and family history if required**- Father had an MI at 60 years old, and he doesn't smoke, drinks occasionally, and denies illicit drug use, specifically denies cocaine use.
- **Vitals**- Significant only for a BP of 150/90
- **Focused and pertinent physical exam**- On exam, his lungs are clear and his heart has no murmurs, rubs, or gallops. I cannot reproduce his chest pain with palpation. He has no peripheral edema and the rest of his exam is normal.
- **Differential diagnosis**- My differential includes MI or ACS, PE, and aortic dissection. I don't think he has a PE or aortic dissection given no PE risk factors and his history isn't consistent with dissection.
- **Plan**- He got an EKG in triage that shows normal sinus at a rate of 80 with normal axis and intervals, and no ST/T wave changes. For further workup, I would like to get a portable chest x-ray, a cardiac lab set with CBC, chem 10, coags, troponin and CK, CK-MB. I would also give him 325 mg of aspirin.
- **Disposition**- If his labs and chest x-ray are negative and he continues to be pain free, I would admit him for a low risk rule out.

## 16 Trauma Resuscitation - Part 1

**Pre-arrival-** starts with notification of an incoming patient

**Triage-** have some system to determine which patients require a greater response from the trauma team (for example- *hypotension, altered mental status, unprotected airway*)

### Preparation

- Do you need blood products?
- Do you anticipate the need for an airway?
  - o If so, draw up medications ahead of time
  - o 30 of **etomidate** and 200 of **succinylcholine**
- Clearly define roles in the trauma bay. Who is the team leader? What is each person going to do? Team leader takes charge and should be the only voice in the room directing the resuscitation. PPE on every person
  - o At a minimum:
    1. Team leader- runs resuscitation and does primary/secondary survey, procedures
    2. Nurse on one side of the patient- IVs, meds, exposure
    3. Tech or medic on other side- IVs, exposure, etc.
    4. Recorder (usually a nurse)
    5. Usual trauma center staffing- adds the following
      - 1) Trauma team leader- ONLY runs resuscitation, stays at foot of the bed, doesn't get involved in patient care
      - 2) Provider at the head of the bed- airway, HEENT exam
      - 3) Provider on either side of the patient- procedures and surveys

### Flow of the resuscitation (with approximate times)

- **Patient arrival and transfer to ED stretcher** (15-20 seconds)
- **Primary survey- ABCDEs/Massive hemorrhage** - (15-30 seconds)
  - o **Airway-** is it patent? Any obstruction? **Ask the patient their name**
  - o **Breathing-** bilateral equal breath sounds (anterior chest)
  - o **Circulation-** distal pulses (radial, femoral, DPs)

- o **Disability-** moves all extremities? GCS

#### How to do a GCS in the trauma Bay

- Awake, talking, and not confused = 15
- Awake, talking but confused/repeating questions= 14
- Awake, not following commands = 8
- Comatose, no response= 3 (3T if intubated)
- Conscious but not following commands = 8 (consider intubation to protect airway)

- o **Exposure-** start removing all patient's clothing, expose injuries
- o Massive hemorrhage- apply tourniquets ASAP
- **EMS report and secondary survey** (3-5 minutes)
  - o Room quiet for EMS report
  - o Secondary survey starts during EMS report (don't report findings until EMS report over)
  - o **AMPLE history** (Allergies, Medications, Past Medical History, Last Eaten, Events Leading) and last tetanus
  - o **HEENT-** Examine scalp for bleeding (if clotted, keep bandages on), check forehead, midface, and jaw for tenderness/injuries, pupil size and reactivity, ears for hemotympanum, nasal septum for hematoma, oral cavity for lacs/broken teeth and mouth opening
  - o **C-spine-** have someone else keep c-spine control, remove collar, palpate c-spine and look for injuries
  - o **Chest-** recheck lung sounds, assess for tenderness, injuries, crepitation
  - o **Abdomen-** check for tenderness, rigidity, rebound/guarding, bruising
  - o **Pelvis-** check for stability- DON'T ROCK!- squeeze laterally from the iliac crests inwards and then push down anterior/posterior
  - o **Lower and upper extremities-** tenderness, deformities, pulses
- **ROLL THE PATIENT-** (1-2 minutes)
  - o Log roll the patient, assess for tenderness, step-offs, injuries



- Rectal exam PRN- if not done, ask patient to “squeeze your butt cheeks together to check general peri-rectal tone
- Place chest x-ray film under patient and roll back
- **Package patient for CT scanner/OR/ICU (30-60 seconds)**

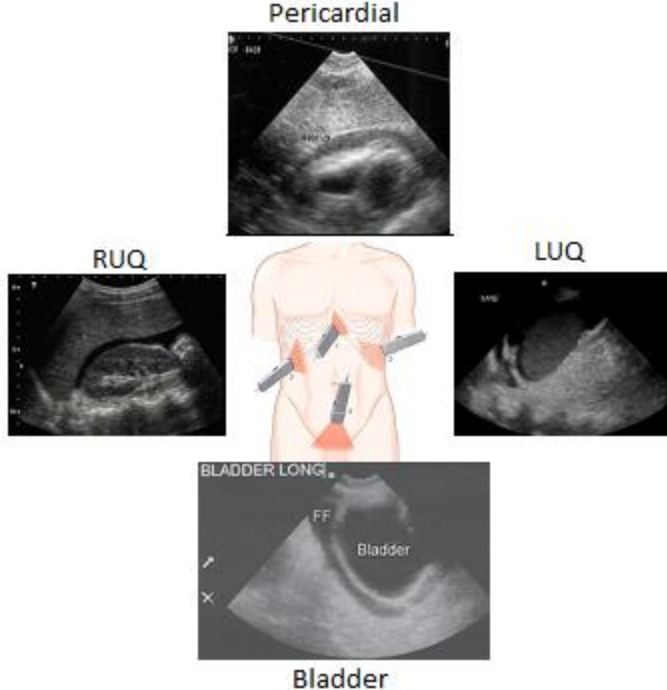
**Goal- out of trauma bay in less than 10 minutes** unless critical interventions are needed (airway, chest tube, emergent lac repair, etc)

## 17 Trauma Resuscitation - Part 2

**Reminder-** limit time in trauma bay to less than 10 minutes unless you need to perform a lifesaving intervention

**FAST exam-** (Focused Assessment with Sonography in Trauma) should be performed during or just after secondary survey but don't delay completion of the secondary survey

- 4 views- free fluid (black stripe)- phased array/curvilinear probe
  - o Use phased array or curvilinear probe
  - o RUQ- liver and right kidney (Morrison's pouch)
  - o LUQ- spleen and kidney
  - o Suprapubic- next to bladder
  - o Cardiac- pericardial space



- EFAST views- adds views of each side of the chest for pneumothorax
  - o Linear probe best, shallow depth, both sides of the sternum
  - o Looking for lung sliding, comet tails- absence = pneumothorax



FAST exam decision algorithm (free fluid in the abdomen)

- **Stable vital signs:**
  - o Positive or negative- further imaging with CT as needed

**PEARL:** positive exam could be other causes of free fluid, negative exam may not detect all bleeding

- **Unstable vital signs:**
  - o Positive- to the OR
  - o Negative- further resuscitation, imaging as needed

### Interventions

- **Massive extremity hemorrhage-** immediately apply **tourniquet** and tighten until you lose a pulse and the bleeding stops, continue with resuscitation and evaluation
- **Airway-** always be prepared to take the patient's airway for decreased mental status, respiratory failure/desaturation, pain control

**PEARL-** be sure desaturation is not due to a tension pneumothorax  
**PEARL-** if EMS report suggests patient may need their airway protected, have RSI meds actually drawn up in the syringe prior to arrival- 30mg of etomidate and 200mg of succinylcholine

- **Breathing-** unequal breath sounds is a pneumothorax until proven otherwise

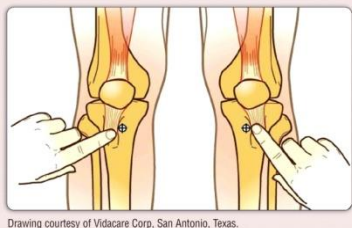
**PEARL**- if the patient is intubated with decreased breath sounds on the left side, check tube depth (3x tube length), if tube is deep, pull back slowly 1 cm at a time and recheck breath sounds

- **Tension pneumothorax**- pneumothorax where there is a one way valve created where air cannot escape- life threatening- needs immediate decompression
- ATLS- **advocates needle decompression**- 14 gauge needle at the 2nd intercostal, mid-clavicular line
  - Problems- available needles are usually too short, patients with thick chest walls are hard to penetrate with needle
- Current practice- rapidly **insert a chest tube** but with an emphasis on rapidly cutting through the chest wall- most important thing is to relieve the tension pneumothorax, not actually inserting the tube- that can come later

- **Circulation**- First step is to establish IV or IO access

**PEARL**- If you can't get an IV within 1 minute or 2 attempts in a critically ill trauma patient, go immediately to an intraosseous line (IO)

- **IO locations**- medial tibia (preferred), proximal humerus, distal femur



- Medial tibia insertion- feel for the tibial tuberosity (bump just below the patellar ligament insertion on the tibia), go one finger breadth below and medial on the flat part of the tibia, insert IO needle perpendicular until there is a lack of resistance, flush 5cc of saline to ensure placement (look for fluid in surrounding skin)

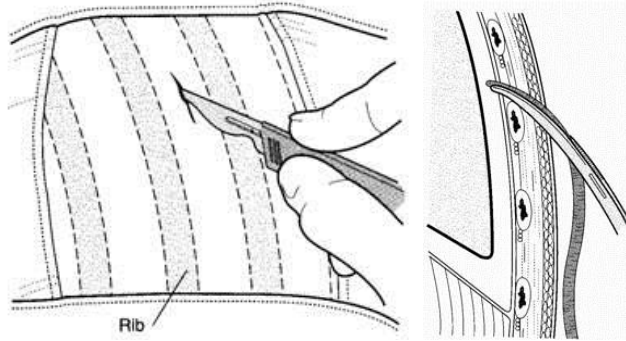
- **Central access**- 2 large bore peripheral IVs can have greater flow than a central line, if central access is desired, usually want a cordis central line with a large single lumen for rapid volume delivery

**PEARL**- one exception- spinal shock- patient with a spinal injury with hypotension in which bleeding has been ruled out, caused by lack of vascular tone- in that case, put a triple lumen (regular) central line in for vasopressors (**norepinephrine** probably best)

- **Fluids**- ATLS advocates 2 liters of warmed normal saline but current practice is to go straight to blood products in trauma patients- saline doesn't carry oxygen or glucose, dilutes clotting factors and hemoglobin
  - **Blood products**- practice is to give blood products- pRBCs, plasma, platelets in a 1:1:1 ratio to approximate whole blood
  - **Blood pressure goal**- "permissive hypotension"- not trying to normalize blood pressure- give enough volume to maintain mental status- roughly systolic of 90 but younger patients will tolerate lower systolics

## Chest tube insertion in tension pneumothorax

- Prep the skin with betadine/chlorhexidine
- Palpate for the 4th/5th intercostal space (lateral to the nipple)
- Cut just above the rib and dissect down to muscle
- Firmly hold curved kellys, placing finger one inch from end
- Apply strong pressure to puncture through chest wall
- Should get a rush of air/improvement in vital signs
- Insert your finger into chest wall and twist 360 degrees
- Place chest tube in a controlled manner



## Sedation and pain control for chest tubes

- In case of a tension pneumothorax, won't have time to sedate since patient is close to cardiac arrest
- However- most pneumothoraxes aren't tension physiology and can wait 30-60 seconds for sedation/pain control
- Best option- **ketamine**- 1-2 mg/kg IV/IO or 2-4 mg/kg IM- in 30-60 seconds you'll have a calm and dissociated patient that won't move during chest tube insertion

## 18 Dizziness

**Triage and Nursing note-** read them and make sure not to miss any other complaints like slurred speech, ataxia, extremity weakness, syncope, etc.

### Check and address abnormal vitals

#### What does the patient mean by dizzy?

- Dizzy= sensation of the room or person spinning
- Lightheaded= almost passing out = near syncope
  - o [Different workup for syncope](#)
- Disequilibrium= loss of balance
  - o Dizziness workup with low threshold for extensive testing
- Generalized weakness- ACS? Electrolytes? Low hemoglobin?
  - o Different workup if it is weakness without dizziness

**PEARL-** Say to the patient “What do you mean by dizzy?”  
“Does it feel like the room is spinning or like you are going to pass out?” “Does it feel like you have lost your balance?”

#### History of dizziness

- Sudden or gradual onset?
- Recent onset or weeks to months?
- Dizzy all the time or just episodes?
- Have you had this dizziness before?
- What makes it better or worse?
  - o Head or body position changes?
- Other neuro symptoms?
  - o Limb weakness, ataxia, slurred speech
- Hearing loss or ringing in the ears (tinnitus)?

Most important question- is this peripheral or central vertigo?

- **Peripheral vertigo-** caused by dysfunction in the ear/inner ear- mostly benign causes- (Benign Paroxysmal Positional Vertigo, BPPV being most common)
- **Central vertigo-** disturbance in CNS, caused by something that is obstructing blood flow- tumor, mass, intracranial bleeding, carotid dissection- serious pathology

**PEARL-** In general, the worse the patient feels, the more sudden the onset, and if episodes of dizziness instead of continuous = peripheral vertigo

Peripheral vs. Central Vertigo- adapted from Rosen’s 7th ed.

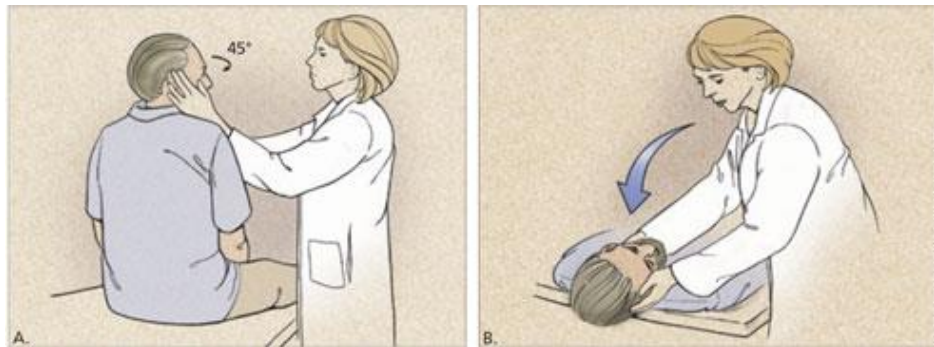
Characteristic	Peripheral Vertigo	Central Vertigo
Onset	Sudden	Usually gradual
Intensity	Severe	Mild
Duration	Seconds to minutes	Usually weeks to months
Nystagmus	Horizontal	Horizontal, vertical, or rotatory
Head position	Worsened by certain positions	No relation to position
Neuro findings	None	Usually present
Auditory findings	May have decreased hearing or tinnitus	None

**Exam-** do a complete exam including examining the ear and ear canal (foreign body, bulging TM, etc?)

- [Neuro exam](#) - really focus on cerebellar testing (finger to nose, rapid alternating movements, pronator drift, and gait)
- Extra-ocular movements- if extra-ocular movements induce patient’s dizziness and resolves with visual fixation- it suggests BPPV

**PEARL-** patients with BPPV may have difficulty walking and positive Romberg as long as no neuro deficits and no red flags

**Dix Hallpike Maneuver** - drop head of bed, tell patient to fall backwards and turn head to one side, observe for symptoms or nystagmus - if positive, suggests BPPV (*BPPV dizziness is often triggered by EOM and resolves with visual fixation*)



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## Differential diagnosis of dizziness

### Central Vertigo

- Tumor/Mass/intracranial bleeding- history suspicious for a central cause of vertigo plus or minus an objective neuro deficit
- Carotid or vertebral artery dissection- challenging diagnosis to make history of even minor head and neck trauma, plus or minus neck pain and neurological symptoms- **non-contrast head CT followed by CT neck angiogram (with contrast)**
- Vertebro-basilar insufficiency- elderly patients with a sudden onset of vertigo and a history of atherosclerosis. Symptoms are more related to movement of their head rather than movement of their entire body. Usually a headache and a neuro deficit or syncope.
- Cerebellar stroke- Dizziness and a neuro deficit or any patient who has what sounds like a central cause of vertigo. Should have a deficit in their cerebellar neuro, may have an abnormal gait. **MRI is imaging of choice after a non-contrast head CT** (see section on HiNTS exam)
- Infection- meningitis, encephalitis, or brain abscess. Patient is febrile and toxic appearing with dizziness, plus/minus neck stiffness or meningismus. **Non-contrast head CT**

followed by a **lumbar puncture** and aggressive antibiotic/antiviral treatment as indicated.

### Peripheral vertigo

- Benign Paroxysmal Positional Vertigo (BPPV) - this is what we are usually talking about when we say “vertigo”. BPPV tells you what it is- BPPV is benign, it has paroxysms or episodes, the vertigo is related to position, and its vertigo.
- Acute otitis media - a patient with a lot of ear pain with a bulging tympanic membrane and viral symptoms. Rare in adults
- Labrynthitis - a patient with dizziness plus hearing loss. Mild cases- outpatient with antibiotics, toxic patients- admit for IV antibiotics. Usually have preceding URI symptoms or the patient is taking ototoxic medications (example- aminoglycosides). **Consider ENT consult**
- Perilymphatic fistula - sudden onset of dizziness and hearing loss that is worse with Valsalva. Causes- congenital, barotrauma, severe coughing, retching, or direct ear trauma. **Consider ENT consult**
- Meniere’s disease- triad of dizziness, fluctuating hearing loss, and tinnitus that waxes and wanes over a period of years.
- Ear canal foreign body- anything that irritates the tympanic membrane can cause dizziness

**Lab Workup**- usually low yield in dizziness, in older patients- consider CBC, Chem 10, UA, coags (if anticoagulated) to look for electrolyte abnormalities, UTI, etc.

**Imaging**- not needed in peripheral vertigo, if suspecting central causes of vertigo, start with non-contrast head CT.

**PEARL**- a head CT is not sensitive for cerebellar or posterior strokes (cranial bones cause scatter)- **MRI is imaging of choice**

HiNTS exam (Head impulse testing, Nystagmus, Test of Skew) - shown in one study to be superior to MRI in diagnosing posterior strokes- see EmCrit podcast 33 at <http://emcrit.org/podcasts/posterior-stroke/>



## Medications

- **Meclizine (Antivert)** - antihistamine with anti-emetic properties
  - o Dose- 25mg PO twice a day, mildly sedating
- **Diazepam (Valium)** - benzodiazepine
  - o Dose- 5mg PO three times a day, very sedating- give sedation warnings (no alcohol, driving, etc.)
- **Ondansetron (Zofran)** - anti-emetic- can be used in between doses of meclizine for vomiting if needed
  - o Dose - 4 or 8mg PO/ODT every 6 hours as needed
- Epley maneuver- can be helpful in patients who are having recurrent vertigo or they failed outpatient medications. Give patient a handout or have them search youtube for videos

## 19 Procedural Sedation Part 1 - Preparation

**Procedural sedation**- sedation, analgesia, and/or amnesia to accomplish procedures in the ED (fracture reductions, I and D, chest tubes, etc.)

**Medical history**- heart disease, afib, hypertension, sleep apnea (snore at night), medication allergies, reactions to anesthesia in the past or known difficult airway

**NPO status**- last food or drink

- Standard OR practice- NPO after midnight- not practical
- Institutional practices vary- follow guidelines
- No great evidence for 2 hours vs. 4 hours vs. 6 hours
- Reasonable approach- large meal prior to ED stay- 2 hours, liquids only 1-2 hours

**Physical exam**- focus on [airway exam](#)- any predictors of difficult airway?

- Restricted mouth opening, short neck, etc.

**Final decision** - take all of the above into account and make a decision as to whether ED procedural sedation is appropriate vs. the OR

- Example- Athletic 17 year old male with shoulder dislocation (good)
- Example - 85 year old obese male with afib, hypertension, sleep apnea with hip dislocation (bad- multiple comorbidities and need for deeper sedation)

**PEARL**- some institutions limit ED procedural sedation to certain ASA classes- follow your institutional guidelines with all of this

**Depth of sedation**- not important to memorize levels but can help you decide on which medication to use

- **Minimal sedation (anxiolysis)**- Patient is drowsy but maintains cardiovascular and respiratory status
  - o Example- Laceration repair on an anxious patient with a few milligrams of [midazolam \(Versed\)](#), Abscess packing change in groin with [fentanyl](#)

- **Moderate Sedation**- The level of sedation we usually aim for- depressed level of consciousness but responds to verbal or light tactile stimulation.
  - o Cardiovascular and respiratory status maintained
  - o Example- Shoulder reduction using [etomidate](#)
- **Deep sedation**- Depressed level of sedation but can't be easily aroused but can respond purposefully after repeated rounds of painful stimulation
  - o Example- Hip reduction using [propofol \(Diprivan\)](#)

**PEARL**- Deep sedation is a dirty word in the ED at some institutions, just about any procedural sedation medication can achieve deep sedation but it is needed sometimes to get the procedure done

- **General anesthesia** - only time we do this in the ED is RSI
- **Dissociative sedation** - a trance-like state of profound amnesia and analgesia with maintenance of airway reflexes and spontaneous respirations- unique to the drug [ketamine](#)

### Preparation for procedural sedation

- Consent for procedure- consent for the sedation and/or the procedure (if a consultant is doing the procedure). Consent usually not necessary for minimal sedation but for moderate sedation it is REQUIRED
- Sample script reviewing sedation, risk, benefits, and alternatives: We would like to give you sedation to do this procedure. We will give you a medication so that you shouldn't remember what is going on. It's possible that you may wake up a little bit during the procedure and be aware of what is going on but you won't really care. During this time you will still be breathing on your own and we will watch you very closely. The benefit to this sedation is that you will be nice and relaxed for the procedure and you probably won't remember most of what happens. This is something that we do a lot in the ED and we are very comfortable doing it. However, as with any sedation, there are risks but they are small. The main risk is that you could stop breathing to the point where we have to breathe for you or put a tube down your throat or that something else unexpected will happen. There are also risks of aspiration where you breathe your stomach contents into your lungs

but that is rare as well. Much more common is being nauseous or drowsy when you wake up from the sedation. The alternative to this sedation is that we only use local anesthesia or no sedation at all. Do you have any questions?"

**PEARL**- If using ketamine on a child- warn the parents regarding nystagmus and the possibility of emergence reaction ("David after Dentist" on youtube- that is a mild but hilarious emergence reaction) . Describe it as a bad dream. **Can be treated with small doses of Versed (midazolam).**

**Equipment preparation** - most important step- probably only need pulse ox for minimal sedation, but all of this is REQUIRED for moderate sedation and above

- Don't leave anything to chance!
- **Pneumonic- ABCDE PO**
  - o Airway
  - o Breathing
  - o Cardiac Monitor
  - o Drugs
  - o End-tidal CO<sub>2</sub>
  - o Paralytics
  - o Oxygen
- **Airway**- Airway cart to the bedside, all equipment pulled out and measured- correct handle and blade, correct tube size, stylets, etc.
- **Breathing**- Correct sized bag valve mask with right sized face mask hooked up to oxygen, suction available and working
- **Cardiac**- Full cardiac monitor hooked up to patient to include continuous EKG, pulse ox, and blood pressure monitoring
- **Drugs**- Procedural sedation meds drawn up, double and triple check the dose, make sure weight is accurate and in kilograms
- **End-tidal CO<sub>2</sub>**- Place an end-tidal CO<sub>2</sub> monitor on the patient and make sure you have a good waveform on the monitor
- **Paralytics**- Have the RSI kit with paralytic meds at the bedside and calculate dose ahead of time (have it ready,

don't have to draw it up), always have to be ready for RSI with procedural sedation

- **Oxygen**- Place the patient on high flow oxygen a few minutes before you do the procedure and keep it on during the procedure

**PEARL** - High flow does NOT interfere with end-tidal CO<sub>2</sub> monitoring

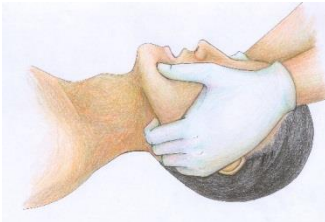
## 20 Procedural Sedation Part 2 - Medications

### Oxygen use during procedural sedation

- My view- use **high-flow oxygen** and **end-tidal CO<sub>2</sub>** on every sedation, lots of literature to say that it prevents desaturation and the need to intervene on the patient's airway. Gives the patient a buffer where they can be apneic but not drop their O<sub>2</sub> sat. Physical exam and observation is NOT sensitive enough to detect apnea- need to use end-tidal CO<sub>2</sub> detector which will tell you the second the patient goes apneic
- Other theory- no oxygen during sedation because you "want to know when the patient goes apneic" More commonly practiced when end-tidal CO<sub>2</sub> monitoring wasn't as available. The problem- without that buffer, patient can desat VERY quickly- gets to 95% then next reading may be 85% or lower. Hypoxia is very bad! Can make an argument that if you don't have end-tidal CO<sub>2</sub> you should do this but I disagree

### Airway interventions- start at the top and work downwards

- Verbal/tactile stimulation- yell patient's name or do a sternal rub
- Reposition the airway- especially if the patient is having snoring respirations- jaw thrust- with both hands, place fingers behind the angle of the mandible and lift up towards the ceiling- double bonus- it hurts!



Kathy Mak

<http://www.aic.cuhk.edu.hk/web8/Modified%20jaw%20thrust.htm>

- BVM ventilation- ventilate the patient using the BVM hooked up to oxygen, use one person to hold the mask in place, the other person squeezes the bag- [see Reuben Strayer's website for a short video](#)

**PEARL**- Ketamine can cause transient laryngospasm, usually in kids but its rare (about 1 in 1000), usually responds to BVM ventilation, however you have to be prepared to do RSI if it is persistent or severe

- Intubation with RSI- **ALWAYS** the final step in any patient who is not oxygenating and ventilating. Need to be prepared to do it with every procedural sedation. This is where having the paralytics at the bedside and the equipment measured ahead of time will save you and the patient.

**PEARL**- Etomidate can cause masseter spasm that may require RSI as well but it is also rare

### Procedural sedation medications

- Minimal sedation- place patient on a pulse ox while using
  - o **Midazolam (Versed)** - benzodiazepine, will make patient sleepy and give anxiolysis
    - Dose - 0.02 to 0.1 mg/kg- 2 to 3 mg/kg IV in an adult
    - Max 5 mg IV at a time- can cause hypotension and respiratory depression,
  - o **Lorazepam (Ativan)** - benzodiazepine - similar to versed.
    - Dose- 0.1 mg/kg- 1 to 2 mg IV in adults, titrate q 5 minutes PRN
  - o **Fentanyl** - short acting opiate
    - Dose- 1 mcg/kg IV, can re-dose q 5 minutes PRN- less hypotension and histamine release than morphine
  - o **Morphine** - longer acting opiate
    - Dose- 0.1 mg/kg IV, most clinicians use 8mg IV as a max, can cause nausea and vomiting, hypotension
- Moderate sedation
  - o **Versed/fentanyl**- least favorite option- hard to titrate, especially the versed, patients have very variable response to versed. Give usual dose **of fentanyl first**, then followed by versed at above dose. Versed takes about 3-5 minute to be effective so be patient- will probably sedate the patient for about an hour and they will be drowsy for a while.

- Cautions: Combination of versed/fentanyl causes more hypotension and respiratory depression than other agents with a long recovery time.
  - **Etomidate** - ultra-short acting non-barbiturate sedative.
    - Dose- 0.1 mg/kg IV- (1/3 RSI dose). Gives sedation for 3-5 minutes but wake up completely alert and oriented. Good muscle relaxation
    - Cautions- can cause masseter spasm that may require RSI (rare), more commonly causes myoclonus (shaking of extremities) that may be mistaken for a seizure, etomidate has no pain control properties, don't push slowly or full effect won't be realized (push over 10-20 seconds- not 2 minutes)
- **Deep sedation** - any agent can cause deep sedation but propofol is the most commonly used drug
  - **Propofol (diprivan)** - sedative hypnotic, quick on/quick off. Unconsciousness within a few heart beats, recovery in 2 to 3 minutes with patient fully awake. Makes it very easy to titrate to correct level of sedation. Can provide excellent muscle relaxation for something like a hip reduction.
    - Dose- 1 mg/kg IV, can repeat doses of 1/4 to 1/2 of first dose as needed to maintain desired level of sedation
    - Cautions - very well known to cause hypotension and apnea, however usually transient given how fast propofol is metabolized. As always, be prepared to intervene on the airway all the way up to an RSI. No intrinsic pain control properties
- **Dissociative sedation – ketamine**
  - **Ketamine- PCP derivative**- Dissociative agent that provides pain control and amnesia while maintaining airway reflexes. Disconnects the brain from the body. Sedation 20-30 minutes IV, 30-40 minutes IM. Onset of action 30-60 seconds IV, longer for IM
- Dose- 1-2 mg/kg IV, 2-4 mg/IM
      - Push slowly, causes apnea if pushed too fast
    - Cautions- Will cause nystagmus (warn parents of pediatric patients about this), avoid in patients with hypertension and coronary artery disease (causes hypertension), in theory- avoid in head injury (raises ICP) but this is debatable and mostly debunked, can rarely cause laryngospasm- usually responds to BVM ventilation but may require RSI, can cause vomiting but this is easily treated with **Zofran (ondansetron)**
    - Emergence reaction- vivid dreams that occur as the ketamine wears off- mostly good dreams but they can be bad and cause the patient and/or family a lot of distress. More common in adults than kids. Can use guided imagery- before you give the ketamine, have the patient think of a nice memory (keep it PG-13 in the adults so they don't go recounting their sexual exploits). Not evidence based (as far as I know) but relatively well accepted. For a child, ask them what they like and have them think about that as the ketamine goes in. You'll be surprised how often this works and they have a good dream.
      - Treating emergence reactions- use small doses of **versed (midazolam)** - probably treats the patient's family and us more than the patient
  - **Ketofol**- a combination of ketamine and propofol- theory is that they counter-act the bad things from each other- propofol causes hypotension but is also an anti-emetic, ketamine causes hypertension but also causes vomiting. Most literature I've seen says that it doesn't improve any clinically meaningful outcomes. Make a 1:1 mixture in the same syringe and dose it as you would dose propofol
    - Example ketofol mixture

- Normal Propofol 10mg/ml
- Normal Ketamine 100 mg/ml (check this as ketamine can also be 50 mg/ml)
  1. Dilute 1 ml of ketamine (100 mg/ml) in 9 ml of normal saline
    - Ketamine is now 10 mg/ml (same as propofol)
  2. In 20 ml syringe- 10 ml of propofol and 10 ml of DILUTED ketamine
  3. Dose- “average 70 kg adult” at 1 mg/kg of propofol = 70 mg of propofol
    - 70 mg of propofol = 7 ml of ketofol (10 mg/ml)

**PEARL-** really make sure you double and triple check your dosing for this, get the nursing staff involved and have two different people look over the drug concentrations, drug dose, and mixture ratio



## 21 Stroke and Transient Ischemic Attack (TIA)

**Stroke-** caused by an acute clot in a cerebral artery (ischemic stroke) or bleeding from cerebral artery (hemorrhagic stroke)

- Ischemic stroke causes- embolized clot (a-fib), septic embolic from a heart valve, embolized DVT with patent foramen ovale
- Hemorrhagic stroke causes- ruptured aneurysm or bleeding from arteries stressed by years of hypertension

**Stroke definition-** an acute onset of a neurological deficit

**TIA definition-** an acute neuro deficit that rapidly improves

- Old definition of stroke- symptoms had to last 24 hours
- Time period is irrelevant in age of thrombolytics since we only have 3 hours (or 4.5 hours in some patients) to give them
- Most TIA symptoms resolve in 30-60 minutes

### **Prehospital concerns**

- Get a good history- when exactly did the symptoms start?  
When was the last time the patient was seen normal?

**PEARL-** Thrombolytic window- 3 hours from onset of symptoms (4.5 in some patients) Patients who “wake up” with symptoms generally aren’t eligible for thrombolytics

- Is this an old neuro deficit or a new deficit?
- Bring family members/bystanders to the ER to help with history, if possible
- Be aggressive with airway management

**PEARL-** **GET A D-stick**- hypoglycemia can mimic stroke (theory- area of brain damaged by a previous stroke is more susceptible to hypoglycemia and causes neuro deficits with low blood sugar)

**Activate stroke protocol (if applicable)** - should alert labs and radiology to expedite labs and page the on-call call neurologist

## **Emergency Department priorities (if not done en route by EMS)**

### **1) Get a good history**

- Find out exactly when the symptoms started, Slurred speech? Confusion? Motor weakness? Any headache or trauma? Any falls?
- Hx of HTN, DM, previous stroke? Surgical history (especially in any surgery in past 14 days, spinal or brain surgery in past 3 months), taking any anticoagulants (warfarin, dabigatran, clopidogrel)?

### **2) Do a rapid neuro exam**

- Use Cincinnati Stroke Scale as a basis
  - **FAST**- **F**acial droop, **A**rm drift, **S**lurred speech, **T**ime from onset
  - Add on to this - extremity strength in all extremities

### **3) Get a D-stick**

- If low, treat and observe for effect, if over 400 may be contraindication to thrombolytics

### **4) IV access/EKG**

- DO NOT let IV access delay transport to CT scanner, if patient is a tough stick then take an IO device to the CT scanner just in case
- **Labs**- CBC, Chem 10, Coags, other testing as clinically indicated

### **5) Non-contrast head CT**

- Do your own wet read looking for blood (bright white) and talk immediately to the radiologist. Defer until creatinine comes back if pt has a history of kidney disease. Acknowledge that you probably don’t have a creatinine back in your chart.
- **Patients with intracranial bleeding aren’t candidates for thrombolytics** If you see blood on the CT, stay in the CT scanner and get a CT angiogram of the brain with contrast (helps determine where the patient is bleeding from).

**PEARL-** the only thing that should delay your transport to the CT scanner is to take the patient’s airway- watch their mental status! Should probably accompany these patients to the scanner with airway equipment

## **Back in ED**

- Repeat your neuro exam and do a [complete NIH stroke scale](#)
  - helps us speak the same language as the neurologists- stroke scale too low or too high may be contraindication to thrombolytics

**PEARL**- important to repeat a neuro exam because if symptoms are improving this could be a TIA

## **Thrombolytics**

- Patient with acute ischemic stroke, in the treatment window, persistent neuro deficit, normal blood sugar, and normal non-contrast head CT
- A word on thrombolytics- lots of controversy in EM regarding their safety and efficacy. Test answer = give them
- **tPA = tissue Plasminogen Activator** – increases conversion of plasminogen to plasmin, plasmin then degrades fibrinogen and fibrin at site of clot; does not attack clot directly, just increased natural rate of clot breakdown

## **Thrombolytic contraindications**

- 4 categories- increased bleeding risk, severe hypertension, history that suggests seizure/SAH, miscellaneous
- Increased bleeding risk:
  - o Surgery or trauma in past 14 days
  - o Intracranial or spinal surgery in past 3 months
  - o Any history of intracranial bleeding
  - o History of brain tumor or aneurysm
  - o Active internal bleeding
  - o Recent puncture at a non-compressible site
  - o Platelets less than 100,000
  - o INR above 1.7 (controversial- some say warfarin use is an absolute contraindication no matter what the INR is)
- Severe hypertension- BP above 185/110 despite aggressive treatment
  - o Use a titratable IV med like **nicardipine**, **labetalol**, or **esmolol** to lower patient's BP to above but no more than 20% in first hour
- History suggesting seizure or subarachnoid hemorrhage
  - o Patients can have neuro deficits after a seizure (Todd's paralysis)

- o Any history of seizure? Intra-oral trauma? Incontinence?
- o A sudden onset of headache could be a SAH- three questions:
  1. Was it sudden in onset?
  2. Is this the worst headache of your life?
  3. Was the headache maximal at its onset?
- o If one is positive, strongly consider SAH
- o Remember that head CT may be negative in the first few hours after a SAH and SAH is an absolute contraindication to TPA
- Miscellaneous contraindications
  - o Pregnancy or lactating
  - o Blood sugar over 400

## **Extended window criteria** (4.5 hours from symptom onset vs. **3) Contraindications for extended window**

- Age over 80
- A history of a previous stroke and diabetes
- More than 1/3 of MCA involved on head CT
- Any history of anticoagulation regardless of INR

## **Use of thrombolytics- TPA most common**

- Get two IV lines if possible (one for TPA, one for other meds)
- Dosing
  - o 0.9 mg/kg (max dose 90mg- maxes out at 100kg)
  - o 10% given as a bolus
  - o 90% given over the next hour
  - o Double and triple check this dose with the entire team
- Routine Foley?
  - o Most medical literature says to avoid Foleys with TPA
  - o Most stroke protocols have it on there
  - o Theory- in case patient gets hemorrhagic cystitis?
  - o If the patient can't void on their own put Foley in prior to TPA
  - o Otherwise not sure about this given risk of catheter related UTI
- **Admit to ICU**

**No bleed but not eligible for TPA**- consult neurology, interventional radiology if available (may be able to do a clot retrieval, intra-arterial TPA)

**Hemorrhagic stroke** - Consult neurosurgery for possible interventions, reverse any anticoagulation, control hypertension below 180/110 but not more than 20% in first hour, transfer if needed for neurosurgical care

**TIA**- Symptoms resolve and do not come back, negative head CT - give aspirin 325 mg PO, if not allergic, and admit for further workup (MRI, Echo, Doppler of carotids)

**Bell's palsy**- stroke mimic, unilateral facial droop and can't close eye w/o any other neuro symptoms, may have viral symptoms, **MUST** involve the forehead or could represent a central stroke (forehead sparing = BAD)

- CT not required for dx- usually caused by viruses
- Steroids effective: prednisone 60mg PO daily for 6 days, taper by 10mg per day over next 4 days.
- Antivirals with less evidence
  - o Acyclovir- 400mg PO five times a day for 10 days
  - o Valacyclovir (Valtrex) - 500 mg PO BID for 5 days, tape eye shut at night
- Lubricating eye drops during the day and lacrilube at night

## 22 Hyponatremia

**Hyponatremia** - serum sodium less than 135 meq/L

- First decision point- seizing, obtunded, or altered mental status?
  - o If yes - go to critical care section
  - o If no - then DO NOTHING (don't try to start correcting the patient's sodium level in the ED)

### *Symptoms*

- Can be vague and non-specific
- Weakness, fatigue, headache, confusion, etc
- May be relatively asymptomatic and hyponatremia discovered during workup for something else
- Usual patient - older patient with "weakness" who is alert and oriented with a sodium of 130 meq/L
  - o This patient accounts for the vast majority of ED patients with hyponatremia

### **Management- alert and oriented patient**

#### **First step- water restrict**

- Write a nursing order to make patient NPO
- Tell patient that they have to be water restricted

#### **Second step- investigate for whether this is acute or chronic**

- Look back in the medical record
- If patient has 3 sets of labs over past 3 months with same sodium level then not that worried
  - o May be possible to discharge patient if they don't need admission for something else
- If this is new for the patient then go to the next step

#### **Third step- investigate for possible cause of hyponatremia**

##### **Causes of hyponatremia**

- Medications are a common cause
  - o Hydrochlorothiazide and SSRIs are common causes
    - SSRIs- Prozac (fluoxetine), Zoloft (sertraline)
- MDMA (street drug "ecstasy") also a cause – pts drink lots of water, and inappropriate ADH release

- o Inappropriate secretion of antidiuretic hormone (ADH) leads to increase free water retention and dilution of sodium level
- Volume losses
  - o Vomiting and diarrhea
- "Leaky fluid states"
  - o Severe liver disease, congestive heart failure (CHF)
- Renal failure
- Endocrine causes
  - o Hypothyroidism and adrenal insufficiency
- "Beer potomania"
  - o Excessive alcohol consumption - alcohols lack electrolytes so drinking large amounts without eating solid food can deplete sodium levels
- Cancer
  - o Lung cancer is notorious for causing hyponatremia
  - o Ask about red flags (unexplained weight loss, night sweats, increased fatigue, unexplained bone or muscle pain, new back pain in an elderly patient)

#### **Fourth Step- Admit the patient and DO NOTHING**

\*\*\***PEARL**\*\*\* Correcting the sodium too rapidly can lead to Central Pontine Myelinolysis which can cause permanent neurological damage and death

- Don't try to correct sodium level in the ED- JUST WATER RESTRICT!
- Resist the urge to gently hydrate with normal saline - even this can raise the patient's sodium too fast
- Inpatient team may want urine electrolytes, osoms, etc.

#### **Hyponatremia critical care - patient is seizing, altered or obtunded**

- Much different patient
- Hypertonic saline to correct sodium until they stop seizing
- Only need to raise sodium about 3-5 points to do this
  - o **Hypertonic saline – 3%**
    - 3 ml/kilogram IV with theoretical max of 100 mls
    - Rapid sequential boluses over max 10 minutes or until seizures stop

- Central access preferred but can give it through a GOOD peripheral IV (AC peripheral, not small hand vein)
- Sodium Bicarbonate
  - A substitute for hypertonic saline in a pinch
  - Equivalent to about 11% hypertonic saline
  - One amp usually is 50 ml but more Na than 3%
  - One amp approx. 210 ml of 3% hypertonic saline
  - Push this slower since more concentrated than 3%
- Benzodiazepines
  - Give Ativan (lorazepam) or Valium (diazepam) in case hyponatremia is not causing seizures and it is a primary seizure disorder instead

\*\*\*PEARL- If you have a patient with seizures that isn't responding to benzos, consider hyponatremia as a cause\*\*\*

- Patient with low sodium (115) but just a little altered and not seizing
  - Give 3% hypertonic saline- 100 ml over one hour
  - Will raise sodium by 2 points

How much to correct the sodium safely?

- Rule of Sixes (borrowed from EmCrit, borrowed from review article)
  - Six points for Severe Symptom, then Stop
    - Once you correct 6 points in 6 hours, stop until the 24 hour mark to avoid overcorrection
  - Six a day makes Sense for Safety
    - More for chronic hyponatremia- don't correct more than 6 points over a 24 hour period

## 23 Hyperkalemia

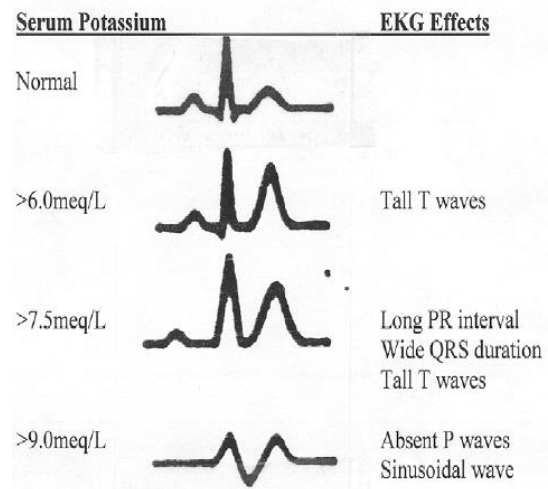
### Hyperkalemia- high serum potassium

- Number one cause- pseudohyperkalemia
  - o Due to hemolysis of blood sample
  - o RBCs hit wall of blood tube and lyse
  - o This falsely elevates potassium level

**PEARL**- ALWAYS check hemolysis level before acting on a potassium level. BUT take it in clinical context- a potassium of 5.2 (upper limit of normal 5) with 2+ hemolysis not worrisome, potassium of 8 with 1+ hemolysis is very worrisome

### First step- Check the patient to ensure stability (ABCs, neuro status)

- Next step - get a STAT EKG
  - o Look for EKG changes
  - o First sign- peaked T waves
  - o Progression to widened QRS
  - o Highest potassium level- sine wave



**PEARL**- Only 20-30% of patients with serious hyperkalemia will have EKG changes. Although the graphic says it- can't accurately predict potassium level based solely on the EKG

### Symptoms of Hyperkalemia

- Can be non-specific
- Nausea, vomiting, weakness, fatigue, altered mental status

### Causes of Hyperkalemia

- Most of the time - renal failure
- Medications- spironolactone, beta blockers, cyclosporine, insulin deficiency (mostly in DKA), crush injuries (rhabdomyolysis)

### Treatment of hyperkalemia

Pneumonic- C BIG K DIE	Mechanism
Calcium	Stabilizes cardiac membrane
Beta Agonists/Bicarb	Pushes K into the cell
Insulin	SAME
Glucose	SAME
Kayexylate (polystyrene sulfonate) And Lasix (or 'LasiKs', furosemide)	Eliminates from the body (causes diarrhea)
DIE- Dialysis	Eliminates from the body

#### - Calcium

- o Calcium gluconate- start with 3 amps IV
- o Calcium chloride- 3 times more calcium, should be given through central line or good peripheral (18 gauge AC, NOT a small hand vein)
- o Mechanism- stabilizes the cardiac membrane, prevents cardiac arrest from hyperkalemia

**PEARL**- Calcium is the most important treatment to give up front and quickly to critically ill patients, most say that you should have EKG changes but calcium is very safe to give

**PEARL**- Mostly debunked but theoretical risk of causing "stone heart" when calcium given to patients with digitalis toxicity. Can't be faulted for giving calcium if you didn't know patient was on dig, if you know they are on dig then document thoroughly that pt was sick and needed calcium. Can reverse with digibind if needed (dig antibody)



- Beta agonists - **Albuterol** neb - one hour neb will bring potassium down approximately 0.5 meq- no IV access required
  - o Mechanism- Drives potassium into the cells
- **Bicarb** - only truly works if the patient is acidotic - DO NOT give in patients with DKA unless they are really sick - fixing their DKA will drive down their potassium
  - o Mechanism - Drive potassium into the cells (if acidotic)
- **Insulin/Glucose** - **10 units of regular insulin IV** with **one amp of glucose (D50)** - check blood sugar first before giving glucose. May not need insulin in patient without diabetes or a patient with high blood sugar but little harm in giving both insulin/glucose
  - o Mechanism- Drives potassium into the cells (insulin required to bring glucose into the cell)
- **Kayexylate (polystyrene sulfonate)** - binding resin that supposedly binds potassium but more likely mechanism is causing diarrhea- not a lot of evidence that it works and can cause harm and can take hours to work. Dose- 15 grams PO or 30 grams PR
  - o Mechanism- Eliminates potassium from the body (via diarrhea)
- **Lasix (furosemide)** - lasix kind of sounds like lasik if you use your imagination - loop diuretic that causes potassium to be excreted into the urine, takes hours to work. Can worsen kidney function - use caution unless already actively on dialysis
  - o Dose - 30 mg IV or daily PO dose as an IV dose
  - o Mechanism - eliminates potassium via urine
- **Dialysis**- the last step in any patient with severe hyperkalemia, especially useful if patient is already on dialysis - do all the other treatments first if you are waiting on nephrology to dialyze

If mild hyperkalemia (6.0 without EKG changes) can start with a beta agonist neb and some insulin/glucose - don't have to throw kitchen sink at the patient unless they are super sick

## 24 Testicular pain

### Most important diagnosis to rule out- Testicular torsion

- Don't let the patient sit out in triage for a long time
- TIME = TESTICLE

### First decision- patient in distress or no apparent distress

- No distress- can get a full history and exam
- Distress- rapid exam and history, **ultrasound**, urology consult

### Usual age of torsion

- Bimodal distribution- neonates and teenagers (ave age 14)
- However, 30% of torsions are over 21 years old

### Anatomical causes of torsion

- "Bell clapper deformity"- testicle is not attached anteriorly to the scrotum like normal
- This allows the testicle to twist on itself -> testicle ischemia

### History

- Onset of pain- When did the pain start
- What was the patient doing when pain started?
- What makes pain better or worse?
- Sudden or gradual onset?
- Constant or intermittent pain?
- Fevers? Urinary symptoms? Abdominal pain?
- Penile discharge? Lesions? Rectal pain?
- Medications, past medical and surgical history, allergies

**PEARL-** Don't discount torsion because patient didn't have direct trauma to the testicle. Mechanisms can be minor or non-existent and torsion can occur during sleep (cremaster contractions during REM sleep)

### Exam

- Do a rapid head to toe exam
- Don't neglect the abdomen! Pain in testicle may be referred from abdomen to the testicle
- Examine the groin for masses, swelling, and hernias
- Try to have the patient stand up to do a testicular exam

- Check the lie of each testicle
  - o Should be completely vertical- **if testicle is at an angle this strongly suggests torsion**
- Check cremaster reflex
  - o Slide glove finger up thigh- should see scrotum retract
  - o **Lack of cremaster reflex strongly suggests torsion**
- Palpate each testicle individually
  - o Start on the unaffected testicle- keeps patient from startling and allows you to get a better exam
  - o Have the patient point to where the pain is
  - o Palpate entire testicle
  - o Epididymis is located on posterior aspect about 2/3rd of the way from the top of the testicle
- Prehn's sign
  - o Elevation of the testicles reduces patient's pain
  - o Suggests epididymitis (reduces stretch on epididymis)

**PEARL-** DO NOT use Prehn's sign to solely rule out torsion. 30% of patients with torsion will have a positive Prehn's sign!

- Check for hydrocele (fluid collection) and varicocele (dilated scrotal veins)

### Patient in lots of distress and/or strong suspicion of torsion?

- TIME = TESTICLE
- **Call ultrasound and urology consult simultaneously**
- Don't delay- salvage rate starts decreasing at 4 hours
- Torsion is a clinical diagnosis but few urologists will take patient to the OR without an ultrasound so bump your patient to the front of the line

**PEARL-** **Get an ultrasound in all patients with testicular pain.** You (and the patient) can't afford to miss torsion- BUT- ultrasound can be falsely negative in a patient who is torsing and de-torsing. The patient may have to go to the OR if the diagnosis and/or ultrasound is equivocal

### Give the patient pain control

- IV morphine, Dilaudid (hydromorphone), fentanyl

## Other testicular diagnoses

### **Epididymitis**- inflammation of the epididymis

- Usually caused by GC/Chlamydia, rarely sterile urine reflux
- Pain can be sudden or gradual- can mimic torsion
- **Check a urine, swab GC/Chlamydia, US**
- In general- Men <35 y.o.- Sexually transmitted infections (STIs); Men >35 y.o. - enteric organisms (E. Coli)
- **Treatment**
  - o **Pain control**- Ibuprofen 400-800mg PO three times per day, opioid for breakthrough pain (Percocet/oxycodone, Vicodin/hydrocodone)
  - o Scrotal elevation- jock strap or two pairs of “tighty whities”
  - o **Antibiotics**
    - STIs - **Rocephin (ceftriaxone)** 250mg IM and **doxycycline** 100mg PO twice a day x10 days
    - Enterics- **Levaquin (levofloxacin)** 500mg PO daily x10 days

**PEARL**- No harm in treating patient with ceftriaxone, doxycycline and levofloxacin to cover all bases if cause is unclear or STI test takes days to come back

### **Torsion of the testicular appendage**

- A small part of the testicle that is not necessary for function
- Can twist on itself and cause pain
- Located close to epididymis- can mimic epididymitis on ultrasound
- “Classic” sign- **blue dot sign near epididymis**
- **Treatment**- pain control, scrotal support, antibiotics if ultrasound is equivocal or suggests epididymitis

### **Varicocele/hydrocele**- PCP/urology routine followup

- Hydrocele- fluid collection in testicle
  - o Small amount of fluid inside testicle is can be normal
- Varicocele- dilation of scrotal veins
  - o Causes dull aching pain

### **Testicular masses**

- Most often found on external exam or ultrasound
- Get **urology followup** (urgent vs. in ED)
- Urology may request **workup labs**
  - o **Beta HCG** (produced by some tumors)

- o **Alpha feto-protein** (usually a send-out test)
- o **LDH**

### **Inguinal hernias**

- First question- does hernia reduce?
- If reduces- routine followup with general surgeon return precautions for hernia that doesn't reduce or causes lots of pain
- If hernia doesn't reduce- consult surgeon
  - o Incarcerated- irreducible hernia
  - o Strangulated- hernia that twists on itself
  - o If incarcerated less than 4 hours can try tilting patient head down on the bed, pain control to reduce
  - o Consult a surgeon before doing this for advice

### **Mumps**

- Viral infection mostly eradicated by vaccination
- Causes testicular pain and swelling
- Supportive care, pain control

### **Fournier's gangrene**- Emergent surgical diagnosis

- Aggressive deep space groin infection
- Most common in immunocompromised and diabetics
- **Discoloration** of the skin, crepitus, tenderness
- Get **STAT CT of abdomen/pelvis with IV contrast**
- **Antibiotics**- **Zosyn (piperacillin/tazobactam)** and **Clindamycin**

### **Manual detorsion**

- If patient has torsion and urologist is far away and/or patient has torted a long time then you may have to attempt manual detorsion
- **“Open the book”**- rotate testicle to the ipsilateral thigh
- Torsions may be anywhere from 180- 720 degrees
- “Open the book” only works if testicle rotated medially
- 30% of children in one study had lateral rotation
- Attempt detorsion- successful if pain relieved, get repeat ultrasound and go to OR non-emergently to secure testicle to prevent re-occurrence
- If pain worse then go the other direction
- Don't totally knock the patient out- need to be awake to see if pain gets better

## 25 Non-invasive Ventilation

### **Non-invasive Ventilation**

- Provides positive pressure to the patient via a tight fitting facemask

### **CPAP- Continuous Positive Airway Pressure**

- Provides a constant level of positive pressure that doesn't vary based on the patient's breathing
  - o Example- CPAP at a pressure of 10 centimeters of water

### **BiPAP- Bi-Level Positive Airway Pressure**

- Provides a baseline level of pressure all the time and increases pressure above that baseline with each inhalation
- Technically BiPAP is a proprietary term but it is often used universally to encompass all modes of non-invasive ventilation
  - o Example- BiPAP at a pressure of 10/5 (centimeters of water) = Pressure of 5 all the time, 10 when the patient inhales

### **BiPAP vs. CPAP**

- No differences in clinically important outcomes in studies
- BiPAP may be more comfortable since it lets patient "rest" in-between breaths
- CPAP tends to be more portable (more used in EMS systems)

### **How non-invasive ventilation (NIV) works**

- Improves laminar flow of air- stents open smaller airways
- This decreases atelectasis which improves pulmonary compliance and decreases the patient's work of breathing
- For pulmonary edema- does not "blow the fluid out of the lungs"
  - o Increases intrathoracic pressure -> decreases venous return
  - o Decreases preload and afterload

### **When to use NIV**

- Any patient with respiratory distress who is not responding to simple interventions like albuterol
- Common indications- COPD, Asthma, CHF, Pulmonary edema, pneumonia
- Can also use NIV to pre-oxygenate prior to intubation
- Don't need to figure out the diagnosis before you start NIV- shoot first and ask questions later- use it early and often
- Least evidence for use in asthma
- Can also use for patients with DNR/DNI to relieve air hunger and/or buy time to address resuscitation status

### **When NOT to use NIV**

- Patients who are unconscious or altered- aspiration risk
- Hypotension- decreasing intrathoracic pressure can decrease BP
- If the patient's mental status decreases, move to intubation

**PEARL** - Make sure the BiPAP machine doesn't have a backup rate that kicks in if the patient goes apneic- you are supporting the patient's ventilation- not providing it

### **NIV and MI**

- Early study with CPAP vs. BiPAP in patients with acute pulmonary edema- more myocardial ischemia in BiPAP group
- Newer and larger studies have not shown this relationship
- Don't let concern for MI stop you from using NIV

### **How to use NIV**

- Get the machine- best to have it already in the ED but call for it early if you don't have it readily available
- Have your airway equipment ready to go if patient gets worse
- Don't just slap it on the patient and turn it up!
  - o This will get you slugged by the patient!
- Coach the patient through it- my standard script
  - o "We are going to help you breathe by giving you a mask. It will blow some air into your face and it will feel really weird but if you relax and let it do some of the breathing for you, I promise you will feel better"

“[Selling Ice Cream in the Desert](#)” - adapted from mdaware.org (Seth Treuger- Twitter- @mdaware)

- Put the mask on with no tubing attached
- Strap the mask firmly onto the patient’s face with an assistant on the other side of the patient
- Set the BiPAP to 0/0 setting at 100% FiO<sub>2</sub>
  - o Blows pure oxygen into the patient’s face to get them used to it
- Start at 0/2 and alternate increasing top and bottom numbers by 1-2
  - o Increase settings every 10-15 seconds
  - o First target 10/5
  - o Can go up to 20/10 as a maximum, some say 25/10
- Keep reassuring the patient
  - o Seth recommends a hand on the shoulder or “smooth jazz PRN”
- SMALL, TINY dose of **fentanyl**
  - o Can help with air hunger
  - o 12.5 to 25 mcg of fentanyl IV
  - o If you get this far, **be 100% ready to intubate**
- **Ketamine and DSI**
  - o This represents the first step of Delayed Sequence Intubation (DSI)
  - o This is an advanced airway technique- can hear all about it at emcrit.org
- The bare bones approach to the above technique
  - o Coach the patient through the process, reassure them constantly
  - o Initial settings of 10/5, go higher after a few minutes if needed

## 26 Psychiatric Medical Screening

### First step = “scene safety”

- Safety of yourself, staff, and the patient
- Patient stripped down to underwear and in a hospital gown
- Clothes and shoes stored outside the room
- Powerful deterrent to the patient suddenly leaving
- If necessary, have security/police search the patient

**Know your state’s laws** on involuntary holds/emergency detention

### Look at chart

- Address abnormal vitals
  - o Pay special attention to fever, tachycardia, low pulse OX
- Read entire triage note for background on the patient
- Is this suicidal ideation (SI) or more of the patient acting bizarrely (more altered mental status than SI)

Introduce yourself to the patient, sit down and listen

- For safety, stay in between the patient and the door
- Don’t get trapped in the room
- Ask the patient why they are in the ED
- Be prepared to listen but be direct if the patient doesn’t talk
- If they don’t volunteer it- ask the patient “Do you want to hurt yourself or anyone else”, “Do you want to die?”
- If the patient has SI, ask them directly what their plan is

**PEARL:** You aren’t going to make a patient suicidal or give them ideas just by asking- you need to ask these questions directly to get the whole story

### Exam and History (Essentially exam for psychiatry)

- Pay attention to the patient’s body language
  - o Are they being evasive?
- Are they hyper and on edge?
- Are they somnolent and depressed?
- Are they blowing off your concerns about SI?
- If the patient has a plan to hurt themselves- how serious are they about carrying it out?

- o Method doesn’t matter- what matters is how much the patient believes it will hurt them
  - Example- 10 motrin won’t kill an adult but if the patient believes that it will, take it seriously
- Ask about **social and psychiatric history**
  - o Social history- who does the patient live with? Support structure? Current life stressors? Drugs or alcohol use?
    - Ask if any guns in the home – hi risk for suicide completion!
  - o Psych history- previous psych admission, medications

Get full medical history- meds, allergies, PMH, PSH

**Do a good review of symptoms-** focus on neuro and endocrine

### Do a good head to toe exam

- Focus on the neuro exam and mental status (A&Ox3?)
- Some suggest doing a mini-mental status on every patient
  - o Probably not necessary but make sure the patient has a clear sensorium/mental status
- Pay attention to any confusion or fluctuating mental status

**Labs-** very low yield on young healthy patients but required by psych facilities/floors prior to admission- trying to catch undiagnosed medical conditions contributing/causing psych condition

### General lab workup with possible explanations

- CBC- anemia
- Chem10- electrolyte disorders (hyponatremia, renal failure, etc.)
- TSH- hypothyroidism (mimics depression)
- Acetaminophen level- very important - OD is asymptomatic and lethal
- ETOH level- general tox workup
- Salicylate level - same (but this is a recognizable toxidrome: tachypnea and respiratory alkalosis, tinnitus, HA, plt dysfunction, hyperthermia)



- UA/Urine Drug Screen- UTI, drugs of abuse
- Urine HCG- females= pregnant until proven otherwise
- EKG- arrhythmias or prolonged arrhythmias (contraindication to some psych meds, *can help you diagnose TCA overdose*)
- LFTs- optional- screen for liver disease?

### Catching the red flags

- Most important part of this workup is to find those patients who have a medical condition causing their psychiatric illness
- Be careful in the young and the old and patients who **all of the sudden** have psychiatric problems **without a previous history**
  - o Example- young patient starts suddenly acting bizarrely- could be herpes meningitis, older patient with SI with no stressors- could be a head bleed

**PEARL- Red Flags-** Sudden onset of symptoms, age greater than 40, visual or tactile hallucinations, fluctuating level of consciousness (delirium)

- Patients with red flags should get a **non-contrast head CT and a lumbar puncture** looking for intracranial masses/bleeding or meningitis and any other indicated testing

**Bottom line-** you have to pretend that you will be the last medical doctor that will see the patient- may be a long time before they see a doctor other than a psychiatrist

### Disposition

**Acting bizarrely with a known history of psychiatric illness-** if history/exam, workup, and sensorium is normal may be able to discharge if the patient doesn't want to stay (you have a right to act bizarrely on the streets as long as you aren't hurting anyone or breaking any laws)- get social services help if you can

**SI/HI-** Should be **evaluated by a psychiatrist in the ED**

- Psychiatrist agrees with admission- admit the patient to the psych floor/facility- may be a long wait- get the patient something to eat, make them comfortable, give **benzos PRN for agitation**

- Psychiatrist disagrees with admission- make sure the patient hasn't changed their story when they talked to the psychiatrist, make sure the psychiatrist has the whole picture/story

Suicide Risk assessment- at community EDs without ready access to psychiatry, may have to make SI low risk vs. high risk decision- go to [blog.ercast.org/suicide](http://blog.ercast.org/suicide) for podcasts and other information on this topic

### Suicide: Risk Stratification

Dr. Rob Orman lecture, 2011

#### Assessment of suicidal patient:

- Primarily based on clinician judgment while weighing risk and protective factors
- 3 red flags (rational thinking loss, ideation, organized/serious plan)

Increased risk	T	Trigger	Acute stressor? <i>Loss of job, support, loved one; anniversaries of loss; recent psych admission or suicide attempt. Teens: disappointment, embarrassment, suicide by peer</i>
	R	Rational thinking loss	Red flag risk: <i>Psychosis, agitation, debilitating anxiety</i>
	A	Age	Age doesn't protect from suicide, but higher risk if age 15-24 and >65 years. 3 <sup>rd</sup> cause of death in age 15-24. Older pts use more violent/lethal methods & give less warning.
	A	Access to means	Are there accessible firearms or weapons? In the US, firearms contribute to 60% of all suicide deaths and are the most common method across all age groups and gender.
	P	Previous attempts	38x increased risk for suicide. Higher risk if previous attempt <1 yr ago or more lethal mechanism.
	P	Previous psychiatric care	Higher risk with higher level of prior psychiatric care (i.e. inpatient)
	E	Excessive ETOH / drugs	50% of deaths involve ETOH intoxication. Increases impulsivity. If d/c patient (no longer suicidal when sober), need outpt substance abuse counseling plan.
	D	Depression, hopeless	Major depression increases risk of suicide 20-fold. Hopelessness is red flag and indicator of depression severity.
	S	Sickness	Medical illness may cause functional limitations, depression, or hopelessness. High risk dz: <i>Epilepsy, malignancy, CNS disorders (MS)</i>
	I	Ideation	Red flag risk: Suicidal ideation (SI) is major precursor to attempted/completed suicide BUT SI denial ≠ zero risk. Study: 78% psych inpts who committed suicide in hosp or shortly after d/c denied SI in last psych eval.
Decreased risk	L	Lack of social support	Lack of PERCEIVED social support. Collaborative history from friends/family helpful.
	O	Organized or serious plan	Red flag risk: More detailed & lethal the plan → greater the risk. Intent to die is more important than lethality of method. If didn't attempt, why not? (protective factors).
	S	Social support	Good support with family, friends, church. <i>Married with children in home</i> is a protective factor.
	A	Awareness	Good insight and coping skills
	F	Future oriented	Thinking about and looking forward to future events.
E	Engaged	Engaged in therapeutic process. Open to participation in evaluation and therapeutic relationship. Does not withhold information.	

## 27 Eye Complaints

### Visual Acuity- The vital sign of the eye

- Make sure it is done in triage
- If not done, get it done ASAP- hanging eye chart in the ED or iPhone app (EyeChart- Free at Apple Store)
- If patient can't see anything- can they see fingers, light, or motion
- If patient doesn't have glasses/contacts- use a pinhole viewer or poke a hole in an index card/piece of paper and have patient hold up to their eye

**PEARL**- Only exception to getting a visual acuity first is a chemical burn to the eye- "test answer" is to get patient irrigated first with copious amounts of water (see section on chemical burns)

### History

- Trauma to the eye, foreign body, or chemical burn?
- Symptoms gradual or sudden?
- Red eye or discharge? Wake up with eyes matted shut?
- Vision loss?
- PMH- Contacts (VERY IMPORTANT TO ASK!)
- Glasses? Last time saw an optometrist/ophthalmologist?
- Hx of eye issues and full PMH, PSH, allergies, meds, etc.

### Exam

- External eye exam- Compare eyes side by side- redness, sclera bleeding, conjunctival injection, lid droop,
- Extra-Ocular movements- trace the H, test accommodation
- Palpate the orbital area for any tenderness/swelling
- Ophthalmoscope exam- check pupil reactivity, bleeding in sclera (subconjunctival hemorrhage), hyphema (blood in anterior chamber)
- Also check for any opaque spots on the cornea (corneal infiltrates/ulcers)- important for corneal abrasions in contact lens wearers
- Evert the eye lids- check for foreign bodies of upper and lower lids, can take moistened cotton swab and wipe inside of eyelids to be sure- foreign bodies can easily hide in the lids

### Topical Anesthesia

- Trauma to the eye can be incredibly painful
- 1-2 drops of tetracaine or proparacaine for pain control/facilitate exam
- Warn the patient that it will sting a little but will feel better- coach them
- Can't send patient home with it (will use too much and impair healing) but small study says dilute proparacaine is ok- needs further study

### Funduscopy exam

- Look for papilledema and changes suggestive of central retinal artery/vein occlusion (see section on CRAO/CRVO)
- Pan-ophthalmoscope is much easier to use
- Check [embasic.org](http://embasic.org) for videos on how to do this exam effectively

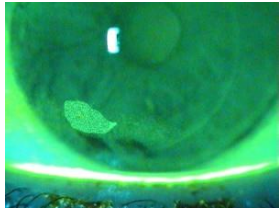
### Slit lamp exam

- Takes a lot of practice- do it on every eye patient to get good at it
- Check [embasic.org](http://embasic.org) for videos on how to do this
- Turn off light and lock lamp into place after exam to prevent damage

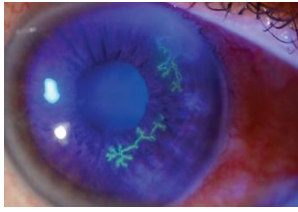
### Fluorescein exam

- Need fluorescein strip, saline, wood's lamp
- Take patient's contacts out (fluorescein will permanently stain them)
- Put strip just above patient's eye, put drop of saline onto strip and let it roll into patient's eye
- Darken room, turn on wood's lamp and examine for any dense, opaque uptake in cornea- will fluoresce = corneal abrasion
- Vertical corneal abrasions = probable upper eyelid foreign body
- Dendritic lesions (herpes simplex infection of eye)
- Seidel's sign- river of fluorescein flowing- indicates open globe

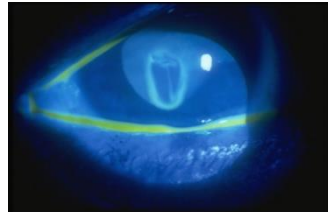
**PEARL**- For routine fluorescein exam, don't have to physically touch the patient's eye with fluorescein strip- technically you should for Seidel's sign but may see it without "painting" it on the eye- try doing it first without touching the eye, if negative then can touch the eye if trauma/suspicious



Corneal Abrasion



Dendritic lesion



Seidel's sign

### Intra-ocular pressure (IOP)

- Done after you have ruled out an open globe- check a Seidel's sign or defer exam if you are very suspicious of one
- Apply topical anesthesia first
- Calibrate tonopen (most common brand in US)- put cover on, press button, hold tip down, flip up quickly to the ceiling when it says "UP"
- Hold patient's eye open, hold tonopen perpendicular to center of pupil, tap lightly multiple times
- Will hear a soft, quick beep with each tap, keep tapping until you get a long, loud beep
- Check the measurement- normal IOP is 10-20

**Final part of exam- do a head to toe exam- don't miss anything!**

### Common eye diagnoses with treatments

**Corneal abrasions**- caused by foreign body or blunt trauma to the eye, dense uptake on fluorescein exam

- **Treatment**- pain control and antibiotics (patching doesn't work)
  - o Pain control- **tetracaine/proparacaine** in ED only, discharge with **Tylenol/motrin +/- oxycodone/hydrocodone** (vicodin/percocet)
  - o Antibiotics
    - Contact lens wearer- have to cover pseudomonas and throw out current contacts, no wearing until they see ophtho in followup
      - **Polymyxin/trimethoprim** (polymixin)
      - **Ciprofloxacin** (Ciloxan)
      - **Ofloxacin** (Oculflox)
      - **Tobramycin** (Tobrex)

**PEARL**- For contact lens wearers, make sure to check cornea for white spots = infiltrates = ophtho referral that same day

- Non-contact lens wearers- can use **erythromycin** ointment instead (doesn't cover pseudomonas but cheap and easier to use in kids) or any of the above antibiotics

**Subconjunctival hemorrhage**- usually a benign diagnosis- patient freaked out when they or someone else notices blood in sclera- should be painless- usually something more serious if associated with pain

- Can be spontaneous or related to vomiting, coughing, child birth



- If visual acuity and exam are normal, **discharge with re-assurance** that will re-sorb in a few weeks
- If on warfarin (Coumadin)- **check INR** and treat PRN- if re-current, outpatient workup for bleeding disorder

### Hyphema



- Usually a result of trauma but can be spontaneous in those with sickle cell
- Blood collects in anterior chamber
- If hyphema + open globe- **emergent ophtho consult**
- **Head of bed to 30 degrees, eye drops as advised by ophtho**
- Usually **admitted** but some studies say outpatient management ok in select cases (about 5% will require surgery)

### Extra-ocular muscle entrapment

- Usually a result of direct orbital trauma- pt complains of double vision
- May be able to see EOM deficit on exam
- **CT orbits** to make diagnosis
- **Ophtho, ENT, or Oral Maxillofacial Surgery consults** or transfer as appropriate (institution and call schedule dependent)

## Retrobulbar hematoma

- EXTREME ocular emergency
- Suspect this if orbit is tense and/or large difference in IOP in setting of trauma
- If not **rapidly decompressed**, can lead to vision loss
- See section on lateral canthotomy below

## Chemical burns

- Important- what patient got in their eye (alkalis worse than acids)
- With few exceptions- need **copious irrigation** with **water/saline until pH is normal (6.5-7.5)**
- Give **topical anesthesia** as well
- Can do this at sink or with bottle of water/saline or morgan lens
- Can also use a bag of saline attached to nasal cannula placed over nose
- Exceptions- elemental metals (sodium/potassium), dry lime, sulphuric acid (drain cleaners)- water will make worse- brush off chemical first
- If job related exposure- should have materials safety data sheet (MSDS) available or look this up online

**Foreign bodies**- if any doubt as to foreign body (for example- working with metal grinder but nothing on external exam), **get CT orbits**, Ultrasound may be more sensitive but CT shows damage caused by FB

## Conjunctivitis

- Can be viral or bacterial
- Bacterial usually purulent discharge, viral watery d/c but lots of overlap
- Difficult to determine viral vs. bacterial- usually err on side of treatment
- **Antibiotics**- same as corneal abrasion including differences between contact lens wearers and non-wearers- throw out contacts as well
- Safe answer is to refer contact lens wearers for ophtho followup but probably overkill
- Hyperacute conjunctivitis caused by gonorrhea- can occur only 12 hour after exposure- copious purulent discharge that

happens suddenly- needs **admission for IV and topical antibiotics, observation for perforation**

## Herpes simplex infection

- Pain +/- vesicles in V2 distribution on face
- Dendritic lesions on fluorescein exam (see above)
- **Ophtho consultation** for further management

## Acute angle glaucoma

- Older patient with sudden eye pain and unilateral vision loss
- Usually when going into dark room, pupil dilates which blocks outflow of vitreous humor through canal of schlemm
- Diagnosis hinges on large difference in IOP between eyes
- Treatment- lower IOP
  - o **Timolol** and **pilocarpine** eye drops
  - o With ophtho input- **prednisolone & acetazolamide IV**

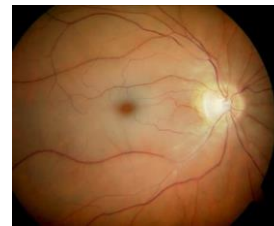
**PEARL**- don't use acetazolamide in patients with sickle cell

## Central Retinal Artery Occlusion- acute clot in retinal artery

- Painless unilateral loss of vision with cherry red spot on macula or whitening of retina on fundoscopic exam
- Usually has risk for clot or emboli like a-fib
- Intermittent digital massage of eye to dislodge clot
- Lower IOP with **timolol, pilocarpine, acetazolamide**
- **Rebreathe into paperbag** to increase CO<sub>2</sub> and lower IOP
- May need **paracentesis** of anterior chamber
- **IV TPA** has been used but not standard treatment

## Central Retinal Vein Occlusion

- Sudden painless unilateral vision loss
- **Same treatments to lower IOP**
- Much more often surgical management



Central Retinal Artery Occlusion



Central Retinal Vein Occlusion



## **Retinal Detachment**

- Spots and floaters in patient's vision
- Can use **ultrasound** for diagnosis but not highly sensitive
- If suspicious, consult ophthalmology

## **Lateral canthotomy**

- If suspecting retrobulbar hematoma- cut first, ask questions later
- If you do in unnecessarily- not a big deal- usually heals on its own, if you don't do it and patient needed it- permanent vision loss
- Numb up lateral canthal area with lidocaine with epi, procedural sedation PRN but preferred without- want to ask patient if vision better
- Clamp lateral orbit with hemostat for 30-60 seconds to devascularize
- Cut laterally with scissors (iris scissors if you have it, otherwise any scissors from laceration tray should work)
- Then cut superior and inferior tendon, check patient's eye and IOP to see if it worked
- If it didn't work, re-cut and be more aggressive- most common area is not actually snipping the tendons

## **Links**

Slit lamp exam- 24 minutes but excellent and great videos of actual exams- worth watching the whole thing

[https://www.youtube.com/watch?v=w9wMJ6job\\_o](https://www.youtube.com/watch?v=w9wMJ6job_o)

Funduscopy exam- kind of cheesy but effective

<https://www.youtube.com/watch?v=wPzCA9k8GRQ>

Pan-ophthalmoscopy-

[https://www.youtube.com/watch?v=a9rhPWqV\\_ac](https://www.youtube.com/watch?v=a9rhPWqV_ac)

Ocular ultrasound- from the ultrasound podcast

<http://www.ultrasoundpodcast.com/2012/04/episode-26-ocular-ultrasound-with-chris-fox/>

Lateral Canthotomy on a cadaver

<http://www.youtube.com/watch?v=cAYBGW3c95M>

## 28 Seizures

- Chart- read triage note, check vital signs, get full history from triage note/paramedics

### Patients who are not actively seizing

- Get a thorough history of the incident
- Any preceding headache, vision changes, aura?
- History of seizure disorder or seizure medications?
- History of preceding trauma or fever?
- Ask bystanders what they witnessed
  - o Loose and floppy with shaking or tense all over?
  - o Eyes open or eyes tightly shut?
  - o How long did it last?
  - o Shaking all over or just one extremity?
  - o Bowel or bladder incontinence?
  - o Confusion after the seizure (post-ictal period)?

**PEARL**- Patients with syncope can have a few non-sustained myoclonic jerks that aren't seizures. On the flip side- make sure this "seizure" wasn't syncope. Syncope is a rapid loss of consciousness and postural tone with a rapid return to baseline.  
Have a low threshold for an EKG.

### Medical history

- Full past medical and surgical history, med list, allergies
- Pay attention to the medication list
- Ask specifically about illicit drug use
- Previous workup
  - o Previous seizures, previous neuro workup or CT/MRI

**Physical exam**- Full head to toe exam for trauma and complete neuro exam

### Categories of seizures

#### Primary or Secondary

- **Primary**- seizure disorder (epilepsy)
- **Secondary**- caused by another process (meningitis, tumor, etc)

#### Generalized or Partial (Focal) Seizure

- **Generalized** - involves both cerebral hemispheres and the entire body

- o Tonic/Clonic - most common (alternating contraction and relaxation)
- o Absence - pediatric disorder - staring off into space for 5 to 30 seconds at a time
- **Partial (Focal)** - involves one hemisphere
  - o Simple - no loss of consciousness
  - o Complex - Loss of consciousness

### **Causes of secondary seizures- AMS differential (AEIOU TIPS)**

**A**- Alcohol/Acidosis

**E**- Electrolytes

**I**- Insulin/Ischemia

**O**- Oxygen

**U**- Uremia

**T**- Toxidromes / Trauma / Temperature

**I**- Infection

**P**- Psych / Polypharmacy

**S**- Stroke/Space occupying lesion / SAH

### **Condensed differential- TINE (or NETTI?)**

**T**- Trauma / Tox

**I**- Infection

**N**- Neurologic

**E**- Electrolytes

**PEARL** - Remember Todd's Paralysis. Some patients can have focal neuro deficits after a seizure that can be mistaken for a stroke. Make sure that your stroke patients don't have a history of preceding seizure- it may make them ineligible for thrombolytics.

**Pseudoseizures**- new term is Psychogenic Non-Epileptic Seizures (PNES) or Non-Epileptic Attack Disorder (NEAD)

- These are episodes that are a patient's reaction to stress. They are NOT faking these episodes and can't control them. This doesn't represent a patient trying to get out of jail by faking a seizure.
- To a bystander, it will look like a seizure. **Best sign of a pseudoseizure - eyes closed tightly instead of wide open.** Generally patients are **tense instead of loose and floppy**.
- Also- **no post-ictal confusion with pseudoseizure**- patients will wake up awake and alert immediately after pseudoseizure stops (cannot have a generalized tonic-clonic seizure without some post-ictal confusion)



- Patients may take years to get diagnosed. It's important to remain non-judgmental. It may take years for them to get a proper diagnosis.

**PEARL** - 10-30% of patients with pseudoseizures will also have a seizure disorder diagnosed by EEG so the two can co-exist

**Workup and Treatment**- Patient who isn't seizing, awake and alert

- **New onset seizure without other suspected cause like trauma/meningitis**
  - o **Labs** - CBC, Chem 10, urine HCG, +/- EKG (all low yield)
  - o **Urine drug screen** - controversial whether needed, consider
  - o **Fingerstick glucose** (low yield unless diabetic)
  - o **Non-contrast head CT**- eval for mass
- **Patient with a known seizure disorder - no suspected secondary cause**
  - o Shouldn't need a lot of testing- **urine HCG mandatory**
  - o Find out if any missed seizure med doses
  - o Search for physiologic stresses that could have triggered it
  - o No imagining needed unless they have NEVER had a CT/MRI
  - o Can draw levels of seizure meds
    - **Dilantin (phenytoin)** usually available on a STAT basis but others such as **Keppra (levetiracetam)** are send outs
  - o Can consider giving the patient a dose of seizure med in ED
    - **Keppra (levetiracetam)**- 500mg IV
    - **Dilantin (Phenytoin)**- 20 mg/kg IV
    - There are rapid oral loading protocols for Dilantin
  - o Can refill patient's seizure medication if needed but give limited amount (1 week or less) to ensure follow up
- **Disposition of patients not seizing**
  - o New onset seizure
    - Discharge with neurology or primary care follow up

- Usually won't start a seizure medications until 2nd or 3rd seizure

**PEARL**: Make sure to give very specific discharge instructions to avoid dangerous activities that could result in bad thing if patient has another seizure like driving, operating heavy machinery, SCUBA diving, skydiving, etc. Also shower with a chair in the shower in of another seizure with someone nearby just in case, no baths. Check your state and local laws regarding notification of the Department of Motor Vehicles for license suspension. This may be a mandatory reporting in your state

### Treatment of active seizures

**Rule #1 \*\*\* ALL PATIENTS WITH AMS ARE HYPOGLYCEMIC UNTIL PROVEN OTHERWISE \*\*\***

- If you can't get a fingerstick blood sugar, give **one amp D50**

**Rule #2- Patients with seizures die from hypoxia**

- Apply a non-rebreather at 15 LPM, can put nasal cannula under mask for extra oxygen and for apneic oxygenation if RSI needed
- Pulse ox readings may be inaccurate in seizing patients - if patient has signs of cyanosis, perform RSI

**Rule #3- Seizures are treated by benzos, benzos, and more benzos**

- Start with **Ativan (lorazepam)** - 2-4mg IV or double dose IM
- **Versed (midazolam)** - 10mg IM- shown effective in [RAMPART trial](#)
- **Valium (diazepam)** - can be given but short half-life, not favored
- Give multiple rounds of benzos in increasing doses

**PEARL**- If you can't secure an IV, don't hesitate to insert an IO, all labs except potassium will be same as labs from an IV

**Differential** - after first round of benzos, consider possible secondary causes of seizures

- **Labs** - CBC, chem 10, creatinine kinase, LFTs, acetaminophen, aspirin, and ethanol levels, UA, serum or urine HCG (females), urine drug screen
- **EKG** - hard to get while seizing, TCA overdose can cause widened QRS
- **Non-contrast CT head**- for new onset seizures

**Treatment of Status Epilepticus** - continuous seizures for more than 5 minutes or multiple seizures without return to baseline (Represents a much more severe seizure)

**Second line medications - rule of 20s**

- **Phenytoin (Dilantin)** - 20 mg/kg IV, don't max out at 1 gram
  - o Given at rate of 50 mg/min
- **Fosphenytoin (Cerebryx)** - 20 mg/kg IV
  - o Preferred agent- can be loaded 3 times faster (150 mg/min)
  - o No harm if it extravasates like phenytoin
  - o Won't precipitate in IV line when combined with benzos
- **Keppra (levetiracetam)** - 500mg IV
  - o Little evidence in status but can try it as part of "kitchen sink approach"
  - o Common outpatient medication, may be worth it to try
- **Phenobarbital** - 20 mg/kg IV
  - o Will likely make the patient apneic, be prepared for RSI

**RSI in status**

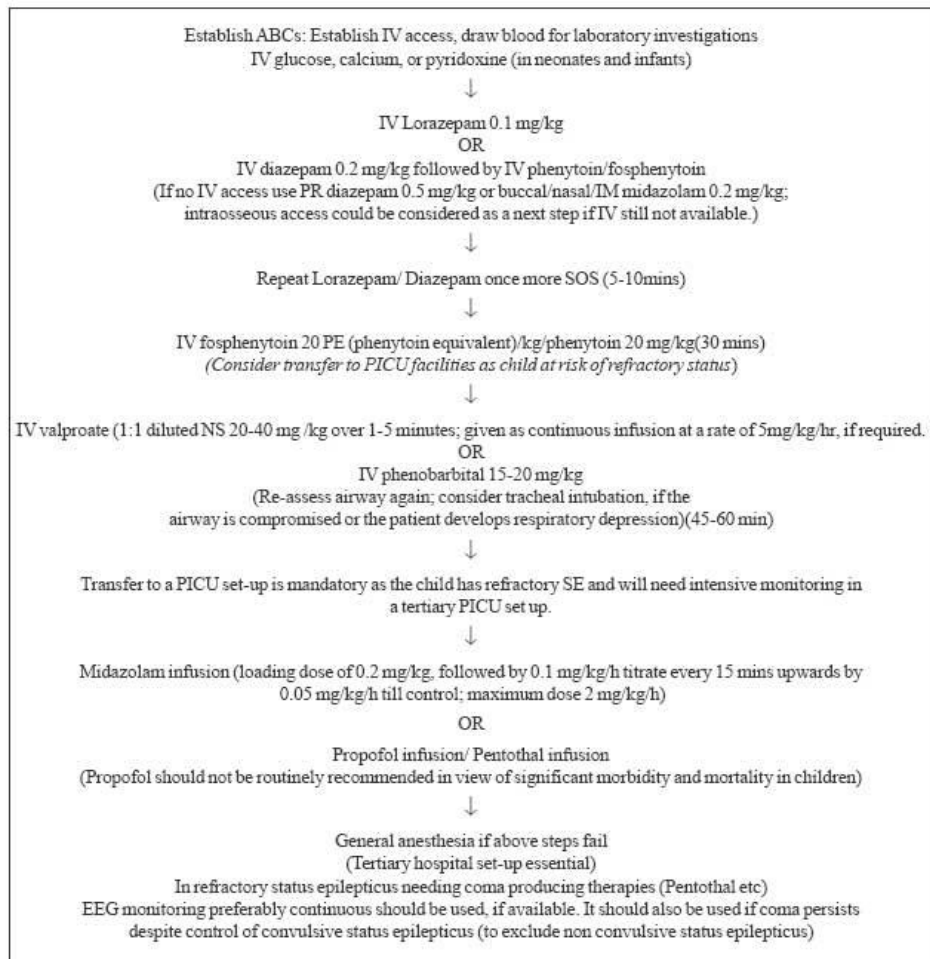
- **Medications**- etomidate fine, ketamine or propofol (diprivan) may be better in status- some evidence for benefit
- **Paralytics**- hotly debated
  - o **Succinylcholine (aka suxs)** - gets neuro exam back in 5-10 minutes, has downsides of hyperkalemia, malignant hyperthermia, etc.
  - o **Rocuronium**- no downsides of suxs but lose neuro exam for 30-45 minutes
- Some prefer to have neuro exam back with suxs, however in these patients will be getting stat EEG and admitting to ICU- rocuronium is ok to use as long as you continue aggressive treatment for status
- Any patient in status should **get a neurology consult for a stat EEG**

**Third line medications**- versed (midazolam) drip, valproic acid, propofol drip- do this in consultation with neuro

**Seizures from hyponatremia**

- Will likely find this out when chemistry panel comes back
- Suspect this in patients who have consumed a lot of water, GHB ingestion, history of chronic hyponatremia
- 3% Hypertonic saline
  - o Only need to increase sodium by a few points to stop seizures
  - o Give 2-3 ml/kg of 3% hypertonic saline (**notice the 3s**) through a large bore, good IV/IO in rapid sequential boluses until seizures stop (150-200 ml in 70kg adult)
  - o After seizures stop, stop hypertonic saline, recheck sodium level, and slowly replace sodium over next few days as an inpatient.

## Status epilepticus algorithm pocket guide (Pediatric but it works for adults too)



## 29 Anaphylaxis - Diagnosis and Treatment

**Initial Assessment**- rapidly evaluate the patient's airway breathing and circulation

Assessment Triangle:

- **Appearance**- overall appearance
- **Work of Breathing**
- **Color**- skin color- hypoxia? Pallor?

Vitals- pay attention to hypoxia or low blood pressure

**History** - once you have established that the patient is stable

- **Onset** of symptoms- what was the patient doing
- **Exposure to known/suspected allergens?** - insects and food most common
- **Trouble breathing?**- most will say "tickle" or tightness in throat- not as worrisome if breathing easily and no stridor
- **Skin symptoms** - any itching, rash, skin erythema, swelling

**PEARL:** If patient can vocalize a high pitched "EEEE" then airway swelling is unlikely

- **GI symptoms** - persistent abdominal pain or vomiting- one of the criteria for anaphylaxis (discussed later)

**Past medical history**- medication, allergies, surgeries, etc. Any new medications or changes in doses?

**Exam** - start with the airway

- **Face**- swelling, erythema
- **Oropharynx**- swelling, erythema- check a [Mallampati](#), mouth opening, vocalize a high pitched "EEEE"
- **Lung sounds**- clear vs. stridor/wheezing?
- **Skin exam**- rash, urticaria/hives? (don't forget the back!)
- **Rest of Head to Toe Exam**- be complete

**Treatment of Mild Allergic Reactions** (skin findings only, stable vital signs, don't meet criteria for anaphylaxis)

- **Antihistamines- Benadryl (diphenhydramine)** - 25-50 mg IV, can also give same dose PO if very mild reaction, 1 mg/kg IV for children
- **H2 blockers- Zantac (ranitidine)** 50mg IV or **Pepcid (famotidine)** 20mg IV.
- **Steroids**- take 4-6 hours to work, **Prednisone** 50mg PO (1 mg/kg peds), **Solumedrol** 125mg IV (1 mg/kg IV)

**PEARL:** IV and PO steroids have equal bioavailability, only use IV steroids if patient can't swallow medications

**PEARL:** The above medications have NO place in the treatment of anaphylaxis- we give them as part of the "kitchen sink approach" but the **treatment for anaphylaxis is epi, epi, and more epi**

### Diagnostic Criteria for Anaphylaxis

Combination of:

- Skin findings (rash, itching, hives) with:
- Low Blood Pressure
- Respiratory Compromise- stridor, dyspnea, wheezing
- Persistent GI symptoms- abdominal pain, N/V

**PEARL:** Skin findings aren't necessary to diagnose anaphylaxis if patient is exposed to a known or suspected allergen and has low BP, respiratory compromise or persistent GI symptoms (don't forget to ask about GI symptoms!)

### Epinephrine (Epi)

- **Sub-cutaneous injections (sub-q)**- not done any more- shallow injection- sub-q layer not well perfused when pt is in shock
- **Intramuscular (IM)**- 0.3mg IM adult, 0.01 mg/kg peds x3 total doses
- **Epi-Pen**- some hospitals stock this in crash cart to avoid confusion about dosing- 0.3mg Epi-Pen IM for adults, 0.15mg Epi-Pen Junior IM for peds

## A word on concentrations of Epi

- 1:1,000: Concentrated Epi for IM injection (1 mg/mL)
- 1:10,000: "Crash cart" Epi- only for patients without a pulse (0.1 mg/mL)
- 1:100,000: Concentration of Epi in lidocaine with epi and epi drip, won't cause tissue damage
- **IV Epinephrine**- for patients who don't get better from IM Epi
  - o Two options- push-dose or drip
  - o **Push dose Epi**
    - 10 cc of normal saline (NS), discard 1 cc = 9cc of NS
    - Crash cart Epi- 1 cc Epi added to 9 cc of NS
    - Push 1-2 cc every 2-3 minutes as needed until patient improves
    - Math:
      - 1 amp Crash cart Epi (1:10,000) = 1 mg Epi in 10 cc or 1,000 micrograms in 10 cc = 100 micrograms per cc
      - 100 micrograms per cc diluted 10 fold (9 cc NS) = 10 micrograms per CC
      - Same concentration as 1:100,000 Epi (safe for local anesthesia and tissues)
  - o Epi drip
    - 1 amp crash cart Epi (1mg)
    - Added to 1 liter of NS
    - Run at 60 cc/hr, titrate up by multiples of 60 cc/hr (or just start at 600 cc/hr)
    - Math
      - 1 amp crash cart Epi = 1 mg Epi = 1,000 micrograms Epi
      - 1,000 micrograms of Epi added to 1,000 cc of NS = 1 microgram Epi per cc
    - Usual Epi drip run at 2-20 micrograms per minute
      - 1 microgram per minute = 1 cc per minute = 60 cc/hr
    - Even more dilute that 1:100,000 Epi so no concerns about tissue extravasation

**PEARL:** ALWAYS be sure to label your syringes and IV bags if you mix up push-dose or a drip

## Special Situations

- Patient on Beta Blockers- they inhibit action of Epi, need to give glucagon to counteract (works by different pathway instead of Epi)
  - o **Glucagon**- 1-5mg IV given slowly over 5 minutes, frequently causes vomiting, **give with Zofran (ondansetron)**

**Fluids**- Give fluid boluses 1-2 liters of NS at a time, anaphylaxis causes vasodilation and capillary leak

**Vasopressors**- If Epi doesn't work, can try **dopamine** or **norepinephrine**

## Disposition

- **Mild allergic reactions**- skin findings only, no diagnostic criteria for anaphylaxis
- Discharge medications
  - o **Benadryl** 25-50mg PO TID PRN itching
  - o **Prednisone** 50mg PO daily for 5 days
  - o **Zantac** 150mg PO BID for 7-10 days
- **Patient given Epinephrine**- observe for at least 4-6 hours in the ED to make sure patient doesn't have rebound (repeat) reaction, low threshold to admit
- **Must discharge patient with Epi Pens**- prescribe at least 2 Epi-Pens- one for patient to carry with them at all times, one for home/school
  - o If possible- prescribe 3 Epi-Pens to have one on the patient at all times, one at home/school, and one in car (not great to have in hot cars in hot climates but better than nothing)

**PEARL:** Be very clear with your discharge instructions about following up with primary care doctor and how to use Epi-Pen. Tell the patient not to wait for EMS to give Epi or it may be too late.



## 30 Monoarticular Arthritis

Dr. Brian Cohn ([EMJ Club](#))

### Anatomy

3 types of joints: synarthrosis (skull suture lines), amphiarthrosis (e.g. pubic symphysis), and diarthrosis (e.g. shoulder, knee, etc.)

### Degenerative Arthritis (Osteoarthritis)

- Most common form of arthritis in adults. Risk factors include obesity and prior injury. Trauma, activity, and weather change can exacerbate symptoms.
- **Osteophytes**: Bouchard's nodes at PIP joints, Heberden's nodes at DIP joints.
- **Treatment**: NSAIDs, rest, ice for acute exacerbation; acetaminophen, strengthening, weight loss for chronic symptoms.

### Crystalline arthropathy

#### Gout

- Caused by monosodium urate crystal formation. Risk factors include thiazides and alcohol.
- The MTP joint is the most common site (Podagra) followed by the knee, ankle, and tarsal joints.
- Presents with **warmth, erythema, swelling, and pain with movement of the affected joint**.
- Serum uric acid levels are not helpful in ruling in or out disease. Diagnosis confirmed **arthrocentesis** and by the presence of needle-shaped, negatively birefringent crystals on synovial fluid microscopy.
- **Treatment**: 1st line = **colchicine** (if started in first 12-24hr of attack) or **NSAIDs** (indomethacin, ibuprofen, naproxen); 2nd line = **glucocorticoids**.

#### Pseudogout

- Caused by deposition of calcium pyrophosphate. Often manifested by chondrocalcinosis on x-rays: calcification of the synovium and surrounding ligaments.

- Presentation is similar to gout. Diagnosis is made by **arthrocentesis** and the identification of rhomboidal, weakly positive birefringent crystals on synovial fluid microscopy.
- **Treatment** is primarily with **NSAIDs** or **glucocorticoids** (colchicine may not be effective).

**Septic Arthritis**: 3 routes of infection: 1) hematogenous spread, 2) direct inoculation, and 3) contiguous spread.

### Pediatric Septic Arthritis

- Primarily occurs by hematogenous spread, and 80-90% of cases involve the lower extremities (knees and hips most common). Can lead to avascular necrosis, particularly when the hip is involved in children < 1 year of age.
- **Clinical presentation may be nonspecific or vague, particularly in the preverbal child (limp, decreased ROM, "pseudoparalysis," fever, sepsis, irritability)**. Erythema, warmth, and swelling are frequently noted over the joint; fever is absent in up to 1/3 of cases.
- The **peripheral WBC** is < 15K in about 1/2 of pediatric cases. ESR and CRP are not diagnostic. **X-rays** should be obtained to r/o fracture or other bony abnormality. **Joint fluid** should be sent for cell count/diff, gram stain, and culture; **blood cultures** should be sent as well.

< 2 mo	S. aureus, Group B strep, gram-neg coliforms	<b>Vanc + cefotaxime</b>
2mo – 5yrs	S. aureus, Group A strep, S. pneumonia	<b>Clinda or Vanc</b>
5 yrs to adolescence	S. aureus, Group A strep, N. gonorrhoea	<b>Clinda or Vanc + Ceftriaxone</b>

- Parenteral antibiotics should be tailored to the most likely bacteria based on age group:
- *N. gonorrhoea* can also be seen in neonates. Patients with sickle cell disease are susceptible to *Salmonella* infections and should also be treated with a **3rd generation cephalosporin**.
- Orthopedic consultation and hospital admission



## Adult Non-Gonococcal Septic Arthritis

- Risk factors include IV drug abuse, HIV, DM, immunocompromised, chronic arthritis, and prosthetic joints. Most commonly occurs by hematogenous spread.
- Predominantly involves gram positive organisms (75-90% of cases), most commonly *S. aureus*, though gram negative bacilli are involved in 10-20% of cases. *Pseudomonas* and *S. aureus* are most common in IV drug abusers.
- The absence of most risk factors (age > 80, HIV, DM) and exam findings (swelling, tenderness, erythema, warmth, fever) do not reliably exclude SA.
  - o The presence of a **skin infection overlying a prosthetic joint** is **highly concerning** for SA
  - o The **absence of pain with joint movement essentially rules it out**.
- Serum WBC, CRP, and ESR also perform poorly at ruling in or out disease.
- **Interpreting Synovial WBC**
  - o Synovial **WBC < 1,700** makes the probability of SA in a native joint **unlikely** (negative LR 0.07).
  - o A synovial **WBC > 100K** makes the diagnosis **highly likely** (positive LR 13.2).
  - o A synovial WBC in between these values is not diagnostic by itself. Synovial lactate, while promising, is not yet ready to be used in evaluating SA.
- **Treatment** involves **surgical arthrotomy** (consult orthopedics) with irrigation and debridement, though some studies suggest serial aspiration may be as effective. **IV antibiotics** should be used in conjunction with either treatment modality.
- Prosthetic joint infection is divided into early, delayed, and late types. Much lower synovial WBCs are seen compared to native joint SA, and WBC of 1,700 is sufficient to make the diagnosis. **Treatment** involves **hardware removal, antibiotic spacers or beads, and IV antibiotics**. When SA is suspected in a prosthetic joint, evaluation should proceed in **consultation with the orthopedist**.

## Gonococcal Septic Arthritis

- The most common form of joint infection in sexually active patients. Less likely to result in joint destruction than nongonococcal SA. Systemic gonococcal infections occur in 0.5-3% of infected patients.
- Two musculoskeletal syndromes associated with systemic gonococcus.
  - o **Disseminated gonococcal infection:** bacteremia, diffuse migratory arthralgias, tenosynovitis, and skin lesions. Not typically associated with purulent arthritis, but some overlap does occur.
  - o **Localized purulent septic arthritis**, more often oligoarticular than monoarticular.
- **Synovial and blood cultures** only positive in 10-50% of cases, so **cervical, urethral, rectal, and pharyngeal cultures should be obtained**. The **synovial WBC** is typically lower than in nongonococcal SA.
- **Treatment involves parenteral third-generation cephalosporins (i.e. ceftriaxone)**.

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## 31 Chronic Obstructive Pulmonary Disease (COPD)

Dr. Timothy Peck and Dr. Colby Redfield

**Triage Note:** 2 days of increasing SOB BIBEMS; given duonebs in truck; no chest pain.

**Vitals:** HR 70 afib, BP 140/80, RR 28<sup>1</sup>, O<sub>2</sub> 98% NRB, T 98.2°F

### SOB Differential Diagnosis:

- Cardiac – MI, angina, CHF, arrhythmia, pericarditis/effusion, myocarditis
- Vascular – AS, P-HTN, PE, Aortic Dissection
- Pulm – COPD, asthma, PNA, cancer, abscess, contusion, ARDS
- Airway – obstruction, epiglottitis, croup
- Extrapulm – PTX, pleural effusion
- Diaphragm/Muscular – trauma, GBS, MG
- Brain – stroke, opioids, tox
- Systemic – anemia, sepsis, DKA, AKA, acidosis, tox

### Assessment Triangle:

- Appearance- overall appearance (alert, posture, comfortable)
- Work of Breathing (fighting for air, able to talk in full sentences, making noise?)
- Color- skin color- hypoxia? Pallor?

**Vitals-** pay attention to tachypnea, hypoxia, tachycardia, and hypotension

- Common pathways to dying = can't breathe, don't have enough O<sub>2</sub>, heart doesn't work, don't have enough volume

**History** - efficient history taking is key in the short of breath patient

- **Try to differentiate from cardiac-** do you have chest pain? (MI, angina)

- **Onset of symptoms-** when exactly did this start? Sudden or gradual?
- **Duration/progression of symptoms-** has it gotten worse since it started?
- **Past episodes-** have you ever had this before? When?
- **Rule out other causes-** does it vary with position (CHF, pericarditis), did you fall (chest wall or CNS trauma), fam/personal hx of PE, unilateral leg swelling (PE), cough/fever/mucus (bronchitis, PNA), blood thinners (anemia), rashes (allergic, meningococcus)
- **Trouble breathing?-** most will say “tickle” or tightness in throat- not as worrisome if breathing easily and no stridor
- **Skin symptoms-** any itching, rash, skin erythema, swelling

**PEARL:** In patients with shortness of breath who are having trouble speaking to you, EMS can be a wealth of information

**Rosen PEARL:** “You have to have patience. It's not the patient who is the bad historian, it's the doctor.”

**Past medical history-** have they ever been intubated, admitted to the hospital/ICU? Medication (are they currently on prednisone). Home O<sub>2</sub>? Allergies, surgeries, etc.

**Exam-** quickly assess airway, breathing, circulation, and mental status

- HEENT- airway ([Mallampati](#), edema, denture, LEMON), JVD
- Lungs- respiratory effort, accessory muscles, belly breathing, lung sounds (wheezing vs. quiet)
- CV- heart murmurs, LE swelling, distal pulses, rate/rhythm
- Extremities- bilateral pitting edema, cool v warm, unilateral swelling
- Skin exam- petechiae, hives, pallor
- Rectal- if anemic and don't have a source
- Rest of Head to Toe Exam- be complete (especially if stable)

## Diagnosics

**Rosen PEARL:** If you wouldn't want to pay for it, don't order it

- Labs- BNP, VBG, CBC (anemia), Chem 7 (tox/met/acid/base), troponin
- EKG- arrhythmia, tachycardia, (N)STEMI, right heart strain, tox
- CXR- eval for PNA, PTX, CHF, bullae, air trapping
- Bedside US: PTX, pericardial effusion, pleural effusion, CHF, right heart strain/septal bowing

## Treatment

- **Albuterol** - only a temporary fix; beta 2 agonist, bronchodilator; q20 min or continuous via nebulizer
- **Ipratropium** - short acting inhaled anticholinergic, bronchodilator; q20 min with albuterol nebs; controversy on how often to give, institution specific
- **Oxygen** - titrate to 90-95% or to patient's personal goal O2 saturation (if known), i.e. titrate to 'where they normally live.'
- **Steroids** - take 4-6 hours to work,
  - o **Prednisone** 40mg PO or
  - o **Solumedrol** 125mg IV (1 mg/kg IV)

**PEARL:** IV and PO steroids have equal bioavailability, only use IV steroids if patient can't swallow medications

- **Antibiotics** - Indications-current recommendations are to give if pt has **1) increased sputum, 2) dyspnea, and 3) sputum purulence**
  - o Abx Choice: **macrolide** (azithromycin), **tetracyclines** (doxycycline), respiratory **fluoroquinolones** (levofloxacin or moxifloxacin), **amoxicillin +/- clavulanic acid**
  - o Treat for 5-10 days (Institution specific)
- Noninvasive Positive Pressure (BiPAP/CPAP)
  - o Avoid intubation at all costs!
  - o Noninvasive positive pressure can prevent many intubations. Use it liberally and early before the patient becomes hypercarbic and loses their mental status.

## Disposition

- ICU: all patients requiring noninvasive positive pressure or intubation. Consider ICU for patients with multiple comorbidities which may worsen their COPD exacerbation in of themselves (eg CHF, PNA).
- Ward: any patient with active comorbidity not easily corrected in ED (anemia, PNA, CHF). Patients not back to their baseline O2 saturation or baseline exercise function.
- Home: Make sure patient has good follow up and good social situation (can get medications from pharmacy, has help at home, etc.).
- If patient requires home O2 at baseline, ensure they have it available upon going home.

## Discharge medications

- All COPD exacerbation patients get steroids:
  - o **Prednisone 40mg PO daily** for 5 days
- Continue home inhalers:
  - o **Albuterol** IH prn
  - o **Tiotropium**
  - o **Salmeterol**

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## 32 Pulmonary Embolism I - Risk factors, Symptoms, & Testing

- **Pathophysiology** - PE is usually from a clot in the deep veins of the lower extremities or pelvis and has travelled or embolized to the pulmonary vasculature. (Clots in upper extremity much less worrisome for PE- but it's a whole other topic for another podcast)
- Clot lodges into pulmonary artery -> increased pulmonary vasculature resistance -> decreased in preload.
- Section of lung supplied by that pulmonary artery branch can't oxygenate -> hypoxia and chest pain
- Clot causes mechanical obstruction of pulmonary artery -> backpressure on the right side of the heart -> left sided heart failure -> hypotension and shock

### Virchow's triad - hypercoagulability, stasis, and vascular injury

- Hypercoagulability - usually inherited diseases like Factor V Leiden, Protein C and S deficiency, also cancer
- Stasis - staying still for a long period of time
- Vascular Injury - some sort of injury to vascular basement membrane to form clot - while trauma does put pt at risk, doesn't have to be present - older pts (over 60) have older vasculature that is prone to "injury"

**PEARL**- don't need to identify all 3 factors to be at risk for a PE, this is the "classic" presentation (*classic usually means ~15%*)

### Major PE risk factors

- Intrinsic clotting disorders - Factor V Leiden, Protein C and S deficiency (usually know this only if pt knows history of it)
- Recent surgery/trauma
- Pregnancy
- Oral contraceptive pills (or any estrogen)
- Cancer
- History of previous PE/DVT
- Advancing age (over 60)
- Autoimmune disease (especially lupus)

**Symptoms of PE** - classic "triad" is *hemoptysis* (present only 2.9% of the time), *chest pain* (47%), and *shortness of breath* (79%)

- **Pleuritic chest pain** - sharp stabbing chest pain in a broad area that is worse with deep breathing, coughing, or talking

**Vital sign abnormalities** - tachycardia, hypoxia, hypotension (sign of severe disease)

**PEARL**- take into consideration the whole picture with risk factors, signs and symptoms when deciding whom to workup for PE

**Gestalt**- "unstructured assessment that the patient has the disease based on the pre-test probability in light of the clinician's clinical experience and the available information" - AKA your "gut feeling"

- **High risk patient (theoretical example)** - A pregnant female with a history of factor V Leiden who just got off a long plane flight with a unilateral swollen leg with chest pain, hemoptysis, shortness of breath, hypoxia, tachycardia, and hypotension
- **Medium risk patient (debatable- everyone has their own definition)** - A 25 year old female on OCPs with some sharp chest pain that lasted a few hours with some shortness of breath now resolved, heart rate 105
- **Low risk patient** - A few minutes of chest pain in a 20 year old female with no PE risk factors (including OCP) without any vital sign abnormalities

**PEARL**- Gestalt can still be used with good accuracy even as a novice learner - one study - 1st year residents had 71% accuracy for PE diagnosis, 74% for 2nd and 3rd year residents, and 78% for 4th year residents and attendings - only a 7% increase in accuracy from intern to attending

**PERC rule** (see essential evidence episode for a “deep dive” on this)

- **First step** - decide that the patient is low risk based on gestalt- language of study was “a low enough risk that a board certified EM physician would be comfortable ruling out the diagnosis of PE if the d-dimer was negative” - approximately 15%
  - o **If medium or high risk**- proceed immediately to advanced imaging (CT or V/Q)
- **Second Step - If low risk by gestalt**- apply the PERC rule
  - o **Mnemonic- BREATHS**
    - Blood in the sputum (hemoptysis)
    - Room air sat less than 95%
    - Estrogen use (OCPs or other estrogens)
    - Age greater than 50
    - Thrombosis - either a PE/DVT in the past or current suspicion of a DVT
    - Surgery or trauma in the past 4 weeks
- **Third Step**
  - o **If all negative** - stop the workup for PE- risk of PE is 1.6%, risk of harms from testing and treatment of DVT 1.8%- will cause more harm than benefit if you test these patients
  - o **If any of those criteria are positive** - do a D-dimer
    - **If D-dimer is negative** - stop the workup for PE
    - **If D-dimer is positive** - get advanced imaging

**Other decision rules- Well’s, Revised Geneva**- not as commonly used

**Workup for PE (after using a clinical decision rule)**

- Chest x-ray - most patients have chest pain/shortness of breath- look for other causes like pneumothorax, pneumonia, pleural effusion, lung mass, etc.

- EKG - looking for signs of cardiac ischemia, signs of MI- “classic” S1Q3T3 sign only about 20% sensitive
- Labs
  - o CBC- look for anemia as cause of chest pain, elevated WBC (infectious causes, low yield), low platelets (if PE found prior to anti-coagulation)
  - o Chem Panel- Check creatinine for IV contrast for CTA
  - o Coags- not very useful but often included on chest pain workup sets- most people want a baseline before anticoagulation but they probably won’t be abnormal unless patient on warfarin AKA Coumadin
  - o HCG- in all females of child bearing age
  - o Troponin- useful for risk stratifying patients with PE once it is diagnosed
    - **HOWEVER**- not everyone agrees with testing all patients with troponin right off the bat- if your CT is negative then you are now stuck with only one troponin- some will argue that “one set is no set” and you have to trend troponins to be sure this isn’t ACS/MI. However, if you explain in your chart that you don’t think this is ACS/MI, you are on ok medico-legal ground. Wouldn’t recommend novice learners suggest this right off the bat but be prepared to justify your decision to order/not order
  - o D-dimer- measures the degradation products of cross-linked fibrin- **don’t order this without using a clinical decision rule first! Only for low risk patients!** Very sensitive for PE (95%) but false positives as high as 50-70%- causes a lot of unnecessary testing if ordered indiscriminately. D-dimer also increases with pregnancy to the point where it really isn’t useful



## Advanced imaging

- CT Pulmonary Angiogram - CTPA or CTA for short
  - o Quick and easy to obtain in most EDs, very accurate and reveals other possible diagnoses that could cause chest pain/shortness of breath
  - o Limitations- patients with renal failure, patient exceeds the weight limit of the CT table, pregnancy (relative limitation- see below)
- V/Q scan - IV radioactive tracer is injected to examine pulmonary vasculature followed by inhaling a radioactive tracer, if a lung segment ventilates but does not perfuse, it suggests a PE
  - o Limitations- much less accurate than CT, does not reveal alternate diagnoses, Chest x-ray needs to be completely clear for it to be useful
  - o Only useful if the test is read as completely negative/normal
    - a “low probability” of PE still has a risk of PE of 20% (way too high)
- Bilateral lower extremity ultrasounds- in a patient with signs and/or symptoms suggestive of PE, a clot in the legs pretty much equals a clot in the lungs- however, if negative it's not helpful at all- can be used in pregnancy as an option but usually prefer better confirmation in form of CT or V/Q scan

## Advanced Imaging for PE in Pregnancy

- CTA
  - o PROS- in pregnancy, even one abdominal CT is still below known threshold of harm for radiation for the fetus so radiation should not be a concern, can adjust CT scanner settings to avoid scanning into the abdomen
  - o CONS- concern over radiation exposure, more non-diagnostic CT scans in pregnancy due to physiologic changes (changes in blood volumes and cardiac output), ? harms of contrast exposure in pregnancy for fetus (not proven in literature but likely never to get a good answer on this)
- V/Q scan
  - o PROS- if chest x-ray is normal then higher rate of diagnostic scans compared to CT, much less radiation exposure
  - o CONS- not as accurate as CT, radioactive tracer concentrates in the bladder which is right next to the uterus (can have patient urinate immediately after scan to reduce radiation exposure)

**PEARL**- follow your institution's guidelines in regards to choice of test and consenting patients for PE imaging in pregnancy. Go through the pros and cons of whatever imaging you choose and have the patient sign a consent form after a frank discussion of all the risks and benefits

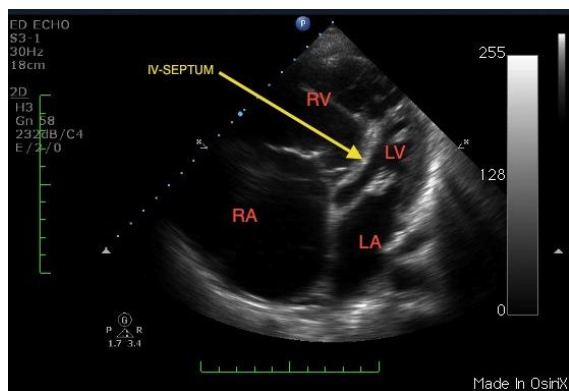
**PEARL**- PE is a serious disease in pregnancy- you can't not pursue the diagnosis because the workup may be difficult



## 33 Pulmonary Embolism II - Risk Stratification & Treatment

### Risk stratification of PE

- **Non-massive** - “regular/small PE” (non-massive not used a lot in the literature/textbooks but I think it works)
  - o PE without any hypotension/hemodynamic instability or signs of right heart strain
- **Sub-massive PE** - A PE with signs of right heart strain WITHOUT hypotension/hemodynamic instability
  - o Signs of Right Heart Strain
    - Increased troponin or brain natriuretic peptide (BNP)
    - Signs of right heart strain on bedside echo
      - Increased ventricular size (RV:LV ratio 0.9 or higher) (nl RV < LV, and lower pressure)
      - Bowing of the interventricular septum into the LV (nl bows to RV)
- **Massive PE** - a PE with hypotension (systolic BP <90) or cardiac arrest, critically ill



Bowing of interventricular septum and increased RV size  
(Credit: <http://emoryeus.blogspot.com/2012/02/right-heart-strain.html>)

### Treatment of PE

- **Non-massive** - anticoagulation
  - o Most common - **enoxaparin (Lovenox aka LMWH)** 1mg/kg SQ BID or 1.5 mg/kg daily (less common **fondaparinaux (Arixtra)**)

**PEARL:** I prefer daily dosing BID in case patient has a bleeding complication after admission

- o **Warfarin (Coumadin)** - have the inpatient team start after Lovenox

**PEARL:** If you start Coumadin first, can make patient transiently hypercoagulable, it also takes days to weeks to get therapeutic anticoagulation (Lovenox is pretty much immediate)

- **Sub-massive PEs** – anticoagulation
  - o **Heparin drip** - can turn infusion off if patient gets worse and needs thrombolytics
    - **80 units/kg IV as a bolus then 18 units/kg/hr as a drip**
  - o Thrombolytics?- older studies did not show mortality benefit but having a large clot in your lungs for a long time can lead to pulmonary hypertension that can make patients into pulmonary cripples
    - MOPPET trial- half-dose TPA (alteplase) vs. placebo- no difference in mortality, 41% absolute risk reduction in pulmonary HTN at 6 months
    - PIETHO trial- full dose TPA vs. placebo- no difference in mortality, decreased risk of cardiovascular collapse within first 7 days- higher mortality in those over 75 years old
    - **Thrombolytics for sub-massive PE**  
**bottom line:** Half dose thrombolytics in those with sub-massive PE who are young and healthy with good functional status and no risk factors for increased bleeding (usual TPA contraindications) is probably a good idea and something you should offer to the patient

**PEARL:** Patients with sub-massive PE should probably go to the ICU or at least step-down with thrombolytics at their bedside in case they decompensate

- **Massive PE** - PE with hypotension (even if transient) or cardiac arrest – **thrombolytics**
  - o **In cardiac arrest** - no consensus on an accepted dosing regimen- 50-100mg TPA bolus IV +/- infusion- **probably best to just do 100mg TPA slow IV push over 1 minute**
  - o **Not in cardiac arrest** - stop heparin drip (if started) and give **TPA 100mg**- 10mg IV as a bolus over 1 minute, other 90mg IV over 2 hours

### **Anticoagulation before CT**

- Low risk for PE- don't need anticoagulation before CT if you can get CT in reasonable amount of time
- Medium risk for PE- AHA says it should be considered but probably not needed if you can get CT in a reasonable amount of time- these patients have a risk of PE that's probably less than 50% and heparin/lovenox won't start to dissolve clot (only prevents clot extension/growth)
- High risk for PE and unstable- **start heparin prior to CT and bring thrombolytics to the scanner as you accompany the patient**, may even need to start thrombolytics prior to CT if patient is very unstable- especially if signs of right heart strain on echo.

**Inpatient vs. outpatient**- standard practice is to admit all patients with PE for monitoring and starting anticoagulation as an inpatient. Newer literature suggests that you may be able to manage non-massive PEs as outpatients with Lovenox/Coumadin or newer oral anticoagulants- this needs institutional support/protocols and primary care coordination

## 34 Asymptomatic Hypertension

**Asymptomatic HTN** - elevated blood pressure with no evidence on end-organ damage

### **Rule number one- DON'T FREAK OUT!**

- Calm down the patient and everyone around them (including the staff)
- Do a **good history** and physical exams
  - o What caused the patient come into the ED?
  - o Pt had a headache and happened to check BP?
  - o Routine home BP monitoring with high BP with their devil machine?
  - o Feeling fine at the pharmacy?
- Do a thorough **review of systems**
  - o Headache
  - o Slurred speech, ataxia, limb weakness, sensory changes, facial droop, change in vision?
  - o Chest pain, shortness of breath, dyspnea on exertion
  - o Blood in the urine

### **\*Headache\***

- Patients will often say BP high and that is giving them a headache
- This has been disproven - it's the opposite (patient has a headache, this causes rise in BP- same for epistaxis)
- Check for red flags
  - o Stroke symptoms?
    - Slurred speech
    - Motor weakness
    - Facial droop
    - Ataxia
  - o Subarachnoid hemorrhage?
    - Headache that is sudden in onset
    - Headache that is maximal at onset
    - Worst headache of their life

**PEARL:** Don't straight up ask "Is this the worst headache of your life?" Ask patient to compare it to their previous headaches

### **Physical** - focus on the neuro exam

- Do a full head to toe exam with a neuro exam and walk the pt

At this point- make a decision- is this truly asymptomatic (non-concerning headache doesn't count as "asymptomatic")?

- If you discover something concerning in your H and P (chest pain, stroke symptoms, SAH) then go down that diagnostic pathway
- If the patient is truly asymptomatic THEN DO NOT LOWER THE PATIENT'S BLOOD PRESSURE IN THE ED
  - o **If bad thing happens slowly over time, should be fixed in a slow manner as well; If bad happens suddenly, needs to be corrected rapidly**

### **Rule number two- DO AS LITTLE AS POSSIBLE!**

- HTN Pathophys - Your brain wants to "see" the same BP all the time- if your systemic BP is high, your brain constricts its blood vessels slowly over time so that the pressure remains the same
  - o If you rapidly drop the patient's BP, the blood vessels will still be constricted-> decreased bloodflow to the brain -> ischemic stroke
  - o **SO DON'T RAPIDLY LOWER BP IN ASYMPTOMATIC HTN!**

**Testing**- not required routinely (to look for end organ damage)

- May consider EKG if strong cardiac history
- Labs only useful if you choose to start oral BP meds

**Starting oral BP meds**- find out what access the patient has to their PCP

- If the patient has good access to their PCP (can get in within the next few days) - **can discharge without starting oral BP meds or talk with PCP to ask what meds they would prefer**
- If the patient doesn't have good PCP access or doesn't have a PCP - can consider **starting oral BP meds from the ED**

- Check a basic metabolic panel - need to know sodium, potassium and creatinine before starting oral BP meds
  - If abnormal Cr → don't start Lisinopril
  - If abnormal Na → don't start HCTZ

### Oral BP med options

- JNC-8 guidelines for initial therapy
  - Start ACEi (-pril), ARB (-sartan), thiazide or CCB
  - Black patients - start thiazide or CCB
- Lisinopril - 10mg PO daily (don't use if elevated creatinine)
  - Warn patients about dry cough (can start immediately or years after starting therapy)
  - Also warn about angioedema (lip/airway swelling) and to go to the ED if it happens (very rare reaction)
- Hydrochlorothiazide (HCTZ) - 25mg daily (don't use if patient has a low sodium)- young patients don't like this med due to frequent urination
- If you start HTN Rx in ED – don't give more than 14 days of medications → you want patient to follow up with PCP!

Is there a BP that is just too high to not send home?

- In theory, no but *once you get to a systolic above 240, likely that you will have something else wrong*

Have a conversation with the patient

- Assure the patient that their BP won't cause them any harm
- Educate the patient that the damage from BP happens over months to years to decades - not hours to days
- Make sure that the patient understands that rapid BP correction can harm them
- Give good return precautions (chest pain, neuro sx's, etc.) and a good plan regarding follow-up

## 35 Acetaminophen (APAP) Overdose

Dr. Andrea Sarchi

### Background

Acetaminophen is a component of hundreds of OTC and prescription medications

### Mechanism

- Therapeutic doses - 90% metabolized in liver by sulfation and glucuronidation to harmless conjugates, then excreted in urine-remaining 10% metabolized by hepatic P450 pathway into NAPQI, which is detoxified by hepatic glutathione
- Toxic doses – more APAP down P450 pathway → more NAPQI and not enough glutathione to keep up → liver injury

### History

- Acute or chronic exposure?
- Ask for ALL poisonings:
  - o What did you take?
  - o Dosage – dose per tablet and how many tablets?
  - o TIME of ingestion?
  - o Suicide attempt?
  - o Single ingestion or repeated ones?
  - o Any coingestants?
  - o Any comorbid conditions? (EtOH use, anticonvulsants, Gilbert's)
- **EtOH use** – chronic use is a risk factor in those who have ingested multiple supratherapeutic doses of APAP
- **Medications that worsen outcome**
  - o CYP inducers – anticonvulsants (carbamazepine, Phenytoin), anti-TB drugs (INH, rifampin)
  - o Others – TMP-SMX (bactrim), zidovudine, herbal supplements

**PEARL** – ask the patient if they have taken any other pain medications such as Percocet (oxycodone + APAP), Vicodin (hydrocodone + APAP), etc, which also contain APAP

## Signs/Symptoms, Physical Exam, and Lab Findings by stage

- **Vital signs** – nonspecific

Stage	Signs/Symptoms/PE	Labs
<b>Stage I</b> (30 min to 24 hrs post-ingestion)	Some asymptomatic, some have N/V, diaphoresis, lethargy	Normal LFTs
<b>Stage II</b> (24 to 72 hrs)	Stage I symptoms resolve, pt appears better clinically. As time passes, may develop RUQ pain/tenderness and hepatomegaly	↑ PT, ↑ total bilirubin, possible oliguria.
<b>Stage III</b> (72 to 96 hrs)	Jaundice, confusion d/t hepatic encephalopathy, cerebral edema, bleeding diathesis, multiorgan failure, possible ARF	↑ AST and ALT, often > 10,000 IU/L, hyperammonemia, ↑ PT/INR, hypoglycemia, lactic acidosis, total bilirubin >4.0 mg/dL
<b>Stage IV</b> (begins anytime 4 days to 2 wks post-ingestion)	Complete clinical recovery, and eventually complete hepatic histologic recovery	

### Workup

- **Serum APAP concentration** – obtain 4 hrs after ingestion or ASAP if ingestion was > 4 hrs ago
- **BMP** (electrolyte, glucose, renal function)
- **ABG/VBG** (APAP ingestion and hepatic failure can lead to acidosis)
- **Coags, LFTs, Ammonia level** (signs of hepatotoxicity)
- **CBC** (baseline)
- **Urine hCG** (women of childbearing age)
- **ECG, ETOH, and ASA level** (coingestions)

**PEARL** – in patients with chronic APAP ingestion who have any signs/symptoms of hepatotoxicity, order a serum APAP concentration and AST regardless of when the ingestion occurred (risk of hepatotoxicity greater in chronic ingestion than for a single, acute OD)

## Management

- **ABCs**
  - o O2 and fluids as necessary
  - o Cardiac monitor (coingestions)
- **Activated Charcoal** – 1g/kg up to 50 g PO within 4 hrs of ingestion
- **N-acetylcysteine (NAC)**
  - o Serum APAP above tx line on nomogram (Fig. 1)
  - o Single APAP ingestion > 150 mg/kg or 7.5 g total in a patient for whom we can't obtain an APAP concentration until >8 hrs post-ingestion
  - o Patient with unknown time of ingestion and serum APAP > 10mcg/mL
  - o Patient with hx APAP ingestion and ANY evidence of liver injury
  - o Patients who present > 24 hrs post-ingestion with lab signs of liver injury

**PEARL** – the nomogram is the most important way to determine the need for NAC therapy in an acute APAP OD

- **72-hour PO protocol** – loading dose 140 mg/kg PO, then 70 mg/kg PO every 4 hrs for 17 total doses
- **21-hour IV protocol** – loading dose 150 mg/kg over 1 hr, then 4-hr infusion of 12.5mg/kg/hr, then 16-hr infusion at 6.25 mg/kg/hr

**PEARL** – NAC is safe and effective in pregnant women. Crosses the placenta and thus IV form preferred.

## Disposition

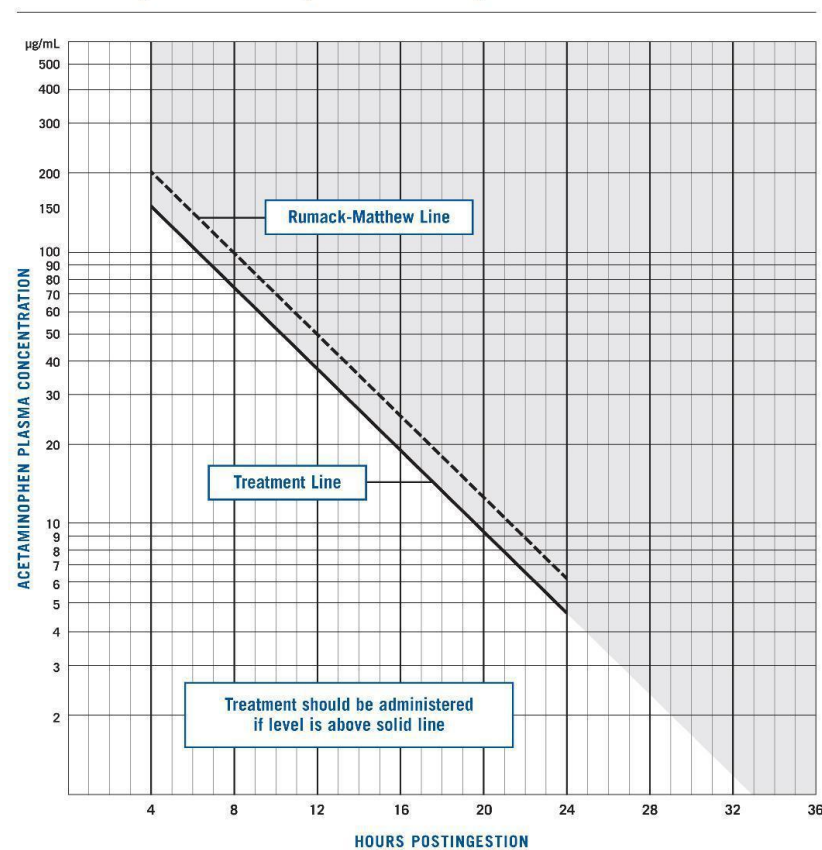
- Patient treated with NAC → admitted
- Patient asymptomatic/mild symptoms → admit to medicine or obs unit

- Patient had evidence severe hepatotoxicity/hepatic failure → admit to medical ICU

**PEARL** – consult a medical toxicologist/regional poison control center as needed and obtain a **psychiatric consult** for intentional overdoses

Figure 1

Single Acute Acetaminophen Overdose Nomogram



**Nomogram:** acetaminophen plasma concentration vs time after acetaminophen ingestion (adapted with permission from Rumack and Matthew. *Pediatrics*. 1975;55:871-876). The nomogram has been developed to estimate the probability of whether a plasma acetaminophen concentration in relation to the interval post-ingestion will result in hepatotoxicity and, therefore, whether acetylcysteine therapy should be administered.

### CAUTIONS FOR USE OF THIS CHART:

1. Time coordinates refer to time post-ingestion.
2. Graph relates only to plasma concentrations following a single, acute overdose ingestion.
3. The Treatment Line is plotted 25% below the Rumack-Matthew Line to allow for potential errors in plasma acetaminophen assays and estimated time from ingestion of an overdose (Rumack et al. *Arch Intern Med*. 1981;141(suppl):380-385).



## 36 Aspirin (ASA) Overdose

Dr. Andrea Sarchi

### Background

Aspirin aka acetylsalicylic acid → hydrolyzed to salicylate in intestinal wall, liver, and RBCs

Other preparations containing salicylate – salicylic acid (acne and warts), bismuth subsalicylate (Pepto-Bismol-antidiarrheal), methyl salicylate (oil of wintergreen-cream for MSK pain)

### History

- Ask for ALL poisonings:
  - o What did you take?
  - o Dosage – dose per tablet and how many tablets?
  - o Time?
  - o Suicide attempt?
  - o Single ingestion or repeated ones?
  - o Any coingestants?
  - o Any comorbid conditions?
- **Associated signs and symptoms**
  - o Nausea/vomiting, tinnitus, hearing loss, AMS, SOB, hyperpnea, diaphoresis
- **Medical history/Medications**
  - o Any conditions requiring chronic aspirin use?

### Exam

- **General** – A & O x 3? Confused? Agitated? Restless?
- **Vital Signs** – Tachypnea, hyperthermia, hypotension, or tachycardia?
- **Lungs** – Hyperpnea? Crackles or signs of pulmonary edema?
- **GU** – oliguria?

### Labs

- **Serum salicylate level** (10-30 mg/dL = therapeutic; >40 = toxicity)
- **BMP** (anion gap, kidney function, hypoglycemia, hypokalemia)

- **ABG** (most patients have primary respiratory alkalosis and primary metabolic acidosis)
- **EKG** (occult ingestion-TCAs cause widening of QRS, QTc prolongation, tall R wave in aVR)
- **Serum acetaminophen level** (occult ingestion- common coingestion in suicide, part of combo preparations with ASA such as Excedrin)

**PEARL** – an EKG and serum acetaminophen level should be ordered in ALL intentional poisonings to r/o occult ingestions

### Imaging

- **CT Head** – if patient has AMS not clearly d/t a non-cerebral cause such as hypoglycemia
- **CXR** – if patient c/o SOB or there are any + findings on lung exam

### Management

- **ABCs**
  - o O<sub>2</sub> as necessary
  - o Replace insensible fluids losses: NS at 10-15 ml/kg/hr first 2-3 hrs, then titrate to urine output of 1-2 ml/kg/hr

**PEARL** – only intubate if pt has rising CO<sub>2</sub> (intubation can worsen acidosis and cause ↑ CNS toxicity)

- **Activated Charcoal (AC)** – 1 g/kg up to 50 g PO (only in acute cases)
- **Dextrose** – add 50-100 g dextrose to each liter of maintenance fluid

**PEARL** – dextrose given regardless of serum glucose concentration bc pt can still have decreased cerebral glucose (neuroglycopenia)

- **Bicarbonate** – 1-2 mEq/kg IV bolus, then infusion of 100-150 mEq in 1 L sterile water with 5% dextrose; titrate until pH is 7.5-8
- **Potassium** – bicarb ↓ K<sup>+</sup> level, so add K<sup>+</sup> to fluids if in low normal range

**PEARL** – an alkalotic pH is NOT a contraindication to bicarb therapy

## Hemodialysis

- Indications
  - o Serum salicylate level > 100 mg/dL in acute; > 50 in chronic
  - o Endotracheal intubation other than for coingestants
  - o Oliguric renal failure
  - o Pulmonary or cerebral edema
  - o AMS
  - o Clinical deterioration despite appropriate supportive care

## Patient Monitoring

- Continuous respiratory and cardiac monitoring
- Serial serum salicylate levels q 1-2 hours until these criteria met:
  - o Decrease from peak measurement
  - o Most recent measurement < 40 mg/dL
  - o Pt asymptomatic with normal rate and depth of breathing
- Serial BMPs, ABGs, and urine pH levels q 1-2 hours

**PEARL:** Do not stop monitoring ASA levels until they are downtrending. Classic mistake is to admit patient to a psych floor with one “therapeutic” ASA level when it is still rising.

## Disposition

- **Acute intoxication** – admit for pulmonary edema, CNS symptoms other than tinnitus, acidosis and electrolyte disorders, dehydration, renal failure, or increasing serum salicylate levels
- **Chronic intoxication** – high mortality rate, most admitted
- **Infant intoxication** – all admitted

## Generic Drug Reference

The following is a list of generic names for the drugs that I have mentioned in the podcast. There are some drugs that I have mentioned only by generic name- they are listed as well just so there is no confusion. I've also included the class of drug and a **PEARL** or two.

Chest pain episode

Erectile dysfunction medications

Viagra (sildenafil)

Cialis (tadalafil)

Levitra (vardenafil)

(If the patient is on these medications, don't give them nitro within 24 hours for Levitra/vardenafil and Viagra/Sildenafil and 72 hours for Cialis/Tadalafil)

Zofran (ondansetron)- anti-emetic

"Blood thinners"

Coumadin (warfarin)

Lovenox (enoxaparin)

Pradaxa (dabigatran)

Mentioned by trade names only:

Aspirin (multiple names)- antiplatelet/antipyretic

Morphine (multiple names)- narcotic

Heparin (multiple names)- blood thinner

Abdominal pain episode

Zofran (ondansetron)- antiemetic

Phenergan (promethazine)- antiemetic

Benadryl (diphenhydramine)- antihistamine

Demerol (meperidine)- but don't use it!- narcotic

Dilaudid (hydromorphone)- narcotic

Mentioned by trade names only

Fentanyl (brand- sublimaze)- narcotic

Morphine (multiple brand names)- narcotic

Female abdominal pain

Flagyl (metronidazole) antibiotic (Trichomonas and Bacterial Vaginosis)

Mentioned by trade names only

Ceftriaxone (Brand- Rocephin)- Cervicitis/PID

Azithromycin (Brand- Zithromax)- Cervicitis

Doxycycline (Brand- Vibramycin)- PID

Fluconazole (Brand- Diflucan)- yeast infections

First Trimester Vaginal Bleeding

Macrobid (nitrofurantoin with BID dosing)- antibiotic for UTI in pregnancy (NB- macrodantin is nitrofurantoin with QID dosing)

Keflex (Cephalexin)- antibiotic for UTI in pregnancy

RhoGAM- Rho(D) immune globulin- prevents alloimmunization in Rh negative mothers who are carrying Rh positive babies

Flagyl (metronidazole)- antibiotic (Trichomonas and Bacterial Vaginosis)

Vicodin (hydrocodone/acetaminophen)

Percocet- (oxycodone/acetaminophen)

Motrin- (ibuprofen)

Generic name only:

Fluconazole (Brand- Diflucan)- yeast infections

Airway episode

Propofol (diprivan)- RSI sedation and post intubation sedation

Versed (midazolam)- post intubation sedation- rarely for RSI

Generic names only:

Premediation meds (atropine frequently used, lidocaine less frequently used in practice)

Atropine (no brand name) anti-cholinergic- premedication for pediatric RSI

Fentanyl (Brand- Sublimaze)- narcotic- head injury premedication

Lidocaine (Brand- Xylocaine)- anti-arrhythmic- head injury premedication

RSI sedatives:

Etomidate (Brand- Amidate)-ultra short acting sedative

Ketamine- (Brand- Ketalar)- dissociative sedative

Neuromuscular blocking agents (paralytics)

Succinylcholine (Brand- Anectine)- short acting neuromuscular blocker

Rocuronium (Brand- Zemuron)- long acting neuromuscular blocker

Vecuronium (Brand- Norcuron)- long acting neuromuscular blocker

Headache episode

Headache treatment

Compazine (prochlorperazine)- phenothiazine, classically used with benadryl

Benadryl (diphenhydramine)- antihistamine

Reglan (metoclopramide)- class B in pregnancy

Headache treatment adjuncts-

Toradol (ketorolac)- NSAID, don't use if suspecting ICH/SAH

Decadon (dexamethasone)- steroid- may prevent bouncebacks for headache

Febrile infants episode

Decadron (dexamethasone)- steroid- may be useful in H Flu meningitis

Generic names only

Ampicillin (no generic name)

Genatmicin (no trade name)- antibiotic for <28 days old

Cefotaxime (alternative to Gentamicin for <28 days old)- Brand- Claforan

Acyclovir (Brand- Zovirax)- antiviral if suspecting HSV infection

Ceftriaxone (Brand- Rocephin)- antibiotic for >28 days old to adults

Vancomycin (Brand- Vancocin)- antibiotic for >28 days old to adults

Back pain episode

Toradol (ketorolac)- IV NSAID

Flexeril (cyclobenzaprine)- muscle relaxer/sedation

Valium (diazepam)- spasm reduced/sedation

Vicodin (hydrocodone/acetaminophen)- oral narcotic

Generic name only

Morphine (multiple brand names)

MI and ACS Episode

Plavix (clopidogrel)- Anti-platelet

Erectile dysfunction medications

Viagra- sildenafil

Cialis- tadalafil

Levitra- vardenafil

(If the patient is on these medications, don't give them nitro within 24 hours for Levitra/vardenafil and Viagra/Sildenafil and 72 hours for Cialis/Tadalafil)

Zofran (ondansetron)- anti-emetic, prevents vomiting from large doses of plavix

Generic names only

Aspirin

Heparin

Nitroglycerin

Altered Mental Status (AMS)

Zosyn (piperacillin/tazobactam)- broad spectrum antibiotic (gram positives and gram negatives)

Vicodin (hydrocodone/acetaminophen)- oral narcotic

Percocet (oxycodone/acetaminophen)- oral narcotic

Oxycontin (oxycodone)- oral narcotic

Narcan (naloxone)- opioid antagonist

Valium (diazepam)- benzodiazepine

Ativan (lorazepam)- benzodiazepine

Tylenol (acetaminophen)- NSAID

Generic names only

Vancomycin- (Brand- Vancocin)- broad spectrum antibiotic (gram positives)

Ceftriaxone- (Brand- Ceftriaxone)- broad spectrum antibiotic (gram negatives)

Diabetic Ketoacidosis (DKA)- no brand names mentioned!

Syncope- no brand names mentioned!

Contact- [steve@embasic.org](mailto:steve@embasic.org). Please email me with any corrections!