Selected Topics by Specialty

The following is a collection articles and information organized by medical and surgical specialty that you will likely encounter in the emergency department. This is not a comprehensive list, but one that is designed to help you get started while in the emergency department.

Anesthesiology

1) **Assess pain scale:**
   Mild, Moderate, Severe: Choose an appropriate pain management strategy and avoid under-dosing and therefore under-treating pain in the ED
   Pain management in the ED

Cardiology

1) Review your **ACLS** algorithms! For those who do not have or who cannot locate them there are multiple Apps on smart phones available for a small fee. Also remember to review PALS.
2) **Myocardial Infarction**:
   a. Chest pain Core Competencies: EKG within 10 minutes of presentation. Aspirin 160 to 325mg upon presentation.
   b. STEMI vs NSTEMI: Appropriate management
      b.i. http://circ.ahajournals.org/content/94/9/2341.full
3) **CHF**
   a. http://circ.ahajournals.org/content/119/14/1977.full.pdf

Gastroenterology

Acute gi bleed

1. Upper VS Lower
   a. Upper- Bleeding proximal to the ligament of Treitz. Ulcer(duodenal, peptic), Mallory Weiss, esophageal varices, boerhaaves, hemmorhagic gastritis
   b. Lower- Hemorrhoids, diverticulosis, fissures, polyps, AVM
   c. Hematemesis- Vomiting blood. Generally upper
   d. Hematochezia- passage of fresh blood per anus. Generally lower however may be upper if large, brisk bleed.
   e. Melena- Dark tarry stools. The black color is caused by oxidation of the iron in hemoglobin during its passage through the ileum and colon.
2. Management
   a. Stages of Shock
   b. 2 large bore IV's. Remember that for acute resuscitation PIV are recommended over triple lumen CVC. However, if no IV access insert CVC.
   c. Continuous monitoring
   d. Type/cross or Type/screen depending on patient's stability. CBC, PT, PTT, LFTs, BMP, EKG, Guiac

e. Chest x-ray, CT abd/pelvis only with abd pain and lower gi bleed.
f. NGT lavage to determine if bleeding is upper. Scant negative may still be duodenal ulcer.
g. Nexium gtt- Reduces the risk of rebleeding.
h. Octreotide gtt- Octreotide, a somatostatin analog, is standardly used to reduce the risk of bleeding from esophageal varices because it inhibits mesenteric vasodilatation induced by glucagon.
i. Blakemore insertion- Only indicated in high volume upper gi bleed thought to be due to bleeding varices in an unstable patient.
j. Endoscopy/Colonoscopy

Endocrinology
Diabetic KetoAcidosis

1. Life threatening complication of Diabetes Mellitus that occurs as a result of the body undergoing a shortage of insulin and subsequently converting to utilizing Fatty Acids which causes the production of Ketone bodies.
    a. Nausea, vomiting, AMS, polyuria, polydipsia, Abd pain may occur. Must have high index of suspicion because symptoms may be vague.
    b. May have profound dehydration, which will produce tachycardia, hypotension and also fast, and deep labored breathing (Kussmaul respirations).
2. Ketones Bodies, specifically acetoacetate and Beta-hydroxybutyrate can serve as an energy source in the event of starvation. They do however cause a metabolic acidosis, which is initially relieved with the body's bicarbonate buffering system. This system is quickly overwhelmed and the body responds with Kussmauls respirations, which causes a compensatory Respiratory Alkalosis.
3. Diagnosed by large amount of Ketones in the blood and urine with a metabolic acidosis in the setting of hyperglycemia.
4. Treat with large amount of fluids followed by Potassium/glucose monitoring and insulin .1 units per kilogram/hr after determining the potassium level.

Thyroid Storm

1. Occurs in untreated hyperthyroidism.
2. May present with fever, diaphoresis, palpitations, AMS and anxiety.
3. Elevated SysBP, Tachycardia, arrythmias and ultimately may lead to congestive heart failure and pulmonary edema.
4. May result in a variety of GI and neurological symptoms including seizures and coma.
5. Treatment
    a. ABC's, treat hyperthermia, cardiac arrythmias
    b. Administer meds in the following order:
        b.i. Propanol to control adrenergic symptoms
        b.ii. Methimazole inhibits peripheral conversion of T4 to T3. Preferred over PTU. PTU is associated with severe liver injury and failure. PTU is considered as a second-line drug therapy, except in patients who are allergic or intolerant to methimazole, or for women who are in the first trimester of pregnancy. Rare cases of embryopathy,

including aplasia cutis, have been reported with methimazole during pregnancy

b.iii. Administer iodine compounds (Lugol iodine or potassium iodide) orally or via a nasogastric tube to block the release of THs (at least 1 h after starting antithyroid drug therapy). If available, intravenous radiocontrast dyes such as ipodate and iopanoate can be effective in this regard. These agents are particularly effective at preventing peripheral conversion of T4 to T3.

b.iv. Glucocorticoids also decrease the peripheral conversion of T4 to T3.

b.v. Rarely, as a life-saving measure, plasmapheresis has been used to treat thyroid storm in adults.

Infectious Disease

1. **SIRS**- Clinical response to a non-specific insult that is defined as 2 or more of the following:
    a. Fever of more than 38°C or less than 36°C
    b. HR > 90bpm
    c. Respiratory rate of more than 20 breaths per minute or a PaCO2 level of less than 32 mm Hg
    d. WBC >12,000/ul or less than 4,000/ul
2. **Bacteremia**- The presence of bacteria within the blood stream
3. **Sepsis**- The systemic response to infection and is defined as the presence of SIRS in addition to a documented or presumed infection.
4. **Severe sepsis**- meets the aforementioned criteria and is associated with organ dysfunction, hypoperfusion, or hypotension.
    a. Early goal directed therapy
    b. Appropriate antibiotics based on presumed or documented infection. Always send cultures prior to initiation.
5. **Pneumonia** is a commonly encountered disease in the Emergency room. Multiple decisions need to be made when encountering these patients. Who can be safely discharged on oral antibiotics and which appropriate antibiotics should be administered?

    a. Severity-of-illness scores, such as the CURB-65 criteria (confusion, uremia, respiratory rate, low blood pressure, age 65 years or greater), or prognostic models, such as the Pneumonia Severity Index (PSI), can be used to identify patients with CAP who may be candidates for outpatient treatment. (Strong recommendation; level I evidence.) For patients with CURB-65 scores >2, more-intensive treatment—that is, hospitalization or, where appropriate and available, intensive in-home health care services—is usually warranted. (Moderate recommendation; level III evidence.)

    b. Antibiotic coverage

b.i. Previously healthy and no risk factors for drug-resistant S. pneumoniae (DRSP) infection: A macrolide (azithromycin, clarithromycin, or erythromycin) (strong recommendation; level I evidence) Doxycycline (weak recommendation; level III.

b.ii. Presence of comorbidities, such as chronic heart, lung, liver, or renal disease; diabetes mellitus; alcoholism; malignancies; asplenia; immunosuppressing conditions or use of immunosuppressing drugs; use of antimicrobials within the previous 3 months (in which case an alter- native from a different class should be selected); or other risks for DRSP infection: A respiratory fluoroquinolone (moxifloxacin, gem- ifloxacin, or levofloxacin [750 mg]) (strong recommendation; level I evidence) A b-lactam plus a macrolide (strong recommendation; level I evidence) (High-dose amoxicillin [e.g., 1 g 3 times daily] or amoxicillin-clavulanate [2 g 2 times daily] is preferred; alternatives include ceftriaxone, cefpodoxime, and cefuroxime [500 mg 2 times daily]; doxycycline [level II evidence] is an alternative to the macrolide.)

b.iii. Inpatient, non-ICU treatment: A respiratory fluoroquinolone (strong recommendation; level I evidence) 19. A b-lactam plus a macrolide (strong recommendation; level I evidence) (Preferred b-lactam agents include cefotaxime, ceftriaxone, and ampicillin; ertapenem for selected patients; with doxycycline [level III evidence] as an alternative to the macrolide. A respiratory fluoroquinolone should be used for penicillin-allergic patients.)

b.iv. Inpatient, ICU treatment: A b-lactam (cefotaxime, ceftriaxone, or ampicillin-sul-bactam) plus either azithromycin (level II evidence) or a fluoroquinolone (level I evidence) (strong recommendation) (For penicillin-allergic patients, a respiratory fluoroquinolone and aztreonam are recommended.) For Pseudomonas infection, use an antipneumococcal, antipseudomonal b-lactam (piperacillin-tazobactam, cefepime, imipenem, or meropenem) plus either ciprofloxacin or levofloxacin (750-mg dose) or the above b-lactam plus an aminoglycoside and azithromycin or the above b-lactam plus an aminoglycoside and an antipneumococcal fluoroquinolone (for penicillin-allergic patients, substitute aztreonam for the above b-lactam).

b.v. For community-acquired methicillin-resistant Staphylococcus aureus infection, add vancomycin or linezolid. (Moderate recommendation; level III evidence.)

Immunology
Allergic reaction

1. Allergic reaction- Anaphylaxis is caused by the degranulation of mast cells and basophils with subsequent release of inflammatory mediators such as histamine, tryptase, prostaglandins, leukotrienes, cytokines and chemokines. These inflammatory mediators cause smooth muscle contraction, vasodilatation and increased vascular permeability, leading to urticaria, angioedema, bronchoconstriction and hypotension.
    a. Most commonly affects Cutaneous followed by Respiratory, Cardiovascular and Gastrointestinal.
2. Anaphylaxis- Acute multisystem allergic reaction. Potentially life threatening.
3. Management- ABC's, cardiac monitoring, IV access, High flow O2.
    a. Pharmacology
        a.i. Epinephrine- 0.3mg IM (1:1000) q5-15min prn. Evidence shows that administration improves symptoms however typically given in anaphylaxis but not allergic reaction. Caution in elderly and those with cardiovascular disease.
        a.ii. H1 blockers- (Benadryl, Hydralazine) primarily effective against cutaneous effects of anaphylaxis. Also may help antagonize cardiac and respiratory effects; should be used routinely in most cases of anaphylaxis. IV administration is preferable when a rapid effect is desired.
        a.iii. H2 blockers- (zantac, pepcid) these agents block effects of released histamine at H2 receptors, thereby treating vasodilatation, possibly some cardiac effects, and glandular hypersecretion. H2 blockers with H1 blockers have additive benefit over H1 blockers alone in treating anaphylaxis. Ranitidine (Zantac) probably preferred over cimetidine (Tagamet) in anaphylaxis in light of the risk for hypotension with rapidly infused cimetidine and the multiple, complex drug interactions with cimetidine. Famotidine (Pepcid) IV is another good alternative.
        a.iv. Corticosteroids- have a delayed onset of action and do not reverse the cardiovascular effects of anaphylaxis. These agents should be used in severe reactions, but the use of epinephrine and H_1 antihistamines has a higher priority. It is unclear whether corticosteroids administered systemically during the initial phase of anaphylaxis can weaken or prevent late-phase reactions.
        a.v. Glucagon- These agents help maintain blood pressure independent of adrenergic receptors by increasing intracellular levels of cyclic AMP. In addition, stimulate release of endogenous catecholamines. Glucagon might be beneficial for severe anaphylaxis in patients taking beta-blockers (it should be used in addition to epinephrine, not as a substitute), although data are limited to case reports. Glucagon can also be used to reverse bronchospasm.
        a.vi. Heparin- Currently being investigated as an adjunct to current

therapy for refractory allergic reaction/anaphylaxis. One time dose of 5000 units IV.

Nephrology

1) **Emergent Dialysis**
    a. AEIOU
        a.i. Acidosis
        a.ii. Electrolytes (Hyperkalemia)
        a.iii. Ingestions (Lithium, Salicylates, Methanol, Ethylene Glycol, Barbituates)
        a.iv. Overload (symptoms of fluid overload unresponsive to diuretics)
        a.v. Uremia (Encephalopathy, pericardial tamponade)
    b. Hyperkalemia
        b.i. EKG changes: Levels based on acute vs chronic hyperkalemia
            b.i.1. The first EKG sign of hyperkalemia is *peaked T waves* and usually appears once K level go around 6 meq/L.
            b.i.2. Second sign is *prolongation of PR interval* which can be seen with K level going around or above 7 meq/L.
            b.i.3. *Absent P wave with widen QRS complex* is the third manifestation and is a very dangerous sign. It means that atrial activity is lost and stage is set for ventricular tachycardia/fibrillation. It is usually seen at level around 8-9 meq/L. AKA Sine Wave
                b.i.3.a. Examples
                b.i.3.b. sine wave
            b.i.4. *Ventricular tachycardia/fibrillation*

Neurology

1. **CVA**
    a. Acute vs Subacute
        a.i. Last seen normal? Accu-check?
        a.ii. Up to 3 hours may benefit from tpa with certain exclusions
        a.iii. Some may benefit from tpa up to 4.5 hours with further exclusions
        a.iv. Neuro-interventional up to 6 hours.
        a.v. Always involve consultants!
    b. Time is brain. Perform NIH stroke scale followed by expedited ct brain without contrast to r/o bleed.
        b.i. If acute -CT brain, CTA head and neck and perfusion study. After initial CT with out contrast get your consultants involved.
        b.ii. If sub-acute -give aspirin, perform CTA of head and neck followed by admission for etiology and prevention of further brain death.
    c. http://stroke.ahajournals.org/content/38/5/1655.full

OBGYN

1. **Ectopic Pregnancy**
    a. Most commonly Tubal however may present in ovaries. Most severe complication is intra-abdominal hemorrhage.
    b. Occurs secondary to scarring from previous infections, adhesions from previous surgeries and commonly with fertility medications.
    c. Bedside ultrasound is a useful adjunct to confirm IUP. Official ultrasound that is indeterminate with a positive urine pregnancy and elevated B-HCG may be followed up in 24 to 48 hours for repeat HCG and ultrasound. Decisions should be made with the consultation of OB/GYN.
    d. Management may be with methotrexate, however surgery may be indicated. Rho-Gam if indicated.

Ophthalmology

1. Visual Acuity- First and foremost! Every ophthalmic complaint gets a Visual Acuity. In the event of chemical exposure irrigate with Morgan lens and then assess VA.
2. Fundoscopy
3. Slit lamp exam
4. DDx of the Red eye

Otolaryngology

Peritonsillar Abscess

a. Incision and drainage
b. Complications:

    b.i. Airway Obstruction

    b.ii. Cellulitis

    b.iii. Retropharyngeal abscess

    b.iv. Endocarditis

    b.v. Pneumonia

Pediatrics

Fever >100.4

a. Full sepsis workup is indicated in febrile neonates (<28 days old) secondary to high risk of SBI.

b. A full sepsis workup for pediatric patients includes the following:

    b.vi. Complete blood count (CBC) with differential

b.vii. Blood culture

b.viii. Enhanced urinalysis (UA) and urine culture (sample obtained by catheterization

b.ix. Lumbar puncture for cerebrospinal fluid (CSF) analysis for cell counts, protein, glucose, and culture

c. Partial Sepsis workup is indicated for well appearing and immunized patients with good follow up with in 12 to 24 hours in patients that are 5 to 8 weeks old. Partial workup omits the Lumbar Puncture. However threshold for LP should be low.

d. Children 2 to 24 months that are well appearing/fully immunized and have evidence of bronchiolitis may not need further workup. However, if no apparent signs of infection threshold for UA should be low.

Crying infant

Evaluate for hair tourniquet, Otitis, Reflux, Hernia, Corneal abrasion, Intussusception, SBI, Sepsis, Abuse/trauma.

Pulmonology

Oxygenation and ventilation

1. Oxygenation- occurs when oxygen molecules (O_2) enter the tissues of the body. oxygen saturation (S_{O2}), measures the percentage of hemoglobin binding sites in the bloodstream occupied by oxygen.
2. Ventilation- is the rate at which gas enters or leaves the lung. Minute ventilation is equal to RR x TV. This refers to the tidal volume of gas entering the lungs per minute.
3. mechanical ventilation
4. Alveolar-Arterial Gradient
    1. $P_AO_2 = (F_iO_2 * (760 - 47)) - (P_aCO_2 / 0.8)$

    2. A-a gradient = $P_AO_2 - P_aO_2$

        i. The A-a gradient is useful in determining the source of hypoxemia. The measurement helps isolate the location of the problem as either intrapulmonary (within the lungs) or extra pulmonary (somewhere else in the body). A normal A-a gradient for a young adult non-smoker breathing air, is between 5-10 mmHg. Normally, the A-a gradient increases with age. For every decade a person has lived, their A-a gradient is expected to increase by 1 mmHg. An abnormally increased A-a gradient suggests a defect in diffusion, V/Q (ventilation/perfusion

ratio) mismatch, or right-to-left shunt.

Psychiatry

1. Delirium is sudden severe confusion and rapid changes in brain function that occur with physical or mental illness.

2. Dementia is a loss of brain function that occurs with certain diseases. It affects memory, thinking, language, judgment, and behavior.
3. Psychosis is a loss of contact with reality, usually including false beliefs about what is taking place or who one is (delusions) and seeing or hearing things that aren't there (hallucinations).
    a. New onset psychosis (i.e. No previous history of schizophrenia/bipolar) rule out medical causes including toxic ingestion, infection, CVA, hypoglycemia etc.
4. Assess behavior, affect, orientation, language, thought content, memory, perception, judgment
5. Determine if patient shows signs or has thoughts of Suicidal/homicidal/hallucinations
6. Pharmacological therapy- acute management
    a. High risk of conduction abnormalities- Ativan 2mg IM/IV, Geodon 20mg IM (ziprasidone), Zyprexa 10mg IM (Olanzapine) ,Ketamine
    b. No concerns for cardiac conduction abnormalities consider Haldol 5mg IM. Avoid IV secondary to high risk of QT prolongation and subsequent Torsades de pointes.
    c. Consider lowering the dose in elderly/demented patients.

Toxicology

TCA overdose

1. Used in the treatment of Enuresis, social phobia, ADHD, OCD, Depression, chronic pain, Migraine prophylaxis
    1.1.a. amitriptyline, desipramine, imipramine, nortriptyline, doxepin, clomipramine, amoxaprine, maprotiline and protriptyline
1.2. The toxic effects of tricyclics are results of the following 4 main pharmacologic properties:

    1.2.a. Inhibition of norepinephrine and serotonin reuptake at nerve terminals

    1.2.b. Anticholinergic action

    1.2.c. Direct alpha-adrenergic blockade

    1.2.d. Membrane stabilizing effect on the myocardium by blocking the cardiac myocyte fast sodium channels

1.3.a.a. decrease the sodium influx through the fast sodium channels and consequently decrease the slope of phase 0, leading to the widened QRS complex that is typically seen on ECGs

2. Chest pain, hypotension, seizures, AMS, respiratory depression, dry mouth, dry

skin, blurred vision urinary retention.

1.3. Classic EKG finding is widened QRS that predisposes to ventricular arrythmias

1.4. Sodium Bicarbonate, rule out co-ingestions, symptomatic and supportive care (Intubation, BZD for seizures refractory to NAHCO3). AC if presents within 1hour.

Tylenol overdose

1. For all suspected/known ingestions always rule out co-ingestions! APAP is the most commonly ingested and co-ingested compound.

2. APAP is broken down to N-acetyl-p-benzo-quinine imine(NAPQI) which with the addition of glutathione is converted to cysteine and mercapto-puric acid by the p450 system. After glutathione stores are depleted NAPQI accumulates and is a toxic compound and causes Hepatic centrilobar necrosis.

3. Clinical presentation: 4 stages

    a. Stage 1- 0 to 1 day post ingestion- Non-specific findings. anorexia, nausea, vomiting, malaise, and diaphoresis. If central nervous system (CNS) involvement and/or severe metabolic acidosis (elevated anion gap) are present, consider co-ingestants. Serum studies are typically within normal limits. About 12 hours postingestion, subclinical elevation of serum liver transaminases (alanine aminotransferase [ALT], aspartate aminotransferase [AST]) occurs.

    b. Stage 2- 1 to 3 days post ingestion- RUQ pain, hepatomegaly, oliguria, Renal failure, acute pancreatitis may occur. Labs may indicate increase in AST/ALT/PT/PTT/Bilirubin/BUN/Cr.

    c. Stage 3- 3 to 5 days- symptoms seen in stage 1 (anorexia, nausea, vomiting, malaise) reappear along with signs of hepatic failure with jaundice, hypoglycemia, bleeding (coagulopathies), encephalopathy, and/or sepsis. Renal failure and cardiomyopathy may also occur. Physical findings reflect clinically significant hepatic injury, such as abdominal pain, jaundice, and gastrointestinal (GI) bleeding due to coagulopathy. Encephalopathy and cerebral edema due to severe hepatic injury occurs. Clinical signs and symptoms of multiorgan failure are noted. Severe toxicity is evident on sera laboratory studies. Lactic acidosis, prolonged PT or international normalized

ratio (INR), markedly elevated ALT and AST (≥10,000 IU/L), elevated total bilirubin level of more than 4 mg/dL (primarily indirect) and hyperammonemia are reported. Hepatic centrilobular necrosis is diagnosed on liver biopsy. Almost 4% of patients who develop this degree of hepatotoxicity progress to fulminant hepatic failure. Renal involvement from acute tubular necrosis is evident with abnormal renal function studies, proteinuria, hematuria and granular casts on urinalysis. Acute renal failure occurs in 25% of patients with significant hepatotoxicity and in more than 50% of those with hepatic failure. Death is most common during stage 3, with multiorgan failure as the primary cause.

   d. Stage 4- 5 to 12 days post ingestion- Stage 4 occurs 5-14 days after ingestion. This stage can last as long as 21 days. Patients either have a complete recovery of liver function and resolution of physical findings or they die.

4. Negligible acetaminophen (APAP) values from an ingestion occurring within 4 hours can be used to rule out hepatotoxicity. Any serum concentration based on a sample drawn 4 hours or longer after a single ingestion may be plotted on an acetaminophen (APAP) toxicity nomogram (Rumack-Matthew nomogram) to estimate the risk of hepatotoxicity beginning at 4 and up to 24 hours. Evidence of hepatic injury due to acetaminophen (APAP) overdose is defined by elevation of the plasma transaminase values of more than 1000 IU/L. A rapid progression of transaminase values to 3000 IU/L or higher reflects worsening hepatotoxicity.

5. N-acetyl-cysteine in its po form is the drug of choice for treatment of APAP OD. If within1 hour administer activated charcoal 1g/kg. May consider gastric lavage if pt presents within 1 hour. NAC is converted to cysteine which replenishes glutathione stores. The entire NAC protocol, either PO or IV regimen, should be completed even if the acetaminophen plasma levels decrease below the toxic range on the Rumack-Matthew nomogram.

Trauma:

1. Nexus Criteria
   a. When a significant mechanism of injury is present, a cervical spine is determined to be stable if:
   b. There is no posterior midline cervical tenderness
   c. There is no evidence of intoxication
   d. The patient is alert and oriented to person, place, time, and event
   e. There is no focal neurological deficit (see focal neurological signs)
   f. There are no painful distracting injuries (e.g., long bone fracture)
   g. If all of the above are negative then no further imaging need be obtained.

2. Ottawa Rules
    a. X-rays are only required if there is any pain in the malleolar zone and any one of the following:
        a.i. Bone tenderness along the distal 6 cm of the posterior edge of the tibia or tip of the medial malleolus, OR
        a.ii. Bone tenderness along the distal 6 cm of the posterior edge of the fibula or tip of the lateral malleolus, OR
        a.iii. An inability to bear weight both immediately and in the emergency department for four steps.
        a.iv. The Ottawa foot rules are for assessing whether a foot X-ray series is indicated. It states that they are indicated if there is any pain in the midfoot zone and any one of the following:
        a.v. Bone tenderness at the base of the fifth metatarsal (for foot injuries), OR
        a.vi. Bone tenderness at the navicular bone (for foot injuries), OR
        a.vii. An inability to bear weight both immediately and in the emergency department for four steps.