

New

- you can order Strep Ag on CSF
- adjuvant steroids good in bacterial meningitis, extrapulmonary TB, PCP, typhoid fever, tetanus
- a fascinating study in the NEJM followed an HIV+ pt w/ concurrent AML who received an allogeneic HSCT from a donor who was homozygotic for the CCR5 delta32 deletion and it was found that the pt had no detectable HIV despite being off HAART for 20 months
- For just generic cellulitis w/ low F and no DM etc just give a shot of Zosyn/Rocephin in office and then Augmentin/Keflex unless concerned about MRSA
- You can write "pharmacy to desensitize penicillin" if you need to give penicillin to an allergic pt (takes 2d)
- If you see a pt with a weird infection w/ constitutional Sx, rash, arthralgias, etc empirically Tx for "The Unusuals" by giving doxycycline but know that some infections will be missed
- Infectious Skin Rashes (Dx: Skin biopsy w/ GS/Cx)
 - Maculopapular: Syphilis, Typhoid, Lyme, HIV, Viral Exanthem, Mono, Disseminated Gonococcal, Scarlet Fever
 - Vesicular/Pustular: HSV/VZV
 - Diffuse Erythema: Toxin Mediated Dz
 - Petechial: Meningococcemia, GN bacterial sepsis, RMSF, Malaria, Viral Hemorrhagic Fever
- ESR (acute, takes shorter to increase and decrease) vs CRP (chronic, takes longer to increase and decrease)
- when you pick abx pay attention to allergies, hepatic/renal fxn for dosing, SEs, etc
- Vanc/Zosyn combo causing interstitial nephritis at Baylor
- If a pt has frequent, severe, unusual infections check for structural defects (imaging) and acquired/congenital immunodeficiencies (CBC w/ diff, quantitative immunoglobulins, complement levels (CH50, C3, C4), HIV)
- Toxin mediated infections: Clostridium, Staph/Strep Toxic Shock Syndrome and in these infections you want to use bacteriostatic abx not necessarily bacteriocidal abx, consider plasma-exchange, etc
- **Surgical Site Infection (SSI)**
 - fluid collections can be seroma, hematoma, or abscess
 - determine if hardware is present
 - determine if osteo is present
 - considered nosocomial if occurring w/in 30d of surgery or 1yr if prosthetic material is used
 - Pathogen: Staph aureus then Enterococci then CNS then GN then Yeast
 - RFs: obesity, age, DM, preop infection, prolonged postop course, poor glucose control, NO perioperative abx prophylaxis
- **Snake Bite**
 - Types: (1) Viperidae (Rattlesnake, Copperhead, Cottonmouth) and (2) Elapidae (Coral "red and yellow kill a fellow, red and black venom lack") NB in general a venomous snake has a triangular head w/ slit pupils
 - S/S: systemic Sx, local tissue damage, coagulopathy esp DIC, rhabdo w/ AKI, shock, neurologic dysfxn (specifically seen in Coral snake bites)
 - Tx: immobilize below heart, clean wound, identify snake and kill it, antivenom (NB do not place pressure dressings, tourniquet, suction, etc)

Pharmacology

- **Pharmacokinetics** (effect body has on drug)
 - Acute Infection (good tissue penetration b/c of increased microvascular permeability 2/2 inflammation therefore shorter abx duration) vs Chronic Infection, Abscess, Inherently Poor Blood Supply, Foreign Material w/ Biofilm (longer abx duration)
- **Pharmacodynamics** (effect of drug on pathogen)
 - **MIC** (Minimum Inhibitory Concentration) lowest antibiotic concentration needed to prevent further bacterial growth vs **MBC** (Minimum Bacteriocidal Concentration) lowest antibiotic concentration needed to kill bacteria
 - some abx are more effective the higher the [] goes above MIC aka "[] dependent killing" therefore best to have high peaks even if they are brief (high dose single administration) vs some abx are more effective the longer the [] is above MIC aka "time dependent killing" therefore best to have one steady [] that is just above MIC (low does frequent administration)
- **Resistance**
 - natural (bug always has resistance) vs acquired
 - intermediate (increasing MIC, therefore need higher [abx]) vs true resistance (therefore doesn't matter how high you increase [abx] it will not work)
 - antibiograms are printed yearly and are in chart
 - in vitro susceptibility does not equal in vivo susceptibility therefore many abx reported as susceptible might not actually be susceptible in the pt
 - many GNR can produce ESBs (extended spectrum beta-lactamases) which inactivate beta-lactams

Septic Shock

- 1st: **Systemic Inflammatory Response Syndrome (SIRS)** (>2/4: (1) temp >100.4 or <96.8 (2) HR>90 (3) RR>20 or PaCO2 <32 (4) WBC >12k <4K or Bands >10%) and is called **Sepsis** when you suspect the cause is from an infection → **Severe Sepsis** (aka organ dysfxn) → **Septic Shock** (aka hypoTN despite fluids)

- Pathophysiology (microbial toxin leads to cell injury leads to dysregulation of inflammation AND coagulation), Complications (Multi Organ Failure (MOF) w/ encephalopathy, ARDS, DIC, ATN, ileus, bacterial translocation from gut, shock, etc)
- 2nd: If Sepsis then check Labs (comes back w/in 30 minutes to check for organ dysfxn and thus severe sepsis) and BP (comes back w/in a few minutes to check for hypotension and thus septic shock)
 - Things to Check: BP, CBC, T&C, CMP, Coags, iSTAT, Cortisol, Lactate, Bld Cx x2, Urine Cx, UA, EKG, CXR, Hemostasis Profile (PT, INR, aPTT, Fibrinogen, Thrombin, Hct, Plt) must also add D-Dimer and FDP (Fibrinogen Degradation Products) aka FSP Flocculation
- 3rd: What to do about BP? If SBP <90 or MAP <65 then 20cc/kg NS or LR over 30min and if Lactate >4 or SBP still <90 or MAP still <65 despite fluids then PAGE RRT, ½-1L NS or LR Q15-30min until SBP >90 and MAP >65 and CVP >8 (12 if on MV) OR until 40cc/kg administered then cont at 150cc/hr, discuss code status w/ family, place central line, BS-abx w/in 1hr and Cx prior, Xigris consult
 - NB "Early Recognition Goal Directed Therapy" check markers for imbalance b/t increased oxygen demand and decreased oxygen delivery by measuring ScvO2 (bad if >70%) and lactate (bad if >4) why? b/c you might have normal BP and assume that everything is alright when they aren't, markers which suggest good balance: ScvO2, Lactate/pH, procalcitonin, UOP
- 4th: If still SBP <90 or MAP <65 or CVP <8 then initiate pressors and place art line
 - NB pressors (norepinephrine (Levophed aka Levo) → vasopressin (Pitressin aka Vaso) → dopamine (Dobutrex) → phenylephrine (Neosynephrine aka Neo))
 - NB always remember that vasoconstrictors are pointless if pt is volume down
 - NB Tachyphylactic Effect (drug responsiveness decreases over time)
- 5th: consider other treatments
 - Steroids are controversial, it is known that sepsis inhibits the axis, trials showing that giving steroids are bad are not great trials b/c of the types of pts studied and time frame when steroids were given, essentially if pt is still "bad" after 6hrs of aggressive Tx give steroids and check a cortisol level
 - inotropes based on ScvO2 (70%)
 - Swan-Ganz catheter if you are suspecting a mixed picture b/t cardiogenic and septic shock
 - Give colloids based on Hct (>30)
 - analgesics/antipyretics/paralytics/intubation to decrease oxygen demand
 - drotrecogin alpha (Xigris) activated protein C but it is the anti-inflammatory effect that is important, main SE is bleeding, use in septic shock w/ multi-organ failure, high Apache, 96hr continuous infusion w/ t1/2 of 15min, effectiveness based on PROWESS study

FUO

- **Definition:** ≥2 episodes of T ≥101 and NO Dx is obtained despite ≥3d in-pt or ≥1wk out-pt
- **Approach:** review ROS, sick contacts, travel, pets, occupation, medication, immunosuppression, TB history, skin findings, LAD, murmurs, HSM, myalgias/arthritis, eyes, GU exam
- **General Studies:** APRs, x3 BldCx each an hour apart and at different sites, Scans
 - **Indium Scan:** WBC are removed from pt and then tagged w/ Indium and then given back to pt where they accumulate in areas of ACUTE infection
 - **Gallium Scan:** Gallium is an APR and when it is given to a pt it accumulates in areas of CHRONIC infection
- **Tx:** do NOT administer anti-microbials/steroids unless you have done everything else b/c most defervesce spontaneously w/in 2mo w/o problems, d/c unnecessary drugs, NO Cooling Blankets, some ID doctors empirically Tx w/ anti-TB meds
- **Mechanism:** cytokines from infection, inflammation, neoplasm, etc go to preoptic nucleus of the anterior hypothalamus and release mediators which increase BMR and cause changes in hemodynamics which enhances immune system and inhibits pathogen replication, remember fever is a sign of inflammation not always infection
- **Pattern:** a single spike is almost never infection, some infections have certain patterns but in general they are not clinically reliable
- **DDx:** more likely to be a subtle manifestation of a common disease than an uncommon disease, 30% infection vs 30% neoplasm vs 20% CTD vs 20% other
 - Infection
 - Bacteria: TB esp disseminated/extrapulm esp to liver, BM, renal, meninges (PPD/Gold) where negative CXR/AFB, Acalculous Cholecystitis, Ascending Cholangitis, Intra-Abdominal and Hepatic/Splenic Abscess esp if pt had prior surgery/infection, h/o diverticulosis/AAA (CT-A/P w/ PO/IV contrast), culture negative SBE (TTE), Vertebral/Mandibular Osteo (MRI Head/Neck), Dental Abscess/Sinusitis/Mastoiditis 2/2 NGT blocking ostia (Water's View of Sinuses, CT Head), Paraspinal Abscess (MRI Spine), The Unusuals, C.diff, Line Sepsis, Wound Infection, SBP, VAP
 - Virus: CMV/EBV (PCR) esp after transfusions, HIV (ELISA and PCR)
 - Parasite: Toxo, Malaria (Thick & Thin Smear), Babesiosis, Q Fever, RFSF
 - Fungus: any type (Beta-D-Glucan)
 - Nosocomial Infection: pneumonia 2/2 ETT, UTI 2/2 Foley, bacteremia 2/2 line, SSI
 - Neoplasm
 - Liquid Tumor: Lymphoma esp retroperitoneal NHL (LDH, BM Bx), Preleukemia
 - Solid Tumor: RCC, HCC, Pancreatic Cancer, right sided CRC, Atrial Myxoma, CNS
 - CTD

- Vasculitis esp TA/PMR, PAN, etc (APRs, ANA, RF, Bx), Adult Onset Still's Dz, SLE, etc
- Other
 - Drugs: Abx (beta-lactams, sulfa, nitrofurantoin, amphotericin), Sleep Aids, AEDs, Sulfa-Containing Meds (diuretics, bactrim), CV (old antihypertensives, anti-arrhythmics), Psych (antidepressants), HB, NSAIDs, etc, Mechanism: unknown sometimes allergic vs idiosyncratic (NB rule out infusion phlebitis), S/S: relatively bradycardia (pulse is lower than expected for temp), rash, eosinophilia (only 25% of time), pts look well for the degree of fever, mild transaminitis, etc, NB often pts have been on these meds for years therefore don't assume that if a pt is on a chronic med that it is not the cause, Tx: d/c all unnecessary meds and fever resolves in <3d
 - Psych: delirium tremens, factitious esp young females in the medical field signified by pulse-temp dissociation
 - CV: MI, pericarditis, endocarditis
 - Pulm: PE
 - GI: pancreatitis, bowel infarction
 - Heme: DVT, hematoma, transfusion reaction
 - CNS: disorder heat homeostasis
 - Metabolic: cirrhosis, hepatitis
 - Endo: thyroid storm, adrenal insufficiency, pheochromocytoma, hyperPTH
 - Genetic: Familial Mediterranean Fever
 - Post-Op: <48hrs (surgery = tissue injury = inflammation, NB atelectasis as a cause of fever is a myth, NB always remember Malignant Hyperthermia) vs >48hrs: Infection
 - Idiopathic: 1/3 go unDx

Temperature

- **<97° (Hypothermia)** (S/S: AMS, CV/Resp depression w/ arrhythmias esp Osborn Waves, dilated fixed pupils, coagulopathy, Tx: bear hugger, warm gas in MV, warm IVF, rewarm but watch for shock as peripheral vessels dilate)
 - **Overwhelming Infection** w/ inability to mount a febrile response (poor prognostic sign)
 - **Advanced Age**
 - **Hypothyroidism**
 - **Cold Exposure**
 - **Uremia**
 - **Burns**
 - **Hypothalamic Dysfunction**
- **98.6±1.8°F/37±1.0°C (Normal)** NB most accurate is bladder catheter measurement, oral/ear/axilla can be lower, rectal can be higher, temporal is pretty accurate, there is diurnal variation w/ nadir (<99) in morning and peak (<100) in late afternoon, body temp is normally higher post-prandial, during menstruation and after exercise, some pts have below nl temp and thus fever for these pts can be lower than others
- **101-106° (Fever = normal thermoregulatory system set a higher set point vs Hyperthermia = abnormal thermoregulatory system)**
- **>106° (Hyperpyrexia)**
 - **Heat Stroke:** often accompanied by CNS dysfxn, severe volume depletion, MOF, Tx: ice packs in axilla/groin, cooling blankets, spray skin w/ cool water to promote evaporation, internal cooling w/ cold water lavage of stomach/bladder/rectum
 - **Central Fever:** infection, malignancy, trauma, hemorrhage, etc
 - **Malignant Hyperthermia (post-op disorder)**
 - Mech: AD inherited skeletal muscle disorder characterized by a hypermetabolic state after exposure to a volatile inhalational anesthetic AND depolarizing muscle paralytic
 - S/S: increased intracellular calcium resulting in uncoupling of oxidative phosphorylation and subsequent rise in metabolic rate w/ hyperthermia, rigidity, autonomic instability w/ tachy/tachy, HypoTN/HTN, arrhythmias, and AMS eventually leading to complications of ARF from rhabdo, DIC, ARDS
 - Labs: leukocytosis, elevated CPK
 - Tx: change meds, dantrolene (SEs: liver failure), MedAlert bracelet, inform family members
 - **Neuroleptic Malignant Syndrome (any low dopamine state)**
 - Mech: idiosyncratic rxn to meds that decrease CNS dopamine including neuroleptics (haloperidol, etc), antiemetics (metoclopramide, etc), CNS stimulants (cocaine, etc) other (Li, etc) or abrupt cessation of anti-Parkinsonin drugs, anticholinergics, etc (NB ? +FHx)
 - S/S: similar to above, can occur anytime after starting/stopping med hence idiosyncratic but most occur 2-3d
 - Tx: bromocriptine (increase dopamine), fluids, cooling blanket,
 - Prognosis: 20% mortality
 - **Serotonin Syndrome (any high serotonin state)**
 - Mech: increase serotonin from (a) increased release from illicit drugs like Ecstasy, amphetamines, etc, (b) decreased reuptake from SSRIs, TCAs, St. John's Wart, Demerol, Fentanyl, Tramadol, etc, (c) decreased metabolism from MAOI, Zovox, Ritonavir, etc, (d) serotonin agonists from Li, triptans, buspirone, etc NB usually multiple drugs but sometimes just one can alone cause SS

- S/S: hyperthermic, tachy, HTN, AMS, diaphoresis, mydriasis, and NM abnormalities like akathisia/tremor/hyperreflexia/clonus which differentiate SS from MH and NMS
- Tx: d/c meds, benzo and cyproheptidine (Periactin) aka serotonin antagonist, supportive care (paralyze, sedate, cooling blanket), NM paralysis

Isolation

- Contact Isolation
 - Use: organisms that can be transmitted by contact
 - Agents: any resistant organisms (Acinetobacter/Pseudomonas/Klebsiella) and C.diff
 - Room: normal
 - Other: gown/gloves
- Airborn Isolation
 - Use: organisms that can be transmitted by particles (<5 microns - can travel long distance)
 - Agents: TB, Measles, SARS, Varicella
 - Room: negative pressure room (8th floor and 1 room on each floor)
 - Other: N-95 mask
- Droplet Isolation
 - Use: organisms that can be transmitted by droplets (>5 microns - can travel only short distance)
 - Agents: Viruses (RSV, Rota, Influenza, Adenovirus, Mumps, Rubella), Bacteria (Diphtheria, Mycoplasma, GABHS, Neisseria meningitidis, Haemophilus influenza)
 - Room: normal
 - Other: general mask w/ shield



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