**Bugs and Drugs**

- **Staphylococcus**
  - gram positive cocci in clusters

- **Staph Aureus**
  - General Syndromes
    - Toxic Shock
    - Scalded Skin
    - Food Poisoning
    - Post-Viral Pneumonia
    - Skin Infections/Abscesses
    - Acute Bacterial Endocarditis
  - **MSSA**
    - Methicillin/Nafillin Sensitivity
    - Treatment: Oxacillin
  - **MRSA**
    - HA-MRSA: vancomycin linezolid, daptomycin
    - CA-MRSA: clindamycin, Bactrim, tetracyclines (in addition to the above)

- **Coagulase-Negative Staph**
  - Prosthesis Infections
  - Frequent Culture Contaminant
  - Particular Species to Know
    - Staph Saprophyticus: UTIs in sexually active women
    - Staph Lugdunensis: can act like Staph Aureus

*Sidenote: What are other causes of UTI? SEEKs PP*
- **Staph saprophyticus**
- **E coli**
- **Enterococcus**
- **Klebsiella**
- **Serratia**
- **Proteus**
- **Pseudomonas**

**Catalase Negative**

**Streptococcus/Enterococcus**
- gram positive cocci in pairs and chains

**Strep Pneumoniae**
- Micro: encapsulated
- Clinical Syndromes: (mnemonic Most OPtochin Sensitive)
  - Meningitis
  - Otitis Media
  - Pneumonia
  - Sinusitis

_Sidenote: other encapsulated organisms, why are these important?_

**Strep pneumo**

**H Flu**

**N Meningitidis**

*Answer: asplenic patients at increased risk for infection from these bugs 2/2 impaired clearance of opsonized bacteria – need to immunize against these at least 14 days prior to a planned splenectomy or 14 days post-splenectomy*

**Strep Pyogenes**
- Micro: Group A Strep
- Clinical Syndromes
  - Pharyngitis
    - Scarlet Fever
    - Rheumatic Heart Disease
  - Skin/Soft Tissue Infections
  - Post-Strep GN

**Strep Agalactiae**
- Micro: Group B strep
- Clinical Syndromes
  - Meningitis/Sepsis in newborns

**Enterococcus**
- Micro
  - E Faecalis
  - E Faecium: more likely to be vancomycin-resistant
- Clinical Syndromes
  - UTI
- Preferred Treatments
  - Enterococcus: ampicillin/amoxicillin
  - VRE: linezolid, daptomycin, quinupristin/dalfopristin can be used to treat E faecalis but not E faecium
- Notable Resistances:
  - Cephalosporins, aminoglycosides

_Sidenote:_

*What other bugs can be treated with Amp/Amox?*
HELPS organisms
- Haemophilus
- Enterococcus
- E Coli
- Listeria
- Proteus
- Salmonella

Gram Positive Rods
Spore Formers: no metabolic activity, resistant to destruction by heat/chemicals
- Bacillus
  - B Anthracis
    - Contact: painless ulcers with black eschar
    - Inhaled: flu-like symptoms, DAH
  - B Cereus
    - Food poisoning after fried rice, acute onset n/v/d
- Clostridium
  - C Difficile
    - Diarrhea, formerly isolated to pts with recent abx use, now seen in other populations with relevant exposures
    - Treatment: metronidazole, PO Vancomycin, fidaxomicin
  - C perfringens
    - Gas Gangrene
    - Food Poisoning
  - C tetani
    - tetanus/lockjaw
  - C botulinum
    - Blocks Ach release from NMJ
    - Floppy Baby
    - Classic story with canned honey

Non-Spore Formers
- Corynebacterium Diphtheria
  - Gray pseudomembrane formation
- Listeria monocytogenes
  - Meningitis/sepsis in newborns and the elderly
  - Reason for empiric use of Ampicillin in meningitis for pts >65
- Nocardia
  - Partially acid fast
  - Lung + Brain symptoms in the immune-compromised
- Actinomycetes
  - Infections that break through fascial planes, classically sinus infections
- Erysipelothrix
  - Hand infection in fisherman
- Rhodococcus
  - PNA in immunocompromised
- Lactobacillus
  - Responsible for the normal pH of vaginal flora
Gram Negatives

Gram Negative Cocci

Neisseria
- Micro:
  - Meningitidis ferments both glucose and maltose while gonorrhea only ferments maltose (Meningitidis with M and G, Glucose with G)
- Meningitidis
  - Clinical Syndromes
    - Meningitis
    - Waterhouse-Friedrichsen
  - Treatment
    - Cephalosporins with CNS penetration: CTX
  - Vaccine
- Gonorrhea
  - Clinical Syndromes:
    - Urethritis
    - Reiter’s Syndrome
  - Diagnosis: Urine/Urethral Swab Testing
  - Treatment
    - Cephalosporins: CTX IM X 1 dose

Gram Negative Rods
- Lactose Fermenters
  - KEE organisms
    - Klebsiella
    - Enterobacter
    - E Coli
  - Non-Fermenters: distinguish based on oxidase
    - Oxidase Positive: Pseudomonas
    - Oxidase Negative: Shigella, Salmonella, Proteus
Review By Site of Infection

Syndromes

Bacterial Meningitis
- Adults <50
  o Bugs: N meningitides, H Flu, Strep Pneumo
  o Treatment
    • Vancomycin for CTX resistant Strep Pneumo
    • Ceftriaxone for others
    • Dexamethasone (with or before first dose)
- Adults >50, alcoholics, impaired immunity
  o Bugs: Strep Pneumo, Listeria, Gram Neg Bacilli
  o Treatment
    • Vancomycin
    • Ceftriaxone
    • Ampicillin for Listeria

Otitis Media
- Bugs
  o Viruses > Bacteria (Moraxella, Strep Pneumo, H flu)
- Treatment
  o amoxicillin, amoxicillin/clavulanic acid, cephalosporins

Pneumonia
- Community Acquired
  o Bugs: viruses, atypicals, strep pneumo
  o Therapy
    • Macrolides
    • Doxycycline
    • Cephalosporins: for macrolide-resistant strep pneumo
    • Quinolones
- Healthcare-Associated
  o Bugs: staph aureus, strep pneumonia, gram negatives
  o Therapy
    • Vancomycin
    • Piperacillin/Tazobactam
    • Double Coverage for pip/tazo resistant pseudomonas
      • Review data: inc renal failure, no diff in mortality in meta-analyses
      • Options: quinolones vs. aminoglycosides but high FQ resistance in our antibiogram
- Indications for Admission/Prognosis Tool
  o CURB-65: (confusion, BUN>19, RR.30, BP<90/60, age>65)
    • Score 1: outpatient therapy
    • Score >1: hospitalize

UTI
- Community
  o Bugs: E coli, enterococcus, staph saprophyticus
  o Drugs: TMP/SMX, nitrofurantoin, fluoroquinolones
    • Can add pyridium for the discomfort
- Healthcare
  o Bugs: resistant gram negatives
  o Drugs: amp + gentamicin
**Cellulitis**
- Community
  - Bugs: strep, staph
  - Treatment:
    - First Generation Cephalosporins
    - Dicloxacillin

**Drugs**

**Cell Wall Inhibitors**

**Penicillins**
- Pen G
  - Strep species, syphilis
- Amp/Amox
  - Enteric Gram negatives, enterococci, strep
- Amox/Clavulanic Acid
  - Improved anaerobic coverage (particularly bacteroides)
- Methicillin/Nafcillin/Oxacillin → PO Form Dicloxacillin
  - MSSA
  - Strep Skin infections
- Ticaricillin/clavulanic acid or Piperacillin/tazobactam
  - Gram negatives, anaerobes, most notably Pseudomonas
  - Ticaricillin treats stenotrophomonas (CF patients)

**Cephalosporins**
- 1st – 3rd: Gram Positives > Gram Negatives
- 3rd
  - CTX: no pseudomonas coverage, CNS penetration
    - PO form: cefpodoxime
  - Ceftazidime: pseudomonas coverage
- 4th Cefepime: pseudomonas coverage
- 5th Ceftobirole: anti-pseudomonal activity

**Carbapenems**
- Examples: Meropenem, Imipenem/Cilastatin, ertapenem
- Broad-Coverage including pseudomonas

**Aztreonam**
- Gram negatives only
- Used in patients with penicillin allergies

**Vancomycin**
- MOA: prevents d-ala d-ala cross-linking in the peptidoglycan cell wall
- Bugs: gram positives
- Side Effects:
  - Red Man syndrome: mast cell degranulation with rapid infusion

**Protein Synthesis Inhibitors**
- Clindamycin: anaerobes, classically assoc with pseudomembranous colitis
- Chloramphenicol
- Linezolid
  - Bugs: MRSA, gram positives more generally as well
  - Side Effects: thrombocytopenia, rarely can interact with MAO inhibitors and SSRIs to inc risk of a serotonin-syndrome
- Erythromycin/Macrolides
  - Bugs: atypical coverage, strep species
  - Side effects: prolonged QT, erythro has pro-motility properties
- Tetracycline
  - Bugs: chlamydia, rickettsia, mycoplasma, brucella
  - Side Effects: photosensitivity
- Aminoglycosides
  - Examples: gentamicin, tobramycin, amikacin, neomycin
  - Bugs: only aerobic organisms
  - Side Effects
    - Nephrotoxicity, ototoxicity, neuromuscular blockade (inc risk when used with paralytics in the ICU)

**Others**

- Fluoroquinolones
  - Examples: moxifloxacin, levofloxacin, ciprofloxacin
  - MOA: DNA gyrase (topoisomerase 2) inhibitor
  - Bugs: enteric gram negatives, intracellular organisms, gram positives
  - Side Effects:
    - Prolonged QT
    - Tendon rupture
- Daptomycin
  - Bugs: gram positives
  - MOA: alters membrane form and then permeability
  - Side Effects
    - Rhabdomyolysis: trend CPK
- TMP/SMX
  - MOA: competitive inhibitors of folate synthesis
  - Bugs: gram positives and gram negatives
  - Side Effects: (Treats Marrow Poorly)
    - Leukopenia, neutropenia, anemia
    - Increased creatinine without AKI (competes with creatinine in proximal tubule secretion)