

Adult Infectious Diseases

Over 200 Case Studies



Intended For:
Medical Students, Ambulists, Hospitalists,
Nurse Practitioners, Physician Assistants

by Robert M. Gullberg MD, FACP

Adult Infectious Diseases

Over 200 Case Studies and
Test Questions

(excellent for Board Review)

Intended for Medical and Nursing Students,
Ambulists, Hospitalists, Nurse Practitioners,
and Physician Assistants

*by Robert M. Gullberg MD, FACP
Associate Clinical Professor*

226 Case Studies in 20 Categories
(Test Questions and Answers with each section)

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The author would like to thank his medical students and patients for the years of enjoyment of bedside, clinical medicine.

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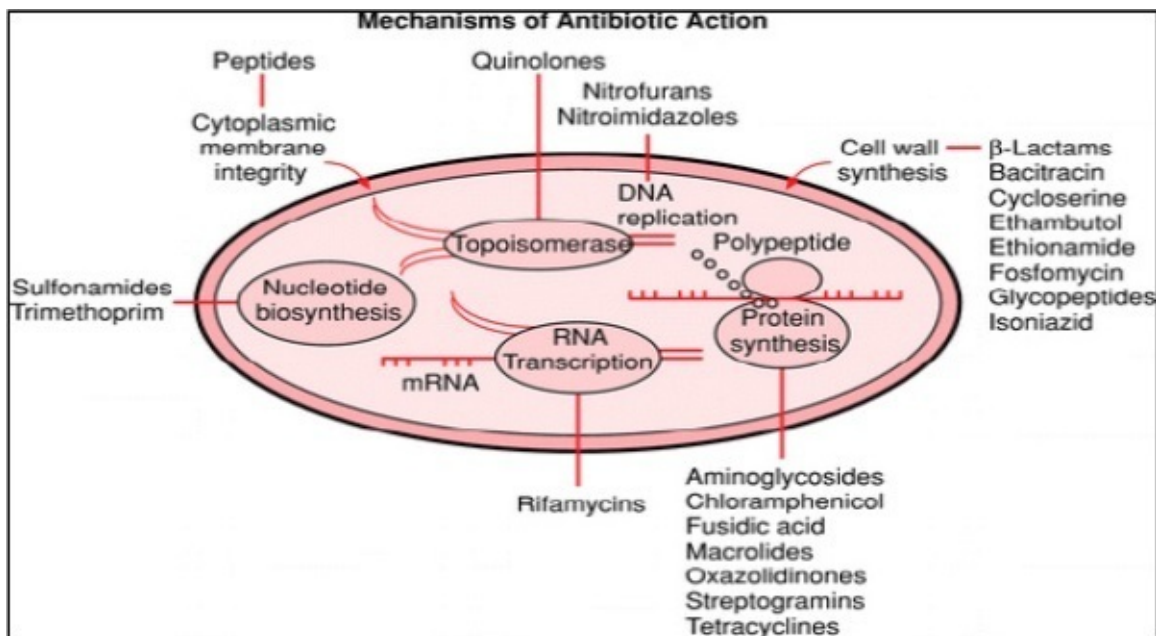
What we can learn from Sherlock Holmes

About the Author

Antibiotics

Introduction:

The issue with antibiotics is that they are generally used for “short term” treatments in patients. Their development by pharmaceutical companies is competing against long-term diseases like diabetes, COPD, MS, asthma and heart disease where medications are used for years. Pharmaceutical companies put their financial resources more in longer term diseases (such as HIV, Hepatitis C) where the “return on investment” (ROI) is higher. The pipeline for new antimicrobials has slowed down over the last several decades.



Case 1

A 20 year old female presents to the ER with acute abdominal pain and peritonitis from a ruptured appendix. You empirically place her on IV metronidazole (Flagyl) to cover anaerobes. To cover gram negative aerobic rods (such as E. coli, or Klebsiella), the choices include an **aminoglycoside**,

aztreonam, cefepime, or levofloxacin. You choose IV **gentamicin** since renal function is normal.

Aminoglycosides- block protein synthesis and inhibits 30S ribosome.

Bacteriocidal. IV Gentamicin/ Tobramycin - 6 mg/kg daily dosing. Pharmacy to help in dosing. Tobra >Gent for pseudomonas. Inhalation route also for bronchiectasis and pseudomonas pneumonia. Amikacin is more commonly used in children. Watch for nephrotoxicity (Gent >Tobra); especially in elderly females, and for ototoxicity. Three mechanisms of resistance: 1) reduced uptake 2) altered ribosome binding sites and 3) gene induced enzyme modifiers. Topical use also. Clinical use- oral neomycin for bowel surgery. Often used in combination with cell-wall synthesis inhibitor. Good for GU/GI infections and best against gram negative aerobes.

Best Agents for Gram Negative Aerobic Rod Infections

aminoglycosides, or

-Aztreonam

-3rd/4th generation cephalosporins

(ceftazidime, ceftaz/avibactam, ceftriaxone, cefepime, ceftolozane/tazo)

-Penams (imi,dori,erta,mera)

-Extended-Spectrum Beta-Lactams (piperacillin-tazo and ticarcillin-clav, ampicillin-sul)

-Quinolones

Bacteriostatic vs. Bacteriocidal-

Static antibiotics include: Chloramphenicol, Macrolides, Clindamycin, Sulfa, Trimethoprim, Tetracyclines

Cidal antibiotics include: Aminoglycosides, Beta-lactams, Vancomycin, Quinolones, Rifampin, and Metronidazole.

Case 2

A 32 year old female presents with vulvovaginal candidiasis. She has a “cottage cheese”, itchy, discharge. Her risks include DM and recent antibiotic use for acne. You recommend a course of oral **fluconazole**.

Antifungals- Azoles- ketoconazole- 1st generation; mostly historical.

Fluconazole (Diflucan)- 2nd generation; 150-400 mg po/IV daily.

Itraconazole(Sporanox)- 3rd generation,100-200 mg bid po. Voriconazole (Vfend)-4th generation-200-300 mg po bid. 4 mg/kg IV q 12 hrs. Posaconazole- 100 mg/day po. Watch for liver toxicity, fluid retention with itraconazole, and drug-to-drug interactions. Multiple imidazole creams for dermatophytoses; clotrimazole is popular.

Echinocandins- Caspofungin 50 mg/day IV. Micafungin 100 mg/day IV. Poor urine concentration. **Polyenes**- Amphotericin B-1-1.5 mg/kg IV daily. Watch for bone marrow toxicity, high LFTs, nephrotoxicity, phlebitis. Lipophilic Ampho. B - 5 mg/kg IV daily- less toxicity than non-lipid formulation. **Terbinafine** (Lamisil)- 250 mg/day po daily for onychomycosis.

How anti-fungal agents work

Cytoplasmic membrane- polyenes-bind ergosterol. Inhibit ergosterol synthesis- allylamines like terbinafine and azoles like ketoconazole (1st generation), fluconazole(2nd generation), itraconazole(3rd generation), voriconazole, and posaconazole (4th generation). Watch for drug-drug interaction with the azoles.

Cell wall inhibitors- echinocandins- inhibit glucan synthesis. Caspofungin, micafungin, and anidulafungin. All are IV only. Protein synthesis- flucytosine. Use for synergy, and resistant UTIs.

Case 3

A 72 year old female presents to the ER with a complicated UTI with emphysematous right pyelonephritis and you are concerned about bacteremia. Urine sediment shows gram negative rods. You want to stay away from aminoglycosides since her creatinine is 1.9. Other choices include IV cefepime, levofloxacin, or aztreonam. You choose **aztreonam**. The following CT of the abdomen shows: Emphysematous pyelonephritis with “air” left kidney



Aztreonam- a monobactam beta-lactam. Well tolerated. Narrow spectrum- gram negative aerobic rods *Tribe 1 (E.coli, Proteus, Klebsiell)* and *Tribe 2 (Pseudomonas, Serratia, Enterobacter, Citrobacter)*. IV use only. Poorly absorbed and cannot be used orally. Generally not nephrotoxic.

Case 4

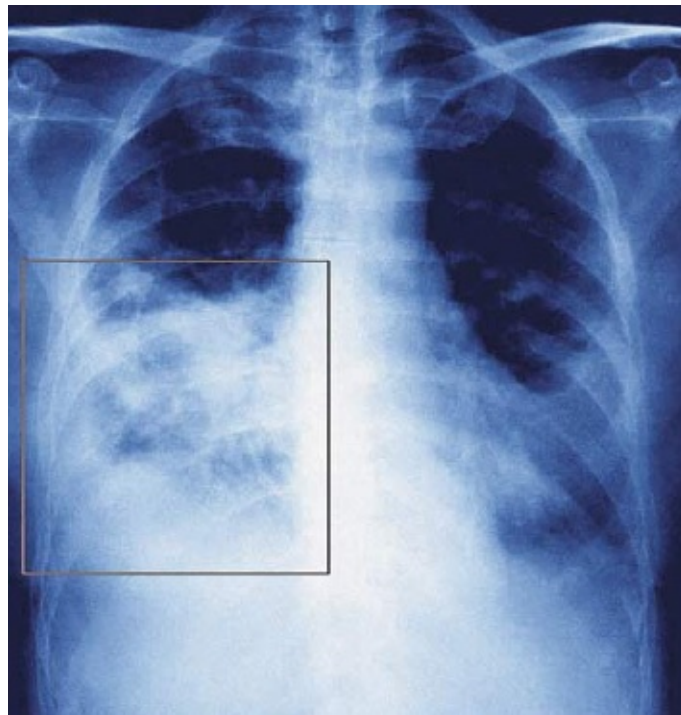
A 40 year old obese patient with venous stasis is admitted to the hospital with fevers to 102 and a hot cellulitis of the leg. You place the patient on IV **cefazolin** to cover MSSA and beta-strep. Blood cultures grow Group G Streptococcus.

Cephalosporins- minimal cross-over reaction with penicillins unless anaphylactic to penicillins. 1st generation- Oral- cefadroxil 500 -1000 mg daily, cephalexin 250-500 mg QID. IV- cefazolin 1-2 gms q 8 hrs. Covers strep (except enterococcus), MSSA and Tribe 1 gram neg rods. 2nd generation- Oral- cefuroxime 750 mg BID, IV- 750 mg IV q 8 hrs.- covers bugs sensitive to 1st generation cephalosporins plus Haemophilus influenza, Pasteurella multocida. Cefoxitin 1 gm q 6 hrs. Cefotetan (watch for bleeding because of one of its side chains) 1 gm q 12 hrs- both cover anaerobes below diaphragm plus Tribe 1 gram neg rods. 3rd generation- ceftriaxone 1-2 gms q12- 24 hrs- long half life.

Use in orthopedic infections-septic joints, osteomyelitis, and bacterial meningitis. Cefotaxime- used in peds. Ceftazidime for meningitis. 4th generation- IV cefepime 1-2 gms q 8-12 hrs. Covers MSSA, strep, Tribe1/Tribe 2 gram negative rods. 5th generation- ceftaroline-covers MRSA, MSSA, strep and CAP organisms. Side effects- similar to PCNs. Cefotetan- bleeding, ceftriaxone- LFTs up, and diarrhea. Later cephalosporins- ceftazidime/Avibactam- good for klebsiella pneumonia carbapenamase strains, and ceftolozane/tazobactam.

Case 5

A 40 year old known alcoholic comes to the ER after his wife witnessed him having a seizure. He is SOB and chest x-ray reveals a RLL pneumonia, likely “aspiration type.” You recommend IV **clindamycin** for treatment. The following chest xray shows: Right lower lobe pneumonia common in Aspiration.



Clindamycin- inhibits 50S ribosome. 150-300 mg po TID-QID in adults. (600 mg IV q8) Covers anaerobes above diaphragm and is a “back up” pneumococcal drug. Side effects- C. difficile diarrhea, neutropenia, increased LFTs. Steroids

helpful if gastric contents are aspirated.

Case 6

A 60 year old female is on chronic **Coumadin**(warfarin) therapy because of atrial fibrillation. She develops walking pneumonia. What antibiotics are safe for her to use without interrupting **Coumadin** therapy?

High INRs can cause epistaxis, bleeding gums, purpura, gross hematuria, hemarthroses, adrenal hemorrhage, hemoptysis, and CNS bleeds.

Coumadin Interaction- *Major-* sulfa, tetracycline, macrolides, quinolones, metronidazole. *Minor-* penicillins, cephalosporins, penams, clindamycin, aminoglycosides.

Case 7

A 33 year old male heroin user who shares needles comes into the ER with MRSA bacteremia and a new heart murmur. You diagnose MRSA endocarditis and start him on **Daptomycin** IV for a minimum of 4 weeks. ECHO and blood work is monitored.

Daptomycin-good Staph aureus drug, also enterococci and strep. Causes cell death by depolarizing the cell membrane. Used from MRSA and MSSA, especially bacteremia and right sided endocarditis, osteomyelitis, soft tissue infections. Surfactant breaks medication down in lung (don't use here). Monitor CPK. If 5-10 X CPK, consider discontinuing. Use 6-10 mg/kg/day. Only IV, and very expensive.

Antibiotics Inherently with NO MRSA Activity

- Penicillins (such as Ampicillin)
- Semi-synthetic penicillins (Nafcillin)
- Extended Beta-lactam Agents (such as Piperacillin-tazobactam)
- 1st-4th generation cephalosporins (like cefazolin)
- Penams (such as meropenam)

Case 8

A 57 year old diabetic has PVD and a malodorous ulcer on the foot. There are signs of acute cellulitis. You are concerned about the “kitchen sink” (polymicrobial) of organisms that could be causing disease. You place the patient on **Zosyn (Piperacillin-tazobactam)** on admission. The following picture shows: Typical infected diabetic foot ulcer



Extended beta-Lactamase Penicillins- Oral- amoxicillin-clavulanate (Augmentin) 500-875 mg bid. IV- piperacillin-tazobactam (Zosyn) 3.375 gms q6 hrs, or ticarcillin-clavulanate (Timentin), ampicillin-sulbactam (Unasyn). Continuous infusions of Zosyn have been used lately and have helped in reducing costs but still giving efficacy. Broad spectrum agents- cover anaerobes, aerobic gram – rods, enterococcus, strep and MSSA. Amox-clav.- watch for diarrhea. Piperacillin tazobactam/Ticarcillin clavulanate- “suicide” inhibitors. Watch for thrombocytopenia. No MRSA activity.

Case 9

A 40 year old firefighter with a history of recurrent MRSA infections of the buttock presents with a severe cellulitis and abscess. He has a high fever, a lot of pain, and is vomiting. You admit the patient to the hospital and place him on IV

Linezolid (Zyvox).

Linezolid- an oxazolidinone, it blocks initial protein synthesis at the ribosomal level. Bacteriostatic rather than cidal. Very expensive, about \$100.00/pill. 100% bioavailable. Watch for bone marrow toxicity (especially low platelets), serotonin syndrome (it is an MAO inhibitor) if given with SSRIs; neuropathy, GI side effects. Very good for VRE, MRSA. New oxazolidinone out in 2014 is Tedizolid. Sivextro (Tedizolid)- use 200 mg daily rather than BID and less BM dysfunction.

Antibiotics That Can Be Used For MRSA

(must check sensitivities)

- Trimethoprim-sulfa (po or iv)
- Doxycycline or Minocycline (po or iv)
- Clindamycin (po or iv)
- Rifampin (po or iv)
- Quinolones (po or iv)
- Linezolid (po or iv)
- Daptomycin (po or iv)
- Vancomycin (iv)
- Ceftaroline (iv)
- Tigecycline (iv)
- Dalbavancin/Telavancin (iv)

Case 10

A 40 year old female smoker presents with a one week history of an exacerbation of COPD with an increase in purulent sputum, SOB, and wheezing, with fevers. You prescribe the macrolide **azithromycin** with prednisone.

Macrolides- block 50-S ribosome. Erythromycin (one of the originals)- 333 mg tid for adults but GI side effects. **Extended macrolides**- Clarithromycin (metallic taste) po- 250- 500 mg bid or Azithromycin- 500 mg bid x day 1, then

daily for 4 days. 63 hour half-life. Watch for drug-drug interactions; liver metabolism. Good for respiratory tract pathogens (S pneumo sensitivities are slowly worsening, H.flu, Moraxella catarrhalis, Mycoplasma, Chlamydia, Legionella) and MAI (atypical TB). Azithromycin IV is now used by general surgeons in patients who need bowel motility.

Case 11

A 21 year old sexually active female presents with a smelly (like dead fish), vaginal discharge. She has a positive “whiff” test and vaginal stains show clue cells. You diagnose BV (Bacterial Vaginosis) and place her on **metronidazole**. The next day, you are working in the health department and diagnosis a Trichomonas vaginal infection and treat the patient with **metronidazole** also.

Metronidazole- nitroimidazole class. Acts by forming thio-ether bonds with cysteine-containing enzymes by being reduced to nitroso intermediates. Best anti-anaerobic antibiotic below diaphragm. Poor lung penetration. Good for certain protozoa- E. histolytica, trichomonas, giardia. Good for C. difficile diarrhea and rosacea, bacterial vaginosis (BV). Adverse effects- bad taste, disulfiram reaction with ETOH, CNS changes or neuropathy, GI side effects. Dosing- 500 mg tid po/iv.

Case 12

A 32 year old female comes in with recurrent HSV genitalis. She gets recurrences every 2-3 months on the vulva. You recommend a daily prophylaxis with **Acyclovir** 400 mg po.

Nucleoside inhibitors- for herpes simplex virus HSV 1 or HSV 2 and HZV.
Acyclovir- (prodrug famciclovir); penciclovir (prodrug valacyclovir).

Case 13

A 65 year old patient in the hospital has just had CABG-4 surgery 3 days ago. You are called to see him for a new pulmonary infiltrates bilaterally, SOB, fevers to 102.5, WBC of 23,000, left shift. Yellow sputum production is growing

Serratia marcescens on culture. You order **Meropenam** IV and respiratory treatments. The following chest xray shows: HCAP- bilateral lower lobes from Serratia



Penams- Imipenam 500 mg q 6 hrs, Merapenam-1 gm q 8 hrs, Doripenam. Ertapenam- 1 gm q 24 hrs. Broad spectrum; especially resistant gram negative aerobes/anaerobes, MSSA and strep. No MRSA or enterococcal coverage. Newer agent- Doripenam- more pseudomonas coverage. Imipenam can cause seizures. Penams are good for ESBL (extended spectrum beta-lactamase producing gram neg rods)

Case 14

A 12 year old child comes to see you with a severe sore throat and tonsillitis, with malaise and fevers. On physical exam, she has an acute tonsillitis. Strep screen is positive. You order **Amoxicillin** for Rx. The following picture shows classic: Purulent tonsillitis from group A Beta-streptococcus



Penicillins- cell wall inhibitor. Oral-amoxicillin 500-875 mg BID. IV-ampicillin 1-2 gms q 6 hrs. Good for beta-Strep. Benzathine Pen G still used for syphilis. Side effects- all penicillin derivatives- skin rash, rare anaphylaxis.

Case 15

A 24 year old **pregnant** female gets very sick with fevers, chills, and a UTI. You recommend **nitrofurantoin** for the E. coli on culture.

Antibiotics Generally Safe in Pregnancy:

- Penicillins
- Cephalosporins
- Macrolides (except Clarithromycin)
- Nitrofurantoin (avoid during 3rd trimester)
- Tri-sulfa (OK during 2nd trimester)

Pregnancy- Contraindicated- tetracyclines, quinolones. (also in pediatrics), Flagyl. Safe- beta lactam agents, nitrofurantoin, and macrolides (except clarithromycin).

Case 16

A 45 year old previously healthy male presents to the hospital with a serious lobar pneumonia and fevers to 102. He is breathing 35 times/min and his BP is 100 systolic. You admit him to the medical floor and place him in the CAP protocol, including **Levaquin** (a third generation quinolone) 750 mg IV daily.

Quinolones- act by blocking DNA gyrase and topoisomerase enzymes. Broad spectrum but poor anaerobic coverage except moxifloxacin. 1st generation- naladixic acid- historic only. 2nd generation- ciprofloxacin 250-750 mg po bid, or 400 mg iv bid. Ofloxacin- 400 mg bid po. Good for Tribe 1 gram neg rods and some Tribe 2 organisms like Pseudomonas. Used for traveler's diarrhea. Fair against respiratory pathogens. 3rd generation- levofloxacin- the L isomer of ofloxacin. Respiratory fluoroquinolone. Excellent for pneumococcus and atypical pathogens. Fair for UTIs. Good gram neg rod coverage. 4th generation- moxifloxacin- coverage like that of levofloxacin plus anaerobes above/below diaphragm. Adverse effects- CNS changes in the elderly, photosensitivity, prolongation of the QT interval. Contraindicated in pregnancy and pediatrics because of tendonopathy.

Case 17

A 76 year old patient has a prosthetic knee infection secondary to Staph epidermidis sensitive to cephalosporins. The prosthesis is retained after surgery. You treat her with 6 weeks of IV Ceftriaxone and **Rifampin** 300 mg/day (then cefadroxil and Rifampin po *indefinitely*).

Rifampin (rifampicin)- has excellent intracellular killing. Good for synergy against staph (MSSA and MRSA), pseudomonas. Excellent when a prosthesis is present. Penetrates biofilms well. Don't use as mono-therapy. Anti-tuberculosis drug for decades. Acts by inhibiting DNA dependent RNA synthesis by blocking RNA polymerase. Turns the urine red-orange! Monitor LFTs. Semi-synthetic rifampicins include rifabutin (Mycobutin) which is used in resistant Mycobacterial disease, has less drug interactions, rifapentine, and rifaximin (Xifaxan).

Also in the Rifampin Class of Medications

Rifabutin (Mycobutin)- dosing is 150 mg po bid or 300 mg daily

Rifapentine is used in latent TB on a weekly dosing schedule

Rifaximin (Xifaxan) is poorly absorbed and big \$. Used in IBS, bacterial overgrowth, traveler's diarrhea Rx. Dose- 200 mg tid to 550 mg bid.

Case 18

A 33 year old male with Type 2 DM presents with acute MSSA cellulitis of the leg with positive blood cultures. You start him on **Nafcillin** IV in the hospital.

Semi-Synthetic Penicillins- Oral- dicloxacillin 250-500 mg QID. IV- nafcillin 1-2 gms q 4 hrs, or oxacillin IV, good for Strep (except enterococcus) and MSSA. Side effects- interstitial nephritis, phlebitis, increased LFTs with oxacillin.

Case 19

A 28 year old high risk male presents with acute interstitial pneumonia secondary to Pneumocystis jirovecii. HIV comes back positive on Western Blot. You start him on IV **Trimethoprim-Sulfamethoxazole** with IV steroids and he promptly improves over 5 days.

Sulfamethoxazole (Tri-sulfa)- bacteriostatic. Blocks synthesis of bacterial tetrahydrofolic acid. Sulfa is a structural analog of PABA (para-aminobenzoic acid), an intermediate in the bacterial production of folate. Trimethoprim binds to dihydrofolate reductase preventing production of THF. Good for most E.coli, MSSA, MRSA, Pneumocystis jirovecii. Rash in 15%; Stevens-Johnson syndrome is rare.

Case 20

A 30 year old male presents with fevers to 2 weeks, muscle pains, headache and a petechial rash. During a recent hunting trip he pulled an imbedded tick off his axilla. You suspect Rocky Mountain Spotted Fever and start him on

tetracycline.

Tetracyclines- inhibit 30S ribosome. Bacteriostatic. QID dosing hard for compliance. Contraindicated in children and pregnancy. Doxycycline is bid; cyclines can cause esophagitis, photosensitivity, drug-induced lupus. Minocycline is one/day; watch for vertigo. Tigecycline- IV only. Cidal, broad spectrum, covers MRSA well, pneumococcus, and anaerobes. Has fallen into disfavor because of deaths attributed to it.

Mnemonic for site of action of Protein synthesis antibiotics:

50S ribosome- **CH-ERY-L**- **Ch**oramphenical, **E**rythromycin (macrolides) and **L**incomycin (clindamycin)

30S ribosome- **AM-TET**- **A**minoglycosides, **T**etracyclines Linezolid binds to the 23 S portion of the 50S ribosome.

Case 21

A 45 year old female presents with a complicated MRSA UTI with pyelonephritis. She develops bacteremia and is placed on **Vancomycin**. After 5 days of treatment, she develops ataxia, a dreaded side effect of vancomycin.

Watch for Vancomycin-intermediate Resistant Staph (VISA) and VRSA. VRE is already a problem.

Vancomycin- 15 mg/kg/dose q 12 hours. Concentration dependent. Acts on cell wall synthesis. Pharmacy to dose. For MRSA, if MIC>2; don't use. IV good for most gram positives, but no anaerobic or gram neg aerobe coverage. Watch for red man (neck) syndrome- histaminic reaction with rapid infusion. Also nephrotoxic and ototoxic. PO dosing not absorbed- good for C.difficile (125-500 mg). Good Rx for penicillin allergic pts. for Enterococcus faecalis, especially for bacteremia. Dalbavancin came out in 2014, and has a longer half life than Vancomycin. Can be used weekly.

Case 22

A 40 year old male has a VAP from a *Klebsiella pneumoniae* organism that is a carbapenamase (*KPC*). You suggest **Colistin (Polymyxin E)** inhalation for treatment. How does Colistin work and what are its potential side effects?

Colistin (polymyxin E) is a bactericidal drug that binds to lipopolysaccharides in the outer cell membrane of Gram-negative aerobic bacteria (*CRE*, *Pseudomonas* and *A. baumannii*) allowing disruption and leakage of cell contents, and death. It causes reversible nephrotoxicity and neurotoxicity. It can cause vertigo, weakness, and paresthesias. Inhalation dose is 50-75 mg in NS via neb 2-3x/day. Especially good in cystic fibrosis pts. It is not active against *Proteus*. IV dose- 1.5-5 mg/kg/day, pending on CrCl.

1. What is the only antibiotic/antibiotic class that targets Topoisomerase in bacterial cells?

- A.) Aminoglycosides
- B.) Beta lactams
- C.) Ethambutol
- D.) Quinolones
- E.) Trimethoprim

2. A 11 year-old boy presents to the ED with diffuse abdominal pain with rebound tenderness and a positive McBurney's sign. Which two medications would you place this patient on to cover both anaerobes and gram negative aerobic rods?

- A.) Clindamycin and Ciprofloxacin
- B.) Clindamycin and Gentamicin
- C.) Metronidazole and Tobramycin
- D.) Metronidazole and Aztreonam
- E.) Metronidazole and Levofloxacin
- F.) B, C, D
- G.) Metronidazole and Burnamycin

3. A 65 year-old female is being treated for a systemic fungal infection with a polyene antimycotic agent that binds ergosterol. Which of the following will reduce the adverse effects often experienced with this agent?

- A.) administer with clavulanic acid
- B.) administer with fluconazole
- C.) administer the lipid formulation
- D.) administer the protein formulation
- E.) administer with terbinafine
- F.) administer with a martini

4. An 83 year-old female presents to the ED from her extended care facility with change in mental status, dysuria, and flank pain. The patient is febrile with a temperature of 102. Past medical history is significant for neurogenic bladder and renal artery stenosis. Which antibiotic would cover systemic gram negative bacilli infections without affecting renal function substantially?

- A.) Aztreonam
- B.) Gentamycin
- C.) Metronidazole
- D.) Tobramycin
- E.) Terbinafine
- F.) Nephrocillin

5. A 24 year-old male is being treated for gonococcal urethritis. When asked about his allergies, he responds that he is allergic to penicillin. Which adverse reaction to penicillin would disallow the administration of ceftriaxone?

- A.) anaphylaxis
- B.) elevated liver function tests
- C.) diarrhea
- D.) rash
- E.) tendonopathy
- F.) Halatosis fugax

6. A 7 year-old was bitten at daycare by a 4 year-old. What is the drug of choice for treatment?

- A.) Ampicillin
- B.) Cefuroxime
- C.) Biteadroxil
- D.) Cephalexin
- E.) Gentamycin
- F.) Vancomycin

7. A 46 year-old homeless male with a history of alcoholism and IV drug abuse presents to the ED with a change in mental status, headache, nuchal rigidity, and fever/chills. He refuses an HIV test, but his CD4 count is 82. You suspect Cryptococcal meningitis. Which medication should be utilized?

- A.) Echinocandins
- B.) Fluconazole
- C.) Itraconazole
- D.) Ketoconazole
- E.) Cryptoconazole
- F.) Voriconazole

8. A 82 year-old female with a history of GERD and dysphagia is seen by her PCP with SOB and consolidated crackles in the left lower lobe. Chest X-ray reveals a LLL pneumonia. Which medications are necessary for the treatment of chemical pneumonitis?

- A.) Clindamycin

- B.) Doxycycline
- C.) Steroids and Clindamycin
- D.) Steroids and Doxycycline
- E.) Vancomycin

9. A 55 year-old female who recently underwent a total knee replacement (on Coumadin) develops cystitis and is placed on Bactrim. The patient returns to your office for follow-up concerned about her bleeding gums, nose bleeds, and large bruises surrounding her joints bilaterally. Which medication can you switch this patient to reduce her drug interaction?

- A.) Erythromycin
- B.) Ciprofloxacin
- C.) Cefadroxil
- D.) Bruisacillin
- E.) Levofloxacin
- F.) Metronidazole

10. A 25 year-old female allowed her partner to inject heroin into her calf muscle and has now developed cellulitis. The patient also complains of fever/chills, headache, and heart palpitations. What antibiotic will effectively treat her bacteremia and cellulitis?

- A.) Amoxicillin
- B.) Clindamycin
- C.) Doxycycline
- D.) Rifampin
- E.) Vancomycin

11. A 6 year-old boy and his parents present to your office with a 4-day history of oily, foul smelling diarrhea, after coming back from a camping trip. The parents and child need to be treated before they can take their son back to daycare. Which medication is most appropriate?

- A.) Clindamycin
- B.) Itraconazole
- C.) Ivermectin
- D.) Loperamide
- E.) Metronidazole
- F.) Foulsmellacin

12. What is the recommended daily prophylactic dose for HSV-2 infections in adults?

- A.) Acyclovir 200 mg po daily
- B.) Acyclovir 400 mg po BID
- C.) Acyclovir 600 mg po daily
- D.) Valacyclovir 400 mg po BID
- E.) Valacyclovir 600 mg po BID

13. A 35 year-old firefighter who sustained third-degree burns from an industrial fire 2 week ago has grown Pseudomonas from his bronchial washings and burn cultures. Which penam antibiotic has the best

pseudomonas coverage?

- A.) Doripenam
- B.) Ertapenam
- C.) Imipenam
- D.) Merapenam
- E.) Obamapenam

14. A 76 year-old female who recently returned from a trip to Australia presents to your office with a large, gaping wound in her foot that she got from stepping on a piece of coral on the beach. She did not want to seek medical attention in another country and did not know how to properly clean and dress the wound. Her right great toe has a large, deep pyogenic ulceration with foul-smelling grey discharge. The patient refuses to be admitted to the hospital. What broad spectrum antibiotic can be given orally in an outpatient setting?

- A.) Augmentin
- B.) Timentin
- C.) Unasyn
- D.) Zosyn
- E.) Zyvox

15. A 58 year-old male patient is being treated for a severe MRSA cellulitis and associated abscess with Linezolid. What is a serious side effect associated with this medication?

- A.) Anaphylaxis
- B.) GI disturbance
- C.) Hepatic encephalopathy
- D.) Hypercoagulability
- E.) Thrombocytopenia
- F.) Turning purple into green poka-dots

16. A 28 year-old G2P1001 at 35 weeks' gestation presents with dysuria, polyuria, fever, chills, and a temperature of 101. What antibiotic class is absolutely contraindicated during pregnancy and why?

- A.) Cephalosporins- CNS malformations
- B.) Penicillins- infantile cataracts
- C.) Macrolides- hydrops fetalis
- D.) Quinolones- tendon dysgenesis
- E.) Sulfonamides- bone deformities

17. A 62 year-old female presents with recurrent UTIs. The patient is allergic to penicillins with an anaphylactic reaction. What medication would be most appropriate for this patient?

- A.) Cefepime
- B.) Ciprofloxacin
- C.) Levofloxacin
- D.) Moxifloxacin
- E.) Rifaximin
- F.) Elderacillin

18. A 35 year-old professional skier developed edema and erythema surrounding his incision post-total knee replacement on post-op day 25. There is evidence the infection spread to the hardware, which is removed and cultured. What is the appropriate treatment to cover MRSA in this situation?

- A.) ceftriaxone and amoxicillin
- B.) ceftriaxone and rifampin
- C.) vancomycin and amoxicillin
- D.) vancomycin and ceftriaxone
- E.) vancomycin and rifampin

19. A 5 year-old boy presents to your office with a large, red lesion that continues to spread, according to the patient's mother. The lesion is now 6 cm in diameter with central and peripheral erythema. The patient had recently gone deer hunting with his father, who denies any signs of a rash. The patient has no other symptoms. What medication would you treat him with?

- A.) Amoxicillin
- B.) Ceftriaxone
- C.) Doxycycline
- D.) Terbinafine
- E.) Tetracycline

20. Match the following drugs to their known side effects:

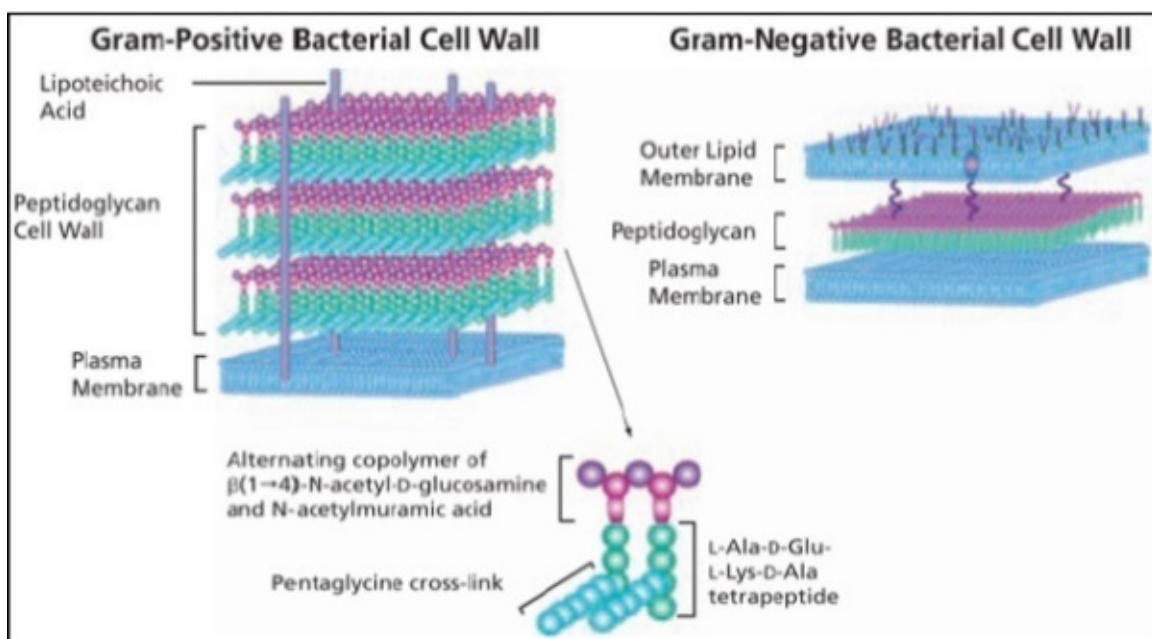
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| 20.) Amphotericin B | A.) Turning red with infusion |
| 21.) Aminoglycosides | B.) Bleeding |
| 22.) Azoles | C.) Bone marrow toxicity |
| 23.) Cefotetan | D.) C. Diff colitis |
| 24.) Clindamycin | E.) Disulfiram-like reaction |
| 25.) Metronidazole | F.) Hepatic toxicity |
| 26.) Vancomycin | G.) Ototoxicity |

Answers:

1. **D** 2. **F** 3. **C** 4. **A** 5. **A** 6. **B** 7. **B** 8. **C** 9. **C** 10. **E** 11. **E** 12. **B** 13. **A** 14. **A** 15. **E** 16. **D** 17. **B** 18. **E** 19. **A** 20. **C** 21. **G** 22. **F** 23. **B** 24. **D** 25. **E** 26. **A**

Basic Microbiology

Bacteria- bacteria are prokaryotes with free circular DNA, ribosomes, no mitochondria or nucleus, and a peptidoglycan cell wall. **Gram negative bacteria** have a periplasmic space and outer membrane. The doubling time for most bacteria is 20 minutes, but 24 hours for **M. tuberculosis**.



MICs (Minimal Inhibitory Concentrations)-this is the **main** way we clinically determine antibiotic sensitivities. A MIC panel is generated for potentially pathogenic isolates. We like to pick “S” (Sensitive) antibiotics rather than “R” (Resistant) antibiotics. *You can't compare the MICs of different antibiotic classes; only the same class.*

In Vitro Susceptibility Testing

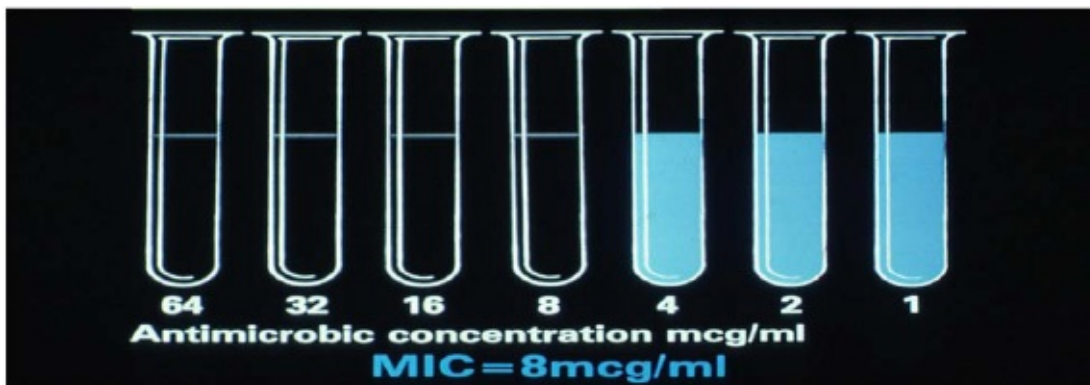
“S” for Sensitive- favorable

“I” for Intermediate- who knows

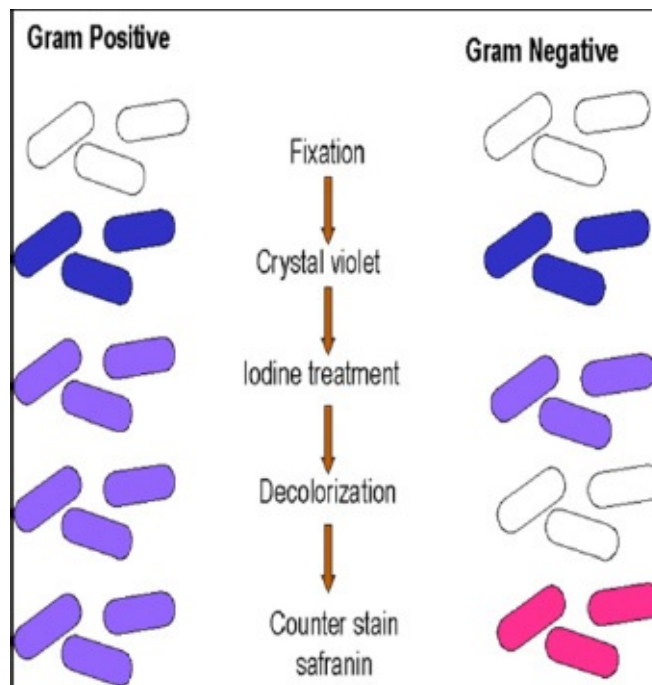
“R” for Resistant- unfavorable

Minimum Inhibitory Concentrations (MIC)-

The following schematic shows: Macrobrotth Dilution; Lowest concentration of an antibiotic that prevents visible evidence of growth after 20-24 h exposure = MIC



Gram Stain- invented by H. Christian Gram in the late 1800's to help identify bacteria.



Fungi-they are **eukaryotic and have a nucleus with a nuclear membrane** and the cytoplasm contains mitochondria, Golgi apparatus, lysosomes and an endoplasmic reticulum. Morphology is either small round yeasts, or filamentous molds with a mycelium of hyphae. Dimorphic fungi have a yeast form in tissues and an environmental mycelial form. Fungi cause disease by mycotoxins, hypersensitivity or invasive infection with tissue damage. Cell mediated immunity is the most important defense.

Viruses-“poisonous fluid” (Latin)- viruses can replicate only in a host cell and cannot survive long outside a host cell. They consist of a central genome of either RNA or DNA, and a protein capsid shell or outer envelope. The genome is either double stranded DNA or single stranded RNA, linear or circular, one piece or segmented. Viral envelopes are lipoproteins, often with glycoprotein spikes.

The Herpes virus group is the most common group of viruses (nine total now) that are seen clinically: Divided into 3 groups: the alpha, the beta, and the gamma. Alpha herpesviruses include herpes simplex 1 and 2, and varicella-zoster virus (VZV; HHV-3). Beta herpesviruses include cytomegalovirus (CMV; HHV-5), HHV-6A and HHV-6B and HHV-7. The gamma herpesviruses include Epstein-Barr virus (EBV; HHV-4) and Kaposi’s sarcoma-associated herpesvirus (HHV-8).

Protozoa- all are unicellular with eukaryote cellular structures. They have a fragile trophozoite stage and most have a resistant cyst form. All have life cycles outside the human host, and most can multiply in humans. Infection is by ingestion, by inhalation, by insect bite or by intercourse. Eosinophilia is not found in protozoal infections, but it is in metazoal (worms- nematodes, trematodes, and cestodes) infections. Protective immunity is poorly developed in most protozoal infections.

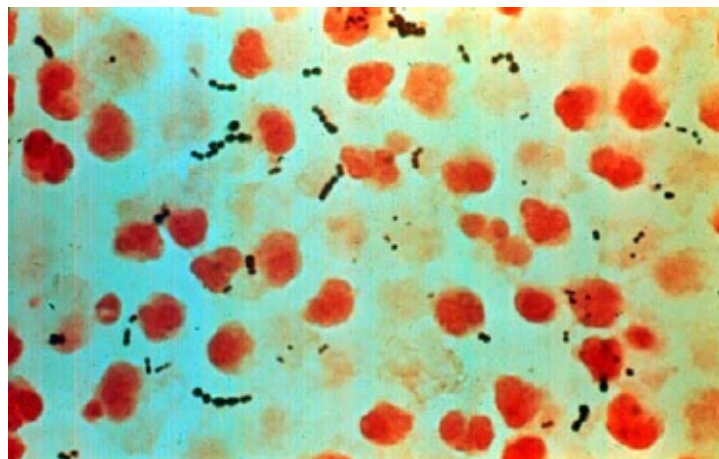
Case 23

A 40 year old male presents with septic shock. He is recently post op cholecystectomy and has a skin-wound infection. Blood cultures grow **Staph**

Biological meshes- Surgisis/Permacol/Xenmatrix/Strattice- porcine dermis. These do not become infected easily. Parietex (polyester synthetic) has more trouble.

Case 24

A 82 year old male comes into the ER with fevers and chills for 7 days. He has gross hematuria and dysuria. On physical exam, his prostate is tender and urinalysis shows 50 WBC/HPF and 3+ bacteruria. Spun down gram stain of the urine shows **gram positive cocci in chains**. Blood cultures subsequently grew **Enterococcus faecalis**, a gamma streptococci.



Gram Positive CHAINS on Gram stain-Alpha-Streptococci- Strep viridans group- endocarditis and pneumonia, Strep. pneumoniae- seen as diplococci; virulence by being encapsulated. Produces pneumolysin, neuraminidase, and purpura-producing principle. Causes #1 pneumonia in USA, also meningitis, DIC, and endocarditis. They partially hemolyze blood agar. **Beta Streptococci-** Groups A (Strep. Pyogenes, M protein is anti-phagocytic. Produces streptolysin O, streptolysin S, DNAses, streptokinases, hyaluronidases, and erythrogenic toxins), B (Strep. agalactiae), C, and G-skin/soft tissue infections. Extremely virulent. They fully hemolyze blood agar. **Gamma Streptococci-** Enterococcus species (faecalis, faecium, VRE) - UTIs, abdominal abscesses, endocarditis. Often not a pathogen in polymicrobial environment. Usually sens. to Ampicillin, Vanco, Dapto. They do not hemolyze blood agar.

Pneumococci-(Strep pneumoniae)- 3 main complications of bacteremia are DIC, meningitis, and endocarditis. 3 main complications of Pneumococcal pneumonia are pericarditis, empyema, and lung abscess. If bacteremic, be sure to add a macrolide (dual therapy) which helps to inhibit pneumolysin production.

Pneumococci Virulence Factors- polysaccharide capsule resists phagocytosis. Lack of activation of alternative complement pathway. Surface protein A- inhibits complement activation. Pneumolysin, cytotoxin, activates complement system. Enzymes- autolysin, neuraminidase, hyaluronidase enhance adhesion and release of pneumolysin. Spread after colonization- upper and lower respiratory tracts by direct invasion (non-invasive)- sinuses, bronchi, eustachian tubes. Reach normally sterile areas by hematogenous spread (invasive). Blood, peritoneum, CSF, joint fluid.

Summary of Gram Positive Cocci- MSSA, MRSA, Staph epidermidis, Alpha-strep (Strep viridans group, Strep pneumo), Beta-strep (Groups A,B,C,F,G), Gamma-strep- Enterococcus faecalis/faecium, VRE.

Case 25

A 40 year old male with history of alcoholism presents to the ER with fevers, delirium, and stiff neck. Lumbar puncture shows a cell count of 2000 with a left shift, a glucose of 10, and a high protein. Gram stain shows **gram positive rods**, and cultures grow **Listeria monocytogenes**. Rx of choice is Ampillin.

Aerobic Gram Positive rods- Listeria monocytogenes - causes bacteremia and meningitis. Intracellular pathogen. Invades pregnant women, newborns, and alcoholics who have chronic liver disease. Corynebacteria- diphtheria. Potent exotoxin. Other corynebacterial infections in device-related nosocomial infections. *JK strain* seen in febrile neutropenics. Bacillus species (anthracis- Anthrax has an antiphagocytic capsule and 3 toxins- protective factor, edema factor and lethal factor) Spore formers and soil and animals are the reservoirs. Bacillus cereus an occasional pathogen. Erysipelothrix rhusiopathiae- found in animals and on fish and can cause *erysipeloid*.

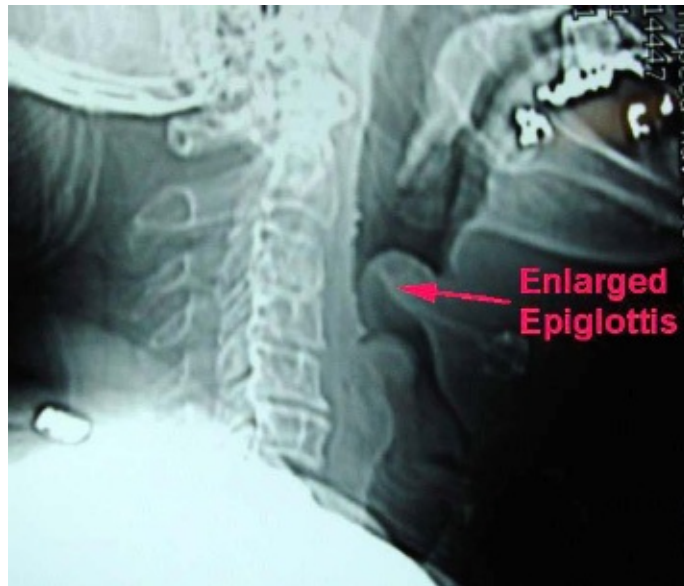
Case 26

A 65 year old male with COPD from smoking presents to the ER with SOB, fevers, cough and a CAP. Gram stain shows **gram negative diplococci** and cultures grow **Moraxella catarrhalis**.

Aerobic Gram Negative diplococci- *Neisseria gonorrhoea* – causes urethritis/cervicitis. Often intracellular. *Neisseria meningitidis*- not inhibited by serum- causes acute meningitis and sepsis. *Moraxella catarrhalis*- URIs, CAP. *Kingella*- associated with endocarditis, septic joints in pediatric patients. *Acinetobacter*- nosocomial pathogen.

Case 27

A 55 year old banker presents to the ER with difficulty speaking and swallowing, and severe pain and fever. Lateral neck x-ray shows the “thumb” sign. Direct laryngoscopy by ENT reveals epiglottitis, and you suspect **Haemophilus influenzae**, a **gram negative coccobacillus**.



Aerobic Gram negative coccobacilli- *Haemophilus influenzae- epiglottis*, pneumonia, cellulitis in peds. Has an anti-phagocytic capsule and endotoxin. Rx- 2nd and 3rd generation cephalosporins. (also *H. parainfluenza*) Also *Bordetella*

(pertussis)- produces 4 exotoxins, and an endotoxin, and Legionella pneumophila (causes mild Pontiac fever or the lethal Legionnaire's disease)- is an intracellular pathogen.

Case 28

A 53 year old internist presented to the ER with RUQ abdominal pain and acute gallstone pancreatitis (amylase was over 400). Blood cultures grew **Escherichia coli (E.coli)** sensitive to cefazolin. He was promptly taken to surgery for a laparoscopic cholecystectomy. E.coli is considered a Tribe #1 aerobic gram negative rod.

Aerobic Gram Negative rods- many contain endotoxin, capsular K, flagellar H and somatic O antigens which provide virulence. Tribe #1- E.coli, Proteus mirabilis, Klebsiella pneumoniae or K. oxytoca. Common cause of UTIs, abdominal infections. Generally sensitive to cefazolin. Tribe #2- Pseudomonas ("grape odor", exotoxin A, exoenzyme S, produces elastase, leucocidin, phospholipase C), Citrobacter, Enterobacter, Serratia, Alcaligenes (Achromobacter), Kluyvera- all more resistant. Cause nosocomial infections, especially lung and urine. Treat with Cefepime or Zosyn. *Oxidase + gram - rods-* Vibrio (cholera), Campylobacter, Helicobacter (associated with PUD, gastric cancer), Aeromonas. *Other-* Eikenella corrodens- seen in dental and human bite infections. It is resistant to clindamycin and metronidazole, but sensitive to penicillins.

E. coli Clinical Syndromes (4 main types)- Enteric Infections-Traveler's Diarrhea. Childhood diarrhea-Hemorrhagic colitis/HUS. Shigella-like dysentery. Cholecystitis and cholangitis-obstruction --> stagnation --> bacterial overgrowth. Intra-Abdominal abscess- due to perforated viscous, abscess, cholecystitis, or ascending cholangitis. Bacteremia also.

Proteus: A.K.A. "the Swarmer"- this organism is part of the **TRIBE I** group, usually P. mirabilis.. It swarms on culture medium. It smells like musty, dirty socks. It takes part in UTIs, intra-abdominal infections, pneumonia, and wound

infections. Some of the species (i.e. *P.vulgaris*) are resistant to cefazolin.

Case 29

A 26 year old female with poor dentition presents to the ER with severe anterior neck pain and swelling. Clinically, you suspect a submandibular abscess and Lemiere's Syndrome (septic jugular phlebitis) from **Fusobacterium necrophorum** and other **mouth anaerobes**. You are concerned about the development of mediastinitis because of bacteria traversing distally in the pre-vertebral space. You suggest surgery for I&D and IV Clindamycin.

Anaerobes above the diaphragm- Gram pos cocci- Peptococcus/Peptostreptococcus (also found in vagina, skin) - “bad breath” organisms; live on gums. Gemella morbillorum. Gram neg diplococci- Veillonella. Gram neg rods- Prevotella species (such as *P. oralis*, *bivia*, *melanogenica*), Fusobacterium (*necrophorum*), other Bacteroides. *Most anaerobes above diaphragm are sensitive to penicillin or clindamycin.* Gram pos rods- Lactobacillus, Propionibacterium acnes (associated with acne), and Eubacterium species.

Case 30

A 70 year old woman presents to the ER with severe abdominal pain from a perforated colon secondary to acute diverticulitis and pericolic abscess. Blood cultures grow **Bacteroides fragilis, gram negative anaerobic bacillus**. She is brought to emergency surgery for partial colon resection.

Anaerobes below the diaphragm- anaerobe/aerobe ratio is 1000:1 in stool. Gram neg rods - *Bacteroides fragilis*- most common pathogen in the gut. Causes abscesses. Gram pos rods- *Clostridia species*. *C. septicum*- associated with GI malignancies. *C. perfringens*- gas gangrene, *C. botulinum*- botulism, *C. tetani*- tetanus, *C. difficile*- associated with pseudo membranous colitis. Spread by spores. Most anaerobes below diaphragm sensitive to metronidazole, or Zosyn/Timentin, or Meropenam/Ertapenam or cefoxitin, more than clindamycin.

Case 31

A 40 year old Marine veteran presents with a draining sinus on his left jaw associated with jaw swelling and pain. You suspect the pathogen is **Actinomyces**, a **gram positive anaerobic rod**.

Actinomyces- gram positive anaerobic rod - (*A. israelii*), causes “lumpy” jaw (osteomyelitis), abdominal, mycetoma, and thoracic infections, sometimes CNS infections. Look for *sulphur granules*. Also causes *PID from IUD use*. Rx- penicillin. *Tropheryma whippelii*- an actinomycete causing Whipple’s disease.

Case 32

A 52 year old construction worker who frequently kneels while working presents with a large draining mass of infected tissue from his left lower leg, associated with pain and low grade fevers. I&D reveals a mycetoma and cultures grow **Nocardia asteroides**, a **gram positive, filamentous rod, weakly acid fast**.

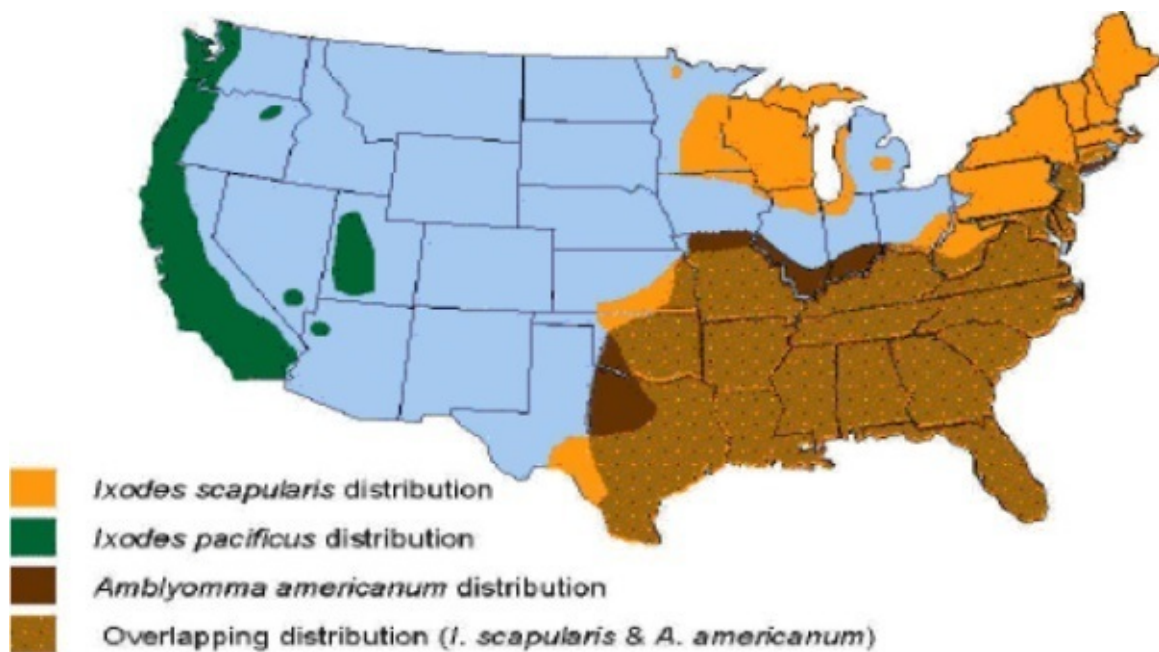


Nocardia asteroides- gram positive filamentous rod, *weakly acid-fast* aerobic soil bacteria. Causes pulmonary pseudo- tuberculosis, brain abscesses, and mycetomas in soft tissue after soil exposure. Often suppuration and scarring. Rx with sulfa.

Case 32

A 40 year old outdoorsman presents with a FUO. He has muscle pains, arthralgias, headaches, diarrhea, and cough, and slight confusion. His wife

pulled a tick off of his groin 2 weeks ago after a camping trip. You suspect **Ehrlichiosis**, one of the **Rickettsiaceae** organisms.



Rickettsiaceae– small gram neg bacilli, includes Rickettsia, Orientia, Coxiella, Anaplasma and Ehrlichia. They have a cell wall, prokaryotic ribosomes, RNA, DNA, and have peptidoglycan in the cell wall. Unlike bacteria, they lack enzymes for energy metabolism, hence they are obligate intracellular parasites, and can't replicate extracellularly. Virulence factors- contain lipopolysaccharide, mild toxins, phospholipase A, and intracellular replication causing host cell death. R. rickettsii- Rocky Mountain Spotted Fever. Ehrlichia- tick borne Ehrlichiosis. Anaplasmosis- tick borne or iatrogenic spread through surgery, or tattoos.

Case 33

This microorganism is spread by body lice and caused more than 1 million infections in infantry men during World War I; called Trench Fever. Symptoms were fevers, malaise, rash, diarrhea, total body ache, and thrombocytopenia lasting for up to 4 weeks. **Bartonella quintana** was the bacteria. The following picture shows a body louse.



Bartonellae- similar to Rickettsiaceae. They will grow in cell-free cultures. *B. bacilliformis*- Oroya fever- spread by sand flies. *B. henselae*- cat scratch disease, bacillary angiomatosis in HIV. *B. quintana*- Trench fever, famous in World War 1-spread by body lice (*Pediculus humanus*).

Case 34

A 43 year old hunter from central Wisconsin presents to you with Bell's Palsy. You order ELISA testing and Western Blot and they are positive for Lyme's Disease. ***Borrelia burgdorferi*** is the spirochete and the deer tick is the vector. You recommend treatment with 30 days of Doxycycline.

Spirochetes – corkscrew appearance. *Treponema pallidum*; causes syphilis. *Borrelia burgdorferi*- causes Lyme disease, found in northern hemisphere in many locations, *B. recurrentis*- causes Relapsing Fever, *Leptospira*-associated with infected animals (rodents) or their urine.

Case 37

You are working as a “prompt care” doctor in Little Rock, Arkansas. Ticks and deer flies have been heavy in the area. A 40 year old hunter who has been recently “skinning” rabbits presents with high fevers, lethargy, anorexia, and with a bite region on the arm with associated painful lymphadenopathy. Some of his lymph nodes have supplicated (like plague). His face is edematous and his conjunctiva are erythematous. You suspect **Tularemia**.

To culture *F. tularensis* -use buffered charcoal and yeast extract

Humans contract **tularemia** by handling diseased carcasses, eating undercooked

meat of diseased animals, or being bitten by certain deer fly or tick vectors. There is a pneumonic form.

Zoonotic bacteria – bacteria that cause human diseases but have an animal or bird reservoir. **Pasteurella multocida**- gram neg rod ; infects humans via dog/cat bite. **Brucella**- gram neg coccobacillus- humans infected by unpasteurised milk/cheese. **Yersinia**- gram neg rod; Y. pestis causes plague. Carried by fleas. **Francisella**- gram neg coccobacilli; **F. tularensis causes tularemia**. Spread by rabbits, rodents, or ticks/deer flies. Epicenter in the US is Missouri, Arkansas, and Oklahoma. Has been used as a biowarfare agent. **Chlamydomphila psittaci** (Parrot fever or ornithosis) is spread by sick birds (parrots, macaws, etc); and causes atypical pneumonia.

Case 36

A 30 year old HIV patient with a history of non-compliance and a CD4 count of 180 presents with difficulty swallowing. EGD shows the “cottage cheese” plaques and dimorphic fungus **Candida** is suspected; and esophagitis is diagnosed. You treat with Fluconazole.



Fungi- most common pathogens are dimorphic (yeasts/molds) Candida species (>150 types). C. albicans by far most common > C. tropicalis, C. parapsilosis, C. lusitaniae. Torulopsis (Candida) glabrata and C. krusei are most resistant to

imidazoles. Mucormycosis- causes invasive sinus disease in diabetics. Other dimorphic organisms- Aspergillus, Histoplasma capsulatum, Cryptococcus neoformans, Blastomyces hominis, Coccidiomyces immitis, and Sporothrix schenckii. Can use serologies and urine antigen screens for some to help in diagnosis, but biopsy usually best.

Case 37

An 18 year old Indian male has had Leprosy (**Mycobacterium leprae**) for over 10 years. He presents with an infected right foot and “auto-amputation” of the part of the foot and hands from peripheral neuropathy.

Mycobacteria- non motile, non-spore forming, strictly aerobic rods.

Intracellular bacteria. Cell wall has waxy lipid layer. Acid fast stain (Kinyoun) or auramine-rhodamine fluorescent stain for diagnosis. Intracellular, *slow growing*, causing granuloma with caseation(cheese like). M. tuberculosis and M. leprae (Leprosy) are most common. *Fast growers* are atypical TB- MAI, M. abscessus, M. marinum (sensitive to sulfa), M. gordonae, M. chelonae, M. fortuitum. M. chelonae and M. fortuitum-associated with sternal wound infections. The following picture shows M. marinum carbuncular lesions sustained from a fishhook injury.



Case 38

A 10 year old female has had a “bug” going around in her large family over the last week. Her brothers have been sick with fevers and cough, as well as her older sister. She presents to you with a painful ear, and fullness with decreased hearing. You suspect **Mycoplasma pneumoniae**, as bullous changes are present.

Mycoplasma/Ureaplasma- smallest free living organisms; about 0.2- 0.7 microns. No cell wall, so doesn't show on gram stain. Slow growing.

Ureaplasma- causes NGU (non-gonococcal urethritis). M. pneumonia cause URIs (including bullous myringitis), transverse myelitis, erythema multiforme, hemolytic anemia. M. hominis- causes UTIs, and PID. Associated with infertility.

Case 39

A 25 year old sexually active white female with multiple partners presents to the health department for treatment of pelvic pain and vaginal discharge. PE shows acute cervicitis, and PCR reveals **Chlamydia trachomatis**. She is treated with doxycycline. One month later, she presents to her internist with severe low back pain, conjunctivitis, and a rash on her feet. You suspect Reiter's Syndrome (an autoimmune reactive arthritis) as a reaction to her previous Chlamydia cervicitis.

Keratoderma blenorrhagicum can be part of this syndrome.

Chlamydia- small, obligate intracellular bacteria. Have a cell wall, RNA and DNA. Unlike bacteria, they have no peptidoglycan in their cell walls, can't synthesize ATP, and have a dimorphic life cycle. The first form is the elementary body and the second is the reticulate body. Causes non-gonococcal urethritis (NGU), trachoma (most common cause of blindness in the non-western world), LGV (lymphogranuloma venereum), psittacosis (Parrot fever), and C. pneumoniae-now Chlamydia (atypical pneumonia, especially in sickle cell patients; called Acute Chest Syndrome).

Case 40

A 50 year old male with profound mental retardation and a brain injury at birth

lives in a long term care head injury center. He has a PEG tube and chronic suprapubic catheter. He battles recurrent serious UTIs and pyelonephritis. A recent urine specimen was loaded with PMNs and cultures grew an extremely resistant **ESBL (Extended Spectrum Beta-Lactamase producing) E. coli.**

Resistant aerobic Gram negative rods- these organisms are becoming more prevalent over the last ten years with the overuse of antibiotics and the institutionalization of elderly Americans, These institutions (nursing homes and the like) are breeding grounds for ESBLs (most common are TEM, SHV, and CTX-M types) and KPCs. ESBLs are enzymes that confer resistance to most beta-lactam antibiotics. Beta-lactamases are enzymes produced by bacteria that open the beta-lactam ring preventing the antibiotic from properly performing its job. Multiple risk factors for ESBL, including indwelling catheters, longer length of stay, hemodialysis, ventilator assistance, and residency in a long-term care facility. The best proven therapeutic options of ESBL infections have been shown to be the carbapenem family. ESBLs were first described in 1960s in Greece. KPCs (Klebsiella pneumoniae carbapenemases) were first described in 1996 in North Carolina and are a special type of beta-lactamase. They are now worldwide.

AmpC Beta-Lactamases are clinically important cephalo-sporinases encoded on the chromosomes of many of the Enterobacteriaceae and a few other organisms, where they mediate resistance to cephalothin, cefazolin, cefoxitin, most penicillins, and beta-lactamase inhibitor-beta-lactam combinations. In many bacteria, overexpression confers resistance to broad-spectrum cephalosporins including cefotaxime, ceftazidime, and ceftriaxone and is a problem especially in infections due to *Enterobacter aerogenes* and *Enterobacter cloacae*. Shy away from cephalosporins.

27. What is true of coagulase positive staphylococcus and coagulase negative staphylococcus?

- a. CONS is never pathogenic
- b. Staph aureus is always coagulase positive
- c. CONS includes Staph epidermidis
- d. A & B are correct

- e. B & C are correct
- f. All the above are correct

28. Which bacteria most commonly infects pregnant women, newborns, and alcoholics with chronic liver disease?

- a. Erysipelothrix rhusiopathia
- b. Legionella pneumophila
- c. Bacillus anthracis
- d. Listeria monocytogenes
- e. Neisseria meningitidis

29. Which of the following is not an aerobic gram negative diplococci?

- a. Neisseria gonorrhoea
- b. Moraxella catarrhalis
- c. Haemophilus influenza
- d. Kingella
- e. Acinetobacter

30. Which of the following is the most common aerobic GNB that causes cystitis?

- a. Proteus
- b. E. coli
- c. Enterococcus
- d. Enterobacter
- e. Klebsiella oxytoca

31. What is the Gram negative bacillus associated with human bites?

- a. Peptostreptococcus
- b. Propionibacterium acnes
- c. Gemella morbillorum
- d. Eikenella corrodens
- e. Pseudomonas aeruginosa

32. What is Lemierre's Syndrome?

- a. Infected cavernous sinus thrombosis
- b. Septic jugular vein thrombophlebitis
- c. Pneumonia caused by an organism discovered after an outbreak at an American Legion convention
- d. Chronic maxillary sinusitis

33. What bacteria is associated with "acute chest syndrome" in patients with Sickle Cell crisis?

- a. Chlamydia
- b. Mycoplasma
- c. Hanta virus
- d. Staph aureus (MSSA)

e. MRSA

34. What is the most common pathogen colonized in the colon?

- a. Clostridium difficile
- b. Escherichia coli
- c. Proteus mirabilis
- d. Bacteroides fragilis
- e. Citrobacter

35. Which of the following is not a gram negative bacilli?

- a. Bacteroides fragilis
- b. Clostridium gangrene
- c. Escherichia coli
- d. Klebsiella
- e. Enterobacter

36. Which of the following is not in the differential if a gram stain of a sputum is reported as GPC?

- a. Streptococcus pneumonia
- b. Staphylococcus aureus
- c. Enterococcus
- d. Moraxella catarrhalis

37. What is the most common vector for Rickettsial disease spread in the US?

- a. Surgical instruments
- b. Tick-borne
- c. Animal bites
- d. Unpasteurized goat cheese

38. Which disease below is not caused by a Bartonella species?

- a. Cat scratch fever
- b. Trench fever
- c. Bacillary angiomatosis
- d. Undulating fever
- e. Oroya fever (Carrion's disease)

39. What is true of the spirochetes?

- a. Will not be seen on gram stain
- b. Treponema pallidum causes lyme disease
- c. Treatment for lyme disease is doxycycline
- d. They are screwed shaped
- e. A, B, and C
- f. B, C, and D
- g. A, C, and D
- h. All of the above are true of the spirochetes

40. Which of the following is not true of *Pasteurella multocida* (choose all that apply)?

- a. Causes cat scratch fever
- b. Zoonotic infection caused by cat bites
- c. It is a gram negative bacillus
- d. Exposure occurs through unpasteurized milk products
- e. A and D

41. Which of the following is not a fungus?

- a. Sporotrichosis
- b. Histoplasma
- c. Cryptococcus
- d. *Candida albicans*
- e. Mycoplasma

42. Which of the following bacteria below are acid fast bacilli?

- a. *Legionella*
- b. *Chlamydia*
- c. *Mycoplasma*
- d. *Mycobacteria*
- e. all of the above are AFB

43. Which organism is the smallest free living microorganism at 0.2-0.7 microns?

- a. Influenza
- b. *Neisseria*
- c. *Mycoplasma*
- d. *Micrococcus*
- e. *Chlamydia*

44. Which bacteria will you never see on a gram stain because it is obligate intracellular?

- a. *Chlamydia trachomatis*
- b. *Clostridium perfringens*
- c. *Neisseria meningitidis*
- d. *Nocardia*

45. What is the best treatment for ESBLs?

- a. Zosyn
- b. Aztreonam
- c. Linezolid
- d. Carbapenems
- e. Ciprofloxacin

Answer Key:

27. E 28. D 29. C 30. B 31. D 32. B 33. A 34. D 35. B 36. D 37. B 38. D 39. G 40. B 41. E 42. D 43. C 44.
A 45. D

Cardiovascular Infections

Case 41

A 50 year old male presents with a 3 month history of intermittent fevers, malaise and chills. He has a history of gum disease (pyorrhea) and recurrent dental work and molar extractions. Blood cultures obtained are positive for Strep viridans. Clinically, he has a new heart murmur, ECHO confirms mitral valve vegetations, and a dx of **SBE (subacute bacterial endocarditis)** is made.

Dental procedures are still a prominent risk factor for SBE. Recent **AHA guidelines** have changed and are *not* recommending antibiotic prophylaxis for most patients.

Bacterial Endocarditis- infection of a valve or endovascular surface of the heart. Three types: *Acute* presents in <7 days. *Subacute* presents in 3-6 weeks., *Chronic*> 3 months. Five major pathogen groups- a) oral alpha streptococci (Streptococcus viridians) or enterococci b) Staphylococcus aureus c) coagulase-negative staphylococci d) aerobic gram negative rods e) candida. Pathogenesis- 1) valve destruction-CHF, heart block. 2) distant metastatic infection from bacteremia with septic emboli to any organ. 3) immune complex disease-- kidneys, Osler's nodes. Diagnosis- use Duke's criteria (new murmur; + blood cxs). Positive blood cultures must be sterilized. Treatment- high dose bactericidal antibiotics for 4-6 weeks. Prosthetic valve disease-usually removal of valve. Dental prophylaxis- generally for congenital heart disease or prosthetic valves. Use amoxicillin 2 grams one hour before procedure. TEE is definitive for diagnosis. TTE misses up to 30% of vegetations. The following picture shows classic Osler's nodes on the 5th left toe.



Septic emboli in endocarditis are only seen in 15-20% of cases. They include splinter/conjunctival hemorrhages, Janeway lesions, and **Osler's nodes**.
 Indications for surgery- CHF, emboli, heart block, perivalvular abscess, and large vegetations >1 cm.

Duke Criteria for Clinical Diagnosis of IE	
Major Criteria	
<ul style="list-style-type: none"> • Positive blood cultures from at least two separate cultures drawn 12 hours apart • Evidence of IE on echocardiogram (eg. a vegetation, abscesses or valve perforation) • New regurgitant murmur 	
Minor Criteria	
<ul style="list-style-type: none"> • Predisposing heart condition such as mitral valve prolapse, rheumatic or congenital heart disease, or intravenous drug abuse • Temperature > 100.4°F (38°C) • Presence of embolic disease or hemorrhage • Presence of immunologic phenomena (eg, glomerulonephritis, Osler's nodes, Roth's spots, rheumatoid factor) • Positive blood cultures but major criteria are not met • Echocardiogram is positive but major criteria are not met 	

Cultures are negative in endocarditis for three major reasons: a) Previous administration of antimicrobial agents b) Inadequate microbiological techniques c) Infection with highly fastidious bacteria or nonbacterial pathogens (eg, fungi)

Possible etiologies-The HACEK organisms (Haemophilus aphrophilus

Actinobacillus actinomycete, Cardiobacterium hominis; Eikenella corrodens; and Kingella kingae) and Brucella were *traditionally thought* to be the most common agents of culture-negative endocarditis. An etiologic agent was identified in 275 patients (79 percent) and included: C. burnetii in 167 cases (48 percent), Bartonella spp in 99 cases (28 percent), Streptococci in 4 cases, Tropheryma whippelii in 2 cases, Abiotrophia elegans in 1 case, Mycoplasma hominis in 1 case, Legionella pneumophila in 1 case, Escherichia coli in 1 case. Diagnosis: PCR for Coxiella, Bartonella can be helpful. Rx- Unasyn/Gent until serologies are back.

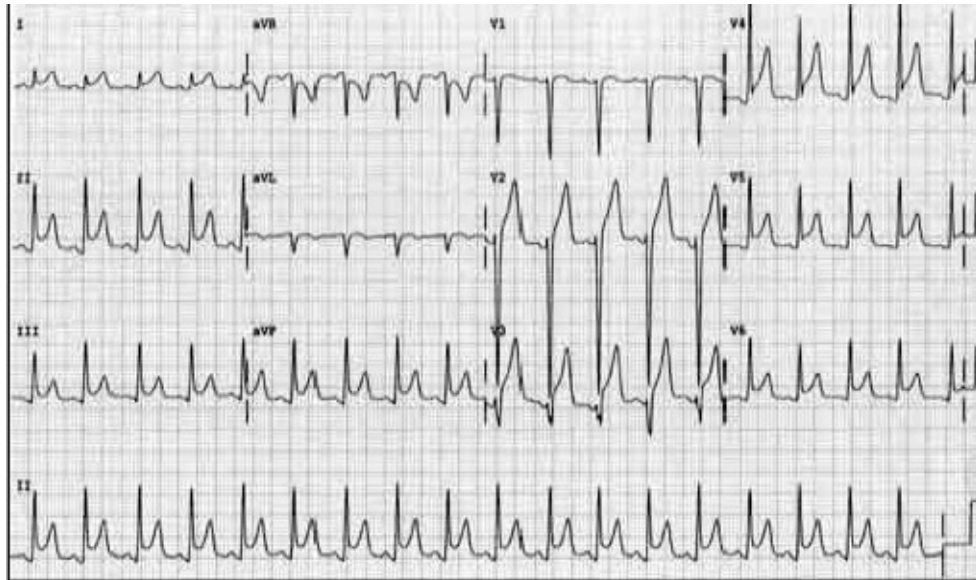
American Dental Association current guidelines state that the use of antibiotics to prevent endocarditis before certain dental procedures is reasonable for patients with:

- prosthetic cardiac valve or prosthetic material used for cardiac valve repair
- a history of infective endocarditis
- a cardiac transplant that develops cardiac valvulopathy
- the following congenital (present from birth) heart disease.
 - unrepaired cyanotic congenital heart disease, including palliative shunts and conduits
 - a completely repaired congenital heart defect with prosthetic material or device, whether placed by surgery or by catheter intervention, during the first six months after the procedure
 - any repaired congenital heart defect with residual defect at the site or adjacent to the site of a prosthetic patch or a prosthetic device (that inhibit endothelialization)

Except for the conditions listed above, antibiotic prophylaxis is no longer recommended for any other form of congenital heart disease.

Case 42

A 32 year old electrician has been sick with a “flu-bug” since working in the United Arab Emirates on a special government job. He notes anterior chest pain with breathing, SOB, and there is a pericardial friction rub on physical exam. He has a large cardiac silhouette consistent with a “water bottle heart.” You suspect **acute pericarditis**. The EKG is as follows and shows global ST_T wave segment elevation.



Pericarditis-patients often present with chest pain and fever. Pericardial rub-auscultated best with patient sitting forward. Watch for cardiac tamponade. Causes: 1) Viral most common. Including: Coxsackie B & A, enteroviruses, influenza, varicella. 2) Bacterial- contiguous spread from bacterial pneumonia. Hematogenous spread from staph, aerobic gm neg rods. 3) TB is rare. Rx- drain effusion (pericardiotomy with window), maybe pericardiectomy if loculated. IV antibiotics for 4 weeks. Rx of viral-consider NSAIDs, colchicine or steroids.

Case 43

A 40 year old healthy male from Texas is in Chicago for the winter holiday visiting his grandmother. He catches a “bad flu” bug with associated achiness, high fever, congestion, and cough. Testing for *Influenza A* is positive. A few days later he develops severe SOB, PND, and orthopnea. Echocardiogram shows an EF of 19%. Five days later expires and autopsy shows severe **Influenza Myocarditis**.

Myocarditis- viral etiology is the most common cause. Coxsackie B>A, enteroviruses, mumps, influenza, rubella, HSV, EBV, HIV, Hep. C, adenovirus, parvovirus, RSV. No infectious treatment. Look for arrhythmias and cardiac failure. Bacterial causes- rarer, consider Lyme disease, rheumatic fever, diphtheria, staph, strep, TB, syphilis, GC, mycoplasma. Fungal- aspergillus and

other dimorphic organisms. Protozoal disease-Chagas' disease- common in South America, caused by Trypanosoma cruzi. Rx- benznidazole. Parasitic worm- Ascaris.

Case 44

A 75 year old male developed sick sinus syndrome and had a pacemaker placed 3 weeks ago. Yesterday, he started with fevers, drainage from the pacemaker site, and tenderness. You diagnose a **pacemaker site infection**. The following picture shows the subtleness of redness and drainage from a pacer infection.



Pacemaker infections- very low 1.6% rate. Perioperative contamination most common. Staph aureus (MSSA and MRSA) and Staph epidermidis account for 75% of infections. Staph bacteremia from distant site can seed generator pockets (look initially for fluid in the pocket) and lead systems. Endocarditis is a complication. Use TEE. Rx- removing the generator system and the lead is best. IV antibiotic 4 weeks. Difficult problem.

Case 45

A 55 year old male has a CABG surgery 15 days ago. Yesterday, his sternal wound dehiscd, and yellow, purulent drainage was cultured, growing MSSA. You diagnose a **sternal wound infection, and mediastinitis**. The following picture shows a patient after muscle flap procedure to repair his mediastinitis.



Post-op Mediastinitis- along with empirical antibiotics, the patient was immediately taken to surgery, where the sternum and the mediastinal region was debrided and lavaged, and pectoralis muscle flaps were rotated into the area. The remainder of the hospital course was excellent, and the patient was discharged to home on IV antibiotics for 6 weeks. Usually monobacterial. 50% are gram-positive cocci (Staph). However, many organisms can cause it...gram negative bacilli, fungi, Legionella, Mycobacterium chelonae, M. fortuitum or Mycoplasma hominis.

Surgical debridement is the mainstay of therapy. Devitalized tissues, bone wax, wires must be removed. Recurrent wound infection is lowest if a muscle or omental flap is used. Prior to cardiothoracic surgery, most cases of mediastinitis occurred from oropharyngeal infections (5% of Ludwig's angina or epiglottitis) or a perforated esophagus.

Harvest Site Infection (HSI)- a 62 year old female had a 3-vessel CABG surgery. Six days after surgery she presents with drainage and ulceration of the saphenous vein harvest site right leg. Debridement and IV antibiotics are needed.

Case 46

T.J. is a 60 year old insurance executive with a history of a congenital bifid aortic valve. Because of stenosis, he had a cow prosthetic valve placed 6 months ago. He now presents with fevers, septic emboli to spleen (CT shows splenic infarct), and a cerebellar stroke. TEE shows a 3 cm vegetation on the aortic prosthesis, and blood cultures grow Staph epidermidis. **Prosthetic valve endocarditis** is diagnosed. Surgery is performed to replace the valve.

MICROORGANISM	EARLY PROSTHETIC ENDOCARDITIS < 2 MONTHS	LATE PROSTHETIC ENDOCARDITIS > 2 MONTHS
Coagulase-negative staphylococci	121 (30%)	229 (24%)
<i>Staphylococcus aureus</i>	77 (19%)	151 (16%)
Streptococci and enterococci	40 (10%)	337 (36%)
Gram-negative bacilli	63 (16%)	69 (7%)
Anaerobes	24 (6%)	11 (1%)
Fungi	46 (11%)	38 (4%)
Others	6 (2%)	21 (2%)
Negative cultures	24 (6%)	89 (9%)
Total	401	945

Prosthetic Valve Endocarditis- majority of patients require surgery to replace infected valve. Early is < 8 weeks, Late is > 8 weeks after valve placement. Mortality for early disease is 70%, and 49% for late. Staph epidermidis is the most common organism, followed by Staph aureus and Strep.

46. In addition to the two major Duke Criteria (positive blood cultures and echocardiogram evidence of disease), which of the following are considered “minor” criteria in the diagnosis of endocarditis?

- A. Fever > 38°C
- B. Arterial emboli, pulmonary infarcts, conjunctival hemorrhages, Janeway lesions, or other vascular phenomena.
- C. Preexisting heart condition such as congestive heart failure, mitral valve prolapse, congenital malformation, or prior surgery.
- D. Intravenous drug use.
- E. Presence of Rh factor, Osler nodes, Roth spots, or other immunologic evidence.
- F. All of the above.

47. Infectious pericarditis is most commonly cause by which of the following “bugs?”

- A. Viruses: Influenza, Varicella, Coxsackie, etc.
- B. Bacteria: Staph, pneumo, Gram negative rods, etc.
- C. Tuberculosis

- D. Parasites
- E. *Cardenella infectiosum*

48. Bacterial causes of myocarditis are much less common than are viral etiologies. Which organisms should a clinician suspect if there is a diagnosis of myocarditis?

- A. *Borrelia burgdorferi*
- B. *Corynebacterium diphtheria*
- C. *Mycobacterium tuberculosis*
- D. *Staphylococcus* and *Streptococcus* species
- E. All of the above.

49. Pacemaker site infections are most often caused by perioperative contamination. With this in mind, which organisms are responsible for the majority of these infections?

- A. *S. aureus* and *S. epidermidis*
- B. *S. viridans* and *Prevotella intermedia*
- C. *S. pneumonia* and *E. faecalis*
- D. None of the above.

5. Mediastinitis is most often a complication of cardiac surgery and requires surgical intervention. What other conditions may cause mediastinitis?

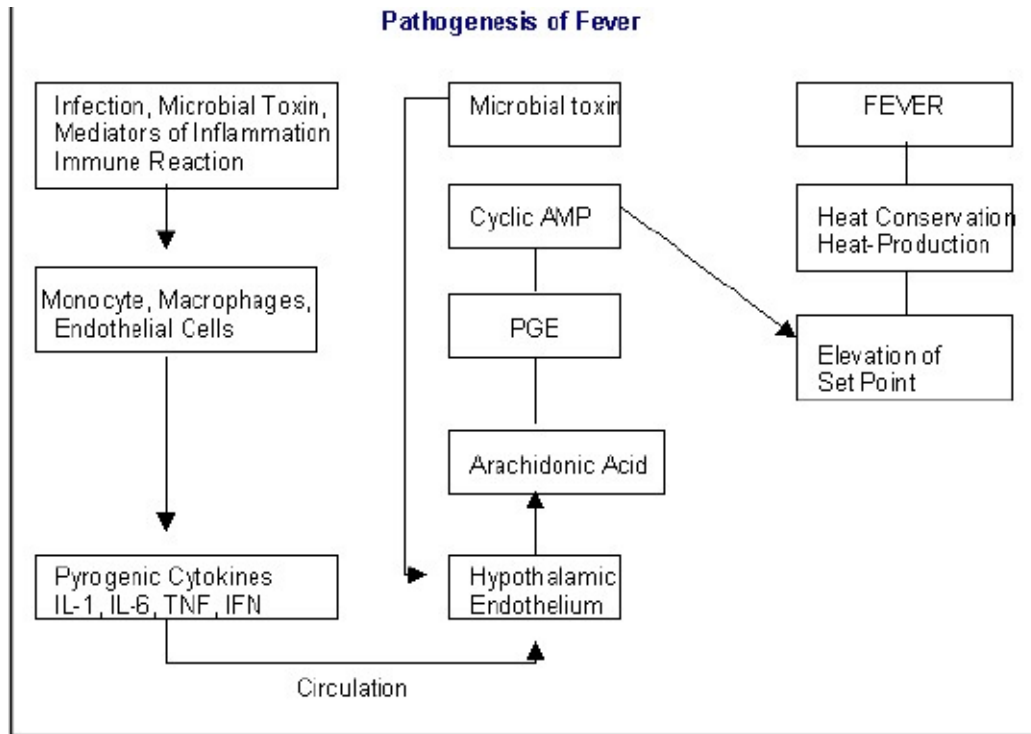
- A. GERD
- B. Epiglottitis
- C. Boerhaave syndrome
- D. Mallory-Weiss tear
- E. A messy divorce
- F. B & C
- G. All of the above except E.

Answers:

46. F 47. A 48. E 49. A 50. G

Fever of Unknown Etiology (FUO)

Introduction: Pathogenesis of fever, definitions of FUO



Classic Definition of FUO- (FUO) was defined by *Petersdorf and Beeson* in **1961** as: Temperatures **higher than 38.3 C or 101 F** on several occasions, a **duration** of fever of more than 3 weeks, and **failure to reach diagnosis** despite 1 week of inpatient investigation.

New Definition of FUO- in July, 2006, *Durack and Street* proposed a new system for classification of FUO: 1) Classic FUO 2) Nosocomial FUO 3) Neutropenic FUO and 4) FUO associated with HIV infection

Classification of Disease Categories- Major disease categories- Infection, Malignancies, and Non-infectious Inflammatory Diseases (NIID).

Minor disease categories- Drug related fever (and NMS).

Key: Always associate a **FUO** with a unique historical finding, unique laboratory finding, or a unique x-ray finding. This will make it easier to figure it out!

Case 47

A 50 year old immigrant from India presents to you with a fever of unknown origin. He has had temps over 101 off and on for 3 weeks. You do a westergren sedimentation rate in the office and it is 112 (normals 5-15). You know something is seriously wrong. Further work-up reveals that he has **extra-pulmonary TB**.

High Westergren Sedimentation Rate- the erythrocyte sedimentation rate (**ESR**), also called a sedimentation rate, sed rate or Biernacki Reaction, is a non-specific measure of inflammation that is commonly used as a medical screening test. Other APR (acute phase reactants) include CRP, ferritin, platelet count, fibrinogen, to name a few. **CRP** is frequently used with ESR. It elevates faster than ESR and goes down faster.

ESR around or > 100 (often associated with FUO)- Differential diagnosis is: 1) occult abscess 2) endocarditis 3) occult cancer 4) occult tuberculosis 5) collagen-vascular disease- i.e. vasculitis (Wegener's, PMR, etc.) or 6) osteomyelitis/septic joint.

Case 48

A 67 year old female presents to you with fevers off and on for 4 months. All of her blood work is normal (except a sed rate of 95) and cultures are negative. Urinalysis shows 5-10 RBCs/HPF. You recommend a CT of the abdomen. CT shows a large mass in the kidney consistent with a **hypernephroma or renal cell Cancer**.

Fever in the setting of cancer- found in GI solid tumors, especially with liver metastases. Atrial myxomas, Renal cell cancer, Lymphomas (Pell-Ebstein fever), pheochromocytoma are also all associated with fever.

Case 49

A 45 y/o insurance broker presents with a 2 month history of night sweats and intermittent low grade fevers. All of his blood tests are normal except his LFTs. LFTs show that the alkaline phosphatase is very elevated to 300, suggesting a ductal obstruction. CT shows hepatomegaly and liver biopsy is performed showing **non-caseating (caseation means “cheese-like” granulomas**. Sarcoidosis is finally diagnosed.

Fever in the setting of granulomatous disease-granulomatous diseases including- sarcoidosis, fungal (non-caseating) diseases like histoplasmosis, blastomycosis, or toxoplasmosis, granulomatous hepatitis, Wegener’s disease, and the *caseating* diseases of TB, or MAI.

Case 50

An 70 year old woman presents with right-sided temporal headaches, right-sided blurry vision, and fevers off and on for 3 weeks. You suspect **temporal arteritis (a collagen vascular disease)** and recommend a stat biopsy and prompt oral steroid treatment.

Fever in the setting of collagen vascular disease- such as SLE, temporal arteritis, polyarteritis nodosa, or autoimmune hepatitis. These patients frequently have high sed rates (ESR) of 80 to 110, and CRP >50, and low complement levels.

Case 51

A 60 year old female presents to the ER with fevers to 104, muscle cramping, tremor, and hypertension. Symptoms have been going on for a week since she was started on Reglan. Her CPK is 16,000 and she has a metabolic acidosis. You diagnose **Malignant Neuroleptic Syndrome** secondary to metoclopramide.

Fever in the setting of medications affects- drug fever (anti-convulsants like dilantin, tri-cyclics like amitriptyline, antibiotics like beta-lactams), or **Malignant Neuroleptic Syndrome-** related to use of anti-psychotic drugs, or Reglan. Look for delirium, fever, autonomic instability with profound diaphoresis, high CPK, muscle rigidity/cramps and tremor. High BP and metabolic acidosis are the rule. Looks like acute PD (Parkinson's Disease) related to D2 dopamine receptor blockade. Treat with Dantrolene, bromocriptine, and valium.

Common Causes of Drug Fever	
Anticonvulsants	Miscellaneous
Phenytoin	Halothane, succinylcholine (malignant hyperthermia)
Carbamazepine	Haloperidol and other phenothiazines (neuroleptic malignant syndrome)
Antimicrobials	Recreational drugs (cocaine, amphetamines)
β-Lactams	NSAIDs
Sulfonamides	Heparin
Minocycline	Interleukin, interferon
Nitrofurantoin	Atropine
Rifampin	Allopurinol
Amphotericin B	Hydralazine
Isoniazid	
Vancomycin	
Clindamycin	
Antiarrhythmics	
Amiodarone	
Quinidine	
Procainamide	

Case 52

A 60 year old car salesman presents with fevers off and on for 6 weeks. He notes being “flushed” and sweating a lot at work which is embarrassing to him. His blood pressure in the office is 210/120 and you suspect a **pheochromocytoma**.

Pheochromocytoma- can be diagnosed by CT of the abdomen and a 24 hour urine for VMA/metanephrines with serum catecholamines

Fever in the setting of endocrine problems- hyperthyroidism (especially in viral thyroiditis-subacute), pheochromocytoma (tumor of the adrenal medulla).

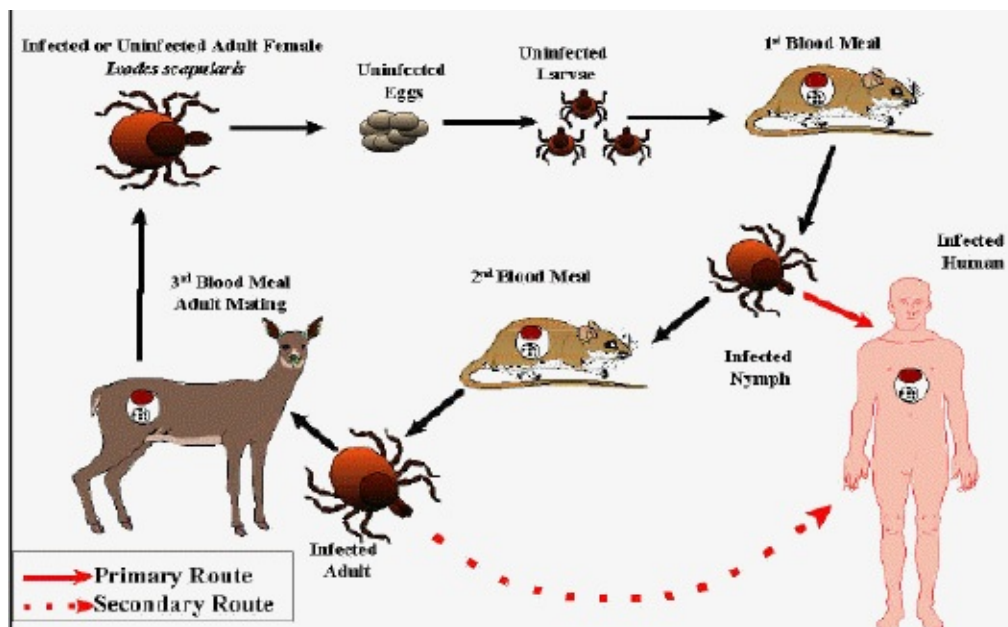
Case 53

A 78 year old female living at home alone fell in her bathtub injuring her pelvis. X-rays show non-displaced fractures of the iliac crest. She is hospitalized for pain control. You note persistent low grade fever and anemia. Pelvic fractures are noted to bleed with the potential to cause large **hematomas**.

Fever in the setting of blood clots and hematomas- pulmonary emboli-CP with SOB, tachycardia, or occult hematoma- from pelvis fractures, CNS strokes (“central fever”), or intra-abdominal-related to trauma.

Case 54

A 50 year old hunter presents to your office in the summer with 4 weeks of malaise, flu-like symptoms, myalgias, skin rash, fevers, and headaches. He is generally healthy previous to this syndrome. Blood work shows leukopenia, thrombocytopenia, and increase in ALT to 200 with a CPK of 1000. He did have a tick bite while hunting about one month ago. You suspect **rhabdomyolysis** and Ehrlichiosis or Lyme’s disease. A serum PCR test confirms the diagnosis of Ehrlichiosis. The following schematic shows the lifecycle of Human Granulocytic Ehrlichiosis.



FUO in the setting of high CPK, Rhabdomyolysis/Myositis- Differential diagnosis: Pyogenic- Staph and Beta-Strep infections, Aeromonas, Clostridia. Nonpyogenic- Leptospira, Mycoplasma, Legionella, Viral causes- influenza A and B, EBV, Coxsackie virus, HIV, Dengue, and Adeno. Tickborne infections are prominent – think about Ehrlichia, Babesiosis, Lyme’s, and Rocky Mountain Spotted Fever. Parasites- Toxo, trichinella, Taenia solium, Sarcosystis.

Fever in the setting of joint pains (polyarthralgias)- Viral- parvovirus B19 (erythema virus), Hepatitis A,B,C, HIV, Rubella, HSV, CMV, Mumps, HTLV-, Chickengunya. Lyme disease. RA. PMR. SLE. Whipples. Fungal infections.

Case 55

A 64 year old retired factory worker presents with low grade fevers off and on for 4 weeks associated with upper anterior neck swelling and pain. She has not seen a dentist for over 5 years because of a lack of dental insurance. Panorex x-rays show a right lower **molar abscess**. She will likely need a root canal or tooth extraction. The following picture shows this process; also called **Ludwig’s angina**.



Fever in the setting of ENT/dental infection- occult sinusitis/dental infection. Generally poor dentition or gum disease. Ludwigs is an infection involving the

submental, submandibular, or sublingual spaces. It can be bilateral.

Case 56

A 14 year old boy recently returned from his first deer hunting trip to the Eau Claire, Wisconsin area. He had multiple **arthropod** tick bites during the trip. He presents to you with flu- like symptoms of 1 week duration and a new skin rash consistent with erythema chronica migrans, associated with myalgias. You suspect Lyme's Disease.

Fever in the setting of arthropod bites- Causes- human monocytic ehrlichiosis (E. chaffeensis), Lyme's disease-caused by Borrelia burgdorferi, Rocky Mountain Spotted Fever- caused by Rickettsia rickettsii, Anaplasma- caused by Human Granulocytic Anaplasmosis, a rickettsial parasite spread by deer ticks inducing hemolytic anemia. Babesiosis-malaria-like parasite disease also spread by Ixodes scapularis (same tick that vectors Lymes/ Ehrlichiosis), Rx with quinine and clindamycin. Lyme's Disease-there are 3 stages described in Lyme infections: early localized, early disseminated, and late. The early localized stage of the infection manifests with a nontoxic, nonspecific febrile illness and the classic ECM (Erythema Chronica Migrans) lesion(s) described as a red patch with central pallor. No immunity in Lymes. The following picture shows classic ECM.



Case 57

A 62 year old short term traveling missionary presents to you with a fever of 2 weeks duration since getting back from Peru, where he was exposed to multiple mosquito bites. He did not take malaria prophylaxis because he was told by his PMD that he did not need it. You order a thin and thick blood smears on labs, and the pathologist diagnoses **Plasmodium vivax**.

A 50 year old ICU nurse went on a 3 week medical missionary trip to India. Two days before leaving, she developed fevers to 104 degrees, malaise, joint pains and muscle pains, headache, and a rash on her trunk. She sees you a week later in the travel clinic with persistent arthralgias. You suspect **Chikungunya**. Chikungunya is an alpha virus spread by the Aedes mosquito in Africa, India, and Southeast Asia. There is no treatment and no vaccine. It looks like Dengue Fever clinically. Dx by serology (PCR). Persistent arthralgia can be severe for weeks, months, or years.

Fever in the setting of international travel- look for Entamoeba histolytica or malaria (Plasmodium falciparum is by far the most lethal of the Plasmodium species), and other parasitic infections (check for high eosinophils if worms

present- see Parasite section), dengue or leishmaniasis (sandfly vector) pending location of travel.

Case 58

A 55 year old farmer presents to you with a 4 month history of diarrhea, weight loss, joint pains, confusion and intermittent fevers. He is up-to-date on colonoscopy 9 months ago, which was normal. Stool for O&P, and routine bacterial pathogens is normal. CT of the abdomen and pelvis is normal. You suspect **Whipple's disease**. How would you diagnose it?

Fever in the presence of abdominal pain, diarrhea- malabsorption syndrome, neurological symptoms, joint pains with negative pathogen stool work-up- think of Whipple's Disease (*Tropheryma whippelii*- in the Actinomycetes family); treated with 1 year of doxycycline, amoxicillin, or sulfa). Also, think about IBD (either Crohn's disease or ulcerative colitis), occult abscess or bowel ischemia in patients with diarrhea and fever, guaiac positive stool with negative stool work-up.

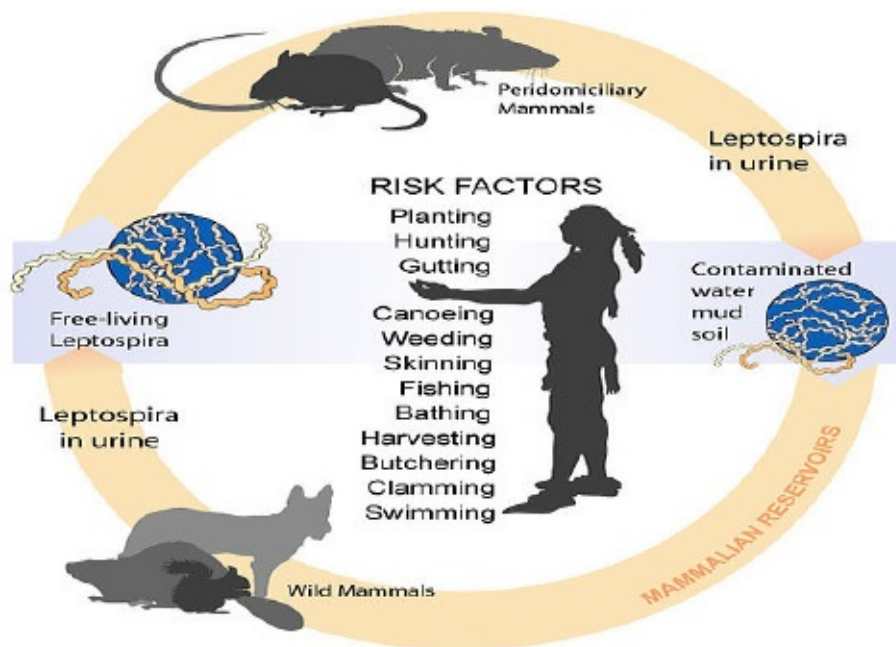
Case 59

A 40 year old horticulturist and DNR worker presents to you with sore throat, jaundice, malaise, and fevers to 100.5 off and on for the last 3 weeks. Direct bilirubin is 6.5 and the ALT is 400. She normally a health individual. What is the differential diagnosis of **jaundice, increased LFTs (transaminitis) and fever?**

FUO- jaundice and high LFTs- Differential diagnosis:Viral diseases- EBV (mono), CMV, Hepatitis A,B,C,D,E,G, Ebola, Yellow fever, Dengue. Parasitic- malaria, *Entamoeba histolytica*, Toxoplasmosis, Babesiosis, Cryptosporidiosis, Ascariasis (roundworm). Bacterial- leptospirosis (Weil's disease), overwhelming sepsis- i.e. staph or strep, *Borrelia* (Relapsing Fever) Granulomatous hepatitis from syphilis, toxo, fungal, or TB like organisms. Our patient had a positive IgM CMV serology titer.

Leptospirosis- a spirochetal disease causing "infectious jaundice". Weil first

described it in 1886. It caused epidemics among Native American Indians in the 1600's. Napoleon's army suffered severely from it. It affected Civil War and World War I troops. Modern day epidemics occur in Nepal. Risk factors are many; crewing is one. Doxycycline prevents it for travelers. The following schematic shows the lifecycle of Leptospirosis.



Case 60

A 24 year old Peace Corp worker in Ethiopia comes home because of malaise and persistent relapsing fevers over the last 6 weeks. She has been living a rural village where she has been exposed to lice and tick bites. Her CBC reveals a hemoglobin of 8.6 gms%. Work-up for **hemolysis** is + and shows high LDH, high retic count, and a + Coomb's test. You suspect *Borrelia recurrentis* (Relapsing Fever).

Infectious causes of hemolytic anemia- Bacterial- sepsis due to staphylococci, streptococci, pneumococci, meningococci. Bacterial endocarditis. Salmonella infections. *Escherichia coli* 0157 gastroenteritis (hemolytic uremic syndrome). *Borrelia recurrentis* (Relapsing Fever)- caused by tick bite or contact with body lice. Leptospirosis (Weil's disease). Mycoplasma (immune hemolysis/+ cold

agglutinins). Viral- Infectious mononucleosis (immune hemolysis). Protozoan- Malaria. Babesiosis-“Malaria of the Northeast U.S.” African trypanosomiasis. Toxoplasmosis. Leishmaniasis.

Case 61

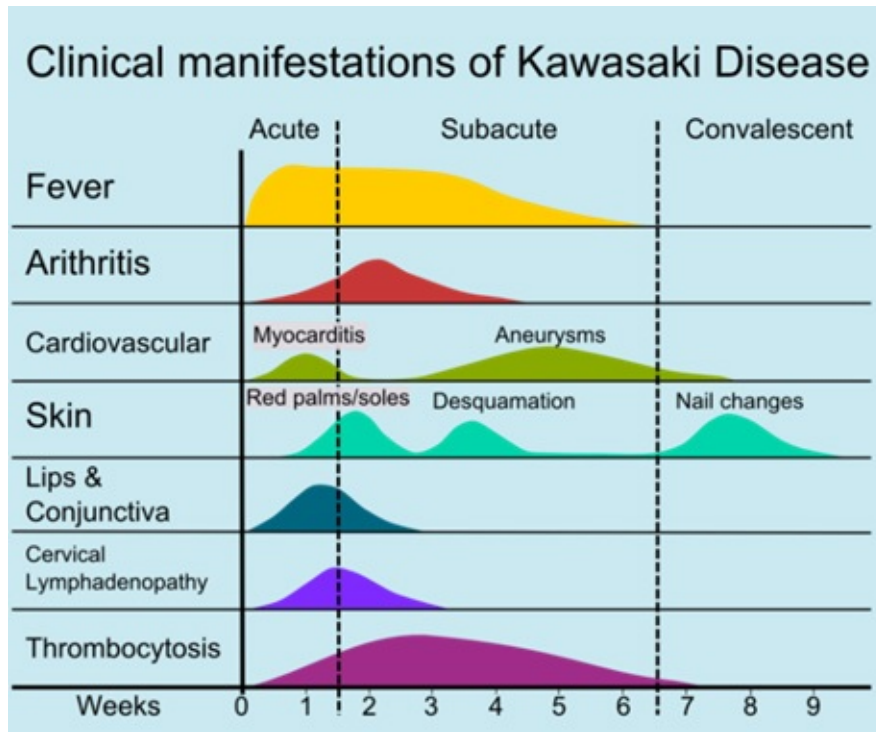
You are asked to see a 50 year old post-op CABG patient who has a FUO. He has been in the ICU for 8 days post-operatively with complications of GI bleeding, delirium, and pulmonary infiltrates. What is the differential diagnosis of **FUO in the ICU**?

FUO in the setting of ICU- Causes-Nosocomial infection- pulmonary, urine, surgical wound, central line infection. Pulmonary emboli. Atelectasis. Sinusitis/OM from mechanical ventilating. Drug fever- i.e. seizure meds, or MNS (Malignant Neuroleptic Syndrome). “Central fever”-stroke or CNS bleed. Phlebitis. Post-op ischemia. Occult Gallbladder disease.

Case 62

A previously healthy 50 year old RN presents to you with a fever of unknown origin for the last 4 weeks with temps greater than 100.5 on and off. She had an uneventful laparoscopic cholecystectomy 6 weeks ago for cholecystitis and gallstones. In the face of a FUO, the CT scan of the abdomen is ordered and shows a **liver abscess**.

An 8 year old child presents with flu like symptoms of 2 ½ weeks duration, associated with sore throat, conjunctivitis, joint pains, swelling of the hands and feet, a strawberry tongue, a macular rash, cracked lips, and cervical lymphadenopathy. Platelet count is over 1,000,000. You diagnose **Kawasaki’s Disease**, an autoimmune vasculitis syndrome.



Kawasaki's Disease- unknown cause. Described in 1961. Thought to be autoimmune. Associated with adenovirus. Systemic vasculitis occurs with coronary arteritis, aneurysms. Treatment with IVIG, steroids, and sometimes biologics.

Fever in the setting of "rarer" infections- deep infection (abscesses-spleen, liver, psoas), Mycobacterial disease (TB, MAI), occult fungal diseases (Blastomycosis can look like lung cancer), occult pyelonephritis, parasitic infections (look for eosinophilia if worms present), viral infections (look for leukopenia and right shift in WBCs-lymphocytosis), HIV, vasculitis.

Work-up of FUO- *Take a thorough history.* Check: CBC, CMP, U/A, Sed rate, CRP, CPK, ANA, TFTs, serum cortisol, serum catecholamines, d-dimer, HIV, check for occult dental/sinus disease, blood cultures, thin/thick blood smears if international travel to developing countries, Lyme's antibody, serum PCR for ehrlichiosis. PCR for *Tropheryma whipplei* if diarrhea present. Review medication profile. Consider chest X-ray, CT abdomen/pelvis, echo- cardiogram, Indium/ gallium scan. Check travel history-consider stools for O & P, bacterial

stool culture.

51. Which of the following statements is not TRUE of extrapulmonary tuberculosis?
- A. Extrapulmonary locations are reactivation sites; the primary infection occurred earlier.
 - B. The pathology of extrapulmonary lesions is very different from pulmonary lesions.
 - C. Patients with extrapulmonary TB often do not have a cough.
 - D. Lymph nodes comprise almost 30% of the cases of extrapulmonary TB.
52. Fever of unknown origin in a person over age 50 should prompt investigation for what problem?
- A. Occult CA.
 - B. Hepatitis
 - C. Blood clot
 - D. PE
 - E. All of the above.
53. Which of the following diseases may cause granulomas of the liver?
- A. Sarcoidosis
 - B. TB
 - C. Histoplasmosis
 - D. Blastomycosis
 - E. All of the above
54. Which combination of laboratory values and symptoms would you expect in a patient with temporal arteritis?
- A. Fever, blurred vision, headache, ↑ESR, ↑CRP
 - B. Headache, blurred vision, joint pain, ↑ESR, no rise in CRP
 - C. Fever, blurred vision, headache, ↑ESR, ↓CRP
 - D. Headache, blurred vision, fever, no rise in ESR or CRP
55. Malignant Neuroleptic Syndrome may be caused by which of these drugs?
- A. Bromocriptine
 - B. Dantrolene
 - C. Valium
 - D. Reglan
 - E. Tylenol
56. Pheochromocytoma classically presents with what symptoms/signs?
- A. Fever

- B. Hypertension
- C. Flushing
- D. All of the above

57. Which of the following statements is FALSE about a hematoma?

- A. It may cause fever in an otherwise-healthy patient.
- B. Bleeding from a pelvic fracture is usually secondary to damage to the pelvis venous plexus.
- C. Leukocytosis caused by large hematomas is treated with empiric antibiotics.
- D. Large volume blood loss may mimic the symptoms of sepsis.

58. How is Ehrlichiosis differentiated from Lyme Disease?

- A. Human Monocytic Ehrlichiosis produces fever; Lyme does only rarely.
- B. Lyme produces fever; Ehrlichiosis does not.
- C. Serum PCR tests for HME; ELISA and Western Blot for Lyme.
- D. Morulae (Ehrlichia inclusion bodies) are present on buffy coat examination in patients with HME.

59. Which of the following signs/symptoms is often present in a patient with Ludwig's angina?

- A. Chest pain and DOE
- B. Bilateral mouth pain/swelling
- C. Peripheral edema and pronounced ecchymosis
- D. Visual impairment

60. Ixodes scapularis is a vector for all of the following human diseases EXCEPT:

- A. Babesiosis
- B. Hanta virus
- C. Anaplasma
- D. Lyme Disease

61. Which of the following statements is FALSE about pyogenic liver abscesses?

- A. They carry a very high mortality rate.
- B. Often, they are cryptogenic.
- C. The most common causes are cholecystitis, trauma, and portal vein infection from the GI tract.
- D. They are treated with percutaneous drainage and antibiotics.

62. Which Malaria-causing organism is known to cause most morbidity and mortality from the disease?

- A. *P. ovale*
- B. *P. malariae*
- C. *P. knowlesi*
- D. *P. falciparum*
- E. *P. vivax*

63. The biggest hurdle to overcome in diagnosing Whipple's Disease is what?

- A. Getting an adequate specimen.
- B. Laboratory error.
- C. Patient noncompliance.
- D. Adding it to the differential diagnosis.

64. Which of the following statements are true of Leptospirosis?

- A. It is prevented by taking antibiotics.
- B. Risk factors include vigorous outdoor activities in areas with infected wildlife.
- C. Fever and jaundice are major signs.
- D. All of the above.

65. Which of the following is an infectious cause of hemolytic anemia?

- A. Salmonella
- B. Malaria
- C. Relapsing Fever
- D. Mononucleosis
- E. All of the above

Answers:

51. C 52. E 53. E 54. A 55. D 56. D 57. C 58. C 59. B 60. B 61. A 62. D 63. D 64. D 65. E

Fungal Infections

Introduction- Anti-fungal Drugs (5 classes)-

Imidazoles- work in cytoplasm. Drug interactions- binds the liver CYP450 system. *Fluconazole*- active against most *Candida* species other than *C. krusei*. Use fluconazole IV at 6mg/kg/day. *Torulopsis glabrata* has increasing resistance ~20%. *Itraconazole* (Sporanox)- use for histoplasmosis, blastomycosis, sporotrichosis, *Aspergillus*. *Voriconazole*- 96% bioavailability, use for *T. glabrata*, *C. krusei*, *Aspergillus* -4mg/kg q 12 hrs IV, then 200 mg po BID. *Posaconazole, isavuconazonium* in 2015- po or iv). Echinocandins- acts on cell wall synthesis. Only IV. Cidal-like amphotericin. Good for azole-resistant *Candida*, *Aspergillo*sis. Caspofungin, mycafungin, anidulafungin. Poor urinary concentration. Polyenes- Nystatin or Amphotericin B- cell membrane inhibitor-.5 mg/kg/day. Toxicities-rigors, phlebitis, bone marrow suppression, renal/hepatic impair, electrolyte imbalance. Lipophilic Ampho B- decreases toxicity. 5mg/kg/day. Very expensive. Terbinafine- allylamine, blocks membrane synthesis. Used for skin and nail disease. 5-Flucytosine- inhibits DNA, use 37.5 mg/kg/dose QID. OK for fungal UTIs or synergy with other agents like Ampho B.

Case 63

A 39 year old male presents to your office with a 6 month history of a rash on his face which is not responsive to OTC meds. Through careful history, you find that he is at increased risk for HIV infection. HIV Elisa testing comes back positive, and the western blot confirms the diagnosis of HIV. You suspect seborrheic dermatitis.

Dermatophyte infections- caused by *Trichophyton*, *Microsporum*, *Epidermophyton*. Papulosquamous rash, usually pruritic. Also called

“ringworm”. Tinea pedis-athlete’s foot, scaling between toes (especially 4th and 5th), Tinea manuum -palms of hands affected. Tinea capitis- scalp. Tinea cruris – groin folds Tinea corporis- body involved, Tinea versicolor- caused by Malassezia. Rx topical imidazoles or weekly fluconazole orally. Seborrheic dermatitis-caused by dermatophytes-Rx with 2% Nizoral shampoo, topical steroids.

Case 64

A 50 year old CEO comes into the office with thickened yellow toe nails and he is embarrassed to go to the beach because of the problem. You diagnose **onychomycosis** and recommend treatment. Remember that removing the nails doesn’t cure onychomycosis.



Onychomycosis- difficult to treat, 30-50% recurrence. Thickened yellowed/darkened nails. Differential: dermatophyte, psoriasis, PVD, lichen planus. Fungus lives in nail bed. Removing nail doesn’t cure. Use po Terbinafine 250 mg daily 6-12 weeks. Fluconazole weekly x 6 months. Itraconazole also used in accelerated regimen. Laser has been used of late with success.

Case 65

A 33 year old patient with HIV infection presents to the office with a sore throat and whitish plaques. You diagnose **thrush**, an oral form of **candida albicans** and recommend treatment.



Candida infections- most commonly *C. albicans* (60%), *Torulopsis glabrata* (15%). Also *C. parapsilosis* (15%), *C. tropicalis*, *C. krusei*, *C. lusitaniae* (Ampho. B resistant). Thrush- increases with steroid use, DM. Rx- Nystatin swish and swallow or Mycelex Troches qid x 10 days. Esophagitis- fluconazole 200 mg (itraconazole also) for 7-14 days, Vaginitis- associated with pregnancy, diabetes, antibiotic use. Intense pruritis, “curd-like” discharge. Rx- topical azole creams or fluconazole. Candida UTIs- increased in diabetics, if hardware, stones, abnormal anatomy then hard to treat. Rule out colonization. Use fluconazole 7-14 days or lipophilic Amphotericin B .3mg/kg X 1 dose. Remove Foley catheter ASAP. **Invasive candidiasis**-1,3)- β -D-glucan(BG) is a biomarker for invasive candidiasis (IC). BG is a major cell wall component of most fungi. A decrease in BG levels was associated with response to antifungal therapy. An increase in BG levels correlates with treatment failure. An initial BG level of <416 pg/mL can potentially predict favorable treatment outcomes. In patients with proven IC, baseline and consecutive BG levels may be useful as prognostic markers of therapeutic outcomes.

Case 66

A 54 year old female with cirrhosis of the liver presents to the hospital with Staph aureus bacteremia, meningitis, and septic shock. After 2 weeks in the ICU on a ventilator, blood cultures grow *Candida albicans* (**fungemia**) and her central line is removed. How would you treat the infection?

Candidemia- often associated with central lines, immune suppressed patients on antibiotics. 8% of all nosocomial bloodstream infections. Increased risk- TPN, neutropenia, DM, chemotherapy, broad spectrum antibiotics, GI surgery, ICU stay, bone marrow transplant. Rx for CLI- remove central line. 10 days of antifungal Rx IV minimum. Look for metastatic infection (BE or endophthalmitis).

Case 67

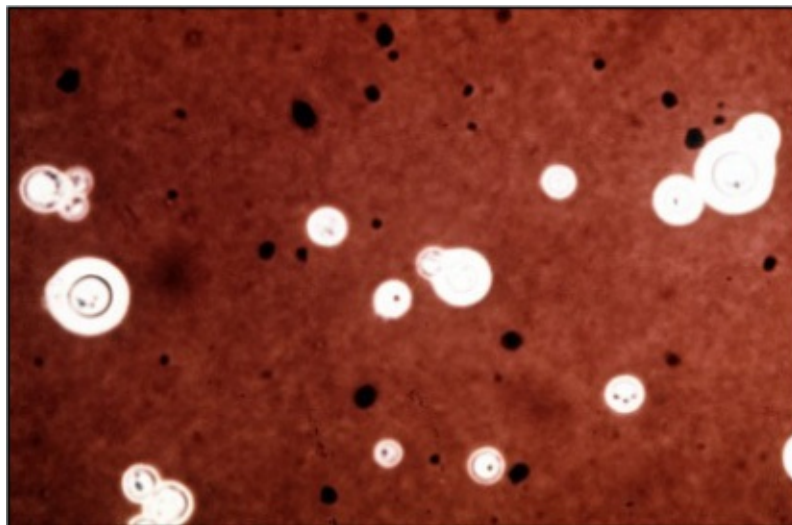
A 50 year old male with acute myelogenous leukemia (AML) on chemotherapy presents to the hospital with febrile neutropenia, hemoptysis, SOB, and pulmonary infiltrates. Bronchoscopy reveals ***Aspergillus fumigatus***. The following CT chest shows the cavitory nature of *Aspergillus*.



Aspergillosis- Clinically there are *five* syndromes- 1) Allergic bronchopulmonary aspergillus (allergy), 2) pulmonary fungus ball (mycetoma or aspergilloma), 3) lobar pneumonia, 4) necrotizing pulmonary vasculitis (aspergillus likes blood vessels). 5) Otomycosis. Aspergillus is resistant to fluconazole. For treatment, use Voriconazole> posaconazole, > the echinocandins.

Case 68

A 46 year old newly diagnosed patient with HIV and a CD4 count of 100 and viral load of 80,000 presents with fevers, malaise, stiff neck, photophobia, and confusion. Spinal tap shows a cell count of 1000 with a right shift, India ink is positive for **Cryptococcus neoformans**, and Cryptococcal Antigen is positive at 1:32. The following India ink stain shows the white “owls eyes” of Cryptococcus.



Cryptococcosis- this dimorphic fungus is more common in AIDs and lymphoma patients. It causes meningitis with positive India ink and positive antigen, cavitation in lung, granulomas in liver, as well as skin disease. Fluconazole and 5-FC- treatment of choice and decent CNS penetration.

Case 69

A 45 year old male DNR worker presents with a chronic pneumonia. He has had

no response to antibiotic treatment and continues with chills, fevers, cough, and SOB. **Blastomycosis** is diagnosed. The following histology stain shows the classic budding yeast of Blastomycosis.



Blastomycosis- once known as “Chicago’s disease”, discovered late 1800’s. Seen from Minnesota to Mississippi to West Virginia. “Budding yeast” seen on histology. Can look like lung cancer. Invades bone, liver, skin, prostate, CNS. Can cause sepsis. Rx- itraconazole p.o. bid for several months. Diagnose with tissue bx. Bronchoscopy can miss the dx.

Case 70

A 52 year old postal worker presents with a FUO for 6 weeks. His only abnormality is high LFTs with an alkaline phosphatase of 400 and ALT of 150. CT scan of the liver is consistent with granulomatous hepatitis. Liver biopsy grows **Histoplasma capsulatum**.

Histoplasmosis- more common in Indiana, Ohio, Kentucky, central Illinois. Clinically similar to Blastomycosis. Can mimic sarcoidosis. Seen in spelunkers. (organism lives in bat guano). Histoplasma likes to invade lung, liver, eye and skin. Similar treatment as Blastomycosis.

Case 71

A 30 year old archeology student from Chicago went out to southern Arizona for

an archaeology dig at an Indian reservation. After 6 weeks, he presents to you with persistent cough, fevers, and SOB. After no response to antibiotics, you suspect **Coccidioides immitis**.

Coccidiomycosis- common in southwest USA, “San Joaquin Valley”. The organism is found in dust. Longer term clinical presentation similar to Blastomycosis and Histoplasmosis. Can cause CNS basilar meningitis, but also the milder form “Valley Fever”.

Case 72

A 60 year old gardener comes to see you with an infected arm and hand after he pricked his finger on a rose thorn. You diagnose **Sporothrix schenckii**. The following picture shows lymphadenitis from Sporothrix but other infectious agents are notorious to do this as well. These include: Atypical mycobacteria (*Mycobacterium fortuitum* or *M. marinum*), *Nocardia* (soil injury), *Francisella tularensis*- rabbit fever or lawnmower’s disease- ticks, flies, mosquitoes are transmitters also, *Erysipelothrix rhusiopathiae*- abrasions from fish/raw meat, Sporotrichosis-rose thorns, *Bacillus anthracis*- woolsorter’s disease, *Yersinia pestis*-spread by fleas, *Borrelia burgdorferi*- deer tick vector, *Bartonella hensalae*- cat vector.



Rare Fungal Infections- sporothrix, scedosporum, fusarium, rhizopus or mucor (Zygomycosis)- all resistant to fluconazole.

Zygomycosis (formerly Mucormycosis)- airborne spores inhaled. Causes sino-orbital, pneumonia, brain abscess. Risk factors- diabetic ketoacidosis, neutropenia, iron overload, burns. Treatment- Surgical debridement and Amphotericin B: lipid form preferred.

Exophiala jeanselmei and **Cladospirium** can cause a nasty fungal infection of the foot resistant to fluconazole called Madura foot. The following is a picture of this awful disease.



Case 73

A 60 year old male with a new diagnosis of an aggressive acute leukemia has started chemotherapy and his WBC has dropped to a total ANC of 100. After one week of fevers, you are asked to consult and adjust his antibiotics and anti-fungals. You are concerned about his immuno-compromised status.

Immunocompromised Hosts- look for **invasive, disseminated disease especially with Candida**; found in lung, liver (granulomatous hepatitis),

cutaneous, retina, heart valves (endocarditis), and blood. Should use oral azoles for neutropenic fever patients as these patients have higher rates of development of invasive fungal disease. Posaconazole 200 mg TID po or Micafungin 50 mg IV/day is frequently added, but Amphotericin B may be necessary.

66. A 28 year-old female construction worker with a past history of IV drug abuse presents to your office with oral and vaginal candidiasis resistant to Fluconazole. Which of the following should be your next step?

- A.) admit the patient and treat with Echinocandins
- B.) admit the patient and treat with Polyenes
- C.) admit the patient and treat with Terbinafine
- D.) perform an HIV ELISA
- E.) perform an HIV Western blot
- F.) Tell her to change what kind of underwear she uses

67. A 70 year-old male presents to your office with persistent onychomycosis. In the past, you have treated him with oral Terbinafine, Fluconazole, and Itraconazole. What is another new avenue of treating nailbed fungal infections?

- A.) Acid therapy
- B.) Emulsification
- C.) Dremmel debridement
- D.) Laser therapy
- E.) Terbinafine nail ointment
- F.) Avoiding strawberries and raspberries

68. A 3-month old infant recently diagnosed with SCID (Severe Combined Immunodeficiency) presents with a persistent oral candidiasis. Mouth scrapings are identified as *Candida lusitanae*. Which medication is this organism inherently resistant to?

- A.) 5-Flucytosine
- B.) Amphotericin B
- C.) Fluconazole
- D.) Itraconazole
- E.) Nystatin

69. What is the bio marker for invasive candidiasis?

- A.) 1,4-alpha-D-gluconate
- B.) 1,3-beta-D-glucan
- C.) Interleukin-6
- D.) Interleukin-9
- E.) Procalcitonin
- F.) An amalgamated ELISA test of serum

70. If you suspect a patient has invasive candidemia, what should you do?

- A.) Delay antifungal therapy until blood cultures come back positive
- B.) Delay antifungal therapy until susceptibilities are known
- C.) Look for metastatic infection
- D.) Immediately treat for a minimum of 10 days with IV antifungals
- E.) A&B
- F.) C&D

71. A 9 year-old boy diagnosed with ALL 2 years ago received a bone marrow transplant 1 week ago. Yesterday, he began to experience dyspnea, hemoptysis, fever, and chest pain when he inhales. In this situation, which etiologic agent most commonly presents with these symptoms?

- A.) Aspergillosis
- B.) Aspiration pneumonia
- C.) Blastomycosis
- D.) Chemical pneumonitis
- E.) Histoplasmosis
- F.) Supercalafragilisticexpiellamosis

72. What is the AIDS-defining illness for 60-70% of HIV-infected patients?

- A.) Candidiasis of the esophagus
- B.) Cryptococcosis
- C.) Kaposi sarcoma
- D.) Mycobacterium avium complex (MAC)
- E.) Pneumocystis jiroveci

73. A 65 year-old deer hunter presents to the ED with fevers, chills, myalgia, headache, unproductive cough, and dysuria. A broad-based budding yeast is defined as the single etiologic agent. How would you treat this patient?

- A.) 5-Flucytosine 3 g po daily x 21 days
- B.) Amphotericin B 50 mg IV daily x 6 weeks
- C.) Caspofungin 70mg po daily x 14 days
- D.) Fluconazole 400 mg po x 10 weeks
- E.) Itraconazole 200 mg po BID x 6-12 months

74. A group of college students traveled to South America for a rock climbing and water cave diving adventure over spring break. The following week, one of the 20 year-old women present to University Health Services complaining of a painful “lump” in her neck. Upon physical examination, you notice multiple enlarged cervical lymph nodes in the anterior portion of the neck. What is the diagnosis?

- A.) Acute viral lymphadenopathy
- B.) Acute Group A Streptococcal infection
- C.) Epstein-Barr viral infection
- D.) Possible toxoplasmosis or atypical mycobacterial infection
- E.) Sporothrix fungemia

75. A 79 year-old male with a 20 year history of diabetes mellitus has recently developed dementia, making it difficult for him to control his diabetes independently. As a result, he is at risk of developing which of the

following fungal infections?

- A.) Aspergillosis
- B.) Esophageal Candidiasis
- C.) Fusarium solani
- D.) Mucormycosis
- E.) Sporotrichosis
- F.) Fungalosis

76. A 45 year-old female was gardening earlier this week and presents to an urgent care facility with lymphadenitis of the right hand that spreads to the elbow. You diagnose Sporotrichosis. What medication is contraindicated due to inherent resistance?

- A.) Amphotericin B
- B.) Azithromycin
- C.) Itraconazole
- D.) Fluconazole
- E.) Posaconazole

77. A 75 year-old ICU patient develops endophthalmitis that is culture positive for Candida albicans. The patient is intubated and has chronic kidney disease. What medication should you use to treat this patient?

- A.) Amphotericin B IV
- B.) Posaconazole po
- C.) Posaconazole po + Amphotericin B IV
- D.) Micafungin IV
- E.) Micafungin IV + Amphotericin B IV

Answers:

66. **D** 67. **D** 68. **B** 69. **B** 70. **F** 71. **A** 72. **E** 73. **E** 74. **D** 75. **D** 76. **D** 77. **D**

Gastrointestinal Infections

Case 74

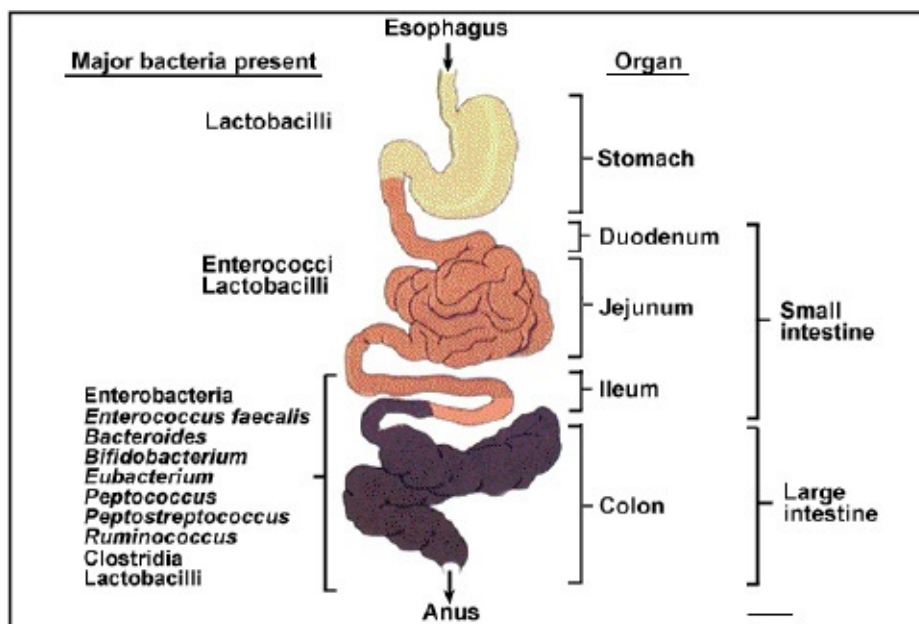
A 50 year old female comes to the ER with severe RLQ abdomen pain, fevers, leukocytosis, with N//V and diarrhea. CT scan shows an appendiceal abscess and air under the diaphragm consistent with a perforated viscus. She is diagnosed with **acute peritonitis (secondary)** from a ruptured appendix. She is brought to surgery for an exploratory laparotomy.

Intraabdominal infections- in secondary peritonitis, the key is to drain all purulent material and remove ischemic tissue. Anaerobes (Bacteroides fragilis/Clostridia)/aerobes ratio is 1000:1 in colonic infections. Anaerobes are responsible for abscesses. Aerobes= E. coli, Proteus, Klebsiella, (responsible for most bacteremia) alpha-Strep, Enterococcus. Candida less common. Anaerobic coverage= Flagyl (metronidazole) »Cefotetan/Cefoxitin > Clindamycin. Zosyn (Pip/tazo) or penams (Meropenam) *excellent anaerobic activity* also. Aerobic gram negative rod coverage= Gentamicin/Tobramycin= Aztreonam= Cefepime= Zosyn/Timentin= Penams >Cefotetan > Ciprofloxacin/Levofloxacin. Enterococcus/Strep- use Ampicillin/Zosyn or Vancomycin in PCN allergic. Candida- use Fluconazole or Lipophilic Amphotericin B. *Basidiobolomycosis* is a invasive GI fungal organism seen in the southwest US which mimics IBD or malignancy and is treated with itraconazole. Empiric coverage of anaerobes and aerobes necessary.

Control the source of infection- Purge the infected abdominal cavity. Treat abdominal compartment syndrome. Prevent or treat re-infection. **Mortality of secondary peritonitis-** Stomach and duodenum: 3-36%. Small bowel: 20-38%. Large bowel: 20-50%. Appendix: 0-8%. Biliary tract: 0-56%. Pancreas: 22-57%.

The following schematic shows how bacterial flora changes from the esophagus

to the anus:



Peritonitis associated with Chronic Ambulatory Peritoneal Dialysis

(CAPD)- this problem carries a 1-6% mortality risk per episode. Repeated bouts may result in sclerosing peritonitis, with resultant failure of dialysis and sometimes intestinal obstruction. Organisms gain entry most commonly by touch contamination, but a significant minority are caused by a prior exit-site infection and possibly by translocations from the bowel. Diagnosis is suggested by a cloudy peritoneal effluent, with abdominal pain, fever, >100 WBC in effluent, and >50% PMNs. Empirically should cover GPC and GNB. A combination of gentamicin and cefazolin is preferred and intraperitoneal routes are superior to parenteral routes. Rx duration is 2-3 weeks. Eradication is 80-85%. About 10% require catheter removal and transfer to hemodialysis. Early removal of peritoneal catheters should occur with pseudomonas aeruginosa, fungi, mycobacterium, and VRE. The catheter should also be removed in patients who fail to respond to appropriate therapy within 4 days and those experiencing recurrent peritonitis.

Case 75

A 72 year old retired grade school teacher with a known history of diverticulosis

comes to see you with a bout of her typical **diverticulitis**. She gets them about once every 2-3 years. She has low grade pain, slight fever, and diarrhea.

Diverticulitis- inflamed diverticulosis. 30% of people by age 60 have diverticulosis. 15-25% of these develop diverticulitis. Complications include perforation, obstruction, fistula, abscess. Clinical -70% with LLQ pain and tenderness. Fever-50%. Rx- bowel rest, Cipro with Flagyl, or Augmentin, or Doxycycline. Inpatient- IV Zosyn or Cefotetan/Cefoxitin empirically.

Case 76

A 49 year old male presents with RUQ abdominal pain, nightsweats, and low grade fevers with shaking chills. He had a cholecystectomy 6 weeks ago complicated by cholangitis because of a common bile duct stone. CT scan shows a large **liver abscess**.

Intraabdominal abscesses- bacteriology generally bowel flora. Locations are:
1) Subphrenic- 60 % after abdominal surgery; 40% after ruptured viscus. 2) Hepatic Abscess- Causes: portal vein bacteremia, acute cholangitis, trauma, cryptogenic, systemic bacteremia, direct extension- infected gallbladder. 3) Splenic- uncommon; assoc. with endocarditis, or bacteremia. 4) Pelvic- s/p abdominal/ pelvic surgery, or PID, appendicitis. 5) Iliopsoas- caused by direct extension of abdominal infection, or vertebral osteomyelitis. Staph aureus causes 80% of primary psoas abscesses. Secondary psoas abscesses are caused by E. coli, strep, or anaerobes. Treat--drainage; 6 weeks IV. (check cx of course)

Case 77

A 25 year old healthy law student presents with increasing belching and midepigastic pains. She notes GERD symptoms once or twice a week. She has no risk factors for PUD but responds poorly to PPIs. The gastroenterologist does an EGD which shows acute gastritis and a CLO test is positive for **Helicobacter pylori**.

H. pylori- is a motile, gram negative, spiral rod which produces urease. It is

acquired through water and food. It must survive the acidity of the stomach. It burrows into the mucous layer. It produces high amounts of urease. The inflammatory response to *H. pylori* is related to its disulfide-bridged proteins. Eating yogurt can help prevent *H. pylori* disease. 50% of people have it in their stomachs. 80% are asymptomatic. It causes a majority of gastric and duodenal ulcers, chronic gastritis, and gastric cancer. Dx by serology (high false +), CLO test/biopsy, urine ELISA test (96% sensitive) HP stool antigen (for cure) or Urea breath test (HP converts urea to ammonia/ CO₂). Rx- 1 week of PPI (generally omeprazole) and Clarithromycin or levofloxacin with Flagyl or Amoxicillin. Adding Pepto-Bismol can be used for resistant cases.

A 67 year old male retired banker comes to see you because of non-bloody, malodorous diarrhea. He notes that the diarrhea started shortly after a course of Cephalexin prescribed for a cellulitis of his foot. Stool samples are positive for ***Clostridia difficile* toxin**. The following picture shows the “pizza” appearance of pseudomembranous colitis on “gross” specimen.



Clostridium Difficile-Associated Disease (CDAD)- *C. difficile* is a gram positive anaerobic bacillus. GI tract colonization - fecal/oral spread by heat-resistant spores. Associated with any antibiotic use; sometimes sporadic, or with chemotherapy. Relapse - 20% after treatment. Smelly diarrhea begins during antibiotic course or up to 6 weeks later. Diagnosis with PCR, or GDH

(Glutamate dehydrogenase) +, then checking for Toxin. Clinical course- mild diarrhea> severe diarrhea> pseudo membranous colitis> toxic mega colon> perforation/ sepsis/death. WBC >15,000 + Creat >1.5 for more severe disease. Treatment- oral Flagyl 500 mg TID po x 10 days for mild to moderate. Severe disease- oral Vancomycin 125-500 mg QID. Consider IV Flagyl. Diagnosis- stool cytotoxin assay for toxin A/B (PCR), but may order GDH assay first. Add cholestyramine for toxin binding for persistent diarrhea. Consider probiotics, adding rifaximin- 400 mg bid po for recurrent disease (not FDA). Dificid (fidaxomicin) 200 mg is a macrolide drug with less recurrences, but very expensive. Surgery is sometimes indicated; total colectomy. The B1 strain (up to 35% of isolates) is harder to cure. Spores live a long time; while in hospital, keep patients in isolation after C. diff is negative. Can be spread nosocomially. NAP1 is a very serious and more potent strain. Future therapies include oral ridinilazole, vaccines, bezlotoxumab, fecal transplants, and nontoxigenic C. difficile strains. All are being studied.

Case 79

A 26 year old engineer just arrived to the US from India. A day after arrival, he develops fevers to 104, profound diarrhea and abdominal pains. In the ER, he is found to be in septic shock and is admitted to the ICU, where **Salmonella typhi** grows from blood cultures.

Gastroenteritis- inflammation of gastrointestinal tract causing abdominal pain, +/- N/V and/or diarrhea. Triple threat of attack: 1) **Non-invasive but toxic**: a) Cholera-voluminous diarrhea. Rx- tetracycline. b) Enterotoxigenic E. coli (traveler's), Rx -doxycycline, ciprofloxacin, or rifaximin. c) Staph aureus. d) Bacillus cereus. e) C. perfringens enterotoxin 2) **Ileitis/colitis**- a) Shigella- most potent; bloody diarrhea; Rx- quinolones. b) Campylobacter- assoc. with undercooked chicken, bacteremia, Guillain Barre syndrome; Rx- macrolides. c) Yersinia enterocolitica. d) Invasive E. coli- 6% cause HUS. e) Salmonella non-typhi strains f) Aeromonas hydrophilia. 3) **Organism transverses intact GI mucosa**- Salmonella typhi- can cause septic shock. Watch for fecal carriers

(especially in those with gallbladder disease). Others- parasites like Giardia, cryptosporidiosis. Viruses like norovirus.

Case 80

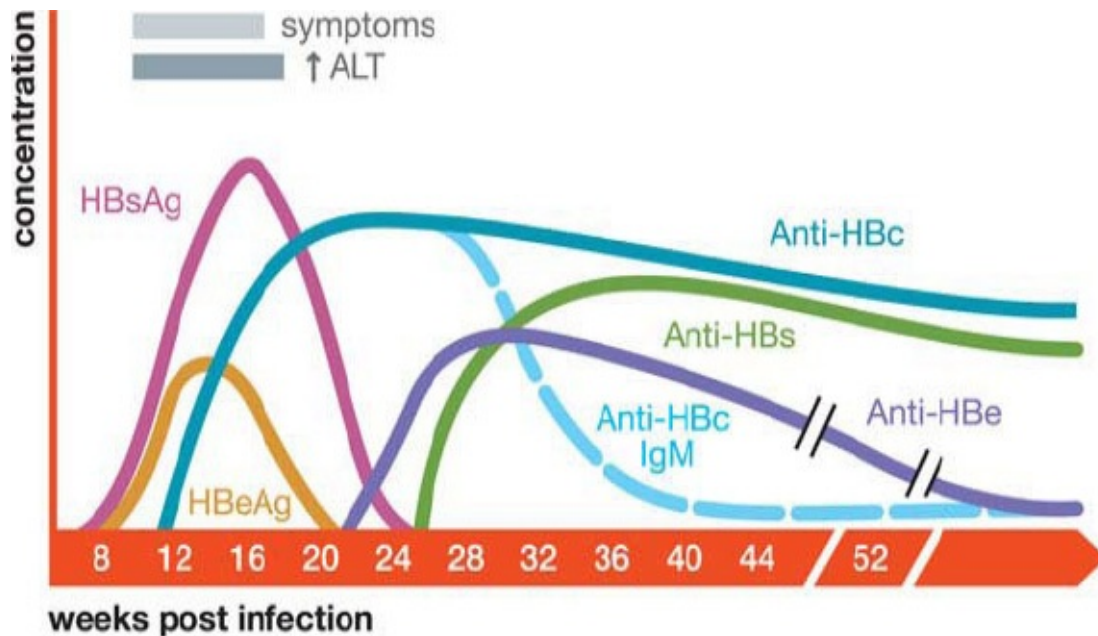
A 57 year old patient with known alcoholic cirrhosis presents with abdominal pain and fevers. Exam shows a tender abdomen and fluid wave from his ascites. You suspect **subacute bacterial peritonitis. (SBP)**

Subacute Bacterial Peritonitis (SBP; Primary Peritonitis)- ascitic fluid infection in cirrhosis patients. PMN count >250 cells/mm³; often + cultures. FUO, abdominal pain, 10% asymptomatic. Etiology- E.coli, Klebsiella, Proteus, Strep pneumoniae. Rx- empiric Ceftriaxone IV; or Zosyn.

Case 81

A 30 year old male recent immigrant from Cambodia presents to you with jaundice, a bilirubin of 5.0, an ALT of 250, and with no history of alcohol use. Workup reveals a **Hepatitis Surface Antigen +, HepB EA_g +, and a Hep B core Ab + and Hep S Ab negative.** You recommend a liver biopsy.

Hepatitis B -One third of the world population has been infected with Hep B. 350 million carriers. Spread by blood and sex, including perinatal. **Seven anti-viral agents** available for Rx, including pegylated interferon. Also, lamivudine (Epivir), adefovir (Hepsera), tenofovir (Viread), telbivudine (Tyzeka), and entecavir (Baraclude). Genotypes differ by at least 8% of their sequence and were first reported in 1988 when six were initially described (A-F) PCR tests have been developed to detect and measure the amount of HBV DNA, called the viral load. These tests are used to assess a person's infection status and to monitor treatment. Response to treatment differs between the genotypes. The following schematic shows what happens to 90% who get infected with Hepatitis B in terms of serologie. 10% of patients with Hepatitis B become chronic carriers and have + Hep B "e antigenemia" or + Hep B "antigenemia"



Remember that Hepatitis B is also a sexually transmitted infection. 10% will develop resistant infection. It is endemic in S.E. Asia. 50% of HBsAg carriers are asymptomatic. 25-30% of carriers develop Chronic Persistent Hepatitis. 25% develop cirrhosis of the liver. 10% develop cancer of the liver (hepatoma).

Case 82

A 78 year old retired cabinet maker from Yugoslavia developed acute pancreatitis thought to be secondary to the use of chronic Aleve for osteoarthritis. He subsequently developed a large pancreatic pseudocyst which became infected. A week later, he now is septic with a **necrotizing pancreatic infection**. Treatment is drainage, trying to stay away from surgery, and IV antibiotics.

Pancreatic abscess- a late complication of necrotizing pancreatitis. About 3% of patients with pancreatitis will develop an abscess. Having 2 pseudocysts increases the risks of developing a PA to 60%. Diagnosis with a CT or MRI. Rx- drainage, preferably non-surgical and long term IV (6 weeks) antibiotics.

Case 83

A 25 year old obese, HIV +, former IV drug user Puerto Rican presents to your

office with malaise, jaundice, and RUQ pain of 2 weeks duration. He is on no medications and he does not drink ETOH. Ultrasound showed no evidence of gallbladder disease but the x-ray did show evidence of a fatty liver. Preliminary testing showed a direct bilirubin of 5.0, alk phosphatase of 300, and ALT of 1,500. A diagnosis of **acute hepatitis C** is made.

Hepatitis C- started testing blood serologies for Hepatitis C in 1992. 3.25% of the US population born between 1945 and 1965 are positive. Genotypes 1-6; 1 is most common in US. Causes-blood products, IV drug use (sharing needles), STI likely. Most common cause of liver transplants in the US today. No vaccine is available; all “baby-boomers” recommended to be tested. HCV viral load can be followed; slow progression of disease without treatment; will need liver biopsy and close follow-up. Mainstay of Rx had been Pegylated Interferon and ribavirin. 50-80% cure. Now a few HAART meds for HIV are being used (same as Hepatitis B) as well as boceprevir and telaprevir. Sofobuvir (polymerase inhibitor)/ledipasvir combo looks promising for 2015. A “Viekira Pak”- ombitasvir, paritaprevir and ritonavir tabs, has been approved for 2015. Many new agents coming out. Many will get cirrhosis of the liver over 30 years if untreated; then 20x the rate of hepatocellular cancer.

78. Abdominal infections involving which major organ has the highest mortality rate?

- A.) Appendix
- B.) Biliary tract
- C.) Large bowel
- D.) Pancreas
- E.) Small bowel

79. What is the most successful empiric treatment for inpatient diverticulitis?

- A.) Ampicillin
- B.) Augmentin
- C.) Cefuroxime
- D.) Doxycycline
- E.) Zosyn
- F.) Have one cup of oatmeal

80. A 65 year-old male presents with RUQ pain, fever, chills, leukocytosis with a left shift, and hypoalbuminemia. What is the most likely diagnosis and treatment for these symptoms?

- A.) Appendicitis; empiric Zosyn
- B.) Bacteremia; empiric vancomycin
- C.) Diverticulitis; Cipro with Flagyl
- D.) Acute Gastroenteritis; rehydration
- E.) Hepatic abscess; drainage

81. What does the CLO test screen for?

- A.) HSV meningitis
- B.) Helicobacter pylori
- C.) Hepatitis B
- D.) Mixed anaerobic diverticulitis
- E.) Pseudomembranous colitis
- F.) Don't have a CLU

82. What strain of Clostridium difficile is the most difficult to cure?

- A.) A1
- B.) B1
- C.) A3
- D.) NAP1
- E.) NASA strain

Answers:

78. **D** 79. **E** 80. **E** 81. **B** 82. **D**

Genitourinary Infections

Introduction-

Definition of UTI- must have > 5 WBCs per HPF (pyuria). Must have < 10 squamous cells per HPF (high power field). Never order a urine culture without an urinalysis. Leukocyte esterase is helpful if positive. Nitrites may be negative in non-gram negative rod infections (enterococcus).

Three Main Factors Causing UTIs- Reduction of urine flow- outflow obstruction of any kind (like BPH), dehydration, or neurogenic bladder. Factors that facilitate ascent- catheterization, sexual intercourse, incontinence, prolapse. Factors that promote colonization- atrophic vaginitis, immunosuppression.

Case 84

A 19 year old college female presents with pelvic pain and painful urination. Pelvic exam is normal. You diagnose **cystitis**.

Cystitis- 85-90% E. coli. 5-15% Staph saprophyticus. Others: Enterococci faecalis (men), Proteus- associated with Foleys, MAP (magnesium-ammonia phosphate) stones, Klebsiella. 10-12% of women suffer from cystitis annually. Greater than 50% of women suffer from cystitis at some time in their lives. Almost 4 million office visits annually. 1.6 billion dollars in direct costs. 5% have multiple recurrences.

Treatment of Cystitis- Oral antibiotics used- 3 or 4 days: Nitrofurantoin. Tri-sulfa. Fosfomycin. Cefadroxil. Quinolones-Cipro/Ofloxacin/Levofloxacin. May add anti-cholinergic for spasm. (such as Urispas-flavoxate). Consider Pyridium for pain.

Antibiotic Sensitivities to E.coli- Cefadroxil- 94%. Cefepime- 99%. Ciprofloxacin-75%. Levofloxacin-75%. Nitrofurantoin- 96%. Trimethoprim·Sulfa- 78%. Fosfomycin (Monurol Sachet)- 99%. Tobramycin- 95%. Amoxicillin- 53%. Enterococcus faecalis- Amoxicillin-99%. Check sensitivities quarterly at your institution.

2011 IDSA guidelines- because of years of overuse of fluoroquinolones for acute uncomplicated UTIs, there has been increased resistance. Nitrofurantoin- should be considered an alternative treatment for acute uncomplicated UTIs, has been used for decades and has maintained high sensitivity. Low cost, generic is less expensive than fluoroquinolones. Need normal renal function to be effective.

Case 85

A 45 year old monogamous, married lear jet pilot comes in with pelvic pressure, pain on urination, and scrotal discomfort. No hematuria is noted. PE reveals a mildly tender epididymis and prostate gland. Urinalysis shows 25 WBC/HPF. You diagnose a **prostatitis and epididymitis**.

Prostatitis/Epididymitis- tender prostate or epididymis often with dysuria. Must cover gonorrhea in promiscuous population. Otherwise, E.coli primary pathogen. Treat for 4 weeks minimum and sometimes longer. Antibiotics penetrate poorly into prostate because of high fat content. Best oral drugs- trimethoprim, trimethoprim-sulfa, or quinolones- (ciprofloxacin, levofloxacin, ofloxacin), or doxycycline. Add a NSAID agent also.

Case 86

A 70 year old female with a history of recurrent bladder infections presents to the ER with nausea, severe right flank pain with a + *Lloyd's sign* (loin pain with CVA palpation over kidney) and stinging on urination and a fever of 103. Blood cultures grow E. coli and you diagnose **acute pyelonephritis**. Renal ultrasound

confirms the diagnosis. U/A shows WBC casts. The following picture shows classic WBC cast in the urine.



Pyelonephritis- this is a complicated UTI. Septic shock possible. Flank tenderness except in diabetics. Look for WBC granular casts in urine. Treat E. coli and Enterococcus empirically. IV antibiotics initially if potentially bacteremic. Ampicillin or Vancomycin with Gentamicin or Cefepime. Watch for abscess. Diagnosis- renal ultrasound or CT. Treat obstruction (stones; stag horn calculi-MAP associated with Proteus) or hydronephrosis. Duration of Rx= 21 days. Most of the treatment is oral pending sensitivities of bacteria. (quinolones, tri-sulfa, amoxicillin, cephalosporins all utilized).

Case 87

An 85 year old NH patient with underlying mild dementia has a Foley catheter because of neurogenic bladder. She develops fevers > 100 , more cloudy urine in her foley catheter, and increasing confusion. On the basis of what criteria would you treat the **healthcare associated UTI**?



Healthcare (and Nosocomial) Associated UTI- most common infection in institutionalized patients. Female/male = 2:1. High risk- neurogenic bladder, foley catheter (CAUTI=Catheter-Associated UTI), understaffing. Diagnosis- use McGeer, Vance or Loeb criteria. This patient population has more resistant bacteria such as pseudomonas, serratia, and enterobacter.

McGeer Criteria: Without indwelling catheter-3 out of 5 of the following: Fever 100.4 or greater. New or increased burning or urination. Frequency or urgency. New flank or suprapubic pain. Tenderness. Change in character of the urine. Worsening mental or functional status. **Loeb Criteria (2001):** Without indwelling catheter- must have one of the following: Acute dysuria alone. Fever > 100.0°F. Temperature 2.4 degrees above baseline. Plus at least one of the following: New or worsening urgency. New or worsening frequency. Suprapubic pain. Gross hematuria. Costovertebral angle tenderness. New or increased urinary incontinence. See ***Vance's Criteria*** for comparison.

Vance's Criteria for UTI

In a patient without an *indwelling* catheter. **Three** of the following must be met: Fever (>100.4) or chills, New or increased burning pain on urination, New flank or suprapubic pain or tenderness, Changes in character of urine and worsening mental function.

In a patient with an indwelling catheter, **two** of the following must be met: Fever (>100.4) or chills, new flank or suprapubic pain or tenderness, changes in character of urine, worsening mental function.

Vance L., **Diagnosing and Managing UTIs**, from *Caring for the Ages*, 2002

Case 88

A 32 year old obese female with fibromyalgia has chronic stinging on urination and pelvic pain. Pelvic exam is normal. Urinalysis shows 5-10 WBCs/HPF and cultures are negative. She does not respond to antibiotics. You suspect a **dysuria syndrome** from interstitial cystitis. You send her to urology for a cystoscopy.

Acute Dysuria Syndrome- stinging on urination (dysuria) mimics cystitis. Causes include: 1) acute cystitis, 2) interstitial cystitis-painful bladder syndrome, 3) pyelonephritis, 4) GU trauma, 5) urethritis from GC, Chlamydia, HSV. 6) Vulvovaginitis from candida, trichomoniasis, bacterial vaginosis, 7) atrophic vaginitis, 8) allergic or 9) chemical irritation.

Case 89

A 72 year old nursing home patient with aortic stenosis has a chronic foley catheter. She presents to the ER with acute pulmonary edema and SOB. She has no urinary symptoms what-so-ever. Her U/A shows 10-20 WBCs/HPF and 2+ bacteruria. She has an **asymptomatic bacteruria**. Would you treat this?

Asymptomatic Bacteriuria- presence of bacteria in urine and possibly pyuria. No symptoms. **It should be treated only a) in pregnancy, b) prior to urological surgery, and c) post renal transplant.** There is no benefit from treating anybody else. (colonization is not always harmful)

Case 90

A 79 year old nursing home patient with Parkinson's Disease and a history of

neurogenic bladder from stroke disease has a history of chronic UTIs and a staghorn MAP kidney stone. She is inoperable. She now presents to the ER with GU sepsis syndrome, and *Torulopsis (Candida) glabrata* is growing from the urine culture. How would you treat this **fungal UTI**?

Fungal UTI- be sure to remove all foreign bodies and obstructions. Remove Foley catheter if possible. Kidney stones cause recurrence. For *Candida albicans*- use fluconazole. For *Torulopsis glabrata*—**lipophilic Amphotericin B**- .3mg/kg IV x 1 dose. Watch for adverse reactions. The addition of lipid decreases adverse reactions.

Case 91

A pleasant 30 year old monogamous, married female presents with pelvic pain and fevers for 4 weeks. She has an IUD in place for contraception. STI work-up is negative. CT scan of the pelvis shows tubo-ovarian abscesses. A diagnosis of PID (**Pelvic Inflammatory Disease**) is made and laparotomy is performed. Cultures grow *Strep viridans* and *Actinomyces*.

Pelvic Inflammatory Disease- look for fever, pelvic pain, and an exquisitely tender cervix or uterus. Palpation of the cervix will cause the patient to want to jump off the exam table in *severe pain* “hitting her head on the chandelier.” (Chandelier’s sign). Endometritis, salpingitis, or tubo-ovarian abscess is the rule. PID is caused by mixed vaginal flora or gonorrhea, or by chlamydia. Rx with Cefotetan with doxycycline or Azithromycin for 4-6 weeks. Surgery may be indicated. Look for *Actinomyces* infection in women with an IUD.

Case 92

You are hired as a Medical Director of the local Gynecology Department and to advise the local nursing home on **prevention of UTIs**. You realize that a huge problem you the nursing home is recurrent urinary tract infections. Many of the patients have chronic Foley catheters. But some of the women do not have Foley

catheters; they just have recurrent bladder infections.

Prevention of UTIs- 1) hydration is key- 1 oz/kg/day. 2) Acidify urine, and vitamin C 500 mg/day. 3) Cranberry juice 4 oz/day; controversial. 4) If Foley in, remove Foley catheter if possible (sometimes this is not possible). 5) Check urodynamic tests. 6) Treat for hydronephrosis and eliminate stones. 7) Check pelvic exam for anatomical problems; i.e. cystocele/rectocele. 8) Consider neurogenic bladder or poor emptying. 9) Urinate after sexual intercourse.

Manage well the chronic illnesses of the patients. Optimize their nutrition. For those with Foley Catheters - a) Maintain downhill flow at all times of catheter. b) Maintain closed drainage system. c) Keep Foley clean. d) Change monthly. e) Bladder and bowel routines. f) Good hygiene for fecal incontinence. g) Intravaginal estrogen replacement.

83. A 35 year-old female presents to your office with dysuria and increased urinary frequency. What etiologic agent is responsible for most cases of acute cystitis?

- A.) Escherichia coli
- B.) Enterococcus faecalis
- C.) Klebsiella pneumoniae
- D.) Proteus mirabilis
- E.) Staphylococcus saprophyticus

84. What oral antibiotic is recommended for pregnant women diagnosed with acute cystitis?

- A.) Cefadroxil
- B.) Ciprofloxacin
- C.) Fosfomycin
- D.) Nitrofurantoin
- E.) Trimethoprim-Sulfamethoxazole
- F.) Pregnamycin
- G.) A or D preferred

85. A 23 year-old college student presents to University Health Services with pyuria, dysuria, pelvic fullness and scrotal discomfort. You diagnose the patient with prostatitis. What is your next step?

- A.) Administer NSAIDs only
- B.) Report the patient to local public health officials
- C.) Test the patient for STDs before treatment

- D.) Treat empirically with Bactrim
- E.) Treat empirically with Bactrim and Ceftriaxone; may add NSAIDs
- F.) Tell him “absolutely no sex for one year”.

86. A 67 year-old female presents to the ED with bilateral flank pain, nausea, vomiting, and fevers/chills. You suspect pyelonephritis and she is allergic to penicillin (not anaphylaxis). She has a positive Lloyd’s sign and has been treated with fluoroquinolones for past UTIs, which caused tendon rupture. What would you treat empirically with?

- A.) Ampicillin and Ciprofloxacin
- B.) Amoxicillin and Cefepime
- C.) Gentamicin and Cefepime
- D.) Levofloxacin and Cefepime
- E.) Vancomycin and Cefepime

87. What do the McGeer’s criteria for nosocomial UTIs use for basis of treatment?

- A.) Abdominal fullness, fever, dysuria, flank pain, change in mental status
- B.) Abdominal fullness, fever, dysuria, change in mental status, change in urine
- C.) Fever, dysuria, flank pain, change in mental status, change in urine
- D.) Fever, flank pain, increased urinary frequency, pelvic pain, change in urine
- E.) Flank pain, pelvic pain, history of UTIs, change in mental status, change in urine
- F.) A consult with Richard Gere regarding his personal hair dresser.

88. Empiric treatment of an asymptomatic UTI is not recommended. What is the one exception to this rule?

- A.) Children under 18 years of age
- B.) Elderly men 75+
- C.) Elderly women 75+
- D.) Pregnant women
- E.) Young women of childbearing age

89. An immunocompromised 89 year-old woman has a history of nephrolithiasis and recurrent UTIs. She recently had a fever, change in mental status, and dysuria. Urine culture grew out *Torulopsis glabrata*. How would you treat this infection?

- A.) Ampicillin
- B.) Aripiprazole
- C.) Fluconazole
- D.) Lipophilic Amphotericin B
- E.) Lipophilic Terbenafine

90. A 25 year-old female has a history of recurrent UTIs. What should you recommend to help prevent future UTIs?

- A.) Increase water intake
- B.) Increase Vitamin C intake
- C.) Urinate after sexual intercourse
- D.) A&B

E.) A&C
F.) A,B,C

Answers:

83. **A** 84. **G** 85. **E** 86. **E** 87. **C** 88. **D** 89. **D** 90. **F**

Health Care Associated Infections

Introduction

Health Care Associated Infections (HCAIs)- occurs in over 2 million hospitalizations/year. Nosocomial infections add an average of 8 days to the hospital stay. Highest rates are in teaching hospitals. Cost 2-3 \$billion/year in US. UTI (50%), surgical wound (20%), pneumonia (18%), primary bacteremia (5%). Other- C. difficile diarrhea. Gram positive cocci (MSSA)>yeast (Candida)> gram negative bacilli (like Pseudomonas). Resistance is increasing- Staph aureus- more MRSA. Gram negative rods- Extended-spectrum beta-lactamases (ESBLs), also quinolone resistance increasing. Enterococcus-VRE on the rise. New pathogens- Torulopsis glabrata, Acinetobacter. ICU to non-ICU= 4:1 of new nosocomial cases. Nursing understaffing increases rates of nosocomial infection.

Case 93

John Luckyman is a 55 year old banker who comes in for an elective laparoscopic cholecystectomy. During the procedure, the gallbladder unfortunately tears, and bile is leaked. Biliary peritonitis is diagnosed. Post-operatively, he develops urinary retention and a Foley catheter is placed. Then, a post-op ileus prompts an NG placement on the 4th hospital day. During the NG placement, he vomits and aspirates, causing an aspiration pneumonia. Two days later, his abdominal wound leaks bile and purulent drainage. His temp spikes to 103 and blood cultures grow E. coli. Where is the likely source of this **Health Care Associated Infection?**

Important pathogens in the ICU: E. coli- 18.6%, Staph aureus- 10.8%, Enterococci- 10.7 %, Pseudomonas aeruginosa- 10.6%, Klebsiella- 7.4 %, Proteus- 5.4%, Enterobacter sp.- 5.8%, Others- 30.7%.

Likely source for the E.coli bacteremia- 1) Surgical wound > 2) Aspiration pneumonia > 3) Catheter-Associated UTI (his U/A shows 100 WBC/HPF)

Case 94

A 40 year old female presents to the ER with hypotension, shock and SVT with HR of 200. An emergent jugular vein central catheter is placed. You suspect a **line-related infection**. What are the four different types of infections related to the line?

Primary Bacteremia- bacteremia related to an access IV line. There are four types of central line infections (CLABSIs (Central Line Associated BloodStream Infections) include dialysis perma-caths, chemo ports, Groshung catheters, and PICC lines). 1) *Transient bacteremia*. Don't pull line initially unless gram negative, MRSA/MSSA or yeast. 2) *Exit site infection*- mild purulent drainage- Rx locally and with oral antibiotics. 3) *Tunnel infection*- this is more serious- the line must be pulled and IV antibiotics started. 4) *Septic phlebitis*- less common, but very serious. Septic pulmonary emboli can develop. Line must come out. Always culture the line tip on removal. >1000 cfu (colony forming units) suggests the line as source of bacteremia.

Is the Catheter the source of bacteremia? Four factors: 1) Look for an absence of evidence of other sources of infection (pneumonia, UTI, wound) 2) Blood culture + for a recognized pathogen for catheter-related infection 3) + blood cultures at least 2 hours faster from CVC than peripheral 4) Catheter tip yielding > 1000 cfu/ml by "roll-tip" method. Vancomycin is the drug of choice for MRSA bacteremia- 7-14 days if MIC <2. MSSA bacteremia- nafcillin or cefazolin- 7-14 days. Gram negative rodemia- aminoglycoside or 3rd-4th gen ceph. Fungemia- fluconazole for *Candida albicans*- 14 days; *Torulopsis glabrata*- caspafungin, or Ampho B for 14 days. Complicated- septic phlebitis = 4 weeks of treatment.



Case 95

A 55 year old alcoholic male presents to the hospital with delerium tremens from excessive ETOH intake; up to a pint of Vodka/day. Chest x-ray is clear on

admission but after 3 days of hospitalization, he vomits several times and develops **HCAP (Healthcare-associated Pneumonia)**.

VENTILATOR BUNDLE ELEMENTS

1. Head of bed > 30 °
2. *Daily* assessment of readiness to extubate & “*sedation vacations*”
3. Peptic Ulcer Disease Prophylaxis
4. Deep Venous Thrombosis Prophylaxis



HCA-Pneumonia- 80% of HCAP are VAPs (ventilator-associated). Often will occur during surgery. Normal oral flora replaced by gram negative rods/Staph within 4-7 days of hospitalization. HCAP adds 11 days to hospital course, 25% mortality. Risk factors- high gastric pH while on PPIs., surgery, elderly, immunosuppressed. Aspiration risks- stroke, seizures, delirium (often ETOH-related). VAP- 1) early first 4 days of intubation- treat normal CAP pathogens. 2) late- > 5 days of intubation- empirically treat MRSA and resistant gram negative rods. Fungal etiology-rare cause.

A negative Gram stain suggests a very low likelihood of VAP. A positive Gram stain is not very specific for VAP. Thus, a positive gram stain should not be used to specify antibiotic therapy until culture results are available. Lab results, physical exam findings and radiographic features should all be considered when diagnosing VAP. *OHora et al., CID 2012:55 (15 August): 551-61*

Case 96

A 32 year old has severe brain trauma from a recent motor vehicle accident. His head injury requires surgery, and he is on ventilator in the ICU for weeks. You

are called to see him because of fevers to 102 and a WBC of 25,000. What is the differential diagnosis of **FUO in the ICU**?

Fever in the ICU- causes are numerous: 1) nosocomial (urine, wound, lung, line bacteremia (also phlebitis), C. diff) 2) sinusitis if intubated 3) Non-infectious causes- a) drug fever/allergy b) PE c) MI/CVA d) adrenal insufficiency e) hematoma-? location f) dehydration g) ischemia

Case 97

A 65 year old former professional football player has a total right hip arthroplasty. Post-operatively, he has a Foley catheter “for a few days” and develops fever to 101 with purulent looking urine. The U/A shows 25 WBCs/HPF and grows out E. coli. You diagnose a **Catheter-Associated UTI (CAUTI)** and treat with cefazolin.

Urinary Tract Infections- most common healthcare-acquired infection. Adds 1-2 days to hospitalization. Highest risk is Foley catheter use. Pathogens- resistant gram negative rods, enterococcus, or yeast. Obtain U/ A- >5 WBCs/HPF and culture. Remove Foley ASAP when possible!

Case 98

A 55 year old smoker with PVD has a right leg iliofemoral bypass. Unfortunately, the wound dehisces, drainage is cultured, and the Dacron graft is exposed. Cultures grow out Staph epidermidis. You diagnose a **surgical wound infection**. The following picture shows a typical “smoldering” infection caused by Staph epidermidis. Not much purulent drainage is noted. Note the exposed graft.



Surgical wound infections- adds about 7 days to hospitalization. Look for purulent drainage, wound dehiscence, erythema, with or without fever. If artificial graft is involved, it may need to be removed. SCIP (Surgical Care Improvement Guidelines) helps to prevent SWIs. High risks for SWIs include- 1) long/ contaminated procedures, 2) long pre-op hospitalization, 3) elderly, 4) steroid use, 5) morbid obesity. Pathogens- resistant Staph aureus (MRSA), resistant gram negative rods (Acinetobacter, Enterobacter). May take 5-14 days to develop.

91. The top four pathogens implicated in nosocomial and HCAs infections are:

- A. E. coli, S. aureus, Enterobacter sp., Enterococci
- B. E. coli, S. aureus, Klebsiella, pneumococcus.
- C. E. coli, S. aureus, Fusobacterium, P. aeruginosa
- D. E. coli, S. aureus, Enterococci, MAI
- E. E. coli, S. aureus, Enteroblastomycosis, Oh my Candida

92. Which kinds of primary bacteremia attributed to the central line require that the line be pulled immediately and antibiotic therapy be initiated?

- A. Transient bacteremia
- B. Tunnel infection
- C. Exit site infection
- D. Septic phlebitis
- E. B & D
- F. All of the above.

93. How might healthcare-associated pneumonia be prevented in a patient requiring ventilator support?

- A. Head of the bed at 45° to help prevent aspiration
- B. Frequent suctioning and excellent oral care to manage secretions and control oral flora
- C. Prophylaxis for GERD and peptic ulcer disease
- D. Deep sedation to allow full management of respirations
- E. B & C
- F. All of the above.

94. If a patient on ventilator support in the ICU spikes a fever of 102°F and a white count of 25,000, and his heart rate increases to 115 beats per minute, how many other criteria does he need to meet before he is diagnosed for SIRS?

- A. 0
- B. 1
- C. 2
- D. We need to find the infection

95. Which of the following are risk factors for UTI in catheterized patients?

- A. Female gender
- B. Diarrhea
- C. Male gender
- D. Heart failure
- E. A & B
- F. C & D

Answers:

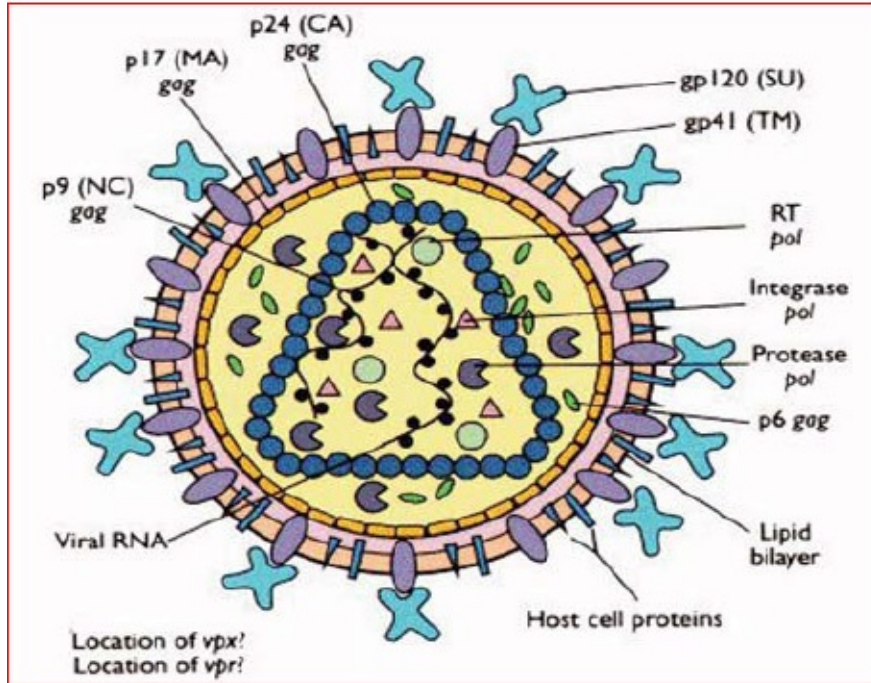
91. **A** 92. **E** 93. **F** 94. **A** 95. **E**

Human Immunodeficiency Virus (HIV) Infections

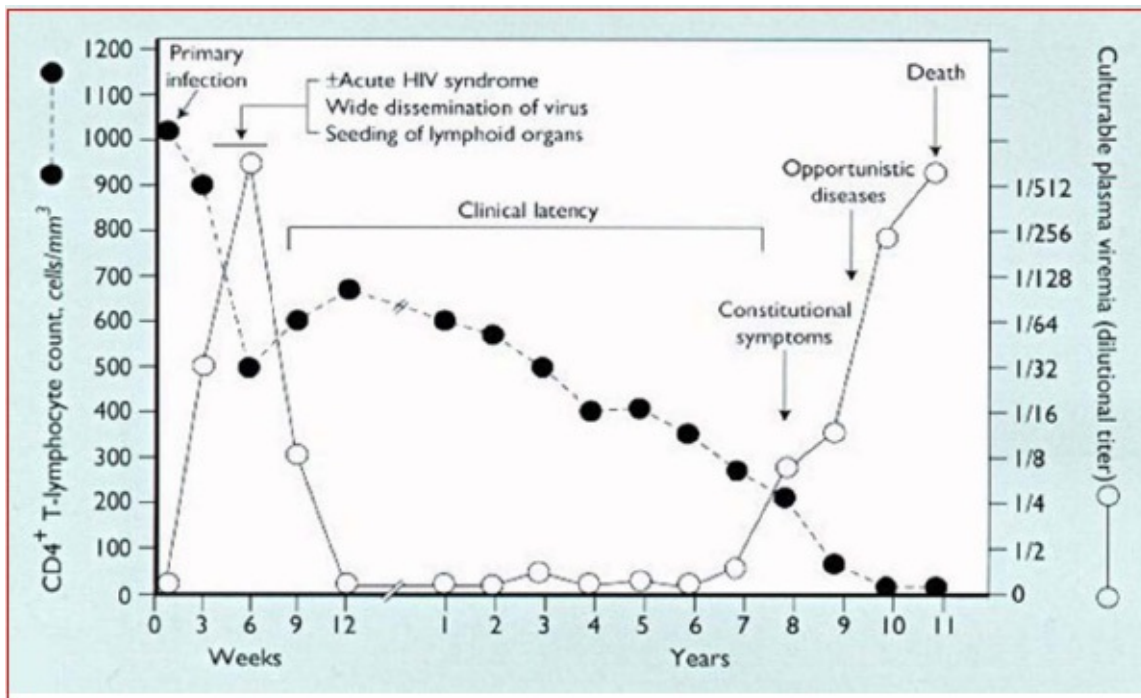
Case 99-Introduction- HIV

A professional basketball player is heterosexually promiscuous in the late 1980s and early 1990's. Unknowingly, he contracts HIV in the late 1980s during an orgy. **Why didn't he have any symptoms for years?** One must understand the clinical course of HIV:

HIV is a lentivirus, a retrovirus (HTLV III). First described approximately in 1981. Attaches to and kills CD4 lymphocyte. Spread by blood and STD. **Five stages:** a) seroconversion illness at 2-6 wks. b) asymptomatic for 4-8 years c) persistent lymphadenopathy d) AIDS-related complex; CD4 count >200. e) AIDS- CD4 count <200. Over 20 different opportunistic infections are associated. HIV has sanctuaries in the lymphatic system where it is difficult to kill. No cures yet. The p24 and p120 antigens are "key" surface proteins on HIV.



Natural History of HIV Infection

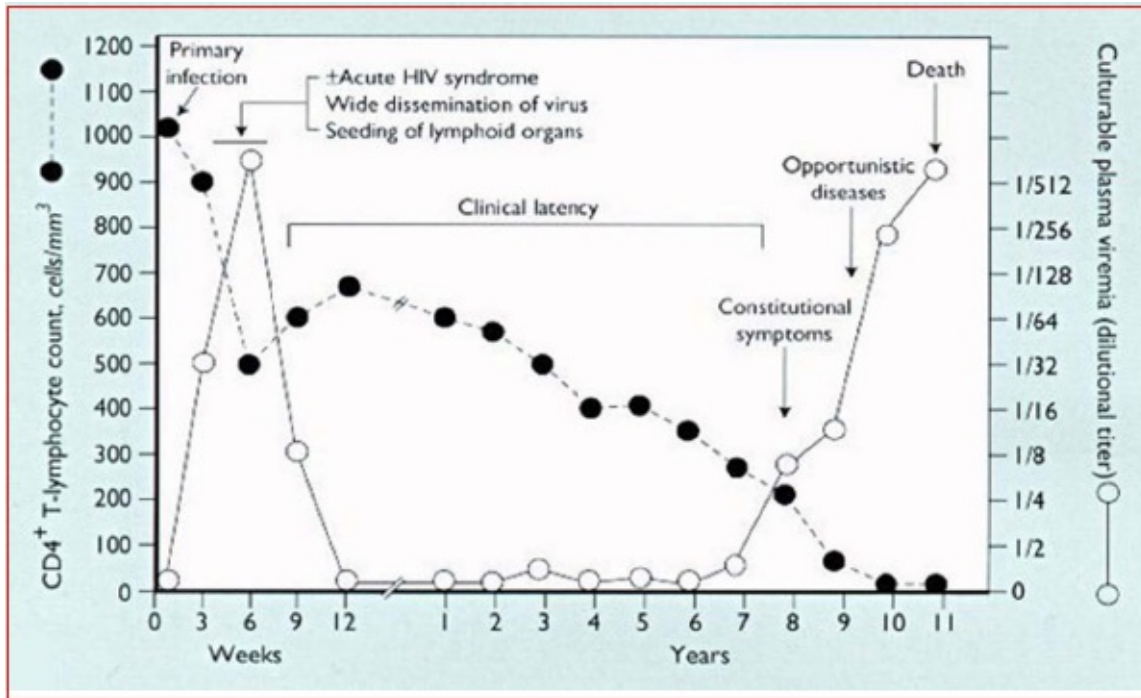


HIV Resistance/Mutations- Major NRTI-Resistance Mutations- M184, K65 (discriminatory), 215 TAM (thymidine analog mutations). Major NNRTI-

Resistance Mutations- K103 to NVP and EFV. Major PI-Resistance Mutations- I54 and V82. There are many many more, but these are the major ones.

Case 100

Over 80% of the cases of HIV are in what areas of the world?

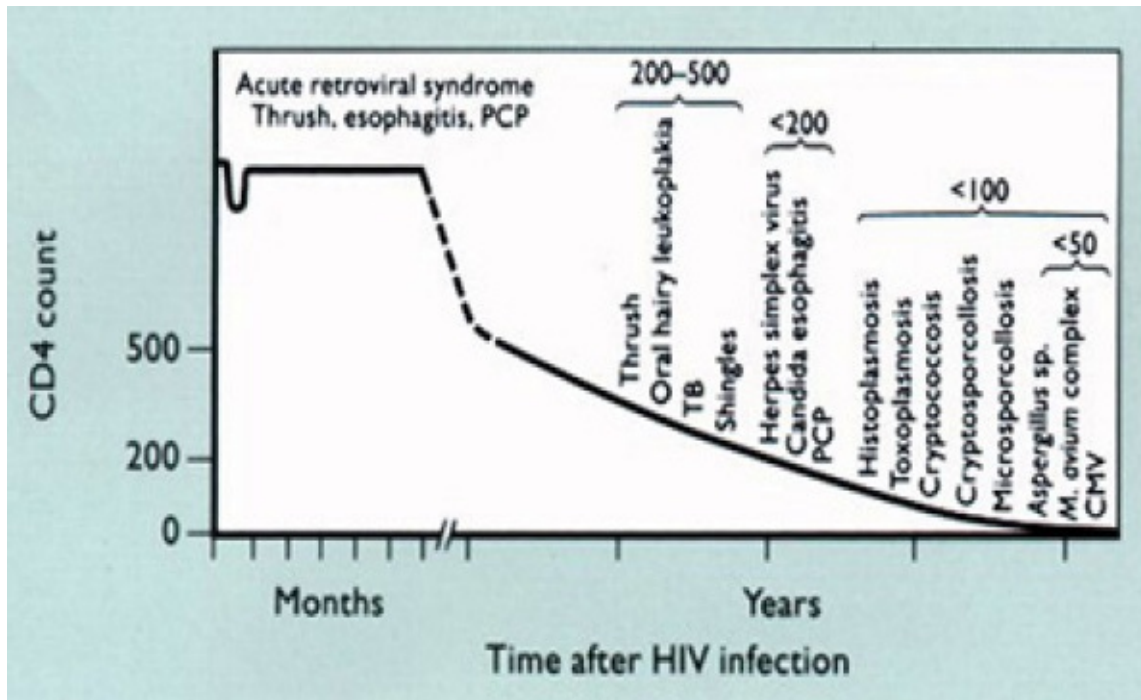


Case 101

A 28 year old male with risk for HIV because of promiscuity and MSM is seeing you for lumps on his tongue. You diagnose oral leukoplakia and suspect HIV.

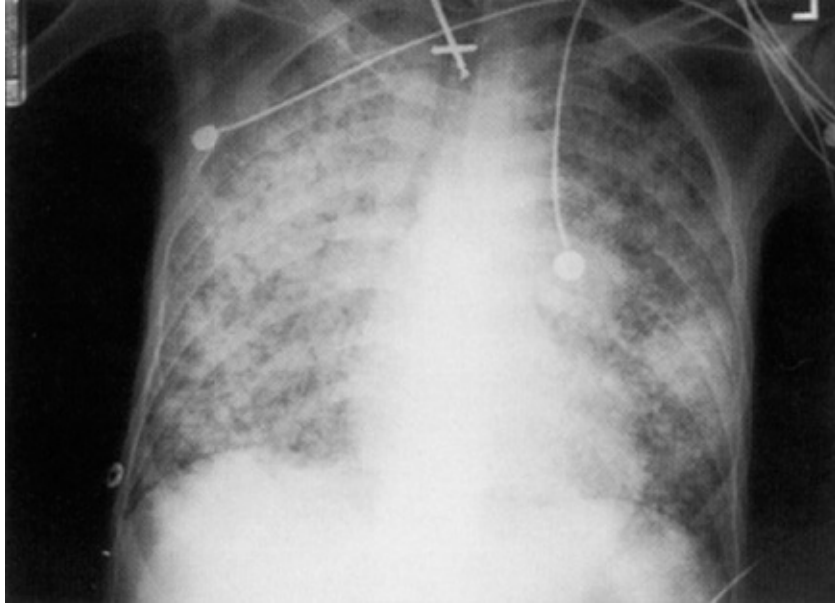
Cell-mediated Immunity- this is significantly affected by HIV. Five types of clinical problems: 1) Bacterial- MAI, Mycobacterium TB, recurrent bacterial pneumonia. 2) Fungal- Candidiasis, seborrheic dermatitis, Cryptococcus (especially CNS), Pneumocystis jirovecii pneumonia. 3) Viral- Cytomegalovirus colitis, retinitis. Ebstein-Barr Virus-lymphoma, oral leukoplakia. Varicella-Zoster virus. Herpes Simplex virus. Human Herpes Virus 8- Kaposi's sarcoma. JK virus- Progressive Multifocal Leukoencephalopathy. 4) Parasitic- Cryptosporidiosis-diarrhea. Toxoplasmosis- brain cysts, retinopathy. 5) Malignant cancers- cervical cancer, lymphoma (especially CNS).

Opportunistic Infections-



Case 102

A 22 year old immigrant from Ghana, Africa presents to the ER with severe SOB and cough, with malaise and fevers for 10 days. Chest x-ray is compatible with **Pneumocystic jiroveci pneumonia**. You suspect HIV infection. You empirically treat him with Bactrim and IV steroids. HIV testing is done and is ++. An increase in LDH is often noted. If pO₂ is < 60, steroids are definitely helpful. The following chest xray shows the typical interstitial appearance of PJP.



Medications for PJP-Trisulfa, Pentamidine, Atovaquone, Primaquine, Dapsone, Clindamycin, Trimetrexate (a quinoxaline derivative)

Case 103

A non- high risk patient for HIV comes in to see you with a positive **HIV ELISA test** found at the blood bank when donating blood. What do you do?
Confirmatory tests-initial testing HIV ELISA; few false negatives. Some false positive. Do Western Blot to confirm. For Rx, viral load testing is key to keep as close to 0 as possible. Check serum **genotyping** for sensitivities of HIV to anti-viral agents.

- Test all persons 13-64 years of age (MMWR-2006).
- Annual testing based upon risk thereafter.

Case 104

A totally asymptomatic HIV patient comes to see you for treatment. How do you know when to start treating the patient?

Treat HIV infected individuals when the following:

- 1) The patient has an AIDS-defining illness such as Pneumocystis pneumonia
- 2) CD4 count <200
- 3) CD4 count 201-350, but viral load > 20,000

4) CD4 count >350, but viral load > 60,000

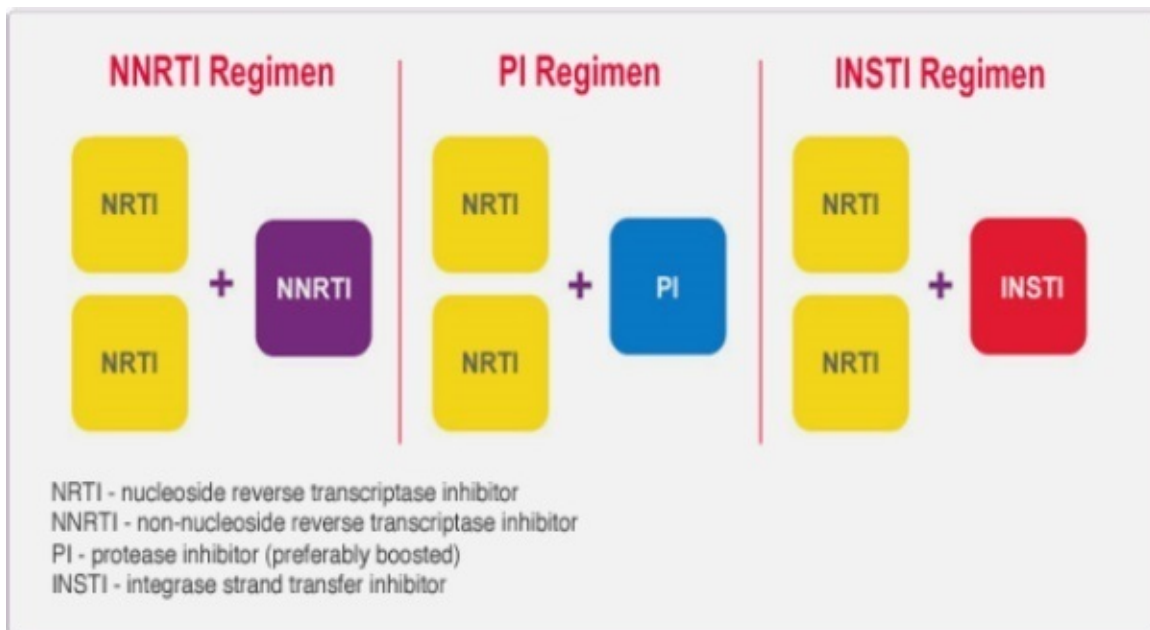
Don't treat if:

- 1) CD4 count 201-350 but viral load <20,000
- 2) CD4 count > 350 and viral load <60,000

Case 105

A patient with a new diagnosis of HIV has a viral load of 25,000 and a CD4 count of 260. You recommend treatment. How do you go about **picking a regimen**?

From 1981-1995 - DISMAL PROGNOSIS of HIV infection. In 1995- HAARTH- Highly A- Active A- Anti- R- Retroviral T-Therapy became available. Mortality rate significantly decreased. Now, HIV treatment is primarily an outpatient clinic treatment, if patients are compliant. Must watch for side effects from the medications and monitor CBC, CMP, Lipids, etc. Must monitor for lipodystrophy that can occur with certain agents.



HIV Medications- 6 types- Nucleoside Reverse Transcriptase Inhibitors-
NRTI (9)- Truvada- emtricitabine/tenofovir, **Viread** (Tenofovir), **Emtriva** (emtricitabine), **Videx** (DDI), **Epzicom** (abacavir/lamivudine), **Epivir**

(lamivudine-3-TC), **Ziagen** (abacavir), **Combivir** (lamivudine/zidovudine) **Retrovir**, **Trizivir** (abacavir, zidovudine, lamivudine), **Zerit** (stavudine-d4T). **Non-nucleoside Reverse Transcriptase Inhibitors-NNRTI (5)**- Sustiva (efavirenz), **Viramune** (nevirapine), **Edurant** (rilpivirine) **Intelence** (etravirine), **Rescriptor** (delavirdine)**Protease Inhibitors (9)**- Reyataz, (atazanavir), **Kaletra** (lopinavir/ritonavir), **Lexiva** (fosamprenavir), **Aptivus** (tipranavir), **Prezista** (darunavir), **Norvir** (ritonavir), **Invirase** (saquinavir), **Viracept** (nelfinavir) **Crixivan** (indinavir) **Integrase Inhibitors (3)**- **Isentress** (raltegravir), **Elvitegravir**, **Tivicay** (dolutegravir) **CCR5 Antagonist (1)**- Mararovic. **Entry Inhibitors (1)**- Fuzeon (enfuvirtide,-T-20) **Atripla**- (efavirenz, tenofovir, and emtricitabine) **Complera**- (emtricitabine, tenofovir, rilpivirine) **Stribild (“Quad Pill” 2012)** (elvitegravir, emtricitabine, tenofovir, cobicistat- boosts the elvitegravir). **Triumeq**- dolutegravir /abacavir/ lamivudine. (2014)

Case 106

A new 28 year old HIV patient admittedly has problems with **noncompliance of taking medications**. He is very busy and it is difficult for him to take medications throughout the day. You review the different options with him.

- 1) **Chemotherapy**- Highly active antiretroviral therapy (*HAART*)-developed in 1995. Triple therapy with medications from at least 2 classes. Usually 2 NRTIs (nucleoside reverse transcriptase inhibitors; and an NNRTI (non-nucleoside reverse transcriptase inhibitor; or 2 NRTIs and a PI (protease inhibitor)
- 2) **Chemoprophylaxis**- guards against Cryptococcosis (fluconazole), MAI (azithromycin), Toxoplasmosis, Candida, CMV (ganciclovir), and PJP (tri-sulfa or mepron).

97. HIV resistance mutations can be found for all of the following **except**:

- a. NRTI mutations
- b. NNRTI mutations
- c. PI resistance mutations
- d. All of the above are possible sites for resistance mutations

98. What is the approximate percentage of global cases of HIV found in the United States?

- a. 1%
- b. 5%
- c. 10%

d. 15%

99. Which of the following diseases are typically found **ONLY** in AIDS patients after the CD4 count drops to less than 50?

- a. M. Avium complex
- b. Oral thrush
- c. CMV infection
- d. All of the above are typically can be found when the CD4 count is below 50
- e. A or C

100. What is the main reason that the ELISA test is a good screening test for HIV?

- a. It is a highly specific test
- b. It is a highly sensitive test
- c. It has a high positive predictive value
- d. It has a low negative predictive value

101. A 32 year-old male with known HIV presents for treatment. Laboratory testing shows his CD4 to be 400. What is the next best step to determine if the patient requires treatment?

- a. Perform a CXR to screen for Pneumocystis jirovecii
- b. Check his HIV RNA levels; if > 20,000, treatment should be started
- c. Check his HIV RNA levels; if > 60,000 treatment should be started
- d. Treatment should be deferred at this time

102. What is the main reason for lack of success of HAART therapy?

- a. The medications are not effective
- b. The HIV virus quickly develops resistance to the medications
- c. Non-compliance due to daily dosing of medications and difficult side effects
- d. It just doesn't have the heart
- e. B and C

Answers:

97. **D** 98. **B** 99. **E** 100. **D** 101. **C** 102. **E**

Immunocompromised Patients

Introduction

Surface barriers- mechanical, chemical and biological- *first line of defense for protection*. Mechanical barriers include coughing, sneezing, the flushing effect of tears, urination, and the mucous effect of the GI tract to entangle bacteria.

Chemical barriers protect us. The skin and respiratory tract secretes antimicrobial peptides called *beta-defensins*. *Lysozyme and phospholipase A2* are secreted in saliva, tears, and breast milk. Vaginal secretions are acidic and this serves to protect from bacterial invasion. Gastric acid and *proteases* in the stomach serve as powerful chemical defenses. Semen contains *defensins and zinc* to kill would-be pathogens. “Normal flora” of the respiratory and GI tract biologically serve to protect us from pathogenic invasion. **The Innate Immune System-Three Parts- Inflammation (1)-** first response of the immune system to infection. Redness, swelling, heat and pain from increased blood flow to area of infection, produced by eicosanoids and prostaglandins released by damaged cells. Leukotrienes attract WBCs to the area of infection. Cytokines include interleukins, chemokines, and interferons (which have anti-viral properties and shut down protein synthesis in a cell). **Complement System (2)-** a biochemical cascade that attacks a foreign cell. Contains over 20 different proteins that “complement” the immune system in killing pathogens. It is the major humoral immune component. Complement binds to antibodies that are attached to microbes, or directly to the microbe. This initiates a rapid killing response. A proteolytic cascade follows, and more opsonization of microbes and killing occurs. **Phagocytosis (3)-** phagocytes include PMNs, macrophages, dendritic cells. Cytokines “call” phagocytes to areas of infection. The pathogen is ingested by phagosome vesicle and then fuses with a lysosome. Dendritic cells are in contact with the external environment; found in the nose, on the skin, GI tract,

and in the lungs.

The Adaptive Immune System- Lymphocytes-this immune system is antigen specific. Accordingly, immune responses are tailored depending on the pathogen. Thus, “memory T cells” are quick at recognizing previous pathogens.

Lymphocytes:B-cells- responsible for the *humoral* immune system and the production of antibody. **T-cells (3 basic kinds; killer, helper, and gamma/delta)**- responsible for *cell-mediated immunity*. **Both B cells and T cells** carry receptor molecules that recognize specific targets on pathogens. **Types of T-Lymphocytes**-Helper T cells- 46% (have CD3, CD4 co-receptors) recognize antigens coupled to Class II MHC. They do no killing, but only direct the rest of the immune response. They are the “conductor of the symphony”. Helper T cells release cytokines that enhance the activity of killer T cells and cidal activity of macrophages. HIV infects these cells. Killer-cytotoxic T cells- 19% (have CD3, CD8 co-receptors) only recognize antigens coupled to Class 1 MHC (major histocompatibility complex). They kill host cells that are infected with viruses or are dysfunctional by releasing cytotoxins like *perforins*. Natural Killer T cells - 7% (have CD16, CD56 co-receptors) Gamma/delta T cells- 5% (a minor subset) recognize antigens not coupled to a MHC. **B-Lymphocytes**-important in the humoral, or immediate immune system. BCRs (B-cell Receptors) are on their cell surface. This allows specific binding to a protein antigen on a pathogen. B-cells produce antibody (then called plasma cells) specific to a foreign antigen, as well as *memory* B-cell lines. B-cells don’t produce antibody until they have been activated by T-helper cells. The **antigen-antibody complex** is taken up by the B-cell and processed into peptides. The B-cell then displays these peptide antigens with its MHC- class II surface molecules. T helper cells are attracted which activate lymphokines and the B-cell is signaled to divide and produce millions of copies of the appropriate antibody. They *mark* the pathogens and allow the complement system to do its thing.

Reasons for Immunodeficiency-The very young or very old. Obesity.

Alcoholism- liver disease. Drug abuse. Kidney disease. Malnutrition. Loss of the

thymus through genetic mutation or surgery. Acquired- Chronic Granulomatous Disease (decreased PMN function), AIDS, cancers. Splenectomy.

Case 107

A 65 year old male with CKD and **End-Stage-Renal-Dialysis** presents with a MRSA infection of his left arm fistula associated with bacteremia.

Chronic Kidney Disease- patients with renal failure have 1) decreased PMN function. Also, there is a 2) decrease in PMN production and 3) atrophy of lymphoid structures. There is a 4) decrease in acute inflammatory response, 5) decrease hypersensitivity. 6) Fever response is also lessened. Acidosis, hyperglycemia (in diabetics with CKD), malnutrition, and hyperosmolarity all decrease WBC function. Dialysis membranes 7) activate the cytokine and complement cascades altering the immune responses. There is a general 8) increase in vascular access infections in dialysis patients, pneumonias and UTIs.

Case 108

A 65 year old female with ETOH liver disease with **cirrhosis** presents with pneumococcal pneumonia and septic shock.

Chronic Liver Disease- 80% of the liver's blood supply comes from the portal vein and 20% from the hepatic artery. 80% of the liver volume is hepatocytes. From an immunity standpoint, it is an important organ for the production of 1) complement (complement consists of 35 proteins that cascade to kill pathogens), 2) natural killer lymphocytes, 3) TLRs (toll-like receptors which help to initiate the immune response) and 4) interferons. It also 5) produces PRRs (pattern-recognition receptors) that recognize pathogen-associated molecular patterns (PAMPs)- lipopolysaccharides in gram negative organisms and peptidoglycan in gram positive organisms. Liver failure seriously messes up the immune system.

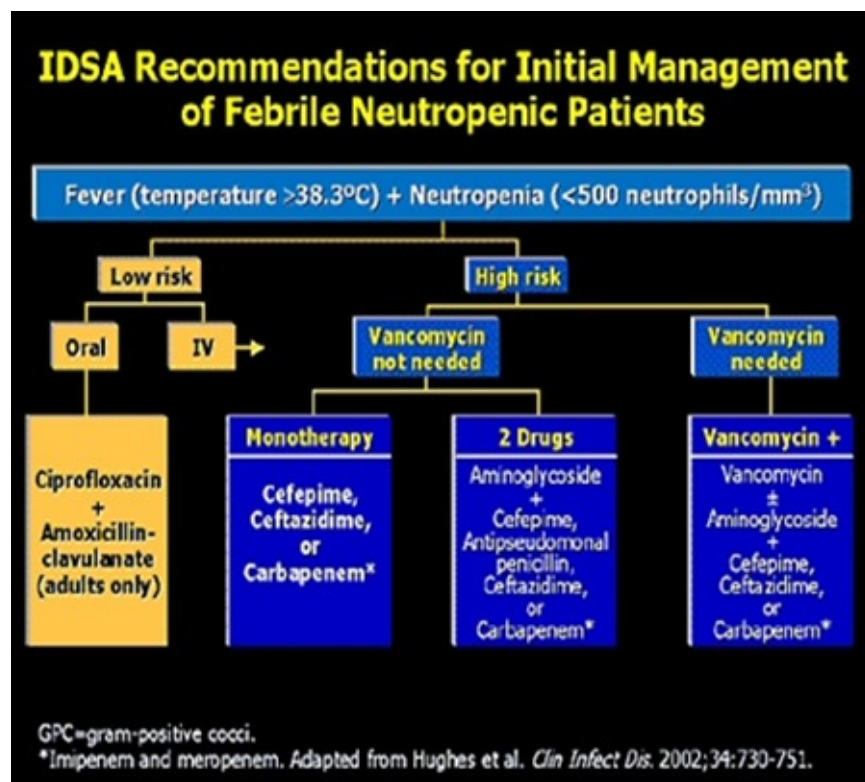
Case 109

A 25 year old male requires a **splenectomy** secondary to an unusual football injury. He will be at increased risk for infection for the rest of his

Post-splenectomy patients- the sinusoids of the spleen serve to filter blood. The PMNs within the spleen serve to ingest circulating bacteria, especially those that are encapsulated. The spleen stimulates production of opsonizing antibody. Splenectomized patients are more prone to H. flu, pneumococcal, and N. meningococcal infections, as well as parasites like malaria and babesia.

Case 110

A 65 year old female develops acute myelogenous leukemia. The oncologist puts her on an aggressive chemotherapy regimen which knocks her **absolute PMNs to 100**. After a **high fever for 48 hours**, he hospitalizes her for work-up.



Fever and Neutropenic patients- once PMN numbers are <1500, there is increased incidence of both bacterial and fungal infections. This is especially true in patients on chemotherapy. Infections usually occur with bacterial

organisms that are part of the GI flora (gram negative rods). If a port or central line is in place, must watch for Staphylococci and cover with Vancomycin. See above recommendations. **Typhilitis** is an inflammatory reaction of the ileum/right colon to chemotherapy in the setting of neutropenia. If F and N > 7 days, fungal infections are prevalent.

Case 111

A 80 year old homeless man and malnutrition with multiple open skin wounds presents with **myiasis**. Brachycera is a type of fly commonly associated with maggots. See the following picture. Elephantiasis verrucous nodosa on the right harbored maggots.



Case 112

You are asked to see a 45 year old patient who is having a planned kidney transplant 4 weeks from now. What infections are a **transplant patient** at risk for, and what is the “pre-transplant” infectious disease work-up for them?

Pre-transplant Work-up-HSV-I, HSV-II, CMV, EBV antibodies, Chickenpox/

HZV Ab, HIV Ab, Toxoplasmosis Ab, Hepatitis A, B ,C Ab.

103. Mechanical barriers of protection for our immune system include:

- A. Coughing and sneezing
- B. Tears and urination
- C. GI tract mucous
- D. All of the above
- E. None of the above

104. Beta-defensins are antimicrobial peptides secreted in:

- A. The skin
- B. The respiratory tract
- C. Semen
- D. All of the above

105. Inflammation causes redness, pain, swelling, heat and increased blood flow at the site of infection. These factors are produced by:

- A. Eicosanoids
- B. Prostaglandins
- C. Leukotrienes
- D. Cytokines
- E. All of the above
- F. A and B

106. Complement is part of the humoral immune system. Its main job is in:

- A. Opsonization
- B. Lysis of pathogens
- C. Phagocyte recruitment
- D. Activating T-cells
- E. All of the above
- F. A,B, and C

107. People with Chronic Kidney Disease are at increased risk of infections due to:

- A. Metabolic acidosis
- B. A decrease in PMN function
- C. A decrease in inflammatory responses
- D. Immunodeficiency
- E. Too much Taco Bell
- F. B,C,D

108. The liver produces:

- A. Complement factors
- B. NK lymphocytes
- C. TLR
- D. All of the above
- E. A and C

109. People who have had splenectomies are more prone to infections:

- A. Because the spleen serves to “ingest” bacteria
- B. Because the spleen opsonizes bacteria
- C. Because the spleen is a producer of TLR
- D. A and B
- E. B and C.
- F. Not really because their bodies make up for the loss

110. Neutropenic patients with a fever who are considered low risk for infections should receive which antibiotic regimen?

- A. Vancomycin
- B. Bactrim
- C. PCN
- D. Ciprofloxacin or Augmentin
- E. Methicillin and Naladixic acid

111. Myiasis is:

- A. Infestation of the body surface by the common brachycera fly
- B. Infection from eating raw meat
- C. Due to rat feces
- D. Only found in epidemic areas such as Africa or South America
- E. Due to too much Spotted Cow Beer

112. Pre-transplant workup includes checking for:

- A. CMV/EBV
- B. Staph aureus
- C. Group B strep
- D. Kaposi Sarcoma

Answers:

103. **D** 104. **D** 105. **F** 106. **F** 107. **F** 108. **E** 109. **D** 110. **D** 111. **A** 112. **A**

Musculoskeletal Infections

Case 113

A 50 year old policeman presents with a fevers and a painful, swollen, warm knee joint. He fell on the knee pursuing a suspect one week ago and scraped it. Arthrocentesis reveals a cell count of 75,000 with 94% PMNs. Cultures grow Staph aureus. (MSSA). You diagnose a **septic arthritis** and orthopedics performs a “cleansing arthroscopy”.

Septic Arthritis- an infected joint. There is a joint effusion, pain, fever, and generally heat from the affected joint. Portal- direct inoculation or hematogenous spread. Staphylococcus aureus (30%), Beta-hemolytic Strep (Group A, B, and G)(25%), Gonococcal (Neisseria gonorrhoea, can be culture neg)(25%; increased in promiscuously sexually active), Gram negative (15%; Pseudomonas, drug users, increase in sternoclavicular joint). Viruses- Hepatitis B and C, rubella, mumps, parvovirus B-19, HIV, arbovirus. Less common-Lymes, TB, SBE, RA, Relapsing Polychondritis, Brucella, Whipple’s disease. Diagnosis- Synovial fluid- 30,000-100,000 cells, left shift, positive culture in 80%. (Thayer-Martin for GC). Rule out gout/pseudo gout with crystal analysis. Treatment- “cleansing arthroscopy”, then 6 weeks IV antibiotics directed at offending pathogen.

Differentiating Gonococcal septic arthritis: sexually active, migratory, tenosynovitis, dermatitis, polyarthritis > 50%, blood cx + < 10%, Joint + cx- 25%. Nongonococcal septic arthritis- very young, elderly, not migratory, tenosynovitis rare, dermatitis rare, monoarthritis, blood culture + = 50%, Joint + cx= 85-95%.

Case 114

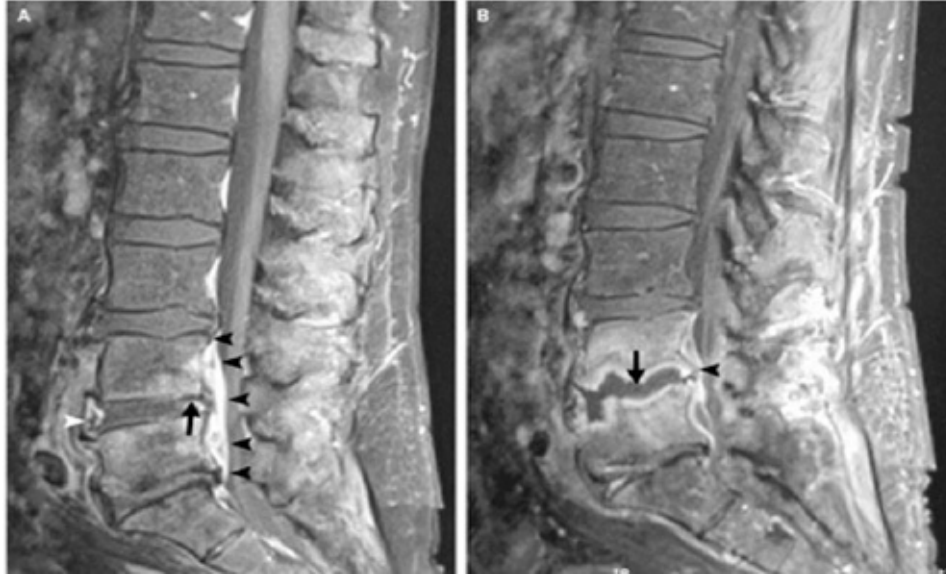
A 75 year old male had a left total knee arthroplasty 3 weeks ago because of disabling arthritis of the knee. He has DM, and rheumatoid arthritis. He presents with ongoing drainage from the incision and cultures grow Staph epidermidis. You suspect a **prosthetic septic arthritis**. Look at the following picture of a post-op wound infection. Note drainage from the proximal wound of the knee. The wound never closed after surgery



Prosthetic septic arthritis-most commonly in knee or hip joint. If infection occurs within 1 month of placement, try to salvage prosthesis. Otherwise, do two-stage Rx. Remove prosthesis, add antibiotic spacer, IV antibiotics for 6 weeks, then replace prosthesis. Staph epidermidis- common pathogen, occasional gram negative rod. Add Rifampin for synergy if prosthesis present. Culture negative- 10-20% of cases. Use Vancomycin.

Case 115

A 35 year old female presented with a chronic low back pain, especially worsening over the last few weeks. She noted pain going down the left leg, and was associated with partial foot drop. She was hospitalized in Texas 3 months previously for MRSA bacteremia, unknown portal of entry, and was treated with IV antibiotics. A MRSA carbuncle was drained by her PMD 3 weeks ago. Her MRI showed L4-L5 **vertebral osteomyelitis and discitis** from MRSA.



Vertebral osteomyelitis- usually caused by hematogenous spread. Staph aureus- 80%. (MSSA/MRSA). MRI scan diagnostic. Look for epidural abscess. Surgery if cord compromise, spine instability or abscess. Treatment- requires 6-12 weeks IV antibiotics, pathogen specific. Add Rifampin for synergy for MSSA/MRSA infections. Monitor labs weekly: ESR and CRP. Biomarker improvement shows high correlation with clinically recovery.

Case 116

A 55 year old male punctured his right hand 3 days ago accidentally while gardening in his back yard. He presents with fevers, a swollen hand, redness, warmth, and severe pain. You diagnose a **palmar space infection** and have orthopedics perform an incision and drainage procedure with cultures. The following picture shows: Group G Streptococcal Palmar space infection; s/p I & D.



Palmar space infection- this infection is considered a surgical emergency as the palmar space is “closed” and must be drained quickly if infected. Infection is usually from skin trauma, animal or human bites. Staph aureus (MSSA/MRSA), beta-strep common. If from bites, watch for Eikenella or Pasteurella multocida.

Case 117

A 70 year old female with Type II DM presents with a chronically infected diabetic foot ulcer of one year’s duration. You suspect an underlying **diabetic osteomyelitis**. Note the two ulcers in the following picture. The ulcer over the ball of the foot is associated with underlying osteomyelitis.



Evaluation of the Diabetic Foot Infection- Check for: systemic toxicity.

Glycemic control. Extent of infection-depth. Arterial/venous insufficiency. Loss of sensation. **Five Risk factors for DFI-** Sensory neuropathy- temp/pain issues. Motor neuropathy-foot deformities. Autonomic neuropathy- decreased sweat. Peripheral vascular disease- poor healing. Hyperglycemia- impaired host defenses.

Bacteriology-Average of 2.6 species per patient. Mixed infections--aerobes, anaerobes, Aerobe/anaerobe about 4:1. Gram positive/Gram negative about 2.5:1. **Osteomyelitis-** Two-thirds of patients with DFIs have osteomyelitis. Increase risk of osteomyelitis: Ulcer depth > 3 mm. Ulcer > 2 weeks old over bony prominence. Exposed bone. + probe test. >70 ESR

Treatment of Diabetic Foot Osteomyelitis-surgical debridement often required. Avoid weight bearing. Empiric antibiotics directed at mixed flora- 6-8 weeks IV. Early surgical intervention (first 3 days) patients are less likely to require ankle amputation (13% vs. 28%) and have a shorter hospital stay (10 vs. 19 days)

Case 118

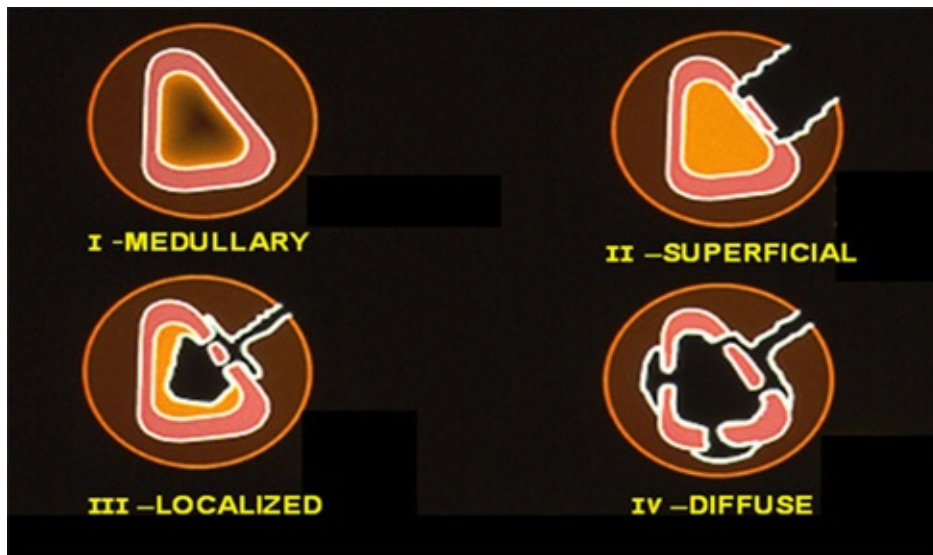
A 35 year old professional ice skater fell on the ice 2 weeks ago directly on his elbow. He didn't feel that he fractured it and just used ice. He presents now with

a red, tender elbow with swelling. You diagnose a **septic olecranon bursitis** after aspiration of the olecranon bursa shows the cell count of bursa fluid to be 20,000 with a left shift and cultures grow Group A Strep.

Septic Bursitis- infected bursa. Patellar bursa and olecranon bursa most frequently affected. Usually direct inoculation by trauma. Diagnosis- aspirate fluid. Cell count > 5,000 with high PMNs. Staph aureus and Beta-strep (Group A,B,G) are usual pathogens on culture. Gram negatives rare. I+D needed and/or bursectomy often required. Treat with IV antibiotics for 14-21 days. Must rule out septic arthritis.

Case 119

A 30 year old Mexican immigrant presents with a chronic draining sinus from the distal right tibia. She has had drainage from the tibia since she was kicked by a horse when she was 21 y/o while living in Mexico. X-rays show **osteomyelitis (chronic)** and cultures grow Staph aureus.



Osteomyelitis- *Acute*- infected bone < 2 weeks duration. *Chronic*- infection > 6 weeks duration. Chronic has higher risk for dead bone (sequestrum), and sinus tracts. Etiology- commonly trauma. MRI scan is the xray modality of choice for diagnosing. *Cierny-Mader Staging*- Stage I- medullary. II- superficial III-

localized IV- diffuse (circumferential.). Monitor ESR and CRP throughout treatment. Diagnosis- plain films delayed 2 weeks. MRI is best for imaging. Treatment- surgical debridement and IV/P.O. antibiotics for 6-12 weeks.

Case 120

A 39 year old mechanic presents with a puncture wound infection of the 3rd finger. After I & D, cultures grow **Group C Beta Streptococcus**. **Acute tenosynovitis, cellulitis, and septic arthritis** is diagnosed. The patient healed very well after surgical I&D, and 6 weeks IV.



Case 121-Dental Prophylaxis and PJI

A 65 year old male had a right hip prosthesis placed 4 years ago and his dentist is calling for your advice on what antibiotics to give before extracting an infected molar. You tell the dentist that the patient doesn't need antibiotics on the basis of recent guidelines from 2013.

ADA (American Dental Association) and AAOS (American Academy of Orthopedic Surgery) 2013: Dental procedures are not associated with increased risk of joint infections, and their use before dental surgeries does not alter risk of infection in prosthetic joints. This is also published in the Clinics of Infectious

Disease by Berbari et al., 2010.

113. Septic arthritis produces pain, fever, and heat from the affected joint. It becomes swollen and difficult to move. Which of the following is NOT a risk factor associated with the development of a septic joint?

- A. arthritis
- B. diabetes
- C. recent trauma
- D. steroid use
- E. age

114. Classically, septic arthritis of a prosthetic joint differs from septic arthritis of a native joint in which way?

- A. Gram-negative bacilli account for a higher percentage of prosthetic infections than native joint infections.
- B. The risk factors for septic arthritis of a prosthetic joint are different than those for a native joint.
- C. Antibiotic treatment for native septic arthritis is of a longer duration than for prosthetic septic arthritis.
- D. Coagulase-negative Staphylococci, such as *S. epidermidis*, account for a greater percentage of prosthetic joint infections than they do native joint infections.

115. Vertebral osteomyelitis may be differentiated from other etiologies of back pain by which of the following?

- A. Elevated ESR and WBC count, fever, and no immediately obvious radiographic changes.
- B. Epidural abscess visible on MRI.
- C. History of recent bacteremia.
- D. All of the above.

116. Why is a palmar space infection considered a surgical emergency?

- A. Infection in this location has easy access to the vascular supply of the hand, and therefore systemic circulation.
- B. Palmar space infections carry significant risk of permanent disability if they are not emergently managed.
- C. The palmar space is “closed” and infection there may cause compartment syndrome.
- D. Tissue destruction and bony involvement may necessitate partial or complete amputation.
- E. All of the above.

117. Which of the following is NOT one of the five risk factors for diabetic foot infection?

- A. Sensory neuropathy
- B. Patient age
- C. Autonomic neuropathy
- D. PVD
- E. Hyperglycemia
- F. Motor neuropathy

118. How might septic bursitis be differentiated from septic arthritis?

- A. The cell count of the aspirate is much lower.
- B. Classically, different organisms are likely found on culture.
- C. The area is inflamed, and the ROM of the nearby joint is unaffected.
- D. Septic bursitis is not painful.
- E. None of the above

119. Chronic osteomyelitis is usually caused by trauma and is characterized by an infection of greater than 6 weeks duration. Which of the following modalities is best in diagnosing osteomyelitis ?

- A. Plain film X-ray
- B. Gallium scan
- C. ^{99m}Tc bone scan
- D. MRI scan
- E. WBC scan

Answers:

113. **A** 114. **D** 115. **D** 116. **E** 117. **B** 118. **E** 119. **D**

Nervous System Infections

Case 122

A 33 year old stewardess presents to the ER with a 3 day history of severe headaches, fevers, stiff neck, hearing loss, and photophobia. You suspect **acute bacterial meningitis**. CT scan of the head is negative. MRI shows meningeal enhancement. You order a lumbar puncture. CSF is turbid and purulent, suggesting a bacterial process.

CSF analysis for bacterial etiology is bacterial antigen screen for H. flu, N. meningitides, pneumococcus, Group B strep. Cell count > 500 with left shift, high CSF protein > 60, low CSF glucose, high opening pressure, + cultures. Empiric treatment is ceftriaxone to cover H. flu, and N. meningitides, ampicillin IV to cover Listeria monocytogenes, vancomycin to cover ceftriaxone-resistant strep pneumoniae, an IV dexamethasone.

Spinal fluid grew out N. meningitidis in this patient.

Bacterial Meningitis- Four most common causes: 1) Neisseria meningitidis- entry through oral pharynx. Prophylaxis to contacts. 2) Streptococcus pneumoniae 3) Haemophilus influenzae- prophylaxis to contacts. 4) Listeria monocytogenes- entry site- GI tract or placenta. Complications of B.M.- shock, DIC, SIADH, seizures, CN III, VI, VIII deficits, coma, hypertension, bradycardia, hydrocephalus, vasculitis, death. Prophylaxis- as above, needed for N. meningitidis and H. influenzae for close contacts (especially household). Accepted regimens are ciprofloxacin 500 mg x 1 dose or rifampin 20 mg/kg/day x 4 days (2 days for meningococcal disease)

Dr. Gullberg's Meningitis Pearls

Diagnose the problem ASAP.

Fever and mental status changes = Spinal tap! (no excuses; no matter what the age of the patient)

Start antibiotics and dexamethasone ASAP!

Anything over 8 cells in the CSF is abnormal.

Calculate traumatic taps with the magical "serum formula":

RBC/WBC in serum = 300-500:1 For example, if there are 500 RBCs and 20 WBCs in the CSF, then there should be only 1 WBC, and this is meningitis.

Repeat the LP in 3 days to assure improvement.

Early Viral can look bacterial (i.e. high PMNs in CSF)

Keep the dexamethasone going for 4-6 days, no matter what, then switch to p.o.

Cancel all CSF labs on patients with normal Cell Counts in the CSF

Case 123

A 21 year old sexually active patient with a history of HSV-2 presents in August with headache, stiff neck, conjunctivitis, photophobia, and flu-like symptoms for 7 days. She has noted numerous mosquito bites lately. CSF shows 210 WBCs with 96% lymphocytes. CSF glucose is normal, protein is normal, and opening pressure is slightly elevated. A diagnosis of **aseptic meningitis** is made. MRI shows meningeal enhancement.

Serology comes back + for West Nile Virus and she does well clinically.

Aseptic meningitis- CSF count is 20-1,000 cells. Predominant lymphocytes, may be PMNs initially. HA, photophobia, nuchal rigidity clinically. Seldom delirium. EEG, MRI- normal. Causes- enteroviruses (echo, coxsackie-A, polio), West Nile, HSV-2, Lyme's, secondary syphilis (check VDRL), cytomegalovirus, HIV, arbovirus, protozoal/helminths, medications- NSAIDs, sulfa, SLE, seizures,

Rickettsial, Mycoplasma, Fungal (Blasto), TB, sarcoid, brucella, nocardia, actinomyces, endocarditis, migraines. Mollaret's meningitis- recurrent meningitis-usually HSV-2. HSV-1 is associated with encephalitis (not aseptic meningitis) of the temporal lobe.

Case 124

A 36 year old iron worker presents to the ER with grand mal tonic-clonic seizures and fevers for 72 hours. He has a history of a CAP that had been unsuccessfully treated with outpatient antibiotics for 6 weeks. MRI of the brain shows a 3 cm enhancing lesion consistent with a **brain abscess** in the parietal lobe.

Brain Abscess- causes include contiguous focus-sinus/ear, dental, hematogenous from endocarditis or pneumonia, or trauma. Neurological presentation depends on location of abscess. Can be polymicrobial or fungal. Headache, mental status change- neurological changes such as seizures, also fever. Diagnosis- MRI scan. Rx- dexamethasone to minimize edema. Anti-seizure meds like Keppra. Surgery if abscess > 2.5 cm. Six weeks IV antibiotics. Antibiotic Rx- empirical Flagyl + Rocephin. There are 2,500 cases/year in the U.S.

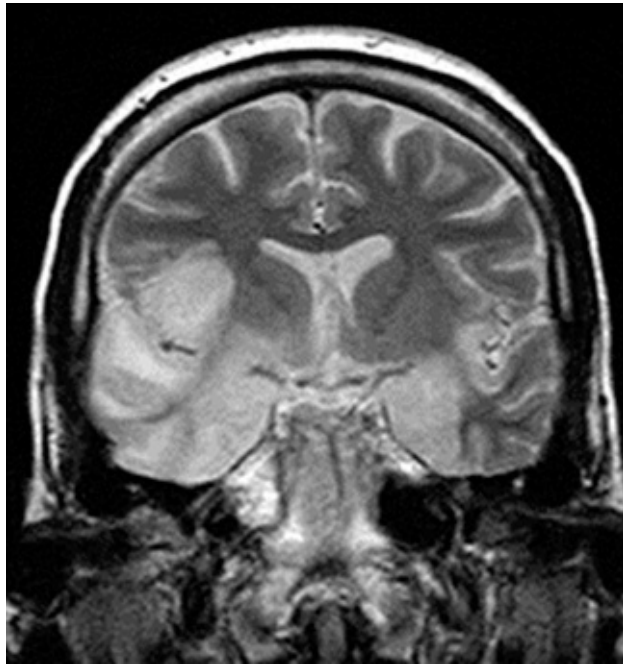
Case 125

A 66 year old female retired RN developed a UTI caused by MRSA in the summer. Blood cultures were also positive. This was complicated by a ureteral stone and a double-j stent placement. A vacation to Italy was cut short by the development of severe mid back pain. MRI scan showed an **epidural abscess**. Aspirates grew out MRSA. No surgery was initially indicated.

Epidural abscess with neurological symptoms is a true surgical emergency. Spine stabilization needed. Once drainage and debridement has occurred, 6-8 weeks of IV antibiotics are required. Usually occur as a metastatic infection from MSSA/MRSA bacteremia (or others).

Case 126

A 65 year old dentist presents in July with fevers and delirium for 4 days, and new onset seizures. MRI shows temporal lobe changes consistent with HSV-1 **encephalitis**. Lumbar puncture shows a cell count of 200 RBCs and 600 WBCs with a predominant lymphocytosis. (75%) The following MRI of the brain shows: Temporal Lobe Changes on the left; ++ PCR for HSV-1.



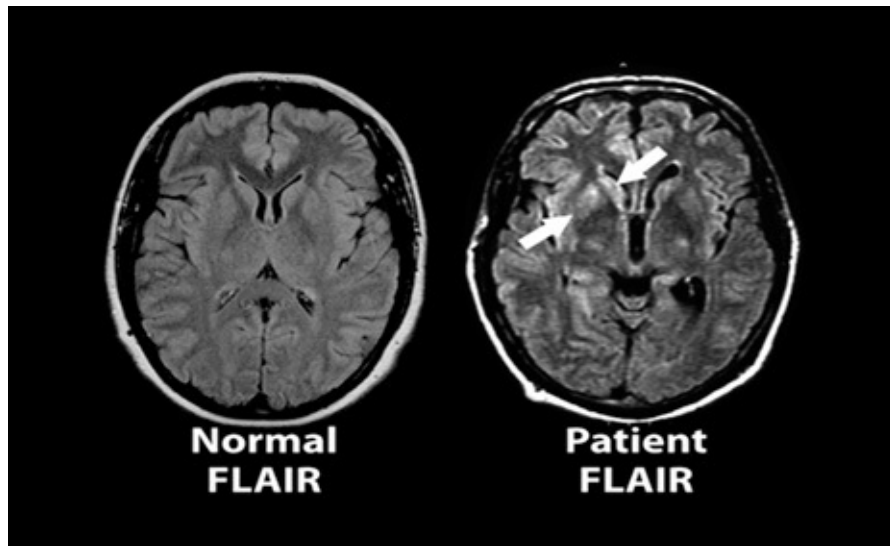
Encephalitis- delirium, fever, seizures. HSV-1- hemorrhagic temporal lobe changes on MRI. Acyclovir 10 mg/kg q 8 hours. Also mosquito borne arboviruses (like St. Louis), VZV, EBV, HIV, Rabies, JC virus (Progressive Multifocal Leukoencephalopathy), Baylisascaris (Raccoon Roundworm) Naegleria fowleri (ameba), Herpes B. Fungal and TB also. Add Dexamethasone. Poor prognosis if diagnosed later.

Case 127

A 48 year old hunter presents with a 4 month history of increasing confusion, memory loss, difficulty with balance, and muscle spasms (myoclonus). You are concerned that he has **Creutzfeldt-Jakob disease**. The patient deteriorates over

the next 4 months and expires.

Transmissible Spongiform Encephalopathy- C-J Disease and others, called Prion Disease. Aberrant form of normal host cellular prion protein: transformation of 3-dimensional structure (unfolding and flipping of normal conformation into an abnormal form which is protease resistant). Prion disease is seen in sheep, goats, mink, cows, deer, humans and elk. The following is an abnormal MRI of the brain in CJD disease.



Diagnosis of Creutzfeldt-Jakob Disease- Clinical TRIAD- rapidly developing dementia, myoclonus, ataxia. Prodrome of weakness, subtle personality changes, disturbances of sleep, eating patterns (~ 2/3 of patients) Rapidly progressive (onset to death = 7-9 months). Visual disturbances (visual field cuts, cortical blindness). Fatal, no treatment. Incubation period- 1-20 years. EEG- bilateral synchronous bi-and tri-phasic periodic sharp wave complexes. CSF- acellular, elevated *Tau protein* or 14.3.3 protein marker on Western Blot. MRI- classic findings. Autopsy- reactive gliosis, vacuolation, + stain for PrP.

Case 128

A 22 year old outdoor DNR worker from central Wisconsin with frequent exposure to deer ticks presents with severe back pain, leg weakness, and

inability of walk well. MRI of the thoracic spine reveals **Transverse myelitis (T.M.)**. Lyme disease was diagnosed.

Infections that can cause T.M. include-CMV, Bartonella (Catscratch disease), Borrelia borgdorferi, Mycoplasma, Schistosomiasis, Vaccines. **Clinical symptoms** depends on the level of spinal cord involvement. **Prognosis** is guarded. Full recovery usually doesn't happen. **Remember** about other disorders such as MS, tumors, epidural abscess, trauma, and ischemia.

Case 129

A 25 year old graduate student who was bit while feeding a raccoon one month ago comes to see you with sore throat, fever, vomiting, and swallowing difficulties and he could drink only small amount of liquids. Three days later he developed profound weakness, confusion and a flaccid motor paralysis. He was intubated in the ICU. A dx of encephalitis was made and initial work-up was negative. MRI was nonspecific and LP was suggestive of encephalitis. CSF and serum for anti-rabies virus antibody, PCR tests of saliva, and nuchal biopsy for **Rabies** RNA were positive.

Rabies- Incubation Period: has been as long as 1-6 years. Typically 1-3 months. Depends on where the bite is; moves faster if the bite is in the upper extremity vs. lower extremity. Once rabies viruses are deposited in peripheral wounds, retrograde passage occurs up the dorsal root ganglia and then to the brain. The virus moves 5-10 cm/day. Produces severe neuronal dysfunction. Spread then occurs from the CNS to the heart, skin, salivary glands, etc. **Five major animal reservoirs:** Bats-dominant source. Raccoons. Skunks. Foxes. Coyotes. No rabies in squirrels, chipmunks, rats, hamsters, gerbils, guinea pigs, mice, rabbits, hares.

Treatment- with a couple of exceptions, no patient who has been exposed to rabies and not been vaccinated before the onset of symptoms has ever survived. Rabies vaccine, HRIG, IV or intraventricular ribavirin, IV IFN-alfa, IV ketamine (dissociative anesthetic agent)- inhibits rabies virus replication in vitro,

midazolam. Amantidine has also been used. Contact Dr. Rodney Willoughby at Children's Hospital of Wisconsin (414-266-2000)

Rabies Prophylaxis- HRIG- there is a worldwide shortage. Human diploid cell vaccine (HDCV)- as of May 2008, a shortage also. Pre-exposure prophylaxis- vets, lab workers, vocations at risk for exposure, international travelers. About 40,000 people get post-exposure prophylaxis/year.

Emergency care: good wound care at bite/exposure site iwht thorough washing of bite wound, scratches. Tetanus prophylaxis, Human Rabies Immune Globulin 20 IU/KG. Infiltrate around the wound, and remaining given IM. Human Diploid Cell Vaccine- IM in deltoid 5 doses day 0,3,7,14 and 28 days. High costs of vaccines.

120. Which of the following is NOT one of the four most common causes of bacterial meningitis?

- A. Neisseria meningitidis
- B. Streptococcus pneumoniae
- C. Staphylococcus aureus
- D. Listeria monocytogenes
- E. Haemophilus influenza

121. Aseptic meningitis is characterized by which of the following?

- A. Elevated CSF cell counts with normal protein and glucose.
- B. Symptoms of headache but no photophobia, nuchal rigidity, or flu-like symptoms.
- C. Depressed CSF counts with abnormal glucose and normal protein.
- D. Symptoms of nuchal rigidity, headache, and photophobia with completely normal CSF.

122. The treatment of a symptomatic brain abscess should include which of the following?

- A. Dexamethasone
- B. Neurosurgical consult
- C. Empiric antibiotics
- D. Six weeks IV antibiotics

E. All of the above

123. Which is the best imaging modality to show an epidural abscess?

A. MRI

B. CT

C. X-ray

D. Indium scan

124. Which of the following statements is/are false of encephalitis?

A. It presents with fever, delirium, and/or seizures.

B. It has a very poor prognosis if diagnosed late.

C. Patients' families may report an untreated animal or insect bite in the recent past.

D. HSV-2 is the most common cause

125. All of these are major clinical symptoms of Creutzfeldt-Jakob disease EXCEPT:

A. Myoclonus

B. Ataxia

C. Confusion/Dementia

D. Visual disturbances

E. Hearing Loss

126. Transverse myelitis is caused by infection from a number of sources. Clinical symptoms depend on the level of involvement. Other disorders that may have similar presentations include:

A. MS

B. epidural abscesses

C. fracture

D. compression of spinal cord

E. all of the above

127. Which of the following statements is/are true about Rabies encephalitis?

A. Bats, raccoons, and skunks are the dominant animal reservoirs of the virus in the US.

B. Incubation period is typically 1-3 months; if treatment begins after symptom onset, the disease is nearly-always fatal.

C. Emergency care post-exposure includes tetanus prophylaxis, human rabies immune globulin (HRIG), and then human diploid cell vaccine given at intervals.

- D. The rabies virus moves 5-10cm per day from the site of the peripheral bite to the brain.
E. All of the above.

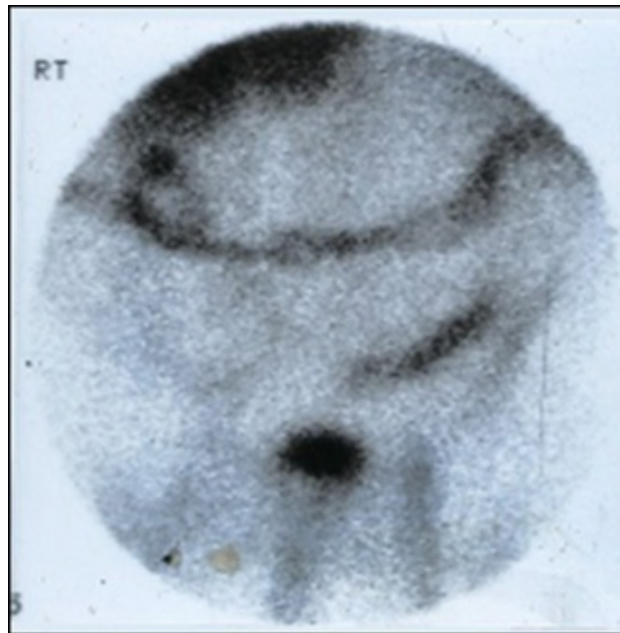
Answers:

120. **C** 121. **A** 122. **E** 123. **A** 124. **D** 125. **E** 126. **E** 127. **E**

Nuclear Medicine Testing

Case 130

A 60 year old retired commercial pilot presents to you with a four month history of an FUIO, with night sweats. Work up done by his PMD is negative. Physical exam reveals vague abdominal tenderness, and he has occasional loose stools. Labs are all normal (including stools) except a westergren sed rate of 102. A CT of the abdomen and pelvis is normal. You recommend a **Gallium scan**. A preliminary diagnose of colitis is made, and a later colonoscopy reveals biopsy proven ulcerative colitis. The following is a Gallium-67 scan showing increase uptake in the colon.



Gallium-67 Scan vs. Indium-111 Nuclear Scans (Scintigraphy)- Gallium-67: the body handles it like ferric-Fe, thus it binds to transferrin, leukocyte lactoferrin, bacterial siderophores, inflammatory proteins, and leukocytes membranes (**dead or alive**). Leukocytes migrate to area of inflammation and

degranulate, releasing large amounts of lactoferrin. **Advantages of Gallium-67 over Indium-111**- good for osteomyelitis of the spine, lung infections, and **chronic** infections. **Indium-111** is **better for more acute** infections (where leukocytes are still actively dividing), osteomyelitis in non-spine areas, abdominal and pelvic infections. **FUO**- can use both scans, but **Indium-111 scans will image only the 25% of such infections that are acute in nature**, whereas gallium scans will be **more helpful** in chronic infections or tumors.

Case 131

John Smith is a 70 year old male with a 30 history of diabetes mellitus and neuropathy of the feet. He developed a large ulcer on the lateral aspect of his 5th metatarsal area for the last 3 months secondary to a “new pair of shoes”. Plain film x-rays are normal. He has a pacemaker. You are concerned about osteomyelitis. **What imaging tests are indicated?**

MRI for Osteomyelitis-Advantages: no ionizing radiation, fast, high sensitivity/specificity. Limited by Charcot joints. Disadvantages: pacemakers, recent stents. Gets a good look at bone marrow and edema. Best modality. Looking for enhanced T2 signal and decrease in T1 signal.

Bone Scan for Osteomyelitis-Tc(Technetium)-99 HDP, 25-30 mCi administered IV. Dynamic imaging for one minute picking up arterial blood flow to soft tissue. Delayed imaging 3-24 hours later- allows soft tissue activity to clear, but metabolic cortical bone activity increases. The “so-called” **Triple Phase Bone Scan- not as good as dual isotope**. **Problems with Bone Scan**- Low specificity- increased activity in DJD, Charcot, fracture, infection, and recent surgery. Ionizing radiation- approximately 6.3 mSv effective dose, vs. .001 mSv for routine foot x-ray.

Tagged WBC scan (Indium)- 60 ml of the patient’s blood is drawn, and the RBCs are allowed to settle. Indium 111-oxime (.5 mCi) or Tc-99 HMPAO (25 mCi) are added and the PMNs are primarily “tagged”. The tagged WBCs are re-injected, and 4-24 hours later, the imaging is done. *Greater specificity* than Bone

scan for osteomyelitis. Disadvantages- Long imaging time >24 hours. Heavy tech support. Heavy radiation. Limited specificity- cellulitis/osteomyelitis or Charcot/osteomyelitis.

Dual Isotope Bone Marrow and WBC Imaging-Tc-99 labeled sulfur colloid, 10 mCi- imaging 30 minutes after injection. Performed simultaneously with Indium-111 imaging. WBC scans + in both Charcot and Osteomyelitis. Tc-99 sulfur colloid localizes in activated bone marrow. Interpretation- **Congruent:** bone marrow activity = or > than WBC activity. **Negative** for osteomyelitis. **Incongruent:** focal WBC activity >bone marrow activity. + for osteomyelitis. **Advances: SPECT (Single Photon Emission-CT)-** Combines the nuclear scans with the CT anatomical evaluation- 2-3 day test. Bone scan; WBC scan (Tc-99 or Indium-111), and Bone Marrow scan (sulfur colloid) + CT- THREE modalities. It helps to localize the WBC scan to soft tissue or bone; example: Increase in WBC scan > sulfur colloid BM scan = osteomyelitis. WBC activity < sulfur colloid BM activity = Charcot foot.

128. What is the best imaging for osteomyelitis?

- A) CT with contrast
- B) Bone scan
- C) MRI
- D) Tagged WBC scan

129. Which of the below are true?

- A) Gallium-67 Scan is better for acute infections
- B) Gallium-67 Scan is better for chronic infections
- C) Indium-111 Nuclear Scan is better for tumors
- D) Indium-111 Nuclear Scan is better for acute infections
- E) Both are equally sensitive for acute infections
- F) B and D

Answers:

128. C 129. F

Outpatient Infections

Case 132

A 30 year old male presents to you with recurrent **furunculitis** for the last 6 months. How would you treat it? The following picture shows a classic furuncle. Carbuncles are “bunches of furnucles” together in one area.



Furunculitis/Carbunculitis/skin abscess- consider culture. 30% rate of MRSA. Don't treat MRSA empirically unless positive history or high risk. I & D for cure. Culture drainage. Same meds as cellulitis. If recurrent problem, be sure to decolonize patient and close contacts. MSSA/beta-strep infections- use cefadroxil, cephalexin. For MRSA- use Bactrim, doxycycline, linezolid, rifampin (not alone), and sometimes clindamycin, or ciprofloxacin.

Case 133

A 49 year old healthy female presents with a rash that started three days ago. She

had 4 days of pain prior to the rash appearing. You diagnose **Herpes Zoster**. The following picture shows classic Zoster, which means “belt” in the Greek. Would you treat it?



Herpes Zoster is reactivation of Varicella virus. Up to 30% of adults get the disease, and most cases are mild. If rash present > 48 hours, antivirals of no value. Antivirals do not prevent post-herpetic neuralgia, may accelerate healing and decrease severity of PHN. Valtrex 1 gm TID, Famvir 500 mg TID, Acyclovir 800 mg 5x/day for 10 days. Herpes Zoster occasionally causes motor neuropathy. Chances for post-herpetic neuropathy increases with age. Consider the new Shingles vaccine recommended at age 50. Overall recurrence rate (getting HZ a second time) of 6.2% at 8 years- 7.2% for women, 4.5% for men.

Case 134

A 15 year old male presents to the office with a very bad sore throat of one week's duration, and low grade fevers. You diagnose **acute pharyngitis/tonsillitis**.

Pharyngitis- viral-40% rhinovirus, adenovirus, coxsackie, EBV, HHV-6. Also mycoplasma and GC. Non Group A Beta (C,G) Streptococci (without tonsillitis – generally does not need treatment. Group A Strep throat is more rare in adults,

but carriage is common, especially with close children contact. Look for fever, tender cervical lymph nodes *without* cough or coryza. Get throat culture if rapid strep screen is negative (15% false -) Rx- Pen VK, cefadroxil, or macrolide.

Cantor Criteria for GAS Pharyngitis- Tonsillar exudates. Tender anterior cervical adenopathy. Fever by history. Absence of cough. If 3 out of 4 criteria met = 60% + predictive value. More importantly, the absence of 3 out of 4 criteria = 80% negative predictive value.

Case 135

A 35 year old clinical psychologist swims every day on his lunch hour at the local YMCA. He comes in to see you because of right ear pain and some drainage. You diagnose **swimmer's ear**, or **External Otitis**. The following picture shows classic Ear Canal swelling, tenderness, and draining of severe disease.



Ear infections- External otitis (swimmer's ear)- often caused by poorly drained water from ear canal. Bacteria associated are- Pseudomonas and Staph aureus. Rx- remove debris from canal. Cortisporin Otic Solution and Ciprofloxacin 500 mg bid. Watch for *malignant external otitis* in diabetics.

Otitis media- rarer in adults because of developed eustachian tubes. Add

decongestant. For OM, same organisms and Rx as Acute Sinusitis.

Case 136

A 25 year old smoker with a history of chronic rhinitis from allergies presents with a 2 1/2 week history of bilateral maxillary sinus pain, purulent nasal discharge, and fevers. You diagnose **acute sinusitis**. How would you treat it?

Acute sinusitis-not common and over-diagnosed. Only 1-2% of all colds develop this. Don't get sinus x-rays unless chronic.

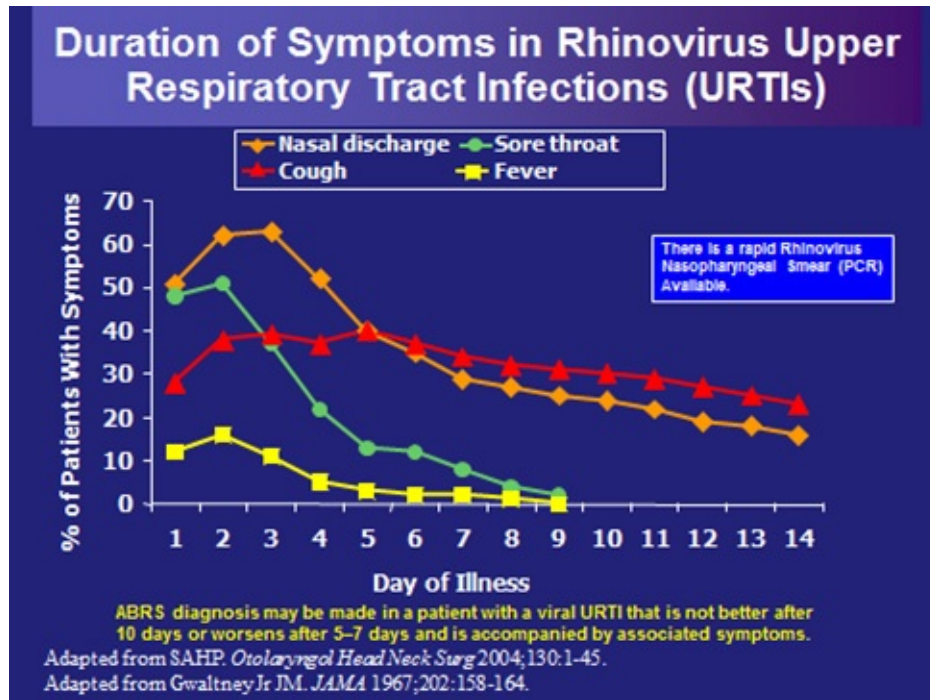
Maxillary>frontal>ethmoid>sphenoid. Caused by Strep pneumoniae, H. flu, and Moraxella catarrhalis. Start with amoxicillin, doxy, or tri-sulfa. Rx 10-14 days. If not better in 4 days, change to: 1) extended macrolides- azithro/clarithro both generic.- they have anti-inflammatory effects. 2) amox/clav. 3) cephalosporin= cefuroxime (generic) 4) respiratory quinolones=levofloxacin or moxifloxacin.

Chronic sinusitis- lengthen Rx to 4-6 weeks; add anaerobic coverage= use clinda/moxi/amox-clav. Flagyl has poor penetration. Consider Coronal CT of the sinuses for diagnosis.

Case 137

A 20 year old college co-ed presents to the student health center with 2 weeks of dry cough and sinus congestion. After a normal chest x-ray, you diagnose **acute bronchitis** and recommend a cough syrup.

Acute Bronchitis in a non-smoker (or no lung disease)- this is primarily a viral disease. Remember that 20% of patients with common cold (rhinovirus) have cough for 2 weeks. These patients are often over-treated with antibiotics. Rx cough only. Mycoplasma/Chlamydia are seen in only 3-5% of these infections. The following schematic shows symptom duration with Rhinovirus. Note that cough and coryza can last for 2 weeks in rhinovirus in 20-30%



Case 138

A 70 year old smoker presents to you with 10 days of cough, productive sputum, and SOB with wheezing. He smokes 1 ppd for 40 years and uses inhalers which are not helping. You diagnose **acute exacerbation of chronic bronchitis** after a chest x-ray shows no pneumonia. How would you treat the problem?

Chronic Bronchitis- usually in smokers or patients with chronic lung disease. Use the same antibiotics as in acute sinusitis. Consider oral/inhaled steroids in addition.

Case 139

A 45 year old housewife with other co-morbidities presents with cough for 2 weeks, fever and malaise. Physical exam reveals rales in the left base. You diagnose **CAP (“walking” pneumonia)** and feel outpatient Rx is warranted. What antibiotics would you start? She can’t tolerate macrolides.

Pneumonia in a normal host- start with doxycycline 100 mg bid or extended macrolide (azithro/clarithro) unless several co-morbidities. For failures, or in patients with co-morbidities like CHF or COPD, start with respiratory

fluoroquinolones-levofloxacin 750 mg bid x 5 days (short course), or moxifloxacin 400 mg daily x 7 days. Avoid ciprofloxacin because of bacteremic failures. Atypical pneumonia caused by Mycoplasma- also causes cold agglutinins, anemia, bullous myringitis, tracheo-bronchitis, pharyngitis, rash, and transverse myelitis.

Case 140

A 75 year old male has had a new hip prosthesis placed 6 months ago. He now goes to the dentist and needs **antibiotic prophylaxis**. What would you recommend?

Antibiotic Prophylaxis for endocarditic/ortho prostheses- only prophylaxis for prosthetic heart valves or congenital heart defects. Use Amoxicillin 2gms 1 hour before dental procedure but not after. Penicillin allergic- use azithromycin 1 gm, or cefadroxil 1 gm, or clindamycin 300 mg. If ortho prostheses < 2 years implanted, then prophylaxis is reasonable. Patients are often prophylaxed life-long however.

Case 141

A 50 year old computer programmer comes to see you because of **leukocytosis** that was found on routine CBC done by health screening. His physical exam is normal and he has no symptoms at the present time. His WBC is 23,000 without a left shift. You proceed on an outpatient work-up. What is the differential diagnosis?

Knowing the differential diagnosis of leukocytosis on the left, you order "inflammatory markers" (acute phase reactants) which include:

Westergren sedimentation rate (> 100 in BE, occult abscess, TB, occult malignancy, Collagen-vascular disease, osteomyelitis) **CRP** (C-reactive protein) **Fibrinogen Ferritin, Platelet Count**. The patient's sed rate is 109, and further work-up yields a diagnosis of pancreatic cancer.

Causes- Neutrophilia- infarction of tissue, ischemia, burns, bacterial infection, steroid use, leukemia, smoking, s/p splenectomy. Left shift-more bands.

Lymphocytosis- chronic infection like TB, Brucellosis, viral infections (Hepatitis A,B,C, CMV, EBV), and pertussis. **Eosinophilia-** neoplasm, allergies, Addison's, collagen-vascular disease, parasites. (NAACP = mnemonic)

Monocytosis- chronic infections like TB, SBE, Rickettsiosis, malaria, IBD, autoimmune disease like SLE **Basophilia-** rare, leukemia (CML).

Case 142

A 20 year old college student presents to the office with a 10 day history of a severe sore throat, malaise, fevers, and a sore neck. Physical exam reveals diffuse adenopathy, especially *occipital* lymphadenopathy, tonsil hypertrophy and splenomegaly. CBC is shows a WBC of 19,000 with 12% atypical lymphocytes. Mono spot testing is positive. You diagnose **infectious mononucleosis**.

Epstein Barr Virus- Herpes virus; associated with most cases of infectious mononucleosis (85%). >95% people worldwide are seropositive. Industrialized countries: half infected by ages 1 to 5, prior to age 1 maternal antibodies protect. Primary infection of young results in nonspecific illness. Typically see infectious mononucleosis in those who have primary infection with EBV during or after second decade (think adolescents) In US: incidence is 500 cases per 100,000 persons per year, highest incidence in 15-24 year olds. No annual or seasonal cycles. EBV associated with Burkitt's lymphoma and nasopharyngeal carcinoma. **Pathogenesis-**Spread via saliva ("the kissing disease") and can stay latent in B cells which act as viral reservoirs over lifetime. Incubation period from time of exposure to onset of symptoms is 30-50 days. **Clinical Findings-** common symptoms: sore throat, malaise or fatigue. Classical triad: Pharyngitis, fever, lymphadenopathy. Important to distinguish from group A streptococcal infection. Also seen: palatal petechiae, periorbital edema, rash, splenomegaly, lymphadenopathy. Possible acute complications include: hemolytic anemia, thrombocytopenia, aplastic anemia, TTP, HUS, DIC, Guillain-Barre syndrome,

meningoencephalitis, splenic rupture, upper airway obstruction. EBV a trigger for hemophagocytic lymphohistiocytosis. Majority of patients with IM recover without any apparent sequelae in 3-6 weeks. Labs- lymphocytosis with atypical lymphocytes (>10% seen on a smear), *monospot* test for heterophile antibodies (sens 85%, spec 94%) IgM and IgG testing for definitive diagnosis: IgM= primary EBV infection. Treatment- Supportive therapy for symptoms: acetaminophen or NSAIDS and rest. Caution against contact sports for at least 3 weeks due to risk of splenic rupture. No conclusive evidence to support use of anti-virals. Steroids occasionally, especially for enlarged tonsils.

Case 143

Mrs. Smith is a 50 year old smoker who comes to Prompt care in January with a 5 day history of cough, fever, and myalgias. Her cough is productive. She thinks she “has caught what everybody else has”. You order a **procalcitonin level** and it is .12 *microgram/L*. Because of this low result, you don’t prescribe antibiotics. Flu testing is negative.

Procalcitonin Levels-Antibiotic initiation should be: Strongly discouraged if PCT < .10 ug/L. Discouraged if PCT <.25 ug/L. Encouraged if PCT >.25 ug/L. Strongly encouraged if PCT >.50 ug/L.

Case 144

A 23 year old male presents with fevers, malaise and joint pains. He had documented strep throat one month ago. He has a new rash that is suspicious for erythema marginatum. Sed rate is 80 and CRP is 100. ASO titer is high at 1000. Cardiac exam shows a new heart murmur. EKG shows a first degree AV block. You suspect acute **rheumatic fever**.

Rheumatic fever- RF occurs 2-4 weeks after group A-strep pharyngitis. There are particular M proteins that are responsible. 5 major criteria are carditis, pericarditis and valvulitis, CNS involvement (Sydenham chorea or St. Vita’s dance), erythema marginatum, and subcutaneous nodules. 4 minor criteria are arthralgia, fever, high esr or crp, and prolonged pr interval. Probability is high if

there are two major, or one major and two minor criteria (Jones; 1944)
Treatment- a) symptomatic relief b) eradication of GAS—check family for carriage, and c) prophylaxis of GAS to prevent future disease (use Pen VK daily or bicillin Pen G q month at least 5 years). ASA 4-8 grams/day or Prednisone 40 mg/day for 2-3 weeks, then lower doses for up to 3 months. The following picture shows classic Erythema marginatum.



130. Which of the following is true of furunculitis/carbunuculitis/skin abscesses? Pick all that apply.

- A) All are caused by MRSA
- B) Cure for furunculitis is I&D
- C) Antibiotics are the same as if you were treating cellulitis
- D) There are no prevention strategies
- E) B and C

131. What is the indication for anti-viral therapy in herpes zoster?

- A) to prevent post-herpetic neuralgia
- B) to treat patients with greater than 48 hrs of herpetic rash
- C) to accelerate healing and decrease severity of PHN
- D) for everyone with herpes zoster

132. What is the percent of false negative rapid strep screens?

- A) 5%
- B) 15%
- C) 25%
- D) 50%

133. What is the treatment for swimmer's ear?

- A) Cortisporin otic and cipro 500mg po BID
- B) Ofloxacin otic
- C) Amoxicillin 500mg BID
- D) Prednisone 20mg qday

134. Which of the following is not true about acute sinusitis?

- A) Caused by the same organisms that cause typical pneumonia
- B) Rare occurrence post URI
- C) First line treatment include azithromycin and respiratory quinolones
- D) Chronic sinusitis should be treated for 4-6 weeks

135. Which of the following is not a risk factor for antibiotic resistance?

- A) >65yo
- B) daycare attendance
- C) prior antibiotics in last 6 months
- D) comorbidities
- E) Immunocompromised

136. How are the treatments for acute bronchitis and exacerbation of chronic bronchitis different or alike?

- A) Both require antibiotics
- B) exacerbation of chronic bronchitis require antibiotics
- C) acute bronchitis require antibiotics
- D) Neither should be treated with antibiotics

137. When is antibiotics prophylaxis pre-dental procedures indicated?

- A) For all orthopedic prostheses forever
- B) Prosthetic heart valves
- C) Congenital heart defects
- D) all the above but A

138. First line treatment of pneumonia in a health host includes:

- A) respiratory fluoroquinolones
- B) doxycycline

- C) ciprofloxacin
- D) Macrolides
- E) Both B&D

139. Which of the following is not an acute phase reactant?

- A) Platelet count
- B) CRP
- C) Fibrinogen
- D) D-dimer

140. Which of the following are included in the classic triad for infectious mononucleosis?

- A) Lymphadenopathy
- B) Fatigue
- C) Pharyngitis
- D) Fever
- E) Atypical Lymphocytes
- F) A, C, D
- G) A, C, E

141. Patients should be treated with antibiotics especially for RTIs if procalcitonin level is:

- A) <.10 ug/L
- B) <.25ug/L
- C) =.25ug/L
- D) =.50ug/L
- E) =.75ug/L
- F) C,D,E

Answers:

130. **E** 131. **C** 132. **B** 133. **A** 134. **C** 135. **D** 136. **B** 137. **D** 138. **E** 139. **D** 140. **F** 141. **F**

Parasitic Infections

Cases 145-155- **Protozoal infections**

Cases 156-164- **Metazoal Nematode infections**

Cases 165-168 **Metazoal Cestode infections**

Case 169-170 **Metazoal Trematode (Fluke) infections**

Case 145

A 34 year old habitual contact lens wearer presents with a severe acute keratitis. Biopsy is required. Histology of the corneal tissue shows **Acanthamoeba**.



Epidemiology- water loving. Cyst stage protects Legionella in water systems. Portal- lung or skin. **Tropism**- brain and cornea (keratitis in contact lens wearers) AIDS patients-disseminated disease. **Diagnosis**- identify organism in tissue. **Treatment**- miconazole. Poor response

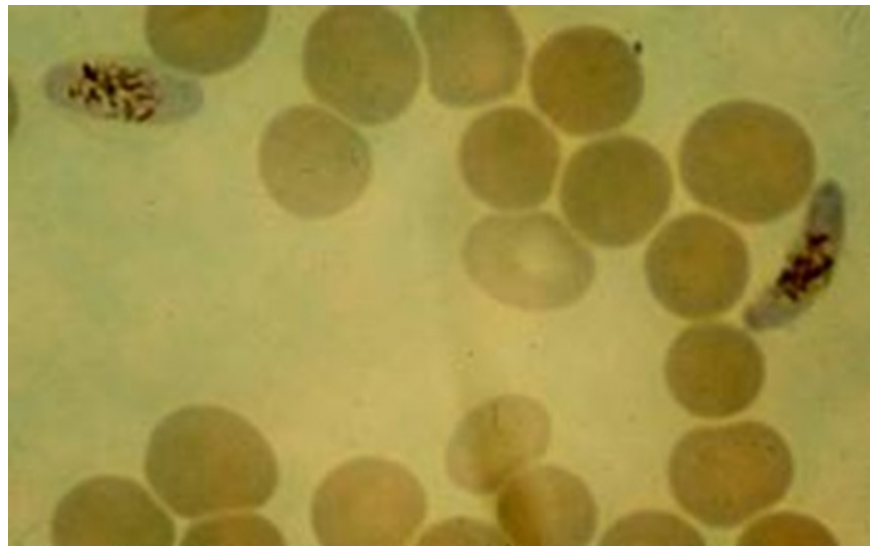
Case 146

A 40 year old chronic sinusitis sufferer presents with signs and symptoms of encephalitis. You suspect **Naegleria fowleri** from a contaminated “Netty pot” that the patient uses for chronic sinus problems.

Epidemiology- found in lakes and ponds, Netty pots. **History**- found in Roman spas in England. **Portal**- nasopharynx. **Tropism**- CNS; encephalitis. **Patients**- anybody. **Diagnosis**- Giemsa stain of CSF. **Treatment**- Amphotericin B and Rifampin.

Case 147

A 59 year old missionary returns from Peru with fevers (temp to 103 degrees), chills every 3 days associated with nausea and diarrhea. You are concerned about **malaria**. Thin and thick blood smears reveal **Plasmodium vivax**.



Plasmodium- at least 11 species; P. falciparum can be fatal. **Epidemiology**- 800 million cases/year. Mefloquine resistance in SE Asia. Chloroquine sensitivity primarily in Central America. **History**- described by Hippocrates in 500 B.C. **Portal**- Anopheles bite. **Tropism**- liver P. ovale and P. vivax- liver; benign, P. falciparum- brain+blood. **Patients**- everyone susceptible. **Diagnosis**- Giemsa stain of peripheral thick/thin smears. **Treatment**- Prophylaxis; otherwise quinine/ doxycycline.

Case 148

A pregnant 32 year old female newly diagnosed with HIV presents with seizures and an abnormal MRI of the brain. You suspect CNS **Toxoplasmosis**.



Toxoplasma gondii- Epidemiology- reservoir is cats, cat feces, cattle. **History-** discovered by Nicolle in 1908. **Portal-** oral. **Tropism-** CNS (large lesions), choreoretinitis, lymphadenopathy, granulomatous hepatitis. **Patients-** contact with cat feces, steak tartar, lamb. **Diagnosis-** serology, PCR. **Treatment-** pyrimeth amine, sulfadiazine, macrolides, clindamycin, atovaquone.

Case 149

A 55 year old college professor presents to you with greasy, foul-smelling diarrhea for one week, associated with cramps and increased flatulence. He just got back from a camping trip in remote Colorado where he drank water from streams. You suspect **Giardia lamblia**.



Giardia lamblia- Epidemiology- infected streams; water sources. Beavers-reservoir. **History-** discovered by Vanleeuwenhoek 1681. **Portal-** oral. **Tropism-** GI tract; colon, SB. **Clinical-** greasy stool; flatulence. **Patients-** everyone. **Diagnosis-** ELISA of stool. **Treatment-** metronidazole; furazolidone in children.

Case 150

A 40 year old immigrant from Mexico works for a landscaper in town. He presents to you with malaise , RUQ abdominal pain, and chronic diarrhea. You suspect **Amoebiasis** and a sizeable right lobe liver abscess for **E. histolytica**.



Entamoeba Histolytica- Epidemiology- developing countries. **History-** discovered by Schaudinn who died at age 35 of amebiasis. **Portal-** GI tract from contaminated water source. **Tropism-** GI tract, liver, brain, lung. **Clinical-** “anchovy” paste liver abscess, brain abscess, pneumonitis. **Diagnosis-** serology, stool Ag. **Treatment-** drainage and metronidazole, diloxanide, iodoquinol for 6 weeks.

Case 151

A Gulf War Marine presents to the infirmary with a large sore on his leg, associated with fevers and malaise. You suspect **Leishmaniasis**.



Leishmania donovani- Epidemiology- equator areas. **History-** Russell in 1856, Leishman and Donovan in 1903. **Portal-** cutaneous, reservoir- dogs and mice, sandfly bites. **Tropism-** skin, liver/ spleen (“Kala-azar”). **Clinical-** oriental/Gulf War sore. **Diagnosis-** biopsy, PCR. **Treatment-** Na stibogluconate, ketoconazole, paramomycin, gentamicin.

Case 152

An 18 year old South American immigrant from Brazil presents with a severe cardiomyopathy. You suspect Chagas’ Disease (**Trypanosomiasis**). How would you diagnose and treat it? The following picture of the right eye shows classic: Chagoma Sign

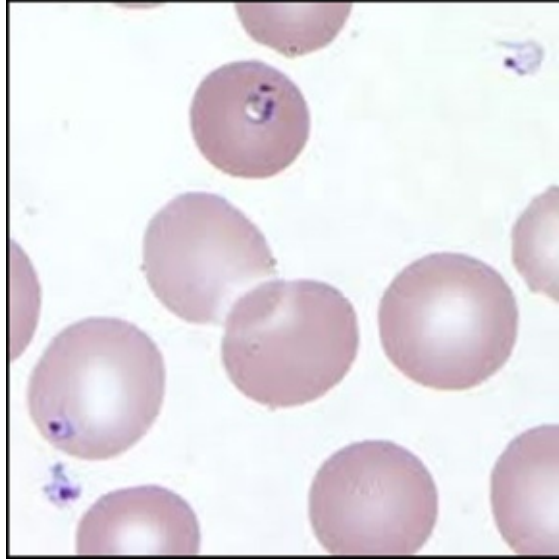


Trypanosomiasis- Epidemiology-African sleeping sickness (brucei); American (Chagas disease-cruzi). **History**- Bruce in 1895. **Portal**- insect vector bites; Tsetse fly in Africa. Kissing bug in South America. Reservoirs- animals like impalas.

Tropism-African-CNS American- liver, heart, spleen. Lymph nodes. **Clinical**-encephalitis, H-S megal, cardiomyopathy, Chagoma sign. **Diagnosis**- Giemsa stain of CSF, blood. PCR. **Treatment**- Suramin for non-CNS disease; DMSO.

Case 153

A 40 year old splenectomized patient (from a previous MVA) living in rural New England presents with worsening anemia, headaches, bradycardia, and a FUO. You suspect **babesiosis** after he tells you that he has had several recent tick bites.



Babesia microti-malaria-like protozoan; also called a “piroplasm.” The above blood smear shows the intraerythrocytic forms. **Epidemiology**- increased in Northeast US and Wisconsin. **History**- Smith and Kilbourne, 1893. **Clinical**- increased in splenectomized patients. Fever, hemolysis, headache.

Portal/Reservoir- Ixodes ticks, blood transfusions. Cattle and dogs are reservoirs. **Diagnosis**- Giemsa smear of blood. **Treatment**- azithro, clindamycin, quinine.

Case 154

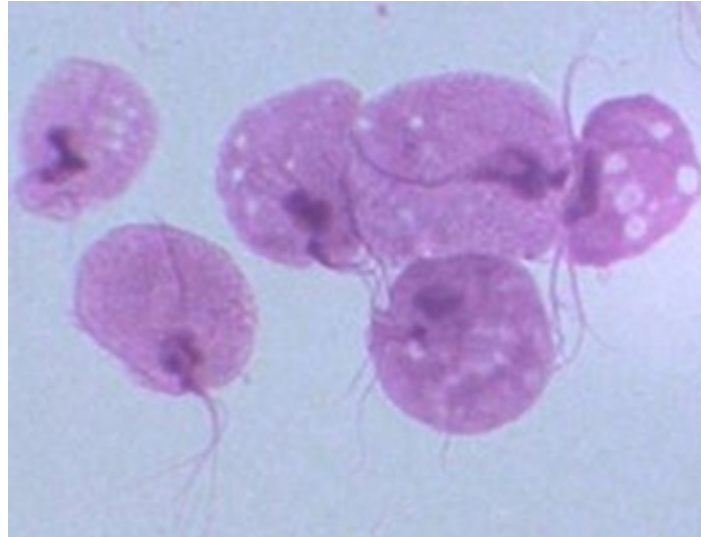
A 42 year old HIV patient presents with foul smelling diarrhea of 3 months duration. **Cryptosporidium** is diagnosed and he was placed on paromomycin for treatment.

Cryptosporidia- *C. parvum* and *C. hominis* most commonly infect humans. *Partially acid-fast*. Can cause chronic or acute diarrheal illness. Outbreak in Milwaukee in 1993 and Sydney, Australia in 1998. Can be difficult to treat in immunosuppressed patients.

Case 155

A 21 year old sexually active female present to the STI clinic with 3 days of a yellowish vaginal discharge. The discharge is described as “frothy” and smell

“fishy”. She has painful urination. Her male sexual partner complains of painful urination also. You suspect vaginitis from **Trichomoniasis**, and look for a “strawberry cervix” on exam.



Trichomonas vaginalis- Epidemiology-152 million people affected globally/year. **Clinical**- men with urethritis, burning. Women with yellow, frothy discharge, smelly. Can be asymptomatic. Look for strawberry cervix appearance. **Portal**- STI for men and women, urogenital tract. **Diagnosis**- wet mount, or nucleic acid testing. **Treatment**- metronidazole, 2 gms in both partners.

Cases 156-164- Metazoal Nematode infections

Case 156

A 3 year old male is brought to you by his mother because of an itchy rectum. You suspect **Pinworm (Enterobius)**.



Enterobius- Epidemiology- most common nematode in temperate climates. High in developing countries. **History-** Linnaeus named it in 1758. **Clinical-** usually asymptomatic; perirectal itching and eosinophilic enteritis.

Portal/Reservoir- GI tract. **Diagnosis-** scotch tape test. Stools often negative.

Treatment- pyrantel pamoate 11 mg/kg, albendazole 400 mg or mebendazole 100 mg -1 dose.

Case 157

A 32 year old architect from suburban Chicago presents to your office after defecating something in his stool that looks like an earthworm. You suspect **Ascariasis (roundworm)**.

Ascaris lumbricoides- Epidemiology- 530 million Chinese infected. **History-** discovered by Tyson in 1683. **Clinical-** migrates through lungs and heart. Causes *GI obstruction*. **Portal/Reservoir-** GI tract. **Diagnosis-** O&P in stool.

Treatment- albendazole, mebendazole, pyrantel pamoate, piperazine.

Case 158

A 25 year old male immigrant from rural China comes to you with severe iron deficiency anemia and a pruritic dermatitis. You suspect **hookworm (Necator)**.



Necator americanus or Ancylostoma duodenale- Epidemiology- worldwide; 17% of China is infected. **History**- Dubini in 1843. **Clinical**- pruritic dermatitis, pneumonia in migratory phase, iron deficiency anemia. **Portal/Reservoir**- GI tract or skin penetration. **Diagnosis**- O&P of stool. **Treatment**- mebendazole 100 mg daily for 3 days or albendazole 400 mg one dose.

Case 159

A 26 year-old newlywed returns from scuba diving in Negril, Jamaica with a pruritic, serpiginous eruption on her foot. She had spent many early evening hours walking the beautiful beaches with her husband. You suspect **Cutaneous Larva Migrans**.



Cutaneous Larva Migrans- *Ancylostoma braziliense* (Dog/Cat Hookworm)-

Local dogs inhabit the beaches by night (and do their “duty”); unsuspecting tourists “pick up” the worm from the sand during the day. They burrow into the dermis. Treatment: Thiabendazole.

Case 160

A 52 year old female immigrant from India presents with chronic diarrhea and pneumonia. Eosinophilia is present at 22%. You suspect **Strongyloides**. Stools grew this organism.

Strongyloides stercoralis- Epidemiology-100 million cases worldwide

History- Bavay and Normand 1876. **Clinical**- diarrhea, malabsorption, colitis, migratory phase-eosinophilic pneumonia. “Creeping eruption” in immune suppressed hosts. **Portal/Reservoir**-skin, GI. **Diagnosis**- O&P stool.

Treatment- thiabendazole or ivermectin.

Case 161

A 29 year Spanish speaking immigrant from Mexico presents with muscle pains, fevers, and periorbital edema. CBC shows eosinophilia of 24%. You suspect **Trichinella**. He admits to eating undercooked pork at times.

Trichinella spiralis- **Epidemiology**-developing countries; Mexico. **History**- Owens in 1835. **Clinical**- gastroenteritis, fever, myalgias, periorbital edema, conjunctival hemorrhages. **Portal/Reservoir**-ingested. **Diagnosis**- CPK, ELISA, biopsy of muscle. **Treatment**- mebendazole and steroids.

Case 162

You are doing a short term medical trip to Honduras and see a patient with severe swelling in left leg. You suspect **Wuchereria bancrofti**. How would you treat it?



Wuchereria (Elephantiasis)- **Epidemiology**-tropical developing world. **History**-Demarquay in 1863. **Clinical**- most are asymptomatic. Elephantiasis, and lymphadenitis; legs>arms. Tropical eosinophilic Syndrome. **Portal/Reservoir**- Culex pipiens mosquito bites. **Diagnosis**- serology or microfilaria in blood. **Treatment**- diethylcarbamazine 6 mg/kg/day for 10 days.

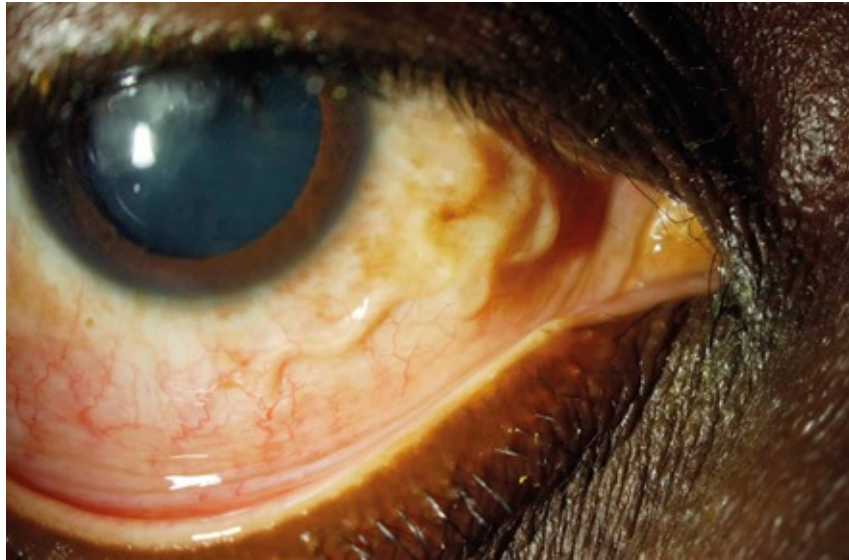
Case 163

On a goodwill medical trip to the Congo in Africa, you see your first case of **River Blindness (Onchocerciasis)**. How would you treat it?

Onchocerciasis- **Epidemiology**-tropical Africa and South/Central America. **History**- Leuckart in 1893 in Africa. **Clinical**- dermatitis, nodules, sclerosing

keratitis, iritis, glaucoma, optic neuritis. **Portal/Reservoir**- black fly along river banks. **Diagnosis**- serology, skin biopsy, Mazzotti test. **Treatment**- ivermectin; one dose 150 micro/kg.

Loa Loa



Epidemiology-13 million cases/year in western Africa. **History**-Argyll-Robertson in 1895. **Clinical**-Calabar swellings on face and extremities. **Portal/Reservoir**- direct through eye. **Diagnosis**- angioedema and worm beneath conjunctiva. Giemsa blood smear. **Treatment**- diethylcarbamazine 8-10 mg/kg/day for 3 weeks.

Guinea Worm- Guinea Worm has been a big problem in equatorial Africa. Check the length of this worm in the following picture.



Dracunculus medinensis (Guinea Worm)- **Epidemiology**-equatorial Africa. **History**-discovered 1863 by Bastian. **Clinical**- cutaneous blisters and ulcers. Larvae penetrate small bowel and migrate to legs. Worm is 100 cm long and 1.5 mm wide. **Portal/Reservoir**- spread in water. Crustaceans (cyclops larvae) are intermediate host. **Diagnosis**- clinical. **Treatment**- mebendazole; metronidazole.

Case 164

A 4 year old male presents with acute encephalitis. You think about **Baylisascaris (Raccoon ascaris)** in the differential diagnosis because of his possible association with raccoons from playing/pooping at night in his sandbox.

Raccoon Ascaris- Epidemiology- raccoons defecate worms into soil or sandboxes. **Clinical**- eosinophilic meningitis and ocular disease.

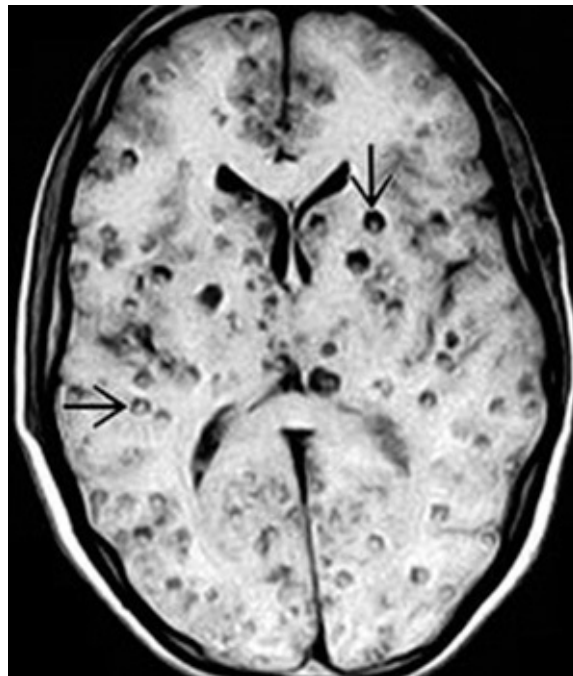
Portal/Reservoir-GI tract/ingestion- children. **Diagnosis**- abnormal spinal tap. + giemsa stain. **Treatment**- little experience, and high mortality rate.

Cases 165-168- Metazoal Cestode infections

Case 165

A 20 year old immigrant from Mexico presents to you in a Los Angeles ER with new onset seizures. MRI is abnormal. You suspect CNS **cysticercosis**. What do you recommend?

Cysticercosis- Epidemiology- pork tapeworm found in developing countries; i.e. parts of Mexico. **Clinical**- usually asymptomatic subcutaneous nodules or in muscle. May lodge in eye or brain and look like a tumor. Can cause arachnoiditis, meningoencephalitis. **Portal/Reservoir**- GI tract by ingesting raw pork that contain *Taenia solium* eggs. **Diagnosis**- ELISA of CSF or serum. Check O&P of stool. **Treatment**- albendazole better than praziquantel. **Neuro-Cysticercosis**- Egyptians described it in 2000 B.C. Can cause hydrocephalus and even grow in the spinal cord. Treatment-albendazole, steroids, and sometimes surgery. The following CT shows: “Moth eaten” brain of NC.



Case 166

A 50 year old recent immigrant from Iran is a sheep herder. He presents with fevers, RUQ abdominal pain, large cystic mass in the liver, pulmonary infiltrates and eosinophilia of 20%. You suspect **echinococcosis**.

Echinococcus granulosus- “junior tapeworm”, one of the smallest tapeworms.

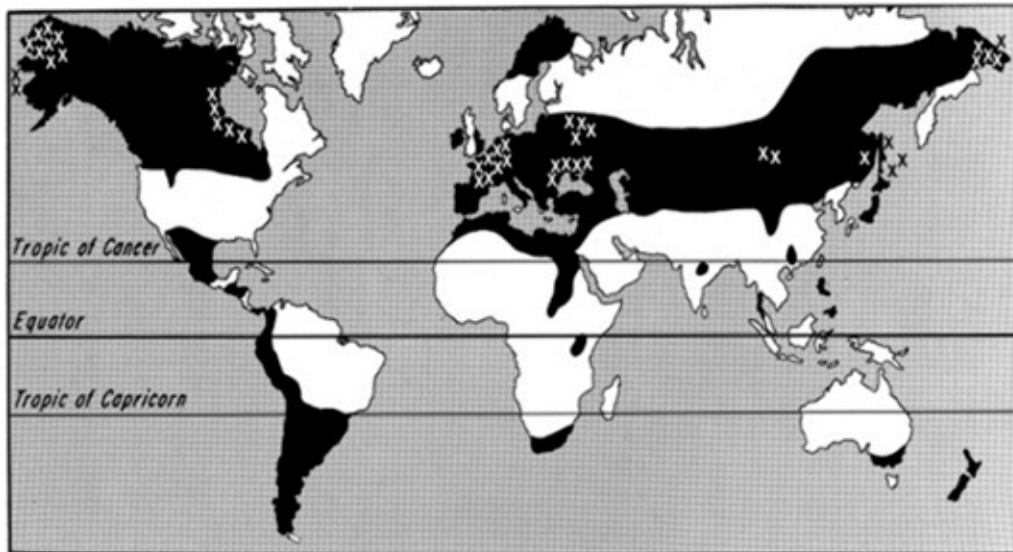
Epidemiology- sheep/dog husbandry in Middle East, Greece and Russia.

History- discovered by Passas in 1766. **Clinical**- hydatid disease in liver, lung, and bone. Anaphylaxis if cyst is ruptured. **Portal/Reservoir**- animal husbandry;

GI ingestion. **Diagnosis**- ELISA of serum. **Treatment**- albendazole, careful surgical care.

Case 167

A 40 year old fur trapper in Alaska presents with an FUO, increased LFTs, eosinophilia of 22%, and RUQ pain and a large liver lesion on CT scan. You suspect **echinococcosis**. The following world map: Blackened areas is where echinococcosis can be seen



Echinococcus multilocularis-**Epidemiology**-seen in fur trappers, Alaska, Siberia, Canada. **Clinical**- same disease as *E. granulosus*. **Portal/Reservoir**- foxes and dogs. **Diagnosis**- ELISA serology. **Treatment**- same: albendazole and careful surgery.

Case 168

A 45 year old Norwegian immigrant from the fiord country presents to you with profound macrocytic anemia, weight loss and diarrhea. He admits to eating raw fish at times. You suspect **Diphyllobothrium latum (Fish tapeworm)**. How would you diagnose it?

Fish Tapeworm- **Epidemiology**- worldwide; especially Scandinavia. **History**- discovered by Plater in 1609. **Clinical**- longest worm to infect humans. Vit B12

deficiency. **Portal/Reservoir**- raw fish eaten by humans. Intermediate hosts- copepods in rivers/lakes ingested by fish, which are ingested by mammals (humans or bears, etc). **Diagnosis**- Stools for O & P. **Treatment**- niclosamide or praziquantel.

Cases 169-170- Metazoal Trematode (Fluke) infections

Case 169

A 40 year old male recent immigrant from Morocco presents with a “typhoid-fever-like” illness and eosinophilia of 26%. He also has gross hematuria. You suspect **Schistosoma haematobium**. How would you diagnose and treat it?

S. mansoni, S. haematobium, S. japonicum (and others)- Epidemiology- affects 200 million people globally/year. 200,000 die/year. Called *bilharzia*. *S. mansoni*- tropical climates. *S. japonicum*- Southeast Asia, *S. haematobium*- Middle East. **History**- known in ancient Egypt. 1851- von Siebold and Bilharz. 1902- Manson. **Clinical**- migrate to liver (common cause of esophageal varices worldwide), bladder, lung, and brain. Acute- typhoid fever-like. Chronic- HS megaly. Transverse myelitis, encephalitis. **Portal/Reservoir**- snails are vector. Cercariae penetrate skin. **Diagnosis**- ELISA of serum, O&P of stool or urine. **Treatment**- praziquantel, or oxamniquine. Avian schistosomiasis causes “swimmer’s itch”-benign.

Case 170

A 25 year old recent traveler to Vietnam presents with pulmonary infiltrates, fevers, cough and eosinophilia of 19%. You strongly suspect **paragonimus** lung infection.



Paragonimus westermani (Oriental Lung Fluke)-History- discovered by Kerbert in 1878. **Epidemiology-**southeast Asia, South America; 20% of Chinese Ab+. **Vector/Reservoir-** snails, crabs. **Portal-** humans ingest undercooked crab. **Clinical-** hemoptysis, eosinophilic pneumonia, lung abscess. **Diagnosis-** ELISA of serum. **Treatment-** praziquantel, triclabendazole.

142. Which parasite has been implicated in keratitis and contact lens wear?

- A. Entamoeba histolytica
- B. Acanthamoeba
- C. Naegleria
- D. Toxoplasmosis
- E. Leishmaniasis

143. A patient gets Naegleria fowleri encephalitis from Netty Pot use for her sinusitis. You recommend what medication(s) for treatment?

- A. IV Flagyl
- B. IV Amphotericin B
- C. Rifampin
- D. IV Praziquantel
- E. B and C

144. Which forms of Malaria are considered potential chronic liver forms?

- A. P. vivax

- B. *P. ovale*
- C. *P. falciparum*
- D. *P. malariae*
- E. A and B

145. What ways have been implicated with developing toxoplasmosis?

- A. Contact with cat feces
- B. Eating raw lamb
- C. Eating steak “tartar”
- D. Contact with dog urine
- E. A,B,C

146. Patients’ stools with intestinal Giardiasis are described as?

- A. bloody
- B. black
- C. greasy with flatulence
- D. stringy

147. *Entamoeba histolytica* is associated with fulminant colitis and abscesses in:

- A. Liver and brain
- B. Liver only
- C. Liver and lung
- D. Liver and spleen
- E. Liver and colon

148. Leishmaniasis is a parasite that causes “Gulf War sore” in our Gulf War veterans. It is spread by sandflies and treated with:

- A. Ketoconazole
- B. Na stibogluconate
- C. Choroquine
- D. Flagyl
- E. A or B
- F. Praziquantel

149. The vector of Trypanosomiasis is:

- A. The tse-tse fly
- B. The kissing bug
- C. Anopheles mosquito
- D. Black fly
- E. River fly
- F. A or B

150. Spread by the Ixodes tick, Babesiosis is more common in:

- A. Those with cirrhosis
- B. Splenectomized patients
- C. Patients with CLL
- D. Those with Lyme's disease
- E. B and D

151. Pinworm:

- A. Causes rectal itching
- B. Causes Eosinophilic enteritis
- C. Is treated with Pyrantel pamoate
- D. Is diagnosed with a scotch tape test
- E. All of the above.

152. One of the most serious complications of Ascaris infections include:

- A. Liver abscess
- B. Intestinal obstruction
- C. Pneumonia
- D. Pericarditis
- E. Appendicitis

153. Necator americanus infections are associated with:

- A. Vit B12 deficiency
- B. Folate deficiency
- C. Iron deficiency
- D. Celiac disease
- E. None of the above

154. You just return from a vacation in Jamaica where you roamed the beaches during the day. You develop an itchy, raised snake-like rash on the outer bottom of the foot. The likely diagnosis is:

- A. Ancylostoma braziliense
- B. Onchocerciasis
- C. Loa Loa
- D. Guinea worm
- E. Necator

155. Strongyloides is a:

- A. Nematode
- B. Cestode
- C. Fluke
- D. Protozoa

156. Which nematode notoriously causes muscle pain, eosinophilia, CNS involvement and myocarditis?

- A. Loa Loa
- B. Trichinella
- C. Guinea Worm
- D. Hookworm
- E. Pinworm

157. *Wuchereria bancrofti* causes elephantiasis. The treatment of choice is:

- A. Ivermectin
- B. Praziquantel
- C. DEC (diethylcarbamazine)
- D. Metronidazole
- E. Mebendazole and steroids

158. Sclerosing keratitis caused by Onchocerciasis (River Blindness) is spread by:

- A. The River fly
- B. Anopheles mosquito
- C. The Black fly
- D. The Kissing bug
- E. The Common House fly

159. You diagnose eosinophilic meningoencephalitis in a 5 year old healthy Wisconsin child. The likely diagnosis is:

- A. Rabies
- B. Arbovirus
- C. Baylisascaris (Raccoon Roundworm)
- D. Trypanosomiasis
- E. McDonaldsitis

160. You diagnose neurocysticercosis in a 19 year old Mexican with new onset seizures. Which of the following statements is not true?

- A. Steroids are indicated
- B. Albendazole is better than praziquantel
- C. The disease does not look like brain cancer
- D. It is diagnosed with ELISA of the CSF fluid.

161. Echinococcus is a small tapeworm that can cause large hydatid cysts in the liver. What is the main danger of the cyst rupturing?

- A. Anaphylactic shock
- B. Septic shock
- C. Cardiogenic shock

- D. There is no danger
- E. Addisonian shock

162. *Diphyllobothrium latum* (fish tapeworm) is found in Scandinavians who eat raw fish. What is the main medical problem brought on by this tapeworm?

- A. Crohn's disease
- B. Ulcerative colitis
- C. Iron deficiency anemia
- D. Vitamin B12 deficiency
- E. Thiamine deficiency
- F. Vitamin C deficiency

163. Which fluke is associated with bladder cancer?

- A. *Shistosomiasis haematobium*
- B. *Shistosomiasis japonicum*
- C. *Shistosomiasis mansoni*
- D. *Paragonimus westermani*

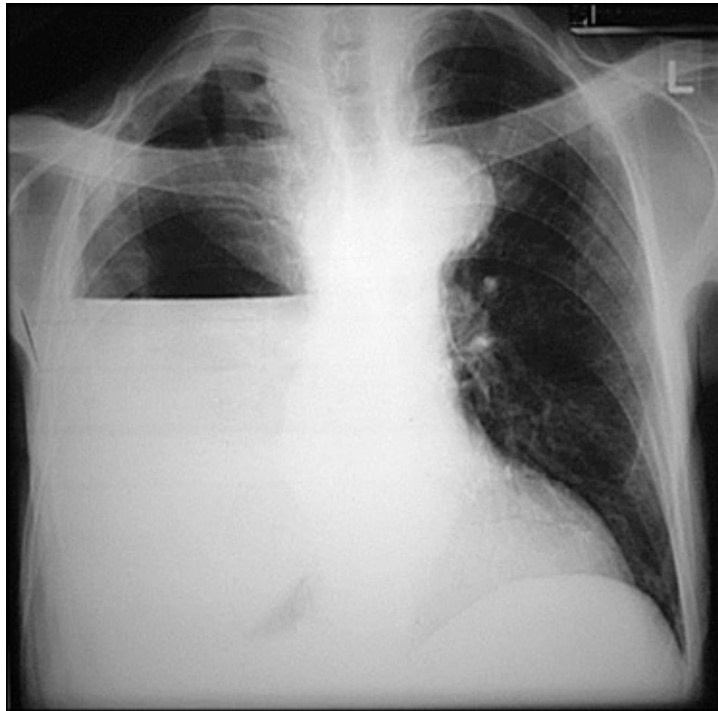
Answers:

142. **B** 143. **E** 144. **E** 145. **E** 146. **C** 147. **A** 148. **B** 149. **F** 150. **B** 151. **E** 152. **B** 153. **C** 154. **A** 155. **A** 156. **B** 157. **C** 158. **C** 159. **C** 160. **C** 161. **A** 162. **D** 163. **A**

Pulmonary Infections

Case 171

A 40 year old Green Bay Packer fan celebrated after the Super Bowl victory by having “one too many” alcoholic beverages. He comes into the ER with suspected **aspiration pneumonia**. The following chest xray is classic: Aspiration pneumonia with air-fluid level + parapneumonic effusion



Aspiration pneumonia- the “Triple threat of aspiration”. These are: 1) Aspiration of oral secretions- caused by mouth flora. These include peptostreptococcus, fusobacterium, prevotella and veillonella. Use clindamycin, amox/clav., pip/tazo. 2) Foreign body- post-obstructive pneumonia, also associated with tumors. Must remove obstruction. 3) Aspiration of gastric contents. “Chemical pneumonitis”. Highly associated with ARDS. Use steroids here also.

Case 172

An 80 year old nursing home resident with COPD and dementia presents to the ER with high fevers, dehydration, SOB and a **healthcare associated pneumonia**. WBC count is 25,000 with a left shift. Sputum cultures grow out E. coli.

Healthcare-associated pneumonia- seen in patients from institutions (NHs), dialysis centers, frequent hospitalizations. Higher prevalence of gram negative aerobes (E. coli, Pseudomonas, Enterobacter, Serratia) and Staph aureus (MSSA and MRSA). Atypicals possible. Use cefepime, pip/tazo, penams, with linezolid or vancomycin empirically. COLONIZATION WITH PATHOGENIC BACTERIA IS THE KEY. Oral pharyngeal *S. aureus* and *Gram Negative Bacilli* increases with severity of underlining disease; with prolonged institutionalization. If MRSA PCR nasal or oropharynx is negative, one can rule out MRSA pneumonia. This has saved our hospital patients significant Vancomycin use.

Bronchoscopy increases diagnostic yield in HCAP to around 40-50%. For PSB (protected specimen brush technique), accepted threshold = 1000 cfu/ml. For BAL (bronchioalveolar lavage), accepted threshold =10,000 cfu/ml.

Case 173

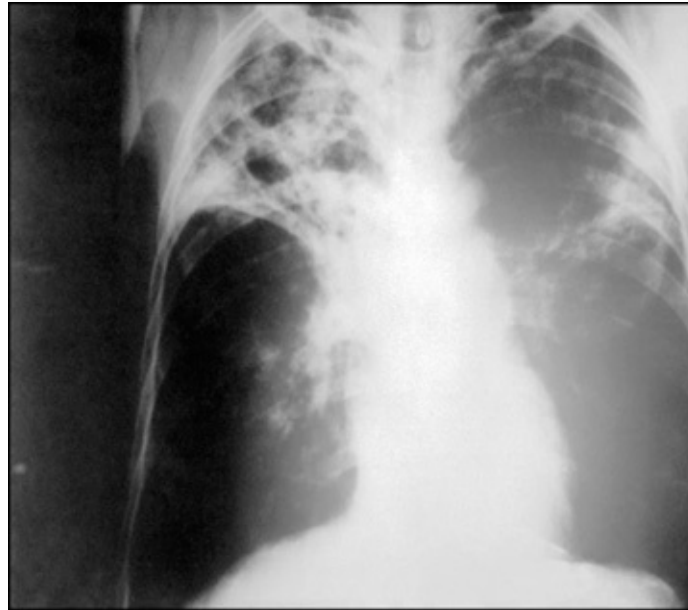
A 42 year old DNR worker who works outdoors presents with a growing lesion on her left thigh for 3 months and mild cough. Work-up reveals pulmonary cavitory disease, and biopsy of the thigh shows budding yeast of Blastomycosis:

Cavitory pneumonia- Causes-Mycobacterium- (M. tuberculosis, M. kansasii, MAI, M. abscessus, M. fortuitum, M. xenopi), Fungal- (blastomycosis, histoplasmosis, cryptococcosis, coccidiomycosis, aspergillus.) Bacterial- actinomyces, nocardia, Staph aureus, anaerobes. Parasitic- paragonomiosis, echinococcosis. The following pictures show: Blastomycosis can cavitate and cause a nasty “heaped up” skin ulcer.



Case 174

A 32 year old female pharmacist who immigrated from India 5 years ago presents with hemoptysis, cavitary pneumonia, weight loss, and malaise for 4 months. Chest x-ray shows upper lobe *cavitary* pneumonia and sputum cultures grow **Mycobacterium Tuberculosis**. The following chest xray shows: Upper lobe TB; reactive type



Mycobacterium Tuberculosis- primary pneumonia is rare. Most cases are reactivation of old TB in upper lobes with cavities. Frequent- night sweats, weight loss, cough and hemoptysis. Initial Tx- isoniazid (INH), rifampin, ethambutol, pyrazinamide (PZA)- 6 months, if extrapulmonary, 12-18 months. Dx- + AFB smear (Kinyoun or Auramine-Rhodamine stain) with culture. MTD

for rapid identification. Cavitory patients are more infectious. N95 mask is used for respiratory isolation in the hospital. Background-Non-motile rod shaped obligate aerobe, commonly infecting the lungs where oxygen is abundant. Facultative intracellular parasite, usually of macrophages, and has a slow generation time, taking up to 6 weeks for visible growth. High lipid content makes them acid fast on staining. MTB is the etiologic agent of tuberculosis (TB) and humans are the only reservoir for this bacterium. Quantiferon Gold serum assay -better than PPD (purified protein derivative) skin test for diagnosing infection. Developed in 2001; passed by FDACDC has recommended since 2003 as TST skin testing. Aid in detecting latent M. TB infection. Based on the quantification of interferon-gamma (IFN-Gamma) released from sensitized lymphocytes in the blood incubated overnight with PPD. Requires phlebotomy, can be done in one visit, less subject to bias and error. PPD stands for Purified ProteinDerivative. A positive PPD means INFECTION, not necessarily DISEASE. Treat a +PPD if a recent conversion, or if < 35 years of age, or if immunosuppressed. Use Isoniazid for 9 months or Rifampin 600 mg/day for 4 months if INH intolerant. New regimen is INH 300 mg- 3 tabs/Rifapentine 6 capsules weekly for 12 weeks. Also add 50 mg Vit B6/day to INH to help prevent neuropathy. Check Chest x-ray. Once PPD +, always PPD +. Monitor LFTs regularly while on INH. Drugs to Treat Tuberculosis- First line: INH (1952), Rifampin (1965), Pyrazinamide (1970), Streptomycin (1944), Ethambutol (1968) . Second line: Ethionamide (1966), Kanamycin/amikacin (1957), Cycloserine (1955), Capreomycin (1967), PAS (1950), Thioacetazone (1946), Quinolones (1980s), Zyxon. INH (1952)-isoniazid kills both actively growing extracellular and intracellular organisms. Rifampin (1971)- acts against all 3 populations-watch for drug interactions. Pyrazinamide- kills intracellular bacteria (can increase uric acid). Ethambutol-bacteriostatic, helps decrease resistance-watch for rash and optic problems. Streptomycin- kills extracellular organisms- nephrotoxic and ototoxic. MDR-TB- Tuberculosis resistant to at least INH and Rifampin. Higher prevalence in urban areas. New drug- 2013- Bedaquiline, of the *diarylquinoline* class- \$30,000 for 24 weeks.

Case 175

A 30 year old smoker presents with an abnormal chest x-ray. A pleural effusion and **empyema** is identified and a thoracentesis is performed. Fluid shows pH is 7.00, glucose is low at 25, cell count is 75,000, and cultures grow Strep. Pneumoniae. How would you treat it?

Empyema-Treatment: Appropriate drainage- may need decortication by VATS (Video assisted Thoroscopy). Antimicrobial doses higher than those commonly used in pneumonia Prolonged therapy may be needed. Oral anaerobes may be present in 40%.

Light's Criteria: Exudative Effusions will have at least one of the following:
Pleural fluid protein / Serum protein >0.5
Pleural fluid LDH / Serum LDH >0.6
Pleural fluid LDH > 2/3 * Serum LDH Upper Limit of Normal. Note: While Light's Criteria are reported to be highly sensitive for exudative effusions, their specificity for exudative effusions is only 83%. Light RW., et al. NEJM 2002; 346: p 1971-1977 Also interested in pH (<7.2 may need chest tube), cell count, histology, culture, smears.

Case 176

A 32 year old mother of two small children comes in with cough and walking pneumonia on chest x-ray. Her children have been very sick with RTIs and her husband has been also in the last 10 days. Because the infection has been “marching” through the household, you diagnose a **contagious pneumonias**.

Pneumonia is the most common cause of death from infection in US. In hospital admissions at patients with pneumonia, 35% have unknown causes. Starting antibiotic treatment within 4 hours within admission lowers mortality rate.

Contagious pneumonia organisms- Yes = viral (influenza, RSV, human metapneumovirus), TB, mycoplasma, chlamydochila, Haemophilus influenza. No = pneumococcus, aspiration type, legionella (spread by aerosol).

Case 177

A 60 year old dairy farmer presents to the hospital with CAP. He has cough, SOB, and fevers. Sputum culture grows *Neisseria meningitidis*. Because of a pericardial friction rub and atypical chest pain, an echocardiogram is performed revealing **pericarditis, a complication of pneumonia**, with a small pericardial effusion.

Complications of pneumonia(3)- 1) Local- abscess, parapneumonic effusion, empyema (may need chest tube if pH<7), 2) pericarditis. 3) Distant- bacteremia, sepsis syndrome.

Case 178

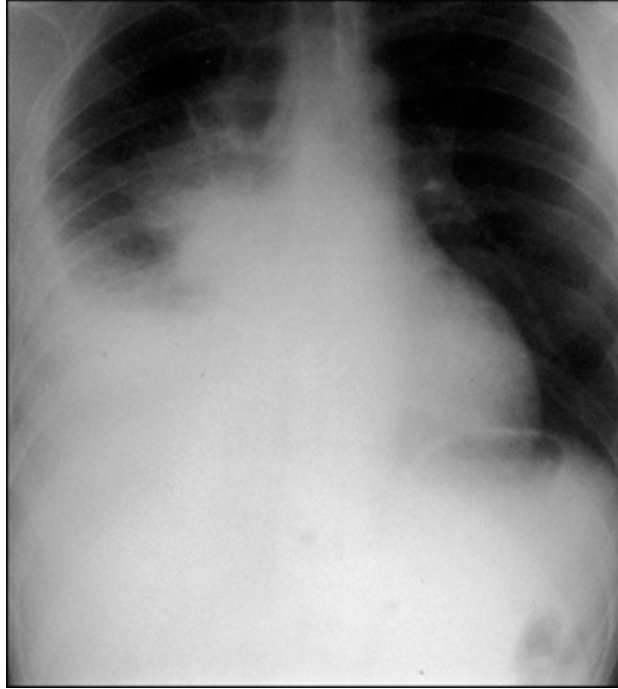
A 76 year old retired school principal comes to the ER with intermittent confusion, SOB with a respiratory rate of 32. His chest x-ray shows pneumonia and the BMP shows a creatinine of 1.8 and a BUN of 48. His blood pressure is low at 88/60 because of dehydration and normalizes after a liter of IV saline.

Would you admit the patient to the hospital?

CURB-65 Score- Pneumonia Severity - use the CURB-65 score. **C**onfusion +/-, **U**rea > 19, **R**espiratory Rate >30, **B**P systolic <90 (diastolic <60), age >65. Hospitalization if > than or equal to 2 factors.

Case 179

A 50 year old presents to the hospital with SOB, cough, high fevers and chills with a **lobar pneumonia** on chest x-ray. Blood cultures grow *Strep pneumoniae*. He has a new heart murmur and you are concerned about endocarditis. How would you treat his pneumonia? The following chest xray shows: Lobar pneumonia with parapneumonic effusion



Typical lobar pneumonia- consolidation; 1 or more lobes. Productive cough. *Streptococcus pneumoniae*- most common. It is an alpha-streptococcus + encapsulated. Watch for bacteremia, endocarditis, meningitis, and DIC. 20% resistance to penicillin. Diagnosis- sputum C+S, blood culture, or urinary antigen. *Note that the urinary antigen may stay positive for up to one year after diagnosis. *Haemophilus influenzae*- gram neg coccobacillus, encapsulated. 40% resistance to ampicillin. Decreased since Hib vaccine. *Moraxella catarrhalis*- gram neg diplococci. 100% resistance to penicillin. *CAP protocol*- use levofloxacin 750 mg daily, or moxifloxacin 400 mg daily, or Ceftriaxone 2 gms IV daily and Azithromycin 500 mg/day.

Case 180

An 80 year old female presents to the ER with interstitial **atypical pneumonia**. She is extremely SOB and has a Na of 124, increased LFTs with an ALT of 160. She got sick in Italy on vacation while staying in an old hotel. She noticed the shower to have a very musty smell. Her urinary antigen screen for **Legionella** is positive.

Atypical pneumonia- interstitial, non-consolidating. Dry, non-productive cough. Causes: Viral- influenza, RSV- Dx- nasopharyngeal smear. Metapneumovirus, Hanta, SARS (corona virus).- check serology. Mycoplasma- also tracheobronchitis, bullous myringitis, hemolytic anemia, transverse myelitis. Dx-serology. Chlamydia- similar to mycoplasma. Dx- serology. **Legionella pneumophila:** a weakly gram negative, aerobic, motile bacillus Genetically unrelated to any known pathogen. It lives within algae, protozoa, amoeba & biofilms. In humans, it lives w/in phagocytes. Associated with potable water sources. GI symptoms, hyponatremia, hypophosphatemia, increase LFTs. Dx- urine antigen for serogroup 1 only. Use doxycycline, macrolides, or respiratory fluoroquinolones.

Case 181

A 55 year old child care worker comes into see you because of persistent cough for 4 weeks. Initially, her symptoms started like a cold with runny nose and congestion. Chest x-ray is normal and she does not have GERD, sinus disease, or asthma. The cough is paroxysmal. You suspect **Pertussis (whooping cough)**. She has small grandchildren that she wants to visit. How do you treat?

Bordetella pertussis is a gram negative coccobacillus with an incubation period of 7-14 days. The bug binds to the cilia on epithelial cells with its **filamentous hemagglutinin**. It produces **tracheal cytotoxin** that paralyzes cilia. **Pertussis toxin** paralyzes PMNs, and there is a lymphocytosis. The first **vaccine** for pertussis was discovered by Dr. Sauer at the Evanston Hospital in 1925.

Highly contagious disease. Disease is worse for children less than 1 year of age- apnea/seizures. Coughing fits with “whoop” in 50%; starts at week 2. Look for vomiting during the coughing, conjunctival hemorrhages, fx ribs. Cough lasts 2-8 weeks before subsiding. Worldwide, it causes 300,000 deaths/year. **Diagnosis-** nasopharyngeal swab on Bordet-Gengou medium, PCR, DFA, or serology.

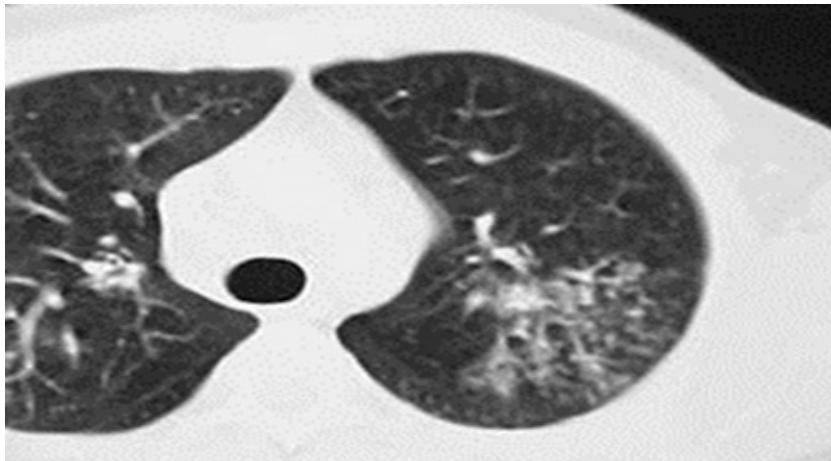
Vaccination- key. Tdap (Tetanus, diphtheria, acellular pertussis) in adults. DPT in children. Prophylaxis is used for those exposed, though studies are not

definitive. **Prevention-** macrolides or sulfa are effective. Treat adults who may spread it to children.

Case 182

A 70 year old female with a long-standing history of COPD from smoking presents with increasing SOB and cough with night sweats and hemoptysis. Chest x-ray and CT shows cavitory-nodular disease consistent with Mycobacterial disease. Bronchial bx reveal **MAI. (Mycobacterium Avium Intracellulare)**

MAI- a ubiquitous soil organism. Spread by migrating birds. Seen in females with COPD (Lady Windermere's syndrome)- RML disease. Can disseminate. Looks like TB, but it grows faster on culture. Not contagious 12-18 months Rx. MAI Rx- Biaxin, Ethambutol, Rifampin



Case 183

An unfortunate 36 year old 4-month pregnant female presents with severe SOB, fevers, malaise, myalgias, and bilateral interstitial pneumonia on chest x-ray. Nasopharyngeal swab is positive for **Influenza A**. You admit her to the hospital for treatment. On history, she did not receive an influenza vaccine.

Influenza- Risks and Complications-influenza has increased in mortality over the past 30 years. Those @ risk for complications: pts with chronic medical

conditions: Pts w/ heart, lung, renal & rheumatologic dx; diabetes, dementia, & stroke pts. Pregnant women. Immune-suppressed people: HIV pts, organ transplant recipients. These groups have increased rates of hospitalization & death. Pulmonary Complications- 1? Influenza Pneumonia, 2? Bacterial Pneumonia- pneumococcus and Staph aureus, 3 Exacerbation of COPD. Miscellaneous Complications- Myositis/rhabdomyolitis, myocarditis. Neurologic: CNS involved most commonly in children, Encephalopathy (Reye's syndrome from ASA use in kids) Also: Transverse myelitis, Aseptic meningitis, Focal neurologic disorders, Guillain-Barré syndrome.

Impact of Prevention- Vaccine: a trivalent killed vaccine most commonly used. Should be administered annually to pts. > 50 y/o. Children 6mos to 5 y/o. Pts. w/ chronic medical conditions. immune-suppressed pts. HCWs & caretakers of high-risk pts. women that will be pregnant. Prevents 50-80% of influenza illness (depending on the strain). Less effective for the elderly & high-risk pts.; though still has decreased risk of hospitalization from respiratory & cardiac disease & all-cause mortality.

Case 184

A 55 year old male presents with hemoptysis and cough of 4 weeks duration. Chest x-ray shows a mass in the chest and CT scan reveals a large **lung abscess**. Thoracic surgery is consulted for a VATS procedure. Cultures of specimens grew peptostreptococcus.

Lung Abscess- necrosis of lung tissue >2 cm. Most are *primary* relating to existing parenchymal disease. In the past, 90% were anaerobes. Now, staph, strep, klebsiella, Nocardia, yeast, pseudomonas are frequent causes. Surgery may be required to drain or resect the affected area.

Case 185

A 60 year old former 30 year coal miner from Kentucky presents with chronic SOB, cough productive of 6 oz of sputum/day, and oxygen dependence. CT scan

of the chest shows **chronic bronchiectasis**. Sputum cultures grow *Pseudomonas aeruginosa* and MRSA. The following gross pathology shows: Bronchiectasis on autopsy



Chronic Bronchiectasis- Chronic dilatation of bronchial tubes with destruction of smooth muscle and elastic tissue. It is a form of **COPD**. Patients produce huge amounts of sputum. Risk factors include IBD, RA, TB, HIV, frequent aspirations such as in hiatal hernia, and ABPA. Treatment- inhaled steroids, chronic antibiotics, and good pulmonary hygiene.

164. The “triple threat” of aspiration pneumonia includes all of the following EXCEPT:

- A. oral secretions
- B. obstruction
- C. gastric contents
- D. dysphagia

165. A patient with healthcare-associate pneumonia is more likely to be colonized with which of the

following pathogenic bacteria?

- A. E. coli
- B. Strep pneumoniae
- C. Mycoplasma pneumonia
- D. TB

166. Blastomycosis is a fungal infection that may cause cavitory pneumonia. How is it usually initially diagnosed?

- A. Fungemia + cavitory pneumonia is pathopneumonic.
- B. Blastomycoses serology.
- C. Budding yeasts on wet mount of bronchoscopy washings or biopsy.
- D. + skin test.

167. A PPD test should be considered positive *and treated* under which of the following circumstances?

- A. Female, age 30, healthy, 2mm induration. Test one year ago with 0mm induration.
- B. Female, age 55, healthy, 10mm induration. Test five years ago with 10mm induration.
- C. Male, age 22, healthy, 15mm induration. No previous test history.
- D. Male, age 75, immune suppressed, 4mm induration. Test 10 years ago with 0mm induration.

168. Light's Criteria for the classification of pleural effusions includes all of the following EXCEPT:

- A. Effusion protein/serum protein
- B. Effusion LDH compared to the upper limit of normal serum LDH
- C. Effusion LDH/serum LDH
- D. Effusion pH/blood pH
- E. All of the above are included in Light's Criteria.

169. Which of the following kinds of pneumonia is/are NOT contagious?

- A. viral (influenza, RSV, etc)
- B. TB
- C. H. influenza
- D. Pneumococcus
- E. Legionella
- F. D and E

170. Local complications of pneumonia include:

- A. Parapneumonic effusion
- B. Abscess
- C. Empyema
- D. Pericarditis
- E. All of the above

171. What comprises the CURB-65 score, a classification of the severity of pneumonia?

- A. Confusion, Urea > 19, RR > 20, SBP < 90, age > 65
- B. Confusion, Urea > 19, RR > 30, SBP < 90, FEF < 65%
- C. Confusion, Urea > 25, RR > 30, SBP < 90, FEF < 65%
- D. Confusion, Urea > 19, RR > 30, SBP < 90, age > 65

172. Community-acquired pneumonia protocols should be initiated in patients with CAP, even before knowledge of the organism is available. Which of the following treatment regimens would be appropriate to start without culture results?

- A. Rocephin + Azithromycin
- B. Ciprofloxacin
- C. Vancomycin
- D. Meropenam

173. In addition to SOB and other symptoms of pneumonia, patients with Legionella may complain of what?

- A. GI symptoms
- B. Back pain
- C. Vision changes
- D. Hemoptysis

174. Treatment for active pertussis infection in otherwise healthy adults includes:

- A. Antibiotics (macrolides and sulfa)
- B. Supportive care
- C. Isolation
- D. Prophylaxis for close contacts

175. Mycobacterium Avium Intracellulare (MAI) may be differentiated from TB in which of the following ways?

- A. Grows faster in culture.

- B. Susceptible to Clarithromycin.
- C. Does not produce cavitations.
- D. Does not disseminate.
- E. A & B.
- F. B & C.

176. The influenza vaccine should be administered to the following patient populations:

- A. Patients > 50 years old.
- B. The chronically-ill.
- C. Pregnant patients.
- D. Healthcare workers and caretakers.
- E. All of the above

Answers:

164. **D** 165. **A** 166. **C** 167. **C** 168. **D** 169. **F** 170. **E** 171. **A** 172. **A** 173. **A** 174. **A** 175. **E** 176. **E**

Septic Shock

Introduction- Definitions

SIRS (systemic inflammatory response syndrome) -2 or more of the following: a) body temp $<36\text{ C}$ or $>38\text{ C}$, b) heart rate >90 c) respiratory rate >20 or $p\text{CO}_2 < 32$, d) WBC <4000 or > 12000 or 10% bands, Related to “cytokine storm”. SIRS from infection is **Sepsis**. **MODS**- multiorgan dysfunction syndrome- liver, kidney (creatinine >2), coagulation problems- platelet count $<100,000$ or PT >1.5 PTT > 60 , ARDS, cardiomyopathy. **Severe sepsis**- MODS for 2 or more organs, lactic acid $>$ or equal to 2 mmol/l and less than 4 mmol/l with a normal blood pressure after 20 ml/kg bolus. **Septic Shock**- MAP < 65 (MAP= DP + $1/3$ SP-DP; 70-110 normal) after fluid bolus of 20 ml/kg , lactic acid level $> 4\text{mmol/l}$ or base deficit $> -9.$, check procalcitonin level. **Cryptic shock**- sepsis with normal blood pressure and lactic acid level $> 4\text{ mmol/l}$. **“Capillary leak syndrome”** occurs in SS with low systemic vascular resistance (SVR) rather than high, which is more typical in other forms of shock. Patients third space and retain fluid (Michelin Tire Syndrome).

Case 186

An 70 year old male presents to the ER with 2 weeks of RUQ abdominal pains associated with fever to 102. His BP in the ER is 75 systolic and does not respond to fluid boluses. His WBC is 22,000 with 11% bands. US shows an inflamed gallbladder with stones. His creatinine is 2.2 and BUN 58. He is SOB and chest x-ray shows ARDS. You diagnose **septic shock** secondary to gallbladder disease.

Antibiotic Rx- initiate within 4 hours of hypotension (often in the ER) which improves mortality. Use broad spectrum initially to cover anaerobes, gram

negative aerobes, staph (MSSA and MRSA)/strep. Use meropenam or Zosyn with vancomycin IV. If meningitis-Amp/Vanco/ Ceftriaxone with dexamethasone.

Case 187

A 65 year old male presents to the hospital from septic shock due to pneumococcal pneumonia. He miraculously lives after 5 days of pressor support. Unfortunately, the use of pressors causes gangrene of his feet, a dreaded complication of **pressor use**.

Fluid Resuscitation- initially 20 ml/kg/hr crystalloids or Hextend (6% hetastarch in Lactated Ringer's Solution mimics plasma). Keep CVP between 8-12 off ventilator and 12-15 on ventilator, monitor lactic acid level, or procalcitonin level. **Pressor Support**- norepinephrine (Levophed) better than dopamine. Use 2-12 mcg/min. Phenylephrine (Neosynephrine) may be added- use 40-60 mcg/min. Add Arginine Vasopressin-ADH (.01-.04 U/min) in norepinephrine resistant (pts. are often anti-diuretic hormone deficient) Keep MAP > 65 mm H₂O. Keep Urine output > .5ml/kg/hour if possible.

Vasopressors and Inotropes- Dopamine- no advantage to norepinephrine in SOAP II trials. Higher mortality rate when used in cardiogenic shock. At low doses less than 5 mcg/kg/min, dopamine affects dopamine 1 receptors, increasing renal blood flow. Between 5 and 10 mcg/kg/min, beta-1 adrenergic receptors are blocked. There is an increase in tachycardia. Greater than 10 mcg/kg/min has an agonist effect on alpha-1 adrenergic receptors.

Norepinephrine- (Levophed), is the pressor of choice in septic shock. 8-12 mcg/min initially, then 2-4 mcg/min up to 8-30 mcg/min. It is a potent alpha-1 adrenergic agonist with less effect on beta-1 receptors. Can increase myocardial contractility and heart rate. **Epinephrine**- use in anaphylactic shock. 1 mcg/min initially, then 1-10 mcg/min. **Phenylephrine**-(**Neo-Synephrine**)- 100-180 mcg/min, then 40-60 mcg/min. Rx in conditions with decreased vascular tone, such as anesthesia-induced hypotension and neurogenic shock. **Vasopressin**-

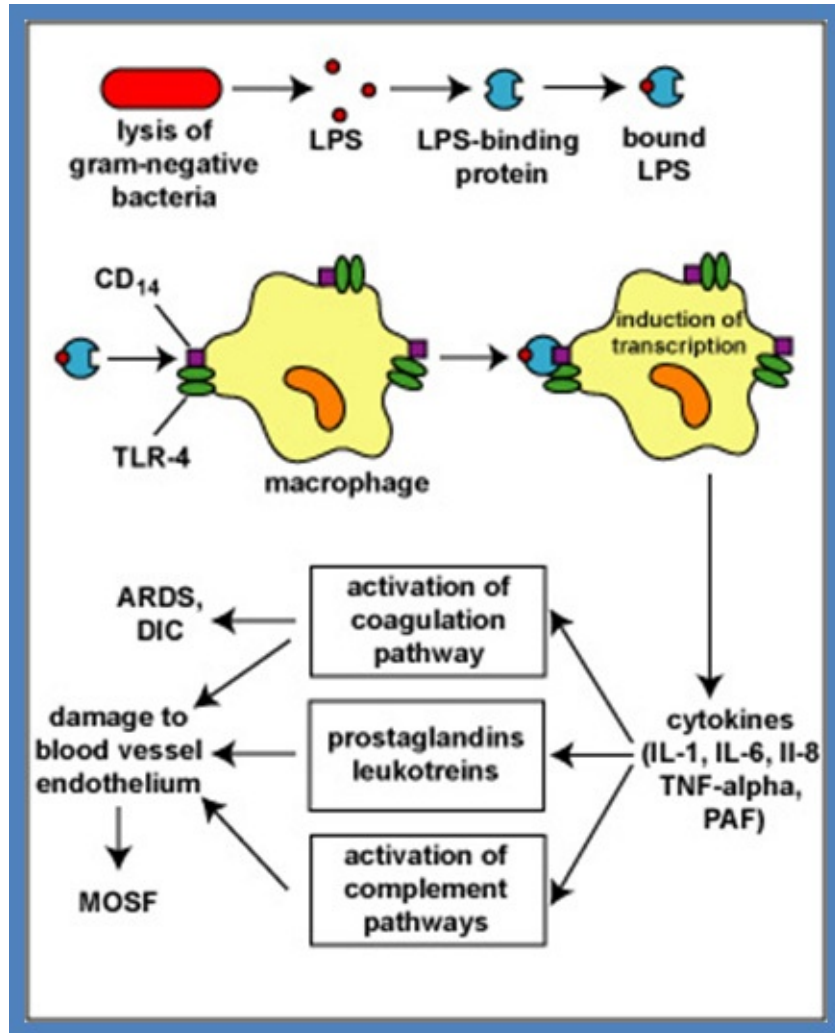
.01-.04 U/min; 40 U IV once for resuscitation. Use as an adjunct to the others. Anti-diuretic hormone. In the VASST trial, 779 patients with septic shock, vasopressin did not decrease mortality when added to norepinephrine. (NEJM; Ja Russell. 2008) Dobutamine- treatment of severe decompensated heart failure. It is a beta-1 agonist, but has some beta-2 adrenergic agonist effects. .5-1 mcg/kg/min, then 2-20 mcg/kg/min. Midodrine- show to have some additional helpfulness in shock.

Case 188

A 75 year old female presents to the ER in septic shock secondary to MSSA bacteremia from her dialysis perma-cath. The perma-cath is removed, and her work-up reveals **low serum cortisol levels**. This is a common finding in septic shock.

Low Dose Hydrocortisone- check serum cortisol. Use 100 mg hydrocortisone loading with 10 mg/hr through day 7. Consider fludrocortisone 50 mg/day for 7 days also.

The following schematic of sepsis shows: Macrophages hold the key to damage



Case 189

A 59 year old male smoker presents to the ER in septic shock with overwhelming CAP secondary to Haemophilus influenza. The patient quickly develops **A.R.D.S.** and requires mechanical ventilation.

Oxygenation-Mechanical Ventilation- 90% of patients require MV. Use small breaths. 4-6 ml/kg. Keep ScvO₂>70% (central venous oxygen saturation)- use central venous catheter. This is most dependent on blood volume and O₂ delivery. ScvO₂ monitoring is standard of care in septic shock.

Case 190

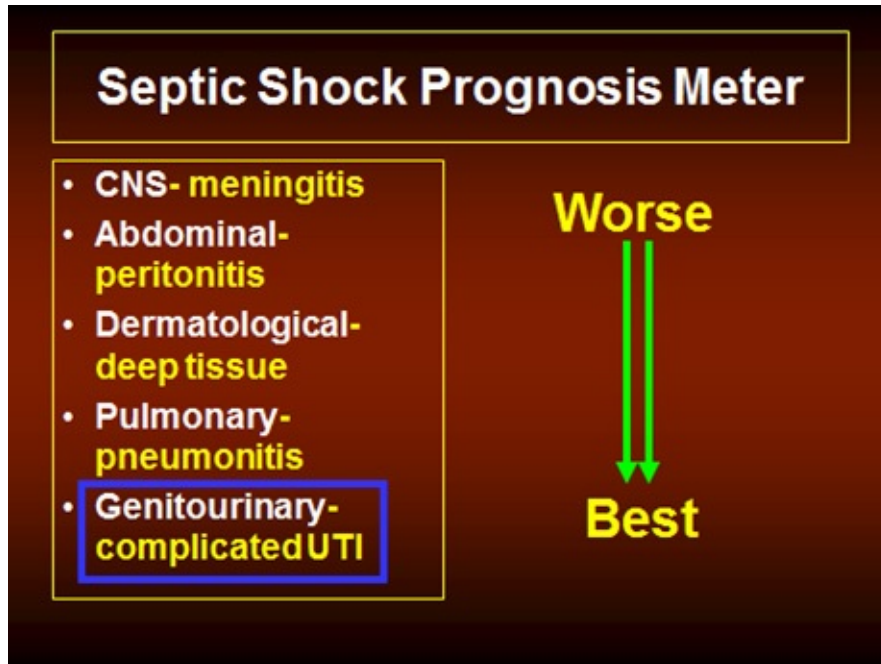
A 40 year old woman presents to the ER with classic signs of acute bacterial meningitis and septic shock. She has fever, delirium, stiff neck, headaches, and photophobia. PE exam reveals a petechial rash and CSF grows *Neisseria meningitidis*. CBC shows a platelet count of 50,000. FSPs are elevated, PT is 18 seconds, and PTT is 80 seconds. You diagnose **DIC (disseminated intravascular coagulation)**.

Activated Protein C - sepsis activates clotting cascade, causing protein C deficiency. *Recent use of Xigris (activated Protein C) has fallen out of favor (NEJM 2012:366:22)*. In DIC, PTT can often be >60 seconds or PT>1.5. Platelet count<100,000.

Supportive Care in Septic shock-

Prevent DVTs with lovenox prophylaxis, GI bleeding with a PPI, skin breakdown, and intense glucose monitoring. Glycemic control reduces mortality rate. Sepsis causes insulin resistance.

Mortality Rate in Septic Shock-50%. GI source>pulmonary>GU. Fungal (*Candida*)>Aerobic gram negative>gram positive. ARDS- (adult respiratory distress syndrome) 20%.DIC (disseminated intravascular coagulation)-40%. ARF (acute renal failure)- 50%. Only 50% of the patients have detected bacteremia. Attack the source promptly; remove infected/necrotic matter.



Procalcitonin Levels in Hospitalized Patients- <0.50 ng/mL: low risk for sepsis; local bacterial infection possible. ≥ 0.50 to 2.00 ng/mL: sepsis is possible. > 2.00 to <10.00 ng/ml: Sepsis likely. ≥ 10.00 ng/mL: Severe bacterial sepsis or septic shock probable.

SOFA (Sequential (Sepsis related) Organ Failure Assessment Score)

Definition: evidence of infection *plus* life-threatening organ dysfunction, clinically characterized by an acute change of ≥ 2 points in SOFA score

The SOFA score should be used to monitor a patient's status in an ICU setting. Higher SOFA scores are associated with an increased probability of mortality. The score grades abnormality and severity by organ system and accounts for clinical interventions. Patients should have a presumed score of 0, indicating no organ dysfunction.

qSOFA (quick SOFA)

The quick SOFA incorporates altered mentation (Glasgow Coma Scale <15), systolic BP ≤ 100 mmHg and RR ≥ 22 /min.

The qSOFA helps to identify patients with suspected infection who are likely to have poor outcomes. Fulfilling ≥ 2 criteria of the qSOFA, should prompt investigation of the full SOFA and treatment of infection.

Sequential [Sepsis-Related] Organ Failure Assessment Score*					
System	Score				
	0	1	2	3	4
Respiration PaO ₂ /FiO ₂ , mmHg (kPa)	≥ 400 (53.3)	<400 (53.3)	<300 (40)	<200(26.7) with respiratory support	<100 (13.3) with respiratory support
Coagulation Platelets, $\times 10^3/\mu\text{L}$	≥ 150	<150	<100	<50	<20
Liver Bilirubin, mg/dL ($\mu\text{mol/L}$)	<1.2 (20)	1.2-1.9 (20-32)	2.0-5.9 (33-101)	6.0-11.9 (102-204)	>12.0 (204)
Cardiovascular	MAP ≥ 70 mmHg	MAP <70mmHg	Dopamine <5 or dobutamine (any dose) ^b	Dopamine 5.1-15 or epinephrine ≤ 0.1 or norepinephrine ≤ 0.1 ^b	Dopamine >15 or epinephrine >0.1 or norepinephrine >0.1 ^b
Central nervous system Glasgow Coma Scale score ^c	15	13-14	10-12	6-9	<6
Renal Creatinine, mg/dL ($\mu\text{mol/L}$) Urine output, mL/d	<1.2 (110)	1.2-1.9 (110-170)	2.0-3.4 (171-299)	3.5-4.9 (300-440) <500	>5.0 (440) <200
Abbreviations: FiO ₂ , fraction of inspired oxygen; MAP, mean arterial pressure; PaO ₂ , partial pressure of oxygen * Adapted from Vincent et al. ²⁷			^b Catecholamine doses are given as $\mu\text{g/kg/min}$ for at least 1 hour. ^c Glasgow Coma Scale scores range from 3-15; higher score indicates better neurological function.		

JAMA. 2016;315(8):801-810.

177. The type of infection with the highest mortality related to septic shock is:

- CNS
- GI
- Pulmonary
- GU
- Dermatologic

178. T or F Dopamine is better than Norepinephrine as a Pressor Agent in Septic Shock.

179. T or F Xigris (activated Protein C) is still very helpful in Septic Shock patients.

180. If a patient on ventilator support in the ICU spikes a fever of 102°F and a white count of 25,000, and his heart rate increases to 115 beats per minute, how many other criteria does he need to meet before he is diagnosed with SARS?

- 0
- 1

C. 2

D. We need to find the infection

Answers:

177. **A** 178. **False** 179. **False** 180. **A**

Sexually Transmitted Infections

Introduction- Average U.S. Statistics of STIs- Chancroid- 100 cases/year. LGV- 500. Syphilis- 40,000. HIV- 50,000. Molluscum contagiosum- 500,000. Hepatitis B and C- 500,000. HPV- 2-5 million. Gonorrhea- 600,000. Herpes- 1 million. Scabies- 1 million. PID- 1million. Mycoplasma genitalium- 2 million. Pubic Lice- 2.5 million. Chlamydia- 3 million. Trichomoniasis-8 million. Vaginitis (BV)- 20 million.

Case 191

A 23 year old sexually active Haitian male presents to you with a **penile ulcer**. He just immigrated from his country 6 weeks ago. What is the differential diagnosis? The following is a picture of: Granuloma inguinale



Genital Ulcer Syndrome- Causes: 1) syphilis- painless, 2) HSV-1, HSV-2- painful with nodes 3) Tropical STIs (3 types) -more common in developing countries. a) Chancroid (*Haemophilus ducreyi*) painful ulcers-Incubation 1-14

days. Suppuration of inguinal nodes. Rx-Ceftriaxone or Cipro b) Granuloma inguinale (Klebsiella granulomatis; associated with Donovan bodies) ulcers are large, look cancerous, painless c) Lymphogranuloma venereum (Chlamydia trachomatis - serotypes L 1 , L2, L3)- painful inguinal-anogenital nodes. Incubation 3-4 weeks. Painless erosion with secondary painful inguinal syndrome (genito-anorectal); more commonly in homosexual men. Rx-tetracyclines, macrolides. Other causes of perineal ulcers include metastatic Crohn's disease, vasculitis, lichen planus, Behcet's syndrome, pemphigus, and drug reactions.

Case 192

A 70 year old male presents with a papulosquamous rash on his soles and feet. He also has developed significant dementia in the last few years according to his daughter. You suspect secondary or tertiary **syphilis**, and Rx with Penicillin after serology testing is positive.

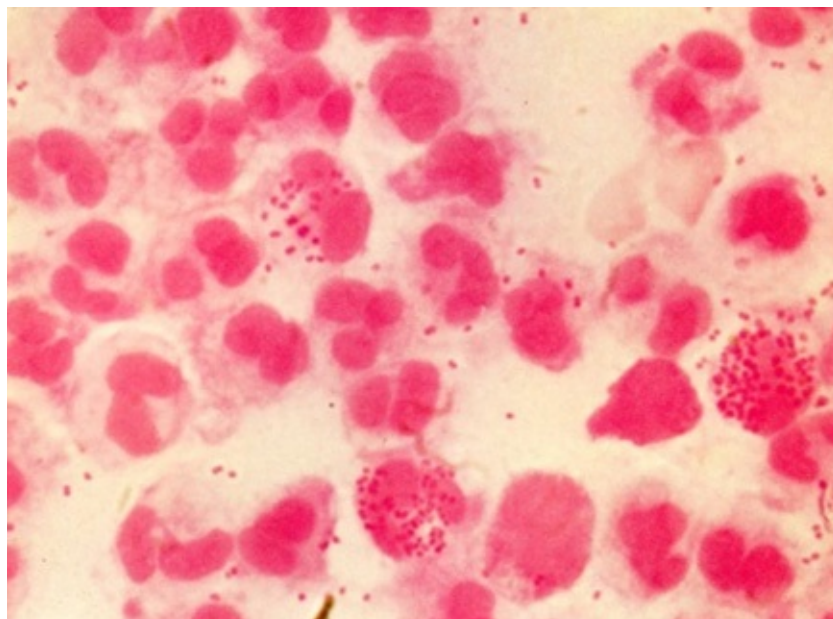


Syphilis- caused by Treponema pallidum. **Primary**- painless genital ulcer. **Secondary**- many organ systems can be affected. Can cause meningitis, hepatitis, glomerulonephritis, papulosquamous rash. Check VDRL (*Venereal Disease Research Lab* test or RPR; *rapid plasma regain* test) highly sensitive. Titer varies with Rx. FTA (fluorescent Treponemal antibody) for confirmation;

always stays ++ after conversion. **Tertiary**- CNS vasculitis or gummatous disease; dementia. Part of the TORCH syndrome in neonates (Treponema, other (syphilis, HIV, Parvovirus, Coxsackie virus), Rubella, Cytomegalovirus, Herpes).

Case 193

A 19 year old male presents to you with a creamy penile discharge and pain on urination. You suspect urethritis from **gonorrhea (GC)** or NGU (non-gonococcal urethritis) from Chlamydia. The following is a gram stain of penile discharge and shows: Intracellular gram negative diplococci of GC



Gonorrhea- Neisseria gonorrhoea is causative agent- gram negative diplococci, intracellular- associated with purulent urethritis, cervicitis, PID. Incubation- 4 days. Can disseminate to joints. Fitz-Hugh-Curtis syndrome- inflammation/ scarring of Glisson's capsule around liver causing RUQ pain associated with PID. Culture- Thayer-Martin. PCR- purulent discharge or urine sample. Rx- ceftriaxone 125 mg 1M. Azithro -2 grams oral. Ciprofloxacin/Levofloxacin -1 dose. Rx sexual partner. Don't use any other cephalosporins other than Ceftriaxone. (Cefixime was previously allowed by the CDC; updated 2012)

Case 194

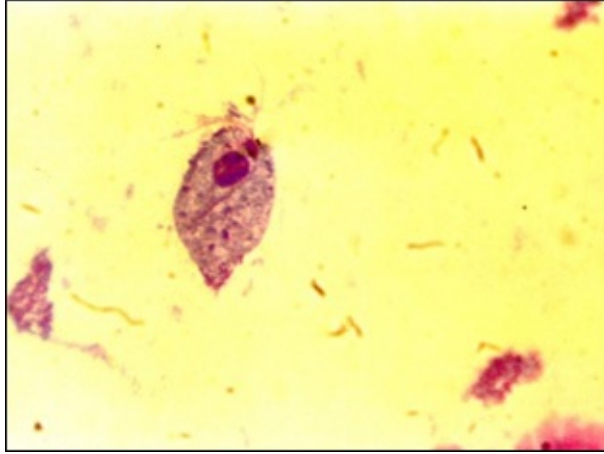
A 22 year old sexually active female presents with pelvic pain and stinging on urination. U/A is normal but pelvic exam reveals a purulent cervical discharge, “chandelier’s” sign (tender cervix on palpation causes severe withdrawal) and cervicitis. You suspect GC or **NGC (non gonococcal cervicitis from Chlamydia)**. The following picture shows: Purulent cervicitis of Chlamydia



Chlamydia trachomatis- 2-3x more prevalent than gonorrhea. Causes NGU (non-gonococcal urethritis in men; cervicitis in females). 8 serotypes. Incubation period-7-21 days. Reiter’s syndrome- arthritis, balanitis, conjunctivitis, keratoderma blennorrhagicum, and “lover’s heel.” Rx- Azithromycin-one gram po or Doxycycline – 100 mg bid x10 days. Diagnosis- PCR (Chlamydia trachomatis trans-muconic acid- CT-TMA) on urine or urethral specimen. Rx sexual partner.

Case 195

A 25 year old sexually active female presents with a copious, frothy green-yellow vaginal discharge and pelvic pain for 7 days. Pelvic exam shows a “strawberry cervix”. You diagnose the parasitic infection **trichomoniasis**.



Trichomonis vaginalis- parasite. Copious, yellow-green vaginal discharge. Strawberry cervix. Pelvic pain. Rx- Flagyl -2 gms po x1. Rx sexual partner. 8 million cases/yr in US.

Case 196

A 30 year sexually active male with 5 or 6 females over the last 5 years presents with recurrent painful ulcers on the scrotum associated with fever, and painful groin lymph nodes. You diagnose **HSV-2 (Herpes Simplex Virus-2)**.



Herpes Simplex 2- painful, recurrent genital ulcers. Rx- Acyclovir, Famvir, Valtrex for 7 days. May suppress HSV with the same meds, lower dosing. All are generally effective. **HSV-1 and HSV-2** are identical clinically.

Case 197

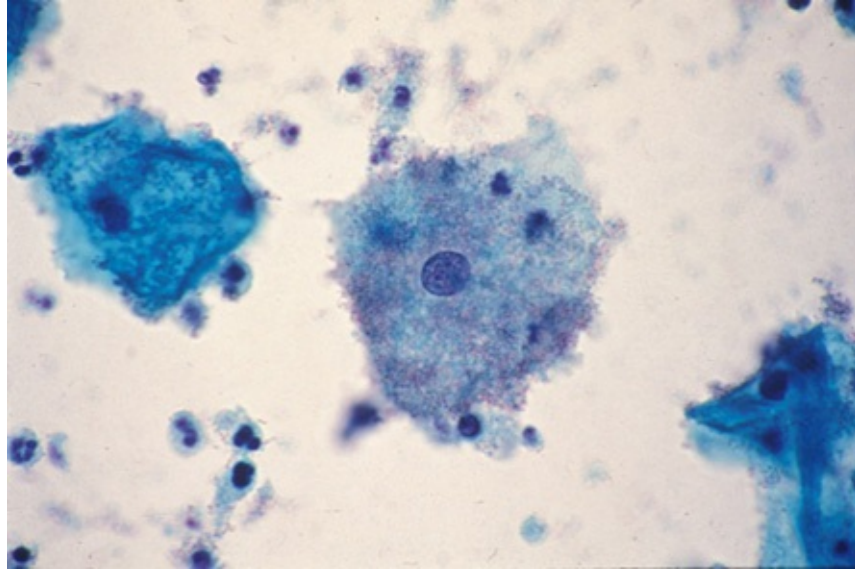
A 72 year old diabetic male presents with an itch, red rash on the crown of his penis consistent with **yeast balanitis**. You recommend treatment.



Candida- dimorphic yeast. “cottage cheese” vaginal discharge in females. Itchy. Men- get balanitis. Rx- oral fluconazole or imidazole creams. (clotrimazole)

Case 198

A 40 year old married female presents with a very smelly vaginal discharge for one week. She states the discharge smells like “dead fish”. You diagnose **bacterial vaginosis** or nonspecific vaginitis. The following slide shows classic: “Clue cells”



Bacterial vaginosis- caused by Gardnerella species in association with Mobiluncus (gram positive anaerobic rod). pH>5.5, malodorous discharge with positive “whiff” test. *Clue cells* on saline wet mount slide- epithelial cells as above. Rx-clindamycin or flagyl or amoxicillin. Associated with preterm labor.

Case 199

A 25 year old sexually active male with multiple females presents with warts on his penis. You diagnose **HPV (Human Papilloma Virus)** and recommend treatment and vaccination.



HPV (Condyloma accuminata)- the cause of genital warts (condyloma accuminata). 1 million new cases/year. 60 DNA types. Serotypes 16, 18 are associated with cervical cancer. 11,000 new cases/year. HPV is also associated with anal cancer. Incubation period- 1-20 months. Rx- electrocautery, cryotherapy. 5-FU, TCA, laser, podophyllin, surgical excision. Recurrences. Vaccines- give Gardasil (quadrivalent) for males and females 9-26 years, or Cervarix- additional bivalent vaccine covering HPV types 16,18. Regimen: 0,1,6 months.

Case 200

A 30 year old sexually active female presents with an itchy vulva and mons pubis. Pelvic exam and vaginal exam is normal but you find nits in the area and diagnose **scabies**.

Scabies (itch mite- Sarcoptes scabiei) and Pubic lice (crabs- Phthirus pubis)- ectoparasites. Rx- permethrin cream or Ivermectin 200 ug/kg po. Lindane is not the drug of choice because of possible toxicity, though it is effective.

Case 201

An unfortunate 19 year old college co-ed is **raped** by a stranger walking back to her dormitory after a long night of studying. She presents to the ER where you see her and get psychological counseling. What infections are you concerned about her possibly contracting?

Rape Victims- order Hepatitis B panel and vaccinate, use azithromycin 2 gms for GC/chlamydia, Flagyl for trichomoniasis, check for HIV and Hepatitis C baseline. Vaccinate for HPV. Consider prophylaxis.

Case 202

A 25 year old sexually active female with multiple partners presents with severe pelvic pain, fevers and “chandelier’s sign” on pelvic exam. The uterus is inflamed and purulent drainage is coming from the cervical os. PCR for gonorrhea is positive. CT of the pelvis shows left tubo-ovarian abscess and fallopian tubitis. You diagnose **PID (Pelvic Inflammatory Disease)**.

PID (Pelvic Inflammatory Disease)- pelvic pain, fever, vaginal discharge. STD or following abortion, birth, surgery. Polymicrobial including colon flora, GC, Chlamydia. Endometritis, salpingitis, tubo-ovarian abscess all possible. I&D can be required. Rx- 4 weeks- Cefoxitin/Unasyn and Azithro/Doxycycline IV. **750,000 cases/year** in the US. 8% of all reproductive-age women. 11% of African-American reproductive-age women. **Differential:** appendicitis, pyelonephritis, stones, bowel ischemia, IBS, gastroenteritis, ectopic pregnancy, torsion or rupture of ovarian cyst, endometriosis.

181. Genital ulcers may be caused by a variety of syndromes and organisms. How does one narrow the differential diagnosis?

- A. Primary syphilis presents with a painless lesion; the initial erosion of LGV is painful.
- B. Suppuration of inguinal nodes is seen in Chancroid but not in LGV.
- C. Granuloma inguinale presents as painless nodules which rupture, and lymphadenopathy is rarely present; primary syphilis presents as a painless pustule that ulcerates, and inguinal lymphadenopathy is often present.
- D. Donovan bodies are visible on a Wright’s stain in lymphogranuloma venereum.

182. Which of the following is FALSE about Syphilis?

- A. It is caused by *Treponema pallidum*.
- B. VDRL is a highly-sensitive lab test used to confirm diagnosis.
- C. Cases of syphilis must be reported to the health department.
- D. Syphilis is part of the TORCH syndrome in neonates.
- E. Patients with syphilis are infectious throughout all stages of the disease.

183. Which of the following is treatment for GC in the outpatient setting?

- A. Ceftriaxone
- B. Azithromycin
- C. Cefixime
- D. Doxycycline
- E. A or B
- F. A or C, and D

184. All of the following statements about Chlamydia are true EXCEPT:

- A. Genitourinary infections are often indistinguishable clinically from GC.
- B. It is caused by *Chlamydia trachomatis*.
- C. Reiter's Syndrome, PID, and infertility are potential complications.
- D. It is caused by the same organism that can cause LGV.
- E. It is part of the TORCH syndrome in neonates.

185. Trichomoniasis is caused by a parasite and produces symptoms of vaginitis. Choose the true statement about this sexually transmitted infection.

- A. The organism is only identified in 20% of sexual partners, so prophylactic treatment of these partners is not recommended.
- B. Pelvic pain is a relatively uncommon presenting complaint.
- C. *Trichomonas* produces a classic "strawberry cervix" on pelvic exam.
- D. Treatment is with Metronidazole 500mg PO x 5 days.

186. Herpes Simplex 2 is classically responsible for which of the following signs/symptoms?

- A. Painful genital ulcers.
- B. Painful oral ulcers.
- C. Painless inguinal lymphadenopathy.
- D. Genital pruritis.

187. How might a candida infection be differentiated from other GU infections?

- A. Thick, clumping, adherent vaginal cottage cheese discharge in females.
- B. Characteristic “dirty socks” odor.
- C. Characteristic “dead fish” odor.
- D. Intense pain of the ano-genital region.

188. Clue cells on a saline wet mount are an indication of which organism?

- A. *Chlamydia*
- B. *Trichomonas*
- C. *Haemophilus*
- D. *Gardnerella*
- E. *Cluecelluria*

189. Which is a true statement about the Human Papilloma Virus?

- A. Serotypes 16 and 18 don’t cause cervical cancer.
- B. Condyloma accuminata, once treated with either electrocautery or cryotherapy, rarely recur.
- C. HPV infection is implicated in the majority of cases of cervical cancer.
- D. Vaccination against HPV is only recommended for girls.

190. Signs and symptoms of scabies in otherwise healthy adults include all of the following EXCEPT:

- A. Intense pruritis, often worse at night.
- B. Pathognomonic burrows most commonly located on the fingers, wrists, genitals, and belt line.
- C. Excoriations, papules, or vesicles in the web spaces, axillae, periumbilical area, and male genitalia.
- D. Lesions of the face and neck.

191. All of the following should be routinely considered in the treatment of victims of rape EXCEPT:

- A. HIV post-exposure prophylaxis
- B. Hepatitis B/C testing and immunization if unvaccinated
- C. Antibiotics (Rocephin, Flagyl, and Azithromycin at minimum)
- D. Anti-fungals (Fluconazole)

192. Pelvic Inflammatory Disease (PID) typically presents with pelvic pain, fevers, and vaginal discharge. What are some common pre-disposing factors for this disease?

- A. Abdominal surgery

- B. Childbirth
- C. Abortion
- D. IUD placement
- E. All of the above
- F. Belly button piercing

Answers:

181. **B** 182. **E** 183. **E** 184. **E** 185. **C** 186. **A** 187. **A** 188. **D** 189. **C** 190. **D** 191. **D** 192. **E**

Skin and Soft Tissue Infections

Case 203

A 5 year old preschool child presents with 3 days of nasal congestion, headache, fevers, a red rash on the cheeks (“slapped cheeks”), and a lacy rash on the rest of the body. You suspect **erythema infectiosum. (Fifth’s Disease)**

Six Pediatric Exanthemous Rashes:

- 1) Measles
- 2) Scarlet fever
- 3) Rubella- German measles
- 4) Duke’s disease- no particular pathogen
- 5) Fifth’s disease- parvovirus B19- erythrovirus)
- 6) Roseola (exanthema subitum- human herpesvirus 6,7)

Fifth’s Disease- named in 1799 by Willan. Also called erythrovirus, or B19 parvovirus. In Japan, called “Apple Sickness”. Hungary- “Butterfly Pox”. 50% of adults are immune. Common age 5-15. Contagious through secretions; outbreaks in schools occur. Rash is generally painless and doesn’t itch. One of 6 pediatric exanthems. Teenagers and adults get arthritis with it. In pregnant women, associated with hydrops fetalis.

Case 204

A 61 year old former Miss America contestant in the early 70’s is now obese over 350 lbs. because of the abuse of Chocolate Chip cookies, bratwursts, and her favorite beer while watching Green Bay Packers games. A Type II diabetic, she presents to the ER with a hot, tender **cellulitis** of the left leg. You suspect bacteremia and admit her for IV antibiotic Rx. What are the risk factors for cellulitis and what antibiotics do you choose?

Risk factors: obesity, DM, tinea pedis, eczema, psoriasis, trauma, venous stasis

Rx: ancef or nafcillin, moisturize skin, Rx eczema, fungal infections or the portal of entry, minimize edema.

Cellulitis- caused by primarily Staph aureus (MSSA and MRSA); + Group A, B, C, G beta Strep. Hot, tender. Legs- 73%. 7% are admitted from ER.

Males>Females- 7:3 ratio. MSSA- pink red; MRSA- often associated with abscesses.(related to PVL toxin) Beta Strep- deeper cherry red, more lymphangitis, blistering. Only 4% cellulitis cases have + blood cxs. Bullous form-15%; associated with sloughing. Rx- minimize edema, avoid trauma, good skin/nail care, Rx eczema and tinea. Moisturize skin. Increase circulation if deficient. Antibiotic Treatment of Cellulitis- MSSA/Beta Streptococci.- Oral for less severe infections- cefadroxil/cephalexin= dicloxacillin. IV- cefazolin = nafcillin/oxacillin. For **MRSA**- PO- tri-sulfa, tetracyclines, +/- rifampin. Linezolid (Zyvox) excellent, but expensive. 600 mg BID (IV or po). Watch for serotonin syndrome. Clindamycin or quinolones may be effective in 50% of MRSA infections. Use Vancomycin if MIC < 2. Consider Daptomycin 6-8 mg/kg/day. Monitor CPK. Ceftaroline- 5th generation cephalosporin effective for MRSA. Duration of treatment- generally 7 to 14 days. The following picture of a patient's left arm showing: Group A Streptococcus- a.k.a. "flesh-eating" bacteria



Case 205

An 80 year old female presents with a painful red rash on her face that is blistering. She notes fevers and chills and you diagnosis **facial cellulitis**.



Facial Cellulitis- Staph aureus (MSSA>MRSA) > Beta Streptococci (Groups A,B,C,G) > Haemophilus influenza and Strep pneumoniae . Children>adult. Recurrences. Watch for orbital cellulitis and the dreaded, rare central venous thrombosis.

Impetigo- Peak incidence is in children 2-5 years old. Tropical/subtropical climates more common. Summertime. Spread by direct contact (like in rugby playing adult males), and possibly flies. *S. aureus* and GABHS. “Different” GABHS type (M protein) than in pharyngitis. Complications rare.

Case 206

A 60 year old retired patent attorney is a poorly controlled Type II diabetic who comes in an **infected diabetic foot ulcer**. You are concerned about underlying osteomyelitis. You admit him to the hospital.



Diabetic Foot Infections- seen in 25% of diabetics. Watch for Group A,B, and G streptococcal gangrene. Risks- neuropathy, high HgbA1c, and PVD, pressure trauma. 2/3's of pts. develop osteomyelitis. Dx of osteo.- MRI is gold standard for imaging. 80% of infections have mixed flora. Infected diabetic foot ulcers- *Staph aureus* and Beta-Strep > gram negative rods plus anaerobes. Rx--assess vascular status and augment if possible, improve diabetic control, minimize edema and pressure, moisturize skin and treat tinea, often present. Surgical debridement of devitalized tissue. Extended- beta lactam penicillins (Zosyn), or penams (dori,imi,mera,erta), +/- MRSA coverage (Vancomycin or Zyvox or Daptomycin or Ceftaroline) pending cultures. Wound vacuum may be helpful.

Wound vacuum (negative pressure therapy)-excessive interstitial fluid serves as a deterrent to healing. Mechanical forces influence the shape and growth of tissues, with deformation of the extracellular matrix and cells. Wound vacs accelerates bacterial removal from wound. It significantly increases blood flow in the wound. The following picture shows: Wound vacuum sponge and hose



Case 207

A 66 year old diabetic with metabolic syndrome had a CABG surgery 4 weeks ago and a **vein harvesting graft** of the left leg. He now presents with cellulitis of the left leg with dehiscence of the graft donor site.

Cellulitis-special cases - 1) Women s/p mastectomy- ipsilateral cellulitis from Beta-strep (A,B,C,G) > Staph. Increased lymphedema. Recurrences common. Often need prophylaxis 2) CABG patients - high rates of leg cellulitis in ipsilateral leg of venous graft harvesting: in diabetics who have tinea pedis.

Case 208

A 60 year old AA male presents with a 10 year history of recurrent inflammation of his armpits, groin and buttock region. He develops large boils and they drain spontaneously. He has had multiple courses of antibiotics without much help. You suspect **hidradenitis suppurativa**. The following picture shows Stage 4 disease in the left axilla.



Hidradenitis suppurativa- disease of apocrine sweat glands. Can affect axilla, under breasts, perineum, or gluteal areas. Inherited tendency. Females>males. Treat apocrine gland inflammation with *anti-androgens*- include estradiol , (50 mcg and cyproterone acetate or norgestrel) spironolactone- 50-100 mg/day, flutamide, or finasteride. Also, retinoids, colchicine, metformin are used. Stop smoking. Also use *immunosuppressants*- steroids (po, or intralesional triamcinolone acetate 10 mg/ml monthly), methotrexate- 15 mg/week, cyclosporine 4-5 mg/kg/day, infliximab, efalizumab for severe cases. Isotretinoin 1 mg/kg for 4 months. Zinc gluconate 50-90 mg/day. *Treat infection*- topical clindamycin bid or oral meds- tetracyclines, rifampin, clindamycin, dapsone-100 mg/day, amoxicillin-clavulanate. Surgical debridement of apocrine glands often required for deeper disease. **Hurley's Classification: Stage 1**- abscess formation, single or multiple. **Stage 2**- recurrent abscesses with tract formation or scarring (cicatrisation). **Stage 3**- diffuse involvement; wide excision recommended.

Case 209

A 50 year old diabetic patient with a history of insulin dependence and non-compliance presents with an enlarging, painful scrotum, in the setting of high fevers and chills. In his history, he noted that he had recently been “popping” a

few pimples on his scrotum with his diabetic lancets. You diagnose Fournier's Gangrene, a form of **necrotizing fasciitis**.



Necrotizing Fasciitis- surgical emergency. Severe infection of subcutaneous tissue that infects fascia and fat. Risks--trauma, diabetes, and surgery. 1 to 4 day incubation period. Edematous, necrotic skin/subcutaneous, doesn't affect muscles. 80% have gas formation. Polymicrobial organisms, but especially Beta Streptococci (Grps. A, B, G), Staph or anaerobes (Clostridia). Multiple surgical debridements often required. Fournier's gangrene--perineal, scrotal, or labial involvement.

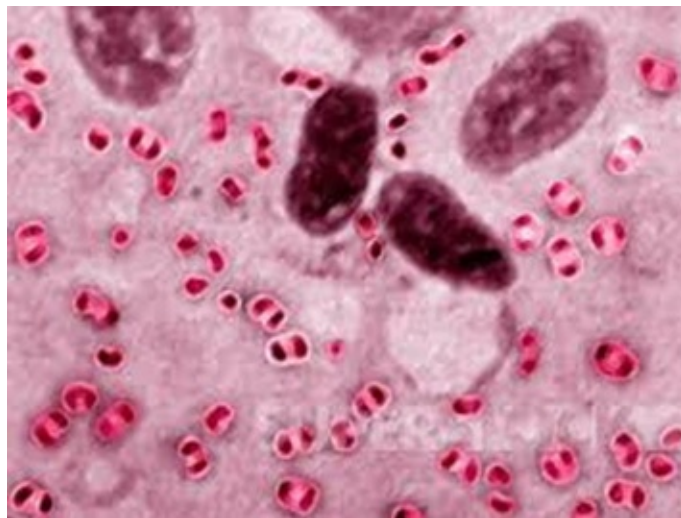
Case 210

A 35 year old male got in a "bar fight" at a local tavern. His assailant bit the patient's right hand. He went to the ER where the wound was cleaned and loosely sutured. He was sent home on Clindamycin, and because of increased pain and drainage, he returned back to the ER two days later for further evaluation of his **bite infection**. The following picture shows: Human bite, infected, after suturing.



Human Bite Infections- look for *Eikenella* (resistant to clindamycin; gram neg rod), strep. Mouth flora such as *Peptostreptococci*, *Fusobacterium*, *Prevotella*, *Veillonella*, *Bacteroides*. If near joints, watch for septic arthritis. Rx- augmentin or cefuroxime.

Dog/Cat Bite Infections- think about Rabies in bat, raccoon, skunk, fox, and coyote bites. Specific to cats- Cat Scratch Disease caused by *Bartonella henselae*. A recent study showed that 1,000 Americans per day are treated in emergency rooms as a result of dog bite. Watch for: *Pasteurella multocida*- seen in 50% of cat/dog bite wounds. *Capnocytophaga canimorsus* species- can cause septic shock. Alpha-streptococci. Staphylococci. The following stain shows: *P. multocida*- a gram neg coccobacillus



Case 211

A 16 year old varsity football player comes to you with recurrent “boils” that often require I & D, though never hospitalized. He has had 3 episodes in the last 3 months; since the middle of football season. They have occurred on the right leg. One other player on the team has the same problem. You culture **MRSA**.

MRSA infections- though many people are colonized with MRSA, a small % show overt signs of infections. Abscesses to be deeper (“spider bite”), and can recur. PVL (Panton-Valentine-Leukocidin) toxin “digs deep”. **MRSA microbiology-** 1961- first seen. Mediated by PBP-2a, encoded by mecA gene, located on a mobile genetic element called Staph chromosome cassette (SCCmec). One clone accounted for most MRSA in the 1960s, now at least five clones have emerged worldwide as of 2002. **Risk Factors for MRSA-** Lacerations/abrasions. Tattoos/IV drug use. Cosmetic body shaving. Sharing equipment. Physical contact with MRSA carriers. Pets can carry MRSA. **Colonization of MRSA-** the anterior nares is the most common site of MRSA colonization. A majority of individuals with nasal colonization are also colonized on other areas. **Health care workers-** In a study of cultures from 200 stethoscope ear tips, 80% were contaminated with microorganisms. Among the positive cultures, 58% were Staph species; and 17% were MRSA. The following picture shows: This debrided MRSA infection occurred over a 24 hour span



Case 212

77 y/o female presents to ER from home - unresponsive, respiratory distress, and intubated in septic shock upon arrival to ER. Pt noted to have a large, foul-smelling Stage 4 **infected sacral decubitus ulcer** >10cm in diameter. Blood cultures grew *Clostridium ramosum*. The patient eventually expired.

Infected Decubitus Ulcers- most commonly found on pressure areas. (often malnutrition also) Easily become infected if near rectum. Look for wound slough which must be debrided. Local debridement by pulse (hydro) therapy/PT, or formal surgical debridement. Must rule out deep infection such as osteomyelitis. Good local wound care. 6 weeks antibiotics- oral or IV, especially if osteo present. Wound vac may be helpful when wound has 75% granulation tissue. Optimize nutrition. Polymicrobial- anaerobes/staph/strep/gram neg aerobes. “Depressurize” the area. Staging of Decubiti- Stage I ulcers exhibit an area of: Intact skin blanchable erythema that dissipates within 24 hours of removing pressure and results from hyperemia, warmth and inflammation As the lesion progresses, the area may no longer blanch and eventually turn white due to lack of blood flow.

Stage II ulcers exhibit an area of: breakdown of the epidermis and possibly the superficial dermis. Appears as abrasion, blister, or superficial ulcer. Stage III ulcers exhibit an area of: decomposition into the subcutaneous tissue, but not into the fascia. Appears as a crater. Neighboring tissue may be undermined. Stage IV ulcers exhibit an area of: necrosis into deeper muscle, bone, tendon, or joint space. Neighboring tissue is often undermined May present with sinus tracts Pt. at risk for osteomyelitis and pathologic fractures.

Case 213

A 25 year old female comes to see you with a painful forefinger. She states that shortly after starting her waitressing job two years ago, she has had recurrent infections of the same finger with symptoms of redness, clear drainage, swelling, itching and pain. She has had 5 recurrences. You suspect **Herpetic Whitlow**.



Herpetic whitlow is often misdiagnosed as recurrent paronychia/cellulitis. HSV-1 is the responsible pathogen.

Case 214

A 50 year old patient with Type II diabetes presents to your office with an irritated, itchy rash on his feet. It is a **papulosquamous rash** and you suspect tinea pedis.



Papulosquamous Eruptions- Differential diagnoses of a papulosquamous rashes include: Tinea. Lichen planus. Secondary syphilis. Eczema. Drug

eruption. Psoriasis.

Case 215

A 60 year old obese male autoparts store worker has varicose veins and chronic edema. He presents with malodourous **infected venous ulcers** for treatment.



Infected Venous Stasis Ulcers- the mainstays of treatment include: Wound debridement to vital, granulating tissue. Rx with topic/systemic antibiotics. Check cultures. Minimizing edema. Maximize circulation.

Case 216

A 78 yr old man with cardiac disease presented with pain in the right great toe of several hours duration. He denied trauma and was admitted to poorly controlled diabetes. Several hours later he developed severe pain, ecchymoses, blistering and crepitus of the forefoot. He became unresponsive and hypotensive. X-rays showed gas in the soft tissue. A diagnosis of **Gas Gangrene** is made.



Clostridial myonecrosis (Gas Gangrene)- Gas gangrene is a **surgical emergency** and requires prompt debridement of dead muscle. Many procedures may be needed. Myonecrosis is caused by alpha toxin produced by the organism. The toxin is a zinc metallo-phospholipase which “turns on” arachidonic acid. Treat with beta-lactam antibiotics (Zosyn) which are effective for Clostridia.

Case 217

A 27 year old male comes in after a mishap 14 days ago when his cat scratched him deeply on the right forearm. He developed fever, elbow pain, and fluctuant epitrochlear lymphadenopathy. Soft tissue abscess is drained x 2; and cultures are negative. Bartonella hensalae IgM titers are >1:1000. You diagnose suppurative **Cat Scratch Disease**. What antibiotics would you choose? The following picture shows: Fluctuant abscess near the elbow joint



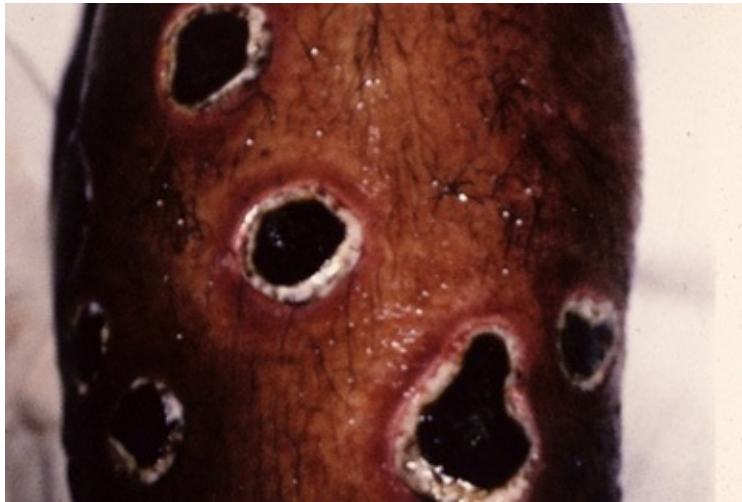
Pathology- Cat Scratch Disease- usually local infection involving lymph nodes; small pleomorphic organism. Cats serve as natural reservoir. Once in humans, the organism invades endothelial cells. Sensitive to penicillins, macrolides, sulfa, and tetracyclines. 90% of CSD presents in children as a localized cutaneous and tender lymph node disorder near the organism inoculation site. Generally self-limited; but nodes can last days to months. In some individuals, dissemination to spleen, liver, eye can occur. Look for sepsis, pneumonia, CNS-encephalopathy or TM in the elderly.

Causes of cutaneous inoculation with lymphadenopathy- Atypical mycobacteria- (*Mycobacterium fortuitum* or *M. marinum*- fish fin injury) Nocardia-soil injury. Francisella tularensis- rabbit fever or lawnmower's disease-ticks, deerflies, or mosquito vectors. Erysipelothrix rhusiopathiae- abrasions from fish/raw meat. Sporotrichosis-rose thorns, fish hooks. Bacillus anthracis-wool sorter's disease- exposure to wool, skin, or meat. Yersinia pestis- spread by fleas. Borrelia burgdorferi- tick borne. Bartonella hensalae- cat scratch.

Case 218

A elderly male with a 6 month history of acute myelogenous leukemia presents to the hospital with temp to 104 degrees, and an absolute PMN count of 200. (patient just finished his 4th round of chemotherapy). Blood cultures are positive

for *Pseudomonas aeruginosa*. The patient notes painful, expanding skin lesions on his shins. You diagnose **ecthyma gangrenosum**.



Ecthyma gangrenosum secondary to *Pseudomonas*. “Grape-like” smell; venulitis. *Pseudomonas aeruginosa* is a virulent gram negative rod, water-loving and responsible for many nosocomial infections.

Case 219

A 75 year old patient who lives in a nursing home has malnutrition secondary to Alzheimer’s dementia. She presents in an **infected heel ulcer**.

Principles of therapy include: Remove pressure! Improve nutrition. Culture drainage and Rx specific pathogen. Remove eschar to prevent undermining. Daily wound care. Assess depth of infection. Poor circulation in area. If down to bone, may need skin and muscle flap.

Case 220

A 60 year old patient with cirrhosis presents to you with nausea, diarrhea, fever, abdominal pain, and a blistering cellulitis of the legs. You suspect **Vibrio vulnificus** after he tells you that he just got back from Seattle and ate his favorite delicacy: raw oysters.

Vibrio vulnificus- a gram negative curved rod discovered in 1976, is found in

brackish water, ponds, and coastal areas. (especially Pacific Northwest) It enters the human by ingestion (oysters) or open skin sores or puncture wound by fish spines of tilapia. It causes a blistering cellulitis that looks like pemphigoid.

High incidence of bacteremia in patients with chronic liver disease like cirrhosis
Rx with Ceftazidime IV with a quinolone or doxycycline.

Rare pathogen- *Aeromonas hydrophilia* is a gram negative aerobe that causes severe cellulitis and myonecrosis. It produces aerolysin toxin, lipase, and hemolysin. It is often obtained through ingestion of sea food or contaminated food products. Treat with tetracyclines or sulfa.

193. The main difference between *S. aureus* and Streptococcal cellulitis is:

- A. MRSA cellulitis often involves an abscess
- B. Strep patients only have infections in the lower extremities
- C. Strep often has a deep cherry red rash, rather than pink
- D. There is no distinction
- E. A or C

194. A main concern of facial cellulitis is:

- A. Central venous thrombosis
- B. Orbital cellulitis
- C. Pharyngitis
- D. Retropharyngeal abscess
- E. Staph pneumonia
- F. A and B

195. A common association with infected diabetic foot ulcers is:

- A. Tinea pedis
- B. Onychomycosis
- C. Corns
- D. Beta strep
- E. A and B and D
- F. Peptic disease

196. What would be considered an appropriate first step when treating someone with cellulitis and wound dehiscence of a vein graft?

- A. Wound vac
- B. Surgery right away to debride tissue
- C. Antibiotics only
- D. Pack wound until it heals by secondary intention.
- E. Hyperbaric treatment

197. What is the difference between Stage 2 and Stage 3 in Hidradenitis Suppurativa?

- A. Stage 2 is a single abscess
- B. Stage 2 is a recurrent abscess with tracts
- C. Stage 3 doesn't involve any tracts
- D. There are only minor changes that does not change your medical therapy

198. Necrotizing fasciitis does not involve the muscle layer.

True (T) or False (F)

199. What bacteria must you worry about with a dog bite?

- A. Pasteurella multocida
- B. Gapnocytophaga
- C. Bartonella
- D. Francisella tularensis
- E. Doganella bitasemia

200. Your patient was bit by a cat. What outpatient antibiotic do you use?

- A. Amoxicillin
- B. Cefuroxime
- C. Augmentin
- D. Bactrim
- E. PCN
- F. Cephalexin
- G. B or C

201. What is the main reason that MRSA penetrates deep into tissue?

- A. It's resilient peptidoglycan layer
- B. PVL toxin
- C. The lipophilic layer
- D. MEC gene
- E. It likes the explore the depths of the universe

202. Stage 3 decubitus ulcers involve?

- A. Subcutaneous tissue, not fascia

- B. The fascial layer
- C. Only the dermis
- D. Seeds into the bone
- E. None of the above

203. Venous stasis ulcers are usually found on?

- A. Medial malleolus
- B. Lateral malleolus
- C. Lateral cutaneous nerve distribution
- D. Posterior popliteal area
- E. The little finger

204. Treatment for Clostridial myonecrosis first includes:

- A. PCN
- B. Zosyn
- C. Augmentin
- D. Vancomycin
- E. Surgical treatment

205. Bartonella hensalae has which reservoir?

- A. Cat
- B. Dog
- C. Pig
- D. Raccoon
- E. Rabbit
- F. Champanzee

206. Which of the following is true of furunculitis/carbunuculitis/skin abscesses? Pick all that apply.

- A) All are caused by MRSA
- B) Cure for furunculitis is I&D
- C) Antibiotics are the same as if you were treating cellulitis
- D) There are no prevention strategies
- E) B or C

Answers:

193. **E** 194. **F** 195. **E** 196. **B** 197. **B** 198. **True** 199. **A** 200. **G** 201. **B** 202. **A** 203. **A** 204. **E** 205. **A** 206. **E**

Vaccines

Introduction- Vaccines are effective! Diphtheria- disease down 99.99%, Measles- down 99.98%, Mumps- down 99.8%, Polio-down 99.99%, Tetanus- down 98%, H.flu- down 99.2%, Rubella- down 99.7%, Pertussis- down 95%

Dosing Schedule in Adults-

INDICATION ▶		Immunocompromising conditions (excluding human immunodeficiency virus [HIV]) ^{3-5,12}	HIV infection ^{3-5,12,13} CD4* T lymphocyte count	Diabetes, heart disease, chronic lung disease, chronic alcoholism	Asplenia ¹³ (including elective splenectomy and persistent complement component deficiencies)	Chronic liver disease	Kidney failure, end-stage renal disease, receipt of hemodialysis	Health-care personnel	
VACCINE ▼	Pregnancy	<200 cells/μL	≥200 cells/μL						
Tetanus, diphtheria, pertussis (Td/Tdap) ^{1,*}	Td	Substitute one-time dose of Tdap for Td booster; then boost with Td every 10 years							
Human papillomavirus ^{2,*}		3 doses for females through age 26 years							
Varicella ^{3,*}	Contraindicated	2 doses							
Zoster ⁴	Contraindicated	1 dose							
Measles, mumps, rubella ^{5,*}	Contraindicated	1 or 2 doses							
Influenza ^{6,*}		1 dose TIV annually							1 dose TIV or LAIV annually
Pneumococcal (polysaccharide) ^{7,8}		1 or 2 doses							
Hepatitis A ^{9,*}		2 doses							
Hepatitis B ^{10,*}		3 doses							
Meningococcal ^{11,*}		1 or more doses							

* Covered by the Vaccine Injury Compensation Program.

For all persons in this category who meet the age requirements and who lack evidence of immunity (e.g., lack documentation of vaccination or have no evidence of prior infection)

Recommended if some other risk factor is present (e.g., based on medical, occupational, lifestyle, or other indications)

No recommendation

Case 221

A 65 year old comes in for a physical exam. He works construction for Habitat for Humanity and builds houses. You recommend a **Tdap, pneumovax** vaccination. Since it is the end of October, you also suggest a flu shot.

Tetanus- (Tdap)- contains diphtheria and acellular pertussis also - approved 2005. Booster every 5-10 yrs. **Pneumovax-** 60% effective. Under-utilized. Start at age 65 unless immunosuppressed with COPD or asthma, etc. Revaccinate

every 5 years and x1 at five years out after 65. 23-valent *pneumococcal polysaccharide vaccine* has been used since 1983. There is a new 13-valent *pneumococcal conjugate vaccine- more immunogenic (PCV13; previously Prevnar-PCV7 for children)* This is recommended for immunosuppressed patients over age 19. Influenza- trivalent vaccine (2-A, 1-B). 70% effective. Not a live vaccine parenterally. Safe in pregnancy. Give late October, early November.

PERSONS FOR WHOM PNEUMOCOCCAL POLYSACCHARIDE VACCINE IS RECOMMENDED ¹²	
●	All persons aged ≥ 65 years
●	Persons aged 2 to 64 years with:
●	Chronic cardiovascular or pulmonary disease
●	Functional or anatomic asplenia
●	Cerebrospinal fluid leak
●	Immunocompromising illness or medication, including:
●	HIV infection or AIDS
●	Malignancy
●	Chronic renal failure or nephrotic syndrome
●	Organ or bone marrow transplantation

Table 3

New Guidelines for Pneumococcal Vaccine: Sept. 2010-Includes: Cigarette smoking. 50% of adults with IPD. Asthma-7% of adults; risk for IPD is twice as high. PCV-13 is the *newer Pneumococcal Conjugate Vaccine*.

PPSV-23 (Pneumovax-Merck; Pneumococcal Polysaccharide Vaccine 23 valent)

- Efficacy best for healthy younger adults
- Affords a 50-75% protection for adults
- Efficacy for the elderly *is not established and multiple revaccinations are not recommended.*
- **RULE #1:** High risk adults ages 19-64 should receive **ONE** single dose of PPSV23, **a booster in 5 years** and no more!
- **RULE #2:** Adults at 65 should receive **ONE** single dose of PPSV23.
- **RULE #3:** **NO** doses of PPSV-23 after age 65 unless there needs to be a “catch up”.
- **Rule #4:** 5 years between PPSV23 doses is necessary

PCV13 (Pevnar13)

- On June 20, 2012, the ACIP recommended that all **high risk adults 19-64** should receive a PCV13 **in addition to** the 23-valent PPSV23 vaccine
- Immunogenicity of PCV13 is similar to PPSV23
- For Pneumococcal Vaccine naïve patients:
 - **RULE #1-** High risk adults ages 19-64 should receive **ONE** single dose of PCV13, followed PPSV23 vaccine eight (8) weeks later, and one booster of PPSV23 in 5 years and no more before age 65, but may repeat PPSV23 at age 65.
- For previous PPSV23 vaccinated persons:
 - **RULE #2 –** High risk adults ages 19-64 should be given **ONE** dose of PCV13 > 1 year after the last PPSV23. For those who require additional doses of PPSV23, it should be given no sooner than 8 weeks after PCV13.

Case 222

A 21 year old Peace Corp worker is leaving for rural Kenya for a 2 year trip. You recommend update on **Tdap, MMR, IPV, Meningococcal vaccine, Hepatitis A vaccine, Vivotif (TF Vaccine), Yellow Fever vaccine.** He had his Hepatitis B vaccine as a peri-newborn.

Inactivated Polio Vaccine (IPV)- given to travelers traveling to developing countries, especially Africa and India. Need two boosters for immunity. Meningococcal- conjugate vaccine (MCV)- ages 2 to 55. Polysaccharide vaccine (MPSV) - > 56 years old. Booster q 5 yrs. Give to dorm students, military recruits, asplenic patients, travelers to endemic zones- especially equatorial Africa. Hepatitis A- 95% effective. Give at time 0, booster in 6-12 months. Give to high risk patients (travelers, MSM patients, chronic liver disease patients. Typhoid vaccine- use for travelers to developing countries. The oral vaccine, Vivotif is live attenuated. Give boosters every 5 years. Injectable-polysaccharide Vi- q 2 ½ years booster.

Yellow Fever Vaccine- YF is a hemorrhagic virus. High risk to travelers to equator areas of Africa, South America need it. YFV is a live vaccine. Life time protection. Risk for liver problems from the vaccine is extremely low. TwinRix- (Hep A/Hep B)- covers both viruses, use for high risk travel, or high risk individuals.

Meningococcal Disease- about 1000-2000 cases of meningococcal disease occur in the US each year. The case fatality rate is 10% for meningitis, and 40% for meningococemia. Five major serogroups are A,B,C,Y, and W-135. B is not covered in any of the 3 quadrivalent vaccines- **Menomune** (contains *unconjugated* polysaccharides), **Menactra**, and **Menveo**. **Menactra** and **Menveo** are *conjugated* and approved for adults <55 years old. Vaccination is recommended for adolescents 11-18 years old, functional asplenia, and college dorm students. Travelers to the meningitis belt of sub-Saharan Africa need it. Also the government of Saudi Arabia requires it for pilgrims during the annual *Hajj*. Use the unconjugated vaccine if the patient is over 55 years of age. Immunity wanes after 3 years.

Case 223

The same Peace Corp worker (as in Case 2) comes back 2 years later and decides to go to Vietnam for 6 months to work at a village in the jungle. You

recommend **Japanese Encephalitis Vaccine**, and warn him about mosquito exposure (*Culex vishnui* spreads it).

JEV (Japanese Encephalitis Vaccine)- used for travelers to Southeast Asia for >4 weeks. *JE-VAX* is used for 1-16 year olds, and *IXIARO* is used for 17 y/o and older-2 dose schedule 28 days apart.

Case 224

A 52 year old comes in for a physical exam and asks for a **Shingles Vaccine**. Her elderly great aunt just had a painful case of ophthalmic shingles and she wants to prevent it in the future. She had chicken pox as a child.

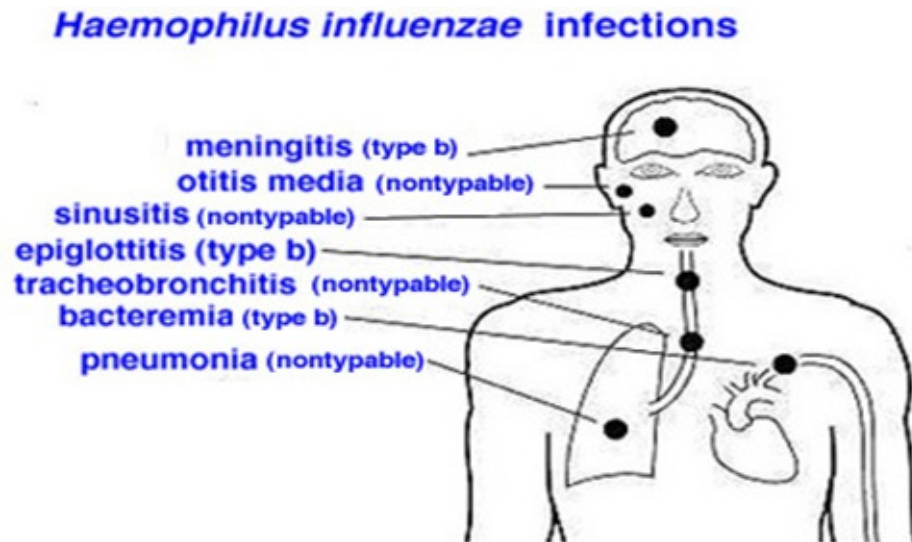
Shingles- 1 million cases/year. Increase risk as one ages, and post-herpetic neuralgia increases. HVZ vaccine- safe, effective. 5X more concentrated than Chicken pox vaccine. Live attenuated. Don't use if immuno- suppressed. The Vaccine is recommended for adults > 50 years old who have had chicken pox, 1 dose. 50% reduction in disease, 60% decrease in post-herpetic neuropathy. LIVE vaccine.

Chicken Pox Vaccine- persons born in the US before 1980 are considered immune to Chicken Pox (Varicella). Two doses of live vaccine, separated by at least 4 weeks, are recommended for non-immune adults. Varicella vaccine was introduced to pediatrics in 1995. It is contraindicated in pregnancy and immunosuppressed patients.

Case 225

A 25 year old male is involved in a severe motor vehicle accident while driving his motorcycle. Because of internal injuries, a splenectomy is performed. As his PMD, you recommend a **Pneumovax, Hib vaccine (Haemophilus influenza type B vaccine), and Meningococcal Vaccine** every 5 years for the rest of his life. Each of these 3 bacteria are encapsulated and dependent on spleen function for proper immunity.

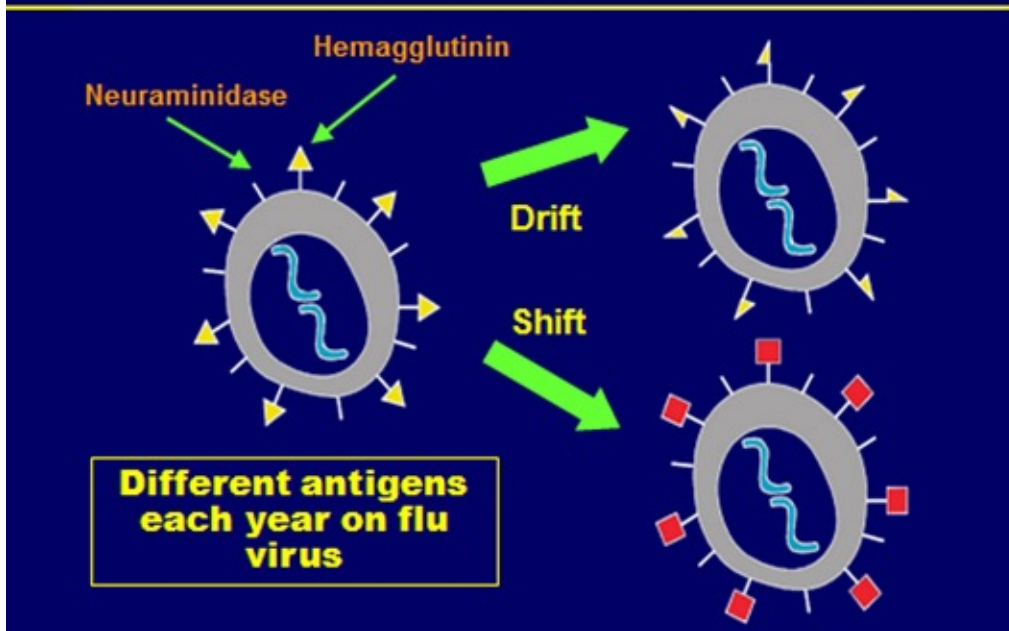
Haemophilus influenzae Vaccine (Hib)- introduced in 1985. There has been a >99% reduction of H. flu illnesses like epiglottitis and pneumonia. (especially the dreaded H. flu meningitis). Although given to children, invasive Hib has also decreased in adults.



Case 226

J.P. is a 70 year old smoker who comes in for his physical exam in October. He smokes a pack of Marlboros/day. He hates going to doctors, having labs drawn, and generally hates needles. He detests vaccines, and “having anything foreign going in me”. You recommend an **influenza vaccine** and discuss its advantages. The following schematic shows the principle of “drift and shift” that occurs yearly with the H and N antigens. H and N Antigens Change Each year and are covered in the trivalent/quadrivalent vaccine

Influenza: Antigenic Drift and Shift



Flu Vaccinations are effective, but not perfect- Large Studies have shown reduction of employee absence rates- 2006-2007 absence rate was 9.14 per 100 employees. In 2011-2012 98% of HCWs received influenza vaccination. 2011-2012 absence rate dropped to 6.15 per 100 ($p=0.0004$) Decreased risk of influenza for patients- 100% HCWs vaccination rate indicated a 43% decline in patient risk for contracting influenza. Nursing home patients' risk declined even more and showed a drop of 60% risk of contracting influenza. The Main Point: HCWs should get vaccinated not to reduce their risk of contracting the flu but reduce their patient's risk of contracting the flu.

- **Influenza Vaccine Program**-the CDC recommends people 6 months and older get the vaccine. Children aged 6 months (6 months to 35 months receive 0.25 ml of TIV (Trivalent Inactivated Vaccine); older receive 0.5 ml) to 8 years receive 2 vaccines, 4 months apart. The intranasal, live attenuated vaccine (LAIV) is intended for non-pregnant, individuals aged 2-49. There is no preference, but people with egg allergy should receive the TIV. The CDC has approved a **quadra-valent** influenza (two A and two B strains) vaccine for 2013-2014. (research since 2009)
There is now (as of 2014) a high dose (60 mcg of hemagglutinin; HD) flu vaccine that is more protective in people > 65 years old. Standard doses are 15 mcg of hemagglutinin)

Hepatitis A vaccine- 95% effective. Give at time 0, booster in 6-12 months.

Give to high risk patients (travelers, MSM patients, chronic liver disease)

patients.

Hepatitis B vaccine- Dose 0, 5 months, 6 months. It is a STD. High risk-healthcare workers, HIV pts, dialysis patients, chronic liver disease patients.

HPV vaccine- causes genital warts.(types 6,11)- Most cases of cervical cancer associated with human papillomavirus -16. STD. 1 million new cases/year. 11,000 cases/yr. cervical cancer. Quadrivalent vaccine (Gardasil)- 3 dose regimen (0,1,6 months). Males and females. Ages 11-26. Cervarix- bivalent vaccine covers serotypes16,18-females. 2015- FAD approved Gardasi-9, a recombinant HPV- 9 valent vaccine (additional- types 31, 33, 45, 52, and 58).

207. Which of the following vaccines are live attenuated vaccines?

- a) Typhoid vaccine (Vivotif)
- b) Yellow Fever vaccine
- c) Meningococcal vaccine
- d) Both A and B
- e) All of the above

208. For which patients is the meningitis vaccine recommended?

- a) Patients with functional asplenia
- b) Patients traveling to sub-Saharan Africa
- c) Patients between the ages of 11-18
- d) All of the above

209. A 22-year old patient is traveling to Southeast Asia for 3 weeks. Which type of the Japanese Encephalitis Vaccine would you recommend?

- a) The IXIARO vaccine
- b) The JE-VAX vaccine
- c) These vaccines would be equally efficacious
- d) No vaccine is recommended for this patient

210. At what age should the administration of the shingles vaccine begin?

- a) 60
- b) 55
- c) 50
- d) 50 if immunosuppressed, but otherwise age 60
- e) There is no proven benefit to the shingles vaccine, so it is not recommended

f) Age 72 ½ is the best time.

211. Which of the following vaccines **IS NOT** contraindicated during pregnancy

- a) MMR vaccine
- b) Zoster Vaccine
- c) Influenza vaccine
- d) Varicella Vaccine
- e) All of the above vaccines are contraindicated in pregnancy

212. Which of the following is true of the live attenuated influenza virus vaccine ?

- a) It can be given to pregnant women
- b) It should be administered to anyone over the age of 6 months
- c) It is delivered through the intranasal route

Answers:

207. **D** 208. **D** 209. **D** 210. **D** 211. **C** 212. **C**

Principles of Patient Care

- .) The patients will tell/show you (most of the time) how sick they are. Listen to them and learn to observe. See Sherlock Holmes' quotes below.
- .) Know what questions to ask your patients. See Sherlock Holmes
- .) Don't treat yourself, treat the patient. For example, when positive cultures come back, treat the actual cultures and not what they should be.
- .) Don't treat the temperature, treat the patient.
- .) Don't treat the WBC count, treat the patient.
- .) Divorce yourself from empiric treatment as soon as possible.
- .) Before you think that antibiotics will work, drain all pus and remove/debride necrotic matter.
- .) Realism is best for patients and their families; don't pretend to be a saviour.
- .) Always give hope to your patients; but realism is best and foremost.
- 0.) Affected hardware (meshes, grafts, lines, prostheses) is infected hardware, and should be removed if you expect the patient to get better.
- 1.) Patients will often get better inspite of your care, so don't take the credit.
- 2.) Using "gorillacillins" can be a sign of a lack of brain activity in the prescriber, and a form a "shot-gunning". Use the safest, oldest, and most specific antibiotic you can as soon as possible.

13.) **Occam's (or Ockham) Razor**- Law of succinctness- use the simplest explanation of an effect. Very common principle in medical diagnoses. Remember it. Don't complicate things. There is probably one diagnosis with many effects rather than many diagnoses. Attributed to 14th century English logician and Franciscan friar Father William of Ockham.

"We are to admit no more causes of natural things than such as are both true and sufficient to explain their appearances."



14.) **Regarding a diagnosis-** when a horse is “running past you”, call it a horse and not a zebra.

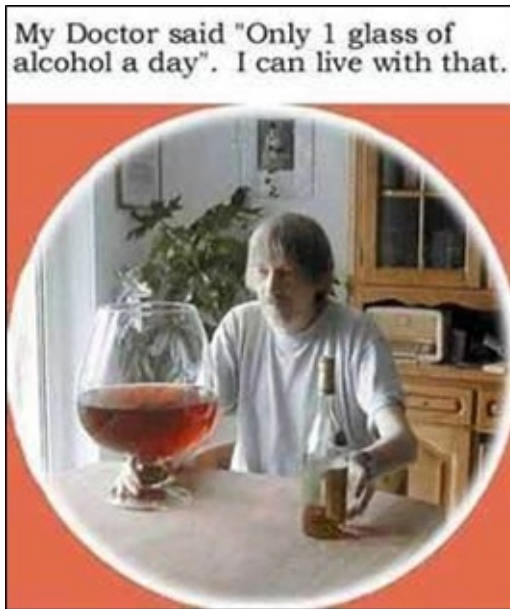


In other words, look for the common diagnosis first before you look for a rarer diagnosis. For example, a cellulitis of the leg from MSSA or beta-strep is much more common than cellulitis from *Vibrio vulnificus*. Don't look for *Vibrio* initially unless there are extenuating circumstances.

However, when calling a horse a horse first, but don't get married to the diagnosis if patients don't respond appropriately. Don't be stubborn. You may

have to change diagnoses.

15.) **Be an Accurate History Taker-** Develop this important skill. For example, when asked about alcoholic beverage intake, each of these men said they drank only one alcoholic beverage a week: There IS a difference. Get the point. In the following pictures, note this: Each of these men drinks one alcoholic beverage per week! The difference is volume!



What We Can Learn From Sherlock Holmes-(On Being a More Complete Healthcare Practitioner, by Dr. Gullberg)

- 1) Dr. Watson to Sherlock Holmes- “I am baffled...when I hear you give your reasons, your deductions seem to be so ridiculously simple that I could easily do it myself, though at each successive instance of your reasoning I am baffled until you explain your process. And yet I believe that my eyes are as good as yours.” Sherlock’s response: “Quite so, my dear Watson. You see, but *you do not observe*. The distinction is clear. For example, you have frequently seen the steps which lead up the hall to this room, at least one hundred times. Tell me then, how many steps are there?” Dr. Watson: “How many? I don’t know. I have no idea.” Sherlock: “Quite so! You have not observed. And yet you have seen. That is just my point. Now, I know that there are 17 steps, because I have both seen and observed.”—from *A Scandal in Bohemia*.

Conclusion: Don’t just look at the patient; observe them.

- 2) Dr. Watson on Sherlock: “Here I had heard what he heard, I had seen what he had seen, and yet from his words it was evident that he saw clearly not only what had happened but what was about to happen, while to me the whole business was still confused.”- from *The Red-Headed League*. Sherlock Holmes to Dr. Watson: “Elementary, my dear Watson. It is one of those instances where the reasoner can produce an effect which seems remarkable to his neighbor, because the latter has missed the one little point which is the basis of the deduction.”- from *The Crooked Man*. Sherlock Holmes: “I am glad to have all of the details, whether they seem important to you (the client) or not.” -from *The Adventure of Copper Beaches*

Conclusion: Deduce the problem by searching the details.

- 3) Sherlock Holmes: “I had come to conclusions (on the case) before I ever entered the room.” -from *The Adventure of the Speckled Band*

Conclusion: Know what you are looking for before you enter the patient’s room and what questions you are going to ask.

About the Author and the Case Studies Book

Robert M. Gullberg M.D., F.A.C.P., grew up in Park Ridge, Illinois. He was educated at Northwestern University with B.S. degree in inorganic Chemistry. He attended the University of Illinois Medical School and graduated in 1981. He did his internship and residency in Internal Medicine at the Evanston Hospital, then affiliated with Northwestern University Medical School. That was followed by a Fellowship in Infectious Diseases at Northwestern University in Chicago, Illinois where he was mentored by Dr. John Phair, Dr. Grant Westenfelder, Dr. Fran Cook, and Dr. Rob Murphy.

He has practiced the subspecialty of Infectious Diseases in the Community Hospital setting for several decades. During that time, he has trained hundreds of medical students, PA students, and nursing students of all levels. He is an active lecturer in clinical areas of Clinical Infectious Diseases.

Because of his years of experience, Dr. Gullberg understands what students should know regarding the core of Infectious Diseases. Dr. Gullberg has found that case studies are the best way to get grounded in this extremely interesting field of medicine. In this case studies book, he has selected over 200 pertinent cases in 20 different areas in the subspecialty of Infectious Diseases.

There are over *200 multiple choice questions/answers* throughout the book that will aid the student in preparation for board review in each of the 20 Categories.

The book is a bottom line format, and should be a very helpful tool for quick reference and learning. It contains Dr. Gullberg's pearls of wisdom that he has learned over the decades. However, it is not a complete source on these complex

topics. There are always the standard, more detailed textbooks that can be reviewed online or at the medical library. As Dr. Gullberg quotes the detective Sherlock Holmes, “A man (or woman) should keep his/her little brain attic stocked with all the furniture that he is likely to use, and the rest he can put away in the lumber-room of his library where he can get it if he wants it.”

The resources are numerous to count, and many are the physicians who have mentored Dr. Gullberg over the last three decades.

A special thank you to Mark Albertini for his assistance with the numerous photographs in this e-book.