Infectious Diseases

Antibiotics

Infectious Disease – Nurse Monitoring

- Clinical response: improvement in signs and symptoms (fever, WBC count, infection site)
- Adverse effects: GI upset, rash, allergic reactions, anaphylaxis
- Renal function: serum creatinine, urine output (especially aminoglycosides, vancomycin)
- Hepatic function: AST/ALT, bilirubin for hepatotoxic agents (e.g., macrolides, rifampin)

Infectious Disease – Nurse Monitoring

- Superinfection: C. difficile–associated diarrhea, oral or vaginal candidiasis
- Therapeutic drug levels: peak and trough levels when indicated (vancomycin, aminoglycosides)
- Drug interactions: QT prolongation, warfarin INR changes, seizure risk, binding
- Adherence: correct dose, timing, and completion of full course
- Culture and sensitivity results: ensure appropriate antibiotic selection and de-escalation

Penicillins

- Examples: amoxicillin (Amoxil), amoxicillin/clavulanate (Augmentin), penicillin (Permapen), ampicillin (Unasyn), nafcillin (Nallpen), dicloxacillin (Dycill), piperacillin/tazobactam (Zosyn), ticarcillin/clavulanate (Timentin)
- Mechanism of Action: Binds penicillin binding proteins in bacterial cell wall, leading to inhibition of cell wall formation and death of bacteria
- Beta-lactamase inhibitors – often used in combination with penicillin and cephalosporin antibiotics to prevent the bacteria from breaking down the antibiotics with enzymatic processes
  - Clavulanic acid, cilastatin, sulbactam, avibactam, tazobactam
- Side effects: GI, rash, itch/hives

Macrolides

- Examples: azithromycin (Zithromax), clarithromycin (Biaxin), erythromycin (Ery-tab)
- Mechanism of Action: Binds to the 23s ribosomal RNA molecule of the 50s subunit which ultimately inhibits bacterial protein synthesis and proliferation
- Side effects: GI, QTc prolongation risk, rare liver concerns
- Clarithromycin, erythromycin often avoided due to significant CYP3A4 interactions

Quinolones

- Examples: ciprofloxacin (Cipro), levofloxacin (Levaquin), moxifloxacin (Avelox), ofloxacin (Ocuflox), gatifloxacin (Zymaxid, Zymar)
- Mechanism of Action: Inhibits DNA gyrase/topoisomerase which prevents the uncoiling of DNA necessary for bacterial replication
- Side effects: Boxed warning for tendon rupture, CNS effects, and neuropathy, QTc prolongation risk (topical eye and ear preparations likely do not share these risks)
- Generally considered a “bigger gun”, reserved for more resistant bugs and patients at higher risk for hospitalization/complication
  - FDA warnings on avoiding use for less serious infections like sinusitis, uncomplicated UTI’s, bronchitis
- QTc prolongation risk
- Spontaneous tendon rupture
- Peripheral neuropathy risk (can be irreversible)
- Binding interactions (i.e. iron, calcium etc.)

Cephalosporins

- Examples:
  - 1st Generation: cefadroxil (Duricef), cephalexin (Keflex), cefazolin (Ancef),
  - 2nd Generation: cefaclor (Ceclor), cefuroxime (Ceftin, Zinacef), cefotetan (Cefotan), Cefprozil (Cefzil)
  - 3rd Generation: ceftriaxone (Rocephin), ceftazidime (Fortaz), cefotaxime (Claforan), cefdinir (Omnicef), Cefixime (Suprax)
  - 4th Generation: cefepime (Maxipime)
  - 5th Generation: Ceftaroline (Teflaro)
- Mechanism of Action: Binds penicillin binding proteins in bacterial cell wall, leading to inhibition of cell wall formation and death of bacteria
- Side effects: GI, rash, itch/hives
- Similar side effect profile to penicillins
- In general, newer generation have a broader spectrum which covers more gram negative and resistant bugs

Nitrofurantoin (Macrobid)

- Mechanism of Action: The drug is altered by bacterial flavoproteins and form reactive metabolites that disable ribosomal proteins and other molecules within bacteria
- Need to avoid if poor kidney function which can be a significant number of elderly patients
  - Clinicians may disagree as far as what CrCl is acceptable to use in (<30 ml/min is contraindicated for sure at this time)
- Educate about change in urine color (brownish/orange)
- Rare side effects
  - CNS changes in the elderly, especially with poor kidney function
  - Neuropathy
  - Respiratory distress

Tetracyclines

- Doxycycline (Vibramycin), tetracycline
- Mechanism of Action: Inhibits protein synthesis by binding the 30s ribosomal subunit
- Depending upon indication, sometimes used if patient has penicillin allergy
- Nice oral option for outpatient therapy for CAP
- Photosensitivity
- Binding interaction with cations (i.e. iron, calcium, etc.)
- Twice daily dosing
- Option if MRSA suspected or confirmed

Carbapenems

- Imipenem/cilastatin (Primaxin), meropenem/vaborbactam (Vabomere), ertapenem (Invanz), doripenem (Finibax)
- Mechanism of Action: Binds penicillin binding proteins in bacterial cell wall, leading to inhibition of cell wall formation and death of bacteria
- Usually reserved for very severe, resistant infections
- Good coverage for gram positive and gram negatives
  - Generally they do not cover MRSA however
- Side effects; GI, rare impact on liver function, thrombocytosis
- Ertapenem has weak activity against Pseudomonas and Acinetobacter species

Sulfamethoxazole/trimethoprim (Bactrim)

- Mechanism of Action: Inhibits bacterial production of dihydrofolic acid by competitive inhibition of paraaminobenzoic acid
- Potential reaction risks in patients with a true sulfa allergy
- Common adverse effects: GI, rash, sun sensitivity
- Notorious drug interaction with warfarin
- Drink with a glass of water
  - Crystalluria risk
- Dose adjustments in CKD
- Good gram negative coverage

Trimethoprim (Trimpex)

- Mechanism of Action: Inhibits dihydrofolate reductase which prevents formation of bacterial tetrahydrofolic acid, a necessary component for cell growth and reproduction
- Drug interaction with potassium elevating potential (ACE, ARB, Aldosterone antagonists)
- Can impair folic acid absorption and increase risk of deficiency
- Phototoxicity risk
- GI upset
- Rash/increased liver enzymes (rare)

Aminoglycosides

- Gentamicin (Garamycin), tobramycin (Nebcin)
- Mechanism of Action: Inhibition of bacterial protein synthesis by binding to the 30S subunit of bacterial ribosomes
- Excellent gram negative coverage
- Only IV (except topical), no oral dosage forms
- Monitor for nephrotoxicity
- Concentration dependent activity (monitor peak levels for efficacy)
- Trough levels targeted for safety
- Nephrotoxic (kidney) and ototoxic (ear) risk
- Target peaks may range from 3-10 mcg/mL (usually depending upon clinical severity of patient) – closer to 6-10 for life threatening infections

Vancomycin

- Mechanism of Action: Inhibits bacterial cell wall synthesis; it does this by binding D-alanyl, D-alanine groups on peptide chains
- MRSA coverage, other gram positive coverage
- If red man syndrome happens, should be able to slow infusion rate to help treat
- Trough concentration and kidney function are important to help guide dosing
- You should not see this medication taken orally for systemic infections; it has poor oral absorption into the blood circulation through the GI tract (oral vancomycin is reserved for GI infection like C. diff)
- 10-20mcg/ml is target trough level – higher end for more serious/life threatening infections

Linezolid (Zyvox)

- Mechanism of Action: Inhibition of bacterial protein synthesis by bind to 23s subunit as part of the 50s subunit
- MRSA and VRE coverage
- MAOI activity so may need to hold or adjust antidepressants that can increase serotonin (SSRIs, TCAs etc.)
- Oral and IV available
- Expensive
- Rare AE’s like myelosuppression (bone marrow suppression, low WBC etc.) and lactic acidosis

Rifampin (Rifadin)

- Mechanism of Action: Binds to RNA polymerase and blocks bacterial RNA synthesis
- Take on empty stomach
- Many drug interactions - CYP enzyme INDUCER (will lower concentrations of many drugs)
- Can cause body fluids to turn reddish-orange

Daptomycin (Cubicin)

- Mechanism of Action: Inhibits synthesis of DNA, RNA, and protein by causing cell depolarization
- Gram positive coverage, MRSA coverage
- Do not use in pneumonia as drug is inactivated by lung surfactants
- Monitor CPK for risk of rhabdomyolysis
- Higher risk of myopathy/muscle pain if previously on statin, if possible avoid using together
- Other unique side effects: neuropathy, eosinophilic pneumonia

Tigecycline (Tygacil)

- Mechanism of Action: Inhibits bacterial protein synthesis by binding to the 30s ribosomal subunit
- Boxed warning for increased risk for all-cause mortality – generally reserved for cases where other options are not appropriate
- Broad spectrum antibiotic that can be used for MRSA, VRE, ESBL bacteria, and carbapenemase positive bacteria (but not Pseudomonas)
- Common SE – Nausea/vomiting

Metronidazole (Flagyl)

- Mechanism of Action: Damages bacterial DNA which ultimately leads to inhibition of protein synthesis and cell death
- Often used for anaerobic coverage
- Avoid alcohol use – potential disulfiram reaction
- Interaction via 2C9 (warfarin is the big one)
- GI side effects most common
- Can cause abnormal taste

Clindamycin (Cleocin)

- Mechanism of Action: Inhibition of protein synthesis by binding to 50s subunit of ribosomal subunit
- Good coverage against anaerobes
- MRSA coverage
- Frequent administration is kind of a nuisance – usually 3-4 times per day
- Recommended to give with a full glass of water to minimize esophageal ulceration risk
- Topical formulation also available (acne or bacterial vaginosis)
- C. difficile (colitis) risk

Influenza

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Influenza Pearls

- Very contagious
- Institutionalized patients at high risk of transmission
  - Prophylaxis in an outbreak
- Vaccination
- Mutations
- Elderly/young at higher risk for complications
  - Secondary pneumonia

Treatment

- CDC recommends early antiviral treatment in people with flu symptoms who are 65 years and older or otherwise at high risk of developing serious flu illness.”
- High Risk Candidates
  - Diabetes
  - Cancer
  - Immunosuppressed (i.e. HIV)
  - Young Children (<2 y/o)
  - Respiratory disease

Medications

- Oseltamivir (Tamiflu)
  - MOA: Inhibits the influenza neuraminidase enzyme, preventing the release of new viral particles from infected cells and limiting viral spread
  - Sooner the better with treatment (less than 48 hours)
  - Watch kidney function/dose adjustments
  - Lower dose for prophylaxis (75 BID vs. QD)
  - GI, psych changes as most common AE’s

Baloxavir (Xofluza)

- MOA: Inhibits the influenza virus cap-dependent endonuclease, blocking viral mRNA synthesis and preventing viral replication
- Indicated for influenza A and B
- Single dose
- 40 or 80 mg dose (weight based)
  - 40-80 kg – 40 mg
  - >80 kg – 80 mg
- Treatment ONLY
  - 12 y/o and older
- Avoidance of cation co-admin (calcium, iron, magnesium, zinc)

Amantadine

- Dopamine Agonist, Antiviral
- AE’s – Hypotension, psych issues
- Activity against Type A only (no B activity)
- Not typically recommended for influenza treatment or prophylaxis

Shingles

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Shingles

- Caused by Varicella Zoster Virus (VZV)
- Same viral infection that causes chicken pox - reactivation
- Pain, burning, red rash, numbness, tingling – “nerve pain”
- Fluid filled blisters can form – fluid can transmit disease to anyone not vaccinated or who hasn’t had the virus before
- Not very common, but can involve the eye and rarely lead to eye damage/blindness
- Postherpetic neuralgia
  - Pain syndrome that remains following resolution of the shingles flare
  - Neuropathic type pain

Shingles Risk Factors

- Age 50+ (highest incidence in the 60 y/o range)
- Immunosuppression
  - HIV/AIDS
  - Chemo
  - Transplant drugs

Vaccination

- Zoster Vaccine “Shingrix” - Recombinant
- Very important to prevent/minimize complications with shingles
- Indicated at age 50 and over or in immunocompromised patients 18 years of age or older
- Two dose course, at least 2 months apart
- Inactivated vaccine
- Zostavax is no longer recommended because Shingrix is much more effective; Shingrix is recommended even in patients who had previously received Zostavax
- CDC states no specific amount of time you need to wait to give the vaccine following a shingles episode but does state that you should not give Shingrix to patients who are experiencing an acute episode of herpes zoster

Treatment

- Pain Management
- Antiviral treatment
  - Get started ASAP
  - Valacyclovir
  - Acyclovir

Antivirals

- Valacyclovir (Valtrex), acyclovir (Zovirax), or famciclovir (Famvir)
  - Inhibition of viral DNA synthesis by metabolite being incorporated into viral DNA and disrupting replication
  - Best within three days of initial onset; seven day course is typically recommended
  - Acyclovir has to be dosed very frequently (5x/day) so it is generally avoided
  - Valacyclovir and famciclovir can be dosed less frequently which is an obvious advantage over acyclovir (3x/day)
  - Valacyclovir is a prodrug and converted to acyclovir in the body
  - Famciclovir is a prodrug that is converted to penciclovir
  - GI side effects, rarely liver issues can exist
  - Can accumulate in CKD
    - Rare neurotoxicity possible
    - Full glass of water is recommended with administration (risk of crystallization in the urine)

Pain Management

- Acute pain relief
  - Simple analgesics (NSAIDs/acetaminophen)
  - Opioids
- Symptomatic treatment of pain associated with postherpetic neuralgia (similarities to neuropathy)
  - Gabapentin (Neurontin), pregabalin (Lyrica)
  - TCAs
  - Topicals (localized, mild to moderate symptoms)
    - Capsaicin
    - Lidocaine

Sexually Transmitted Viral Infections

Genital Herpes

- HSV 1 and 2 subtypes
  - Most genital cases caused by subtype 2
- Antivirals – therapy for outbreaks
  - Acyclovir, valacyclovir, and famciclovir all options
  - Acyclovir's frequent dosing may create an issue with adherence so valacyclovir is most often used in practice
  - Length of therapy based on factors such as initial episode, recurrent episode, suppressive therapy, or concurrent HIV infection but will most often run for 7-10 days for an initial episode
- Avoid sex when lesions or prodrome symptoms

Human Papillomavirus

- Genital warts
- Patient applied
  - Imiquimod 3.75% or 5% cream
  - Podofilox 0.5% solution or gel
  - Sinecatechins 15% ointment
- Provider administered
  - Cryotherapy
  - Trichloroacetic acid or bichloracetic acid 80%-90%
  - Surgical removal

HPV Vaccination

- Gardasil 9
  - Protects against 5 additional HPV strains - 31,33,45,52,58
  - Approved for 9 to 45 year old males and females
  - 3 doses administered IM at 0, 2, and 6 months
  - 2 dose regimen approved for ages 9 to 14 years old, administered IM at 0 and 6-12 months

Fungal Infections

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Nurse Monitoring - Antifungals

- Azoles:
  - Drug interactions: CYP450 inhibition with azoles (warfarin, statins, immunosuppressants)
  - QT prolongation: monitor ECG risk with azoles (e.g., fluconazole, voriconazole)
  - Hepatic function: AST, ALT, alkaline phosphatase, bilirubin (common with azoles and echinocandins)
- Amphotericin B
  - Renal function: serum creatinine and urine output, especially with amphotericin B
  - Electrolytes: potassium and magnesium levels (notably amphotericin B–induced wasting)
  - Infusion-related reactions: fever, chills, hypotension, phlebitis
- Therapeutic response
- Adverse effects: rash, GI upset, headache, visual disturbances (voriconazole)
- Adherence: correct dosing, duration, and administration timing

Azole Antifungals

- Triazoles (three nitrogen's in the azole ring) – fluconazole (Diflucan), itraconazole (Sporanox), posaconazole (Noxafil), Voriconazole (Vfend)
- Imidazole's (two nitrogen's in the azole ring) – clotrimazole (Lotrimin), econazole (Spectrazole), ketoconazole (Nizoral), miconazole (Oravig), tioconazole (Vagistat-1)
- Mechanism of Action: Inhibits fungal cytochrome P450 dependent enzyme lanosterol 14-alpha-demethylase which converts lanosterol to ergosterol
- GI side effects most common, Liver failure (very rare) more likely with chronic use
- Notorious cause of drug interactions via CYP 3A4 inhibition – It can increase concentrations of statins, seizure medications, and many more
- Can potentially cause prolonged QTc intervals especially in patients on other medications that prolong the QTc

Amphotericin B – Clinical Pearls

- Mechanism of Action: Binds ergosterol which alters cell membranes and leads to fungal death
- Conventional and lipid based formulas
  - Lipid formulation can potentially reduce risk of nephrotoxicity and infusion reactions at the downside of increased cost of drug
  - Different formulations available and they are not interchangeable
- Infusion reaction
  - Diphenhydramine with APAP or NSAID - pretreatment
    - Corticosteroids as option as well
- Flu-like adverse effects (more common with first doses)
  - Chills, headache, pain, hypotension
- Can drop K+, Mg+
- Renal insufficiency – nephrotoxic
- Boxed warning (conventional) – use for severe, life-threatening infections

Echinocandin

- Caspofungin (Cancidas), micafungin (Mycamine), anidulafungin (Eraxis)
  - Mechanism of Action: Inhibition of 1,3 beta-D glucan synthase (key enzyme involved in fungal cell wall synthesis)
  - IV drugs only
  - Usually better tolerated than systemic ampho B or azoles
  - Less risk of infusion reaction
  - Less risk of impact on liver function

Tinea pedis

- Athlete's foot
  - Itching, burning, redness between toes, on feet
  - Warm moist environment
- Treatment
  - Topicals
    - Fungal infections can take a while to heal (up to 6 weeks)
    - Clotrimazole, miconazole, ketoconazole (imidazoles)
    - Terbinafine (allylamines)
  - Orals
    - Don't use for mild cases
    - Itra/fluconazole
      - Drug interactions! (3A4)
    - Terbinafine

Tinea cruris

- Jock itch
  - Warm/moist environments
    - Keep areas cool and dry as much as possible
    - May see higher incident in summertime/warm climate temps
- Topical agents, similar to Tinea pedis
  - Clotrimazole
  - Terbinafine
  - Miconazole

Ringworm

- Tinea family
  - Topical agents
    - Terbinafine
    - Ciclopirox
  - Orals
    - Systemic azoles
    - Terbinafine

Thrush

- Candida albicans
  - White gunk, pain, inflammation, difficulty swallowing
  - Immunosuppression from meds increases risk
    - Chemo, steroids (including inhaled)
  - Treatment
    - Clotrimazole troche
    - Nystatin topical (swish/swallow or swish/spit)
    - Systemic fluconazole for non-responders, adherence concerns, more severe disease
    - Ampho B – life threatening

Yeast Infection

- Candida albicans
  - Itching, burning, cottage cheese type discharge
  - May be exacerbated/caused by changes in normal flora
    - Recent antibiotics
  - Topical azoles
    - Clotrimazole, miconazole, etc.
  - Systemic
    - Fluconazole

PCP – Pneumocystis Pneumonia

- Pneumonia
- Sulfamethoxazole/TMP
  - Longer length of treatment usually necessary compared to UTI or antibacterial use (i.e. a few weeks)
  - Prophylaxis often necessary in HIV/AIDS patients
- Alternatives: Atovaquone or clindamycin + primaquine or IV pentamidine

HIV

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What is HIV?

- HIV (Human Immunodeficiency Virus) is a virus that attacks the immune system, specifically CD4 T cells
- It progressively weakens immunity, increasing the risk of opportunistic infections and certain cancers
- HIV is transmitted through blood, sexual contact, and from mother to child during pregnancy, birth, or breastfeeding
- Without treatment, HIV can progress to AIDS (Acquired Immunodeficiency Syndrome), the most severe stage of infection

Nurse Monitoring

- **CD4 count and viral load**: track immune status and response to antiretroviral therapy (ART)
- **Signs of opportunistic infections**: fever, cough, oral thrush, diarrhea, weight loss
- **Adherence to ART**: ensure correct dosing, timing, and completion to prevent resistance
- **Adverse effects of medications**: liver and kidney function, GI upset, metabolic changes (lipids, glucose)
- **Psychosocial status**: mental health, support systems, risk behaviors, and stigma-related concerns
- **Vaccination and infection prevention**: monitor immunization status and teach safe practices

HIV Pearls

- Drug resistance
  - Frequent mutations
  - Adherence CRITICAL
- Immune deficiency
- Rare, opportunistic infections
- Monitoring
  - CD4 counts
  - RNA

Medications for HIV

- Nucleoside/nucleotide Reverse Transcriptase Inhibitors
- NNRTIs
- Integrase inhibitors
- Protease inhibitors
- CCR5-inhibitors
- Fusion Inhibitors

Drug Mechanisms

- Nucleotide Reverse Transcriptase Inhibitor (NRTI)
  - Mechanism of Action: Converted to active triphosphate forms which competes with natural substrates to inhibit reverse transcriptase; the HIV virus uses the enzyme reverse transcriptase to convert RNA into DNA
  - Lamivudine (Epivir, Combivir, 3TC), Emtricitabine (in combo brands, Sustiva, Atripla, Stribild, Emtriva), Tenofovir (Viread, TDF), Zidovudine (Retrovir, AZT), Abacavir (in combo brands, Epzicom, Trizivir, Triumeq, Ziagen, ABC)
- Integrase inhibitor - raltegravir (Isentress), dolutegravir (Tivicay), bictegravir, (Bictarvy – combo), elvitegravir (Stribild – combo), cabotegravir (Cabenuva – combo)
  - Mechanism of Action: These drugs inhibit the viral enzyme integrase by binding enzyme cations and preventing viral DNA integration into the host genome

Drug Mechanisms

- Non-Nucleoside Reverse Transcriptase Inhibitors (NNRTI)
  - Efavirenz (Sustiva), delaviridine (Rescriptor), etravirine (Intelence)
  - Mechanism of Action: Do not require active conversion to triphosphate forms like NRTI's, they bind to a hydrophobic site of the HIV Reverse Transcriptase and inactivates it
- Protease Inhibitors (PI's)
  - Atazanavir (Reyataz), lopinavir/ritonavir (Kaletra), saquinavir (Invirase), indinavir (Crixivan), darunavir (Prezista), fosamprenavir (Lexiva), nelfinavir (Viracept), darunavir/cobicistat (Prezocobix), atazanavir/cobicistat (Evotaz)
  - Mechanism of Action: Bind to site where protein cleavage occurs and prevents protease from releasing essential proteins

Drug Mechanisms

- CCR5-Inhibitors
  - Maraviroc (Selzentry)
  - Mechanism of Action: Bind CCR5 receptor on the surface of CD4 T lymphocytes which prevents HIV from cellular entry
- Fusion Inhibitors
  - Enfuvirtide (Fuzeon)
  - Mechanism of Action: Disrupts HIV at the last step in fusion with the target cell (CD4 T-cells)

NRTIs

- Tenofovir disoproxil fumarate (TDF)
  - Adenosine analog (DNA component)
  - Osteoporosis risk
  - Renal toxicity
  - GI adverse effects
  - Lactic acidosis/fatty liver boxed warning
  - Elevation in cholesterol
- Tenofovir alafenamide (TAF)
  - Adenosine analog
  - Lower renal toxicity risk than TDF
  - Lower osteoporosis risk than TDF
  - Elevation in cholesterol, blood sugar
  - Weight gain

NRTIs

- Abacavir (ABC)
  - Guanosine analog
  - Must screen for HLA-B*5701 (contraindicated in patients who test positive due to increased risk for hypersensitivity reaction)
  - Generally avoided in patients with a history of coronary artery disease
- Emtricitabine (FTC)
  - Cytosine analog
  - Lactic acidosis/fatty liver risk
  - Hyperpigmentation
  - GI adverse effects
- Lamivudine (3TC)
  - Cytosine analog
  - Indicated for hepatitis B
  - Risk of HIV resistance if used for hepatitis B and HIV infection goes unnoticed
  - Lactic acidosis/fatty liver risk

HIV Medications

- Integrase inhibitor (raltegravir, dolutegravir, bictegravir, elvitegravir)
  - Elevated LFT's
  - Skin reaction risk/SJS (rare, but possible)
  - CNS changes possible
  - GI adverse effects
  - CPK increase/myopathy
  - Typically included in healthcare associated post-exposure prophylaxis
  - Bictegravir comes in a single pill combo with emtricitabine and tenofovir
  - Elvitegravir requires boosting with cobicistat

Starting Regimen

- Common starting regimen (if resistance testing is not available)
  - Tenofovir
  - Emtricitabine
  - Integrase inhibitor

Novel Agent – Long Acting Injectable

- Injectable integrase inhibitor and NNRTI
  - Cabotegravir and rilpivirine (Cabenuva)
  - Given every 1-2 months
  - Need to prove viral suppression and adherence on oral therapy for 6-12 months (significantly limits use)
  - Must be administered in a healthcare facility

HIV Medications

- Non-Nucleoside Reverse Transcriptase Inhibitors (efavirenz, delaviridine, etravirine)
  - CNS side effects, psychiatric changes
    - Hallucinations, abnormal dreams etc.
  - Hepatotoxic
  - Rash – can monitor if mild, but DC if severe
  - Potentially lowers seizure threshold

Protease Inhibitors

- Atazanavir, darunavir, fosamprenavir, lopinavir/ritonavir, cobicistat
  - Lipodystrophy (buffalo hump)
  - CYP3A4 interactions
  - Rash
  - Hyperglycemia
  - Ritonavir is a booster – increases concentrations of lopinavir
  - Atazanavir requires acidic stomach pH for absorption – watch PPI/H2 blocker use

HIV Medications

- CCR5-Inhibitors (maraviroc)
  - Boxed warning – hepatotoxicity
  - CNS effects
  - Orthostasis
  - Skin reaction risk
- Fusion Inhibitors (enfuvirtide)
  - Twice daily injection (so rarely used long term)
  - Injection site reactions
  - Possible increased risk in pneumonia, especially in patients already at risk (i.e. smokers, lung disease, low CD 4 count)

Opportunistic Infections

- PCP (Pneumocystis pneumonia)
  - Sulfa/TMP
  - Refractory treatment
    - TMP/dapsone
    - Pentamidine (severe)
  - Glucocorticoids
- Kaposi Sarcoma
  - Chemo or radiation
- Mycobacterium Avian Complex (MAC)
  - Macrolide
  - Ethambutol
  - Rifampin

Opportunistic Infections

- Cytomegalovirus – ganciclovir or valganciclovir
- TB – see TB
- Candidiasis – fluconazole
- Toxoplasmosis – pyrimethamine
- Cryptococcus – Ampho B, flucytosine, fluconazole

Lab Values

- RNA viral load
  - >100,000 copies/mL in early disease
  - Goal: undetectable (less than 50 or 20 depending upon lab)
- CD4 Count
  - 500-1500 is normal
  - Following trend
  - Lower = higher risk for infection
- If less than 200
  - PCP prophylaxis
- If less than 50
  - MAC prophylaxis

PrEP: Pre-Exposure Prophylaxis

- Patients who are HIV negative but at high risk of developing HIV
  - Sexual partners of HIV infected patients are the most common patients that may be impacted and candidates
  - High risk behaviors (i.e. multiple partners or sexual activity with a patient who has high risk behaviors)
  - IV drug users who share needles
- There is an extremely low risk of transmission in patients who are adherent to HIV therapy (highest risk of transmission is in patients who have a detectable amount of virus)
- Tenofovir and emtricitabine (oral)
  - Truvada – TDF; Descovy – TAF
- Cabotegravir (CAB) 600 mg injection q 2 months (brand name Apretude®)

Post-exposure prophylaxis (PEP)

- Initiate PEP for patients who have been exposed through needlestick or other means of puncturing the skin and has been working with a high risk patient
- Alternatively, PEP should be considered if a caregiver has an open sore or other nonintact skin and has been exposed to blood from a patient at risk for HIV
- Drug therapy should be offered even before HIV testing has been completed if the source of the blood is not known (i.e. ASAP drug initiation if there is potential for HIV risk)
- May offer PEP up to 72 hours after exposure (not recommended after this per CDC)
- Tenofovir-emtricitabine, and integrase inhibitor
- Or substitute protease inhibitor for integrase inhibitor