## Essential Learning
# HIV

- **What are risk factors associated with acquiring HIV infection?**
    - Some risk factors include sexual transmission with the majority of HIV cases in the US occurring through men who have sex with men, IVDU, blood transfusion prior to 1985 and maternal HIV infection.
    - New HIV infection rates continue to rise among disadvantaged minority populations.

- **What are the clinical stages of HIV?**
    - Stage 1 (acute retroviral syndrome)
        - Occurs 2 to 4 weeks after infection
        - Nonspecific presentation, flu-like illness; diagnosis is missed in 75% of cases
        - Symptoms occur within a month of being infected and include:
            - Fever, fatigue, pharyngitis, rash, headache, lymphadenopathy, weight loss, headache and diarrhea
    - Stage 2 (clinical latency)
        - Patients have no complaints
        - If not taking meds, median time is 10 years before development of AIDS
    - Stage 3 (AIDS)
        - CD4 count < 200 or occurrence of AIDS defining illness

- **Clinical practice pearls for evaluating patients with HIV/AIDS**
    - The absolute lymphocyte count can serve as a proxy CD4 count in patients who are presenting with AIDS without previous serology.
        - ALC < 1000 is predictive of a CD4 count < 200
        - ALC > 2000 is predictive of CD4 count > 200
    - Whenever possible, perform the LP in the lateral decubitus position to obtain a reliable opening pressure.
    - You need A LOT of CSF for the studies on these patients (at least 10 cc)

- **What is the most common type of pneumonia in a patient with HIV and what opportunistic infections should be considered?**
    - HIV patients are more likely to get typical community acquired infections. *Streptococcus pneumoniae* is the most common, followed by PCP and tuberculosis.
    - As the CD4 count drops, consider these infections
        - <500: TB, HSV, zoster, Kaposi's
        - <200: PCP (*Pneumocystis jirovecii*), candidiasis

        - <100: toxoplasmosis, histoplasmosis, cryptococcus, MAC (*Mycobacterium avium* Complex)
        - <50: PML (Progressvie Multifocal Leukoencephalopathy), CMV (GI, Pulm, retinitis), CNS lymphoma

- **What are the typical symptoms, work-up, and treatment for PCP pneumonia?**
    - Typical symptoms
        - Fever, cough (usually nonproductive) and shortness of breath, progressing from only with exertion to at rest
    - Specific workup
        - CBC with diff - a total lymphocyte count <1700 correlates well with a CD4 count < 200
        - Order a CXR - often shows diffuse interstitial infiltrates or granular pattern ("bat-wing appearance")
        - Consider LDH - may be elevated in patients with PCP but has low sensitivity and specificity
        - ABG - usually demonstrates hypoxemia and an increase in the A-a gradient
    - Treatment
        - First line is trimethoprim-sulfamethoxazole 15-20 mg/kg per day -> two double strength tablets TID x 21 days or 5 mg/kg IV 3-4x/day
        - Can also use pentamidine IV (caution due to side effects of hypoglycemia, hypotension), trimethoprim-dapsone or atovaquone
        - Steroids (prednisone at 40 mg BID, tapering over 21 days) in patients with PaO2 <70 mm Hg or A-a gradient >35 mm Hg
        - Start or continue anti-retroviral therapy

- **Why obtain 1-3-beta-D-glucan in labs?**
    - Component found in the cell wall of *P. jirovecii*
    - Elevated plasma levels have been found in patients w/ HIV and PCP
    - PCP pneumonia is suspected in patients with levels greater than 80 pg/mL
    - Has a sensitivity and specificity of 92% and 65% respectively
    - Elevated levels can be observed in other fungal infections, including histoplasmosis

- **What is appropriate treatment for an immunocompromised patient with suspected meningitis?**
    - Place the patient on droplet precautions and use appropriate personal protective equipment.
    - Administer empiric antibiotics as soon as possible and at a minimum within 2 hours of presentation. Stat LP may be performed before antibiotics if CT is not indicated
        - Delayed antibiotics increases mortality and the risk for residual neurological deficits.
        - If an LP can be performed quickly, antibiotics may be started immediately after the procedure.

        - If CT is required (see below) before LP or there will be a delay in the procedure, draw blood cultures and then proceed with dexamethasone and empiric antibiotics without additional delay.
            - Antibiotic administration before LP should not significantly affect cytology of CSF, but may reduce yield of CSF cultures.
        - Consider the ideal order of operations for patients with clinical suspicion of bacterial meningitis to be 1) nurses obtain access and draw blood cultures while physician orders empiric antibiotics and dexamethasone, 2) prioritize performing LP if no CT is indicated, 3) administer dexamethasone immediately, 4) start antibiotics when LP is complete or sooner if there is an anticipated delay.
    - Empiric meningitis/encephalitis treatment should include (must include adequate coverage for Listeria and Pseudomonas)
        - Dexamethasone 0.15 mg/kg IV (preferably 15 min prior to antibiotics)
        - Ampicillin 2 g IV
        - Cefepime 2 g IV OR Meropenem 2 g IV
        - Vancomycin 1 g (15-20 mg/kg) IV
        - Acyclovir 500 mg (10 mg/kg) IV
    - Supportive care may also include
        - Airway management as needed
        - Careful fluid management to avoid over or under-hydration (use POCUS IVC or UOP)
        - ICP monitoring may be required

- **For suspected meningitis, when should I get a CT head before doing an LP?**
    - Patients with a mass lesion or increased ICP are at risk for cerebral herniation with removal of CSF during LP. This occurs rarely but brings devastating consequences.
    - If you think CT will show a cause for the headache, do a CT.
    - Do a CT before planned LP for patients with:
        - Advanced age > 60 years
        - Decreased level of consciousness
        - Focal neurological deficits
        - Papilledema
        - Recent seizure
        - History of known CNS disease (mass, stroke, infection)
        - Immunocompromised state (HIV, immunosuppressive therapy, etc)
    - If none of the above are true, in general, LP may be completed without CT.
    - CT may also be completed before or after LP when indicated for a broader differential (SAH, malignancy, etc).
    - Prompt appropriate antibiotics should NOT be delayed for either CT or LP.

- **What CT findings prohibit an LP?**
    - Midline shift
    - Obstructive hydrocephalus

- Compressed basilar cisterns
- Posterior fossa mass
- Even with a “normal” CT, if the patient has evolving signs of herniation (devolving LOC, pupillary changes, posturing) consider deferring LP.

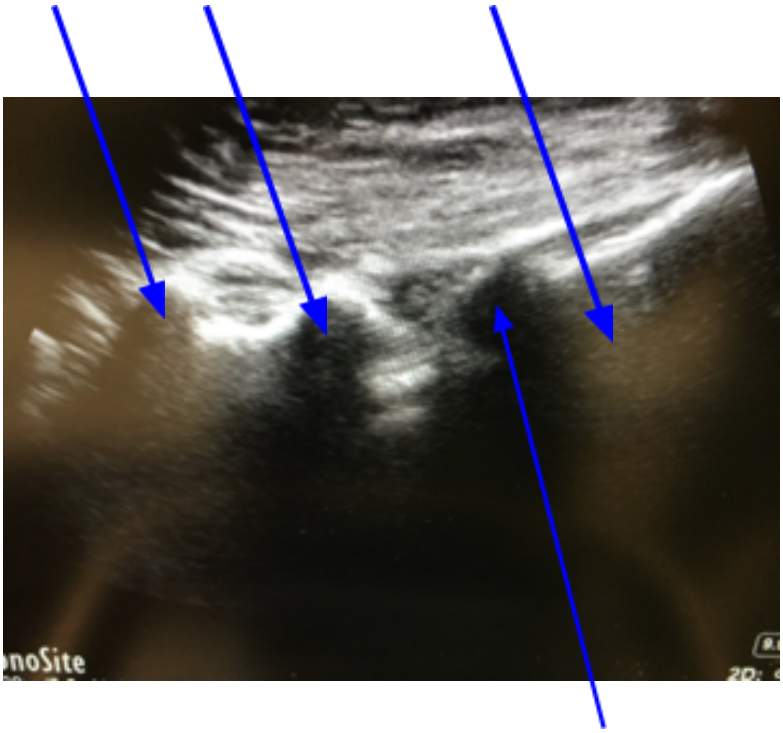
- **Neuroimaging in AIDS patients with suspected CNS pathology**
  - In HIV patients, consider CT with and without contrast
  - Toxoplasmosis, CNS lymphoma and TB can all present with mass lesions
  - Conversely, mass lesions in Cryptococcus are rare.
  - Toxoplasmosis:
    - Neuroimaging with contrast illustrates multiple ring enhancing brain lesions
    - The prevalence of reactivated Toxo is as high as 30% in patients with CD4 counts < 100 who are not on prophylaxis
  - Tuberculosis Meningitis:
    - Neuroimaging with contrast may show only meningeal enhancement, but can also see mass lesions called tuberculomas.
  - CNS Lymphoma:
    - Usually a single enhancing lesion, however up to 25% can have multifocal lesions.
    - These lesions are one of the few to cross midline on neuroimaging.
  - Progressive Multifocal Leukoencephalopathy:
    - CNS demyelinating disease caused by reactivation of the JC Virus.
    - Neuroimaging shows multifocal white matter lesions without mass effect or contrast enhancement.

- **Cryptococcus Fundamentals**
  - Cryptococcus meningoencephalitis is a fungal infection caused by *Cryptococcus neoformans* and *Cryptococcus gattii.*
  - Common cause of meningitis in patients with AIDS
  - Uniformly fatal if untreated
  - Even with treatment, the 3-month mortality can be as high as 30%.
  - Cryptococcus LP findings:
    - WBC < 50, mildly elevated protein and decreased glucose
    - Elevated CSF pressures (normal range generally 10-20 cm H20, > 25 is definitively abnormal)
      - If opening pressure is elevated, drain enough CSF to get pressure < 20 cm H20 (or 50% reduction if > 40).
  - Treatment consists of combination antifungal therapy with amphotericin B plus flucytosine (for the induction phase of therapy) followed by fluconazole (for the consolidation phase).
  - Starting HAART therapy early in the course of cryptococcal treatment puts the patient at risk for Immune Reconstitution Inflammatory Syndrome.

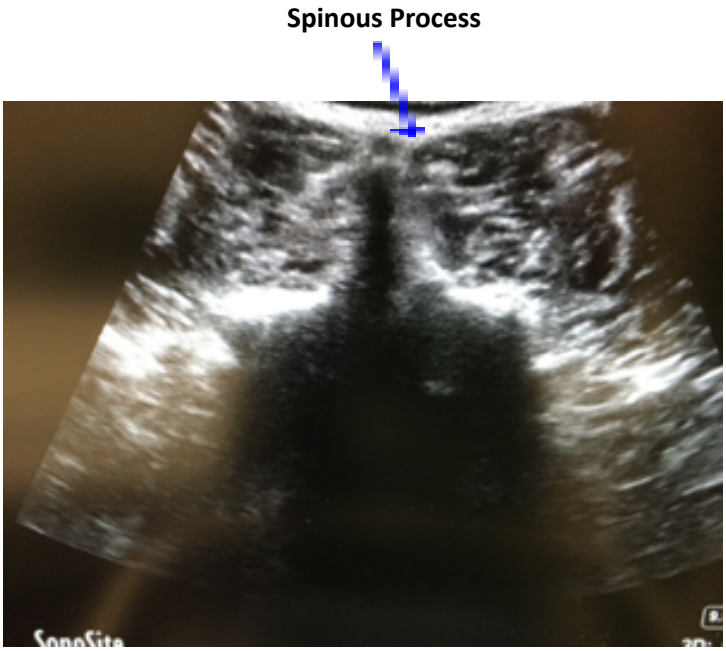
- **POCUS Pearls**
    - US-guided LP may be beneficial in patients with landmarks that are difficult to palpate
    - US-guided LP may be performed with the patient sitting or in lateral decubitus position, depending on whether an opening pressure is needed.
    - How to perform an US-guided LP (**Figure 229.2**):
        - Set depth to 10-12 cm in MSK preset
        - Using curvilinear probe, start midline lumbar spine with probe marker cephalad
        - Slide lateral until facet joints noted
        - Slide down until sacrum visualized
        - At this point identify L3, L4 facet joints which correspond to the L3-L4 and L4-5 interspaces
        - Mark patient with skin marker at level of L3-4, L4-5
        - Rotate probe into transverse orientation and slide to midline, moving probe caudad and cephalad to identify patient's true anatomic midline by identifying the spinous process of 2 contiguous vertebrae.
        - Mark patient with skin marker at bony midline
        - The LP needle entry site will be at the 90-degree intersection of bony midline with a previously marked interspace
        - Proceed with standard LP technique

## Figure 229.2- Ultrasound-Guided LP

**L3-L4 and L4-L5 Interspaces** **Sacrum**



**L5-S1 Interspace**

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