

Cerebrospinal Fluid (CSF) Collection Guidelines: Rationale for Specialized Microbiology CSF Tests

A. Acute bacterial meningitis is a medically urgent condition that requires prompt institution of appropriate antimicrobial therapy. CSF abnormalities associated with this condition typically include an elevated total protein, decreased glucose compared to the serum level, an elevated WBC count that is predominantly polymorphonuclear cells, and a positive Gram stain and bacterial culture of the CSF. Since this is the most common type of infection, routine microbiology CSF tests should always include a bacterial culture. Although anaerobes rarely cause acute bacterial meningitis, anaerobic culture of the CSF should be done in patients with a parameningeal infection, particularly in cases where there has been leak or rupture into the cerebrospinal space (i.e., brain abscess, suppurative thrombophlebitis, mycotic aneurysm). CSF should also be cultured for anaerobes, particularly *P. acnes* in patients with central nervous system shunt infections.

B. Patients with acute aseptic meningitis due to a viral infection may present with a similar picture as those with a bacterial infection. Viral tests should be done on the CSF if the Total Protein and WBC count is elevated and the CSF Gram stain and bacterial culture are negative. Enterovirus infection occurs during the late summer and fall months in most temperate climates. CSF viral culture or PCR for enteroviruses should be done during this period. West Nile Virus is a flavivirus that is seasonally transmitted by infected mosquitoes that has recently been introduced to North America and causes acute meningitis or encephalitis in susceptible patients during the summer and early fall months. WNV may be detected in the CSF using a combination of ELISA and PCR methods. Herpes simplex virus (HSV) encephalitis may produce hemorrhagic necrosis of the temporal lobe resulting in an increased CSF RBC count. PCR for HSV should be done on patients suspected of having meningitis or encephalitis.

C. Chronic meningitis due to yeast or fungal infection of the central nervous system is uncommon and requests for specialized tests should be restricted to patients with exposure to systemic fungal pathogens (*C. immitis*, *H. capsulatum*, *B. dermatiditis*) and those who are immunocompromised. Cryptococcal meningitis is an opportunistic infection that indicated an HIV infected patient has AIDS. Microbiology laboratories should be able to detect the presence of Cryptococcus on a CSF Gram stain, and a Cryptococcal antigen test should routinely be done in this case and on CSF samples collected from immunocompromised patients. Cryptococcal antigen testing should also be routinely done whenever a yeast or fungal culture is ordered. The sensitivity of cryptococcal antigen (CRAG) testing approaches 100% from serum and 98% from CSF in diagnosing disseminated Cryptococcal infection. A CSF India ink wet mount stain is only 50%, so that laboratories should be performing CRAG tests. Although CRAG testing may not be performed routinely as a STAT procedure, it should be urgently done when Cryptococcus meningitis is clinically suspected in an immunocompromised patient and when Cryptococcus infection is suspected on the basis of CSF Gram stain or India ink wet mount stain. The sensitivity of CSF fungal culture for systemic mycosis agents is only ~30% even when large volumes of specimen (i.e. 10 mL) are cultured. Serology should be performed on the CSF for *C. immitis* since it has a sensitivity of 100%.

D. Chronic meningitis due to *Mycobacterium tuberculosis* (TB) infection of the central nervous system is also uncommon and requests for AFB testing should be restricted to patients with a history of exposure or risk of TB infection and those with a positive purified protein derivation skin test, those with military TB, and immunocompromised patients. The clinical symptoms that suggest TB meningitis include progression mental status changes, chronic headache and neck stiffness and cranial nerve palsy since the infection is mainly located along the base of the brain. Characteristic CSF abnormalities include an elevated total protein to the extent CSF will form a protein precipitate of pellet in a tube, a decreased glucose compared to serum levels and an elevated WBC count that is predominantly lymphocytic. The sensitivity of AFB culture is only ~30% even if 10 mL of CSF is submitted for culture and a result is not available for 4 to 8 weeks. The current recommendation is to perform a PCR assay if tubercular (TB) meningitis is suspected. The PCR TB assay has a sensitivity that approaches 100%, it requires a small sample volume (0.5 mL) and can be performed within 2-4 days of receipt of the sample.

E. Acanthamoebic meningitis is a life threatening condition with a high mortality rate. CSF tests for detection of Acanthamoeba should be done in patients who develop acute meningitis with a recent history of swimming in fresh water. Differentiation between *Naegleria fowleri* infection and *Acanthamoeba spp.* infections requires wet mount examination and culture of a large volume of CSF.