

Cerebrospinal Fluid Interpretation

	Normal	Normal Neonate	Viral Meningitis	Bacterial Meningitis	Fungal Meningitis	TB Meningitis
Appearance	Clear	Clear	Clear	Cloudy and Turbid	Fibrin Web	Cloudy and Viscous
White Cells (x10 ⁶ /L or /cumm or /μL)	Normal <5	Normal <20	↑ 5-1000	↑↑↑ 100-50,000	N/↑ 0-1000	↑ <500
Predominant White Cell Type	All lymphocytes	Mainly lymphocytes, 5% neutrophils	Lymphocytes	Neutrophils <small>NB: Some bacteria can cause a lymphocytic CSF (e.g. Listeria, Mycoplasma, Lyme, Syphilis)</small>	Lymphocytes	Lymphocytes
Red Cells (x10 ⁶ /L or /cumm or /μL)	Normal <10					
Protein (g/L)	Normal 0.2-0.4	Normal <1	N/↑ 0.4-1	↑↑ >1	N/↑ 0.2-5	↑↑ 1-5
Glucose (CSF: blood ratio)	Normal >60% plasma			↓ <40% plasma	N/↓ <40% plasma	↓↓ <30% plasma
Opening CSF Pressure* (cmH ₂ O)	Normal 10-20		Normal/slightly high	High	High/very high	High

*CSF pressure ≥25cmH₂O = intracranial hypertension (idiopathic, meningitis, intracranial haemorrhage, tumours etc)

NB: in bacterial meningitis patients who have had antibiotics prior to LP, CSF may be more lymphocytic and have a normal glucose

Typical Pathogens

- Bacteria in newborns: group B strep, E. coli/coliforms, listeria monocytogenes
- Bacteria in young children: N. meningitidis, strep pneumonia, Haemophilus influenzae
- Bacteria in teens/adults: strep pneumonia, N. meningitidis, listeria monocytogenes (if >50 years/pregnant)
- Virus: enterovirus, VZV, HSV, HIV, mumps
- Fungal: cryptococcus neoformans

Additional Tests

- Culture: grow bacteria
- PCR: for viruses e.g. enterovirus, herpes simplex, EBV
- Electrophoresis: oligoclonal bands (MS)
- Acid-fast stain and TB PCR: TB
- Xanthochromia: subarachnoid haemorrhage
- India ink stain and cryptococcal antigen test: cryptococcus
- Cytology: to look for malignant cells

Traumatic tap adjustment

- Allow 1 white cell for every 500 red cells
- Allow 0.01g/L protein for every 1000 red cells

Causes for abnormal CSF

- Increased neutrophils: bacterial meningitis, early TB, some viruses (e.g. enterococcus), some fungi (usually <80%), following seizures, following CNS haemorrhage, following CNS infarct, foreign materials, metastatic tumour
- Increased lymphocytes: viral meningitis, viral encephalitis, HIV, partially treated bacterial meningitis, some bacterial meningitides (Listeria, Mycoplasma, Lyme, Syphilis), cryptococcal meningitis, TB meningitis, parasitic meningitis, parameningeal bacterial infections, others uncommon (UTI <3m old, SSPE, MS, encephalopathy due to drugs, sarcoidosis, neoplastic/paraneoplastic, autoimmune, e.g. SLE)
- Increased eosinophils: parasitic infections (Angiostrongylus, Gnathostomiasis, Baylisascaris), fungal infections, reaction to foreign material, occasionally bacterial/TB meningitis, lymphoma, sarcoid