

Cerebrospinal Fluid (CSF) – High Yield Summary

■ Definition

CSF is a **colorless, clear fluid** that fills the brain ventricles and spinal cord. It acts as a **lubricant, cushion, and shock absorber** for the CNS.

■ Volume & Composition

- 1 Adults: **100–150 mL**
- 2 Infants/children: **10–60 mL**
- 3 **~99% water**
- 4 Low protein & lipids compared to blood



■ Formation & Circulation

Formed mainly by **ultrafiltration of blood** (choroid plexus).

Circulation: Lateral ventricles → **Foramen of Monro** → 3rd ventricle → central canal of spinal cord.

■ Functions

- 1 Mechanical support & protection
- 2 Shock absorption
- 3 Nutrition for neurons & glial cells
- 4 Waste removal (lymphatic-like function)
- 5 Maintains ionic microenvironment
- 6 Transport of hormones, cofactors & neurotransmitters
- 7 Reflects CNS pathological states

■ Indications for CSF Analysis

CNS infections • Demyelinating diseases • CNS malignancy • CNS hemorrhage • Autoimmune disorders

■ CSF Collection

- 1 Lumbar puncture at **L3–L4**
- 2 Strict sterile conditions
- 3 **10–20 mL** collected
- 4 3 tubes: Chemical • Microbiology • Cell count

■ Physical Examination

- 1 Normal: colorless, crystal clear
- 2 Specific gravity: **1.006–1.008**

■ Xanthochromia

Pink/yellow CSF due to lysed RBCs, bilirubin, high protein, disinfectants, carotenoids or melanin.

■ Bloody CSF

Indicates hemorrhage or traumatic tap (more blood in first tube, clot formation).

■ Chemical Examination

- 1 pH: alkaline
- 2 Spontaneous clotting → TB meningitis or CNS tumors

■ Lactate

Useful in metabolic disorders: gluconeogenesis, PDH deficiency, Krebs cycle & ETC disorders.

■ Proteins

Normal: **15–45 mg/dL**. Increased in Froin's syndrome, CNS tumors, meningitis due to BBB damage or increased Ig synthesis.

■ IgG–Albumin Index

Normal: **0.34–0.58**. Increased in multiple sclerosis. Decreased in meningitis, infarction & tumors.

■ Glucose

CSF glucose = **60–70%** of plasma. Low in bacterial & TB meningitis and glucose transport disorders.

■ EXAM PEARLS

- 1 Low glucose + neutrophils → **Bacterial meningitis**
- 2 High protein + normal glucose → **TB or tumors**
- 3 High IgG index → **Multiple sclerosis**

Table 9-6 Major Laboratory Results for Differential Diagnosis of Meningitis			
Bacterial	Viral	Tubercular	Fungal
Elevated WBC count	Elevated WBC count	Elevated WBC count	Elevated WBC count
Neutrophils present	Lymphocytes present	Lymphocytes and monocytes present	Lymphocytes and monocytes present
Marked protein elevation	Moderate protein elevation	Moderate to marked protein elevation	Moderate to marked protein elevation
Markedly decreased glucose level	Normal glucose level	Decreased glucose level	Normal to decreased glucose level
Lactate level >35 mg/dL	Normal lactate level	Lactate level >25 mg/dL	Lactate level >25 mg/dL
		Pellicle formation	Positive India ink with <i>Cryptococcus neoformans</i>
Positive Gram stain and bacterial antigen tests			Positive immunologic test for <i>C. neoformans</i>

