

CSF ANALYSIS

LEC 2

Dr. Shaimaa Munther

Cerebrospinal fluid (CSF)

Is the liquid that surrounds the brain & spinal cord.

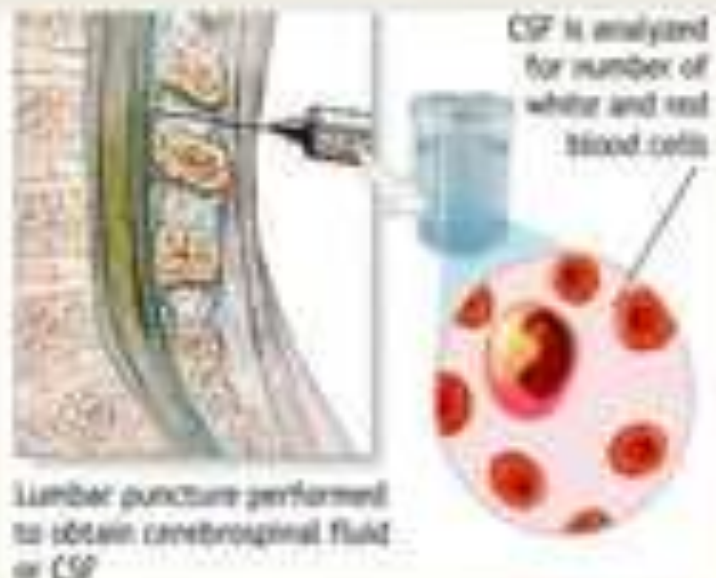
Functions of CSF

- 1- Physical support & protection of the CNS from trauma.
- 2- Supplying nutrients to the CNS & removal of metabolic wastes from CNS
- 3- Intra-cerebral transport
neuroendocrine role i.e. distribution of hypothalamic hormones within the brain.

CSF analysis

- Cerebrospinal fluid (CSF) analysis is a way of looking for conditions that affect brain and spine.

Analysis of CSF can help detect certain conditions and diseases



A lumbar puncture, also called a spinal tap



CSF pressure
100-180 mm of H₂O (8-15 mm Hg)

Clinical Indications for CSF Analysis

CSF is performed in cases of suspected:

- 1- CNS infections (infectious meningitis & encephalitis)**
- 2- CNS malignancy (as malignant infiltrates as in leukemia ..etc)**
- 3- CNS hemorrhages (as subarachnoid hemorrhage)**
- 4- CNS demyelinating diseases (as multiple sclerosis)**

Routine Laboratory CSF Analysis

Collection

Lumbar puncture

With complete aseptic techniques

Sampling:

Collected CSF sample is immediately divided into three tubes:

Tube 1: Chemical Investigation

Tube 2: Microbiology Investigation

Tube 3: Microscopic Investigation



Normal CSF Analysis

Normal Physical Examination

Appearance & Color	Clear ,Colorless
pH	7.4
Daily Secretion	450-500 ml
Specific Gravity	1.006-1.007

Normal Microscopic Examination

Lymphocytes	1-5 /H.P.F
--------------------	-------------------

Normal Chemical Examination

Protein	15-45 mg/dl
Glucose	50-80 mg /dl
Chloride	115-130 mmol /L
Calcium	1.0-1.40 mmol/L
Phosphorus	0.4-0.7 mmol/L
Magnesium	1.2-1.5 mmol/L
Potassium	2.6-3.0 mmol/L

Normal Microbiological Examination

No pathogenic microorganisms

Physical examination of CSF

Normal CSF: Clear & colorless

Viscosity: ~equal to water (increased with increased proteins)

Color and/or turbidity of CSF: observed only in pathological circumstances.

Turbid CSF

Bacteria

WBCs cells or pus cells: suggestive of a CNS infection (meningitis or encephalitis)

Blood : suggestive of hemorrhage

Red & brown colour :

Blood

Yellow colour

1- Jaundice (bilirubin in CSF)

2- Xanthochromia (hemoglobin breakdown pigments in CSF)

Xanthochromic CSF suggests that a subarachnoid hemorrhage has recently occurred.

Microscopic examination of CSF

WBCs

Normal Total WBCs count: 1-5 lymphocytes /HPF

Increased neutrophils: bacterial meningitis

Increased lymphocytes: aseptic and viral meningitis

RBCs

Normally CSF is blood free

RBCs in CSF: subarachnoid hemorrhage & malignancy

Artifact: traumatic tap (should be excluded)

Chemical examination of CSF

In addition to the major ions, **CSF** contains oxygen, sugars (e.g. glucose, fructose), lactate, proteins (e.g. albumin, globulins), amino acids, urea, ammonia, glutamine, creatinine, lipids, hormones (e.g. insulin) and vitamins.

CSF Glucose

- **Normal CSF glucose:** 50-70 mg/dl
- **The actual CSF glucose concentration** may be:
 - 1- Falsely low in the presence of hypoglycemia
 - Or* 2- Incorrectly interpreted as normal when the patient is hyperglycemic
- **Accordingly, CSF glucose should always be compared with a simultaneous plasma glucose that is drawn prior to lumbar puncture.**

Normal **CSF glucose/ plasma glucose ratio** is approximately 0.6-0.7

CSF Protein cont.

Lumbar CSF protein: 15 - 45 mg/dl (mostly albumin)

The majority of CSF protein is derived from the plasma by ultrafiltration

Interpretation of CSF Examination

	Normal	Bacterial	Viral	Fungal/TB
Pressure (cmH ₂ O)	5-20	> 30	Normal or mildly increased	
Appearance	Normal	Turbid	Clear	Fibrin web
Protein (g/L)	0.18-0.45	> 1	< 1	0.1-0.5
Glucose (mmol/L)	2.5-3.5	< 2.2	Normal	1.6-2.5
Gram stain	Normal	60-90% Positive	Normal	
Glucose - CSF:Serum Ratio	0.6	< 0.4	> 0.6	< 0.4
WCC	< 3	> 500	< 1000	100-500
Other		90% PMN	Monocytes 10% have >90% PMN 30% have >50% PMN	Monocytes

The
End