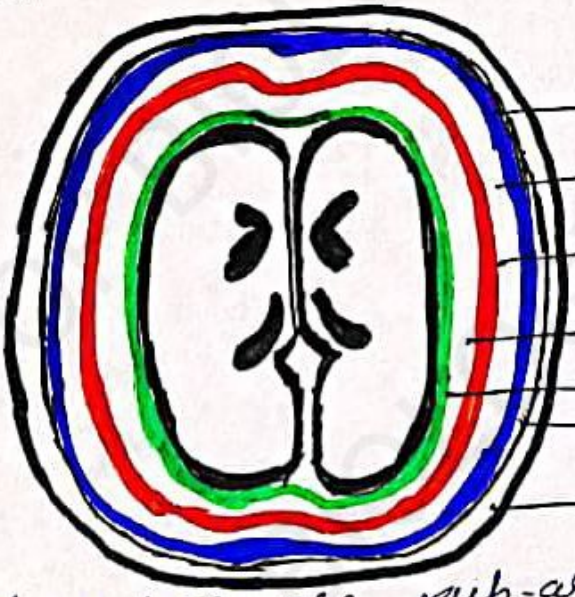
# Meningitis

* Mening — meninges * itis — Inflamation.
* refered to meninges [DEPTH OF BIOLOGY]

3 protective layers of the membranes cover the brain and spinal cord.

* Mostly inflamation of 2 inner layer called leptomenengies → Arachanoid mater and Pia mater




[DEPTH OF BIOLOGY]

Blw the leptomeninges the sub-arachnoid space which houses CSF.

#There is about 150 ml of C.S.f. in the body.
and 500 ml of new Cs.f produced everyday.
500-150 = 350 ml is absorbed in the blood
Here Blood Brain Barrier is present.

Blood vessel of Brain

[DEPTH OF BIOLOGY]

other endothelial cells are tightly bound one another

↓

That they prevent leakage and only allow certain molecules to pass through them.

Meningitis → inflamation of leptomeninges

* it is not the inflamation of brain itself (encephalitis) [DEPTH OF BIOLOGY]

* But when sometimes both occurs called Meningoencephalitis.

Meningitis is triggerd by :-

* Autoimmune disease - body attck itself.
* Adverse reaction of Medication (Intrathecal Therapy)

↓

medication is directly injected into CSF :

* Infection — Most common

[DEPTH OF BIOLOGY]

eg by Herpes Simplex Virus.

* There are two routes through which the infect -ion, reaches the CSF and leptomeninges.

↙ ↘

Direct Spread

Hematogenous spread.

[DEPTH OF BIOLOGY]

# DEPTH OF BIOLOGY

① Direct Spread → when a pathogen get inside the skull or spinal column and then penetrates the meninges eventually up in CSF.

↓

Sometimes the pathogen will have to come through the overlying skin or up through the Nose.

② Hematogenous Spread →

Pathogen enters [DEPTH OF BIOLOGY] Blood stream

↓

and moves through the endothelial cell in the blood vessle

↓

making up to the Blood Brain Barrier and get into the CSF.

Now, Once the pathogen enters into the CSF.

↓

It can stard multiplying

↓

WBC which is present in CSF. Identifying the Pathogen and release cytokines to recruit additional Immune cells.

[DEPTH OF BIOLOGY]

↓ The additional Immune cells attract more fluid to the area and start causing local destruction as they try to control the Infection [DEPTH OF BIOLOGY]

↓

As a result

CSF pressure typically rises 200 mm of $H_2O$. The Immune response also causes the Glucose conc. in the CSF to fall to below two third of the conc. in the blood.



↓

Makes the protien level increase ↑ to over 50 mg/dl

| Type | Normal range WBC | Diseased values WBC |
|---|---|---|
| ① Bacterial | > 100 WBC / μl<br>> 90% PMNS | > 5 μl WBC<br>Normally<br>1 μl<br>Hence<br>Meningitis |
| ② Viral | 10 - 1000 WBC / μl<br>> 50% lymphocytes<br>< 20% PMN | |
| ③ Fungal | 10 - 500 WBC<br>50% lymphocytes | |
| ④ Tuberculosis Meningitis | 50 - 500 WBC<br>80% of lymphocytes | |



## Causes

① Bacterial and Viruses ⟶ Acute Meningitis.

② Fungi ⟶ Chronic Meningitis

→ In Bacterial lots of possibilities 

- In New Born's ⟶ Group B streptococci, E Coli
- In Children and Teens ⟶ Most common cause are Nesseria meningitidis and

Streptococcus Pneumoniae.

•In adults and Elderly — caused by streptococcus Pneumoniae and Listeria monocytogens



In Viruses :-

Main Viruses are → Enteroviruses (Cox-Sackie)
→ Herpes Simplex Virus.
→ HIV
→ Mumps (less common)

Fungi → Cryptococcus Genuses
→ Coccidioides Genuses



•Tubercular Meningitis → caused by Mycobacterium tuberculosis and Parasitic cause also like P. Falciparum

Symptoms :-



→ Nuchal Rigidity
→ Headache
→ Fever
→ Photophobia — Discomfort with Bright light
→ Phonophobia — Discomfort with sound.

[Classic Triad]

# Diagnosis

(1) Kernig's sign
(2) Brudzinski sign [DEPTH OF BIOLOGY]
(3) Lumbar Puncture → CSF is extracted few ml using Needle pierced b/w $L_3$ & $L_4$
- opening pressure is measured
- Analyse for WBC, Proteins & Glucose

(4) PCR → to find specific cause like HIV, enterovirus, HSV
(5) Thin Blood & Smears
(6) western blot → for Borrelia based on fecal bacteria

# Treatment [DEPTH OF BIOLOGY]

(1) In case of Bacterial Meningitis —
steroid — To prevent massive injury.
then Antibiotics — because inflamation prod. by this to kill the bacteria.
* steroid prevent massive injury to the leptomeninges. [DEPTH OF BIOLOGY]
(2) Drugs — Antiviral, Antibacterial, Antifungal, Antiparasitic drug.
(3) Vaccine — for Mumps and disseminated TB.
(4) Prophylactic antibiotic