

Meningitis

Including: **Lecture Slides + Our Notes**

The colors indicate: **important points** – **Team notes in boxes**

Gray Slides are **MOST** important

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CNS Infections

Portals of entry of infection into the CNS:

- Hematogenous spread

the most common

- Direct implantation

traumatic or in congenital CNS malformation

- Local extension

occurs secondary to an established infection in a near by organ (air sinus, an infected tooth or middle ear)

- Through the *peripheral nervous system* into the *CNS*

certain viruses, such as rabies and herpes zoster.



Transmitted from the saliva from a dog's bite

* * Meningitis * *

An inflammatory process of the leptomeninges and CSF within the subarachnoid space.

- 1- Acute → Bacterial
- 2- Aseptic → Viral
- 3- Chronic → Mycobacterium

Meningoencephalitis?

Meningoencephalitis: Encephalitis with meningitis. a medical condition that simultaneously resembles both **meningitis**, which is an infection or inflammation of the meninges, and **encephalitis**, which is an infection or inflammation of the brain.

Leptomeninges: Pia-mater + Arachnoid Mater

1- Acute meningitis (Pyogenic – bacterial)

Pyo- : pus

It's a Medical emergency (acute infection)

I. The causative microorganisms:

– Neonates :

* *Escherichia coli*

* *group B streptococci*

– Infants: * *Streptococcus pneumoniae*

– Adolescents and young adults:

* *Neisseria meningitidis* (Meningococcal meningitis)

* *Haemophilus influenzae* (becoming less due to immunization)

– Elderly: * *listeria monocytogenes*

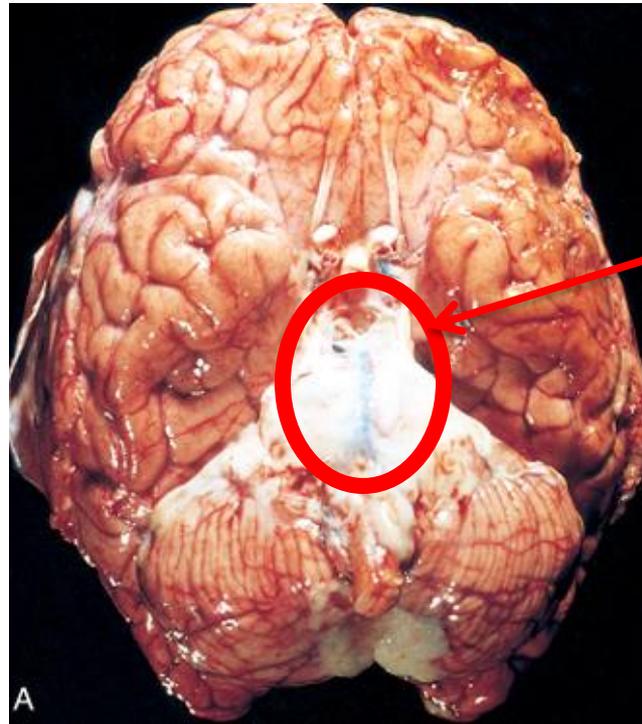
* *Streptococcus pneumoniae*

Most Common Organisms
Causing Meningitis
in general:

1- *Neisseria Meningitidis*

2- *Streptococcus Pneumoniae*

- II. CSF Findings in spinal tap (lumbar puncture):
- cloudy or frankly purulent CSF (containing pus)
 - Many neutrophils (more than 90,000 per millimeter)
 - **↑ protein level** (due to damaged BBB → more cells present: more protein)
 - **↓ glucose content** (due to high bacterial consumption)
 - bacteria may be seen (on a Gram stained smear or can be cultured, sometimes a few hours before the neutrophils appear).



Pus

III. Clinical Features

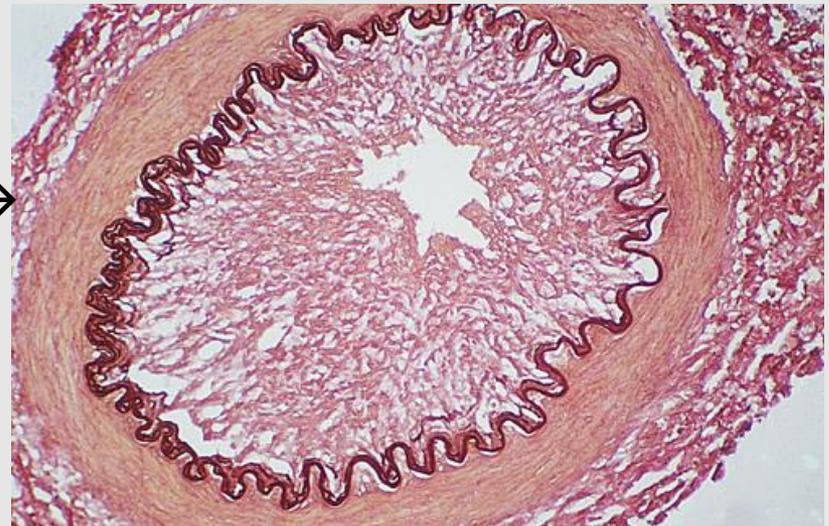
- Systemic *non-specific signs* of infection, (ex. Fever, body-ache)
- Meningeal irritation signs and neurologic impairment:
 - Headache, photophobia, irritability, clouding of consciousness and neck stiffness
- Untreated, pyogenic meningitis can be fatal
- Effective antimicrobial agents markedly reduce mortality associated with meningitis.

IV. Complications

1. Phlebitis → venous occlusion → hemorrhagic infarction of the underlying brain
2. Leptomeningeal fibrosis → hydrocephalus
3. Septicemia → hemorrhagic infarction of the adrenal glands and cutaneous petechiae (known as **Waterhouse-Friderichsen syndrome**, particularly common with meningococcal and pneumococcal meningitis)
4. Focal Cerebritis & seizures
5. Cerebral abscess
6. Cognitive deficit
7. Deafness

- Pheleb: veins
- **Septicemia**: A systemic disease caused by pathogenic organisms or their toxins in the bloodstream

Phlebitis →



Septicemia is one of the most common predisposing factors to bacterial meningitis, especially in the following organisms:

1- Meningococcal Meningitis.

2- Pneumococcal Meningitis.

2- Aseptic Meningitis (Viral Meningitis)

Aseptic meningitis is a misnomer

(wrong name considering it doesn't cause any sepsis: toxin/pathogen in blood)

I. It is a clinical term for an illness comprising:

1- Meningeal irritation

2- Fever

3- Alterations of consciousness of relatively acute onset

((without a recognizable organism >> 70% if identified are "Enterovirus"))

The clinical course is less **fulminant** (Violent, severe)
than in **pyogenic meningitis**, WHY??

a- It is **usually self-limiting**.

b- It is most often treated symptomatically

(we treat symptoms and then the body will have to kill the virus by itself)

II. CSF:

- ↑ lymphocytes (pleiocytosis)
- ↑ Protein (moderately)
- Glucose is nearly normal (usually) (viruses don't consume glucose)

IV. Macroscopic (gross) Characteristics

Brain swelling (seen in only some instances)

V. Microscopic Characteristics:

no recognizable abnormality

OR

a mild to moderate infiltration of the leptomeninges + lymphocytes.

3- Chronic Meningitis (Tuberculosis)

The subarachnoid space contains a fibrinous **exudate**, most often **at the base of the brain**

I. May appear from:

a- A rupture of Tuberculoma

((a well-circumscribed intraparenchymal **mass**

– may be up to several cm. in diameter causing significant mass effect))

ruptures → goes into subarachnoid space → **Tuberculosis Meningitis.**

b- Dissemination (spread) of an organism from a primary pulmonary infection

An organism of primary pulmonary infection → go into the blood

→ to the brain (Hematogenous infection) → **Tuberculosis Meningitis**

II. Microscopic Examination:

a central core of **caseous necrosis**

surrounded by a “typical tuberculous granulomatous reaction”.

III. CSF

* Pleiocytosis : moderate **increase in cellularity** of the CSF

made up of

- Mononuclear cells

- or A mixture of polymorphonuclear and mononuclear cells

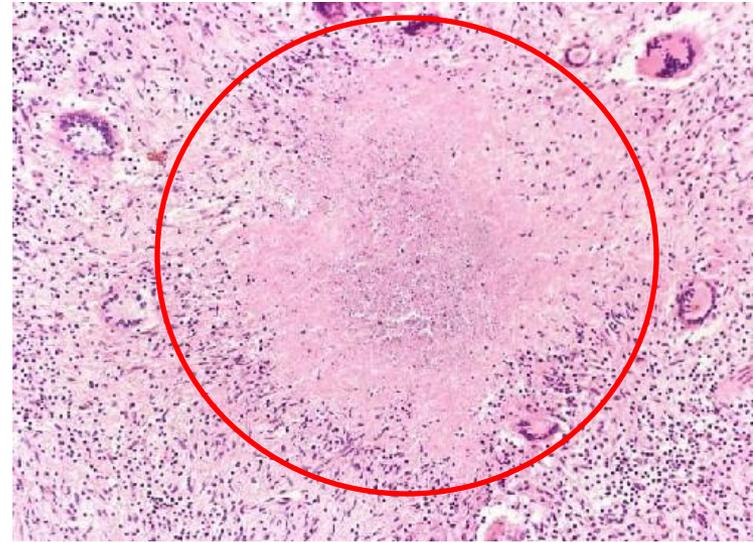
* **Elevated protein**

* ↓ glucose (or normal)

Pleiocytosis : different types of cells



caseous necrosis with palisading around it



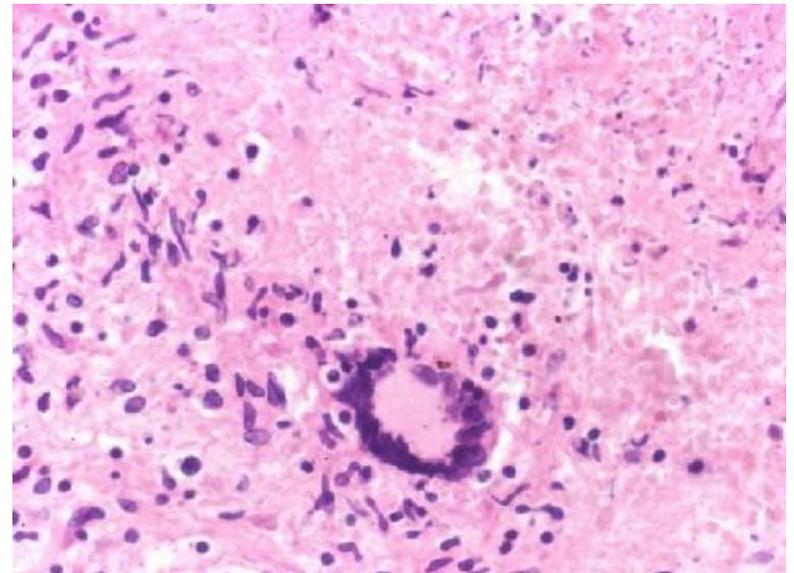
TB meningitis

Exudate at the base of the brain

((The subarachnoid space contains a fibrinous exudates))

IV. Clinical Presentation

- 1- Headache
- 2- malaise
- 3- mental confusion
- 4- Vomiting



* * * Brain abscess * * *

I. The Most Common Organisms:

Streptococci and staphylococci

(identified in non-immunosuppressed populations).

II. Predisposing conditions (infections that might lead to it):

- Acute bacterial endocarditis (usually give multiple microabscesses)
- Cyanotic congenital heart disease (in which there is a right-to-left shunt).
- Loss of pulmonary filtration of organisms (e.g, bronchiectasis)

III. Most common place: cerebral hemispheres

MCQ:

A child with Rheumatic fever :

>> vegetations >> emboli >> *CNS Abscess*

CNS Abscess>> *Mass* >> *Herniation* >> *sudden death (if in respiratory centers)*

IV. Morphologically,

- Liquefactive necrosis
- The surrounding brain is edematous , congested & contains: **reactive astrocytes**
(sometimes it confuses pathologist & they think it's a malignancy)
& **perivascular inflammatory cells**

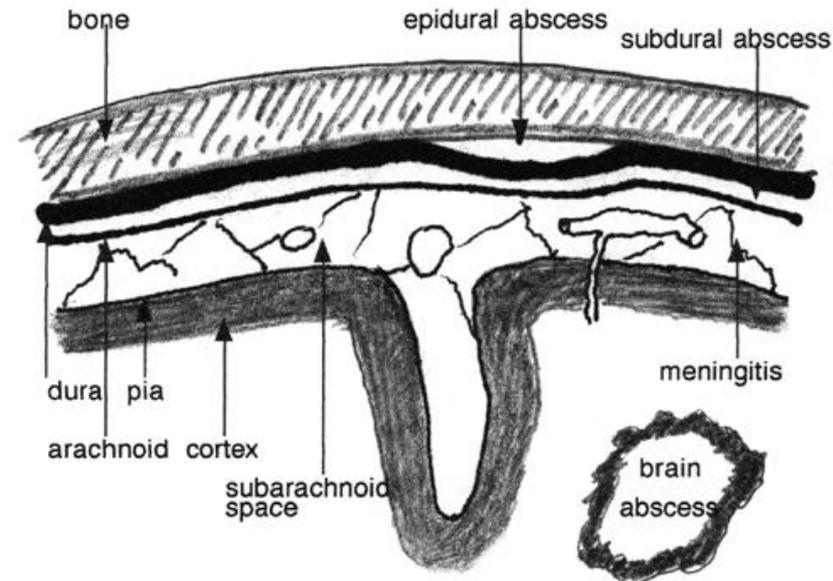
V. Present clinically with progressive focal neurologic deficits in addition to the general signs of **↑ intracranial pressure**

VI. The CSF

- Contain only scanty (adequate) cells
- **↑ protein**
- **Normal level of glucose**
- Increased WBCs

VII. Complications of Brain abscess:

- **Herniation**
- **Rupture of abscess into subarachnoid space or ventricle**



*** Epidural & Subdural Infections ***

These spaces can be involved with **bacterial or fungal infections**. usually as a consequence of direct local spread

A. Epidural abscess

Epidural abscess in the brain :

fungal infections with direct invasion to the CNS are especially in diabetic patients

Associated with **osteomyelitis** . Arises from *sinusitis* (Adjacent focus of infection) or a *surgical procedure*

Epidural abscess in the spinal cord :

It may cause compression and constitute a neurosurgical emergency. (or otherwise it causes Paralysis)

B. Subdural Infections (Empyema):

Arises from *infection of the skull or air sinuses*, may also spread to the subdural space

The underlying arachnoid and subarachnoid spaces are usually unaffected.

I. Complications :

1- Mass Effect : from the large subdural empyema produced by it.

2- Thrombophlebitis : in bridging veins crossing subdural space → venous occlusion & infarction of the brain

II. Symptoms: (referrable to source of infarction)

1- Febrile Patients (fever) 2- headache 3- neck stiffness

III. Treatment:

Surgical Drainage → resolution of the empyema → if resolution is complete, we only find a thickened dura

With prompt (punctual) treatment, complete recovery is usual.

if untreated may develop focal neurologic signs, lethargy, and coma

Homework

- Create a table of CSF findings in Meningitis, aseptic meningitis, TB meningitis, Brain abscess and multiple sclerosis!

Check the “**Biochemistry of CSF**” Lecture ;)