وقل رب زدني علماً

النادي الطبي

# PERIPHERAL NERVOUS SYSTEM

SUBJECT : Pathology - TABLES

LEC NO. : 5

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# PNS

# Pathology Lecture 5

# CNS Infections

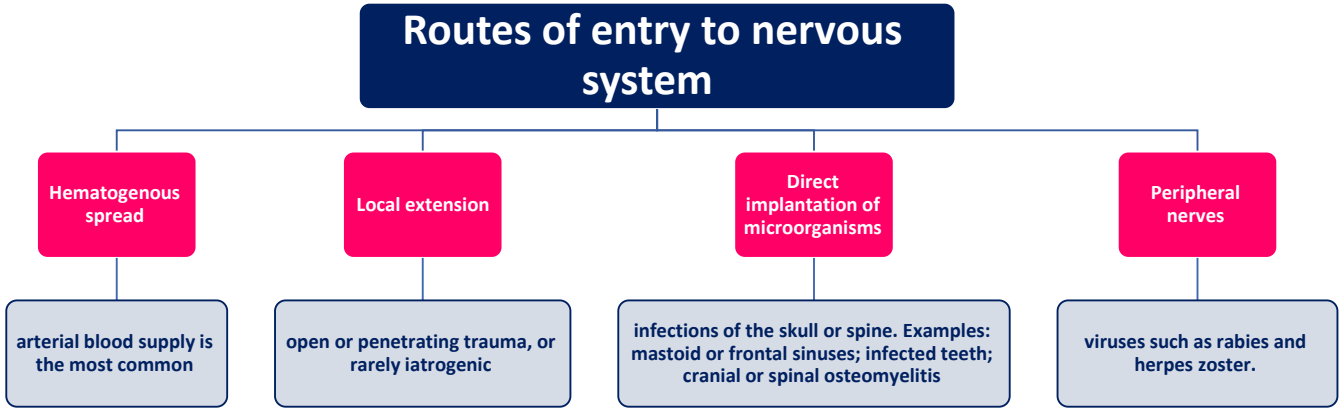
**Damage** to nervous tissue may be the **consequence of** direct injury of neurons or glial cells by the infectious agent or microbial toxins, or may be a consequence of the host immune response

**Meningitis**: Inflammation of leptomeninges (arachnoid and pia) / It is an inflammatory process involving the leptomeninges within the subarachnoid space.

If the infection spreads into the underlying brain, it is termed **meningoencephalitis**

Examination of the **CSF** is often useful in distinguishing among the **various causes of meningitis**

| Infectious meningitis | - Acute pyogenic (usually bacterial) |
|---|---|
| | Aseptic (usually viral) |
| | Chronic (usually tuberculous, spirochetal, or fungal) subtypes |




## 1. Acute Pyogenic Meningitis

## (Bacterial Meningitis)

| Common causes of bacterial meningitis in different age groups | |
|---|---|
| Neonates | Most common are:<br>- Escherichia coli - Group B streptococci |
| Adolescents and young adults | Neisseria meningitidis is the most common pathogen |
| Older adults | Streptococcus pneumoniae and Listeria monocytogenes are more common |

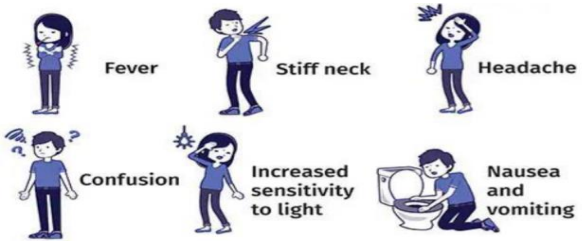
| Kernig sign | Brudzinski sign |
|---|---|
| Resistance to extension of the leg while the hip is flexed | Flexion of the hips and knees in response to neck flexion |

**Both are signs of Meningeal Irritation**

**(Pictures below)**

**Across ages, patients typically show systemic signs of infection along with meningeal irritation and neurologic impairment, such as:**

| Headache | Photophobia | Neck stiffness | Clouding of consciousness | Irritability |
|---|---|---|---|---|




## Acute Pyogenic Meningitis (Bacterial Meningitis)

### Diagnosis

- Made by lumbar puncture (sampling of CSF) ( Performed by placing a needle between L4 and LS [level of the iliac crest] Spinal cord ends at L2, but subarachnoid space and cauda equina continue to S2)

- CSF findings: abundant neutrophils, elevated protein, and reduced glucose

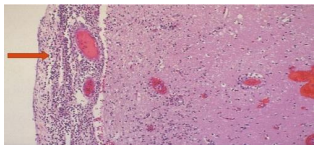
- Gram stain and culture often identify the causative organism

### Morphology

- The yellow-tan clouding of the meninges seen here is obscuring the sulci and is due to an exudate

Microscopically

a neutrophilic exudate is seen involving themeninges at the left, with prominent dilated vessels. There is edema and focal inflammation



- This acute meningitis is typical for bacterial infection.

### Treatment and complications

Untreated pyogenic meningitis is often fatal

Complications can occur, such as:

-Hydrocephalus, hearing loss and seizures - due to fibrosis

-Death - due to herniation and cerebral edema

But with prompt diagnosis and administration of antibiotics, most patients can be saved

### Complications

Severe involvement of leptomeningeal veins (phlebitis) may lead to venous occlusion and hemorrhagic infarction of the underlying brain

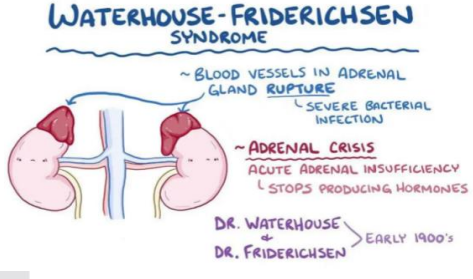
When fulminant, it may spread into the underlying brain (focal cerebritis), sometimes leading to abscesses

Also, extension to the ventricles (ventriculitis) may occur

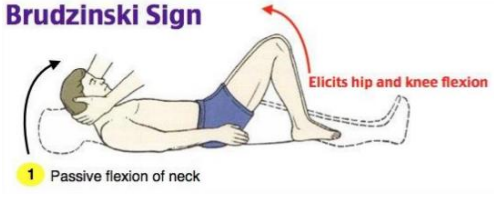
## Waterhouse Friderichsen Syndrome

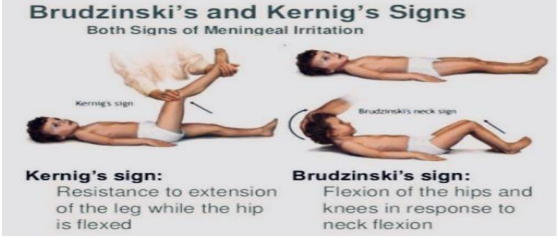
Results from meningitis associated septicemia with hemorrhagic infarction of the adrenal glands and cutaneous petechiae

(Mainly with meningococcal and pneumococcal meningitis)







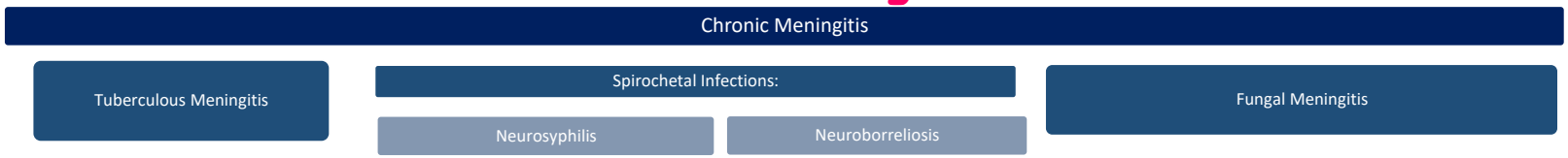



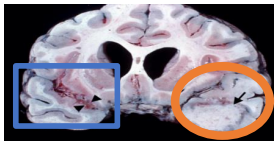
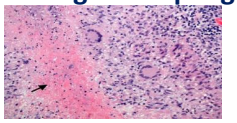
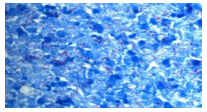
# 2. Aseptic Meningitis

## (Viral Meningitis)

| | | |
|---|---|---|
| **Aseptic Meningitis (Viral Meningitis)** | **General Features and Diagnosis** | Aseptic meningitis is believed to be of viral origin<br>- The clinical course is less fulminant than in pyogenic meningitis and is typically self-limiting<br>CSF findings:<br>lymphocytosis, moderate protein elevation, and a normal glucose level<br>- It is often difficult to identify the responsible virus by culture and serologic methods |
| | **Morphology** | - Gross findings: some cases show brain swelling<br>- On microscopic examination, there is mild to moderate leptomeningeal lymphocytic infiltrate |

# 3. Chronic Meningitis



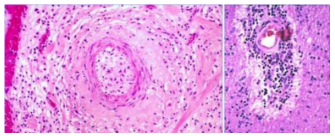

| | | |
|---|---|---|
| **Tuberculous Meningitis** | **General Features** | - Infection with Mycobacterium tuberculosis - Hematogenous spread from lung → brain<br>- Patients presents with generalized signs and symptoms of headache, malaise, mental confusion, and vomiting<br>- CSF findings: Marked elevated Protein, glucose normal or decreased, increased lymphocytes and/or neutrophils<br>- Infection can also result in a well-circumscribed intraparenchymal mass (tuberculoma), which may be associated with meningitis |
| | **Morphology** | Tuberculous meningitis, ventral surface of brain:<br>A thick, opaque exudate is visible on the ventral surface of the brain, obscuring normal landmarks.<br>  |
| | | Tuberculoma: A large left temporal lobe tuberculoma (Circle)<br>The tuberculoma contains abundant caseous necrosis that extends to the cortical surface.<br>There is concomitant meningitis, evidenced by the presence of dense exudate<br>in the contralateral Sylvian fissure (rectangle)<br>  |
| | **Histology** | Histology of a tuberculoma: Area of caseous necrosis (arrow) associated with a mixed inflammatory infiltrate containing macrophages, multinucleated giant cells and lymphocytes<br>  <br>Ziehl-Neelsen stain of a tuberculous abscess,<br>demonstrating numerous red staining bacilli (Mycobacterium)<br>  |

**Neurosyphilis**, a **tertiary stage** of syphilis, occurs in about 10% of individuals with **untreated Treponema pallidum infection**.
**HIV infection** increases the risk for neurosyphilis, and it's more aggressive **Patterns** of CNS involvement by syphilis **can occur alone or in combination**

## Spirochetal Infections: NEUROSYPHILIS

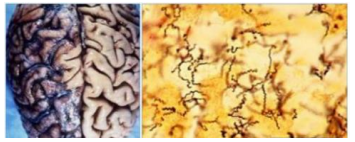
### Meningovascular neurosyphilis

- A form of **chronic meningitis**
- Usually involves the **base of the brain**, often with an **obliterative endarteritis** rich in **plasma cells** and **lymphocytes**



### Paretic neurosyphilis

- **Parenchymal involvement** by **spirochetes** and is associated with **neuronal loss** and marked **proliferation of microglial cells**
- **Clinically**, this form of the disease causes an insidious **progressive loss** of **mental** and **physical** functions, **mood alterations**, and eventually **severe dementia**



Moderate cortical atrophy/ *T.pallidum* (silver stain)

### Tabes dorsalis

**Results from damage** to the **sensory nerves** in the dorsal roots

**Consequences**:
- **Impaired joint position** sense and ataxia; **loss of pain sensation**, leading to skin and joint damage (**Charcot joints**)
- Other **sensory disturbances**, particularly **characteristic** "**lightning pains**"; and the **absence of deep tendon reflexes**

## Spirochetal Infections: NEUROBORRELIOSIS

### Lyme disease

**Lyme disease** is a multisystem disorder **caused by** spirochete Borrelia burgdorferi
- The bite of an **infected Ixodes dammini tick** causes **proliferation** of spirochetes **in the dermis**
- Causes a **rash** known as **erythema chronicum migrans**
- Over days, the **spirochetes spread** to the **nervous system**, **cardiac tissue** and **joints via the blood stream**
- **Neuroborreliosis** is involvement of the nervous system

Tick

### Neurologic signs and symptoms

- Aseptic meningitis
- Facial nerve palsies
- Mild encephalopathy
- Polyneuropathies


## FUNGAL MENINGITIS

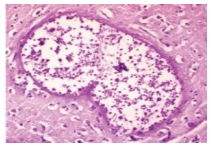
### General Features

- **Meningitis** and sometimes **meningoencephalitis**
- **Immunosuppression** increases the risk

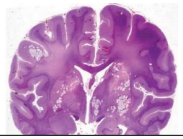
**Examples include:**
- Cryptococcus neoformans
- Histoplasma capsulatum
- Coccidioides immitis

### *Cryptococcus neoformans*

- **Meningitis** and **meningoencephalitis**
- Often in **immunosuppressed** patients
- **Extension** into the brain follows **vessels in the Virchow- Robin spaces**
- As organisms proliferate, these **spaces expand**, giving rise to a "**soap bubble**"–like **appearance**



Higher magnification of cryptococci in the lesions.



Whole-brain section with numerous areas of tissue destruction associated with the spread of organisms in the perivascular