

CENTRAL NERVOUS SYSTEM

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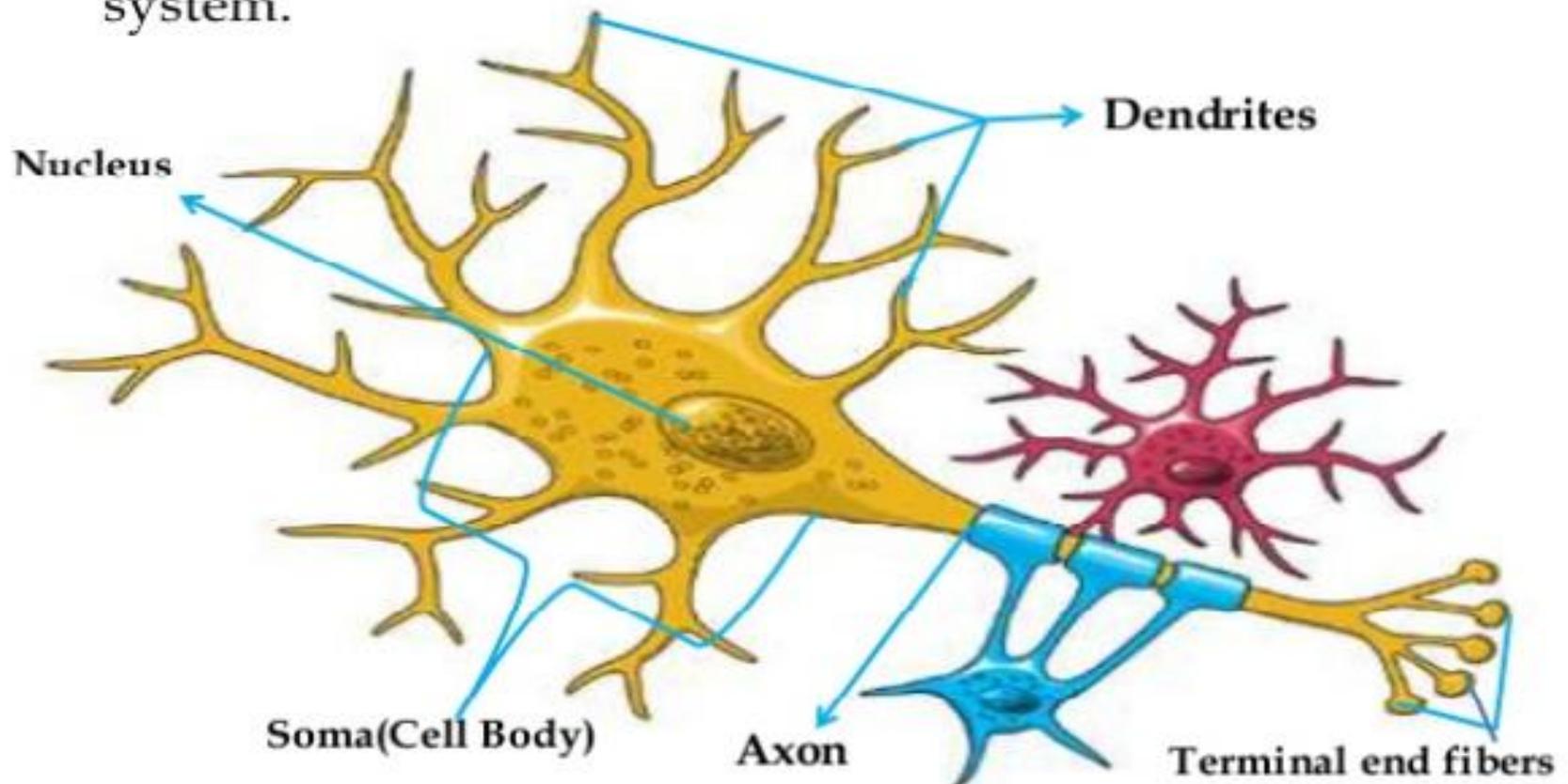
CENTRAL NERVOUS SYSTEM

- **Type of Tissue**
 1. Neuroectodermal tissues
 - Neuron
 - Neuroglia
 - Astrocytes
 - Oligodendrocytes
 - Ependymal Cells
 2. Mesodermal tissues
 - Microglia
 - Dura mater
 - Leptomeninges (pia-archnoid)
 - Blood Vessels



Structure and function

Neurons (nerve cells) are the basic elements of the nervous system.



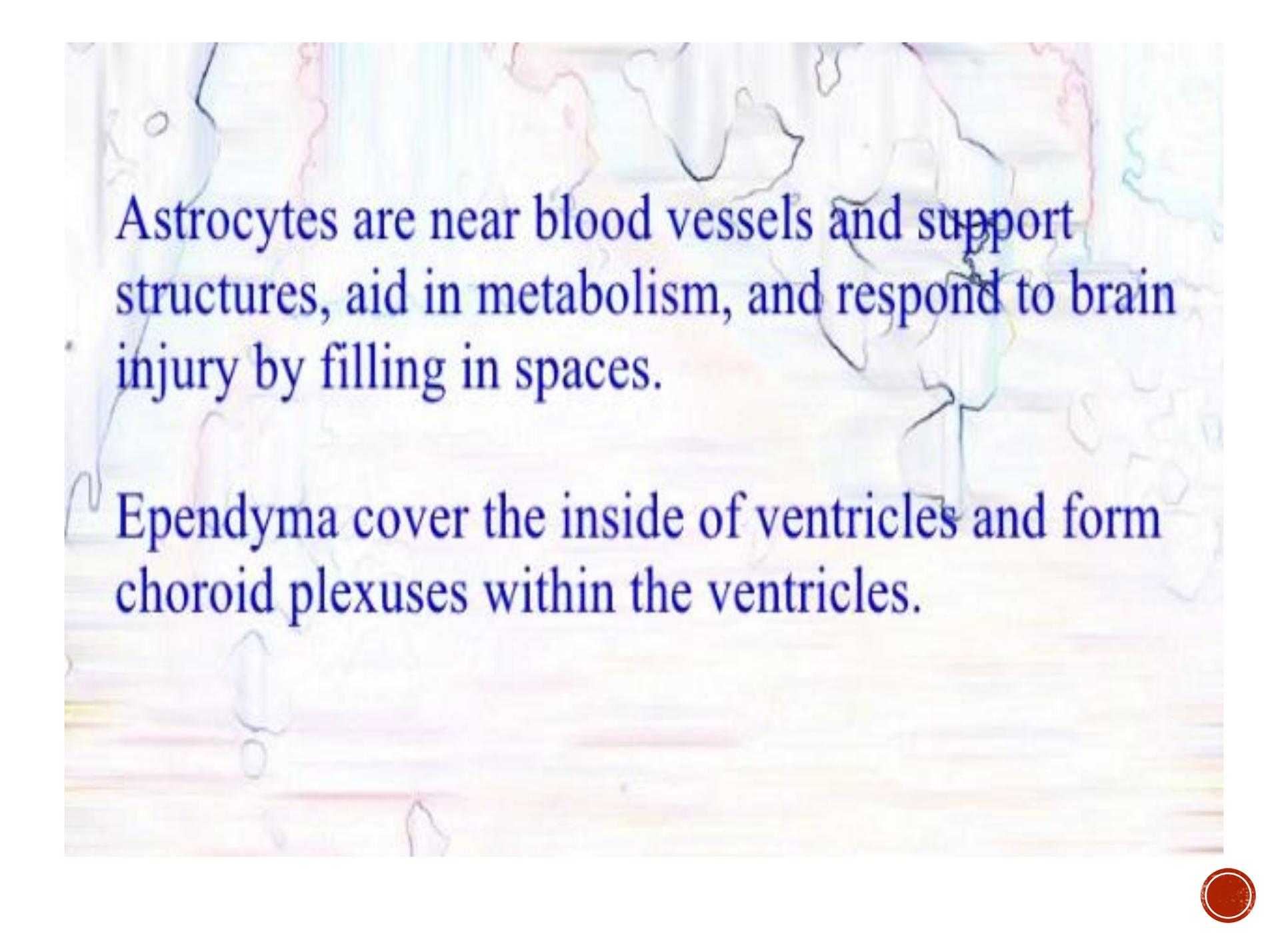
Classification of Neuroglial Cells

Neuroglial cells fill spaces, support neurons, provide structural frameworks, produce myelin, and carry on phagocytosis.

Schwann cells are the myelin-producing neuroglia of the peripheral nervous system; other types are components of the central nervous system.

Microglial cells are small cells that phagocytize bacterial cells and cellular debris.

Oligodendrocytes form myelin in the brain and spinal cord.

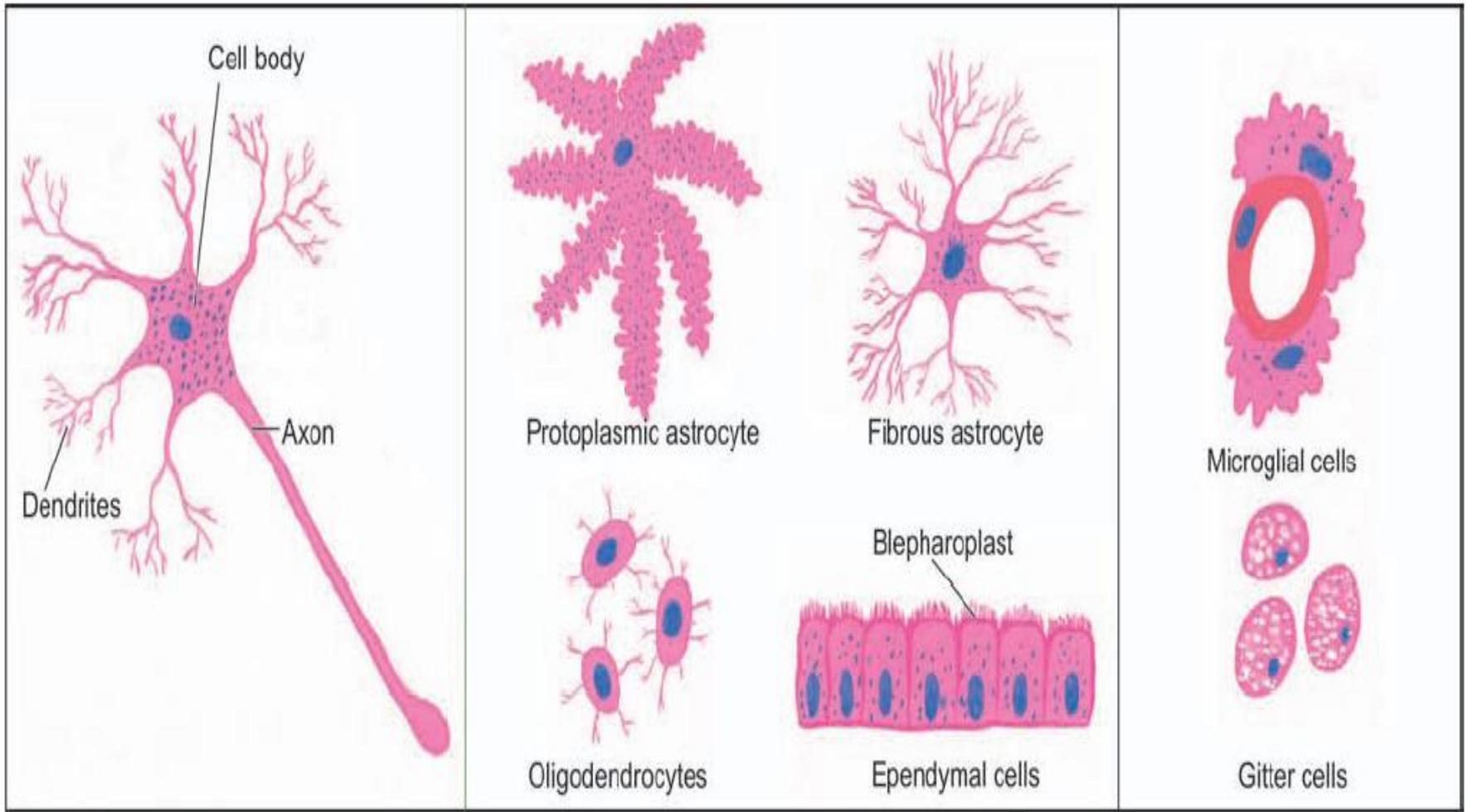
A microscopic image of brain tissue, likely a histological section, showing various cellular structures. The image is somewhat blurry and has a light, textured background. The text is overlaid on the image in a dark blue font.

Astrocytes are near blood vessels and support structures, aid in metabolism, and respond to brain injury by filling in spaces.

Ependyma cover the inside of ventricles and form choroid plexuses within the ventricles.



CELLS COMPRISING THE NERVOUS SYSTEM



A, NEURON

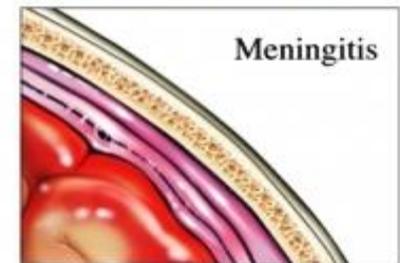
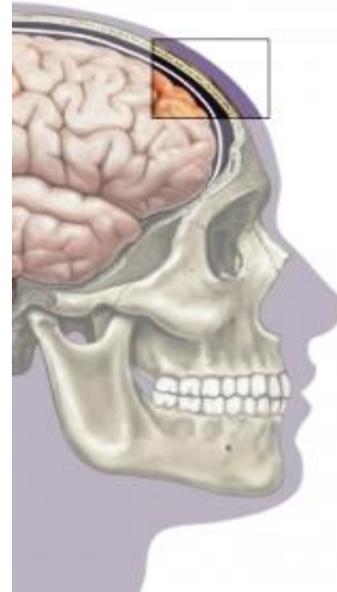
B, NEUROGLIA

C, MICROGLIA



MENINGITIS

- **Definition:**
Meningitis refers to an inflammatory process of the leptomeninges and CSF within the subarachnoid space.



■ **Types:-**

1. Infectious Meningitis

- Acute pyogenic meningitis (bacterial meningitis)
- Aseptic (acute viral meningitis)
- Chronic (Tuberculosis & Cryptococcal)

2. Chemical Meningitis

- Non bacterial irritant introduced into the subarachnoid space



ROUTE OF SPREAD

1. Haematogenous Spread
 - Commonest
2. Direct implantation of micro organism
 - Traumatic
 - Iatrogenic
3. Local Extension
 - Air Sinus
 - Infected tooth
 - Surgical site in the cranium or spine causing osteomyelitis, bony erosion and propagation of infection into the CNS
4. Through the peripheral nervous system into the CNS
 - Viruses – Rabies and Herpes zoster.



ACUTE PYOGENIC MENINGITIS (BACTERIAL MENINGITIS)

- Definition – Acute Inflammatory process of the leptomeninges & CSF within the sub arachnoid space.

- Etiology –

Neonates: E. coli

Group B streptococci

Infants:

S.pneumoniae

H.influenzae

Adolescent &

Young Adult:

Neisseria meningitis

Elderly:

S.pneumoniae,

Listeria monocytogen



■ **Morphology:**

Gross –

- Exudates within the leptomeninges over the surface of the brain.
- Meningeal vessels are engorged and stand out prominently.

Microscopy

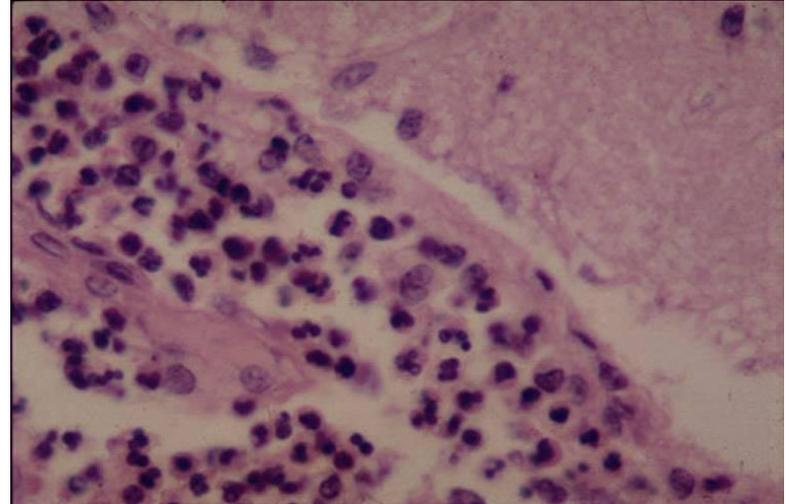
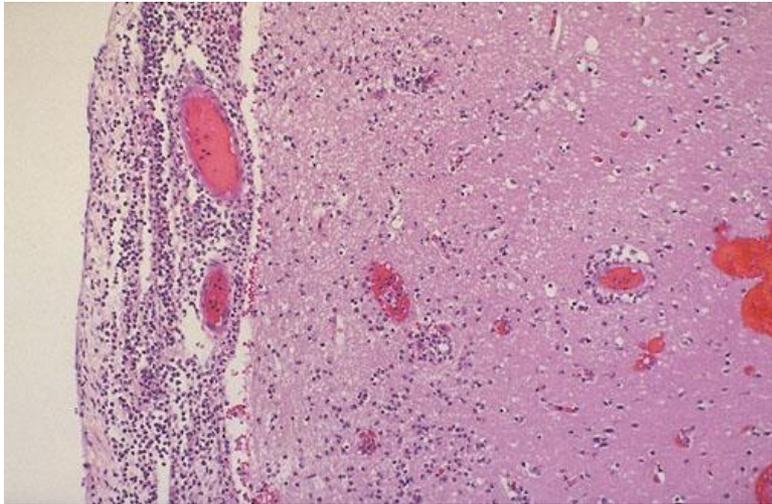
- Neutrophils, congested blood vessels



PURULENT (BACTERIAL) MENINGITIS



ACUTE PYOGENIC MENINGITIS



CLINICAL FEATURES:

- **Fever**
- **Meningeal irritation**
- **Headache**
- **Irritability**
- **Clouding of consciousness**
- **Neck stiffness**



CLINICAL FEATURES

Symptoms of Meningitis



Central
- Headache
- Altered mental status

Ears
- Phonophobia

Eyes
- Photophobia

Neck
- Stiffness

Systemic
- High fever

Trunk, mucus membranes, extremities (if meningococcal infection)
- Petechiae



Investigation:

Spinal Tap - CSF finding:

Cloudy or frankly purulent CSF

Elevated CSF pressure

Neutrophils increased

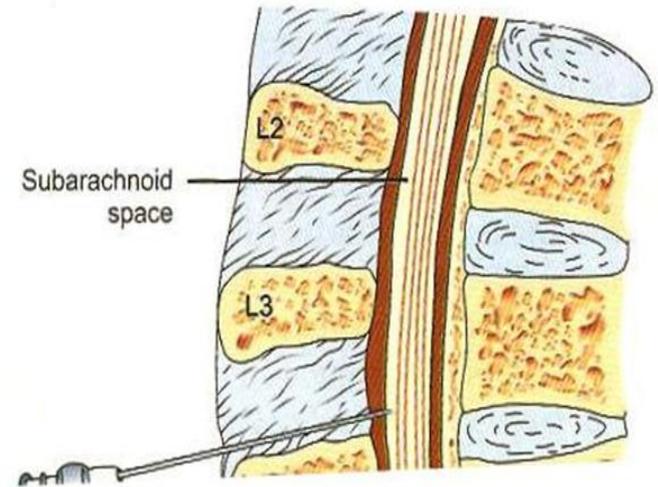
Protein increased

Decreased CSF glucose- due to consumption by bacteria

Bacteriological Examination by → Gram Stain
→ CSF Culture

Treatment:

Effective antimicrobial agents



LUMBAR PUNCTURE NEEDLE

- **Instrument:** Lumbar Puncture Needle
- **Uses:**
 - Collect CSF sample (spinal tap) for biochemical, microbiological and cytological analysis
 - Spinal anesthesia
 - Therapeutic lumbar puncture (to relieve increased ICP)
- **Site of insertion:** Between L3 and L4 in adults
- Between L4 and L5 in children



ACUTE ASEPTIC (VIRAL) MENINGITIS

- **Definition:**

It is a clinical term referring to the absence of recognizable organism in an illness with meningeal irritation, fever and alteration of consciousness of relatively acute onset.

- **Aetiology:** Children and young adults

Viral – Enterovirus

- Echo virus

- Coxsackievirus



Morphology:

Gross: No distinctive macroscopic features except brain swelling.

Microscopic: No abnormality

Mild to moderate lymphocytes

Clinical Features : is less fulminant

CSF Examination:

Lymphocytic pleocytosis

Moderate increased protein

Normal sugar

Treatment: Self – limiting, Symptomatic treatment.

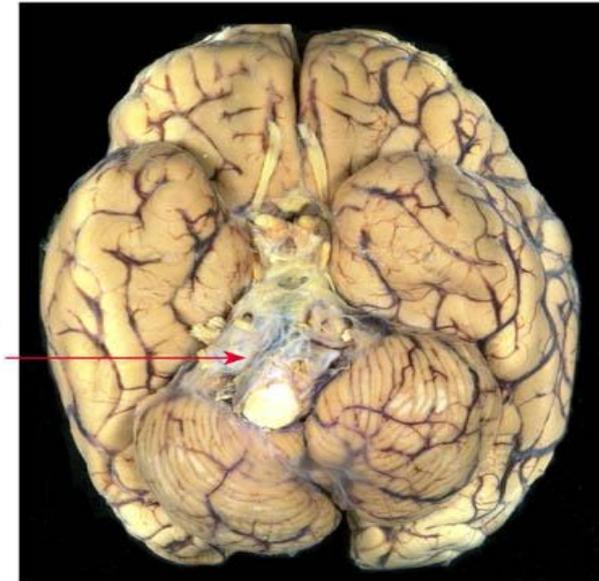


TUBERCULOUS MENINGITIS

- Morphology:

Gross –

- Gelatinous or fibrinous exudate at the base of the brain.
- Discrete, white tubercles, scattered over the leptomeninges.



Thick grey shaggy
exudate encasing
cranial nerves
& blood vessels

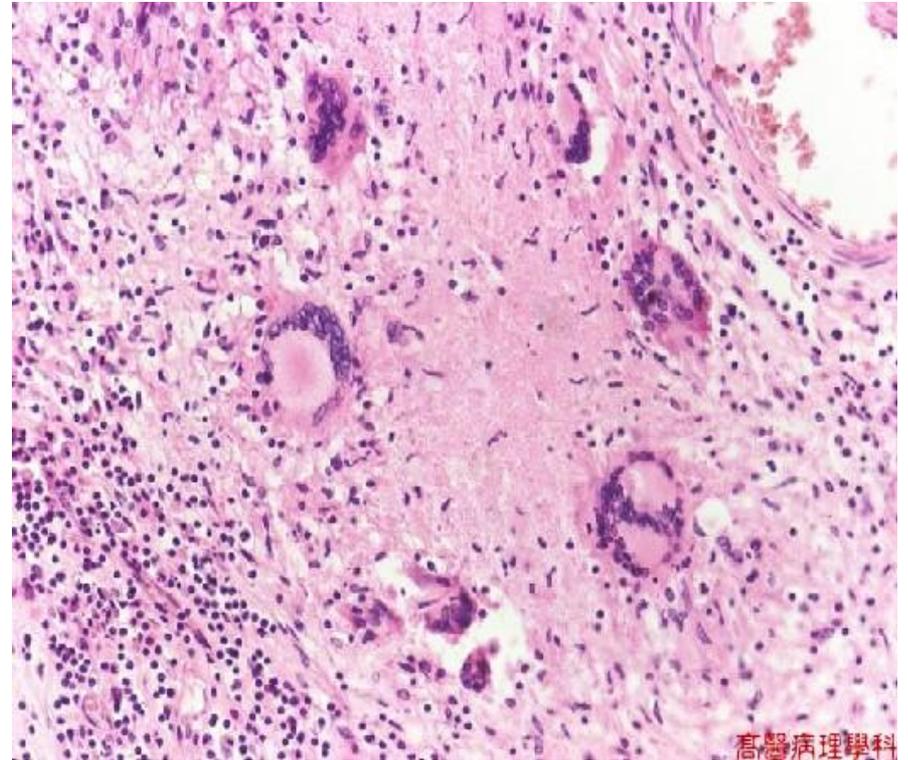
Tuberculous Meningitis



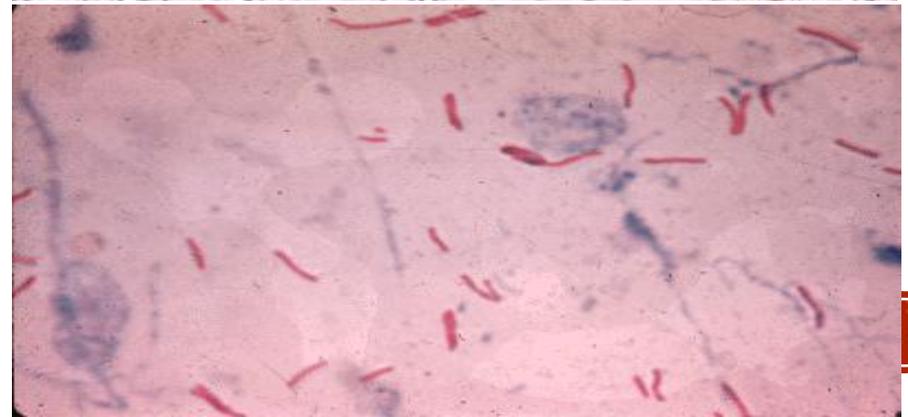
TUBERCULOUS MENINGITIS

Microscopic –

- Mixture of lymphocytes, epithelioid cells, plasma cells
- Well – formed granulomas.



高醫病理學科



- **Clinical Feature:**
- Fever, Headache, malaise, vomiting, mental confusion
- **CSF Examination:**
 - Moderate pleocytosis (Lymphocytes)
 - Increased protein
 - Moderate reduced glucose
- **Complication:**
 - **Arachnoid Fibrosis – Hydrocephalous**



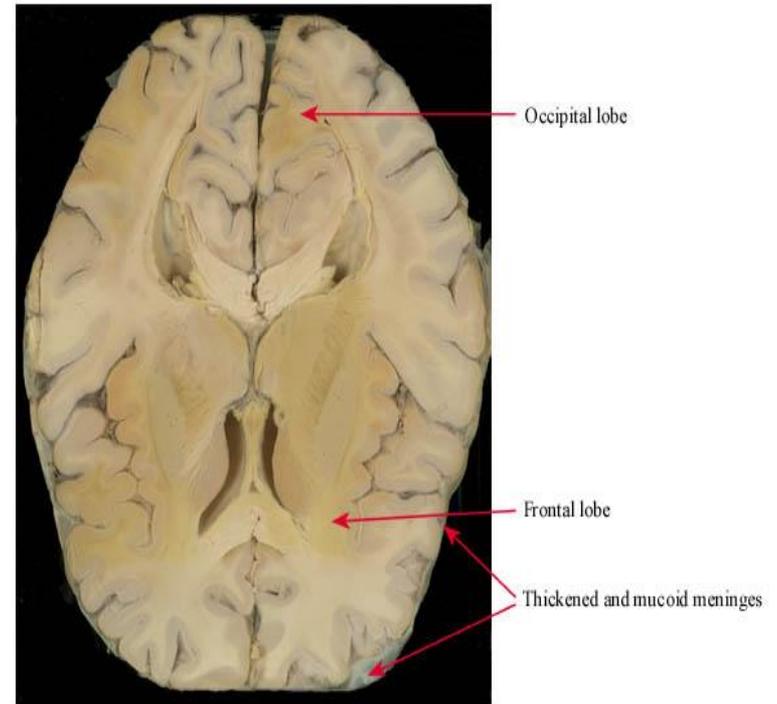
FUNGAL MENINGITIS

- Immunocompromised patients
- *Candida albicans*, *Mucor*, *Aspergillus*, *Cryptococcus neoformans*

Grossly,

basal leptomeninges are opaque and thickened.

Exudate is gelatinous



Cryptococcal meningitis - A horizontal section of the brain



❖ Microscopy –
Chronic inflammatory
cells
and fibroblasts
admixed
with cryptococci



Figure 30.4 ◀ Cryptococci in CSF as seen in mucicarmine stain.



3 main patterns of fungal infection in the CNS:

1 Chronic Meningitis

- ❖ Cryptococcal
- ❖ HIV patients
- ❖ Fulminant or indolent
- ❖ Grossly, basal leptomeninges are opaque and thickened. Exudate is gelatinous
- ❖ Micro – Chronic inflamm cells and fibroblasts admixed with cryptococci
- ❖ CSF Findings – Few Cells
 - increased protein
 - India ink preparation → cryptococci

2. Vasculitis: Mucor, Aspergillus

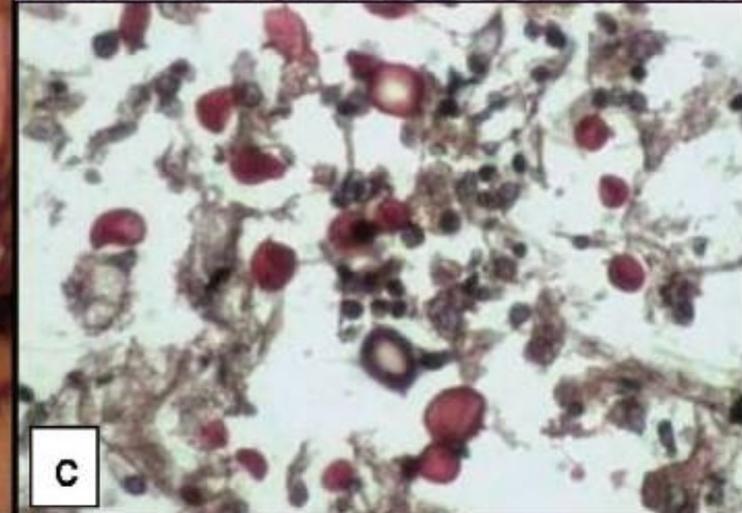
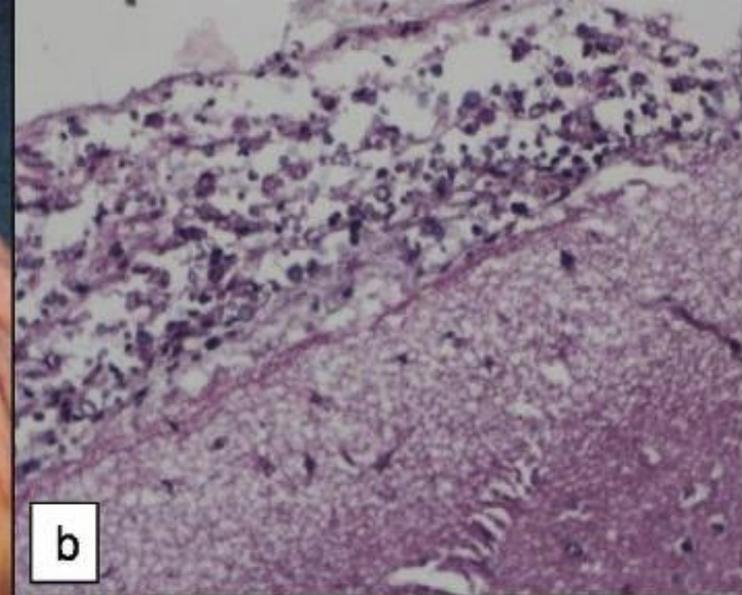
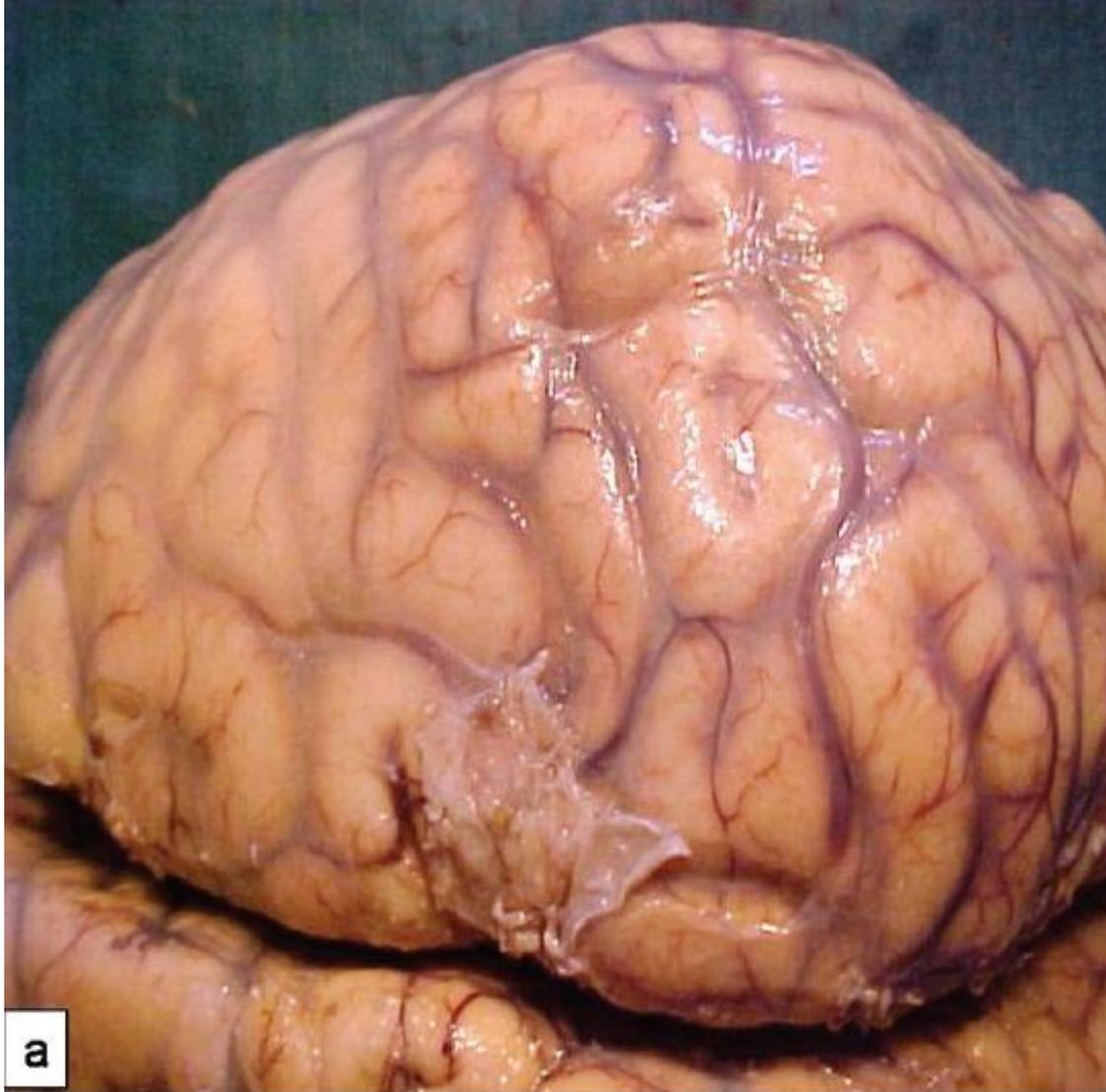
Vascular thrombosis → Infarction

3 . Parenchymal Invasion:

- ❖ Granulomas
- ❖ Candida, cryptococcus



FUNGAL (CRYPTOCOCCAL MENINGITIS)



CSF FINDINGS IN HEALTH & VARIOUS TYPES OF MENINGITIS

Feature	Normal	Bacterial meningitis	Viral / lymphocytic meningitis	Tuberculous meningitis
Appearance	Clear	Cloudy / purulent	Clear-slightly turbid	Turbid & forms coagulum on standing
CSF pressure	60-150 mm of water	> 180mm of water	>250 mm of water	> 300 mm of water
Cells	0-4 lympho/ml	1000-1 lac neutrophils/ml	10-100 mononuclear cells / ml	100-1000 mononuclear cells/ml
Proteins	15-45 mg/dl	Raised	Raised	Raised
Glucose	50-80 mg /dl	< 40 mg/dl	Normal	< 40 mg / dl
Bacteriology	Sterile	Causative organism present	sterile	Tubercle bacilli present

THANK YOU

