

YU - MEDICINE
PASSION ACADEMIC TEAM

Central Nervous System

SHEET# 5 - PATHOLOGY

LEC. TITLE : INFECTIONS OF CNS (PART 2)

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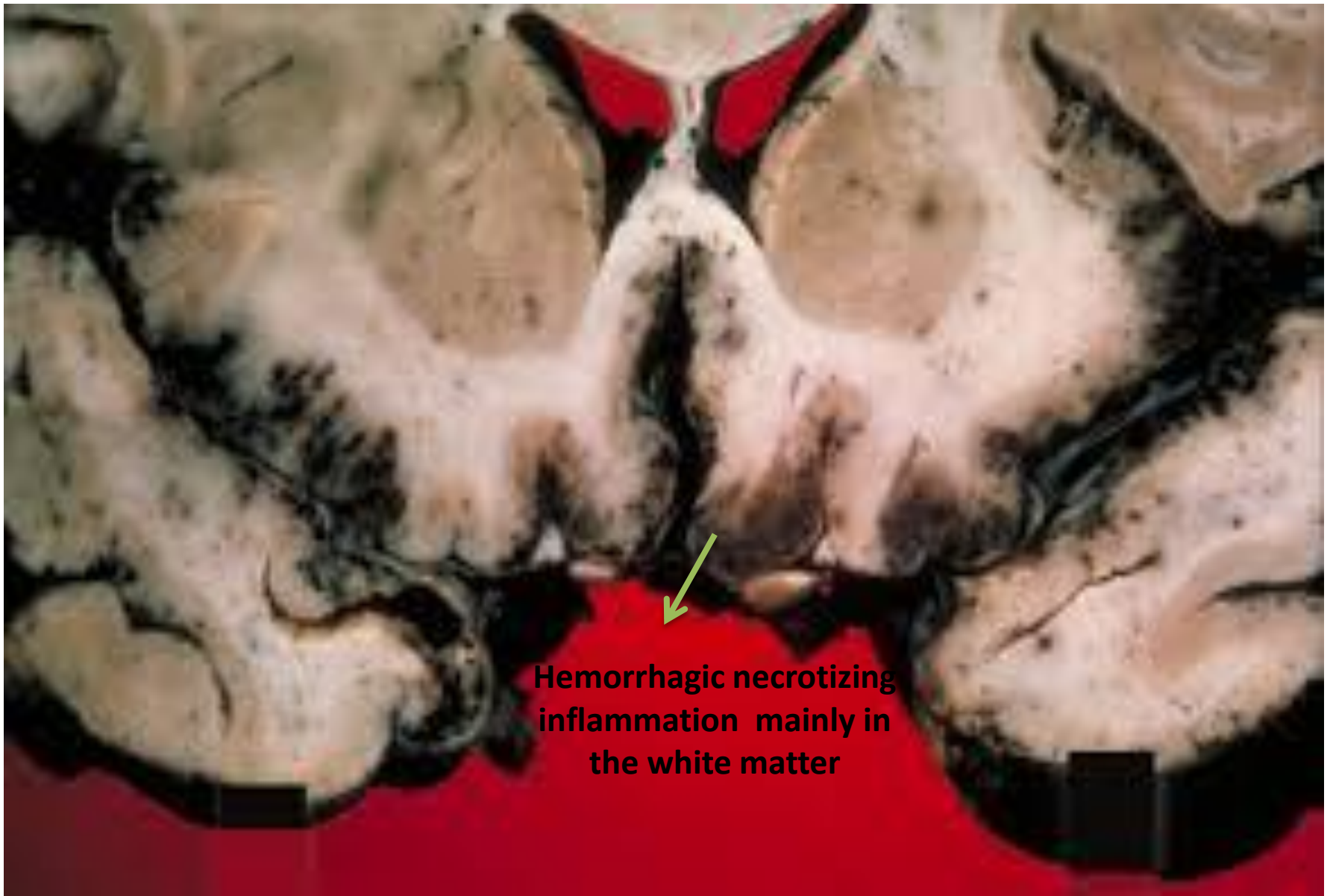


If you come by any mistake , please
kindly report it to
shaghafbatch@gmail.com

1- Herpes Simplex Virus type 1 & 2

- HSV1

- Children or young adults
 - Hemorrhagic necrotizing inflammation in temporal lobe & orbital gyri of frontal lobe
 - Alteration in mood, memory and behavior
 - All common features of viral encephalitis seen (Perivascular mononuclear infiltrate, Neuronophagia, Microglial nodules) + Cowdry type A **intranuclear** viral inclusions in neurons & glial cells
- **HSV-2** in adults may cause meningitis



Hemorrhagic necrotizing
inflammation mainly in
the white matter

HERPES ENCEPHALITIS

2- Varicella –Zoster Virus (Herpes-Zoster)

- Causing Chicken pox during primary infection in children.
- latent infection in **dorsal root ganglia**.
- Reactivation in adults (Shingles): painful vesicular skin eruption along a dorsal nerve in one or a few dermatoms, Self limited.
- Lesion is typical of viral infection, inclusions
± granulomatous arteritis & infarction
- In immunosuppressed patients, may show acute encephalitis.

Patient with shingles



Shingles (herpes zoster) rash



Shingles (Herpes Zoster)

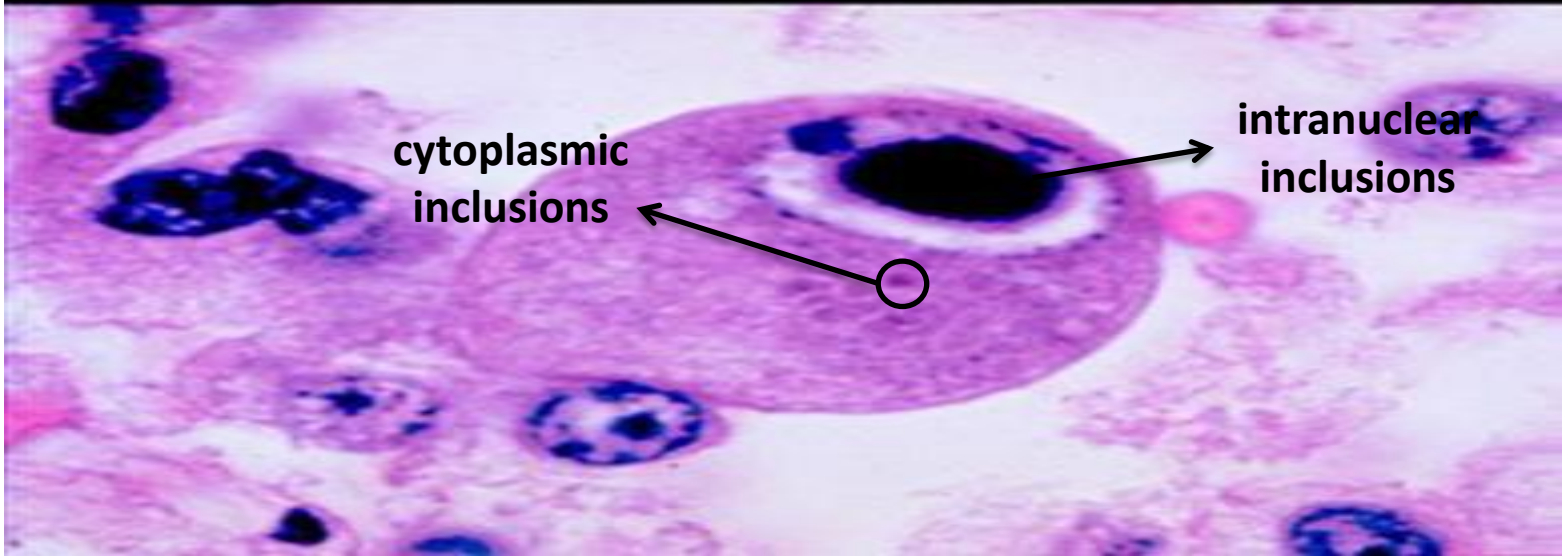
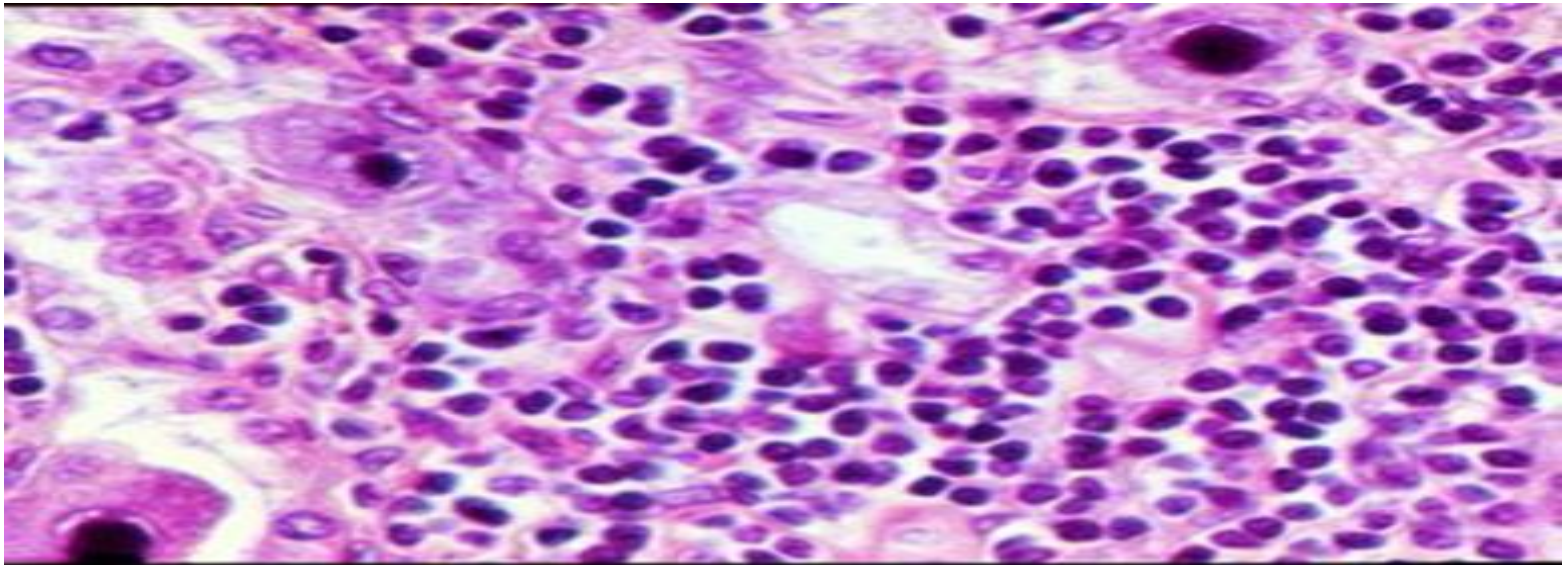


Herpes zoster blisters



3- Cytomegalovirus (CMV)

- **Immunosuppressed** especially AIDS : subacute encephalitis in any region & any cell but mainly **Paraventricular subependymal region** of the brain → **Sever hemorrhagic necrotizing ventriculoencephalitis** (mainly around the ventricles)
 - hemorrhagic necrosis of ependymal lining with large **cytoplasmic & intranuclear** inclusions
- **Fetus** : intrauterine infection:
 - Periventricular necrosis and brain destruction , microencephaly & calcification



4- Rabies

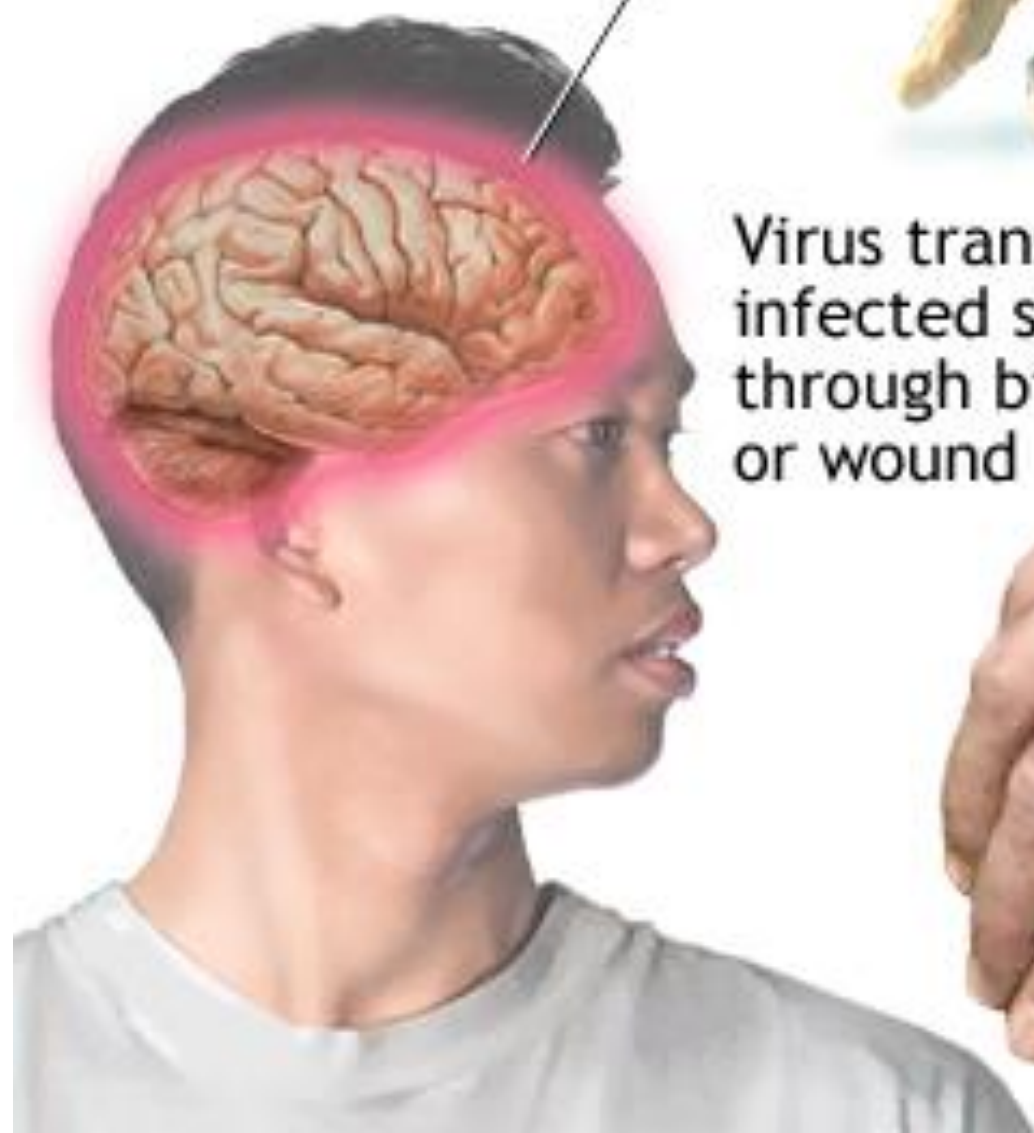
- Severe encephalitis
 - Transmitted to humans by bite of a rabid animal such as dog
 - Ascends along peripheral nerve from bite
- Headache, fever, extraordinary CNS excitability, Periods of mania and stupor. فجأة يبصيرون نشيطين وفجأة ينجيهم خمول
- Neuronal degeneration and inflammatory reaction , most severe in brain stem
 - also can be in basal ganglia, S.C, dorsal root ganglia
- Presence of **Negri bodies** : cytoplasmic, eosinophilic inclusions in pyramidal neurons of the **hippocampus** & **Purkinje cells of cerebellum**, in sites usually devoid of inflammation

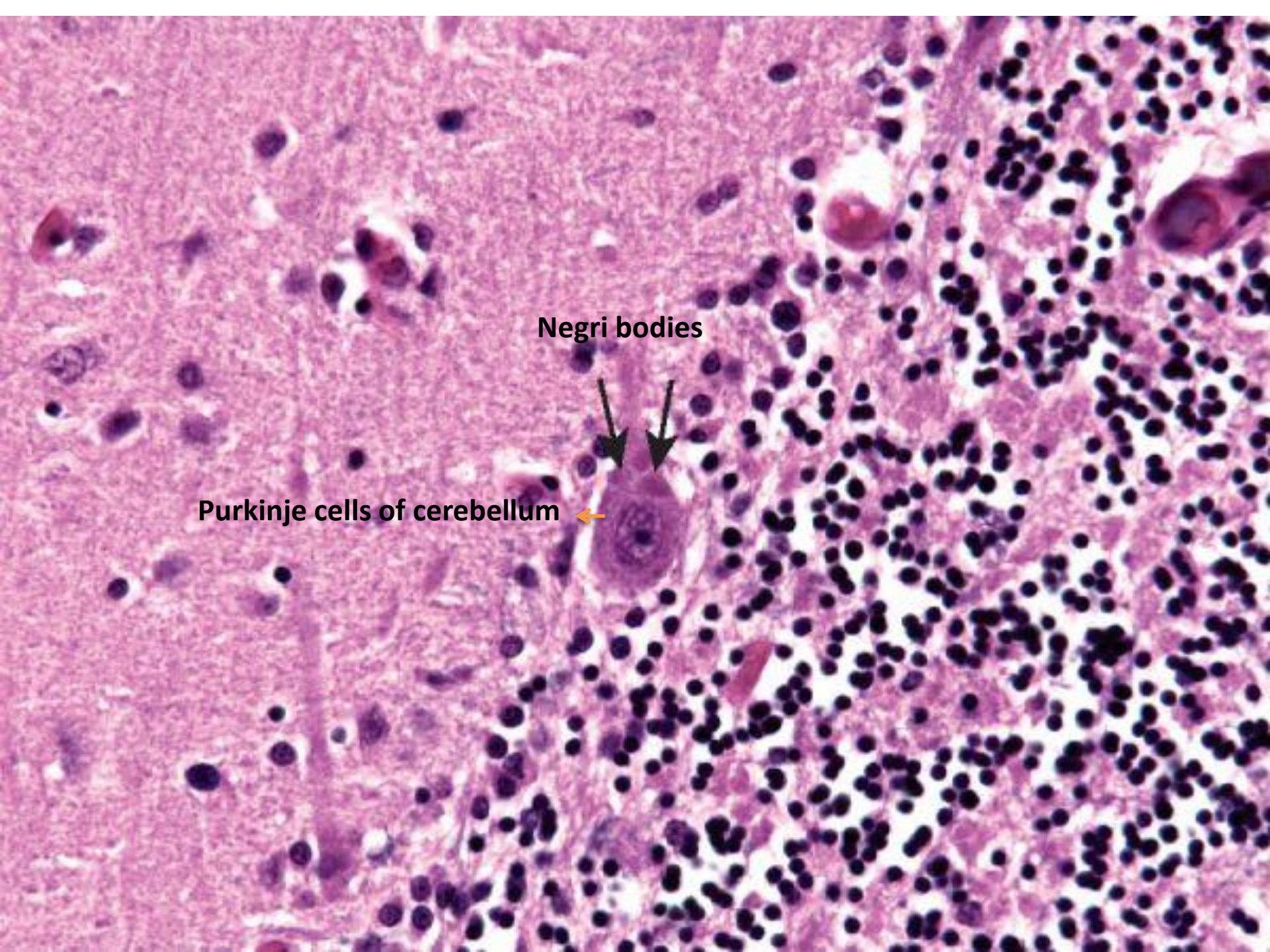
negri bodies _ يعني الأماكن الي فيها **inflammation** ما يكون فيها

Brain inflammation



Virus transmitted by
infected saliva
through bite
or wound





Negri bodies

Purkinje cells of cerebellum

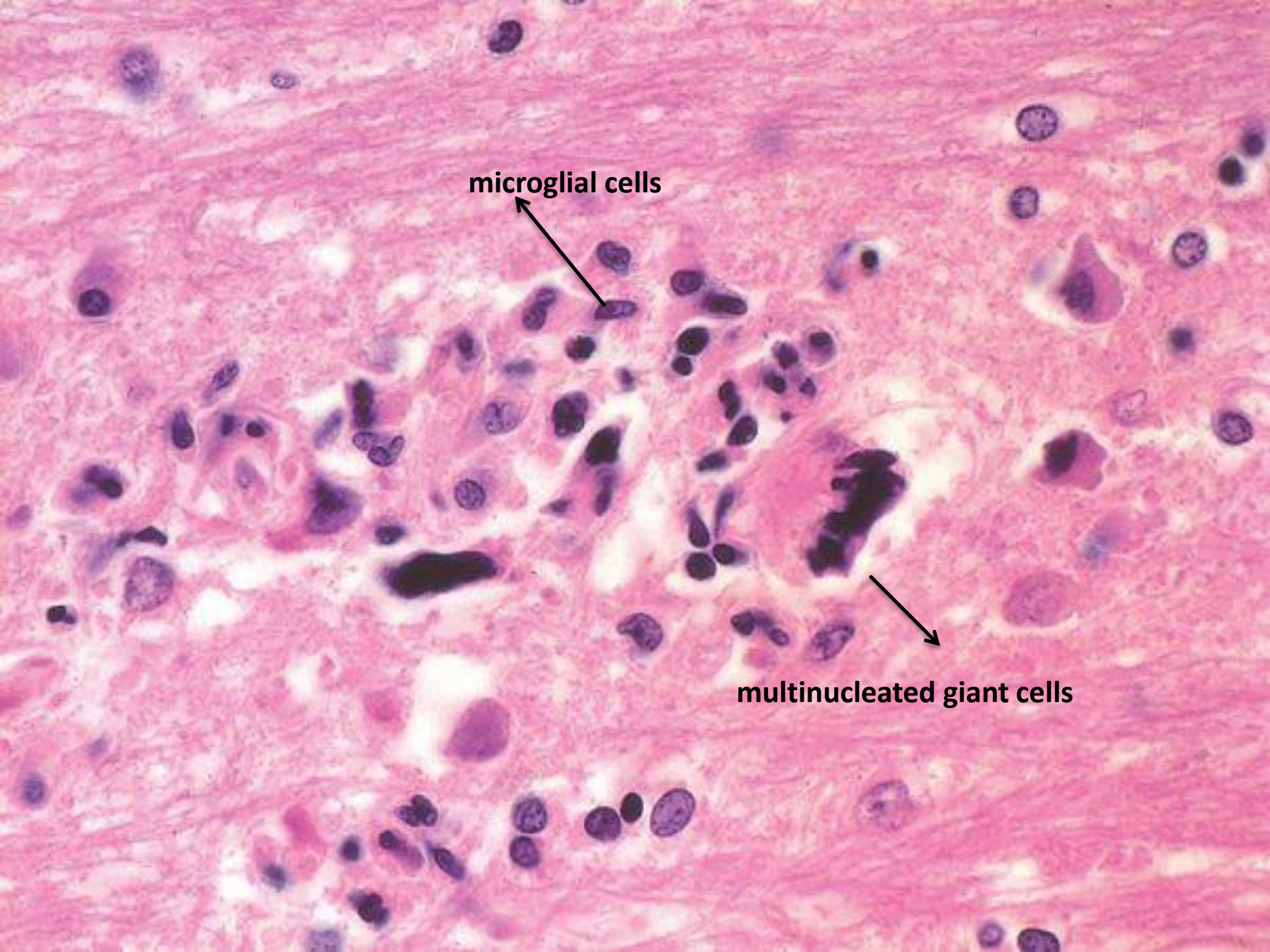
5- Poliovirus

- Enterovirus causing mild gastroenteritis
- Involvement of CNS in the non- immunized
- Acute :
 - mononuclear cell perivascular cuffs and neuronophagia of the **anterior horn motor neurons** of the spinal cord
- Chronic :
 - Loss of neurons and atrophy of the anterior (motor) spinal roots,**and neurogenic atrophy of muscle.
- Clinical presentation:
 - Flaccid paralysis with muscle wasting
 - Death can occur from paralysis of the respiratory muscles in acute phase.



6- Human Immunodeficiency Virus (HIV)

- **Early:** aseptic viral meningitis in 10%
- **Chronic : HIV Encephalitis:** chronic inflammatory reaction with **widely distributed microglial nodules with multinucleated giant cells**
- Can cause disorder of white matter : Multifocal or diffuse area of myelin pallor, axonal swelling and gliosis
- **HIV- associated dementia**



microglial cells

multinucleated giant cells

7- JC virus → PML

(Progressive Multifocal Leuko-Encephalopathy)

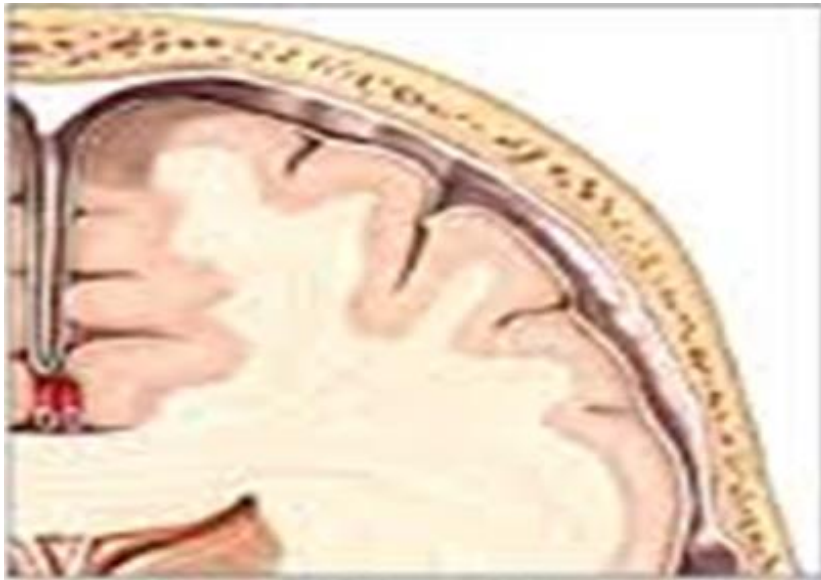
↓
More than one area

↓
Related to white matter

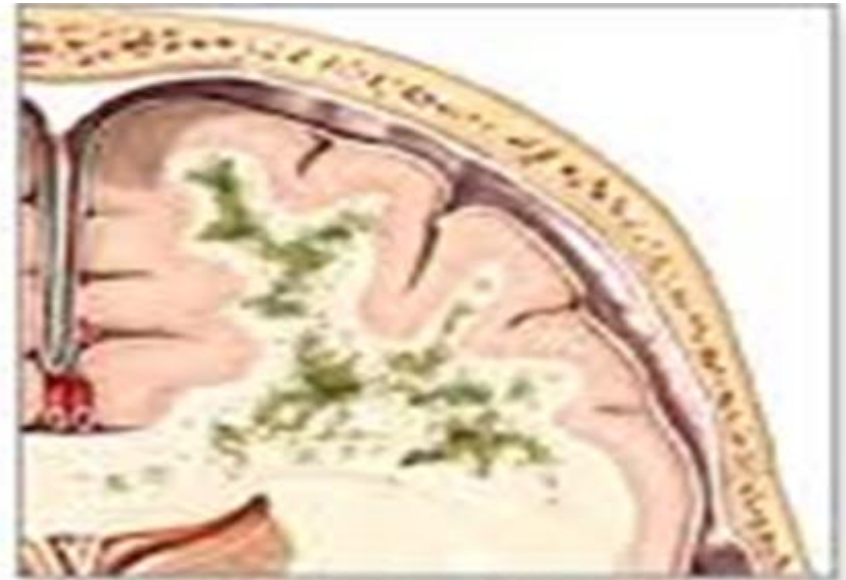
- Caused by **JC polyomavirus** exposure during childhood
- Reactivation mainly in AIDS patients & other immunosuppressed patients
- Infect **oligodendrocytes**

RESULT : Progressive **demyelination** of white matter

- **Grossly:**
 - Patches of irregular, ill-defined destruction of white matter from mm to extensive involvement of the entire lobe



Normal brain



Brain with lesions



Normal area

- **Microscopy:**

- Patch of demyelination , with scattered lipid laden macrophages at the center (to engulf dead cells), and reduced number of axons
- Enlarged oligodendrocyte nuclei with viral inclusions
- Large astrocytes are also seen.

FUNGAL ENCEPHALITIS :

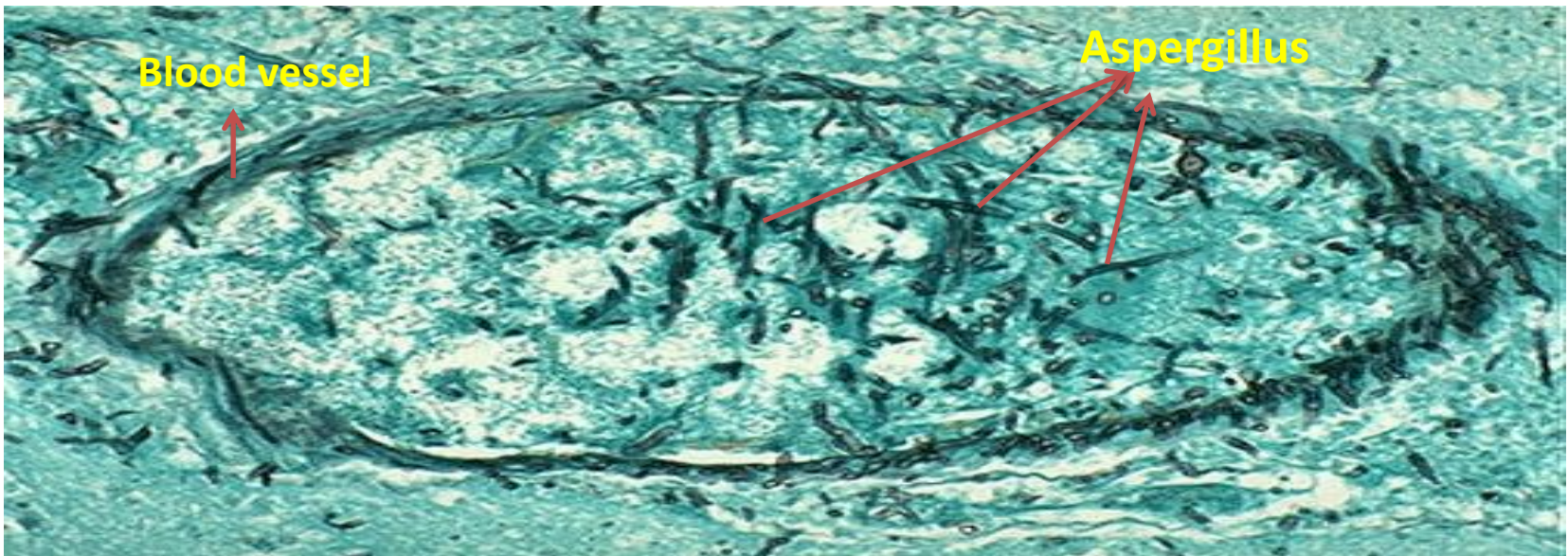
- Candida, Cryptococcus , Aspergillus, & Mucor
- Mainly in Immunocompromised patient
- Hematogenous or direct invasion
- Parenchymal granulomas or abscesses, often associated with meningitis
- AIDS patients **in particular** are prone to cryptococcal meningoencephalitis

- **Candida albicans** : Multiple microabscesses, with or without granuloma formation.
- **Mucormycosis** :
 - Presents as an infection of the nasal cavity or sinuses of a **diabetic** patient with ketoacidosis.
 - May spread to the brain through vascular invasion or by direct extension through the cribriform plate.

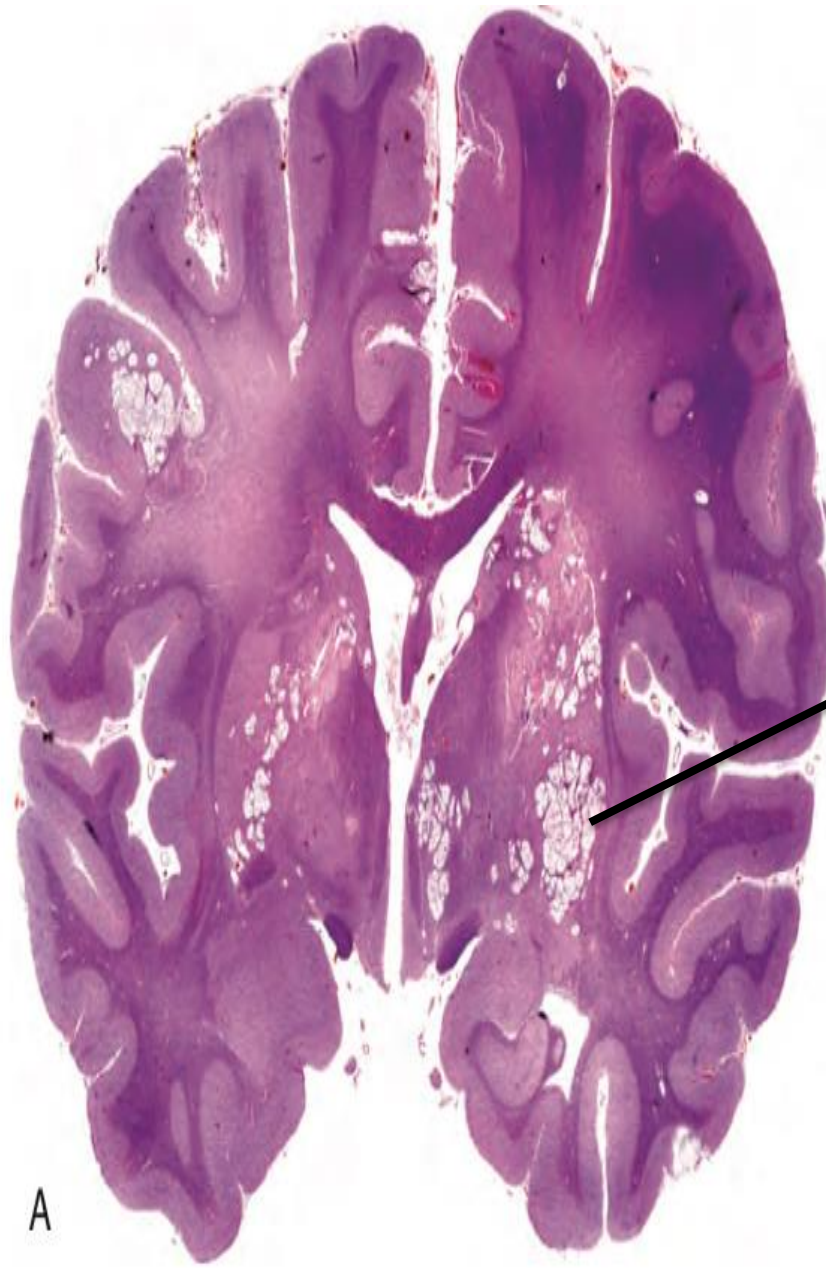
Important slide!

- **Aspergillus fumigatus :**

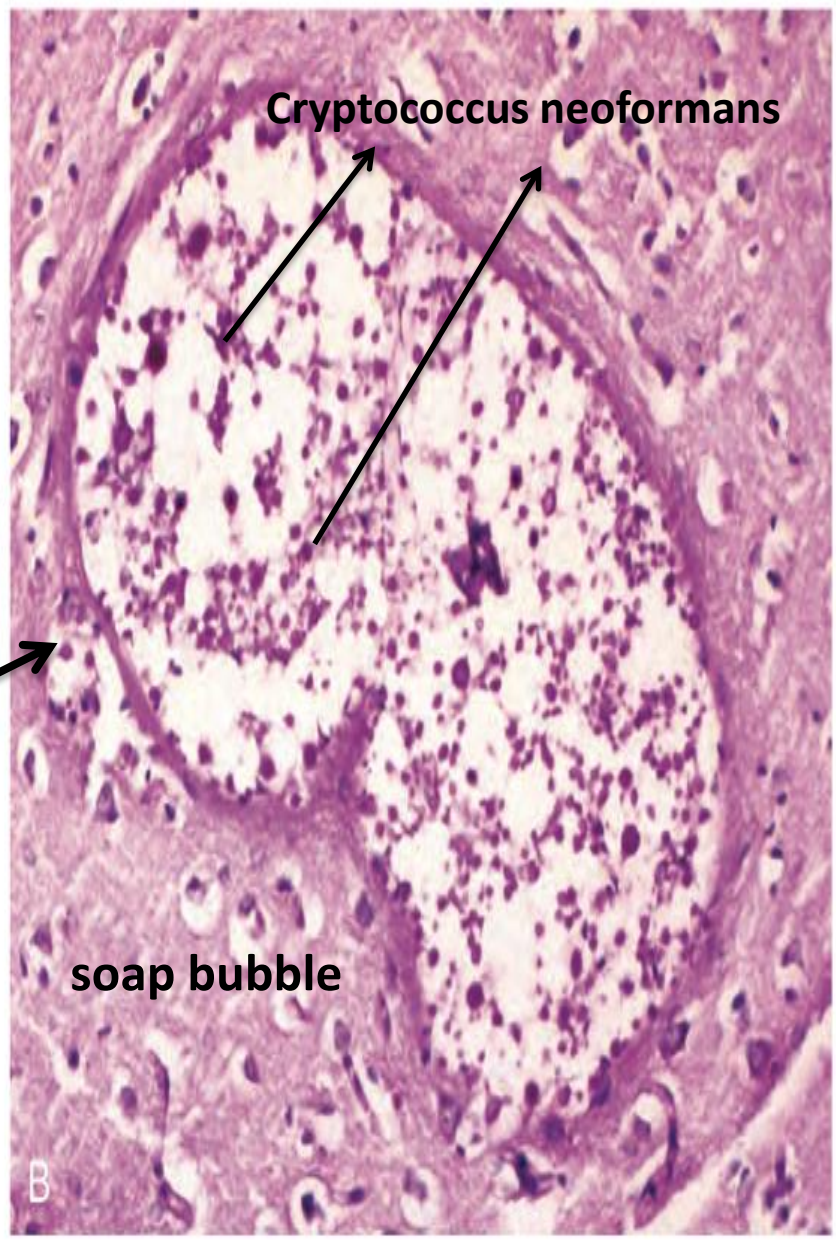
- Widespread septic hemorrhagic infarctions, Why?? We said all of them causes inflammation why here is infarction?? **Because this microorganism invade blood vessel wall → causing inflammation and thrombus formation → leading to occlusion → infarction**



- **Cryptococcus neoformans:**
 - Meningitis or meningoencephalitis
 - 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



A



Cryptococcus neoformans

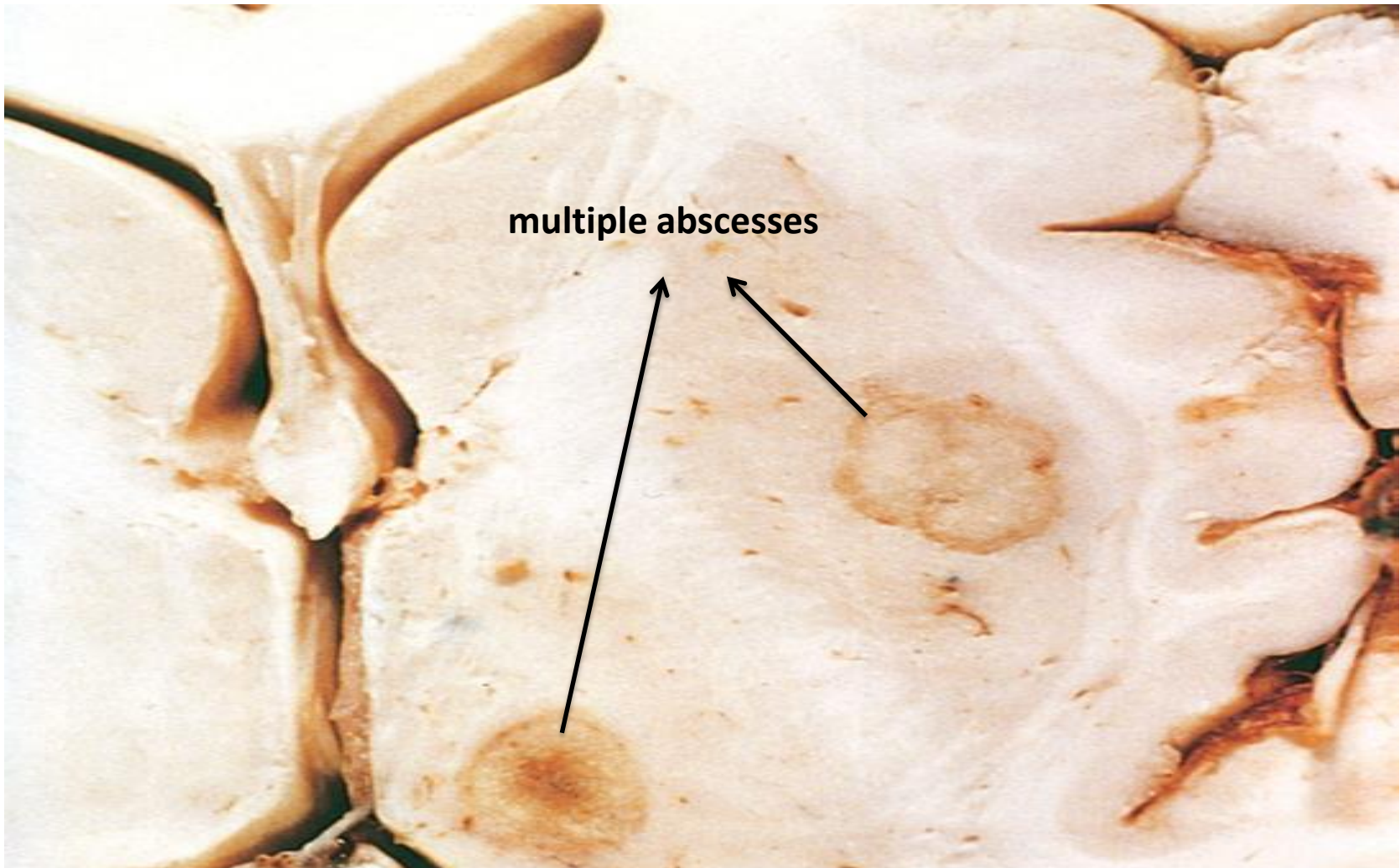
soap bubble

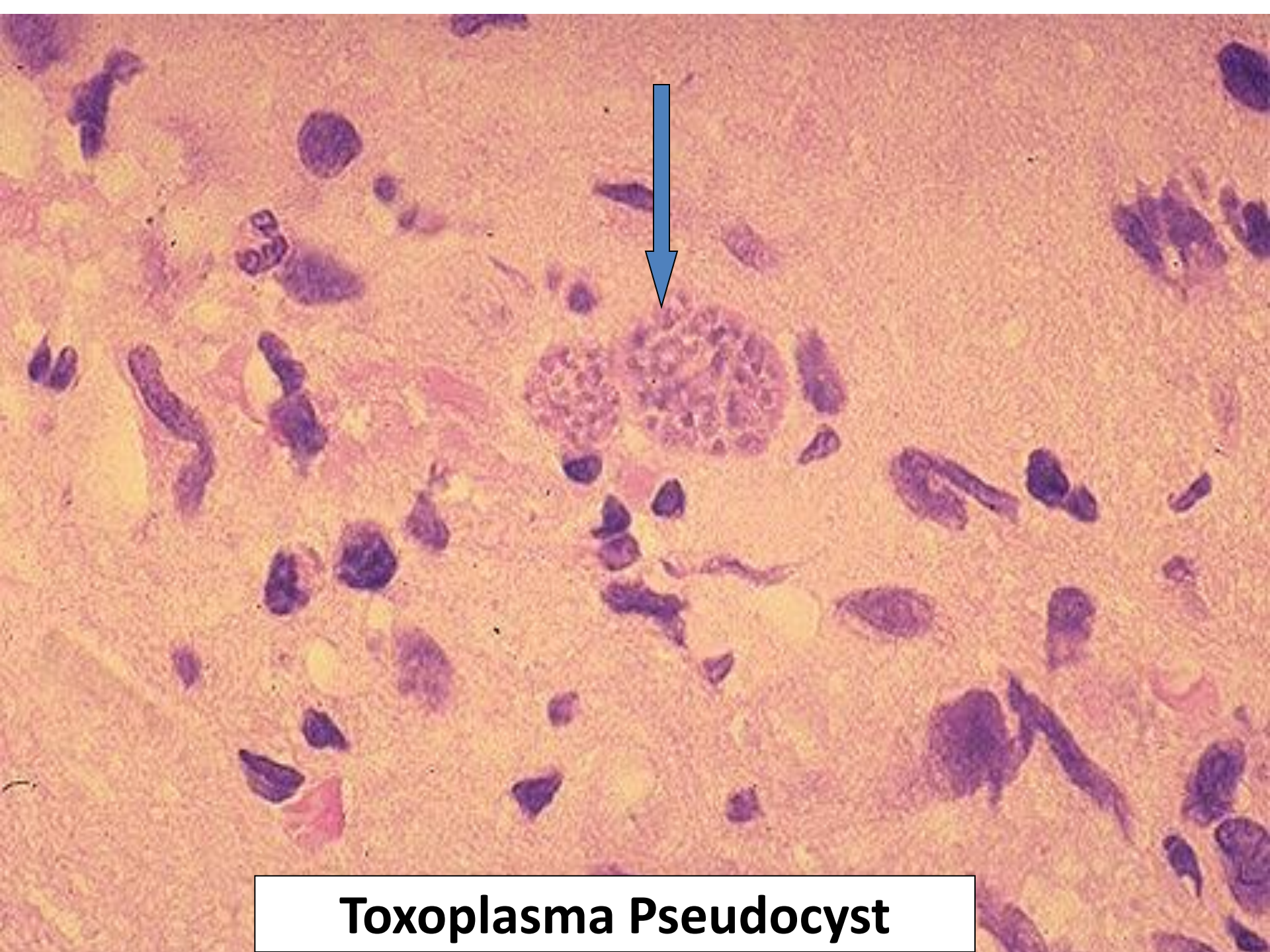
B

Other infections :

- **Cerebral Toxoplasmosis :**
 - Immuno-compromised patients, especially(AIDS)
 - Small, usually multiple abscesses & necrotic foci
 - Both free tachyzoites and encysted bradyzoites may be found at the periphery of the necrotic foci
 - In newborns who are infected in utero: triad of chorioretinitis, hydrocephalus, and intracranial calcifications

These masses could be tumors, tuberculomas or toxoplasmosis, we can't differentiate between them grossly so we have to use microscope





Toxoplasma Pseudocyst

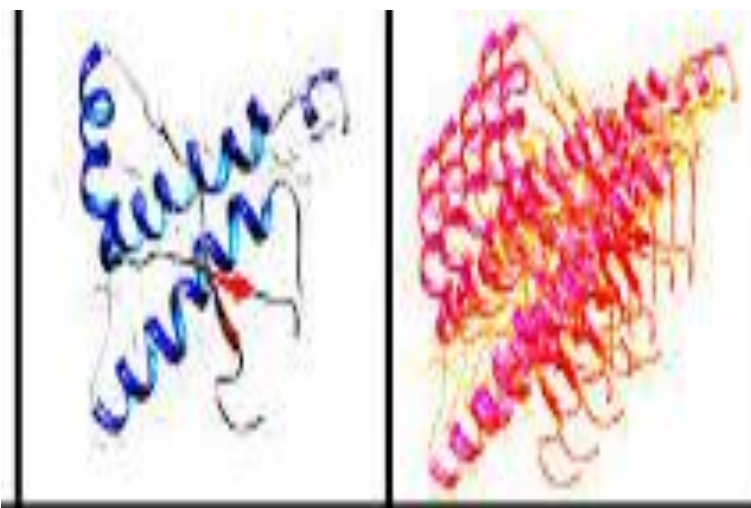
- **Cysticercosis:**

- Infection of a human brain with the larva of the pork tapeworm (*Taenia solium*) .
- Clinically: - Mass lesion, seizures.



PRION DISEASES : **infectious particles!!**

- Normal PrP (prion protein) is a cellular protein present in neurons
- Disease occurs when the PrP undergoes conformational changes from its normal shape (PrP^c) to an abnormal conformation called PrP^{sc}.



Prion protein or PrP is a protein on the surface of your cells

A prion is an infectious particle made up of misfolded prion proteins

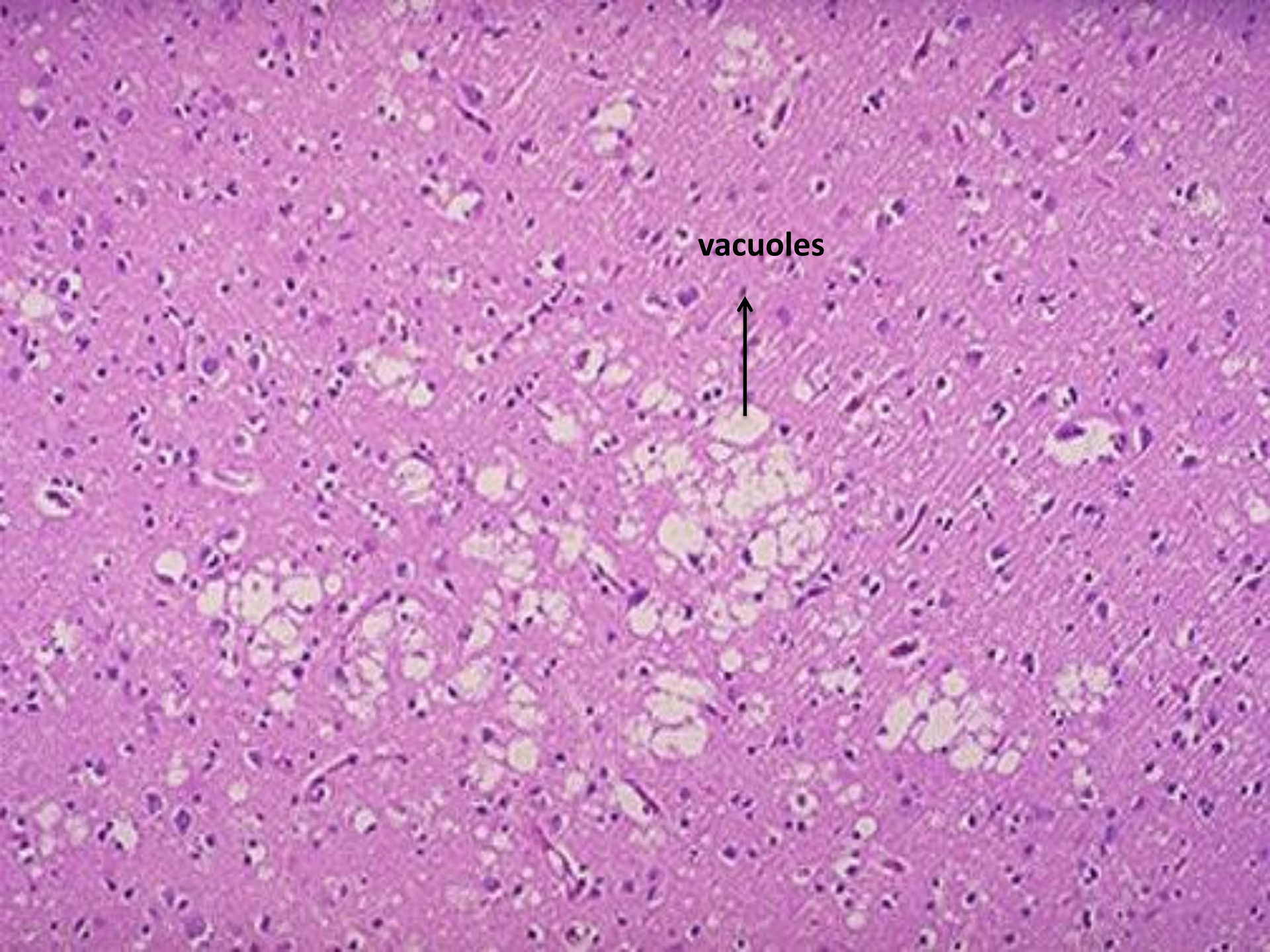
Include a variety of conditions : **forms of prion diseases**

- Sporadic and familial Creutzfeldt- Jacob Disease
- Scrapie in sheep
- bovine spongiform encephalopathy in cattle (“mad cow disease”)

CJD (Creutzfeldt-Jakob)

- 1 per million incidence, 7th decade
- Sporadic cases 85%
- Familial cases (15%), younger
- **Rapidly progressive dementia**
- Onset of subtle changes in memory and behavior to death is only 7 months
- FATAL, no treatment known, like ALL prion diseases

- **Microscopy:**
 - Multifocal spongiform transformation (Intracellular vacuoles in neurons and glia) of cerebral cortex & deep gray matter.
 - Advanced cases:
 - Neuronal loss
 - Gliosis



vacuoles

