CNS

Brain cells.

Neuroectodermal.

1) Astrocytes
   i) Blood Brain Barrier.
   ii) Wound Healing/Repair.
   Ependymal injury (donot Regenerate)
   ↓
   Subependymal granuloma.
   (astrocytes)

2) Oligodendrocytes - myelination of CNS.

3) ependymal cells
   Fatty-acid Binding protein/w.
   *
   Mature astrocytes.
   ↓
   Radial glial system.
   ↓
   Morphogenesis of Cortical layers.

mesodermal.
modified macrophages
↓
Microglial cells.
↓
modified Lipid Lipophages
↓
Gitter cells
Hoteg cells

1) Red neurons - Hypoxic / Ischemic injury
because of apoptosis, necrosis, cytoplasm - Red.

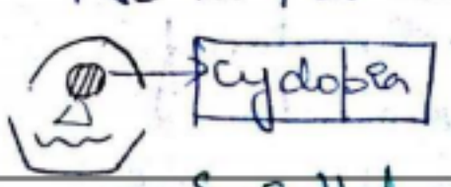
2) Rosenthal fibres - Both tumor & inflammation.
→ Tumor Juvenile Pilocytic Astrocytoma
→ Inflammation → Gliosis
Composition - heat shock proteins HSP-27
αB crystalline.

3) Alzheimer Type-II astrocytes - No association with Alzheimer's disease.
Due to Liver cell failure
↓
Hyperammonemia
↓
Swollen astrocytes - Alz. Type-II

Alzheimer Type-I astrocytes - Progressive multifocal Leucoencephalopathy
JC polyoma virus
↓
Oligodendrocytes.
↓
Ground glass nuclei.

Forebrain Anomalies -

1) Holoprosencephaly: (Whole forebrain fused)
No Rt / Lt Cerebral Hemispherese.



→ Sonic Hedge Hog gene mutation.

↑ Mutation genes

↑ Morphogenesis

Homebox Hox

Decide Anterior-Posterior axis.

[Head-Tail pattern]

Sonic Hedgehog genes

Patterning of limbs, midline structures, Brain & Spinal cord

Neuronal Migration disorders

Normal migration — 12-16 weeks (Completed migration)

1) Lissencephaly

Less of gyrus → Agyria. Flat Brain

Lis-1 gene mutation.

2) Polymicrogyria

3) Neuronal Heterotopia

4) Agenesis of Corpus Callosum.

Batwing / Deformity - Radiologically

5) Agenesis of Cranial nerves

Hind-Brain Syndromes

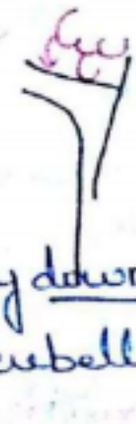
- Dandy-Walker Syndrome - Cystic dilatation of IV ventricle

↑ post. fossa volume (↑ CSF - Hydrocephalus)

Direct Transformation - Cerebellar Herniation.

I

Quadrigeminal plate Tectum intact.



∴ only downward displacement of cerebellar vermis.

II Arnold-Chiari.

Damage of quadrigeminal plate / Tectal plate.

Cerebellar Herniation

Banana Sign.

Chiari → neural Tube defect

Vascular

Hemorrhages

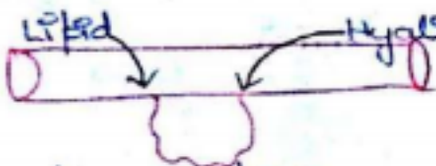
Intracerebral (m/c type of Bleed)

→ HTN

m/c A : Middle Cerebral A.

↓

Lenticulostriate branch.



Lipohyalinosis of BV

↓

Aneurysm.

Charcot-Bouchard aneurysm.

↓

Basal ganglia (m/c)

putamen.

SAH.

m/c Cause - Trauma >

Berry aneurysm

Congenital aneurysm / Sacular

→ can also be a/w Atherosclerosis

- Tunica media defect

m/c Site : Ant Cerebral A, Ant. Communicating A - Junction

Least Common :

Vertebral Artery

Ruptured HTN Bleed

↓

HTN encephalopathy

Binswanger disease

Infections:

1) m/c fungal meningitis - Cryptococcus.

Site - Virchow-Robin space

microscopic stain - Red Cryptococcus

2) TB meningitis -

m/c presentation - Diffuse meningoencephalitis

characteristic - Basal exudate.

m/c complication → Cerebral infarction.

3) Cytomegalovirus → Periventricular Calcification + necrosis.

Cells are enlarged.

Basophilic inclusions in nucleus + cytoplasm

$CD_4 < 200$ - Pneumocystitis Carini.

$CD_4 < 150$ - CMV.

HIV: TB, CD_4 count > 300.

Atypical TB CD_4 count < 150.

lymphoma < 200/μL.

CMV, Physical, TB, 1° CNS lymphoma

HIV meningitis - AIDS dementia Complex.

HIV carried by - macrophages, Dendritic cells, T cells

Characteristic complex

Cortex Spared.

only, Sub-cortical area affected.

m/c Cause of Space occupying Lesion → Toxoplasmosis

m/c Cause of Space Occupying Tumor → 1° CNS lymphoma

Histology - most Characteristic - microglial nodules

→ white matter necrosis

→ Demyelination

→ Perivascular inflammation

Spinal Cord - Vascular myelopathy → Posterolateral, Anterolateral Tract

Vacuolar

↓

Subacute combined Degeneration

~~Vasculitis~~

~~Viral Inclusions~~

Rabies - Negri Bodies (cytoplasmic) eosinophilic.

Hippocampus → m/c Site in Dogs.

Brain stem → m/c & most Severe form of encephalitis

Cerebellum - Negri Body - m/c Site:

CSF - Analysis

	(N)	Bacterial	TB.	Fungal Viral.
Gross	Clear & colourless	yellowish/ pus like	Cob-web coagulum	Clear & Colourless
Pressure -	60-150mmH2O.	↑	↑(max)	↑
Cells -	lymphocytes (0-5cells) (15-45mg/dl).	Neutrophils↑	Lymphocytosis >>>	Lymphocytosis
Sugar -	40-70 mg/dl	Decreased↓↓	↓	Normal
Protein -	15-45mg/dl.	↑(mild)	↑↑↑	↑
Chloride -	116-122mEq/L.	↓(mild)	↓↓↓ Severe Reduction.	

Protein ↑ – (N) cell ↓ ↑

↑ Albumin – Cell count - Normal. Albumino-cytological dissociation

1) Guillian-Barre Syndrome
2) Late Stage of polio
3) Intracranial Neoplasm.

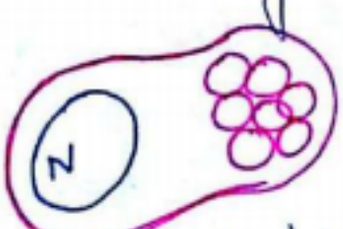
Prion disease - Infectious protein.

→ Longer incubation period.

PrP^c – (N), α-Helix
protease sensitive.
↓ conformational change
PrP^{sc} – sc-Scrapie (1st to discover)
β-pleated Sheets [Congo Red] +ve.
protease Resistant.

m/c Cause: Iatrogenic (Neurosurgery/Corneal Transplant)

Bx:



Cluster of grapes
Spongiform vacuoles.

Types: i) Creutz-feldt Jacob
ii) Fatal familial insomnia. No Spongiform vacuoles
iii) Scrapie.
iv) Kuru.
v) Mad-cow disease / Bovine Spongiform

Degenerative disease

1) Alzheimer's disease.

→ m/c Cause of dementia.

Sporadic
misfolding of protein

Hereditary
Presenilin-1: Ch-19
Presenilin-2 ch-1

Trisomy 21 — Ch 21 → APP

>40 years - Alzheimer's disease.
T → extracheomosome.

Stress → misfolding of protein.

Aβ amyloid → Damage Basal ganglia nucleus.

Nucleus - Basalis of Meynert.

Neurotransmitter → Ach.

↓ Ach.

↓

MR, progressive dementia.

Gross: Gyral-atrophy
Sulci-widening.

Hydrocephalus ex vacuo:
→ alzheimers
→ Picks disease

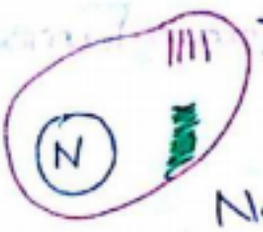
Microscopy

1) Neuritic plaques - Senile Plaques
extracellular.

y - Neurons damaged

2) Neurofibrillary Tangles - Best Correlates with Severity of disease.

Normal Tauprotein
↓
Hyperphosphorylation
↓
Condensed Tauprotein
↓
Neurofibrillary Tangles



Initially intracellular
↓
Neuron damage
↓
extracellular

Bielschowsky stain.
(appear dark)

3) Granulovacuolar degeneration

4) Hirano Bodies - α-actin (paired)

Lewy Bodies - α-Synuclein. Parkinsonism

gross: Pallor of Substantia nigra.
due to loss of dopaminergic neurons

Pallor - Correlate to degree of Severity.

Huntington's Disease

CAG Repeat
Ch-4
↓
misfolding
↓
Huntingtin
↓
Damage Caudate nucleus
↓ GABAergic neurons

→ Ballooned neurons → Pick's disease / Lobar atrophy

Brain Tumors

m/c Brain Tumors → metastasis
m/c i → Lung Ca. [Small cell Ca]

m/c primary lung tumor - meningioma > glioma

m/c i° malignant Brain tumor (adults) - glioblastoma

Child

i° Brain malignant - medulloblastoma

Benign - Juvenile pilocytic astrocytoma
↓
m/c Cerebellum
Cerebellar astrocytoma

Malignancy

Astrocytoma

WHO I - JPA
- pilocytic astrocytoma
- Subependymal giant cell astrocytoma - arise in foramen monroe

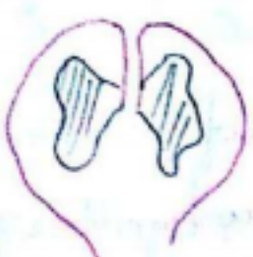
Low grade, no CSF mets
II - Diffuse

High grade, CSF metastasis
III - Anaplastic
IV - Glioblastoma multiforme

CSF metastasis

→ glioblastoma } astrocytoma
→ Anaplastic }
→ 1° CNS lymphoma
→ Medulloblastoma
→ extragonadal germ cell tumors involving brain

Glioblastoma - m/c site - frontal lobe



Butterfly tumors (due to spread to adjacent lobe)

M/F:

Pseudo palisading

Serpentine necrosis

Palisading
Pseudo Palisading necrosis

Schwannoma - Infiltrative vestibular nerve S/b N

Histology - Tumefalisading

DDDDDDDDDD Hypercellular - Antoni-A

Hypocellular - Antoni-B.

DDDDDDDDDDDD Hypercellular.

Verocay Bodies

Lungs

1) Bronchial asthma - Reversible bronchospasm

2) Bronchiectasis

3) Emphysema [pink puffers]

4] Chronic Bronchitis (blue bloaters)

C-OPD.

Bronchial asthma -

Chronic inflammation - ↑ Responsiveness of Bronchial mucosa.

Reversible - Bronchoconstriction

Etiology: chromosome - 5q associated with atopy & bronchial asthma.

→ most strongly m/c a/w — IL-13 gene polymorphism.