

CNS pathology

Third year medical students

Dr Heyam Awad

FRCPath

2017

Lecture 4: intracranial hemorrhage



" He can't stand the sight of blood. "

Causes of intracranial hemorrhage

- 1. primary brain parenchymal hemorrhage .
- 2. hypertensive cerebrovascular disease
- 3. cerebral amyloid angiopathy = الداء النشواني
- 4. ruptured aneurysms = تمدد كيسي دموي
- 5. vascular malformation
- 6. vasculitis
- 7. trauma

Other causes of intra-cerebral hemorrhage

- Bleeding disorders
- Drug related: anti-coagulants
- Cocaine use
- Tumors.. Can encroach on a vessel and cause bleeding

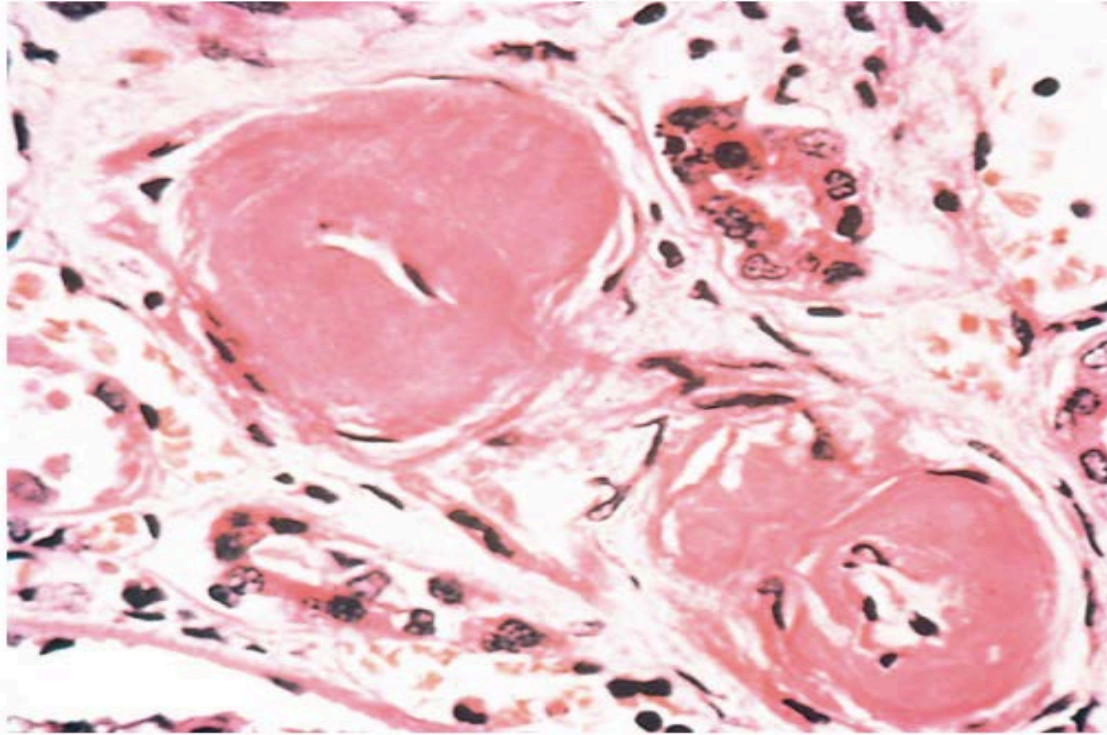
Primary brain parenchymal haemorrhage

- Primary = spontaneous = non-traumatic.
- Peak 60 years
- Mostly due to rupture of a small intra-parenchymal vessel.
- **Hypertension** is the leading cause.
- Most affected sites: basal ganglia, thalamus, pons and cerebellum.
- Outcome depends of the site and extent of haemorrhage

Why hypertension causes parenchymal hemorrhage ?

- Hypertension causes **hyaline arteriolar-sclerosis**.
- This results in weak arterioles, so the arterioles can rupture especially if there is sudden or sustained increase in blood pressure.
- Minute aneurysms can form (**Charcot- Bouchard micro aneurysms**) because of the weak vascular walls and these also can rupture.

Hyaline arteriolosclerosis



Hyaline arteriolosclerosis

- Homogeneous pink hyaline thickening of the arteriolar walls with luminal narrowing and loss of underlying structural detail.
- Occurs due to leakage of plasma components across injured endothelial cells into vessel wall and increased extracellular matrix production by smooth muscle in response to chronic hemodynamic stress.

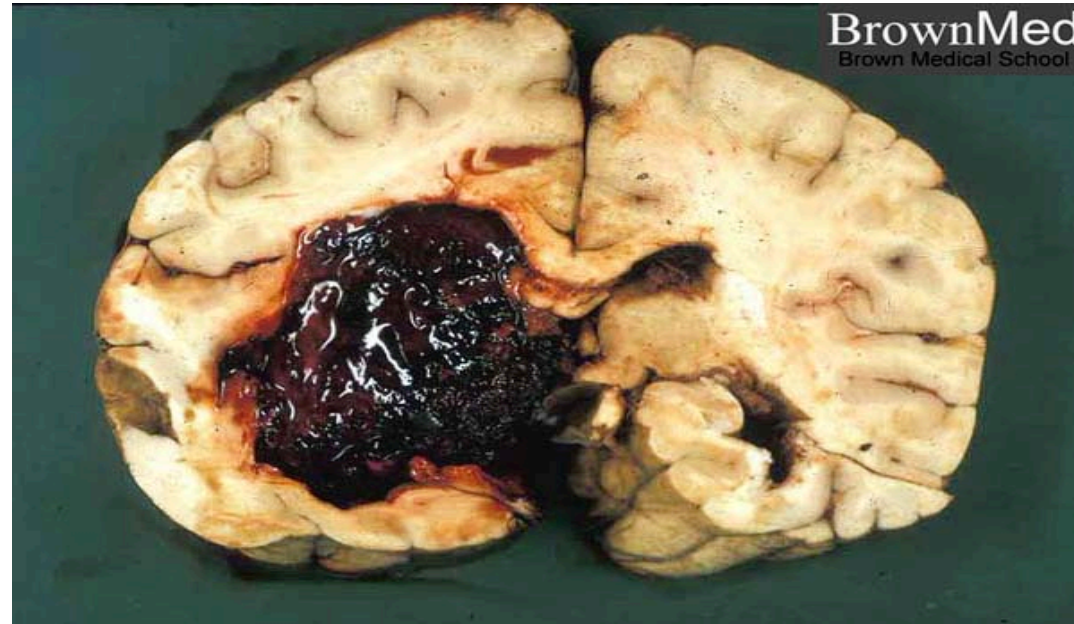
Symptoms of parenchymal brain haemorrhage

- 1. neurological symptoms related to the area affected
- 2. symptoms of increased intracranial pressure

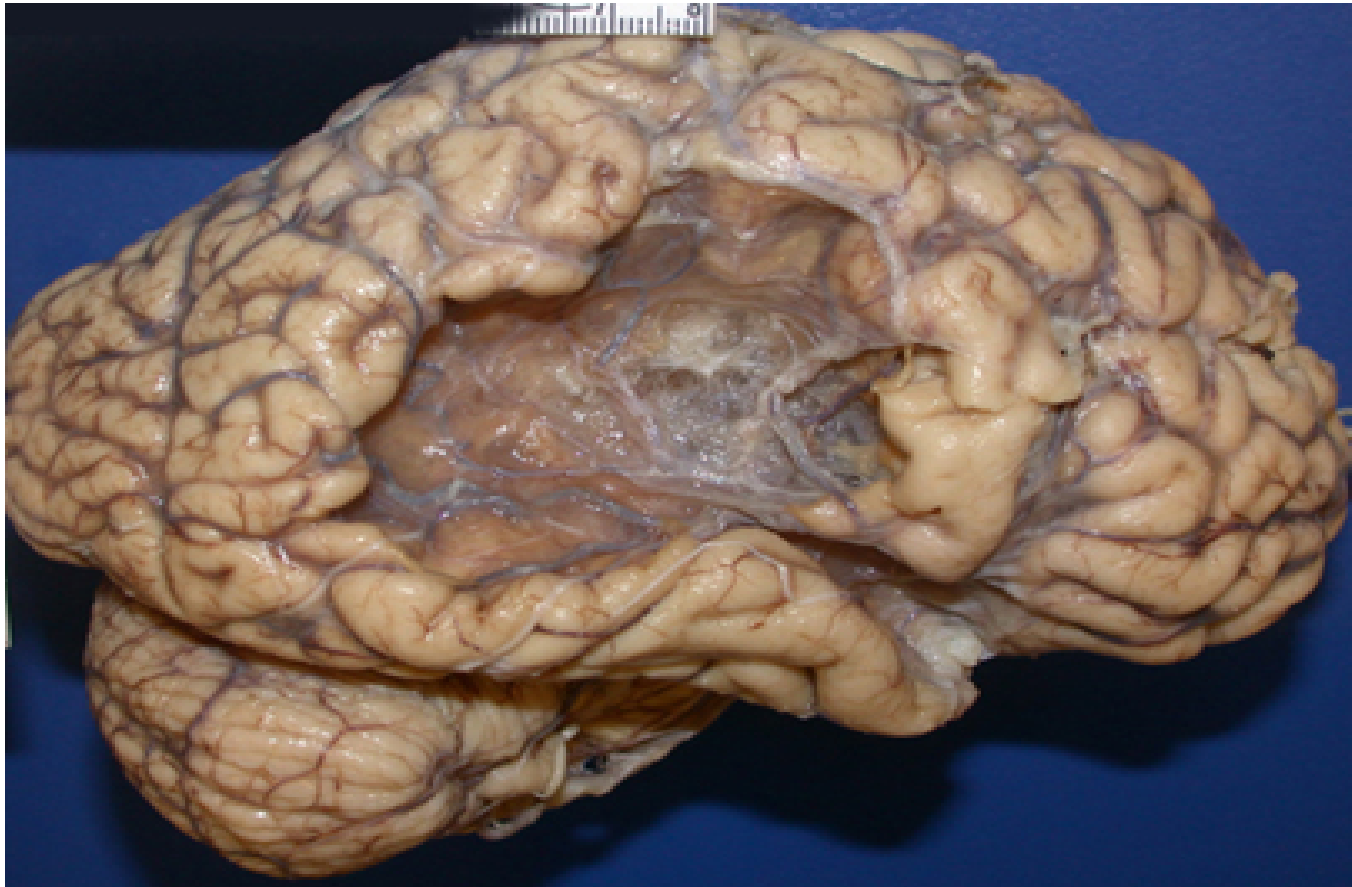
morphology

- Extravagated blood.
- With time.. Resolution and cavity formation

Brain haemorrhage



Cavity.. Old infarct or old hemorrhage; both will end up with a cavity!



Hypertension/ effects

- Massive intracranial haemorrhage.
- Lacunar infarcts.
- Rupture of small penetrating vessels
- Acute hypertensive encephalopathy

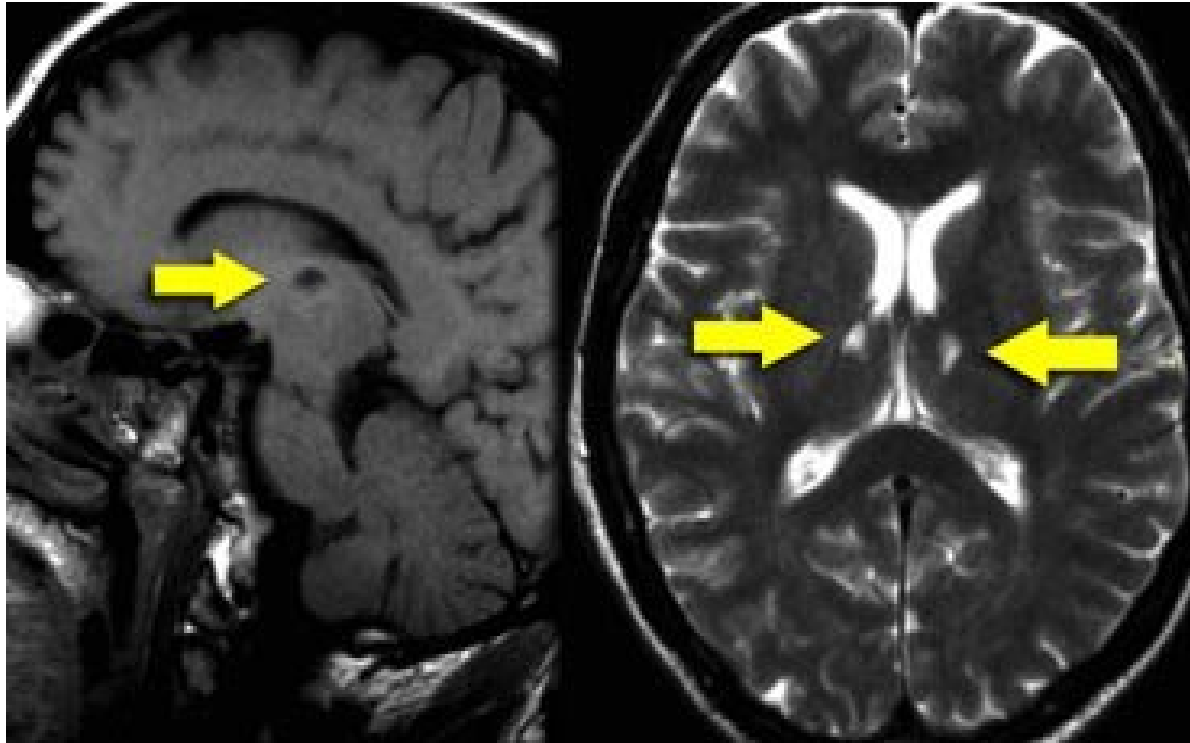
Vessel rupture

- Small penetrating vessels may rupture.
- Cause small haemorrhages = **slit haemorrhages**.

Lacunar infarcts

- Small infarcts, mostly in deep grey matter (basal ganglia and thalamus), internal capsule, deep white matter and pons.
- Caused by occlusion of penetrating branch of a large cerebral artery.
- Effect: depends on site

Lacunar infarct



Acute hypertensive encephalopathy

- Happen with sudden sustained rise of diastolic more than 130.
- Increased intracranial pressure , global cerebral dysfunction (headache, confusion, vomiting, convulsion, or coma)
- Rapid intervention to decrease intracranial pressure is essential.

vasculitis

Infectious arteritis:

- previously seen with syphilis and TB.
- Now in association with: CMV, herpes, aspergillosis.....
immunosuppression

Polyarteritis nodosa.

Primary angiitis of CNS cause diffuse encephalopathy with cognitive dysfunction.

Cerebral amyloid angiopathy

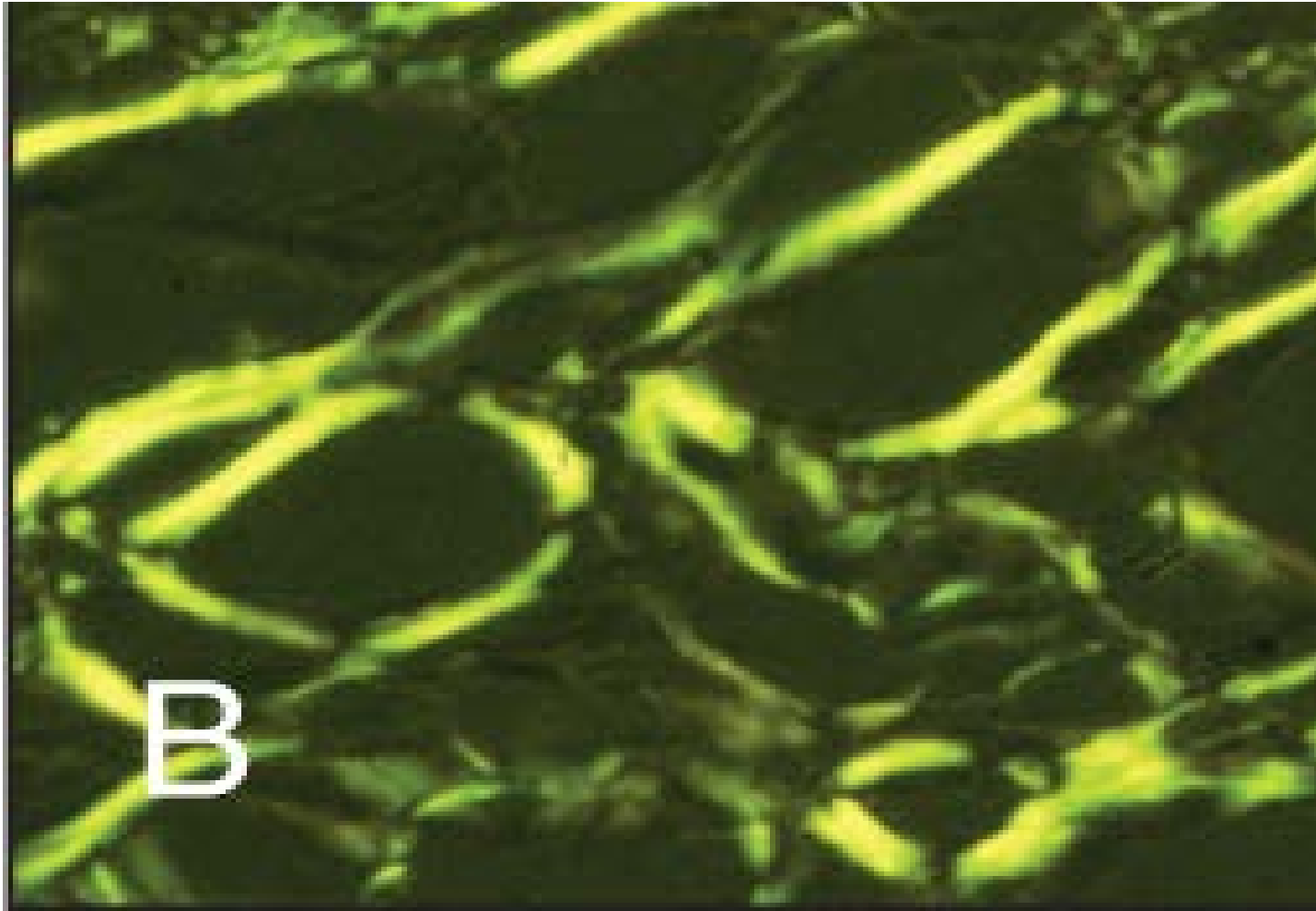
- Amyloid deposition in the walls of arteries
- Causes weakness in vessel wall
- Bleeding , usually in the lobes of cerebral cortex (lobar hemorrhage)

amyloidosis

- deposition of extracellular fibrillar proteins
- These abnormal fibrils are produced by the aggregation of misfolded proteins (which are soluble in their normal folded configuration).

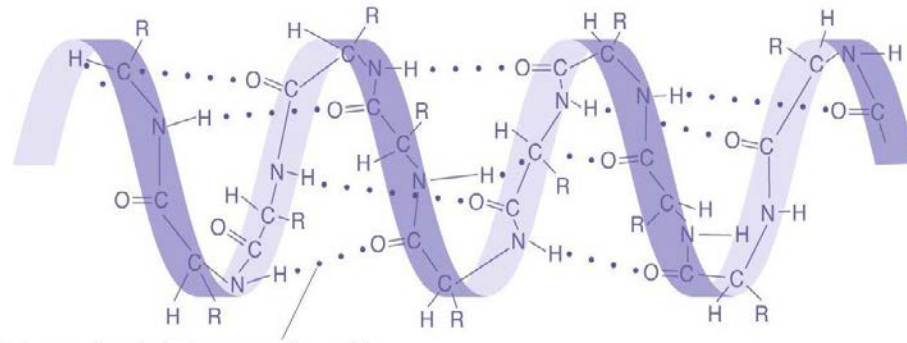
- Amyloid is deposited in the extracellular space in various tissues and organs of the body
- These fibillary proteins are responsible for tissue damage and functional compromise

Congo red stain

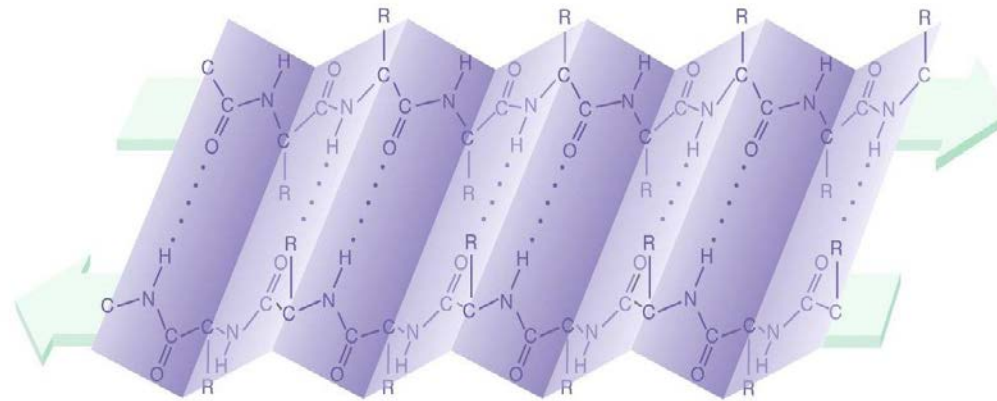


By electron microscope

- All types of amyloid consist of continuous, non-branching fibrils with a diameter of approximately 7.5 to 10 nm. With a cross- β -pleated sheet conformation



Hydrogen bonds between amino acids
at different locations in polypeptide chain α helix



Pleated sheet

- **Chemical Properties of Amyloid Proteins**

- Amyloid is **not** a single chemical entity.
- Several types exist

Ruptured aneurysm

- Mainly causes subarachnoid hemorrhage but also can cause hemorrhage within brain.

Subarachnoid hemorrhage

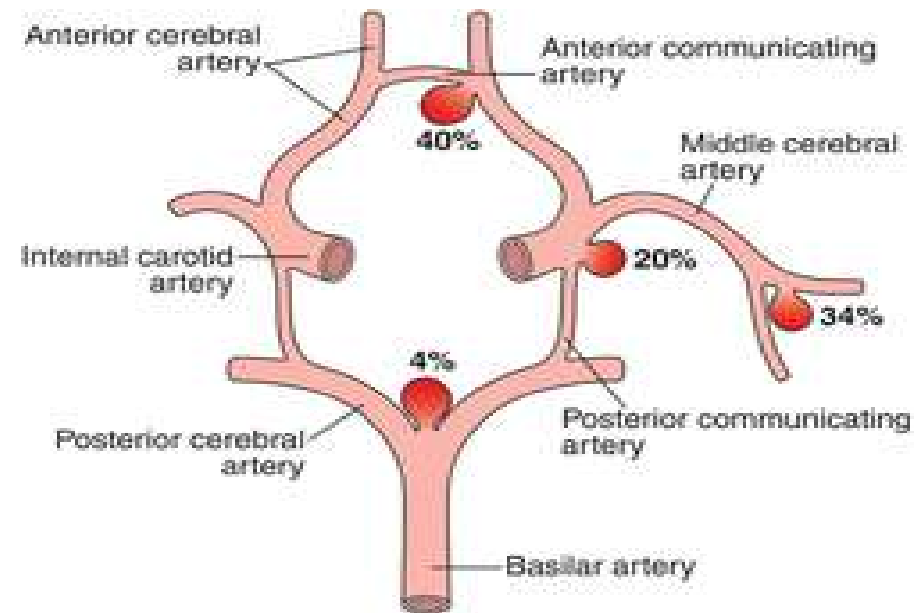
- Most common cause: ruptured berry aneurysm.
- Other causes: vascular malformations, trauma, tumors, hematological disturbances.

Ruptured berry aneurysm

- Rupture happens usually due to **increased intracranial pressure**.
- Sudden severe headache followed by loss of consciousness
- 25-50% die
- Survivors: risk of recurrent bleeding

Berry aneurysm

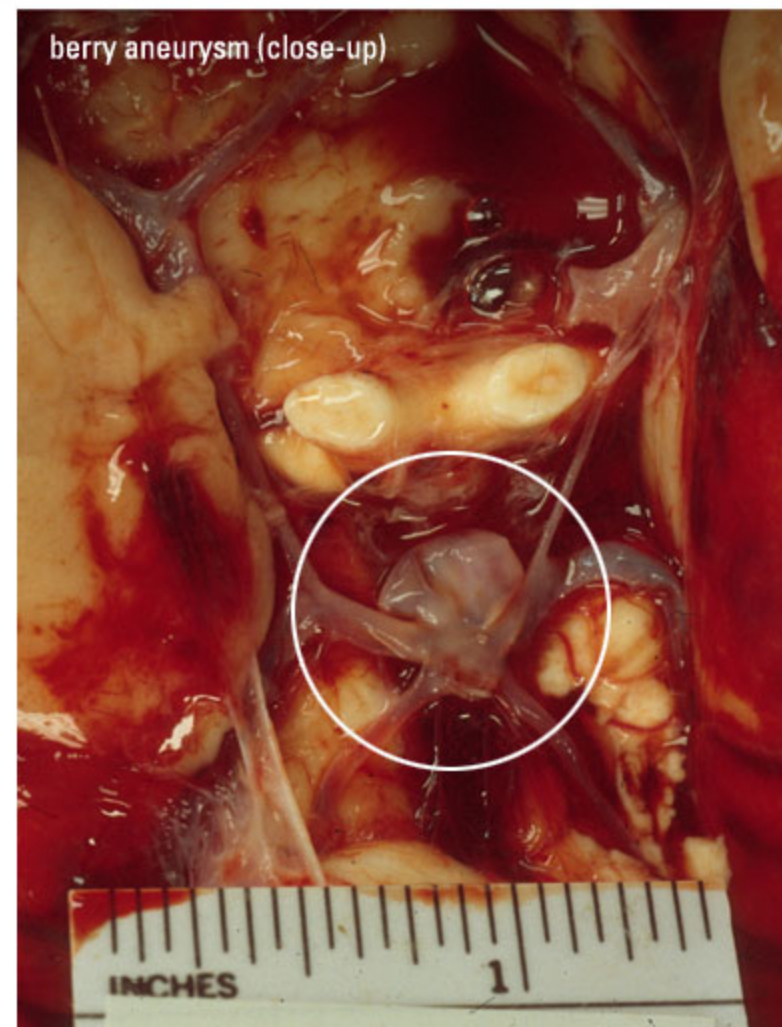
- 90% in the anterior circulation
- Near major arterial branching points
- Multiple in 20 – 30 % of cases



morphology

- Berry aneurysm: thin walled outpouching of an artery





Subarachnoid Hemorrhage



*** Restricted use. PEIR; University of Alabama at Birmingham, Department of Pathology**

Vascular malformations

- Arteriovenous malformations
- Cavernous malformations
- Capillary telengectasia
- Venous angioma

AV malformation

- Most common type of vascular malformation
- Males more than females
- Present at 10-30 years of age
- Symptoms: seizures and intracranial hemorrhage

Morphology of AV malformation

- Network of disorganised vascular channels



M1360300 [RM] (c) www.visualphotos.com

Traumatic lesions

- Trauma to CNS causes mortality or disability
- Outcome depends on extent of trauma and site affected.
- Spinal cord trauma.. can cause severe disability.
- Brain stem trauma... can be fatal

Head injury

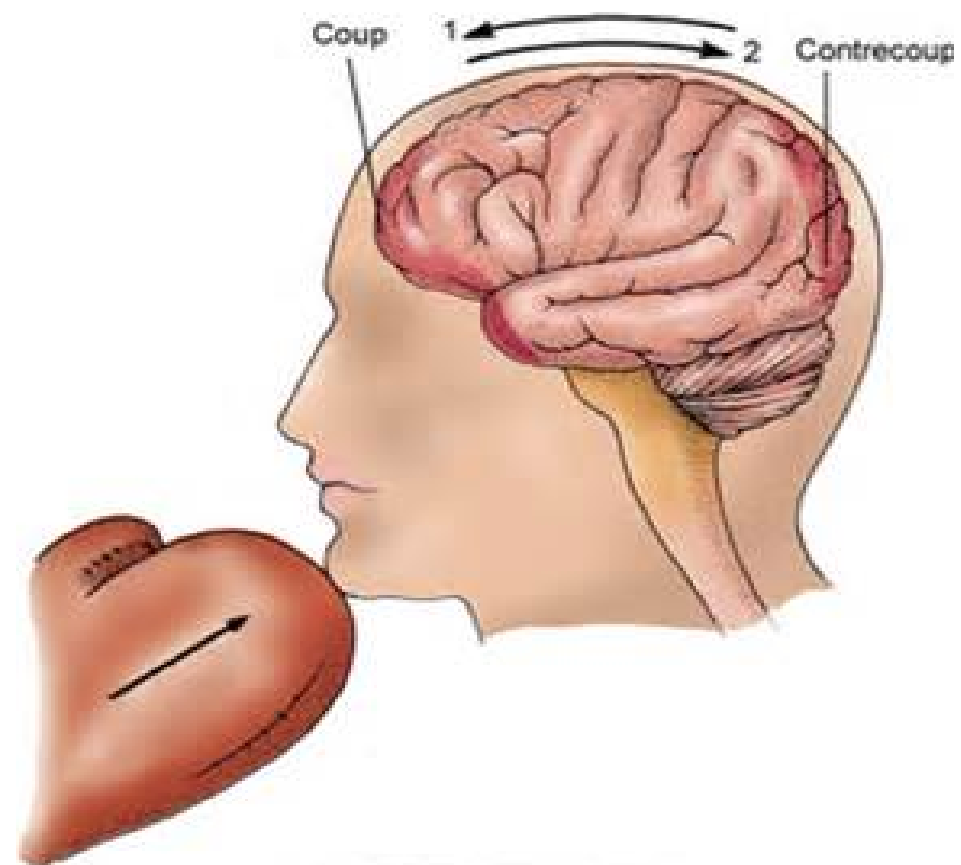
- Blunt or penetrating.
- Open or closed.
- Severe brain damage can occur without external signs of head injury
- Lacerations and even skull fractures are not necessarily associated with brain damage

- Repetitive episodes of trauma can later lead to neurodegenerative process e:g Alzheimer

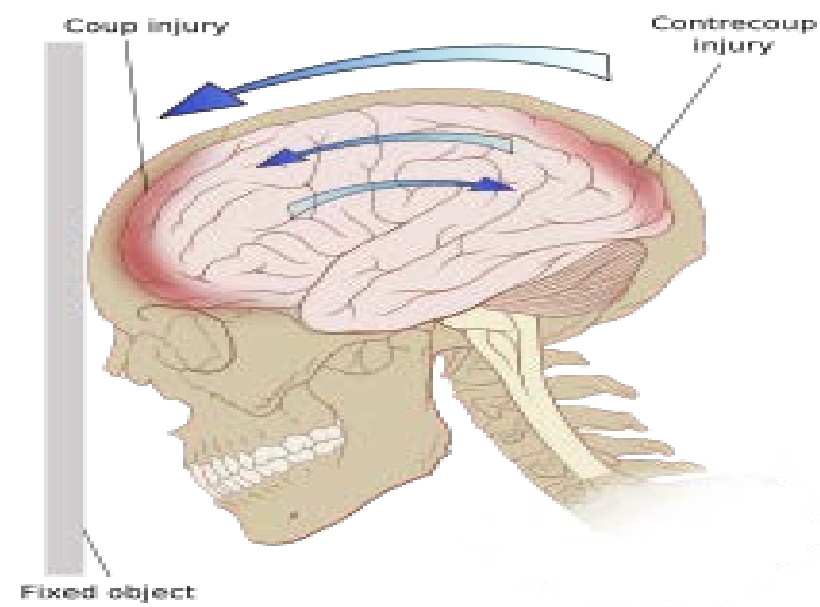
Traumatic parenchymal injury

When an object impacts the head:

- Injury of brain at site of impact: **coup injury**
- Injury opposite to site of impact: **countercoup**
- Both are contusions



Copyright © 2015, 2008, 2005 by Saunders, an imprint of Elsevier Inc.



Brain injury

- Concussions
- Contusions
- Lacerations
- Diffuse axonal damage

concussions

- Reversible altered consciousness after head injury in the absence of contusions
- Transient dysfunction in the form of: loss of consciousness, temporary respiratory arrest, loss of reflexes.
- Pathogenesis: unknown
- Recovery is complete but amnesia of the episode.

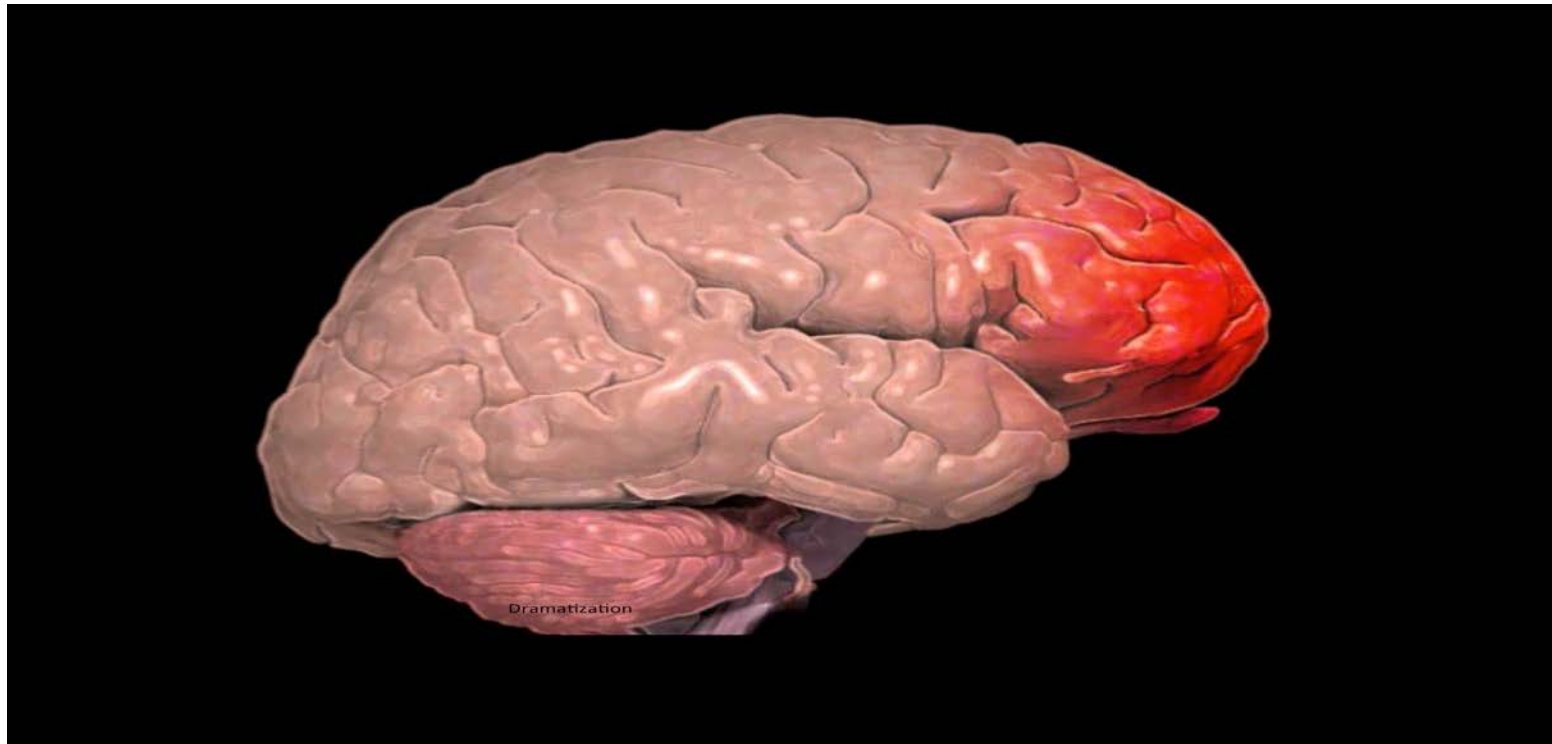
contusion

- Caused by rapid tissue displacement , disruption of vascular channels with subsequent haemorrhage, tissue injury and edema.
- Common in areas overlying rough and irregular bone surface: orbitofrontal region, temporal lobe tips.

lacerations

- Penetrating injuries cause skull fractures and brain lacerations
- Laceration: tissue tearing and hemorrhage.

contusion



laceration



Contusion/morphology

- Wedge shaped, widest aspect closest to point of impact.
- Edema and extravasated RBCs.
- Superficial aspects of cortex affected more (contrary to ischemic injury)

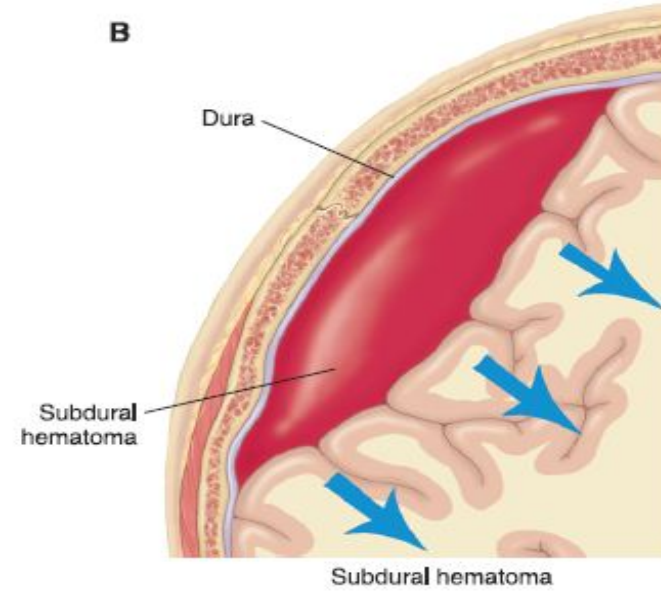
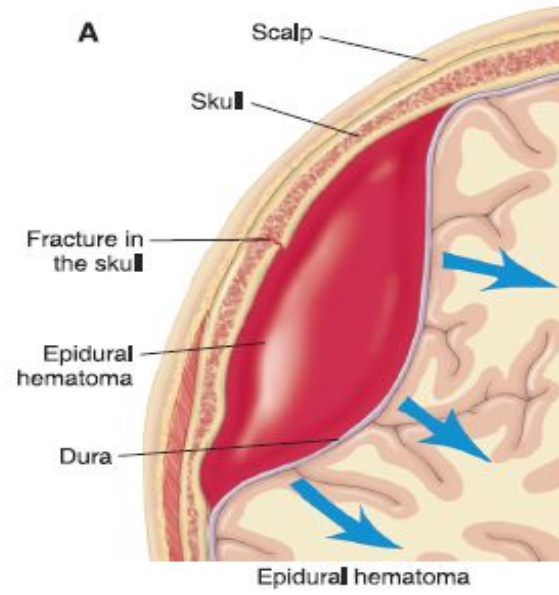
- Old traumatic injury: depressed, retracted, yellow brown patches involving the gyri.
- Larger lesions: cavity, resembling remote infarcts

Diffuse axonal injury

- Brain trauma can cause subtle widespread injury to axons within the brain:= diffuse axonal injury
- Movement of one region of the brain relative to another.. disrupt axonal integrity.
- Appear under LM as axonal swelling
- Can lead to severe irreversible neurologic deficit.

Traumatic vascular injury

- Epidural
- Subdural
- Subarachnoid
- intraparenchymal



Epidural hematoma

- Dural vessel torn due to fracture.
- Usually: middle meningeal artery
- Blood accumulates under arterial pressure and dissects the dura, compressing the brain parenchyma

Subdural hematoma

- Rapid movement of brain during trauma.. Can tear the bridging veins
- This leads to bleeding in the subdural space

