Pathology

Sheet

Lec No: 4

Subject:

Done By: Mohammad Dqour

Corrected By: Heba Al-lala

Doctor: Heyam Awad

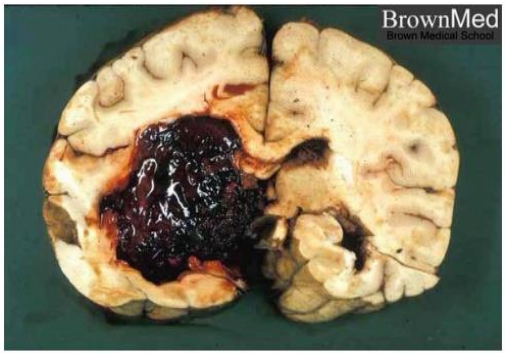
00/00/2017

• This sheet may seem to be long; but it is too easy!
• I strongly advise you to study the **slides** mainly because that's what the doctor said, and to use the sheet for clarification.
Let us start.. ;D
* In the last lecture, we covered the Stroke topic, and we said that it stems either from ischemia or hemorrhage. We agreed that though both of them show the same signs
and symptoms, each needs a different treatment.
* This lecture focuses more on the causes/diseases that cause the hemorrhage in the brain.
* Keep in mind that hemorrhage in the body -including the brain- is either traumatic or non-traumatic.
* Brain hemorrhage is mainly due to four causes (All are non-traumatic) :
1. Hypertension
2. Vasculitis
3. Cerebral amyloid angiopathy
4.Ruptered aneurysm
5. Vascular malformations

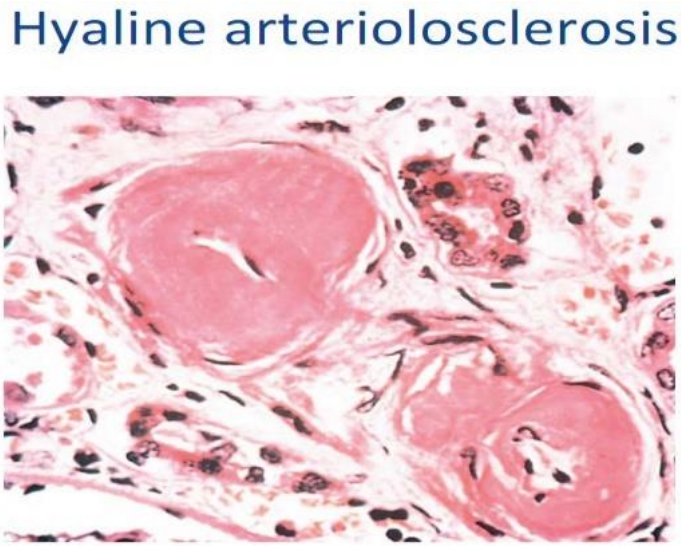
 # HYPERTENSION

Case: Our 65 years old male was having a nice vacation with his wife in Hawaii, when during dinner time, he felt a **sudden severe headache**. He decided not to give attention to it. Later in that vacation, his headache prolapsed and the man died. On the postmortem autopsy, a **massive brain hemorrhage was detected affecting the deep structures of the cortex** (like the Thalamus).
- It was concluded that his brain hemorrhage was due to hypertension.

*Hypertension is thought to be the most common cause of the intra-cranial hemorrhage especially in people older than 60 years old.
* Hemorrhage that is due to hypertension is called; Primary brain parenchymal hemorrhage.
* Primary = spontaneous = **non-traumatic**



* Hypertension –it is a physical injury to the cells as an increased pressure- causes the rupture of the small blood vessels. How?
- Hypertension causes hyaline arteriolosclerosis (which results in weak& narrowed arterioles, so the arterioles can rupture especially if there is sudden or sustained increase in blood pressure.
- Minute (small) aneurysms can form **(Charcot- Bouchard micro aneurysms)** because of the weak vascular walls and these also can rupture. And this is an acquired type of aneurysms.



*Hyaline arteriolosclerosis
Homogeneous pink hyaline thickening of the arteriolar walls with luminal narrowing and loss of underlying structural detail, which occur 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.
* Hypertension usually causes intra-cerebral hemorrhage, yet sometimes can cause sub-arachnoid hemorrhage by two mechanisms:
- rupturing the vessels.
- congenital aneurysms that rupture due to an increased pressure.

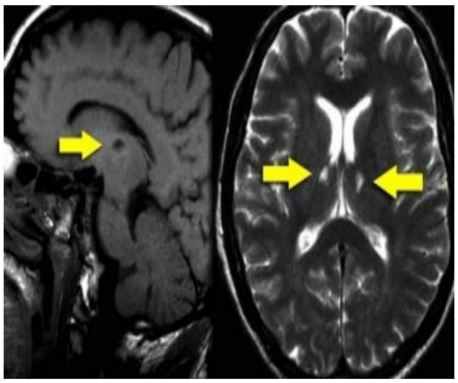
* Symptoms of parenchymal brain hemorrhage:
1. neurological symptoms related to the area affected.
.2. symptoms of increased intracranial pressure
* If the patient would live, the morphology of the brain would be described as:

-Extravagated blood

-With time.. Resolution and cavity formation that is lined by gliosis. (Keep in mind that; Old infarct or old hemorrhage; both will end up with a cavity!

* Hypertension effects on the brain:
• Massive intracranial hemorrhage.
• Rupture of small penetrating vessels (slit hemorrhage), which its severity depends on the area affected in the brain.

• Lacunar infarcts.
-Small infarcts, mostly in deep grey matter (basal ganglia and thalamus), internal capsule, deep white matter and pons. It is caused by occlusion of penetrating branch of a large cerebral artery. Its effect depends on site.
- The view depends on the use of the contrast. If we use it, the area appears white.
• Acute hypertensive encephalopathy (cerebral edema& increased intra-cranial pressure)
- 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

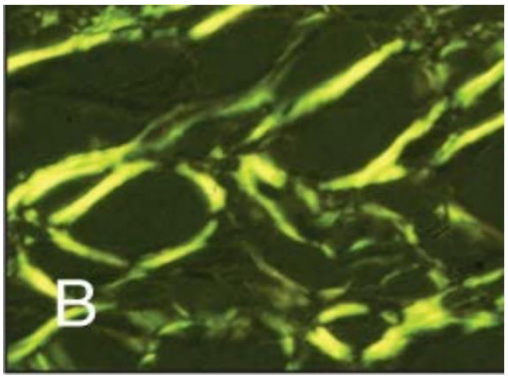
- In case your patient is young like 25 years old and has AIDS, and came to you with signs of intra-cranial hemorrhage; you should be thinking about vasculitis rather than hypertension!
* It is the second common cause for hemorrhage in brain.
* The damage in the brain vessels is either due to an infection or an autoimmune condition.

* As an infection:
- Infectious arteritis: was previously seen with syphilis and TB. But now is in association with: CMV, herpes, aspergillosis; immunosuppressive bacteria or fungi!
* As an autoimmune condition:
-Polyarteritis nodosa.(Example on generalized autoimmune vasculitis)
- Primary angiitis of CNS cause diffuse encephalopathy with cognitive dysfunction. (being a systemic condition that affects the CNS)

#CEREBRAL AMYLOID ANGIOPATHY:

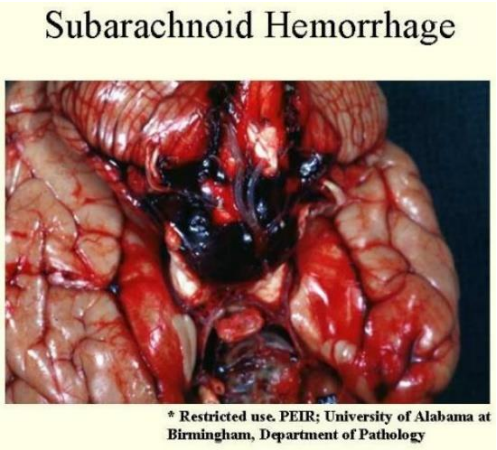
* Amyloid deposits *in the walls of arteries* and causes weakness in the vessel wall that leads to bleeding; usually in the lobes of cerebral cortex (lobar hemorrhage)
* What is amyloidosis?

The deposition of extracellular fibrillary 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 fibrillary proteins are responsible for tissue damage and functional compromise!



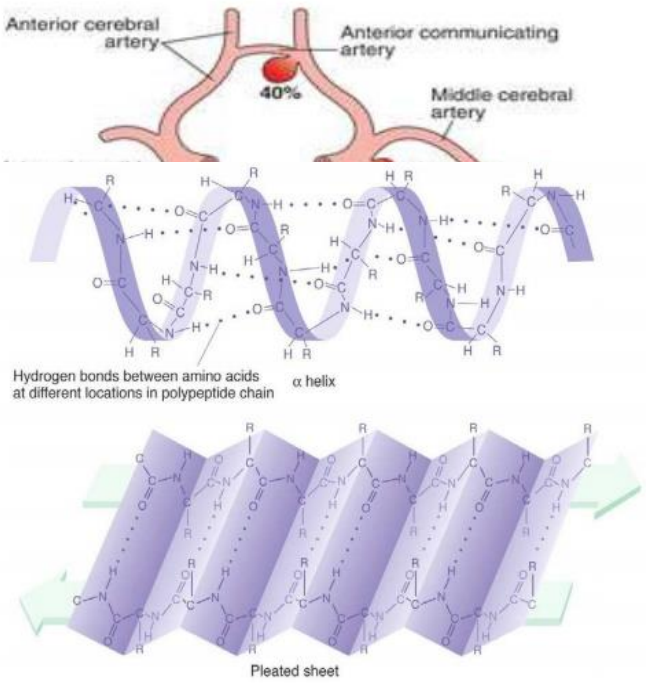
* It can be seen using the Congo Red Stain. It shows as apple-green color!
* Under the electron microscopy; **all types of amyloid consist of continuous, non-branching fibrils with a diameter of approximately 7.5 to 10 nm. With a cross- β-pleated sheet conformation.**

* Amyloid is not a single chemical entity which means that several types exist.

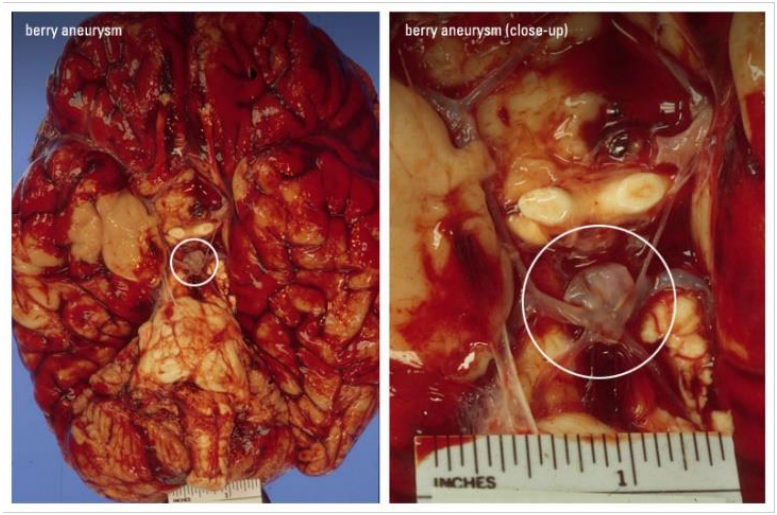


 # <u>RUPTURED ANEURYSMS</u>:

* The majority of these aneurysms are congenital.
* They mainly cause **subarachnoid hemorrhage** but also can cause hemorrhage within brain.
* The subarachnoid hemorrhage is usually due to ruptured berry aneurysm. Other causes include :
- vascular malformations
- trauma
- tumors& hematological disturbances
* Ruptured berry aneurysm happens usually due to increased intra-cranial pressure. Seen as a sudden severe headache that is followed by loss of consciousness.
* With a mortality rate of 25-50%. The rest of the survivors go under the risk of recurrent bleeding because the congenital aneurysm is multiple.
* Berry aneurysm is seen in the anterior circulation in 90% of cases and the rest in the posterior. It is seen also near the major arterial branching points.



* Keep in mind that berry aneurysm is seen morphologically as thin walled outpouching of an artery.



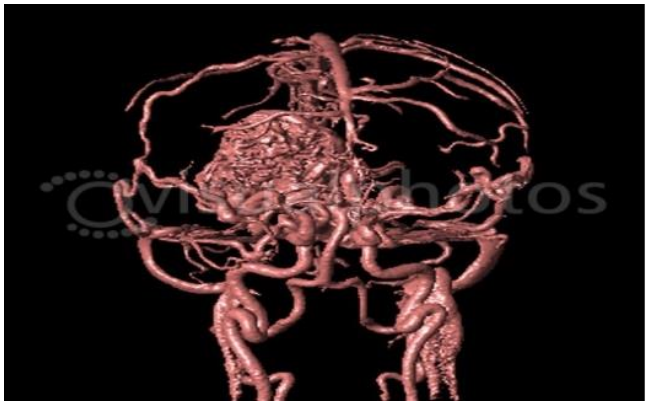
#VASCULAR MALFORMATIONS:

• Arteriovenous malformations • Cavernous malformations
• Capillary telengectasia • Venous angioma

* AV malformation

- It is the most common type of vascular malformation. It affects males more than females and it presents at 10-30 years of age.
- Symptoms: seizures and intracranial hemorrhage!

- The morphology can be seen as a Network of disorganized vascular channels.

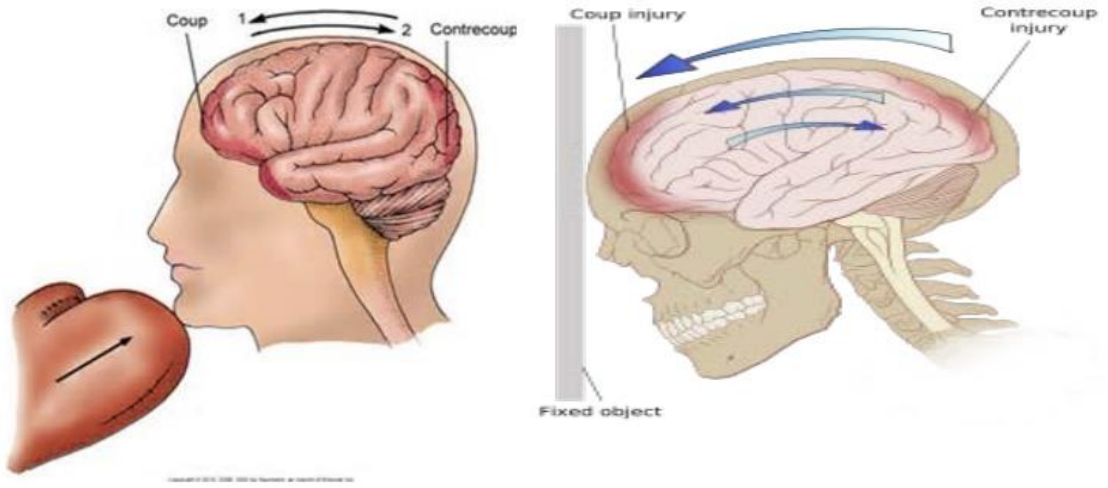


** ***Note*** that some drugs like anti-coagulants and the cocaine use could cause intra-cranial hemorrhage, but less commonly than the other causes discussed above!

$ This concludes our talk about some of the **non-traumatic** causes, now we will talk about some of the **traumatic** ones.

* Traumatic lesions to the CNS can cause mortality or disability, and that depends on the extent of the trauma and the site affected.
- Spinal cord trauma; causes severe disability
- Brain stem trauma ; can be fatal
* An injury to the head can be blunt or penetrating, open or closed.
* A patient with severe brain damage could present without any external signs of head injury.
* The repetitive episodes of trauma can later lead to neurodegenerative process like Alzheimer.
* When an object impacts the head; we can differentiate the injury of the brain based on site of impact to:
- at site of impact; coup injury
- opposite to site of impact; countercoup

AND BOTH are contusions & a traumatic parenchymal injury!



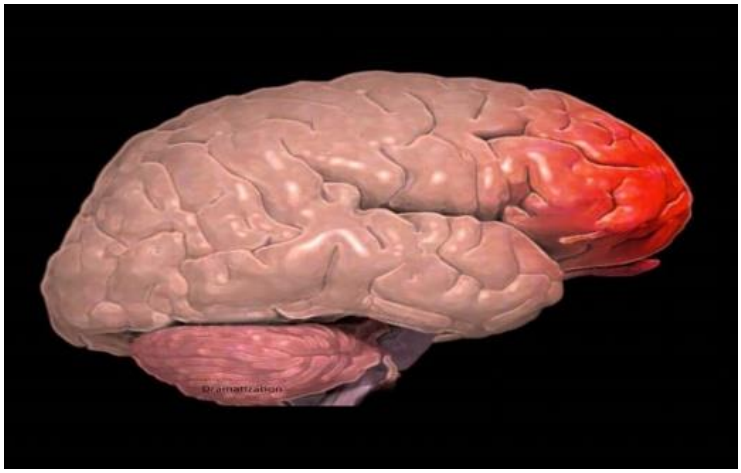
* Brain injury is classified as:

• 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
- Mildest form.

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

-



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

* Lacerations:

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

* 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 which can disrupt axonal integrity.
- Appear under LM as axonal swelling
- Can lead to severe irreversible neurologic deficit.

* We end this lecture by talking about the traumatic vascular injury:

• **Epidural** • **Subdural**

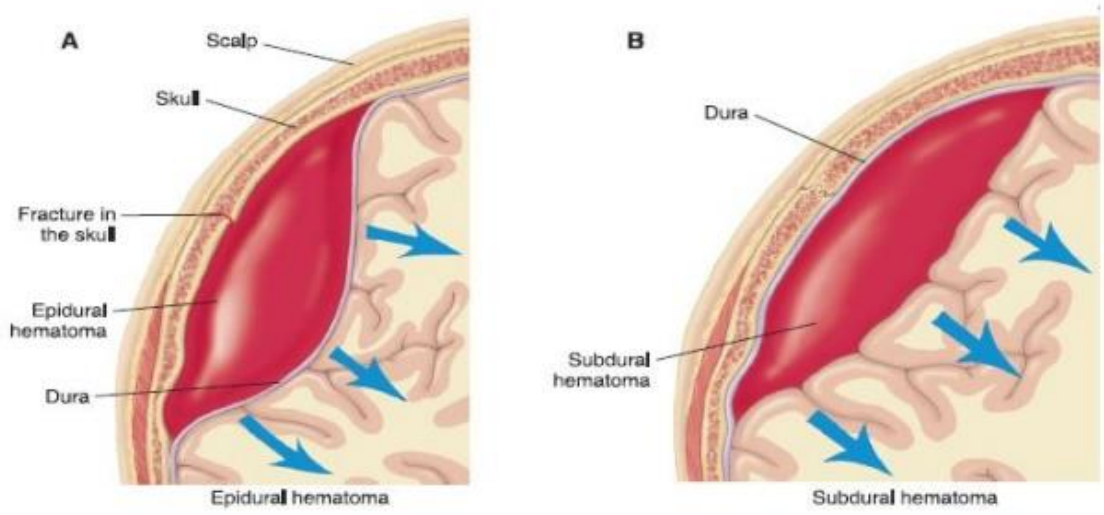
• Subarachnoid • intraparenchymal

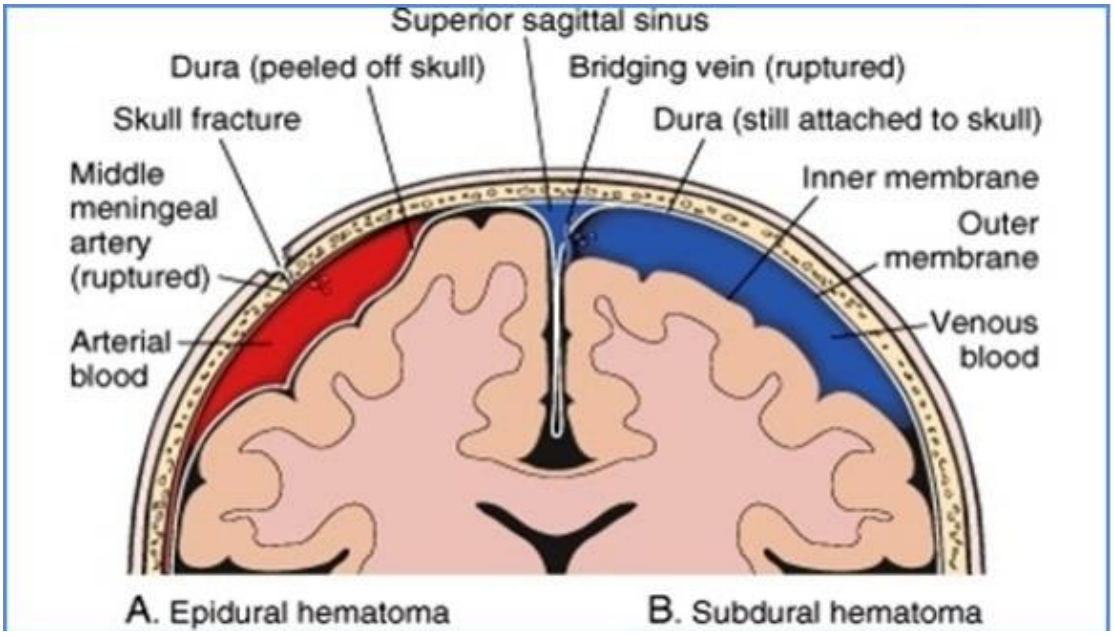
* Epidural hematoma

- 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 which can tear the **bridging veins**
- This leads to bleeding in the subdural space.


A
Scalp
Skull
Fracture in the skull
Epidural hematoma
Dura
Epidural hematoma
B
Dura
Subdural hematoma
Subdural hematoma


Superior sagittal sinus
Dura (peeled off skull)
Bridging vein (ruptured)
Skull fracture
Dura (still attached to skull)
Middle meningeal artery (ruptured)
Inner membrane
Outer membrane
Arterial blood
Venous blood
A. Epidural hematoma
B. Subdural hematoma

THE END