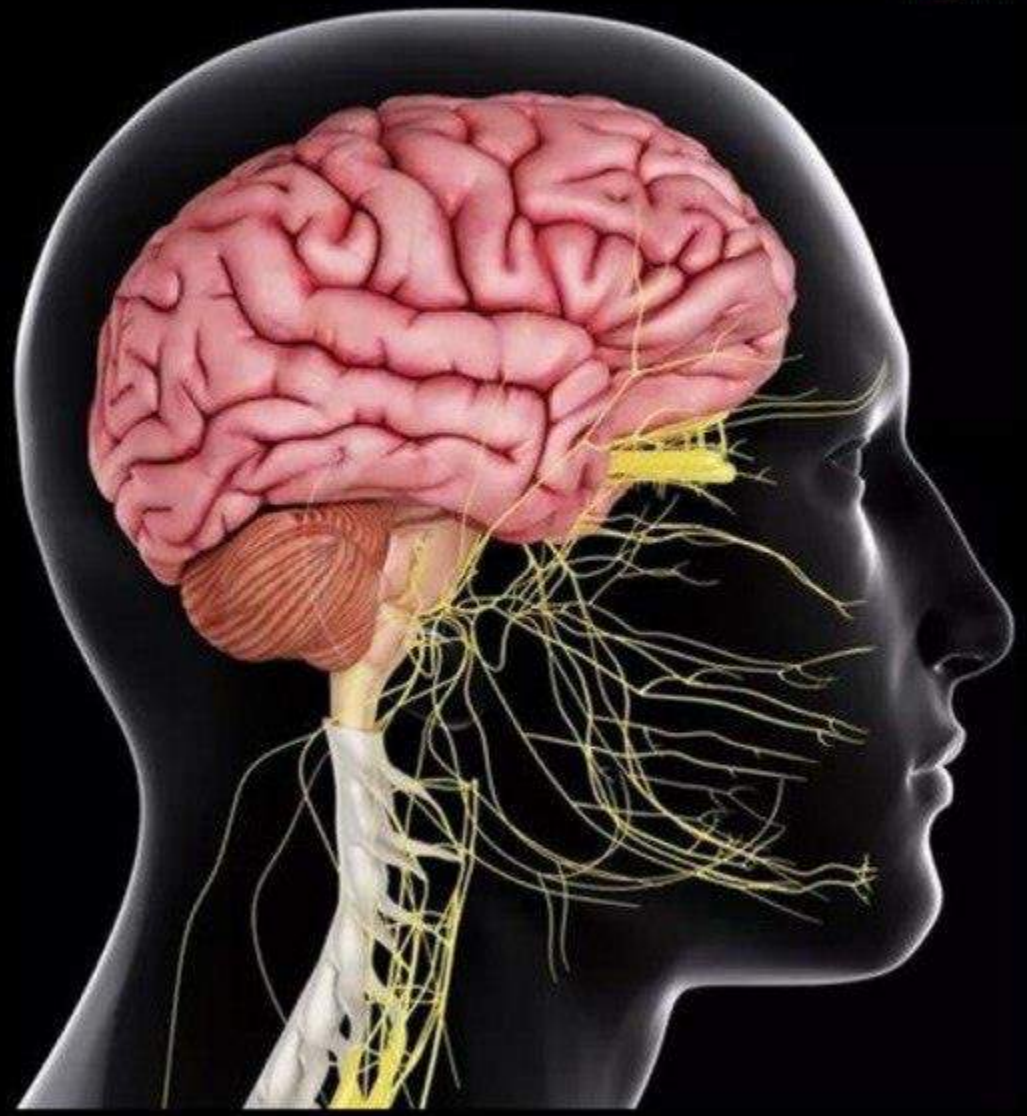
وقل رب زدني علماً



CENTRAL NERVOUS SYSTEM

SUBJECT : Patho

LEC NO. : Lec 3

DONE BY : Salsabeel almtour

CNS LECTURE 3

CENTRAL NERVOUS SYSTEM (CNS) TRAUMA

Dr. Dua Abuquteish

" ربي لك الحمد كما ينبغي لجلال وجهك وعظيم سلطانك، اللهم إني توكلت عليك، وسلمت امري إليك، لا ملجأ ولا منجي منك إلا إليك"

وهلاء خلينا نبلش بالمحاضره 🤍

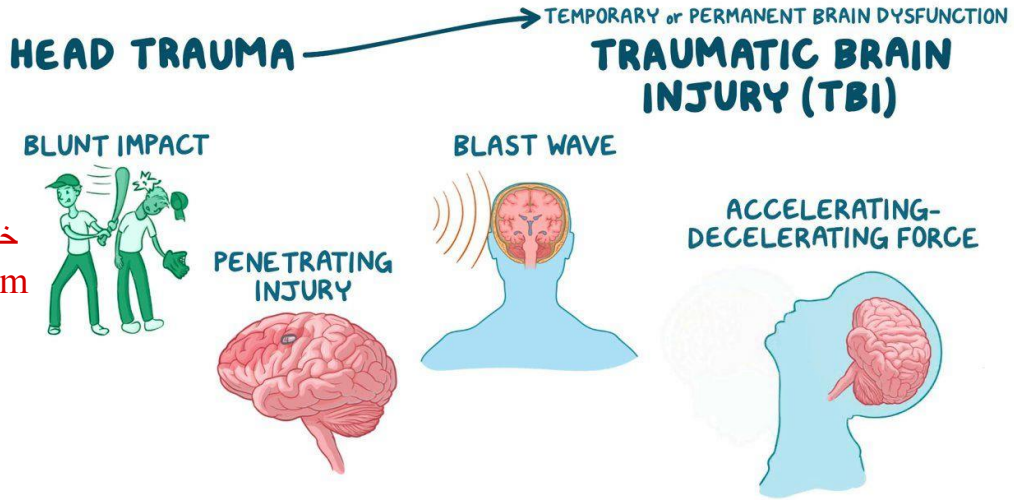
رح نحكي اليوم عن الخبطات اللي بتصيب الرأس و انواعها

CENTRAL NERVOUS SYSTEM (CNS) TRAUMA

- The severity and site of injury affect the outcome: may be clinically silent (if in the frontal lobe), severely disabling (affecting the spinal cord), or fatal (involving the brain stem).

خبطه خفيفه

خبطه قويه و عملت herniation على ال brain stem فهون ممكن المريض يموت



اشي مش حاد زي خبطه بكتاب او شنته

زي سكينه او gunshots

- Penetrating or blunt injury, shape of the object causing the trauma, the force of impact, and whether the head is in motion at the time of injury.

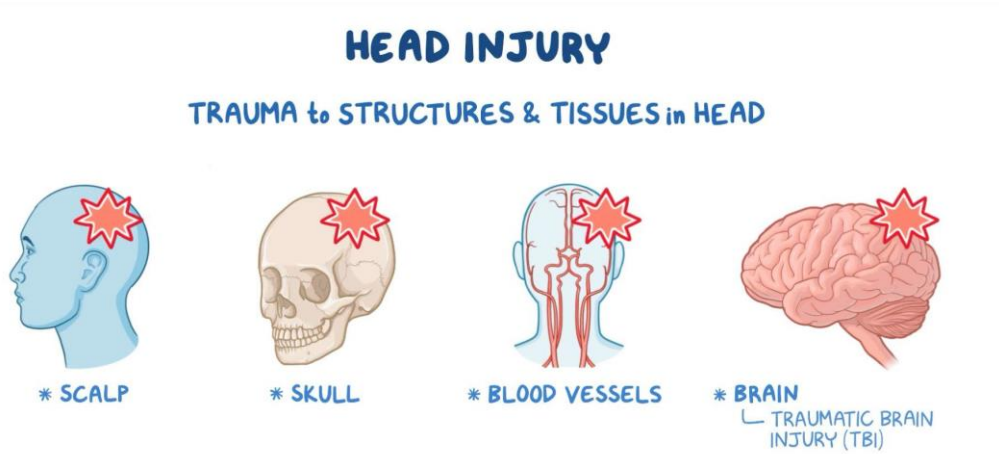
مثلاً واحد سايق السياره و فجأه دعس بريك فهون ال head كان in motion فممكن يصير عنا accelerating decelerating injuries

(Trauma can result from a rapid change in the head's velocity)

CENTRAL NERVOUS SYSTEM (CNS) TRAUMA

معناتو من هاد الحكي بنستنتج انو مش المنظر الخارجي بعد الضربه بحدد ال severity of the injury فلازم نعمل imaging و assessment للمريض لنقدر نحدد خطورة الحاله

- Severe brain damage can occur in the absence of external signs of head injury, and conversely, severe lacerations and even skull fractures do not necessarily indicate damage to the underlying brain.



- Injuries may involve the **parenchyma**, the **vasculature**, or both

parenchyma يعني بال نفسها زي ال lobes مثل ال frontal lobe و ال stem و غيرهم

Rupture of BV in the brain

هلاء حنبلش نحكي عن ال types و بدنا نعرف قبل ما نبلش انو
عادي ممكن يجي اكثر من type بنفس ال case

TRAUMATIC PARENCHYMAL INJURIES

① CONCUSSION

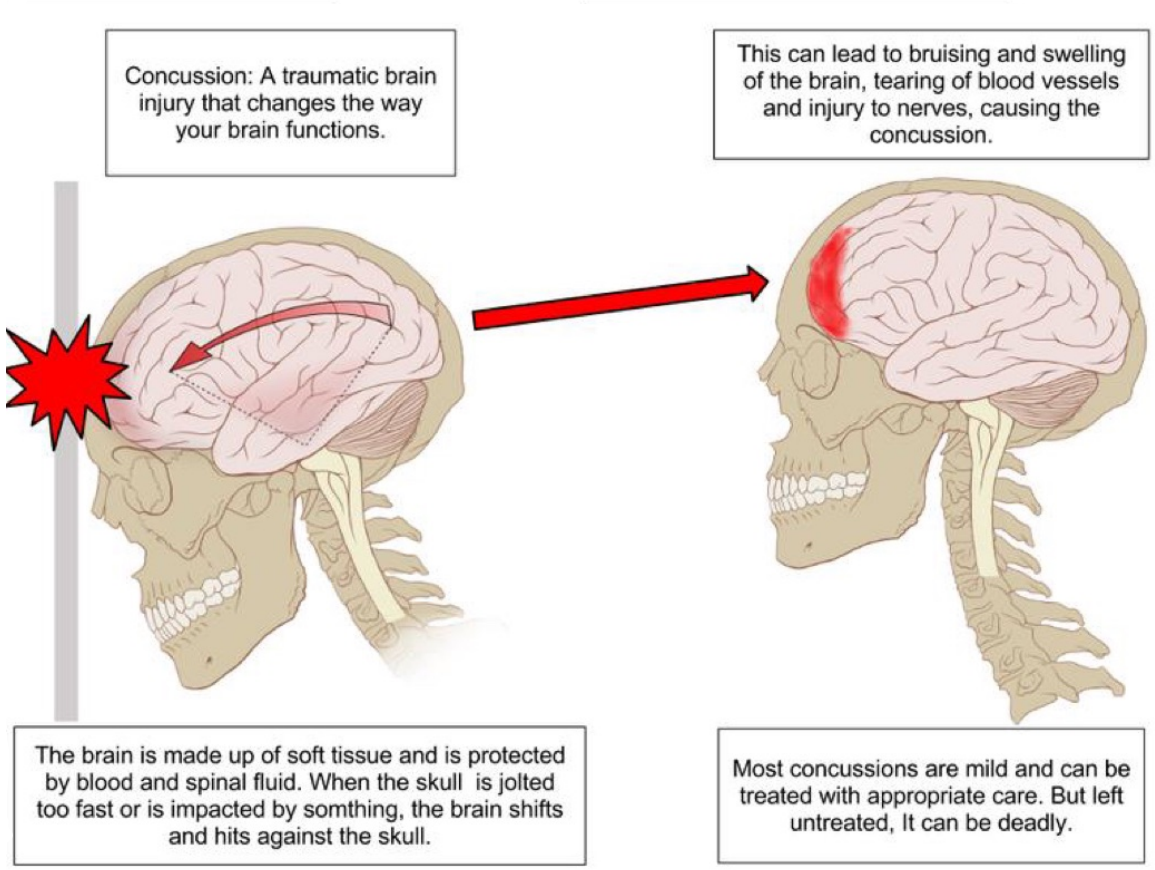
Concussion describes reversible altered brain function, with or without loss of consciousness, from head injury.

بصير عندي injury بال brain على
مستوى الneurons بس فعلياً لما اعمل
صوره او ct scan ما ببين عندي اشي
فمثلاً بيجي المريض عامل حادث سياره
ناسي شو صار معو او وين هو او فاقد
للوعي فبروح اعملو صوره للbrain
بس ما ببين معي اشي مع انو عندو
injury على مستوى ال neurons بس
و بالعاده بكون microscopic
reversible

Two types of injury:

1. **Coup-Contrecoup**
2. **Torque**

(more severe with loss of consciousness)



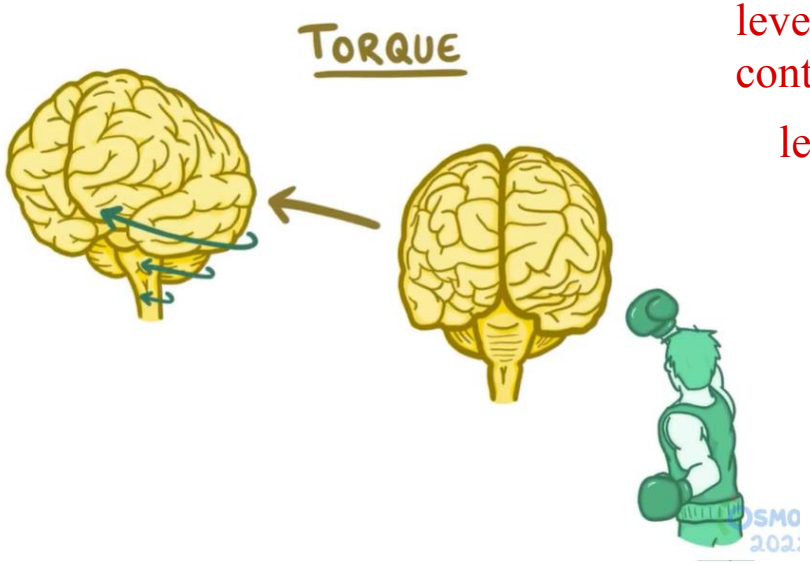
TRAUMATIC PARENCHYMAL INJURIES

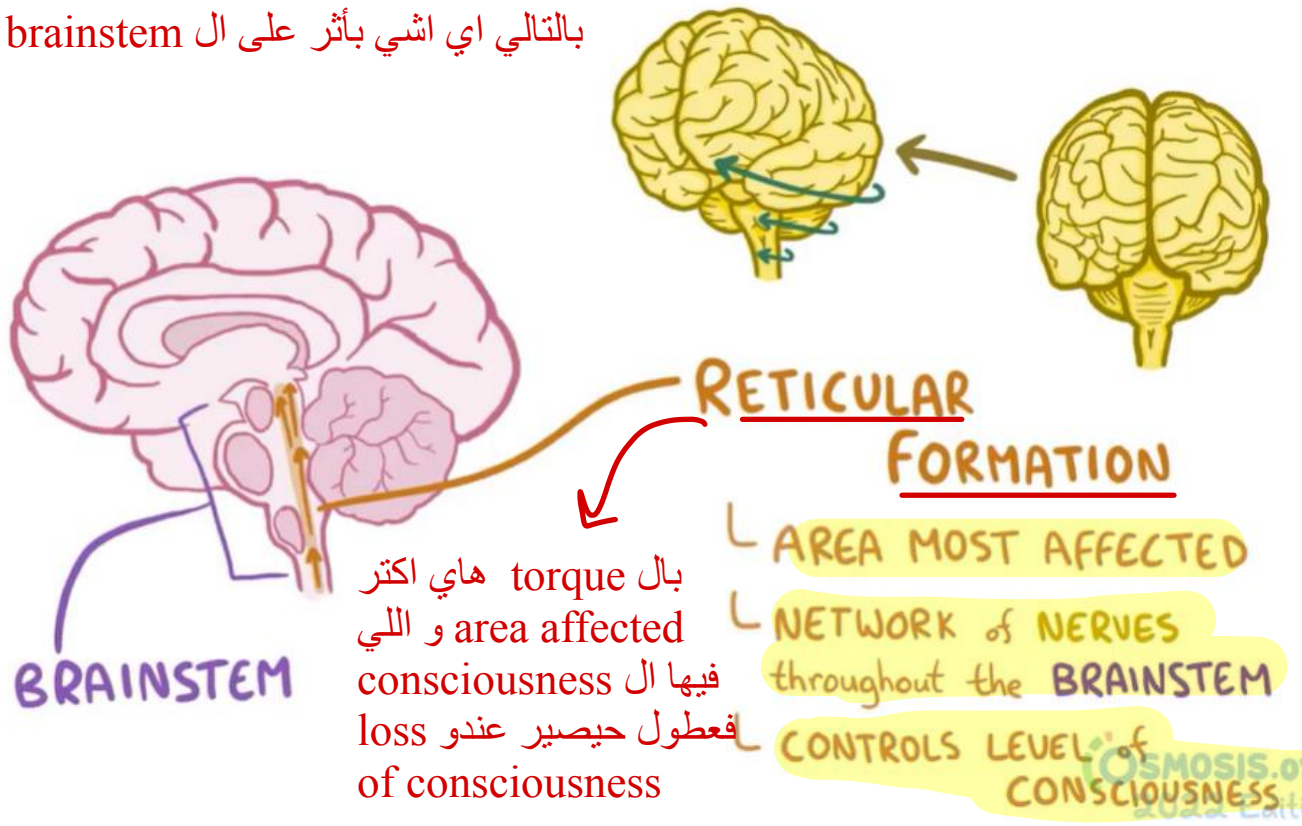
CONCUSSION – TORQUE

بصير لما نتعرض لضربه مباشره ع ال brain تعمل twist فيه

و هون اكتر area رح تتأثر هو ال brainstem و اللي مسؤول عن ال level of consciousness و ال control of heart rate /respiratory rate/ gi

بالتالي اي اشي بأثر على ال brainstem بكون lethal



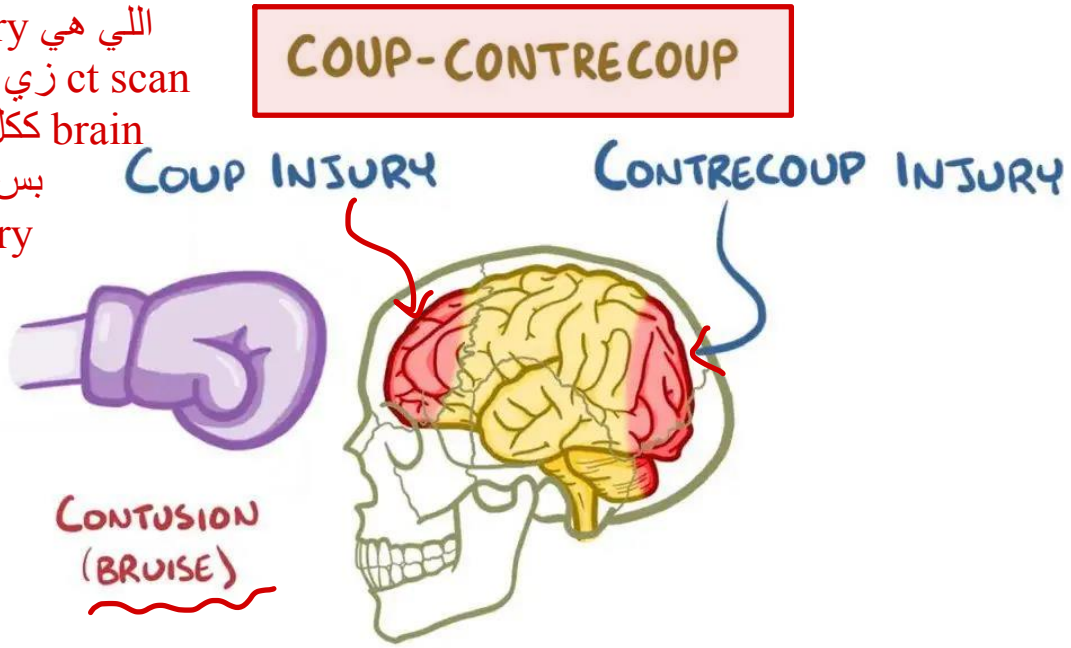


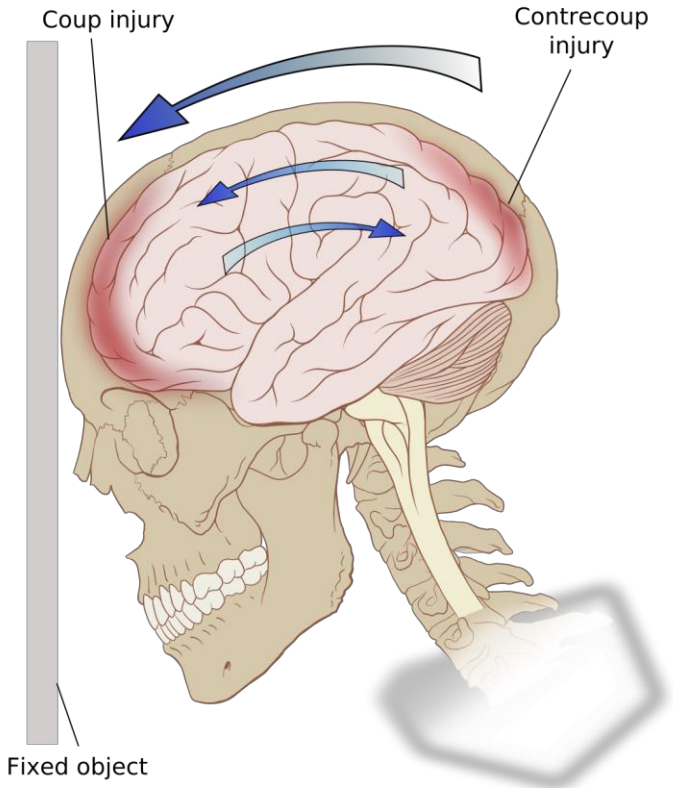
بال torque هاي اكتر area affected و اللي فيها ال consciousness فعطول حيصير عندو loss of consciousness

TRAUMATIC PARENCHYMAL INJURIES

اخد ضربه على راسو و usually بتكون frontal occipital يعني يا بياخد الضربه بال frontal و ال brain بتحرك لل occipital area فبتخبط بال skull او العكس بالتالي بصير injury بالمنطقتين وهون المنطقه اللي اخدت الضربه direct بسميها coup و اللي اخدت الضربه indirect بسميها countercoup

حيصير بالمنطقتين contusion و اللي هي injury واضح على ال ct scan زي ال bruise و باقي ال brain ككل حيصير فيه injury بس يعني concussion microscopic injury





وهون يعتبر مثال لما حكينا انو بنفس ال case ممكن اشوف اكثر من type و هون بكون مثلاً المريض ماخد ضربه عامله injury بجزء كبير من الbrain لكن لما رحت اشوف بال ct لقيت بس منطقتين واضح فيهم ال injury و مبينين(contusion) و باقي المناطق اللي فعلياً كمان فيها injury مش مبين فيهم اشي يعني (concussion) microscopic injury

TRAUMATIC PARENCHYMAL INJURIES
CONCUSSION

- Usually a hit to the head causing diffuse brain injury
- No obvious brain trauma on imaging (normal CT scan)
- Damage is usually microscopic – at the level of the neurons
- **Most likely injuries**: motor vehicle accidents, falling down stairs, recreational activities, and violence
  ↳ زي المصارعه و ال boxing
- **Symptoms** include confusion, memory loss, and loss of consciousness. Followed by headache, nausea/vomiting, and dizziness.
- **Treatment:** rest and ensure complete recovery

فمثلاً لو اجاني مريض و عملتلو ct لل brain و كان طبيعي بس عندو هاي الاعراض فهون بدخلو على ال ICU يومين تلات لحد ما يرجع طبيعي و يرجع ال normal function لل brain لانو حكينا ال injury هون reversible

TRAUMATIC PARENCHYMAL INJURIES COUP-CONTRECOUP

- When an object impacts the head, brain injury may occur at the site of impact—a **coup injury**
- Or opposite the site of impact on the other side of the brain—a **contrecoup injury.**
- Both coup and contrecoup lesions are contusions (Bruise)
- A contusion is caused by rapid tissue displacement, disruption of vascular channels, and subsequent hemorrhage, tissue injury, and edema.
- Contusions are common in the orbitofrontal regions and the temporal lobe tips

اللي هي coup- contrecoup او العكس

The characteristic location of the **dark red-black hemorrhage over the anterior inferior surface of this brain** is consistent with a **fall backwards resulting in a contracoup injury** to the inferior frontal and temporal lobes.

This has resulted in extensive contusions and subarachnoid hemorrhage.

هون المريض واقع على ورا فال coup على ال occipital area و ال countrecoup على ال frontal area

A coronal section through the frontal lobes reveals extensive contusions involving the inferior gyri.

This was a contracoup injury from a fall in the bathtub by an elderly person.

Where is an external contusion (bruise) most likely to be seen in this case?

A Vertex

B Forehead

C Right side

D Left side

E Occiput

معناتو هو وقع على ظهرو و اجت الضربه بال occipital و صار عندو contrecoup بال frontal part

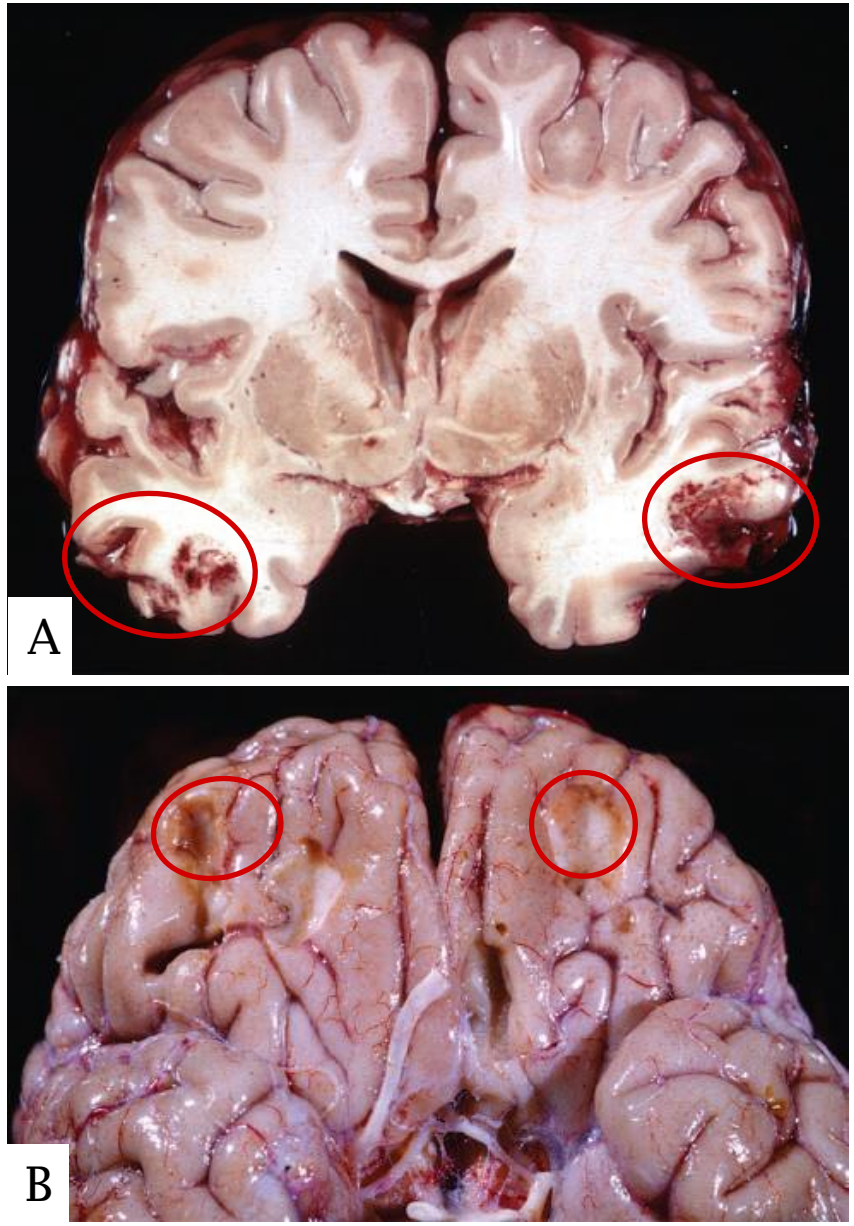
TRAUMATIC PARENCHYMAL INJURIES
2 CONTUSIONS

تماماً نفس لما ناخد رضّه على الايد bruise بتبلش بلون ازرق و احمر مكانها بسبب ال extravasation of Blood بعدها بتموت خلايا المنطقه و بعد كم يوم neutrophils و macrophages بتيجي بتاكل ال RBCs اللي طلعت و بتصير Hemosiderin laden macrophages بتقلب المنطقه على اصفر

- **Contusions** are wedge-shaped, with the widest aspect closest to the point of impact
- First few hours of injury , blood extravasates throughout the involved tissue, across the cerebral cortex, the white matter and subarachnoid spaces.

Signs of neuronal death

- Morphological evidence of neruonal injury (nuclear pyknosis, and cytoplasmic eosinophilia) takes about 24 hours to appear.
- The inflammatory response occurs, with neutrophils, then macrophages.
- Old traumatic lesions are depressed, yellowish-brown patches, and show gliosis and residual hemosiderin-laden macrophages.



TRAUMATIC PARENCHYMAL INJURIES

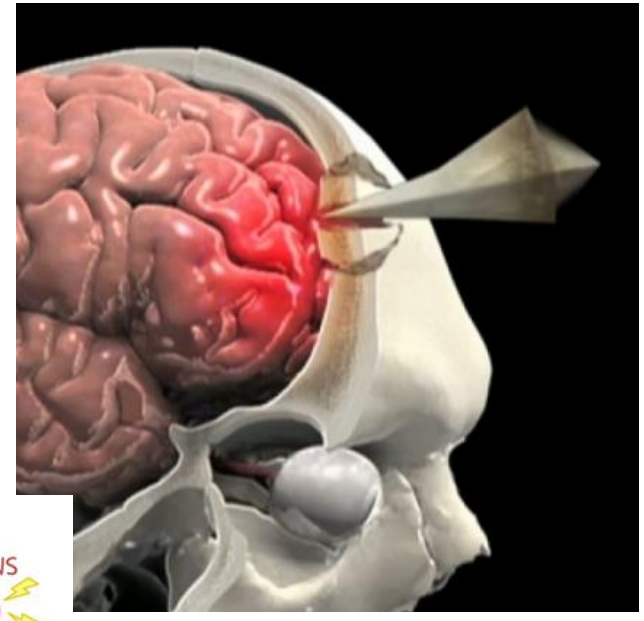
Cerebral trauma. (A) Acute contusions are present in both temporal lobes, with areas of hemorrhage and tissue disruption.

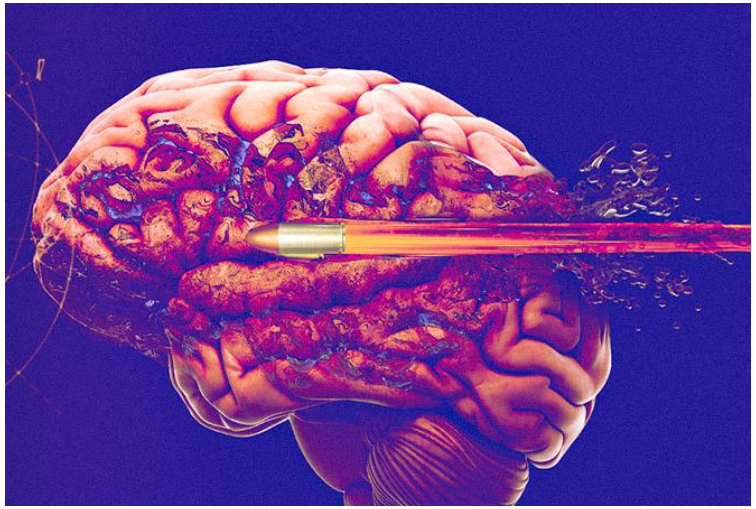
(B) Old Remote contusions, seen as discolored yellow areas, are present on the inferior frontal surface of this brain.

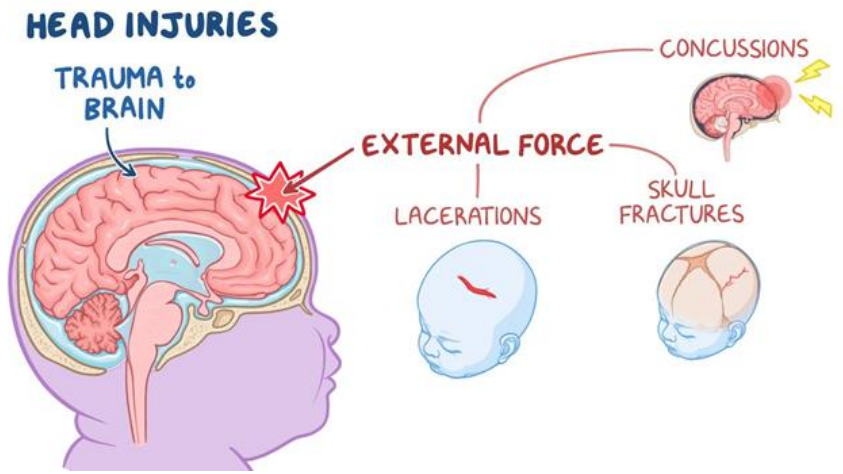
TRAUMATIC PARENCHYMAL INJURIES

By a sharp object

3. Penetration of the brain by a projectile such as a bullet (رصاص) or a skull fragment from a fracture causes a laceration, with tissue tearing, vascular disruption, and hemorrhage.

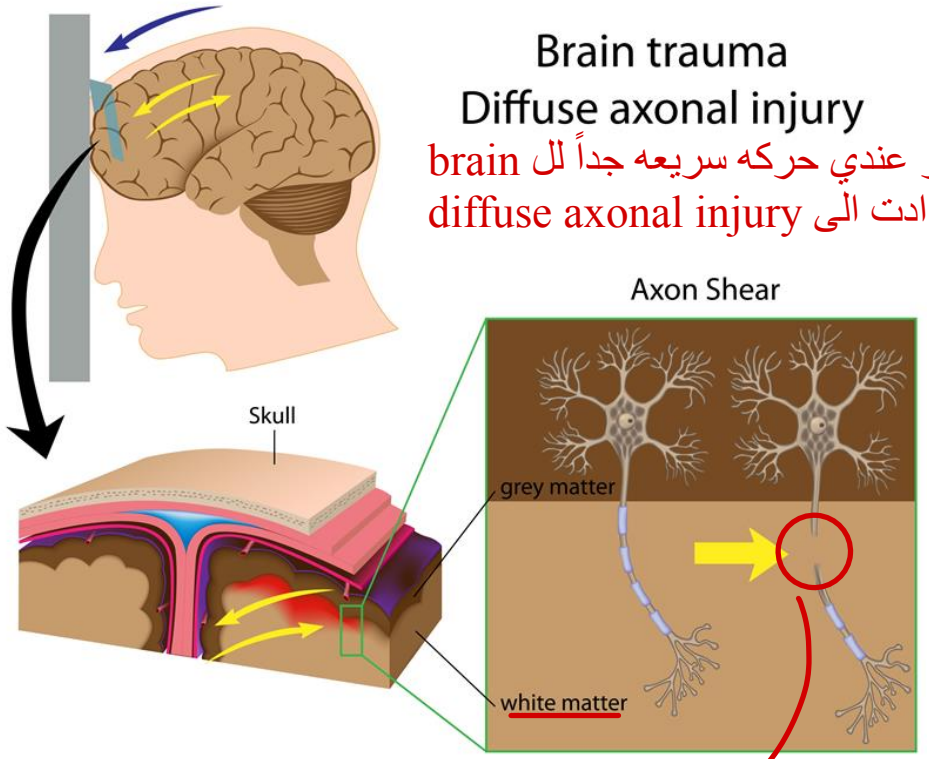






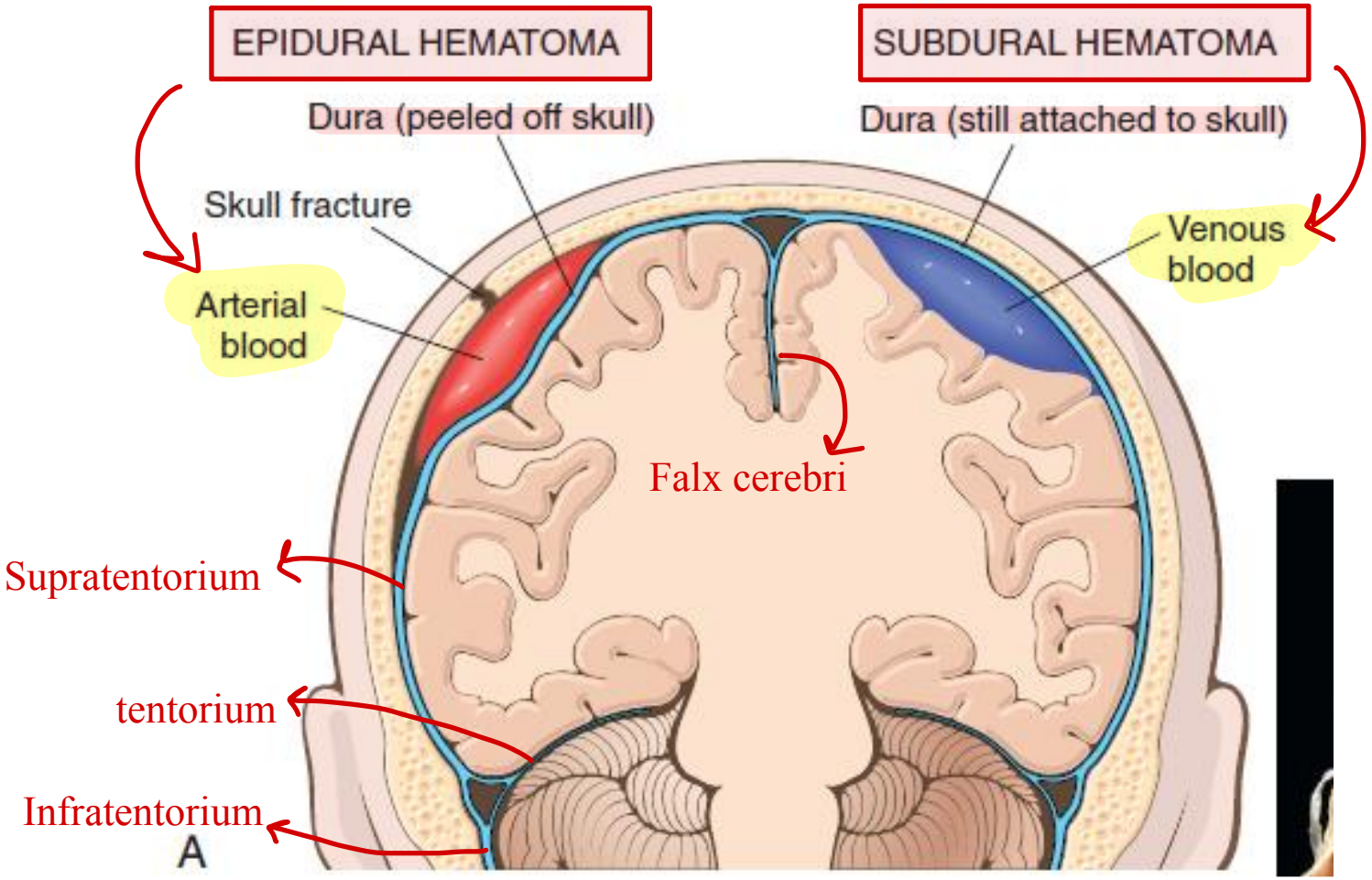
TRAUMATIC PARENCHYMAL INJURIES
٤ DIFFUSE AXONAL INJURY

- Rapid displacement of the head and brain can tear axons
- Sever, irreversible neurologic deficits.
- As many as **50% of patients who develop coma** shortly after trauma are believed to have white matter damage and diffuse axonal injury.
- Affect deep white matter
- Microsopy: axonal swelling



هيك خلصنا ال parenchyma و حنبلش بال vascular

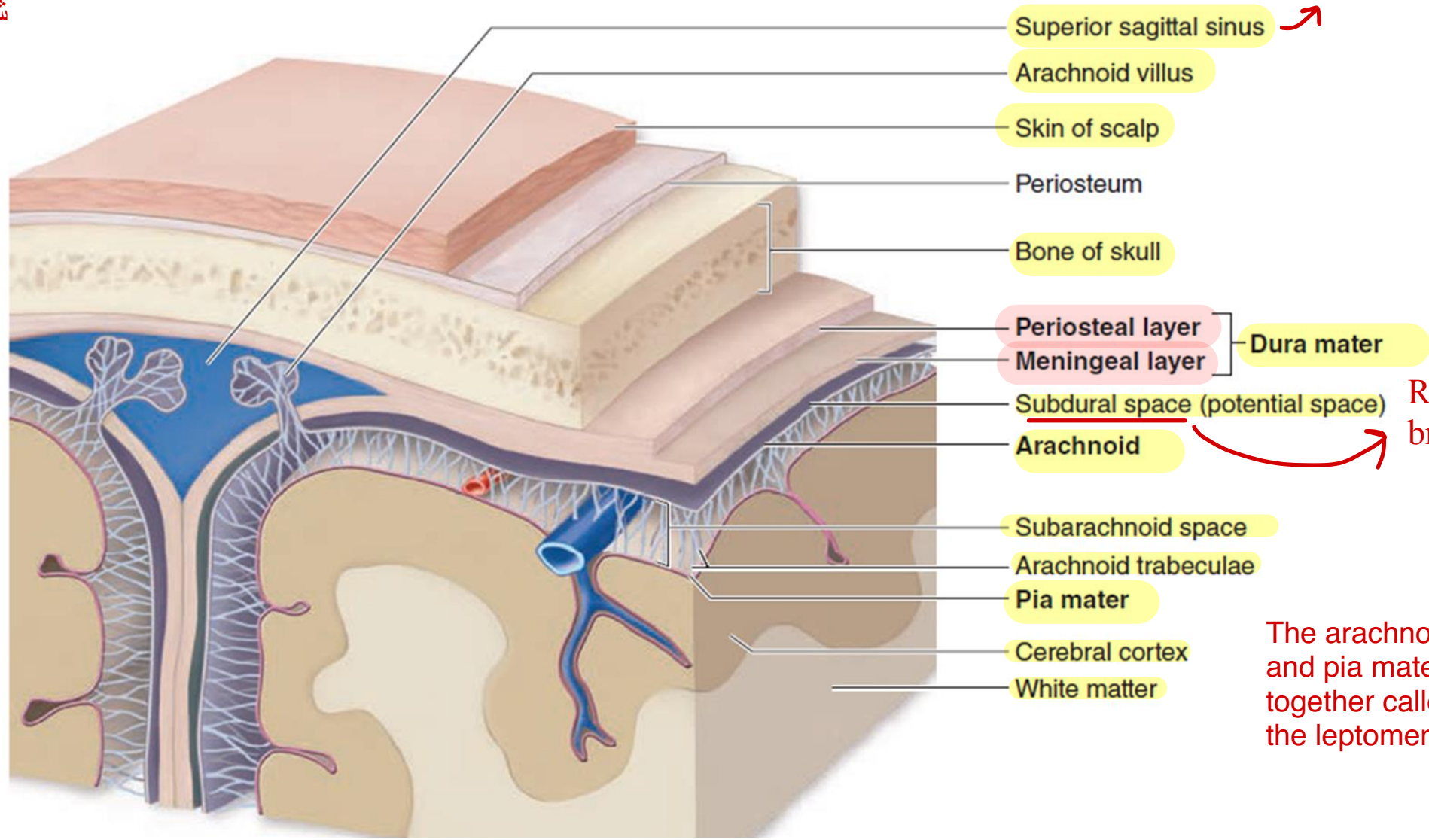
TRAUMATIC VASCULAR INJURY



The flax cerebri and tentorium are coming from the first layer of the dura mater

هون شوية
اناتومي للفهم
شرحناها باول
محاضره

بتصب بال IJV لل sys circulation



Rich in
bridging veins

The arachnoid
and pia mater are
together called
the leptomeninges

Bleeding above the dura and below the skull

Accumulation of blood

1 EPIDURAL HEMATOMA

مشكلة هاد ال blood اللي حيتجمع انو حيعمل زي mid mass حتضغط فبتعمل line shift/edema / herniation /increase ICP بالتالي كل هدول
اعراض ممكن تصاحب ال epidural hematoma و بحدثوا خلال وقت قصير

- Usually acute & accompanied by skull fracture
- Rupture of **middle meningeal artery**
- Once a vessel tears, blood accumulates under arterial pressure and dissects the tightly applied dura away from the inner skull surface producing a hematoma that compresses the brain surface

لانو هي not slow forming يعني تعتبر rapid forming لانها نزيف من artery فبسرعه بتتكون بالتالي مقارنة مع ال subdural hematoma فهي not slow و احياناً ال fracture بكون كتير كبير فبعمل very acute epidural hematoma وهون ممكن يدخل ب direct loss of consciousness وتعتبر emergency او ممكن يكون fracture صغير فتكون less acute or slowly

Clinically :

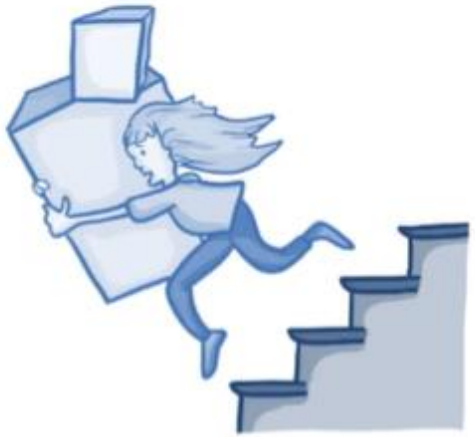
- When blood accumulates slowly: Patient has a short LUCID interval followed by rapid loss of consciousness

not as slowly as the subdural hematoma

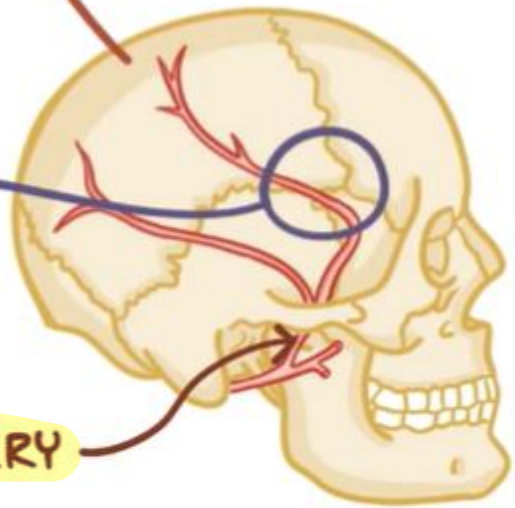
- May expand rapidly leading to a Neurologic emergency

يعني اجتو الضربه و عادي ما صار فيه اشي لكن بعد ساعتين صارلو rapid loss of consciousness

CAUSE



* HEAD TRAUMA
* MENINGEAL ARTERIES
  - PROTECTED by the SKULL
  - DAMAGED by SERIOUS HEAD TRAUMA
  - USUALLY at the PTERION

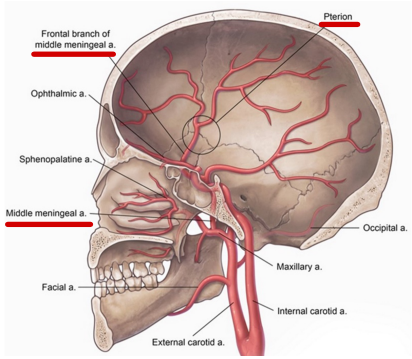


FRONTAL
PARIETAL
TEMPORAL
SPHENOID

Pterion :
The meeting point of four bones

~ THIN
~ ABOVE MIDDLE MENINGEAL ARTERY

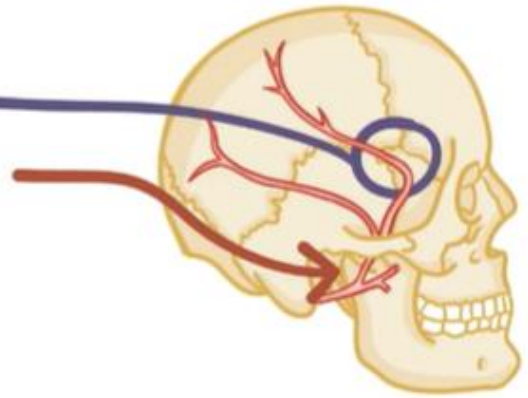
صوره خارجيه لتوضيح مسار ال MMA داخل ال skull



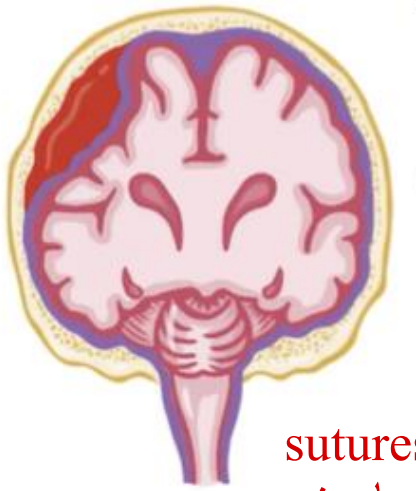
EPIDURAL HEMORRHAGE

ABOVE — DURA MATER — BLEEDING

* CAUSED BY HEAD TRAUMA
  - COMMONLY at the PTERION
  - ABOVE MENINGEAL ARTERY



* SLOW FORMING
  - LUCID INTERVAL



* CT SCAN
  - DON'T CROSS SUTURES
  - BICONVEX

ال periosteal layer of dura بتكون ملزقه بال skull و خصوصاً كتير ملزقه باماكن ال sutures
بالتالي لما يصير ال epidural hematoma الدم اللي حيتجمع ما في كتير مساحه يمشي فيها يعني limited space فبكبر بمكانه بعطي biconvex bleeding او بعض الكتب بوصفوه ب lemon shape

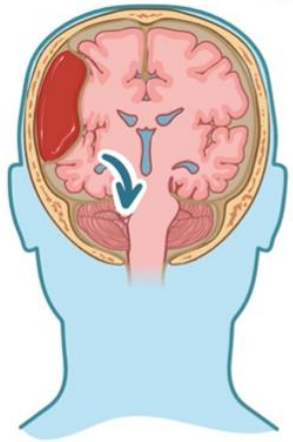
EPIDURAL HEMATOMA

A blood clot is seen over the external surface of the dura within the cranial cavity after removing the top of the skull at autopsy. طبعاً هون المريض توفى فهاي
Is always the result of trauma.

A tear in the **middle meningeal artery**, is the most likely source.

The arterial source means that the bleeding is brisk and blood collects quickly, leading to neurologic signs and symptoms within minutes to hours.

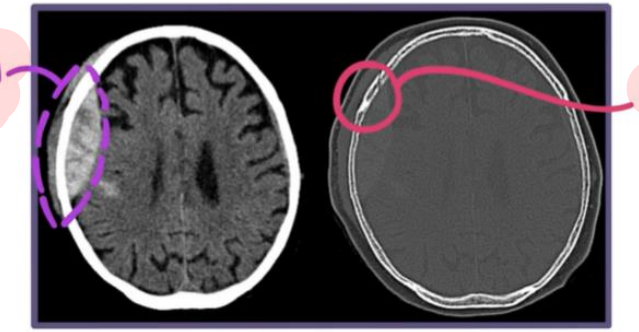
EPIDURAL HEMATOMAS



* BRAIN HERNIATION
  - ↳ LOSS of CONSCIOUSNESS
  - ↳ COMA
  - ↳ DEATH

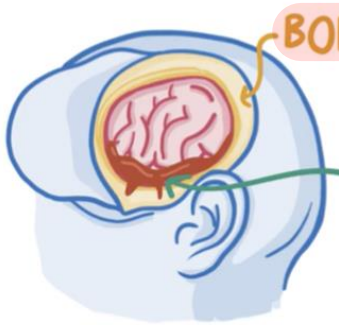
DIAGNOSIS

* CT SCAN
  - └ HYPERDENSE MASS



TREATMENT

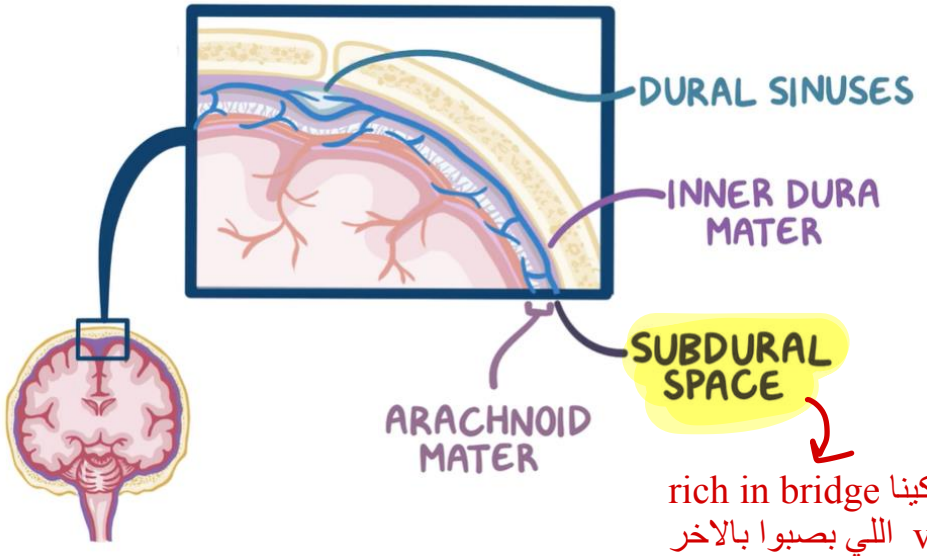
* CRANIOTOMY



Bleeding under the dura

2 SUBDURAL HEMATOMA

- **Source:** Tearing of Bridging Veins
- Gross: Collection of fresh blood (slow bleeding)
- Mass effect causes brain compression, midline shift, and herniation
- **Clinically:** headache and confusion and slow progressive neurologic deterioration
- **CT scan**: crescent shape hyperdense mass
- **Treatment:** remove blood and associated organizing tissue.



rich in bridge حكينا veins اللي بصبوا بالاخر dura بال Sinuses

هون ال bleeding بما انو تحت ال dura فما في اشي يعمل limiting لمكان ال bleeding فحيبين بال ct زي شكل الهلال scan

SUBDURAL HEMORRHAGE

BELOW

OUTERMOST PROTECTIVE LAYER

↓

DURA MATER

BLEEDING

* BLEEDING BELOW the DURA MATER

CAUSE

عند ال aging او اللي عندهم زهايمر
فبقل حجم ال gyri و يزيد ال sulci
بالتالي ال bridging veins اللي بينهم
حتصير اقل حمايه و اكثر عرضه لل
tearing

* **BRAIN ATROPHY**
  - BRAIN SHRINKS
  - BRIDGING VEINS UNSUPPORTED

* **HEAD TRAUMAS**
  - WHACKING YOUR HEAD
  - SHAKEN BABY SYNDROME

واللي هي بتكون مع ال baby
بحيث بمسكوا البيبي و abuse
بضلو يهزو براسو كتير فهون الطفل
ال gyri تاعتو لسا صغيره و ال
bridging veins تاعتو مش
protected و risk to rupture
retinal hemorrhage و احياناً بصير معها

* **ALCOHOL ABUSE**
  - VEINS ARE THIN WALLED
  - LIKELY TO BREAK

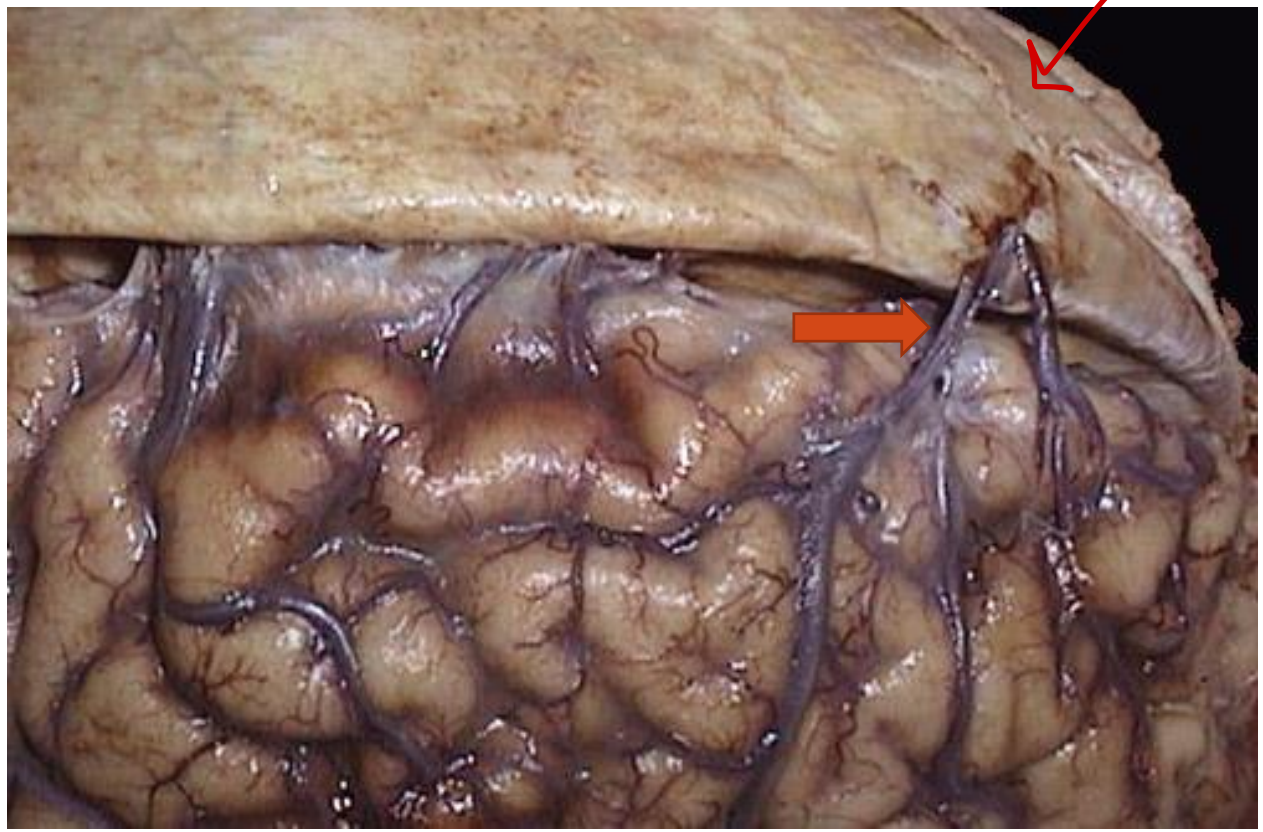
\+
Atrophy
in brain

* **ACCELERATION - DECELERATION INJURY**

In car accidents

SUBDURAL HEMATOMA

bridging veins ال
between the sulci بمشوا

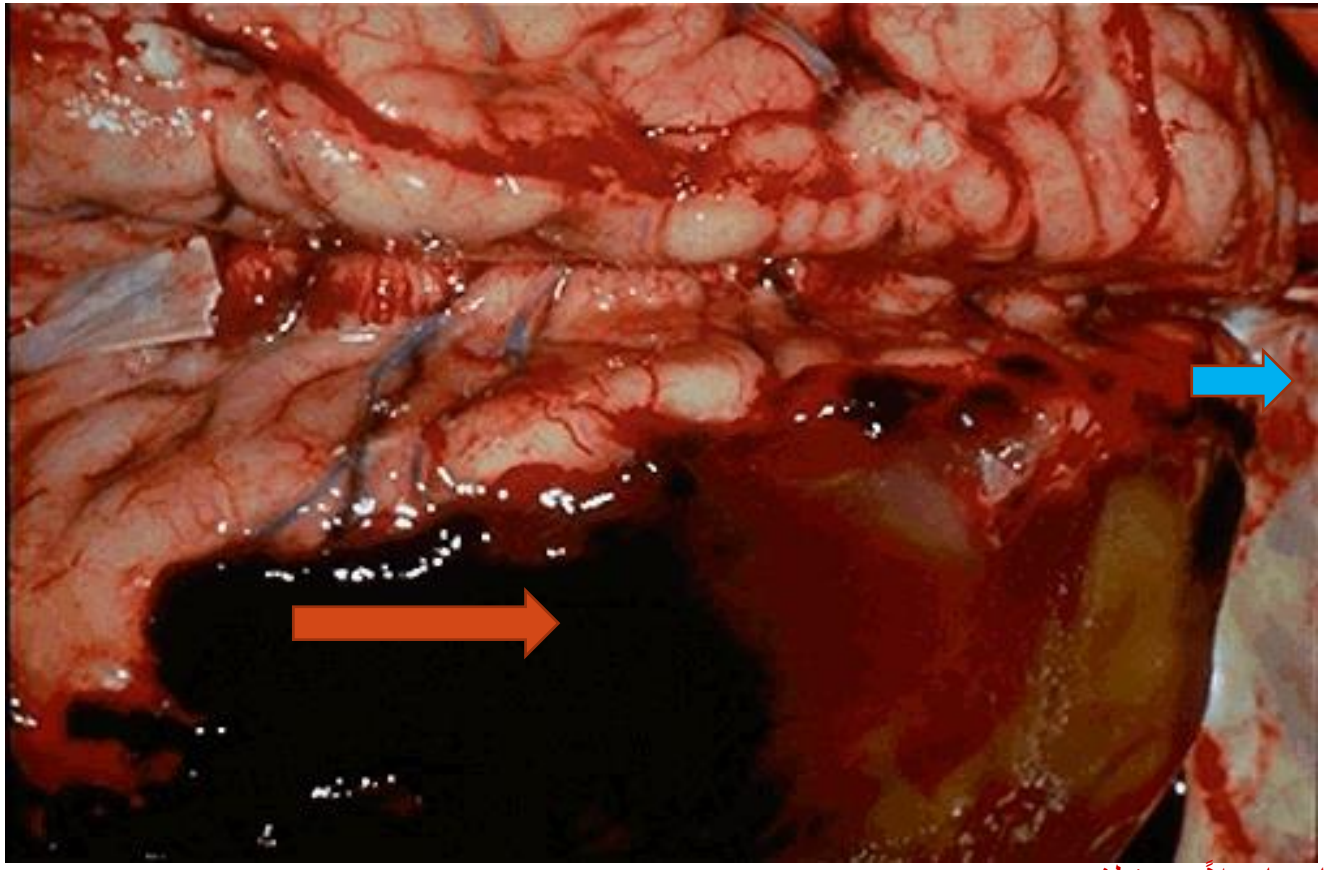


شلنا ال dura لانو ال
هون تحتها بتكون hematoma

The dura has been reflected above to reveal the **bridging veins that extend across to the superior aspect of the cerebral hemispheres.**

These cerebral veins can be torn with trauma, particularly if there is significant cerebral atrophy (as with aging) that exposes these veins even more.

ACUTE SUBDURAL HEMATOMA



The dura has been reflected back (blue arrow) to reveal a subdural hematoma (orange arrow).

Usually the result of trauma with **tearing of the cerebral bridging veins** at the vertex.

The venous source means that the bleeding may be slow and blood collects over a variable length of time, leading to neurologic signs and symptoms within hours to days or even weeks.

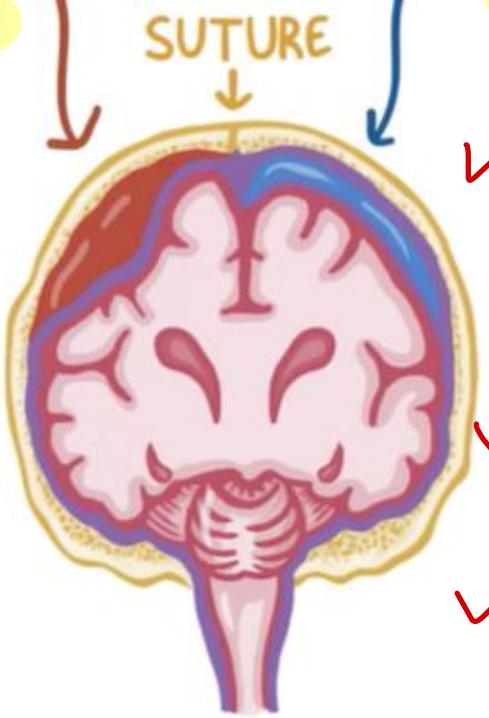
لانو هون النزيف من vein فال formation تاعو بكون slow بالتالي الواحد اصلاً بس تبلش تطلع عليه الاعراض بكون مر فتره منيحه على بداية النزيف بحيث ممكن اصلاً يكون نسي متى وقع او انضرب عكس ال epidural اللي كانت الاعراض خلال دقايق ل ساعات تطلع

Summary

DIAGNOSIS

* EPIDURAL HEMORRHAGES

- BETWEEN the OUTER LAYER of the DURA MATER and the SKULL
- DO NOT CROSS SUTURE LINES
- BICONVEX SHAPE



* SUBDURAL HEMORRHAGES

- BETWEEN the ARACHNOID and the INNER LAYER of the DURA MATER
- CRESCENT SHAPE
- CROSS SUTURE LINES

جدول بلخص ال vascular injuries

Table 23.1 Patterns of Vascular Injury in the Central Nervous System

Location	Etiology	Additional Features
Epidural space	Trauma	Usually associated with a skull fracture (in adults); rapidly evolving neurologic symptoms requiring intervention
Subdural space	Trauma	Level of trauma may be mild; slowly evolving neurologic symptoms, often with a delay from the time of injury
Subarachnoid space	Vascular abnormalities (arteriovenous malformation or aneurysm)	Sudden onset of severe headache, often with rapid neurologic deterioration; secondary injury may emerge due to vasospasm
	Trauma	Typically associated with underlying contusions
Intraparenchymal	Trauma (contusions)	Selective involvement of the crests of gyri where the brain contacts the skull (frontal and temporal tips, orbitofrontal surface)
	Hemorrhagic conversion of an ischemic infarction	Petechial hemorrhages in an area of previously ischemic brain, usually following the cortical ribbon
	Cerebral amyloid angiopathy	"Lobar" hemorrhage, involving cerebral cortex, often with extension into the subarachnoid space
	Hypertension	Centered in the deep white matter, thalamus, basal ganglia, or brain stem; may extend into the ventricular system
	Tumors (primary or metastatic)	Associated with high-grade gliomas or certain metastases (melanoma, choriocarcinoma, renal cell carcinoma)

هاي للمحاضره الجاي

3 SUBARACHNOID HEMORRHAGE

Bleeding in the subarachnoid space where the CSF exist
lumber puncture فلو عملت
bloody CSFحيطلع معي

و هون ال hemorrhage بمشي بال subarachnoid space through out all the brain فبعمل للمريض severe headache

Causes:

حنحكي بس عن اول ثلاث

- Rupture saccular (berry) aneurysm
- Vascular malformations
- Trauma
- Coagulopathies
- Tumors

هاي للمحاضره الجايه ↘

weakening in the هو wall of the artery

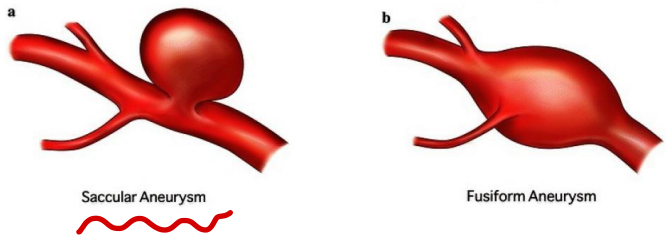
SACCULAR (BERRY) ANEURYSM

- Commonest cause of spontaneous subarachnoid hemorrhage
- 2% of population, Rupture in fifth decade, F > M
- Not present at birth, but develop over time because of underlying defect in media of the vessel بتكبر شوي شوي
- Rate of bleeding: 1.3% / year.

Extra:

the most common type of intracranial aneurysm

and it is bulging or weakening in the media in the wall of the artery



CONDITIONS ASSOCIATED WITH SACCULAR ANEURYSMS

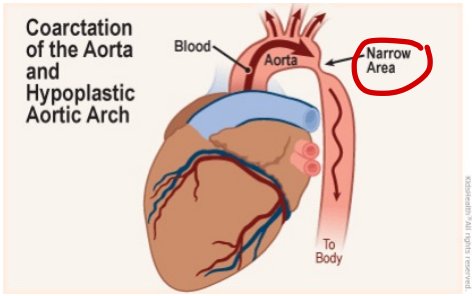
Genetic:

- Polycystic kidney disease (autosomal dominant)
- Defects in extracellular matrix proteins (Connective tissue diseases)
- e.g. Marfan's syndrome, Others

Non-genetic:

- Coarctation of aorta

حيصير الضغط بال upper part عالي و بال lower part منخفظ بالتالي risk لل aneurysm بال brain



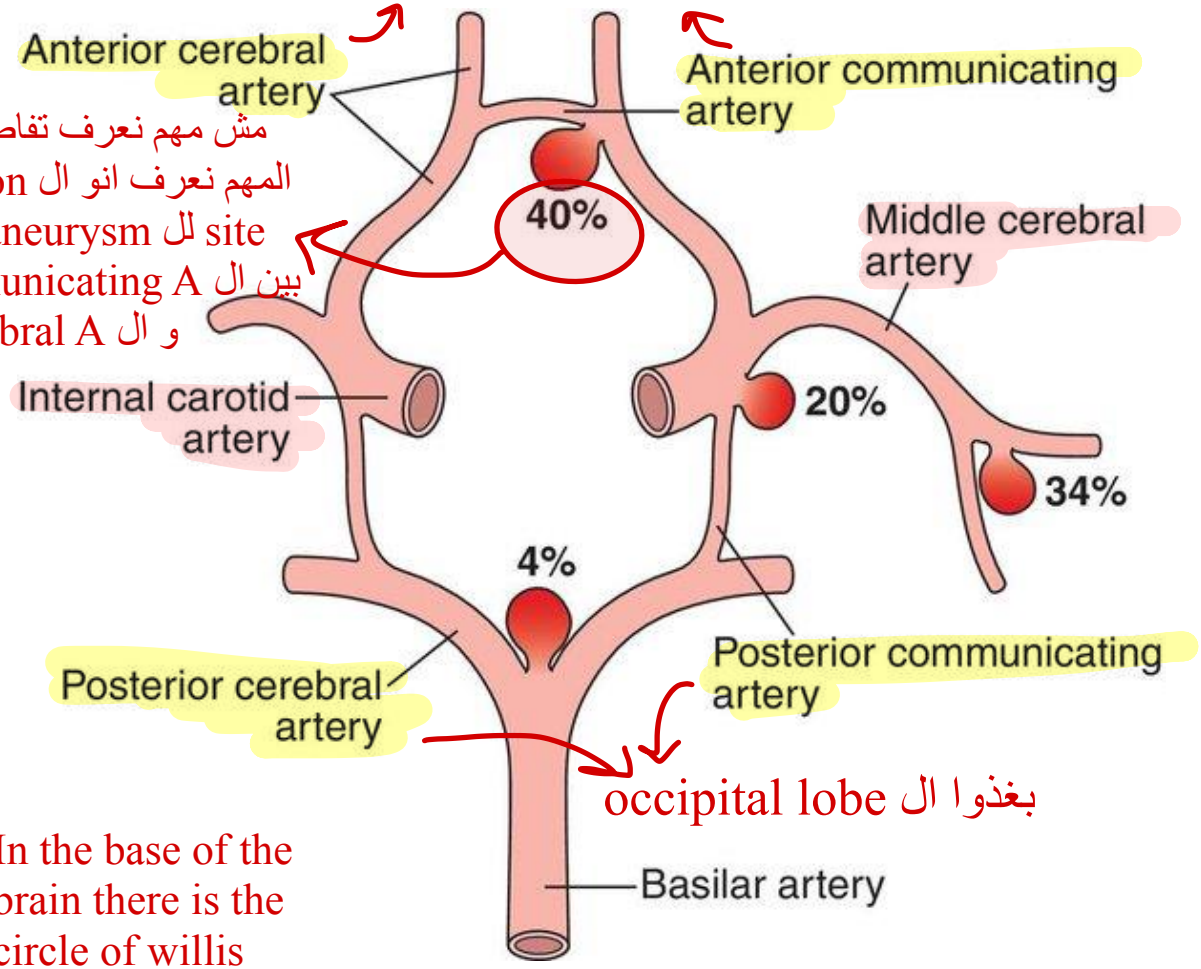
Extra

Predisposing conditions:

- Hypertension زي كأنها بلون فلو نفختها اكيد حتفقع
- Cigarette smoking

SACCULAR (BERRY) ANEURYSM

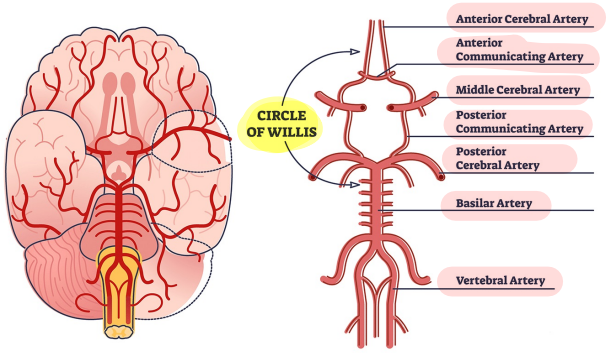
anterior and the بغذوا ال
inferior of the frontal lobe



مش مهم نعرف تفاصيل الرسمه لكن المهم نعرف انو ال most common هو saccular aneurysm لل site بين ال anterior comunicating A و ال anterior cerebral A

بغذوا ال occipital lobe

In the base of the brain there is the circle of willis



Extra

- About 90% near major arterial branch points in anterior circulation

اغلبهم بطلعوا باماكن ال branching

- 20-30% multiple

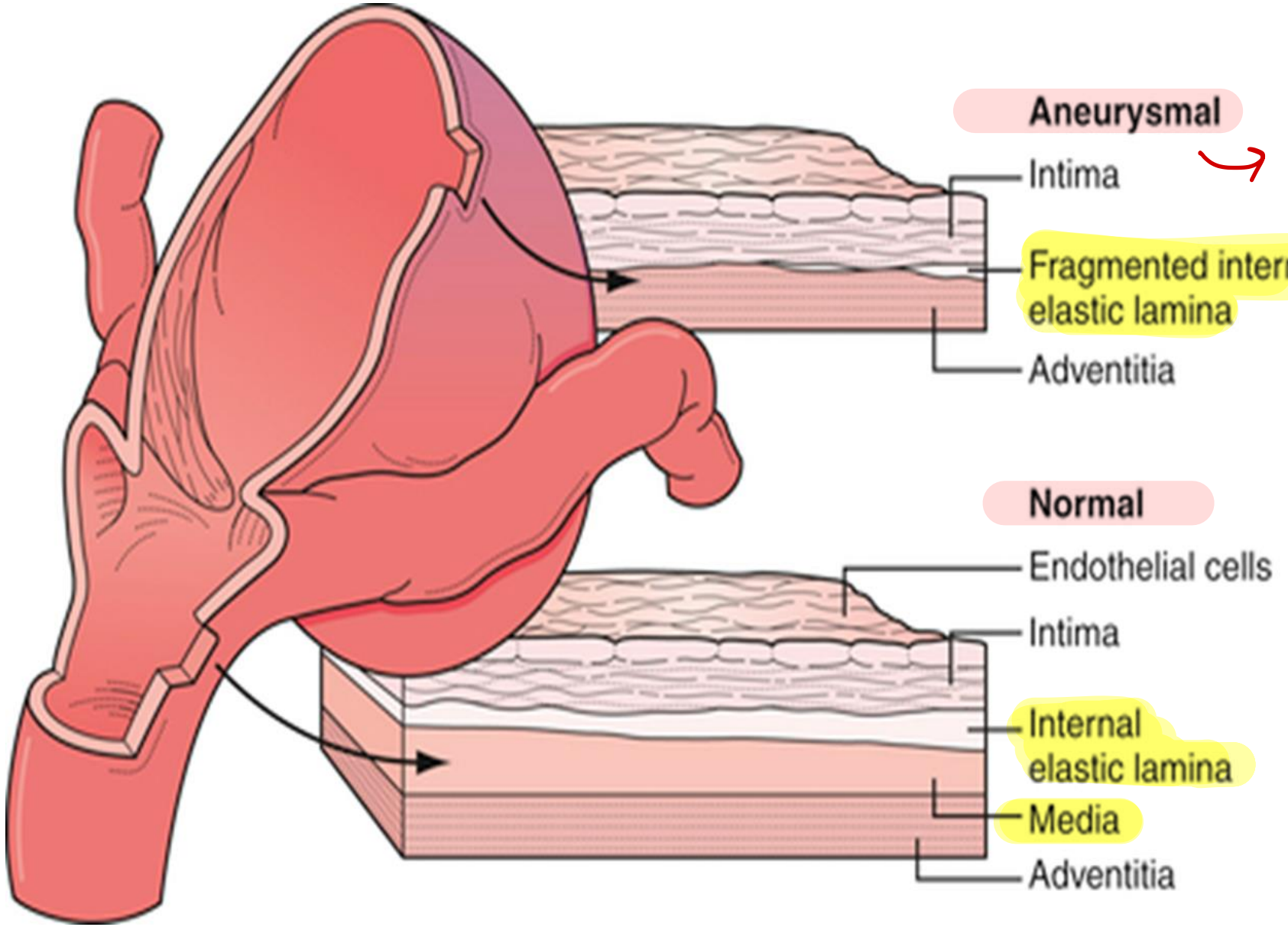
Come with multiple aneurysm

SACCULAR (BERRY) ANEURYSM MORPHOLOGY

- Size: from few mm to 2-3 cm.
- Muscular wall and internal elastic lamina are absent beyond the neck of the aneurysm.
- Aneurysm sac is lined only by thickened hyalinized intima. The adventitia covering the sac is continuous with that of the parent artery.
- Rupture usually occurs at the apex of the sac, releasing blood into the subarachnoid space or the substance of the brain, or both.

missed احياناً fragmented احياناً

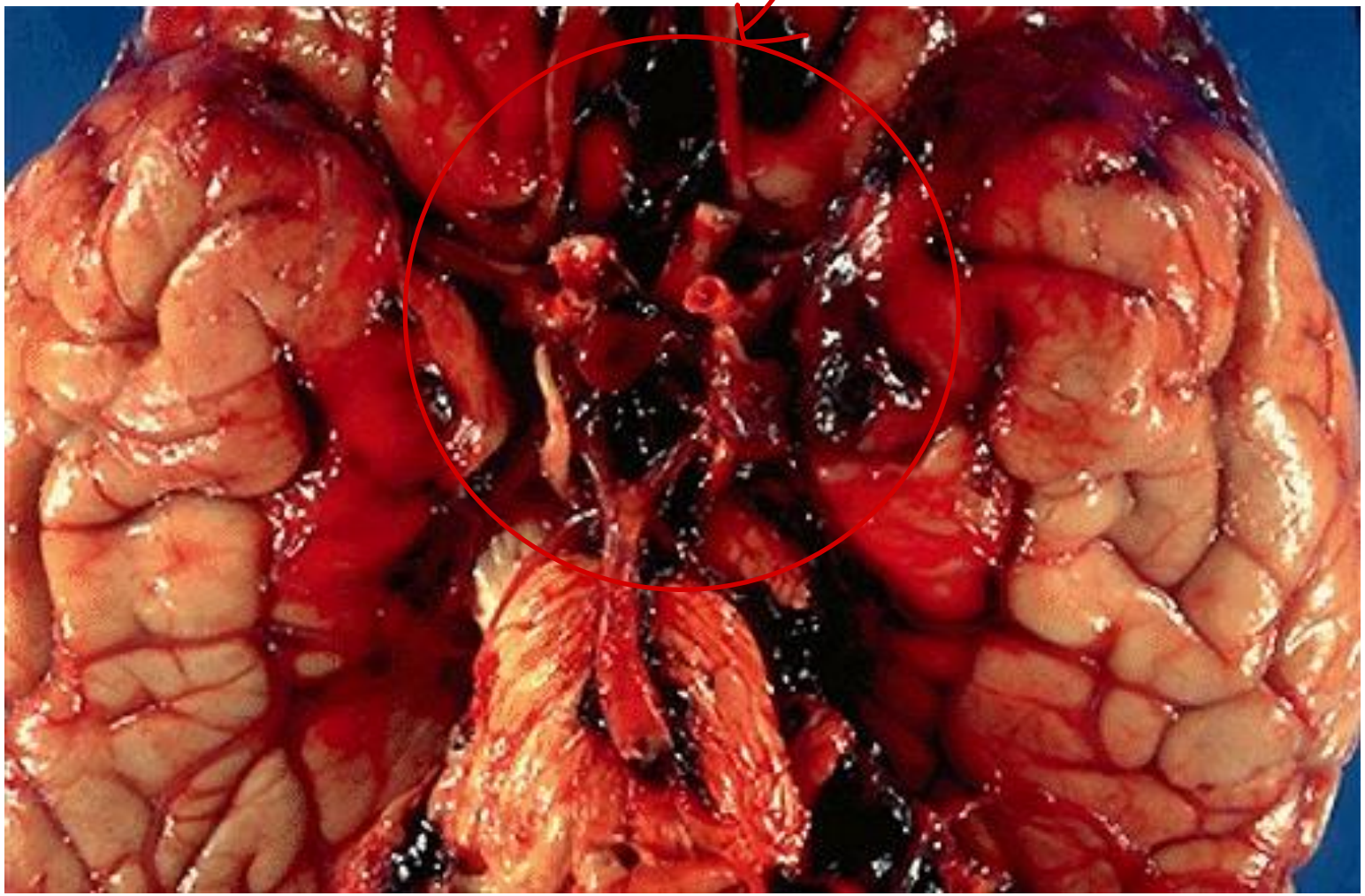
بتحاول تعوض عن نقص ال media اللي تحتيها



There is no media that is used to give the strength of the arterial wall

Saccural aneurysm in the circle of willis

Apex/ Site of rupture

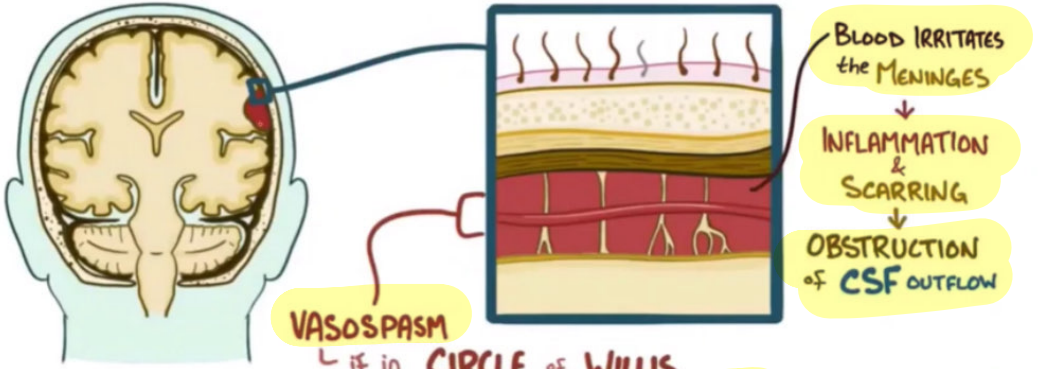


The subarachnoid hemorrhage from a ruptured aneurysm shown here at the base of the brain is more of an irritant producing vasospasm than a mass lesion

كل هاد ال hemorrhage بالمنطقه رح يعمل irritation لل meninges اللي فوقيها فيجي ب symptoms of meningitis زي ال Nuchal rigidity كمان بعمل irritation لل BV اللي جمبها بحيث يصير فيهم vasospasm بالتالي ischemia

ONCE THERE'S AN

SUBARACHNOID HEMORRHAGE



SACCULAR (BERRY) ANEURYSM

- Clinical: **Worst headache of my entire life**, sudden, excruciating with loss of consciousness. Nuchal rigidity.
- 25-50% die at time of first rupture
- **Acute**: in the first few days: vasospasm of other vessels >> Increased risk of additional ischemic injury
- **Repeat bleeding** is associated with increased mortality
- **Chronic (healing phase):** Meningeal fibrosis and scarring leading to obstruction of CSF flow or disruption of CSF resorption leading to hydrocephalus.

اذا عاش بعد ال first
repeat فاي bleeding
bleeding حيزيد من
احتمالة الوفاة

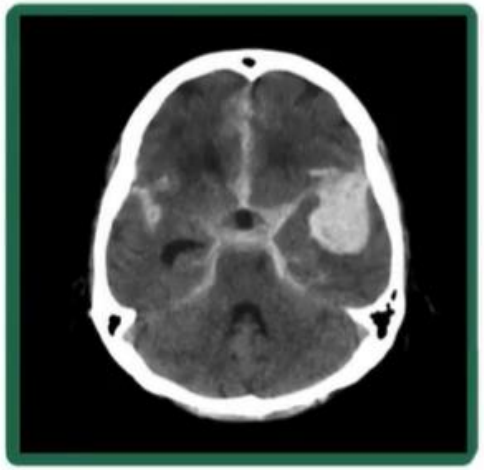
لانو صار عندي fibrosis بال subarachnoid
space بالتالي حيعمل عندي non communicated
obstructed hydrocephalus

SACCULAR (BERRY) ANEURYSM

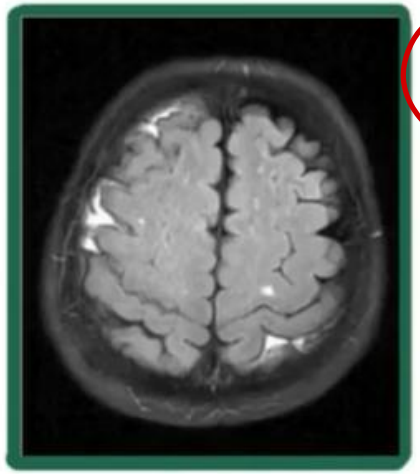
" اللهم لا سهل إلا ما جعلته سهلا وأنت
تجعل الحزن إن شئت سهلا، اللهم اشرح
لي صدري ويسر لي أمري واحلل عقدة من
لساني يفقه قولي، افتح علي فتوح العارفين
بفضلك"🤍

DIAGNOSIS

1. Imaging



CT



MRI

2. LUMBAR PUNCTURE
   ↓
   RED BLOOD (FRESH)
   or
   YELLOWISH BLOOD (OLD)
   (XANTHOCHROMIA)

localized or diffuse ممكن يبين