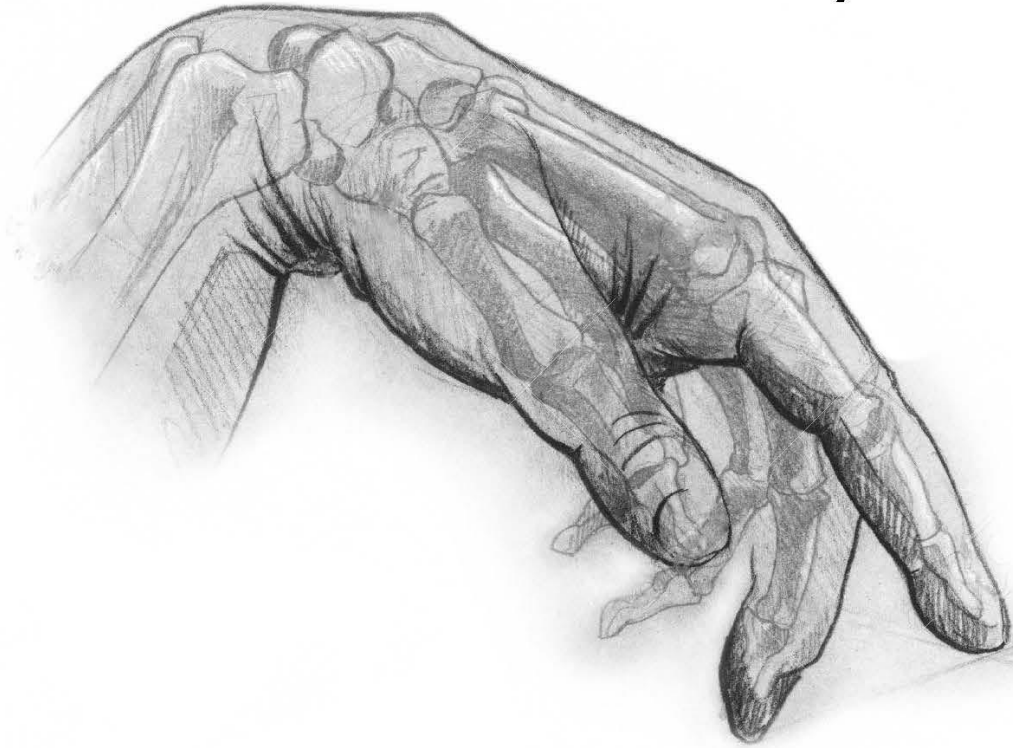


The **Musculoskeletal** System



Anatomy

☒ Sheet

☐ Slide

☐ Handout

Number: 2

Subject: Cranial cavity clinical apps.

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Price:

Introduction

- Our brain is composed of nearly 100 billion neural cells, each one has its own function, these cells work in a great harmony to give you movements, sensations, dreams and your distinct personality!

To imagine the complexity of our brain, think about the piano. The piano has 82 keys, these keys can produce millions of tones, how about your complex brain, with all these cells !

- The Medical specialty that deals with cranial cavity surgery is the *neurosurgery*, as a surgeon your knowledge in anatomy is your weapon, that help you to take the right decision in diagnoses and surgical intervention.



- The figure above shows one of the first surgical interventions in history, it's a craniotomy done by the Inca 500 years ago !
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Cranial cavity Anatomy

- Why is it important to study cranial cavity anatomy?
 - *Simply because we have to find the safest way to enter this cavity. in the past we used to open a big window in the skull to find the lesion, nowadays we have many safer ways to localize these lesions and reach it with minimal damage to the skull, by microsurgeries.*
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- As you know, the cranial cavity is composed of 3 major fossae; *the frontal (anterior) fossa, middle cranial fossa and posterior cranial fossa*. each fossa has its own characteristics and its own points of entry.
- The upper part of the skull is called the *vault* which is the easiest and safest point of entry to the skull. On the other hand, the most difficult point of entry is the base of the skull.
 - Note: *it's noteworthy that when we say the base of the skull, it means usually internal aspect of the base.*
- After opening the skull we will face the meninges; *Dura mater, arachnoid mater* and *pia mater*, the pia mater is adherent to the brain.
- Dura and brain have different blood supply, blood supply for the Dura is from *external carotid (maxillary branch from external carotid artery → gives me middle meningeal artery)*, while the brain takes blood supply from *internal carotid and two vertebral arteries*.
 - This artery has very important clinical application, a bleeding from this artery will lead to *extradural (epidural) hematoma* that may cause death due to brainstem herniation. Trauma in the pterion region(المقتل) in the skull may cause *rupture in the anterior branch of middle meningeal artery*.
 - Extradural hematoma occurs in the potential space between the skull and the Dura, due to the fact that this space is too small, it's more dangerous than subdural hematoma, that have a larger space - between the brain and the dura-.
 - Another difference between extradural hematoma and subdural hematoma is the type of the blood: (important)
 1. in extradural hematoma, it's arterial blood (as we explained above).
 2. in subdural hematoma it's almost always venous, but why?

- *In the subdural space, we have some veins that connect the brain to the sinusoids (like bridges), known as bridging veins. In elderly people the brain undergoes atrophy, a trauma may cause a rupture in these veins, leading to an acute/chronic subdural bleeding.*

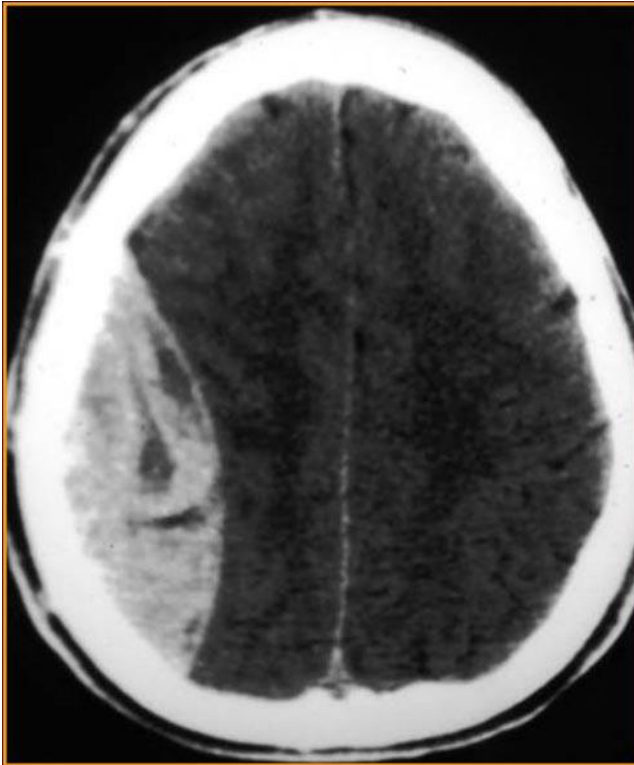


Figure 1 : a biconcave extradural hematoma.



Figure 2 : subdural hematoma.

Important Note: you have to identify all the foramina of the base of the skull.

Cranial cavity injuries

- what's the importance of the skull?!
- Think about it, if you have two patients with a head trauma, one with skull fracture and the other with no or minimal damage to the skull, which one of these conditions is worst?! Which one of them will have a better prognosis?!

- The skull works as a shock-absorber that protects the brain, so if the patient comes to you with damaged skull, that's a good sign, the tension of the trauma has been absorbed by the skull and didn't cause a significant damage to the brain.

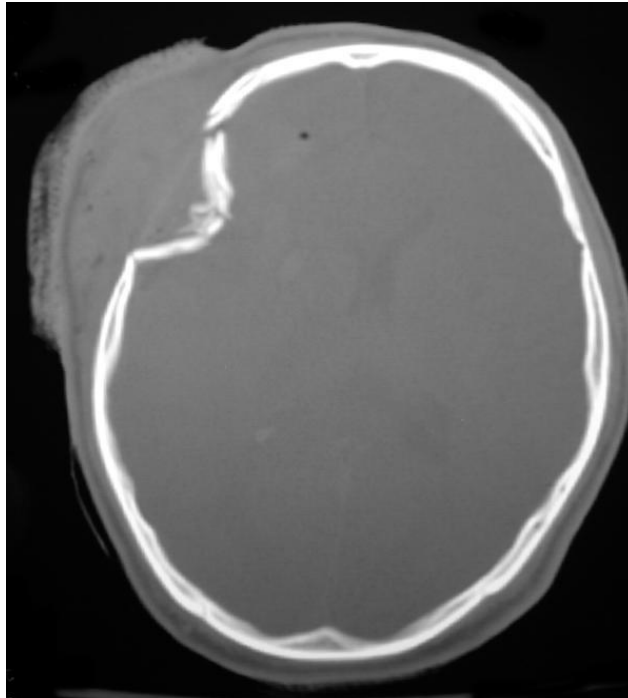


figure 3: a depressed skull fracture

- A Clinical case about figure 3 :

- An 8 months baby came to you after falling from the bed, a CT-Scan showed a closed skull fracture (without wounds or external bleeding) It's a depressed skull fracture with hematoma.
- The patient suffered from *Concussion* (ارتجاج الدماغ); *a short coma due to compression of the brain after a trauma, without any brain damage*. Sometimes, however, the condition of the patient may deteriorate after a temporary improvement, especially if the injury involved subdural hematoma. This condition is known as *lucid interval*.

- The treatment: as you see in figure 4, you open the skull and remove the blood clot (hematoma).



Figure 4

- the doctor showed as a picture for a patient after a surgical resection of a tumor in the eye ball (*typically such tumors invade upward toward the cranial cavity*).
- the classical way to do this procedure was to do a wide craniotomy, removing the skull, and resecting this tumor from the roof of the orbit (the best way to open the scalp is by doing C shaped incision, the concavity of this C shape must be inferiorly).
- Nowadays, we have new points of entry for such cases, one of the most common points is the supraorbital, that will have less complications, with better cosmetic value.

- Important note: surgical incisions must to be *straight* or *curved* (according to the blood supply). But never do surgical incision with an angle, this angle will bleed forever, and leave a wound that will never heal.

new neurosurgical techniques

- Many techniques have improved the accuracy of microsurgeries, like *neuro navigator* and *gamma knife*:
 - Neuro navigator helps you to localize the tumor or the lesion, and guides you so you can do more accurate incision. (Comparison between old and new surgery).



Figure 5 : neuro navigator

- *Gamma Knife radiosurgery*, is a very precise form of therapeutic radiology. Even though it is called surgery, a Gamma Knife procedure does not involve actual surgery, nor is the Gamma Knife really a knife at all. It uses beams of highly-focused gamma rays to treat small to medium size lesions, usually in the brain. Many beams of gamma

radiation join to focus on the lesion under treatment, providing a very intense dose of radiation without a surgical incision or opening.

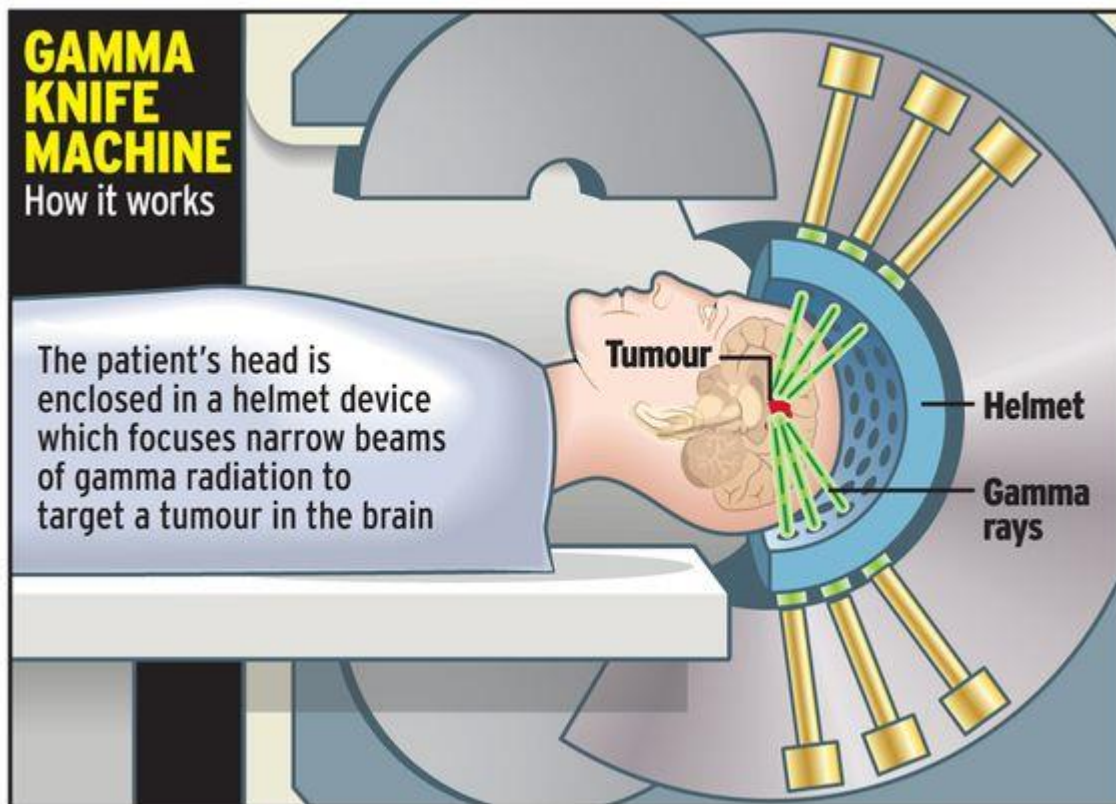


Figure 6: Gamma knife

Differential diagnoses quiz !

- In the next few pages, there's some images for some clinical problems with it's differential diagnoses.
- Try to apply you anatomical knowledge to localize these lesions:

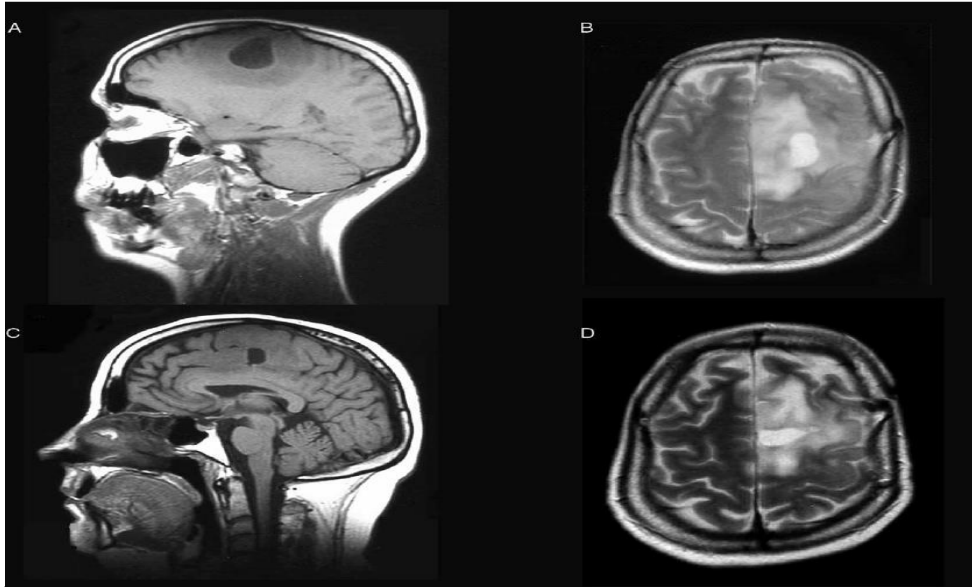


Figure 7 shows a tumor in the left central sulcus(*), resection of such tumors causes loss of motor and sensory functions.

- Note: The central sulcus is a sulcus (fold) in the cerebral cortex, it's a prominent landmark of the brain, separating the parietal lobe from frontal lobe and the primary motor lobe from the primary somatosensory lobe.

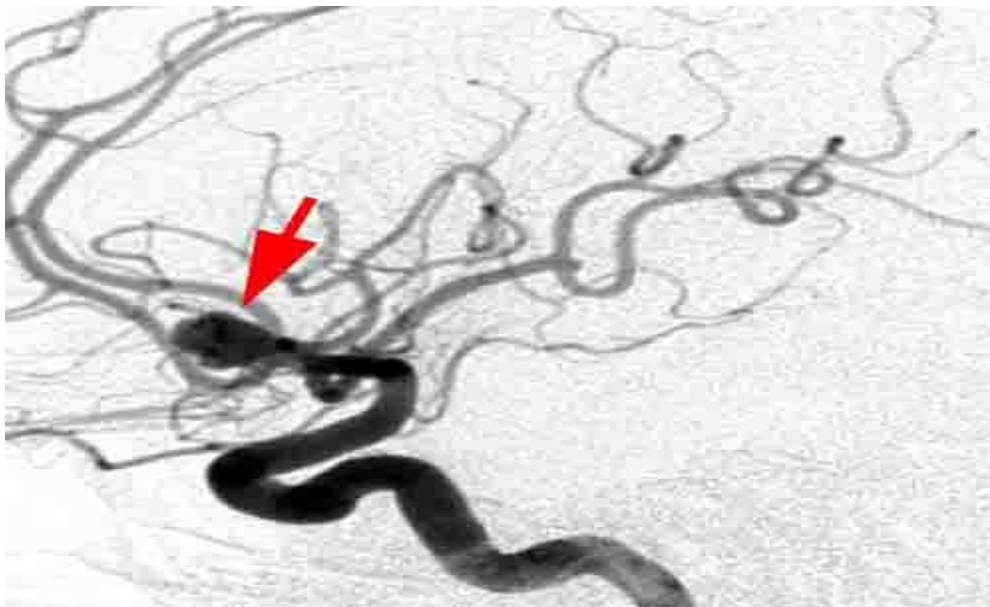


Figure 8 shows a brain angiogram, here you can see *Internal carotid artery, anterior and middle cerebral artery.*

- Note: The arrow (in figure 8) indicates a dilation in the blood vessels, it's known as an *aneurysm* (أم الدم). It requires a surgical intervention. Rupture of aneurysm causes *subarachnoid bleeding*.



Figure 9: maxillary tumor that invade the base of the skull, the best surgical point of entry is from the base.

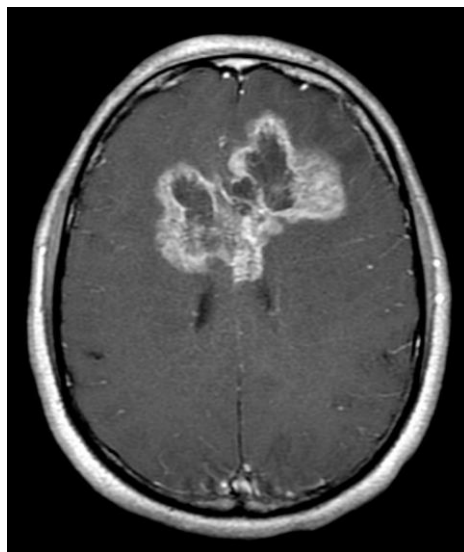


Figure 10 : a butterfly lesion –between right and left hemispheres- it's a glioblastoma.

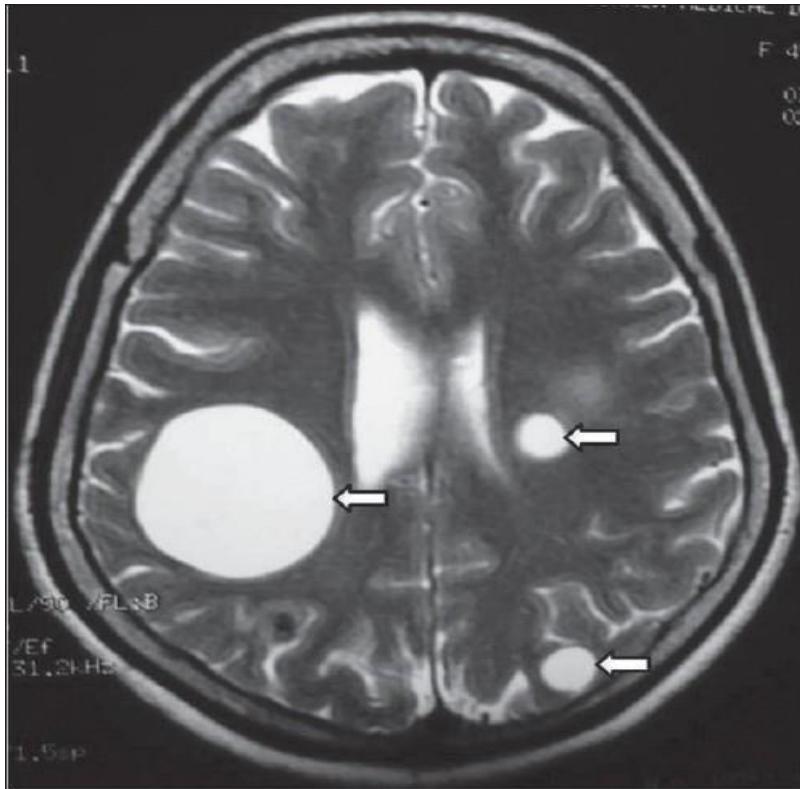


Figure 11 : hydatid cysts, such lesions results from parasitic infections.

*The large cyst is in the right occipital lobe.

Skull fractures

- We have 3 types of skull fractures:

1. Linear
2. Depressed
3. compound.

●As we said previously, the skull protects the brain from any injury by absorbing the shock, but what will happen if the skull failed in protecting the brain?

- Actually, a brain injury will occur, which varies according to the severity of the trauma, common brain injuries include:

1. brain contusion (رضة)
2. intracerebral bleeding
3. Diffuse axonal injury.
4. Herniation.

- Note: *Brain herniation* is a potentially deadly side effect of very high pressure within the skull that occurs when a part of the brain is squeezed across structures within the skull. The brain can shift across such structures as the *falx cerebri*, the *tentorium cerebelli*, and even through the *foramen magnum*.
- Note: in trauma or any condition that increases the intracranial pressure, first thing that will be observed is CSF rhinorrhea (leakage of the CSF from the nose), if the problem wasn't treated, blood may leak from the nose and finally brain herniation may develop.
- Important note: Cerebrospinal fluid (CSF) is a clear, colorless body fluid found in the brain and spine. It is produced in the choroid plexuses of the ventricles of the brain.

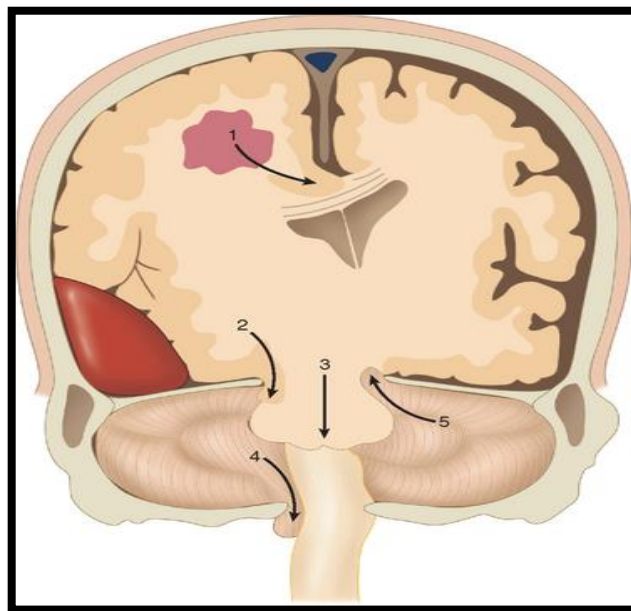


Figure 12: a brain herniation in the tentorium



Figure 13: papilledema seen by an ophthalmoscope,
A sign for increased intracranial pressure

● *basal skull fracture* is a rare type of skull fractures, occurs in the base of the skull, the most 4 characteristic symptoms are: (important)

- Raccoon eyes (figure 14).
- Battle's sign – bruising of the mastoid process of the temporal bone.
- CSF rhinorrhea.
- CSF otorrhea (CSF accumulate in the middle ear space, and dribble out through a perforated eardrum)
- pneumocephalus (air in the cranial cavity)



Figure14: Raccoon eyes, accumulation of the blood around the eyes as a result of basal skull fracture or subgaleal hematoma (in the potential space under occipitofrontalis aponeurosis in the scalp)

The end ...

-Note: Dr Tariq said that the most important topics are:

- The differentiation between extradural and subdural hematoma.
- The base of the skull foramina.
- Definition of CSF.
- Basal skull fracture.
- Scalp layers.

-“A smooth sea never made a skilled sailor”

-Good luck

-Mohammad Qussay Al-Sabbagh