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21/01/2020

AT309 — Introductory Anatomy III

HEAD & NECK + Neuroanatomy

HEAD + NECK

- ⇒ Osteology / skeletal framework of H & N
- Overview
 - Bones of the skull
 - Views of the skull / sutures / fontanelles / foramina / fissures.
 - Cervical vertebrae
 - Clinical correlations.

The bony framework of the H & N is made up of the following:

- ⇒ skull
- ⇒ Cervical vertebrae
- ⇒ Hyoid bone.
- ⇒ Laryngeal cartilages.

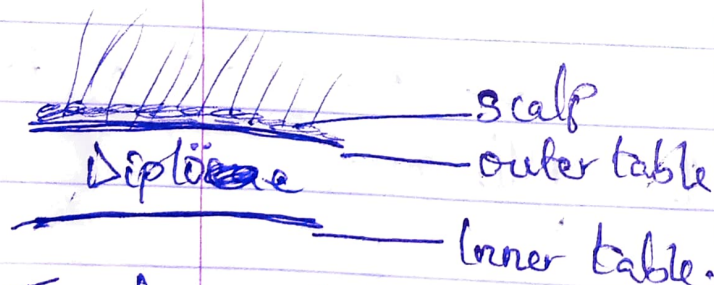
SKULL

This is the skeleton of the head. It is the most complex bony structure of the body because several bones fuse together

auditory → hearing
vestibular → balance

(2)

to form the skull. It is a compact bone (i.e. having 2 layers; outer table and inner table. The inner table is softer and more brittle than the outer one. The scalp lies on the outer layer.) In between these two layers, there is a spongy or cancellous layer called ~~DIPLOEA~~ Diploë.

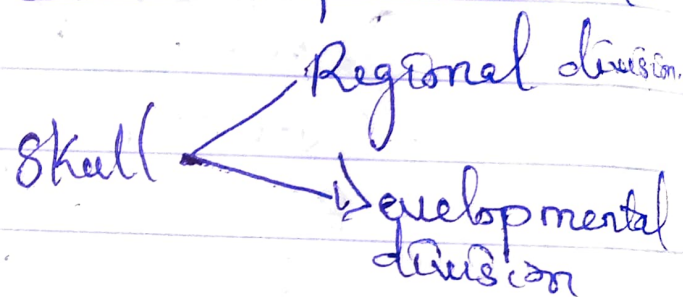


Functions of the skull:

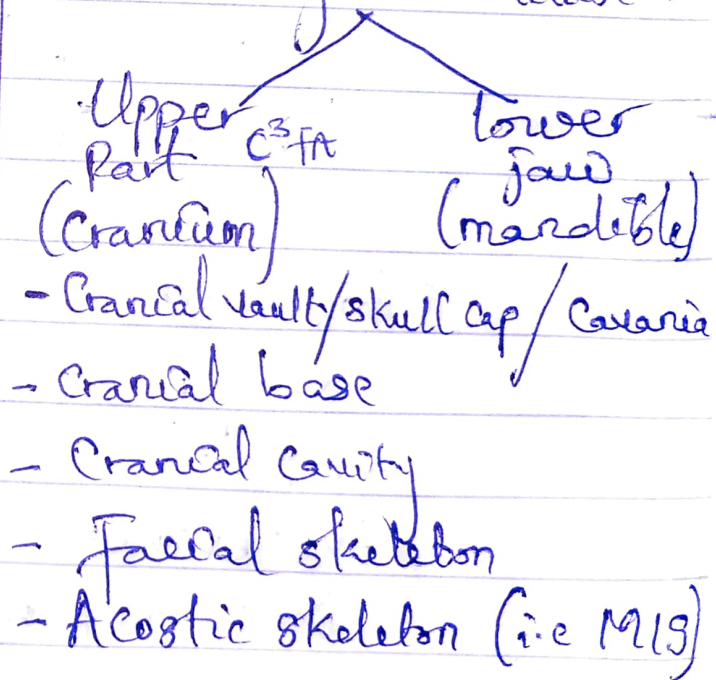
- ① Protects the brain
- ② Provides attachments for muscles of the head.
- ③ Protects the organs of special senses.
- ④ Protects the cranial parts of the respiratory and digestive system.

- 5) Shapes the head
- 6) Houses the brain.

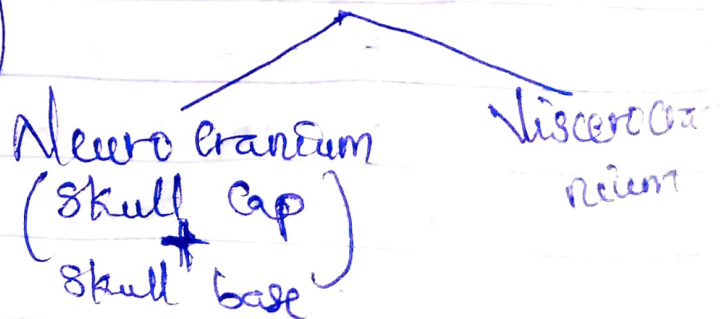
Divisions of the skull



Regional division



Developmental division



(3)

Neurocranium: This comprises the skull cap and skull base. It protects the brain and five special sense organs. 8 bones make up the neurocranium; 2 paired and 4 unpaired.

Viscerocranium: Comprises the facial skeleton, palate, acoustic skeleton, larynx/pharynx. It is made up of 14 bones, 6 paired and 2 unpaired. It aids in feeding, breathing and muscle attachment.

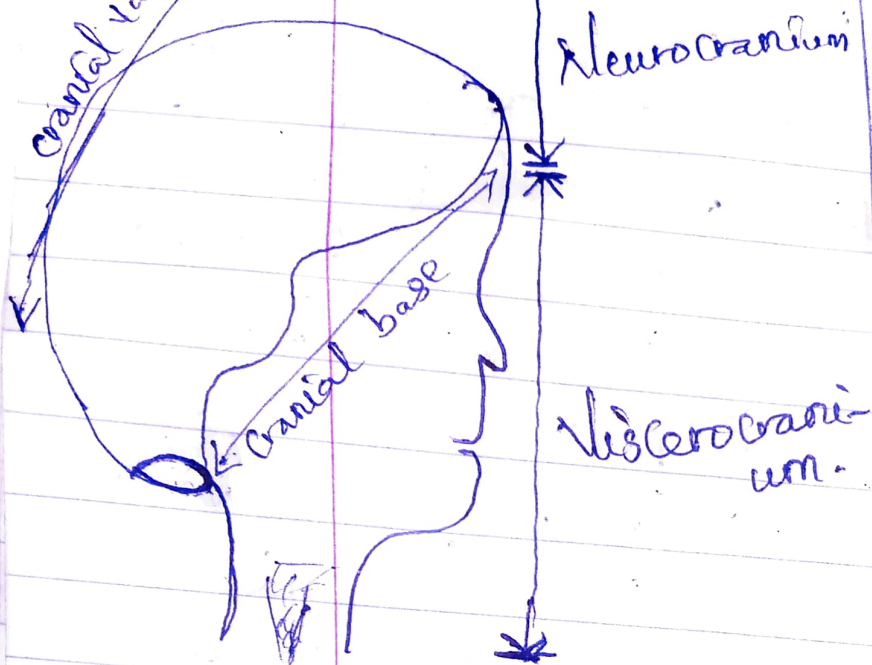
The skull is made up of 28 individual bones, including the mandible. Out of the 28 bones, 11 are paired, 6 are unpaired.

Paired bones (11)

- 1) Parietal bone NC
 - 2) Temporal bone NC
 - 3) Lacrimal bone VC
 - 4) Nasal bone VC
 - 5) Inferior cornua VC
 - 6) Maxilla VC
 - 7) Palatine bone VC
 - 8) Zygomatic bone VC (cheek bone)
 - 9) Malleus
 - 10) Incus
 - 11) Stapes
- MIS = Acoustic bones of the ear.

Unpaired (6)

- 1) Frontal bone NC
- 2) Occipital bone NC
- 3) Ethmoid bone NC
- 4) Sphenoid bone NC
- 5) Vomer VC
- 6) Mandible VC



This skull is wearing shower cap ☺

SUTURES

The paired bones are connected together by sutures.

In babies, the ~~paired~~ ^{paired} bone is joined by dense connective tissues. These are immovable joints (SYNDESMOSIS)

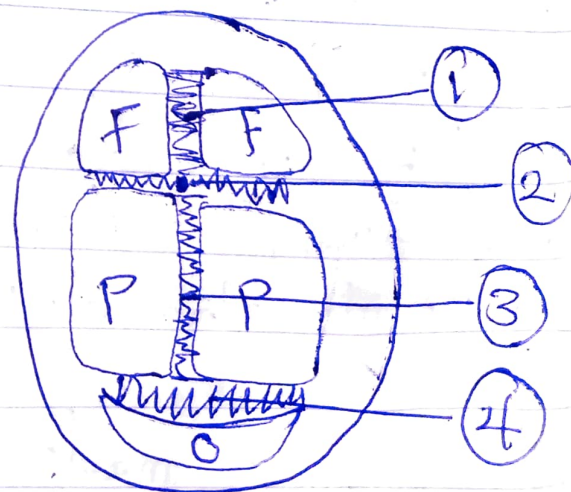
In adults, the paired bones are linked by connective tissues which later become a bone called **SYNTOSIS**

In babies, the skull is larger compared to the facial bones.

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- Importance of Sutures
- 1) In childbirth, the sutures overlap to allow the Passenger (baby's head) to pass through the birth canal.
 - 2) Sutures help the skull expand to accommodate the growing brain.

5 basic types of Sutures



- ① Frontal suture runs between the two frontal bones antero-posteriorly in the median plane.

② Coronal suture runs from side to side with frontal bone anteriorly and parietal bone posteriorly.

③ Sagittal suture runs between the two parietal bones in the median plane.

④ Lambdoid suture runs from side to side with the parietal in front and occipital at the back.

⑤ Squamous suture is between the temporal bone and the parietal bone. It is on either side.

These sutures are found usually in foetal and early childhood. It fuses with time.

CLINICAL CORRELATIONS

① Microcephaly: This is the premature fusion of the sutures while in the uterus.

② Craniosynostosis: The failure of the sutures to fuse as expected. The commonest example is scaphocephaly in which the head elongates anteriorly and posteriorly due to the premature closure/fusion of the sagittal plane sutures. Others include;

Plagiocephaly - premature closure of the frontal and lambdoid sutures asymmetrically. Here the shape of the head is asymmetrical. It is

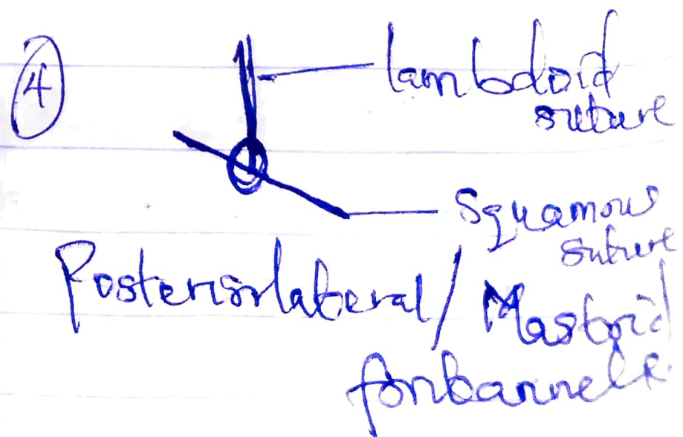
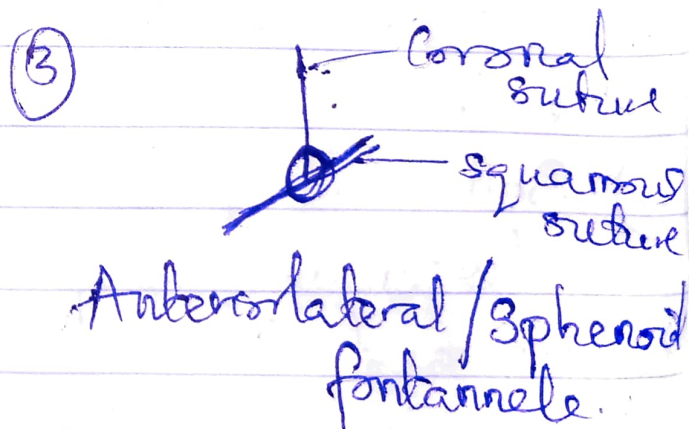
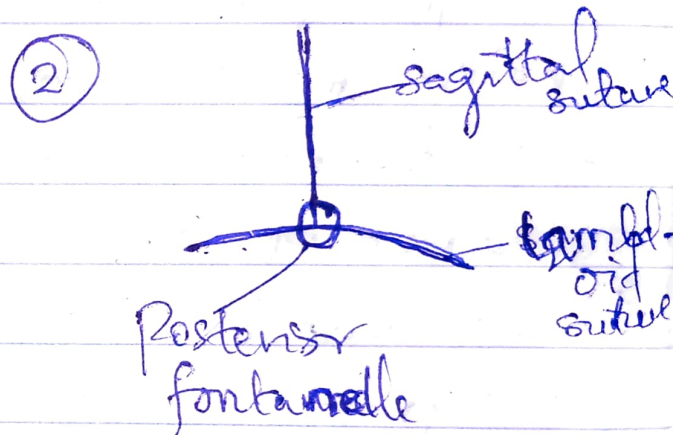
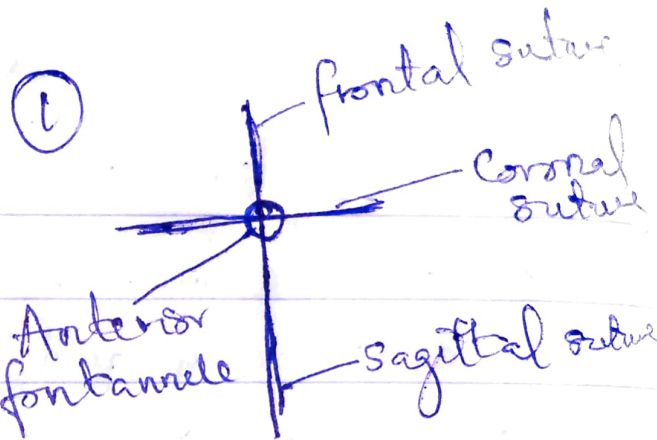
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Congenital and can only be managed by surgery.
In positional or deformational plagiocephaly, the head appears asymmetrical as a result of the position of the foetus' head during the fetal stage. It is not congenital and can be managed by conservative methods such as "molding" of the head done by some nurses.

Oxycephaly: Here, the Coronal and lambdoid sutures close prematurely, making the head look like a tower. ☹️

FONTANNELLES

These are points where sutures unite together or intersect. There are 6 fontanelles, 2 paired and 2 unpaired.



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Functions of fontanelles

- 1) They are used to assess the level of hydration. A sunken or depressed anterior fontanelle is indicative of dehydration.
- 2) Used also to assess intracranial pressure. A raised intracranial pressure is indicative of encephalitis or meningitis. This should be treated as an emergency.
- 3) The pulsations of the anterior fontanelle in babies is due to the underlying arteries; hence blood samples can be gotten from the Superior sagittal sinus.



① Anterior fontanelle is the largest of all the fontanelles, it is diamond shape and is expected to fuse in 18-24 months after birth. Once it fuses, it becomes/~~the~~ called **BREGMA**

② Posterior fontanelle is triangular in shape and fuses 2-3 months after birth. It is called **LAMBDA** when it fuses.



③ Anterolateral / Sphenoid fontanelle fuses 6 months after birth and becomes the **PIERION**

④ Posterolateral / Mastoid fontanelle fuses

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6-18 months after birth
It becomes **ASTERION**

The sphenoid and mastoid fontanelles have irregular shapes.

* While boxing, boxers try to shield/protect the SF because of the thin bone there, and also because the blood vessel underlying the thin bone could get ruptured. 

22/01/2020

VIEWS OF THE SKULL (NORMA)

1) Norma Frontalis (Anterior view of the skull)

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- frontal bone
- Nasal bone
- lacrimal bone
- maxilla
- zygomatic bone
- mandible.

2) Norma Occipitalis (Posterior view of the skull)

- Occipital bone
- Parietal bone.

3) Norma Verticalis (Superior view of the skull)

- Parietal
- Temporal

4) Norma Lateralis (Side view of the skull).

- Temporal
- frontal
- zygomatic
- Parietal
- maxilla

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- greater wing of sphenoid bone.
- nasal bone
- mandible.

5) Norma Basalis (Inferior view of the skull)

- Palate
- maxilla
- Sphenoid bone (its legs called pterygoid process)
- under surface of occipital bone

6) Cranial Cavity (Interior view of the skull).

- Sphenoid bone.
- with its different landmarks;

* hypophysial fossa where the pituitary gland sits. This sphenoid bone is butterfly shaped, has

(11)

a body, greater and lesser wing, pterygoid process. If pterygoid process has two parts; medial pterygoid plate and lateral pterygoid plate.

- Squamous part of the temporal bone.
- Petrous part of the temporal bone where the middle and inner parts of the ear is housed.

- tympanic part of the temporal bone that forms the external acoustic meatus of the ear.

- mastoid part of the temporal bone.

Cranial cavity/Interior part of the skull is divided into three fossae

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or Compartment divided by the lesser wing of the sphenoid bone, petrous part of the temporal bone and body of the sphenoid bone.

They are;

- 1) Anterior Cranial fossa
- 2) Middle Cranial fossa
- 3) Posterior Cranial fossa

1) ACF -

- ethmoidal bone (its cribriform plate)
- Crista galli
- foramen caecum which lies anterior to the crista galli

* An emissary vein passing from the nose to the superior sagittal sinus. This means that an infection of the nose can affect the brain.

- olfactory foramina which transmits the 1st cranial nerve

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(Olfactory nerve)

+ lateral to these olfactory foramina are the anterior and posterior ethmoidal foramen.

2) MCF

- optic canal which transmits cranial nerve II (optic nerve) and the ophthalmic artery.

- Superior orbital fissure transmits the Cranial nerve III, IV and the ophthalmic division of the V Cranial nerve (oculomotor, trochlear and trigeminal respectively).

- Foramen rotundum which transmits the maxillary division of the trigeminal nerve (CN V2)

(14)

- Foramen ovale which transmits the mandibular division of the trigeminal nerve (CN V₃) and accessory meningeal artery.

- Foramen spinosum which transmits the middle meningeal artery lying directly opposite to the pterion. *Remember boxes



- Foramen ^{Lacerum} ~~Lacerum~~ transmits internal carotid artery.

3) PCF

- Foramen magnum is the most conspicuous of all the foramina.

- Internal acoustic meatus transmits the facial nerve (CN VII) and the

(15)

vestibulocochlear nerve (CN VIII) and the labyrinthine artery (which supplies the inner ear).

- Jugular foramen transmits CN IX, X and XI (glossopharyngeal, Vagus and Accessory).

- Hypoglossal canal which transmits CN XII (hypoglossal nerve)

* The 6th CN (Abducens) has no relation to the foramina.

- Foramen magnum transmits the lower end of the medulla oblongata and its meninges, anterior and posterior ~~trans~~ spinal artery, and a branch from the 11th cranial nerve (Accessory nerve), vertebral artery.

Clinical Correlations

1) LeFort fracture (1, 2 and 3)

* All the joints of the skull are ~~immovable~~ immovable except the temporomandibular joint. Hence the mandible is the only bone that forms a movable joint with the skull. It has 16 mandibular teeth. Gliding + hinge joint

⇒ The skull of a male is more robust and heavier than the female skull

⇒ Rough and exerted chin in males.

⇒ Rough mental protuberance in males.

28/01/2020

SCALP

The soft tissue that envelops the cranial vault

The boundaries are;
Anterior: Supraorbital margin

Posterior: ends at the external occipital protuberance and the superior nuchal lines

Lateral: Ends at the zygomatic bones.

It consists of 5 layers;

SKIN

Connective tissue.

Aponeurosis

Loose Areolar tissue.

~~Pariosteum~~ Pericranium.

⇒ SKIN: It consists of hair follicles and

two different glands;

- Eccrine sweat glands
- Sebaceous glands

It has root hair plexus, melanocytes and blood supply.

⇒ **Connective Tissue**: is a dense subcutaneous layer of fat. It also has fibrous tissue, nerves, and the main arteries and veins of the scalp.

⇒ **Aponeurosis**: This is a tough tendinous sheath, part of the occipitofrontalis muscle. It connects the temporalis and the auricularis muscle laterally.

⇒ **Loose Areolar Tissue** is a connective tissue

that allows the more superficial layers to slide as one unit.

This ~~area~~ ^{layer} is prone to infection spread. It is composed of a central dense collagenous layer and it is surrounded by areolar tissue.

⇒ **Pericranium**: This is the periosteum of the skull bones. It provides nutrition to the bones, is strongly attached to the cranial sutures.

It has anterior & posterior boundaries.

Anterior: starts at the frontalis.

Posterior: terminates at the occipitalis. It also has a lateral

border which starts from the origin of the temporalis muscle.

MUSCLES OF THE SCALP

Five (5) main muscles of the scalp;

- 1) Temporalis
- 2) Frontalis
- 3) Occipitalis $\text{O}^2 \text{JAT}$
- 4) Auricularis
- 5) Orbicularis Oculi

ARTERIAL SUPPLY

Five (5) main arteries mostly from the external carotid artery;

- 1) Occipital artery
- 2) Posterior auricular artery
- 3) Superficial temporal artery
- 4) Supraorbital artery $\left\{ \begin{array}{l} \text{opthalmic} \\ \text{from} \\ \text{ICA} \end{array} \right.$
- 5) Supratrochlear artery

The venous drainage accom-

paries these arterial supply.

NERVE SUPPLY Divided into 2.

- 1) Five anterior to the auricle.
- 2) Five posterior to the auricle.

1) $\Rightarrow$ Made up of 4 sensory nerve and 1 motor nerve.

2) $\Rightarrow$ 4 sensory and 1 motor.

The four Sensory nerves anterior to the auricle are;

- 1) Supratrochlear n.
- 2) Supraorbital n.
- 3) Zygomatico-temporal
- 4) Auriculotemporal n.

The nerves (sensory)

Posterior to the auricle are;

- 1) Great auricular n.
- 2) Lesser occipital n.
- 3) Greater occipital n.
- 4) 3rd occipital n.

The motor nerves are;

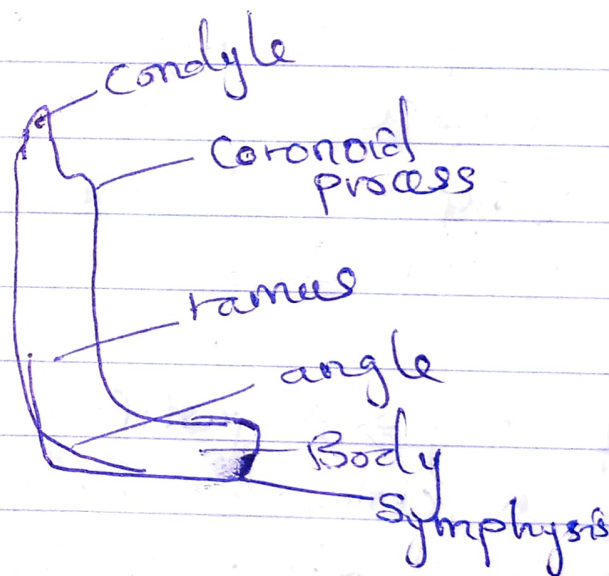
- 1) Posterior auricular
 - 2) Temporal branch
- i.e 8 sensory and 2 motor

CLINICAL CORRELATION

- 1) Lacerations to the scalp can cause severe bleeding.
 - many anastomoses
 - occipital arteries pull blood vessels adhere to dense connective tissue, no vasoconstrict
- 2) The most dangerous layer is the loose areolar tissue.
- 3) Loss of blood supply to the skull scalp does not lead to bone necrosis as most of the blood supply to the skull comes from the middle meningeal artery.

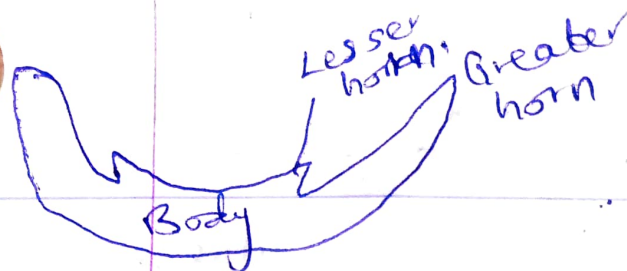
Mandible

The mandible is a double jointed bone and the only bone that forms a movable joint (TMJ).



Hyoid Bone

Located between the skull base and thyroid cartilage. This is the only bone present in the midline on the neck. Lies directly opposite C3. This bone has a body with two horns.



It has no connection with any other bone. Hence, only muscles and some ligaments help to keep it in place. These muscles include;

- 1) Suprahyoid muscles
- 2) Infrahyoid muscles

1) E.g. $\Rightarrow$ Digastric muscle, mylohyoid muscle, stylohyoid muscle, geniohyoid

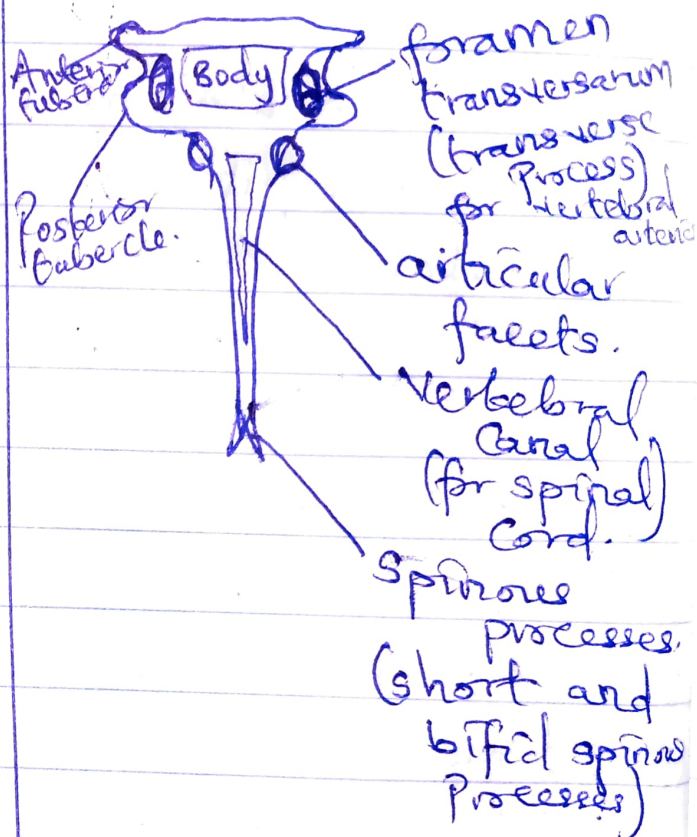
2) E.g. $\Rightarrow$ Omohyoid muscle, sternohyoid muscle, thyrohyoid muscle,

Cervical vertebrae

They are smaller in size, 7 in number.

7 $\leftarrow$ Typical CV (similar shape) C3 - C6
Atypical CV (unique features) (C1, C2, C7)

Typical CV (C3 - C6)

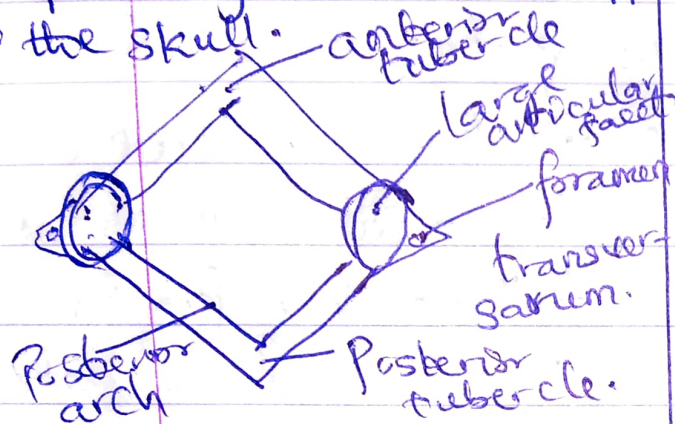


Atypical CV

C1 - Atlas

- Has no body
- No spinous process
- Very large articular facets which has a superior surface and inferior articular surface. The superior articular surface facet articulates with the condyle

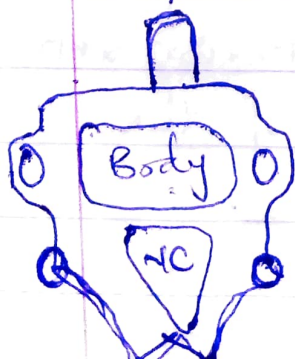
of the occipital bone of the skull forming the atlanto-occipital joint which supports the skull.



The inferior facet articulates with the C2 to form the atlanto-axial joint which permits the neck to move.

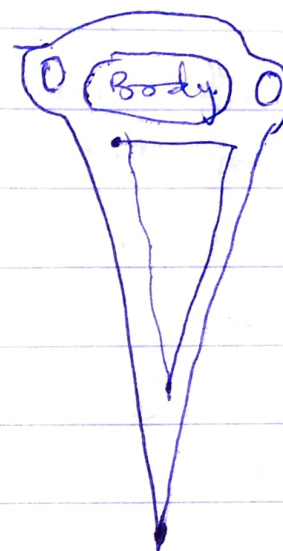
C2 — Axis

- Has a body
- A short bifid process.
- Has dens/odontoid process



C1 — Cervical Prominence

- A very long and non-bifid spinous process.



CLINICAL

- 1) The Nasal bone is the ~~most~~ bone in the skull most susceptible to fracture. The zygomatic bone is next to it.
 - 2) Lefort fracture: fracture in the midface of the skull.
- 21 — Complete detachment

of the maxilla from the floor of the nose

L2 - Here, the detachment involves/includes/continues to other parts such as the zygomatic bone, even to the orbit.

L3 - Detachment of the facial skeleton from the skull base. This is really uncommon and more of abstract (Academic purpose)

3) The body of the mandible is the most likely part to be fractured in the mandible.

4) Heavy loads on the head can fracture the lamina or arches of the C1 (Atlas)



This may usually not present with symptoms other than severe neck pain.

⇒ Stable fracture: If the ligament remains intact.

⇒ Unstable fracture if the ligaments are detached too.

Fracture of the C1 (Atlas) is called Jefferson fracture. It could be stable or unstable.

The unstable fracture would be managed by surgery.

5) Fracture could occur between the superior and inferior articular facets of the C1 vertebrae.

* Occurs most in people who die by hanging.

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Skull + meninges + CSF

*Maryam Sarda. Eggah ☹️

The impact of this fracture is felt most on the C2 vertebrae.

Fracture to the C2 vertebrae is called the Hangman's fracture.

c) Fracture of the odontoid process is called Odontoid fracture.

Type 1 — tip of the op.

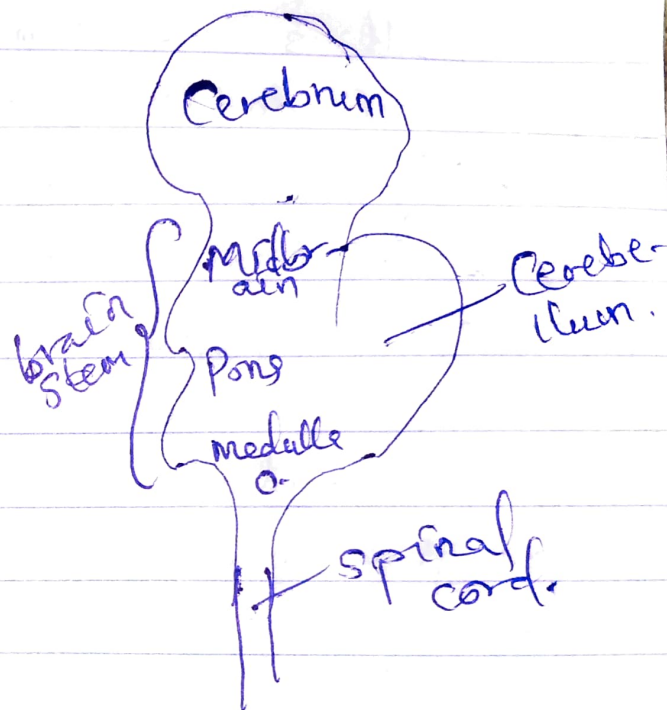
Type 2 — body of the op.

Type 3 — towards the body of the vertebrae.

MENINGES OF BRAIN

This is another structure (connective tissue) that envelopes the brain as well as the spinal cord. They function together

with the skull to protect the brain.



It has 3 layers;

From inside outside is,

- 1) Pia matter
- 2) Arachnoid matter
- 3) Dura matter

PAID

P + A = Leptomeninges^{enrizes}

D = Pachymeninges.

Pia matter: pia = soft matter = mother. This is

Dural Venous Sinus = The venous drainage of the brain.
(25) spidery mother.

thin,

the innermost, very delicate layer that protects the brain. It is very intimate to the brain and spinal cord. This layer is vascularised (i.e. having blood vessels). It follows the contour of the brain and enveloped blood vessels. Pia mater gives small extension at the lateral side of the spinal cord that extends up to the outer layer (Dura mater). This projection are called

DENTICULATE LIGAMENT and it functions to anchor the spinal cord. The lower part or tip of the spinal cord is conical in shape. It is called CONUS MEDULLARIS. The pia mater around the conus medullaris gives a single tapered extension ~~into~~ that extends up to the Coccyx. This extension is called FILUM

TERMINALE and it functions to support the spinal cord.

Arachnoid matter

This is the next layer after the pia mater.

It is translucent (filmy) and delicate. It is avascular (having no blood vessels).

This layer is separated from the pia through the Subarachnoid space. It projects into the Dural venous sinus. These projections are fingerlike and are called (Arachnoid villi). The collection of this arachnoid villi forms an entity called the arachnoid granulation inside the dural venous sinus. This is where the CSF is absorbed.

hard mother Dura mater

This is the outermost,

toughest layer than covers the brain. It is made up of two sublayers:

Outer layer (Periosteal meningeal layer)

Inner layer (Meningeal layer of the dura mater)

⇒ This outer layer lies adjacent to the table of the skull bone hence it is called the periosteal meningeal layer. The epidural space is found

⇒ The inner layer is in direct contact with the arachnoid matter.

These two layers are fused together except at some points where they part, with the inner meningeal layer forming the dural fold as it enters the cranial cavities.

The space left as they part forms the dural

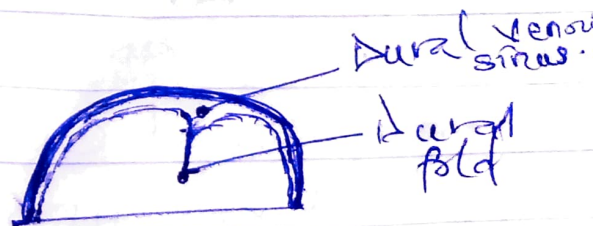
venous sinus. This name is dependent on where the dural fold is found in the skull.

Example:

1) Falx cerebri which lines the longitudinal fissure that divides the brain antero-posteriorly into two hemispheres.

It extends from the Crista galli anteriorly to the other fold in the posterior cranial fossa.

This sickle shaped dural fold is called falx cerebri.



The falx cerebri has two layers/borders. The dural venous sinus located on the outer body of the

Pituitary stalk = Infundibulum.

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Falx cerebri is called the superior sagittal sinus.

Another dural fold that is found at the back of the skull in the posterior cranial fossa that ~~is~~ forms a roof over it is called the tentorium cerebelli.

The space allowed in the tentorium cerebelli for passage of the spinal cord is called tentorial aperture.

Infratentorial cavity, below the tentorium cerebelli.

Supratentorial cavity, above the tentorium cerebelli.

The brainstem lies in the ~~the~~ infratentorial cavity.

Cerebrum is found in the supratentorial cavity.

② Falx cerebelli is the dural fold located between the two cerebellar hemispheres.

③ Diaphragma sellae which forms the roof (sella turcica) of the pituitary gland. This sella turcica is the seat for the pituitary gland.

