

Head topography

OVERVIEW

- ⊙ Head-superior part of the body that is attached to the trunk by the neck
- ⊙ The control and communications center
- ⊙ It houses the brain=>the site of our consciousness: ideas, creativity, imagination, responses, decision making, and memory
- ⊙ The head consists of the *brain* and its protective coverings (cranial vault and meninges), the *ears*, and the *face*.
- ⊙ It includes special sensory receivers (eyes, ears, mouth, and nose), broadcast devices for voice and expression, and portals for the intake of fuel (food), water, and oxygen and the exhaust of carbon dioxide.
- ⊙ The face also provides our identity as individuals-Disease, malformation, or trauma of structures in the head form the bases of many specialties, including dentistry, maxillofacial surgery, neurology, neuroradiology, neurosurgery, ophthalmology, oral surgery, otology, rhinology, and psychiatry.
- ⊙ The **face** is the anterior aspect of the head from the forehead to the chin and from one ear to the other
- ⊙ The basic shape of the face is determined by the underlying bones

!!The bones of the calvaria (skull) of a neonate are separated by fibrous membranes. They include the *anterior* and *posterior fontanelles* and the paired *sphenoidal* and *mastoid fontanelles*. Palpation of the fontanelles during infancy, especially the anterior and posterior ones, enables physicians to determine the:

- Progress of growth of the frontal and parietal bones.
- Degree of hydration of an infant (a depressed fontanelle indicates dehydration).
- Level of intracranial pressure (a bulging fontanelle indicates increased pressure on the brain). (1)

-5th-7th-the face develops **from primordia that surround the oral pit**. The primordia are: **frontal** process, **maxillary** processes, the **mandibular** process; the mandibular process is initially divided (bilaterally located) than merges and forms the mandible, the lower part of the face and the body of the tongue

-4th week-nasal placodes appear bilaterally

- One week later-the mesenchyme proliferates and give birth to two prominences: the nasal pits-with an open end in contact with the oral cavity
- when the medial nasal process fuses with the maxillary process the upper lip is formed
- 6th week-the two nasal processes fuse to form the intermaxillary segment-this segment will give birth to the upper lip, primary palate and the alveolar process carrying the incisor teeth
- The intermaxillary segment together with the growing maxillary processes forms the upper lip

Facial development

-it happens in the period of time from 5th-7th of intrauterine life

-develops from the primordia that surrounds the oral pit represented by the frontal process, the two maxillary processes

the mandibular process (which is initially a partially divided bilateral structure)

-from the mandibular process the mandible, the lower part of the face and the body of the tongue are formed

-from the end of the 4th week the nasal placodes develop bilaterally; from this point in time the mesenchyme proliferates and produce medial and lateral nasal prominences that enlarge transforming the placodes into pits/nostrils

-in the 7th week the medial and lateral nasal prominences communicates with the oral cavity

Development of facial features=the sum of the differential growth of the medial and lateral processes in relation with the maxillary processes

-In the 7th week the fetus has human features-the medial part of the face increases in an anterior direction, the vertical height increases, the bridge of the nose develops and the eyes are not in the same plane anymore

-in the newborns **the nose is not yet shaped; the final /inherited shape and sized is reached at puberty**

-the distance which separates the eyes influence the aspect of the face

-narrow interocular distance=hypotelorism=fox-like appearance/sharp face

-an increased interocular distance=hypertelorism/broad face

-however, the final /adult dimension of the orbital cavities is reached at 7 years of age

The palate development

-palate=the area between the oral and nasal cavities

-is formed by one medial and two lateral palatine processes

The medial palatine/primary palate is an intermaxillary segment, supports the four maxillary incisor teeth and appears at the beginning of the sixth week

At the end of the sixth week the lateral palatine process forms the secondary palate

Tongue development

-believed to take part in palatal closure it has a body/anterior movable part and a base/posterior/pharyngeal part

-develops from the 1st, 2nd and 3rd branchial arches and also from the muscles of the occipital myotomes

-the body develops from 3 central features of the-tuberculum impar and the two lateral lingual swellings

-the base-develops mainly from the 3rd branchial arches and is first indicated by the hypobranchial eminence (2)

-The site of union between the base and the body of the tongue=sulcus terminalis

Topography

The frontal region

The frontal region of the head is an area superior to the eyes and below the hair line.

-Eyebrows are the raised arches of skin with short, thick hairs above the supraorbital margins.

Just deep to eyebrow is the curved bony ridge or superciliary arch. It is more prominent in adult males.

The smooth nonhairy elevated area between the eyebrows is called **glabella**, which tends to be flat in children and adult females, and forms a rounded prominence in adult males.

The parietal region

It is an area limited anteriorly by hair line and posteriorly by a coronal plane behind the parietal eminences and on either side by the temporal line. The parietal eminence can be felt on either side in this region about 2 inches above the auricle.

The parietal prominences are evident on or just in front of the interauricular line.

The occipital region

The occipital region is an area of cranium **behind** the parietal eminences, and **above the external** occipital protuberance and superior nuchal lines.

The external occipital protuberance can be felt in the median line just above the nuchal furrow.

The superior nuchal line, one on either side of external occipital protuberance, runs laterally with its convexity facing upwards.

The soft tissue covering frontal, parietal, and occipital regions forms the scalp.(3)

The temporal region

The temporal region is the area on the side of skull between the temporal line and zygomatic bone and arch. It is the site of attachment of temporalis muscle, which can be palpated when the teeth are clenched repeatedly . The superficial muscular layer of this region include: superior auricular muscle, temporo-parietal muscle, anterior auricular muscle. Soft tissue in the temporal region includes skin,subcutaneous tissue with the superficial muscular layer, temporal fascia, and temporalis muscle. In the anterior part of temporal region, deep to soft tissues is a small area where four bones meet the **pterion**. This region is clinically important because it is the site of entrance to cranial cavity in craniotomy to remove the extradural hematoma.(1,4)

The infratemporal region

- ⊙ The infraorbital region of head is located below the orbital region and corresponds to the upper part of the anterior surface of the maxilla.
- ⊙ The **infraorbital foramen** is located in this region about 1 cm below the infraorbital margin in line with the supraorbital notch or foramen. The knowledge of its location is important for giving **infraorbital nerve block**.(3)

The zygomatic region

- ⊙ The zygomatic region overlies the zygomatic (cheek) bone and zygomatic arch. The zygomatic arch extends from just inferior to lateral margin of the eye towards the upper portion of the auricle.
- ⊙ Inferior to the zygomatic arch and just anterior to the tragus of the ear is the **temporomandibular joint**.
- ⊙ The zygomatic arch is bony bridge that spans the interval between the ear and the eye. The zygomatic bone forms the bony prominence of the cheek below and lateral to the orbit.
- ⊙ The movements of the temporomandibular joint can be felt by opening and closing the mouth or moving the lower jaw from side to side. One way to feel the movements of head of mandible is to gently place a finger into the outer portion of the external auditory meatus.(3)

The parotid region

- ⊙ it is region around the ear (para =around; otic = ear).
- ⊙ It is limited in front by anterior border of masseter, posterior by mastoid process and inferior by a line extending from angle of mandible to the tip of mastoid process.

- ⊙ This region is occupied by parotid gland.
- ⊙ The *mastoid process* lies behind the lower part of the ear. Its anterior border, tip and posterior border can be easily felt.
- ⊙ The *masseter* overlies the ramus of the mandible. It can be felt when the teeth are clenched.(vs)
- ⊙ The parotid gland is often enlarged following infection by mumps virus. This produces a painful swelling in the parotid region elevating the ear lobule. The parotid gland is also more frequently the site of slow growing painless benign tumors like *mixed parotid tumor* or *Warthin tumor*.(3)
- ⊙ The **parotid region** is the posterolateral part of the facial

region, bounded by the:

- Zygomatic arch superiorly.
- External ear and anterior border of the sternocleidomastoid posteriorly.
- Ramus of the mandible medially.
- Anterior border of the masseter muscle anteriorly.
- Angle and inferior border of the mandible inferiorly.(1)

The parotid region includes the parotid gland and duct, the parotid plexus of the facial nerve (CN VII), the retromandibular vein, the external carotid artery, and the masseter muscle

The maseter region

Limits: superior-zygomatic arch

Inferior-inferior border of the masseter muscle

Anterior-anterior border of the maseter muscle

Posterior-posterior border of the mandible ramus

Structure: skin, cellular tissue, masseter aponeurosis, masseter muscles

Mastoid region

Limits:

-superior-supramastoidian crest

-Inferior-mastoid process

-anterior-vertical line tangent to the posterior border of the external acoustic meatus

Posterior-occipital border of the mastoid part of the temporal bone

Layers: skin, subcutaneous tissue (muscles, vessels and nerves), musculo-aponeurotic layer, osteo-periosteal layer (4)

The ocular region

- ⊙ The ocular region includes the eyeball and associated structures.
- ⊙ Most of the surface features of the ocular region protect the eye. Eyebrow is a ridge of hair along the superciliary arch above the orbit, which protects the eyes against sunlight and mechanical blow. The two movable eyelids reflexly close to protect eyes from foreign particles and bright sunlight. The eyelashes are a row of hair at the margins of eyelids. The eyelashes prevent airborne objects from contacting the eyeball.
- ⊙ Behind the lateral part of the upper eyelid and within the orbit is the **lacrimal gland**, which produces lacrimal fluid or tears. The tears wash away chemical and foreign particles and lubricate the front of the eye to prevent the surface of the eyeball, particularly the all-important cornea from drying.(3)

The nasal region

- ⊙ The main feature of nasal region is the external nose. The root of the nose is located between the eyes inferior to glabella. The firm narrow bony portion below the nasion is the bridge of the nose. The nose below this level has pliable cartilaginous framework that maintains the openings of the nose. The tip of the nose is called *apex*. It is flexible when palpated because it is made up of cartilage. Inferolateral to the apex on either side is a nostril (or nare). The nostrils are separated from each other by a

- midline nasal septum. The nares are bounded laterally by wing-like alae of the nose. The alae of nose forms the flared outer margin of each nostril.
- ◎ The distinctive external nose with exuberant growth of cartilages forming prominent dorsum, tip, and alae is a characteristic feature of human beings.
 - ◎ A well-marked depression at the root of the nose is called **nasion**.(3)

The buccal region

- ◎ The buccal region of face is a broad area of the face between the nose, mouth, and parotid region. It overlies the **buccinator muscle**. It is made of soft tissues of the cheek.
- ◎ The **pulsations of facial artery** can be felt about 1.25 cm lateral to the angle of the mouth.(3)

The mental region

- ◎ The mental region is an area of face below the lower lip and is characterized by the presence of mental protuberance or mentum, a privileged feature of human beings.(3)

The skull features

- ◎ The **anterior fontanelle**, the largest one, is diamond or star shaped; it is bounded by the halves of the frontal bone anteriorly and the parietal bones posteriorly. By 18 months of age, the surrounding bones have fused, and the anterior fontanelle is no longer clinically palpable.
- ◎ The **posterior fontanelle** is triangular and bounded by the parietal bones anteriorly, and the occipital bone posteriorly. It is located at the junction of the lambdoid and sagittal sutures, the future site of *lambda*.
- ◎ The posterior fontanelle begins to close during the first few months after birth, and by the end of the 1st year, it is small and no longer clinically palpable.
- ◎ The **sphenoidal** and **mastoid fontanelles**, overlain by the temporalis muscle, fuse during infancy and are less important clinically than the midline fontanelles.
- ◎ The halves of the mandible fuse early in the 2nd year.
- ◎ The two maxillae and nasal bones usually do not fuse.
- ◎ The softness of the cranial bones in fetuses and their loose connections at the sutures and fontanelles enable the shape of the cranium to be molded during birth. During passage of the fetus through the birth canal, the halves of the frontal bone become flat, the occipital bone is drawn out, and one parietal bone slightly overrides the other. Within a few days after birth, the shape of the neonatal cranium returns to normal. The resilience of the cranial bones of infants allows them to resist forces that would produce fractures in adults.
- ◎ The fibrous sutures of the calvaria also permit the cranium to enlarge during infancy and childhood. The increase in the size of the calvaria is greatest during the first 2 years, the period of most rapid brain development. The calvaria normally increases in capacity for 15–16 years. After this, the calvaria usually increases slightly in size for 3–4 years as a result of bone thickening. (**moore**)
- ◎ The individuality of the face results primarily from anatomical variations in the shape and relative prominence of the features of the underlying cranium; in the deposition of fatty tissue; in the color and effects of aging

on the overlying skin; and in the abundance, nature, and placement of hair on the face and scalp.

- ◎ The relatively large size of the **buccal fat-pads** in infants prevents collapse of the cheeks during sucking and produces their chubby-cheeked appearance.
- ◎ Growth of the facial bones takes longer than those of the calvaria. The ethmoid bone, orbital cavities, and superior parts of the nasal cavities have nearly completed their growth by the 7th year. Expansion of the orbits and growth of the nasal septum carry the maxillae infero-anteriorly. Considerable facial growth occurs during childhood as the paranasal sinuses develop and permanent teeth erupt.
- ◎ the adult form of the face=influenced by the development of paranasal sinuses, nasal conchae and teeth
- ◎ The mandible is the most dynamic of our bones; its size and shape and the number of teeth it normally bears, undergo considerable change with age. In the neonate, the mandible consists of two halves united in the median plane by a cartilaginous joint, the *mandibular symphysis*.
- ◎ Union between the halves of the mandible is effected by means of fibrocartilage; this union begins during the 1st year and the halves are fused by the end of the 2nd year.(3)

The scalp

- ◎ The **scalp** consists of skin (normally hair bearing) and subcutaneous tissue that cover the neurocranium from the superior nuchal lines on the occipital bone to the supra-orbital margins of the frontal bone. Laterally, the scalp extends over the temporal fascia to the zygomatic arches.
- ◎ *The scalp is composed of five layers*, the first three of which are connected intimately and move as a unit (e.g., when wrinkling the forehead and moving the scalp).
- ◎ Each letter in the word *scalp* serves as a memory key for one of its five layers:
 - ◎ -**S**kin
 - ◎ -**C**onnective tissue
 - ◎ -**A**poneurosis
 - ◎ -**L**oose areolar tissue
 - ◎ -**P**ericranium (3)

The scalp layers:

- ◎ **Skin**: thin, except in the occipital region, contains many sweat and sebaceous glands and hair follicles. It has an abundant arterial supply and good venous and lymphatic drainage
- ◎ **Connective tissue**: forms the thick, dense, richly vascularized subcutaneous layer that is well supplied with cutaneous nerves.
- ◎ **Aponeurosis (epicranial aponeurosis)**: the broad, strong, tendinous sheet that covers the calvaria and serves as the attachment for muscle bellies converging
 - ◎ from the forehead and occiput (**occipitofrontalis muscle**) and from the temporal bones on each side (**temporoparietalis** and **superior auricular muscles**). Collectively, these structures constitute the musculo-aponeurotic **epicranium**. The *frontal belly of the occipitofrontalis* pulls the scalp anteriorly, wrinkles the forehead, and elevates the eyebrows; the *occipital belly of the occipitofrontalis* pulls the scalp posteriorly, smoothing the skin of the forehead. The superior auricular muscle (actually a specialized posterior part of the temporoparietalis) elevates the auricle of the external ear. All parts of the epicranium (muscle and aponeurosis) are innervated by the facial nerve.
- ◎ **Loose areolar tissue**: a sponge-like layer including potential spaces that may distend with fluid as a result of injury or infection. This layer allows free movement of the **scalp proper** (the first three layers—skin, connective tissue, and epicranial aponeurosis) over the underlying calvaria.

- ⊙ Pericranium: a dense layer of connective tissue that forms the external **periosteum** of the neurocranium. It is firmly attached but can be stripped fairly easily from the crania of living persons, except where the pericranium is continuous with the fibrous tissue in the cranial sutures.(3)

Scalp innervation and vascularization:

- ⊙ *The superficial vessels and nerves.* They enter from the limits of the region and they had ascending and converging trajects towards the vertex. They can be grouped into ten pedicles, called the vasculo-nervous pedicles of the scalp, on each side having five, respectively two pedicles in the anterior group, two pedicles in the lateral group and one pedicle in the posterior group

The medial frontal pedicle

- ⊙ Supratrochlear vessels from ophthalmic artery (branch of the internal carotid artery)
- ⊙ The medial frontal branch of the frontal nerve (from ophthalmic nerve - branch of trigeminal)

The lateral frontal pedicle

- ⊙ Supraorbital vessels (from ophthalmic artery)
- ⊙ Lateral frontal branch from frontal nerve

Preauricular pedicle

- ⊙ The superficial temporal vessels (terminal branch of the external carotid artery)
- ⊙ The auriculo-temporal nerve (branch of the mandibular nerve from the trigeminal)

Retroauricular pedicle

- ⊙ Posterior auricular vessels (from external carotid artery)
- ⊙ Auricular and mastoid branches of the cervical superficial plexus

Occipital pedicle

- ⊙ Occipital vessels (from external carotid artery)
- ⊙ The first three posterior branches of the cervical spinal nerves, which sometimes are anastomosed, forming "the posterior cervical plexus of Cruveilhier". The second posterior branch (C2) is the most voluminous, being known as "the great occipital nerve of Arnold", which can be discovered two centimeters laterally and inferiorly to the external occipital protuberance (inion).

Due to the ascending direction of the vasculo-nervous pedicles of the scalp, incisions at level of the vault of the scalp mandatory have a vertical traject with aim not to injury (section) the pedicles. Whenever a larger operatory area is necessary, one can raise an entire skin area by creating by two vertical incisions which at their superior extremities are united by an arched incision, convex towards the vertex.

- ⊙ Among the vessels that constitute the vasculo-nervous pedicle of the scalp there are a lot of anastomoses, fact that in case of hemorrhage from a seized vessel this hemorrhage can not be stopped by simple compression of the respective vessel; it is necessary to apply a circular garrot around the vault.
- ⊙ **The lymphatic vessels.** The lymphatic drainage of the fronto-parieto-occipital region is common with that of the temporal region.
- ⊙ Three lymphatic areas have been described (lymphatic groups) that drain into four groups of lymphatic nodes. (4)

References

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