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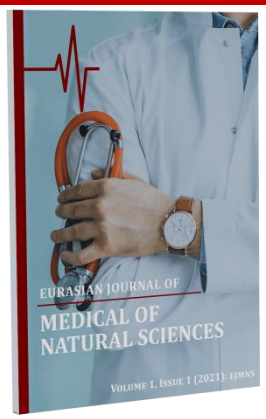

ANATOMY OF THE HUMAN SKULL

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ABSTRACT

This comprehensive article provides an in-depth exploration of skull anatomy, covering various aspects, including the structure and functions of cranial and facial bones, sutures, foramina, and internal structures. It delves into developmental anatomy, clinical significance, and common pathologies related to the skull. The article aims to offer a holistic understanding of the human skull, from its intricate components to its functional significance.

The human skull, a marvel of anatomical complexity, serves a dual role as the protective fortress for the brain and as a foundation for essential sensory and respiratory functions. This comprehensive exploration delves into the intricate details of skull anatomy, examining its bones, sutures, foramina, and the vital structures housed within.

Introduction to Skull Anatomy. The skull is divided into two main parts: the cranium, which encases the brain, and the mandible, or lower jawbone. Together, they form a bony structure that undergoes complex morphological changes from infancy to adulthood.

Bones of the Skull

Cranial Bones: The cranium consists of several bones, including the frontal, parietal, temporal, occipital, sphenoid, and ethmoid bones, each with distinct functions and characteristics.

Facial Bones: The facial skeleton comprises bones such as the maxilla, mandible, zygomatic bones, and nasal bones, contributing to the structure of the face and supporting sensory organs.

Cranial Bones: Structure and Function

Frontal Bone

Structure: The frontal bone forms the forehead and the upper part of the eye sockets.

Function: It provides structural support to the face and protects the frontal lobe of the brain.

Parietal Bones

Structure: Paired bones forming the top and sides of the skull.

Function: Protection of the parietal lobes of the brain.

Temporal Bones

Structure: Paired bones on each side of the skull.

Function: Housing the ear structures, including the auditory ossicles and the temporal lobe of the brain.

Occipital Bone

Structure: The posterior bone forming the base of the skull.

Function: Protecting the cerebellum and the brainstem.

Sphenoid Bone

Structure: Butterfly-shaped bone at the base of the skull.

Function: Central role in forming the eye sockets and the base of the skull.

Ethmoid Bone

Structure: Located between the eyes, forming part of the eye sockets and nasal cavity.

Function: Contributing to the structure of the eye sockets and separating the nasal cavity from the brain.

Facial Bones: Form and Function

Maxilla

Structure: Upper jawbone, forming the upper jaw and part of the eye sockets.

Function: Providing structural support to the face and housing the upper teeth.

Mandible

Structure: Lower jawbone, the only movable bone of the skull.

Function: Facilitating speech, mastication, and providing support for the lower teeth.

Zygomatic Bones

Structure: Cheekbones.

Function: Contributing to the structure of the face and protecting the eyes.

Nasal Bones

Structure: Small bones forming the bridge of the nose.

Function: Supporting the nasal cavity and contributing to facial aesthetics.

Sutures: Connecting the Skull Bones

Overview

Sutures are fibrous joints that connect the various bones of the skull, allowing for growth during development and providing stability.

Types of Sutures

Coronal Suture: Between the frontal and parietal bones.

Sagittal Suture: Between the two parietal bones.

Lambdoid Suture: Between the parietal and occipital bones.

Squamous Suture: Between the parietal and temporal bones.

Foramina of the Skull: Gateways to Vital Structures

Foramina are openings in the skull that serve as passageways for blood vessels, nerves, and other structures.

Important Foramina

Foramen Magnum: Allows the spinal cord to pass through the skull.

Optic Foramen: Transmits the optic nerve and ophthalmic artery.

Foramen Ovale: Passageway for nerves in the jaw.

Foramen Rotundum: Transmitting nerves responsible for facial sensation.

Internal Structures of the Skull

Brain Housing

Cranial Vault: Protects the brain from external forces.

Cranial Base: Supports the brain and forms the floor of the skull.

Sinuses

Paranasal Sinuses: Air-filled spaces in the skull that contribute to the resonance of the voice and reduce the skull's weight.

Nasal Cavity

Functions: Filtering, humidifying, and warming inhaled air.

Structures: Conchae, meatuses, and nasal septum.

Developmental Anatomy of the Skull

Fontanelles

Function: Soft spots in the infant skull allowing for compression during birth.

Closure: Gradual closure as bones fuse during infancy and childhood.

Changes from Infancy to Adulthood

Cranial Shape: Transformation from a relatively large and rounded infant skull to the adult form.

Suture Closure: Closure of fontanelles and gradual fusion of sutures.

Symptoms: Pain, clicking sounds, limited jaw movement.

The cranium (skull) is the skeletal structure of the head that supports the face and protects the brain. It is subdivided into the facial bones and the brain case, or cranial vault (Figure 1). The facial bones underlie the facial structures, form the nasal cavity, enclose the eyeballs, and support the teeth of the upper and lower jaws. The rounded brain case surrounds and protects the brain and houses the middle and inner ear structures.

In the adult, the skull consists of 22 individual bones, 21 of which are immobile and united into a single unit. The 22nd bone is the mandible (lower jaw), which is the only moveable bone of the skull.

Anterior View of Skull. The anterior skull consists of the facial bones and provides the bony support for the eyes and structures of the face. This view of the skull is dominated by the openings of the orbits and the nasal cavity. Also seen are the upper and lower jaws, with their respective teeth.

The orbit is the bony socket that houses the eyeball and muscles that move the eyeball or open the upper eyelid. The upper margin of the anterior orbit is the supraorbital margin. Located near the midpoint of the supraorbital margin is a small opening called the supraorbital foramen. This provides for passage of a sensory nerve to the skin of the forehead. Below the orbit is the infraorbital foramen, which is the point of emergence for a sensory nerve that supplies the anterior face below the orbit.

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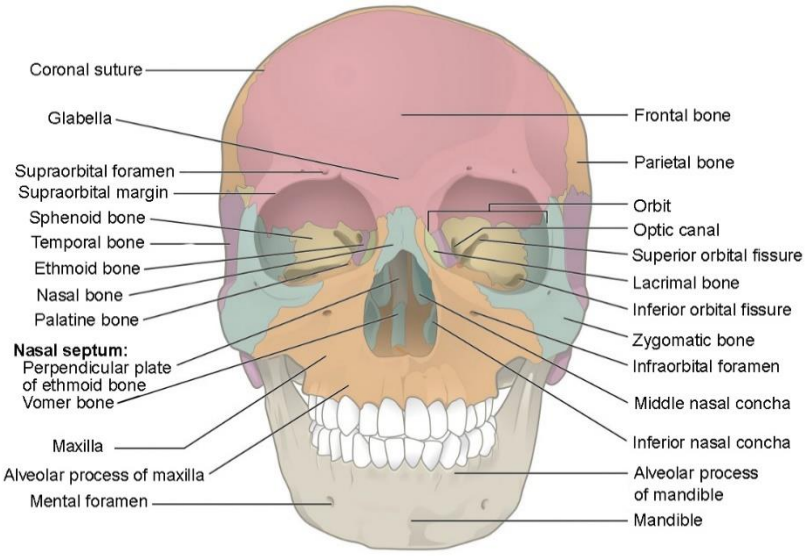

Anterior View

The nasal septum splits the nasal cavity in half inside the nasal region of the skull. The perpendicular plate of the ethmoid bone forms the upper part of the nasal septum, while the vomer bone methods the lower part. The nasal cavity is shaped like a triangle, with a wide inferior space that narrows superiorly on each side. Two bony plates can be seen protruding from each lateral wall of the nasal cavity when viewed from the front of the skull. The bigger of these is the apart skull bone known as the inferior nasal concha. Part of the ethmoid bone, the middle nasal concha hangs just above the inferior concha. A third bony plate, also part of the ethmoid bone, is the superior nasal concha. It is much smaller and out of sight, above the middle concha. The superior nasal concha is located just lateral to the perpendicular plate, in the upper nasal cavity.

Side View of the Head. The large, rounded brain case above and the upper and lower jaws with their teeth below dominate a view of the lateral skull (Figure 3). The zygomatic arch, a bone bridge, separates these regions. The bony arch on the side of the skull that extends from the cheek geography to just above the ear canal is known as the zygomatic arch. The temporal process of the zygomatic bone, or cheekbone, is the short anterior component that joins the longer posterior zygomatic process of the temporal bone, which additionally forward from the temporal bone, to form this structure. The zygomatic arch therefore originates by the anterior temporal process and the posterior zygomatic process joining together like the two ends of a drawbridge. The zygomatic arch gives rise to one of the main muscles that pulls the mandible upward during biting and chewing.

The temporal fossa is a shallow area located above the level of the zygomatic arch on the lateral side of the brain case. The infratemporal fossa is another area that lies deep under the mandible, below the level of the zygomatic arch. The muscles in the temporal and infratemporal fossas work on the mandible when chewing.

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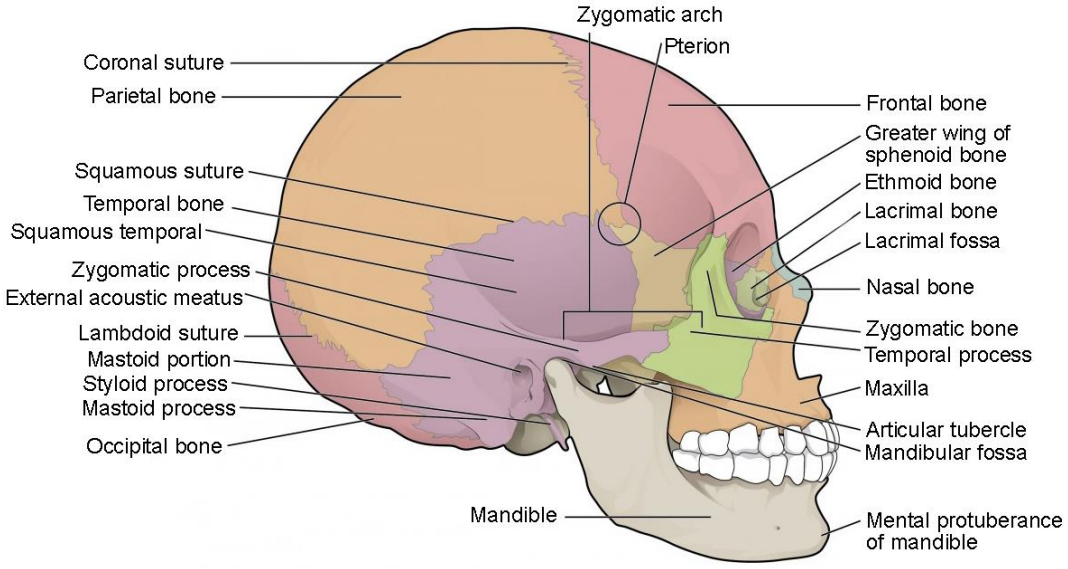
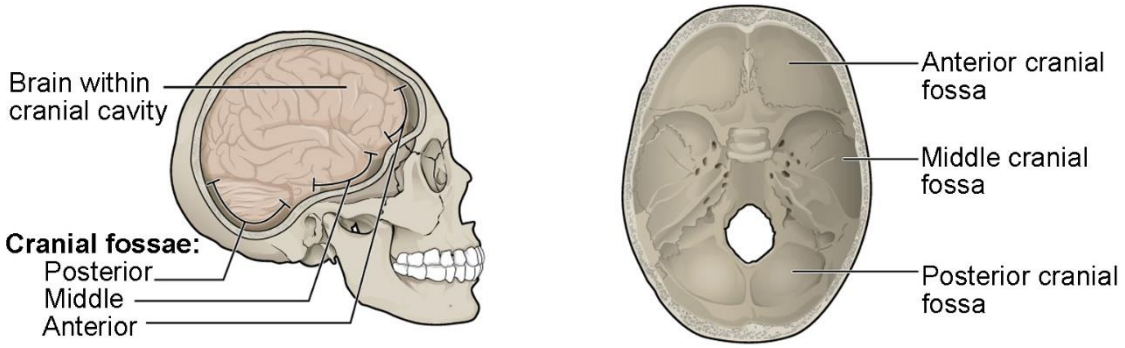


Right Lateral View

The brain case's bones. The brain is housed and shielded by the brain case. The term "cranial cavity" refers to the interior area that the brain takes up nearly entirely. The calvaria, or skullcap, which is the rounded top of the skull, as well as the lateral and posterior sides of the skull, form the superior boundaries of this cavity. The term "flat" bones of the skull usually refers to the bones resulting in up the top and sides about the brain case.

The base of the skull refers to the floor of the brain case. This is a multifaceted region with multiple openings for the spinal cord, blood vessels, and cranial nerves. The area additionally varies in depth. The base of the skull is divided into three large spaces that are referred to as the anterior, middle, and posterior cranial fossas (the word "fossa" means "trench or ditch"). The depth of the fossae increases from anterior to posterior. Every fossa has a specific shape and depth that correspond to the size and shape of the brain region it houses. A later section will describe the cranial fossae (singular: fossa) and the spaces between them.



Lateral View Superior View

Frontal Bone. The only bone that makes up the forehead is the frontal bone. The glabella is a small depression located between the eyebrows at its anterior midline (see Figure 3). The orbit's supraorbital border is additionally formed by the frontal bone. A sensory nerve can pass into the supraorbital foramen, which is located close to the middle of this margin, to reach the forehead. The rounded brow ridges are formed by the thickening of the frontal bone slightly above each supraorbital margin. These are situated directly behind your eyebrows and come

in a variety of sizes, with men typically having larger ones. The frontal bone extends posteriorly within the skull.

Sutures of the Skull. An immobile joint connecting two adjacent skull bones is called a suture. Dense, fibrous connective tissue fills the small the space between the bones, binding them together. The lengthy sutures that run between the brain case's bones follow erratic, tightly twisted paths rather than being straight. By tightly interlocking the nearby bones, these twisted lines strengthen the skull and protect the brain.

The coronal and sagittal sutures are the two suture lines visible on the top of the skull. Within the coronal plane of section, the coronal suture extends from side to side across the skull. It connects the left and right parietal bones to the frontal bone. In the sagittal plane of section, the sagittal suture runs along the middle line at the top of the skull, extending posteriorly from the coronal suture. It joins the parietal bones on the left and right. The sagittal suture ends on the posterior skull where it joins the lambdoid suture. The lambdoid suture spreads apart from its intersection with the sagittal suture, extending outward and downward. The occipital bone is joined to the left and right parietal and temporal bones by the lambdoid suture. his suture is named for its upside-down “V” shape, which resembles the capital letter version of the Greek letter lambda (Λ). On the lateral skull is where the squamous suture is situated. It connects the parietal bone and the squamous section of the temporal bone. The pterion, a small, capital-H-shaped suture line region that connects the frontal bone, parietal bone, squamous portion of the temporal bone, and greater wing of the sphenoid bone, is located at the intersection of four bones. It is the skull's weakest area. The pterion is situated a thumb's width behind the upward part of the zygomatic bone and roughly two finger widths above the zygomatic arch.

DISORDERS OF THE SKELETAL SYSTEM

Traumatic brain injuries and head injuries are the leading causes of immediate death and disability; other potential complications include bleeding and infections. Injuries to the head account for about 30% of injury-related fatalities in the US, according to the Centers for Disease Control and Prevention (2010). Most head injuries are triggered by falls. They are most prevalent in young children (0–4 years old), teenagers (15–19 years old), and senior citizens (over 65 years old). There are other causes as well, but car and motorcycle accidents are common ones.

Breaks can result from forceful strikes to the area of the skull that houses the brain-case. These could cause internal bleeding in the skull, which would injure the brain. A linear skull fracture, in which the fracture lines extend from the site of impact, is the most frequent type. Other forms of fractures include a depressed fracture, in which the fractured bone is forced inward, and a comminuted fracture, in which the bone breaks into multiple pieces at the site of impact. In a contrecoup (counterblow) fracture, the opposite side of the skull sustains a fracture rather than the bone at the impact site bursting. This is one way that fractures of the occipital bone at the base of the skull can happen, leading to a basilar fracture that can damage the artery that passes through the carotid canal.

The pterion's bones can break in a blow to the side of the head. The pterion is a significant clinical landmark because a major branch of an artery supplying the skull and the layers of the brain covering it is situated deep within the skull right next to it. The bones surrounding the

pterion may break in a severe blow to this area. Hemostasis (blood clot) between the brain and the inside of the skull can result from bleeding if the underlying artery is getting hurt. The brain will be squeezed as blood clots. Even though hematoma symptoms might not show up right away after the injury, if blood buildup is left untreated, the pressure on the brain will increase.

Facial Bones of the Skull. The nose, nasal cavity, nasal septum, orbit, and upper and lower jaws are all formed by the facial bones of the skull. There are two unpaired and six paired bones in the 14 bones that make up the face. The maxilla, palatine, zygomatic, nasal, lacrimal, and inferior nasal conchae bones are the paired bones. The mandible and vomer bones are the unpaired ones. The ethmoid bone is categorized with the brain-case bones, but it also contributes to the nasal septum, orbital walls, and nasal cavity walls.

Zygomatic Bone. The cheekbone is another name for the zygomatic bone. Much of the lateral wall of the orbit and the lateral-inferior margins of the anterior orbital opening are composed of the paired zygomatic bones. The anterior part of the zygomatic arch takes shape by the short temporal process of the zygomatic bone, which projects posteriorly.

Nasal Bone. The nasal bone is one of two small bones that articulate (join) with each other to form the bony base (bridge) of the nose. They also support the cartilages that form the lateral walls of the nose. These are the bones that are damaged when the nose is broken.

Lacrimal Bone. Each lacrimal bone is a small, rectangular bone that forms the anterior, medial wall of the orbit. The anterior portion of the lacrimal bone forms a shallow depression called the lacrimal fossa, and extending inferiorly from this is the nasolacrimal canal. The lacrimal fluid (tears of the eye), which serves to maintain the moist surface of the eye, drains at the medial corner of the eye into the nasolacrimal canal. This duct then extends downward to open into the nasal cavity, behind the inferior nasal concha. In the nasal cavity, the lacrimal fluid normally drains posteriorly, but with an increased flow of tears due to crying or eye irritation, some fluid will also drain anteriorly, thus causing a runny nose.

Inferior Nasal Conchae. A curved bony plate formed by the inferior nasal conchae on the left and right protrudes from the lower lateral wall into the nasal cavity space . Looking into the nasal cavity's anterior opening, one can easily see the inferior concha, which is the largest of the nasal conchae..

Vomer Bone. The triangular-shaped unpaired vomer bone, also called the "vomer," forms the posterior-inferior portion of the nasal septum . The best way to see the vomer is to look into the nasal cavity's posterior apertures from behind. This view shows that the nasal septum's vomer forms the entire height of the structure. Gazing into the nasal cavity's anterior opening reveals a much smaller portion of the vomer.

Conclusion: The Remarkable Harmony of Form and Function

In conclusion, the anatomy of the human skull is a testament to the marvels of evolutionary design and intricate functional adaptation. From providing a protective enclosure for the brain to housing essential sensory and respiratory structures, the skull embodies a remarkable harmony of form and function. Understanding its anatomy not only contributes to medical knowledge but also fosters appreciation for the intricate mechanisms that sustain human life.

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