

THE SKELETAL SYSTEM - THE AXIAL SKELETON

Chapter 7

Anatomy and Physiology Lecture

THE SKELETAL SYSTEM – THE AXIAL SKELETON

Skeletal System forms the framework of the body.

TYPES OF BONES: FOUR PRINCIPAL BASED ON SHAPE

- A. Long Bones - have greater length than width and consist of a diaphysis and a variable number of epiphyses

Examples: Bones of the thighs, legs, toes, arms, forearms, and fingers.

- B. Short Bones - Are somewhat cube-shaped and nearly equal in length and width.

Examples: Wrist and ankle bones.

- C. Flat Bones - Are generally thin and composed of two more or less parallel of compact bone enclosing a layer of spongy bone.

Examples: Cranial bones (which protect the brain); sternum and ribs (which protect organs in the thorax) and scapulas.

- D. Irregular Bones - Have complex shapes and cannot be grouped into any of the three categories.

Example: Vertebrae and certain facial bones.

Two Additional Bones Based on Location

- A. Sutural or Wormian Bones - Are small bones between joints of certain cranial bones.

- B. Sesamoid Bones - Are small bones in tendons where considerable pressure develops, for instance, in the wrist.
Examples: Patellas (kneecaps).

DIVISIONS OF THE SKELETAL SYSTEM

Adult human skeleton usually consist of 206 named bones.

Tubercle or Process – Where ligament or tendon attached.

Smooth Surface – Part of a joint and was covered with articular cartilage.

Foramen – Was occupied by nerves or blood vessel.

Sinuses – Contained mucous membrane-line air spaces.

Grouped in Two Principal Division:

1. Axial Skeleton - Consists of the bones that lie around the axis: ribs, breast-bone, hyoid bone, bones of the skull, and backbone.
2. Appendicular Skeleton - contains the bones of the free appendages (upper and lower extremities (limbs)), plus the girdles, which connect the extremities to the axial skeleton.

Number of Named Bones Listed By Category

Note: Complete Skeleton and Named Bones.

<u>Region of the Skeleton</u>	<u>Number of bones</u>
<u>Axial Skeleton</u>	
A. Skull:	
1. Cranium	8
2. Face	14
B. Hyoid	1
C. Auditory Ossicles (3 in each ear)	6
D. Vertebral Column	26
E. Thorax	
1. Sternum	1
2. Ribs	<u>24</u>
	<u>80</u>
<u>Appendicular Skeleton</u>	
Pectoral (shoulder) girdles	
Clavicle	2
Scapula	2
Upper Extremities	
Humerus	2
Ulna	2
Radius	2
Carpals	16
Metacarpals	10
Phalanges	28
Pelvic (Hip) Girdle	
Coxal, pelvic, or hip bone	2
Lower Extremities	
Femur	2
Fibula	2
Tibia	2
Patella	2
Tarsals	14
Metatarsals	<u>28</u>
	<u>126</u>
	<u>Total: 206</u>

THE AXIAL SKELETON

SKULL

- Contains 22 bones
- Rests on the superior end of the vertebral column,
- Composed of two sets of bones:

a) Cranial Bones - enclose and protect the brain.

8 Cranial Bones

Frontal Bone
Parietal Bones (2)
Temporal Bones (2)
Occipital Bone
Sphenoid Bone
Ethmoid Bone

b) Facial Bones - constitutes the facial structure

Nasal Bones (2)
Maxillae
Zygomatic Bones (2)
Mandible
Lacrimal Bones (2)
Palatine Bones (2)
Inferior Nasal Conchae (2)
Vomer

Sutures

Suture (seam or stitch) - is an immovable joint found only between skull bones.

Four prominent sutures are:

1. Coronal Suture - between the frontal bone and the two parietal bones.
2. Sagittal Suture - between the two parietal bones.
3. Lambdoidal suture - between the parietal bones and the occipital bone.
4. Squamosal suture - between the parietal and the temporal bones.

CRANIAL BONES

- a. Frontal Bone - Forms the forehead (the anterior part of the cranium), the roof the orbits (eye sockets), and most of the anterior part of the cranial floor.
-Left and right parts of the frontal bone are united soon after birth by a suture.

(This suture disappears by age 6)

Metopic Suture - if this suture somehow persist throughout life.

Supraorbital margin - a thickening of the frontal bone.

- b. Parietal Bone - form the greatest portion of the sides and roof of the cranial cavity.
- c. Temporal Bones (a pair) - form the inferior sides of the cranium and part of cranial floor.
 - 1) Petrous Portion of the Temporal Bone - contains the internal ear in which are located the structures involved in hearing and equilibrium (balance).
 - 2) Carotid Foramen (canal) through which the internal carotid artery passes
 - 3) Jugular Foramen (fossa) through which the internal jugular vein and the glossopharyngeal (ix) nerve, vagus (x) nerve, and accessory

(xi) nerve pass.

4) Mastoid Portion of the Temporal Bone - in adult, contains mastoid air "cells".

5) Mastoid process - serves as a point of attachment for several neck muscles.

d. Occipital Bone - forms the posterior part and a prominent portion of the base of the cranium.

(1) Foramen Magnum is a large hole in the inferior part of the bone through which the medulla oblongata (part of the brain) and its membranes, the spinal portion of the accessory (xi) nerve, and the vertebral and spinal arteries pass.

(2) Occipital Condyles - articulate (form a joint) with depression on the first cervical vertebra.

e. Sphenoid Bone is situated at the middle part of the base of the skull.

-Referred to as the keystone of the cranial floor because it articulates with all the other cranial bones.

f. Ethmoid Bone is a light, spongy bone located in the anterior part of the floor of the cranium between the orbits.

-Is the principal support structure of the nasal cavities.

FACIAL BONES

Growth of the face ceases at approximately 16 year of age.

a. Nasal Bones are small, oblong bones that meet at the middle and superior part of the face. Are paired.

b. Maxillae (are paired) - unite to form the upper jawbone and articulate with every bone of the face except the mandible, or lower jawbone.

- c. Paranasal Sinuses not cranial or facial bones.
-Besides producing mucus, lighten the skull bones and serve as resonant chambers for sound as we speak or sing.
- d. Zygomatic Bones (malars) commonly referred to as the cheekbones.
(are paired)
- e. Mandible the lower jawbone.
-Is the largest, strongest facial bone.
-It is the only movable skull bone (other than the auditory ossicles).
- f. Lacrimal Bones are thin bones roughly resembling a fingernail in size and shape.
-Are the smallest bones of the face. (are paired)
- g. Palatine Bones are L-shaped and form the posterior portion of the hard palate. (two)
- h. Inferior Nasal Conchae are scroll-like bone that form a part of the lateral wall of the nasal cavity and project into the nasal cavity inferior to the superior and middle nasal conchae of the ethmoid bone.
- i. Vomer is a roughly triangular bone that forms the inferior and posterior part of the nasal septum.

ORBITS

Orbit (eye socket) is a pyramid-shaped space that contains the eyeball and associated structures.

-Formed by seven bones of the skull.

Principal Openings of each Orbit:

1. Optic Foramen (canal) at the junction of the roof and medial wall.

2. Superior Orbital Fissure at the upper lateral angle of the apex.
3. Inferior Orbital Fissure at the junction of the lateral wall and floor.
4. Supraorbital Foramen (notch) on the medial side of the supraorbital margins of the frontal bone.
5. Canal for Nasolacrimal Duct in the nasal bone.

FORAMINA

Openings or perforations in a bone.

HYOID BONE

-U-shaped

-A unique component of the axial skeleton because it does not articulate with any other bone.

VERTEBRAL COLUMN

Vertebral Column (spine) + Sternum + Ribs
 -----> Skeleton of the Trunk of the body

Vertebral column consists of a series of bones called Vertebrae, which makes up about 2/5 of total height of the body.

Vertebral Column is a strong, flexible rod that moves anteriorly, posteriorly, and laterally and rotates.

-Functions - it encloses and protects the spinal cord, supports the head, and serves as a point of attachment for the ribs and muscles of the back.

Intervertebral Foramina - openings between vertebrae

-The nerves that connect the spinal cord to various parts of the body pass through these openings.

Typical Adult Vertebral Column

-Contains 26 vertebrae

1. 7 Cervical vertebrae (cervix = neck) C1 - C7
2. 12 Thoracic vertebrae (thorax = chest) T1 - T12
3. 5 Lumbar vertebrae (Lumbus = loin) L1 - L5
4. 5 Sacral vertebrae fused in one called Sacrum.
5. 4 Coccygeal vertebrae fused into one or two bones called coccyx.

*Prior to the fusion of the sacral and coccygeal vertebrae, the total number of vertebrae is 33

Intervertebral Discs- found between vertebrae.

-Form strong joints, permit various movements of the vertebral column, and absorb vertical shock.

-Under compression, they flatten broaden, and bulge from their intervertebral spaces.

NORMAL CURVES

Convex ϵ

1. Cervical Curve (formed by cervical vertebrae)
3. Lumbar Curve (formed by lumbar vertebrae)

*Called secondary curves- are modified of the fetal position.

Concave δ

2. Thoracic Curve (formed by thoracic vertebrae)
4. Sacral Curve (formed by sacral vertebrae)

*Called Primary Curve - retain the anterior concavity of the fetus.

TYPICAL VERTEBRAE

All the vertebrae are basically similar in structure, despite variations in size, shape, and detail.

1. Body (Centrum) - thick and disc-shaped anterior portion is the weight-bearing part of the vertebra.

-Superior and inferior surfaces are roughened for the attachment of intervertebral discs.

2. Vertebral (neural) Arche - Pedicles and Laminae.

-Extends posteriorly from the body of the vertebra.

-Surrounds the spinal cord together with the body of the vertebra.

*The Space that lies between the vertebral arch and body contains the spinal cord.

Vertebral Foramen - is the space between the vertebral arch and the body of the vertebrae.

*Vertebral (spinal) Canal - the vertebral foramina of all vertebrae put together.

3. Processes - seven of them, arise from the vertebral arch.

Transverse process (2)

Spinous process (1)

Superior articular process (2)

Inferior articular process (2)

Cervical Region

Cervical Vertebrae are smaller than those of thoracic vertebrae. [C1- C7]

C1 (The Atlas) -named for its support of the head. It lacks a body and a

spinous process.

C2 (The Axis) - have a body. A peglike process called the dens (dens= tooth) projects up through the ring of the atlas.

-The dens makes a point on which the atlas and head rotate.

C3-C6 Correspond to the structural pattern of the typical cervical vertebrae previously described.

C7 Called the Vertebra Prominens, is somewhat different. Is marked by a large, nonbifid spinous process that may be seen and felt at the base of the neck.

THORACIC REGION

Thoracic Vertebra are considerably larger and stronger than the vertebra of the cervical region.

T1- T2 Articulate with ribs.

LUMBAR REGION

Lumbar Vertebrae are the largest and strongest in the column.

L1-L5 stomach area.

SACRUM AND COCCYX

Sacrum (Sacred or holy bone) is a triangular bone formed by the union of five sacral vertebrae (S1- S5)

-Serves as a strong foundation for the pelvic girdle.

Coccyx is also triangular in shape and is formed by the fusion of the coccygeal vertebrae, usually the last four.

Co1- Co4

THORAX

Thorax refers to the chest.

-The skeletal portion of the thorax is a bony cage formed by the sternum, costal cartilage, ribs, and the bodies of the thoracic vertebrae.

Sternum - the breastbone.

Ribs - makes up the sides of the thoracic cavity.

- a. 1 - 7 Ribs -- True (vertebrosternal) ribs.
Attachment to the sternum by a strip of hyalin cartilage called costal cartilage.
- b. Remaining 5 pairs of ribs - False ribs because their costal cartilage do not attach directly to the sternum.

*The cartilages of the 8th, 9th, and 10th ribs attach to each other and then to the cartilage of the 7th rib. These false ribs are called Vertebrochondral ribs.

*The 11th and 12th False ribs are designated as Floating (vertebral) ribs because their anterior ends do not attach even directly to the

sternum.

DISORDERS: HOMEOSTATIC IMBALANCES

- a. Herniated (slipped) disc
- b. Abnormal curves
- c. Spina Bifida
- d. Fractures of the vertebral Column