

OSTEOLOGY

osteo means bone and logy means study. osteology is that branch of medical science which deals with study of structure of bones. Study of bone (osteology) constitutes one of the most important part of the study of anatomy.

Skeleton → Bony and cartilaginous framework of the body constitutes the skeleton.

Endoskeleton → Where the skeleton is located internally in the body. In human anatomy, the term skeleton usually means endoskeleton.

Exoskeleton → In human beings the exoskeleton is very rudimentary, being represented by nails and animal of teeth only.

Q. Name the bones of upper & lower limbs and what are the functions of bones?

Bones of upper limb.

- (1) scapula -
- (2) clavicle ~
- (3) Humerus -
- (4) Radius -
- (5) Ulna -
- (6) carpals (1. Scaphoid 2. Lunate 3. Triquetral

4. Pisiform S. Trapezium C. Trapezoid T. capitate 8. Hamate.

7. Metacarpals.

8. Phalanges.
Bones of lower limb

(1) Hip bone

(2) Femur

(3) Patella.

(4) Tibia

(5) Fibula.

(6) Talus (1. Talus 2. calcaneous 3. Navicular

4. Cuneiform 5. cuboid)

(7) Metatarsal

(8) Phalanges

Functions of Bones

1. constitute the framework of the body and so give shape and form to the body.

2. form the central axis of the body.

3. Support and transmit the weight of the body.

4. Provides the levers essential for locomotion.

by following articulation and giving attachment to muscles and ligaments.

5. Provide mechanical protection to vital organs.

Such as the brain, heart and lungs.

6. Store calcium.

7. Form blood in their marrow.

Number of Bones

The human skeleton consists of 206 bones.

1. Upper limbs — 64, 2. Lower limbs — 64

3. vertebrae — 26 (33) 4. Skull — 29 (facial

bones — 14, cranial bones — 14, hyoid — 1)

5. Ribs — 24, 6. Sternum — 1.

Classification of bones

(a) According to position;

Axialis — Bones forming the axis of the

body e.g. Skull, ribs, sternum and vertebrae.

Apodialis — Bones forming the skeleton

of limbs.

(b) According to size and shape;

Long bones: Presents in upper and lower

limbs. Possesses three parts i.e. upper end

shaft (iii) lower end. The two ends are

usually expanded for forming articulations

and giving attachment to muscles and liga-

ments. The shaft is tubular with a

central medullary cavity e.g. Humerus, Radius,

Ulna, Femur, Tibia and Fibula. Long bone

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acts as levers for movements and locomotion.

(2) Short long bones: Same as above but use ~~various~~ miniature in size e.g. Metacarpals, Metatarsals and Phalanges.

(3) Short bones: Small polyhedral and generally cuboidal in shape e.g. carpal and tarsal bones.

(4) Flat bones: Expanded and plate like. They protect vital structure and provide extensive area for muscular attachment e.g. scapula, sternum, ribs, parietal and frontal bones.

(5) Irregular bones: Irregular in general outline and do not fit in any of the above categories e.g. vertebrae, some skull bones.

(6) Pneumatic bones: Flat or irregular bones possessing a hollow space within their body which contains air e.g. ethmoid, maxilla, mastoid part of temporal bone.

(7) Sesamoid: Sesamoid means seed like. They are nodules of bones which develop in certain tendons e.g. pisiform, patella.

(8) Sesamoid: Sesamoid means seed like.

(2)

(which is the largest sesamoid bone and helps in quadriceps femoris tendon).

Introduction to skeleton system

Skeleton has two major divisions.

(1) Axial skeleton consists of: 1. Skull 2. vertebral column 3. Ribs and sternum (Bones of thorax)

4. Hyoid bone.

(2) Appendicular skeleton consists of (1) Bones of upper limb and shoulder

Axial skeleton

1. Skull consists of 22 bones and are divided into two groups:

(1) Facial bones: comprise bones of face

(2) Cranial bones: comprise the portion of skull which lodges the brain and special sense organs

(1) Facial bones: 14

Nasal 2

Maxilla 2

Zygomatic 2

Mandible 1

Palatine 2

Lacrimal 2

(2) Vomer 1

(3) Inferior nasal concha 2

(4) Superior nasal concha 2

(5) Middle nasal concha 2

Cranial bones: 14

- (1) Occipital (2) Parietal 2 (3) Frontal 1
 (4) Temporal 2 (5) Ethmoid 1 (6) Sphenoid 1
 (7) Malleus 2
 (8) Incus 2
 (9) Stapes 2

Anatomy and Physiology of Skull:

The skull: It rests upon the upper end of the vertebral column and its bone structure is divided into two parts the ~~cranium~~ cranium and the face.

Cranium: It provides a bony protection for the brain. It is described in two parts; the base and the vault. The base is a part of which the brain rests and the surrounding part is termed as the vault. The base is divided into the anterior, middle, posterior, cranial fossae. The bone surfaces of all the cranial bones are supplied with blood vessels. The bones which form 1 frontal bone, 2 Parietal bones, 1 occipital bone, 1 sphenoid bone, 1 ethmoid bone, 2 temporal bones.

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(3)

1. Frontal Bone: The frontal bone is a large flat bone which forms the forehead and also the upper part of orbital cavities. It develops into one bone. It contains two cavities called the frontal sinuses which lie one on each orbit. They contain air which enters by small opening leading from the nasal cavities. These sinuses give lightness to the bones and so in the bone, in the voice acting as sounding chamber.

- (1) External or Frontal surface.
 (2) Internal or cerebral surface.

(3) Parietal Bone: The parietal bones are 2 bones that bones forming sides and back of the skull. They articulate with occipital and with frontal, occipital and temporal bones. The inner surface is concave and is grooved by the brain and blood vessels.

Face:

- Surfaces: (i) External (ii) Internal.
 Processes: (i) Superior (ii) Anterior (iii) Anterior (iv) Posterior.

(3) Occipital Bones: It forms the region of occipital (back of the head) and is trapezoid in shape. It forms immobile joints with parietal and sphenoid bones.

There is a roughened area called occipital protuberance. On this bone there is a large opening known as the foramen magnum for the passage of spinal cord.

(4) Temporal Bones: The temporal bones lie on each side of the head.

(5) Sphenoid bones: The sphenoid bone is an irregular bone in the shape of a bat with its wing out stretched and lies in the centre of the base of the skull.

(6) Ethmoid bones: The ethmoid bone is a very little ~~of the~~ irregular bone and occupies anterior part of the base of a skull and helps to form a cavity, the nasal septum and the lateral walls of the nasal cavity.

(7) Bones of Face: These are 14 bones which form the skeleton of face:

- 1 Zygomatic, 2 Maxillae, 2 nasal,
- 2 lacrimal, 1 vomer, 2 Palatine bones,
- 2 Infusor conchae or turbinated or 1 mandible

Intelligence plus character - that is the goal of true education. - Martin Luther King Jr.

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Zygomatic bone: Each zygomatic bone is the prominence of the cheek and part of the floor and lateral walls of the orbital cavity. It articulates with the zygomatic process of the

maxillae bone. It forms the zygomatic arch.

Maxillae Bone: Maxillae bone or upper jaw bone forms the upper jaw, the anterior part of the roof of the mouth, the lateral walls of the nasal cavities and part of the floor of the orbital cavity. It presents the alveolar ridge which projects downwards and carries the upper teeth on each side. These are a large air sinuses, the maxillary sinus which is dilated with and communicates with the nasal cavity.

Mandible Bone: It is the largest and strongest bone of the face, forms the lower jaw, consists of a central body and two ramus parts.

Body: Horse shoe (U) shaped; horizontal and convex forwards.

Ramus: One ramus on each side projecting upwards from the posterior end of the body.

Body: It possesses 2 surfaces: External and 2 Internal

When you find this first unit of education, that brings a new thinking. - John F. Kennedy

Vertebrate Bones: The thoracic bones are two small scroll shaped bones which form part of the lateral walls of the nasal cavity.

VERTEBRAE

vertebral column consists of a number of separate irregular bones called 'vertebrae' forms the central axis of body.

functions

1. Protects spinal cord.
2. Supports and transmits body weight.
3. Provides attachment to axial muscles.
4. Provides movement of the trunk.

vertebrae are named according to region in which they lies. There are 33 vertebrae but only 31 spinal nerves.

1. Cervical	7	cervical	8
2. Thoracic	12	thoracic	12
3. Lumbar	5	lumbar	5
4.	5		5
5. Coccygeal	4	coccygeal	1

In adult, the 5 sacral vertebrae fuse together to form sacrum and the 4 coccygeal vertebrae fuse together to form

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Conty.

CHARACTERISTICS OF VERTEBRAE

1. Body: The anterior or ventral part.
2. Arch: The posterior or dorsal part.

Vertebral foramen lies between the body and arch. These are placed one above the other inter-vertebral discs between them and form the vertebral canal which lodges the spinal cord with its meninges and blood vessels.

BODY OF VERTEBRAE

1. It is nearly cylindrical in shape the size and shape varying in vertebrae of different regions.

2. It possesses 6 surfaces → upper, lower, anterior, posterior, 2 lateral.

VERTEBRAL (Neural) ARCH

(1) The vertebral arch consists of a pair of pedicles.

(ii) A pair of laminae

3. 7 processes → (a) spinous - 1 (b) articular - 4

(c) Transverse - 2. The arch is connected to the body by the pedicles.

2. alveolar: 1. upper (Alveolar) and 2. lower (Base)

- 1) Surface: (a) External surface: convex is outline: it presents 1. Symphysis menti
2. Mental protuberance 3. Mental tubercles
4. Mental foramen.

(b) Internal surface: concave in outline.

(ii) Alveolar: (1) upper alveolar (Alveolar fossa) presents: 1. in adults: 16 sockets, 8 on each side, for lodging the roots of teeth, named from before backwards.

1. Medial or 1st incisor 5. 2nd premolar
2. lateral or 2nd incisor 6. 1st molar
3. canine 7. 2nd molar
4. 1st premolar 8. 3rd or last molar.

Dental formula $\frac{I C P M}{2 1 2 3}$

(I = Incisor, C = canine, P = Premolar, M = Molar).

(3) Lower Alveolar: (Base of the mandible thick and rounded).

(2) Ramus: Flattened, quadrilateral part projecting upwards from the posterior end of the body on each side. It possesses 2 surfaces: 1. lateral (external) 2. Medial

Intelligence and characterisation is the goal of this education - Dr. H. L. K. K. K.

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(Anterior)

4. alveolar: (1) Anterior (2) Posterior (3) upper (4) lower.

2. Processes: (1) Coronoid (2) condylod.

Nasal Bone: The nasal bones are two small bones which form greater part of the lateral and superior surface of the bridge of the nose. They articulate with each other medially.

Lacrimal bone:

The lacrimal bones are two very small bones located in a position posterior and lateral to the nasal bone. They also form inner wall of the orbit. They are grooved and the groove contains the lacrimal sac and nasal duct. It carries tear or lacrimal fluid from eye down to the nasal cavity.

Vomer bone: The vomer is a thin plate bone which extends upwards from middle of the nasal plate and separates the two nasal cavity. Palatine bone: The palatine bones are two irregular bones which form the back of the hard plate and extend up the outer wall of the nasal cavity into the floor of the orbit.

When you take this from with out an admission, your name is also recorded, when you take it.

lies obliquely at the upper and posterior part of pelvic cavity between 2 hip bones. Because of its oblique position, it forms an angle with the rest of vertebral column known as sacrovertebral (lumbo sacral) angle which is about 90 degrees.

Parts:-

- (i) Apex (ii) Base (iii) 3 surfaces: Pelvic, Dorsal and lateral.

Coccyx:- (Prominence coxistid) derives its name from its resemblance to the beak of a chicken. A small triangular bone which is formed by fusion of 4 rudimentary coccygeal vertebrae may exist at separate piece. 2nd and 3rd coccygeal vertebrae diminish successively in size.

- Parts:- (i) Base (ii) Apex (iii) 2 surfaces; Pelvic and Dorsal.

Anatomy and Physiology of Ribs

- (i) They are elastic arches of flat bones which are 12 in number on each side. They are numbered from above downwards.

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- (2) They represent developmentally the cost element in the thoracic region.

- (3) They form a large part of thoracic wall and are connected behind to the vertebral column, in front of the upper 7 pairs anteriorly through costal cartilages with the sternum. They form the anterior, posterior and lateral walls of bony thoracic cage.

- (4) Their length increases from 1st - 7th ribs and then diminishes from 8th - 10th ribs. The breadth decreases from above downwards.

- (5) The ribs lie one above the other and the spaces between them are known as intercostal spaces.

- (6) The ribs are obliquely placed so that intercostal spaces are deeper in front than behind.

Classification - I (A) True ribs:- 1st to 10th. They are connected in front through costal cartilages with the sternum.

False ribs:- 11th to 12th - (i) vertebro-chondral ribs: The cartilage of 8th, 9th and 10th ribs are joined each to the cartilage of the rib just above.

- (ii) Floating ribs: 11th and 12th - They are free at their anterior ends.

- (i) Pedicles — short thick processes pass backwards from the junction of lateral and posterior surface of the body.
 - (ii) Laminae — Broad plates of bone lying behind and medial to pedicles.
 - (iii) Processes — (A) Spine process — passes backwards and downwards from the junction of the laminae. Its shape and size varies in vertebrae of different segments.
 - (B) Articular processes — 4 in number, 2 superior and 2 inferior.
 - (C) Transverse process — 2 in number. Project laterally from the junction of pedicles and laminae. In thoracic region they articulate with ribs.
- The most important distinguishing feature of vertebrae of different segments is the presence of a foramen transversarium.
- (i) Cervical: Presence of a foramen transversarium.
 - (ii) Thoracic: Presence of costal facets on the body.
 - (iii) Lumbar: No foramen transversarium and no costal facets on the body.

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Cervical vertebrae

Cervical vertebrae are 7 in number and form the axial skeleton of the neck.

Identification: Presence of foramen transversarium in the transverse process.

Typical cervical vertebrae — 2nd, 4th, 5th and 6th present similar features hence called typical.

A typical ~~vertebra~~ cervical vertebrae — 1st, 2nd and 7th cervical vertebrae presents special features, hence called atypical; 1st cervical vertebra is called Atlas, and cervical vertebrae is called Axis; 7th cervical vertebrae is called Lumbar prominence.

Lumbar vertebrae

5 in number which occupy the region of lumbar.

Distinguish points:

(1) Big size of body.

(2) Absence of costal facets on body.

(3) Absence of foramen transversarium.

only 5th lumbar vertebrae present some special features. The rest are known as typical lumbar vertebrae.

Sacrum: It is a large triangular bone formed by fusion of 5th and 6th vertebrae. It

1. Manubrium sterni: (i) Nearly triangular in shape.

(ii) It has processes (i) 2 surfaces: anterior and posterior. (ii) 4 borders: superior, inferior and 2 lateral.

(i) Surfaces: (1) anterior surface: (a) convex from side to side, concave from above down inside: attachments. (a) Pectoralis major. (b) sternocleidomastoid.

(ii) Posterior surface: (a) attachments (a) sternoclavicular (b) sternohyoid.

2. Body of sternum: (i) long, narrow, thin, nearly rectangular. (ii) It has processes (1) 2 surfaces: anterior and posterior. 2 ends: upper and lower. (ii) 2 borders: anterior surface - attachment - pectoralis major.

(i) Post surface - attachments - sternocostalis.

3. Xiphoid process: (1) smallest part of sternum which lies in epigastrium.

(a) Shape and size and vary variable may be bilobed, perforated, broad, thin etc.

(a) Rectus abdominis (ii) On posterior surface - diaphragm (b) Transverse thoracic

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Anatomy and Physiology of CLAVICLE

CLAVICLE (collar bone) lies horizontally in front of the root of the neck. It is a long curved bone, somewhat resembling the letter 'L'. It is subcutaneous throughout. It differs from other long bones in that:

(1) It has no medullary cavity

(2) It ossifies in membrane.

(3) It secretes clapping of the point of shoulder.

(4) It keeps the arm away from the trunk.

(5) Transmits weight of the upper limb.

(6) It has 3 parts: (1) Acromial end (2) sternal end. (3) Shaft

(a) Flattened acromial end lies laterally

(b) Enlarged, rounded sternal end lies medially.

II (A) Typical is the ribs which present common features:

- (B) A typical: The ribs which present special features: They are: 1st, 2nd, 10th, 11th and 12th ribs.

Characteristics of a typical Rib

- (i) Typical rib is (i) curved
- (ii) Angulated: The angle lies about 2.5 inches from the tubercle.
- (iii) Twisted: Such that the 2 ends will not touch the horizontal surface.

Parts of Rib

- (i) Anterior (ii) Posterior (iii) Shaft.
- (1) Anterior end: Recognized by the presence of a small cup shaped depression which articulates with the lateral end of the corresponding costal cartilage.
- (ii) Posterior end: It consists of 1, head (3) neck, 3, Tubercle.
- (1) Head: Bears two small facets separated by a transverse ridge called crest.
- (2) Neck: Flat portion adjoining the head, about 1 inch long.
- (3) Tubercle: Built on posterior surface of the rib at the junction of neck.

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(6)

and shaft.

- (ii) Shaft: (1) thin and flat. (2) It is curved, bent and twisted on itself. (3) It possess 2 surfaces; External and Internal; 2 borders; superior and inferior.
- (1) External surface: - convex and smooth.
- (2) Internal surface: - concave and smooth.
- (3) Superior border: (i) rounded (ii) it has got an inner and outer lips. Inner lip gives insertion to the internal inter costal and inter muscles. Outer lip gives insertion to external inter costal muscles.
- (4) Inferior border: Sharp border (ii) gives origin to external inter costal muscles.

STERNUM

A long flat bone, lying in the median plane of anterior thoracic wall. Its average length is 17 cm. Its upper end articulates with clavicle. Its margins articulate with costal cartilages of 1st 7 pairs of ribs.

Parts:

- (1) Manubrium sterni
- (2) Body.
- (3) Xiphoid process.

Shoulder joint.

Processes: (1) Spine of scapula - It is a shelf like projection on the upper part of the dorsal surface of scapula.

(ii) Acromion: (a) Arises medially at right angles from lateral end of spine and projects forwards.
(b) Subacromioid and overhangs the glenoid cavity.

acromion's Deltoid (a) Leverages.

(iii) Glenoid process: Arises from upper part of the head (glenoid cavity of scapula) and lies below the clavicle.

HUMERUS

Humerus forms the skeleton of upper arm and is the longest and strongest bone of upper limb.

(1) upper end (2) shaft (3) lower end

Determination of side:-

(1) Head lies at the upper and medial part of the upper end and faces medially, backwards, upwards.

(2) olecranon fossa lies downwards and posteriorly.

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(1) upper end consists of: (i) head (ii) neck (iii) greater tubercle or lesser tubercle. (iv) tuberosity of scapula (v) bicipital groove

(1) Head: It is small, rounded and projects upwards and medially from the upper end. It is covered with articular cartilage and articulates with the glenoid cavity of scapula forming the shoulder joint.

Neck: There is an anatomical and surgical neck. (a) anatomical neck: It is the constricted portion adjoining the head.

(b) Surgical neck: It is the place where the upper end joins the shaft. It is a common site for fracture of upper end of humerus. So it is called surgical neck.

(2) Greater tubercle (tuberosity): It lies at the posterior lateral part of the upper end and forms the prominence of shoulder - attachment (a) subscapularis (b) supraspinatus (c) infraspinatus (d) teres minor (e) teres major (f) serratus anterior (g) latissimus dorsi (h) pectoralis major (i) pectoralis minor (j) subclavius (k) coracobrachialis (l) brachialis (m) biceps brachii (n) brachioradialis (o) brachiocephalic (p) brachioaxillary (q) brachiohumeral (r) brachiocondylar (s) brachiocondylar (t) brachiocondylar (u) brachiocondylar (v) brachiocondylar (w) brachiocondylar (x) brachiocondylar (y) brachiocondylar (z) brachiocondylar

(3) Bicipital groove: It lies between the two tubercles and contains the tendon of long head of biceps and ascending coracoacromial ligament.

Anatomy of SCAPULA

large, triangular, flat bone lying at the posterior lateral aspect of chest wall opposite 4th-5th ribs. Forms part of the shoulder girdle.

It possesses 2 surfaces, 3 borders & 3 angles and 3 processes.

(I) Surfaces: costal and dorsal.

(II) Borders: lateral, medial and upper.

(III) Angles: superior, inferior and lateral — lateral angle bears the pear shaped acromioclavicular joint called glenoid cavity.

(IV) Processes: spine, acromion, coracoid.

Determination of side

(I) Glenoid cavity should face forwards, laterally and slightly upwards.

(2) Dorsal surface bearing the spine should face backwards.

(3) Inferior angle should face downwards

(A) (i) Surface — (I) costal surface.

(ii) Face forwards and medially.

(iii) Concave and flattened, called subscapular fossa.

Attachments of muscles (i) Subscapularis

(ii) Pectoratus anterior

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(2) Dorsal — (i) Divided into 2 halves by parts of a sharp like projection called spine. Upper smaller part is supraspinous fossa and lower large part is infraspinous fossa.

Attachments: (1) Supraspinatus (2) Infraspinatus (3) Teres minor. (4) Teres major (5) Latissimus dorsi.

(II) Borders: (i) lateral (axillary) border (i) thickest of all the borders (ii) Extends from the lower part of glenoid cavity to the inferior angle.

(3) Medial border — (i) longest of all borders (ii) Extends from superior angle to inferior angle.

(ii) Rhomboid minor.

(ii) Upper border: (i) Thickest and shortest of all borders.

(ii) starts from the superior angle and extends laterally subscapular notch.

(3) Angles: (i) Superior angle: formed where lateral and medial borders meet.

(ii) Superior angle: lies at the junction of superior and medial borders.

(iii) Lateral angle: bears the glenoid cavity which articulates with the head of humerus to form

It articulates with radial notch of ulna. It is hollow upper surface articulates with the capitulum.

(2) Neck: It is the constricted part below the head attachments - spiracle.

(3) Tuberosity: It is below the medial part of the olecranon process is inserted into the deep posterior fossa.

(3) Shaft: It is massive above and broad below. It possesses 3 borders; medial - lesser, anterior and posterior. (1) 3 surfaces - anterior, posterior and lateral.

Supracondylar (1) anterior surface - lies between anterior and interosseous borders - attachment - flexor pollicis longus (2) posterior surface - lies between interosseous and posterior borders - attachment - abductor pollicis longus (3) Extensor pollicis longus

(4) Lateral surface - lies between anterior and posterior borders - attachment - pronator quadratus (5) Medial surface - lies between anterior and posterior borders - attachment - pronator quadratus

(6) Lower end - broad and expanded. It possesses four surfaces; lateral, medial, anterior and posterior.

(7) Head - It is small and rounded. It articulates with the radial notch of ulna.

(1) Lateral surface: It forms a conical bony projection and its lower end called styloid process.

(2) Medial surface: It bears a smooth notch (ulnar notch) for articulation with the head of ulna in forming the hinge radioulnar joint.

(3) Anterior surface: Smooth, convex and triangular. Its medial part articulates with the head of ulna and lateral part articulates with the radius.

(4) Posterior surface: Very narrow and presents as a thick prominent ridge.

(5) Distal surface: It is broad and irregular and has a tubercle (distal tubercle) with a groove on its lateral side.

ULNA

It is the medial bone of forearm. Its size diminishes from upper to lower ends. Parts: (1) upper end, (2) shaft (3) lower end (head).

Determination of side

Upper end is strong, expanded and has a hook like projection called "Trochlear notch".

ultrastrong (a) - Pectoralis major (b) has major (c) latissimus dorsi.

2 Shaft is cylindrical above but flat and and triangular below (it consists of 3 borders: anterior, lateral and medial).

(iii) 2 Surfaces: Anteromedial, anterolateral and posterior.

Surfaces:-

(i) Antero lateral surface: lies between anterior and lateral borders - attachments brachialis, antemedial surface: lies between anterior and medial borders - attachment brachialis

(ii) Posterior faces.

(a) Posterior surface: lies between medial and lateral borders - attachments triceps brachii.

Lower end:- flattened anterior posteriorly and broader transversely. It consists of articular and non-articular part (a)

Articular part consists of (1) capitulum and (2) trochlea (b) Non-articular part consists of medial epicondyle. (2) lateral

epicondyle (3) olecranon fossa. (4) coronoid fossa (5) radial fossa.

Applied anatomy

1. Dislocation of shoulder joint is common

Dislocation of shoulder joint is the most common upper limb injury.

(8)

because the capsule is loose and the size of the head is very large in comparison to shallow glenoid cavity.

(ii) Fracture of surgical neck may damage axillary nerve.

(iii) Fracture of lower end may damage ulnar nerve.

RADIUS

It is the lateral bone of forearm.

Parts:- (1) upper and (2) shaft (3) lower end. Deformation of side

(1) upper end is rounded and bears the head of ulna and is broader than the upper end. (2) lateral surface of the shaft is convex and its anterior surface is concave in the lower part.

(4) styloid process projects from lateral surface of the lower end. The bone belongs to the side opposite to which the radial tuberosity points.

(5) upper end consists of: (1) Head (2) neck (3) tuberosity.

(1) Head:- It is like a shaped overhangs the neck. on all sides except medially where

When you rotate the forearm into of supination, the head of radius articulates with the radial notch of ulna.

The concavity of which faces forwards.

2. Lower end is smaller and has a small rounded head.

3. The thin sharp erect like hyposternous border of the shaft lies laterally.

(iv) Styloid process projects downwards from the radio-medial aspect of the end.

Upper end is upper end possesses: (i) 2 process olecranon process and coronoid process.

(ii) Two articulation notch: trochlear notch and radial notch.

Olecranon process projects upwards and forms the upper most part of ulna. It is bent for-wards forming a hook like projection.

Coronoid process is it is a shelf like projection from the upper end. Anterior part of the shaft below the olecranon process.

(ii) Notches is (i) Trochlear notch: articulates with trochlea of humerus.

(iii) Radial notch is it is an oval depression on the upper part of the lateral surface of the coronoid process of articulates with the head side of the radius.

Shaft of Ulna

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Triangular in cross-section in the upper part rounded in the lower part. It possesses

(i) 3 borders: anterosuperior, anterior and posterior.

(ii) 3 surfaces: anterior, medial and posterior.

Lower end is lower end is slightly expanded and consists of (i) head, (ii) styloid process

(iii) Head is has a smooth, convex articular surface on its lateral part for articulation with the radius.

(iv) Styloid process is it is a short rounded process which projects downwards from posterior medial aspect of the lower end of ulna. Its tip is palpable on the radio-medial part of wrist.

Applied Anatomy

In fractures of medial side of radius and ulna, there is a separation of broken pieces because of common muscles attachments to both bones and these may be cross union.

Bones of Wrist and Hand is

Carpal Bones is wrist is anatomically known as carpus and the end of small bones supporting it is known as carpus. They use os-

ped to five irregular. series of 4 bones each.
They are from proximal to medial
1) Proximal series - Scaphoid, lunate,
triquetrum, pisiform.
2) Distal series - Trapezium, trapezoid, tri-
apezoid, trapezoid.

Carpal bones are bound together joint-
edly by ligaments. To allow limited mo-
vements. Bones of the proximal articulation
distally with proximal articular surfaces
of bones of distal row. except pisiform
which lies upon triquetrum. Bones of dist-
al row articulate with metacarpal bones.

Metacarpals and Phalanges

Metacarpals are the bones of hand and
phalanges are the bones of digits. Meta-
carpals do not have individual names and
are numbered from 1-5 beginning with
metacarpal of the thumb and continuing
medially to metacarpal of the little finger.
Each metacarpal possesses a base which arti-
culates with carpal and a head which
articulates with proximal phalanx of
corresponding digit. The heads of meta-
carpals form the 'knuckles' of the hand.

is relatively long and curved, lies like head
and base.

There are 14 phalanges in each hand. Each
digit has 3 phalanges proximal, middle and
distal phalanx, except the thumb which has
only 2 proximal and distal.

Bones of Lower Limb

HIP BONE -> Hip bones are two in number
and together form the greater part of pelvic
girdle. Hip bone is a large irregular bone
which is expanded both above and below but
contracted in the middle. Its lateral aspect pres-
ents a large cavity, the acetabulum for articu-
lation with the head of femur.

Parts -> (i) Ilium (ii) Pubis (iii) Ischium.

Determination of Side

Ilium is expanded and projects upwards
Pubis faces forwards and medially and articulates
with femur.
Acetabulum cavity faces forwards, downwards
and laterally.

(1) Ilium -> It is a flat and expanded portion
above the acetabulum cavity. It possesses (1) two
ends - upper and lower.

FEMUR

It is the longest and strongest bone in the body and lies in the thigh.

Parts: (1) upper end (2) shaft (3) lower end.

Determination of side:

1. Anterior surface of the shaft is convex.
2. Head lies at the upper end and faces upwards and medially.

1. Upper end is upper end possesses (1) Head (2) Neck (3) Greater Trochanter (4) Lesser Trochanter.

- (i) Head: projects from medial side of upper end of shaft. (ii) Faces upwards, forwards and medially and articulates with the acetabulum cavity of hip bone. (iii) There is a small depression behind it called - the fovea of pit, it gives attachment to ligament of head of femur.

- (ii) Neck: it is about 5cm in length and joins the head to the shaft forming an angle of 135° .

- (iii) Greater Trochanter: it is a large quadrangular prominence which projects upwards from the junction of the neck with the shaft.

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- (iv) Lesser Trochanter: it is a blunt conical projection at into medial part of junction between neck and shaft.

Infer. Trochanteric line: it is a rough ridge place at the junction of neck and shaft.

Infer. Trochanteric crest: it is a small, rounded ridge placed at the junction of posterior surface of neck with shaft.

2. SHAFT: The shaft is massive opposite to its medial part but expands at its upper and lower parts. it possesses - (1) 2 borders: laterally medial, posterior (called linea aspera)

- (ii) 4 surfaces: it has upper and lower thirds but only three surfaces in its middle third.

- (i) Anterior: it lies between medial and lateral borders. it is smooth and convex.

- (ii) Lateral surface: it lies between lateral and posterior borders.

- (iii) Medial surface: it lies between medial and posterior borders - attachments on shaft - vastus intermedius, vastus lateralis, vastus medialis, gluteus medius, abductor magnus, adductor magnus, biceps femoris.

muscular - attachment - soleus (2)

Stenodiplosis longus

Lower end: 3 processes known:
 (i) 1 process known as
 the medial malleolus (ii) 5 surfaces, anterior,
 medial, posterior, lateral and inferior.

Applied Anatomy of 'TIBIA'

1. Once third of fibia has a completely broken blood supply, so non union of fracture is commonest of the lower end.
2. Ingression injury results in transverse fracture of medial malleolus of the base.
3. Fracture of injury results in fracture of the tip of medial malleolus.

PATELLAE

It lies in the tendon of Quadriceps femoris
in front of the knee joint. It is a largest
triangular bone. It is triangular in shape
and broad. It is triangular in shape.

Factorial Structures: anterior and posterior

(iii) Products: Medical, Latex and Squeezing (Base)

iii) Apoc.

Determination of Side:

- (1) Parotid apex lies inferiorly.
- (2) Anterior surface is rough.

then the $\text{rank}(\text{vec}(A)) = \text{rank}(A) = 1$ and the proof of the theorem follows. $\square$

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Discussion

Prognosis and Treatment

- (ii) Posterior Suture:- It is an oval suture in its

Foot which is divided into two by a vertical ridge.
The lateral part which joins articulates with
lateral condyle of femur and the medial part
with medial condyle of femur. Lower more
articulation part gives attachment to ligamentum
patellae.

Superior Border (Base): Thick border of dense attachment to the part of quadriceps femoris which divide from scutal femoris and vastus lateralis.

Medial and Lateral Border → gives attachment to radius medialis and radius lateralis part of quadriceps femoris respectively.

Apex is of Spindle chambraces and gives attachment to Ligamentum patellae.

FIBULA

It is the lateral bone of leg and is long and very cylindrical. It takes no part in the articulation of body.

Parts $\rightarrow$ upper end (head) (ii) shaft (iii) lower end (distal malleolus)

- (3) Lower End: It is broadly expanded. so as to provide a good bearing surface for transmitting the body weight to the upper end of tibia. It consists of two prominent thick masses of bone called medial and lateral condyles separated from each other by inter condylar fossa. It has 2 articular surfaces: the patellar and tibial articular surfaces.

TIBIA

It is the medial and stronger bone of the leg. It takes part in the formation of knee and ankle joints and these by helps in transmission of the body weight from the femur to the foot.

Parts: (1) upper end (2) shaft (3) lower end. The lower end has a strong process (medial malleolus) on its medial side.

Deformation of side

- (1) upper end is broad.
(2) Anterior border of the shaft is sharp and prominent.
(3) Medial malleolus projects from medial side of the lower end.

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- (i) Upper end: It is upper end is expanded transversely. It consists of (i) Medial condyle (ii) lateral condyle (iii) Tuberosity.
- (ii) Medial condyle: It is large of the 2 but does not project so much backwards as the lateral condyle. Lateral condyle: It overhangs upper part of posterior surface of shaft.
- (iii) Tuberosity of tibia: It lies at the upper end of anterior border of shaft and at the place where anterior surface of the 2 condyles become continuous.
- (iv) SHAFT: (1) It is prismoid in shape and gradually tapers from above downwards. (2) It possesses (i) 3 borders - anterior, posterior, lateral and medial (ii) 3 surfaces - medial, lateral and posterior.
- (v) Surfaces: (i) Medial surface: It lies between anterior and medial borders. It is subcutaneous in nearly the whole of its extent - attachment of gracilis (2) gracilis (3) semitendinosus.
- (vi) Lateral surface: It lies between anterior and posterior borders - attachments - Tibialis anterior (b) Extensor hallucis longus (c) Extensor digitorum longus.
- (vii) Posterior surface: It lies between interosseous and