JHARKHAND RAI UNIVERSITY

RANCHI

LAB MANUAL

ANATOMY - II

BPT II

LIST OF PRACTICAL

ANATOMY - II

(23A201P)

S.NO	PRACTICAL
1.	To study and identify Cervical vertebrae
2.	To study and identify Thoracic vertebrae
3.	To study and identify Lumber vertebrae
4.	To identify and palpate bony prominence of upper limb through surface anatomy
5.	To identify and palpate soft tissue of upper limb through surface anatomy
6.	To identify and palpate bony prominence of lower limb through surface anatomy
7.	To identify and palpate soft tissue of lower limb through surface anatomy

PRACTICAL 1

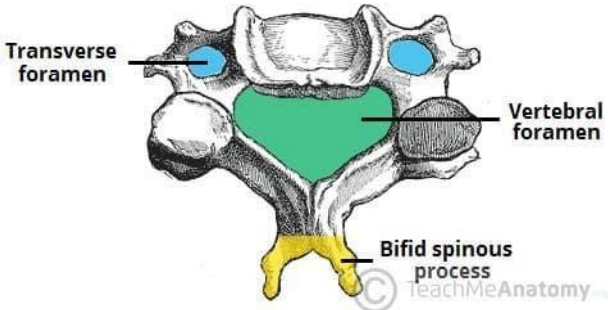
Aim: To study and identify cervical vertebrae

Theory: The cervical spine is the most superior portion of the vertebral column, lying between the cranium and the thoracic vertebrae. It consists of seven distinct vertebrae, Cervical vertebrae C3 to C6 are typical and CI (Atlas), C2 (Axis) and C7 (Vertebra Prominens) are atypical vertebra.

Learning Outcome: At the end of the practical student can able to identify different cervical vertebra

Distinguish features of Typical Vertebra [C3 to C6]

The cervical vertebrae have three main features which distinguish them from other vertebrae:
Triangular vertebral foramen
Bifid spinous process – this is where the spinous process splits into two distally.
Transverse foramina – holes in the transverse processes. They give passage to the vertebral artery, vein and sympathetic nerves.



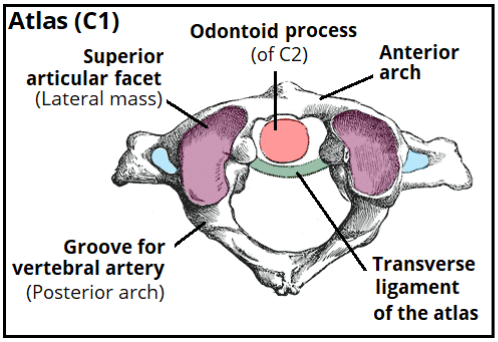
Typical Cervical Vertebra

Atypical Vertebrae C1 - Atlas

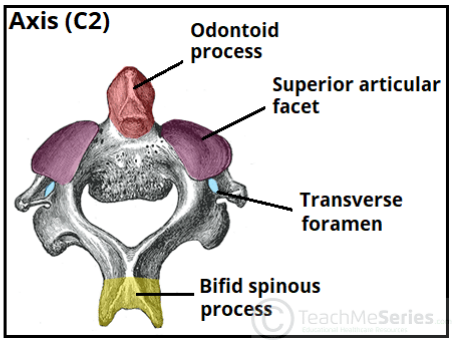
The atlas is the first cervical vertebra and articulates with the occiput of the head and the axis (C2).
It differs from the other cervical vertebrae in that it has no vertebral body and no spinous process. Instead, the atlas has lateral masses which are connected by an anterior and posterior arch. Each lateral mass contains a superior articular facet (for articulation with occipital condyles), and an inferior articular facet (for articulation with C2).
The anterior arch contains a facet for articulation with the dens of the axis. This is secured by the transverse ligament of the atlas – which attaches to the lateral masses. The posterior arch has a groove for the vertebral artery and C1 spinal nerve.

Atypical Vertebrae C2 - Axis

The axis (C2) is easily identifiable due to its dens (odontoid process) which extends superiorly from the anterior portion of the vertebra.
The dens articulates with the anterior arch of the atlas, in doing so creating the medial atlanto-axial joint. This allows for rotation of the head independently of the torso.
The axis also contains superior articular facets, which articulate with the inferior articular facets of the atlas to form the two lateral atlanto-axial joints.



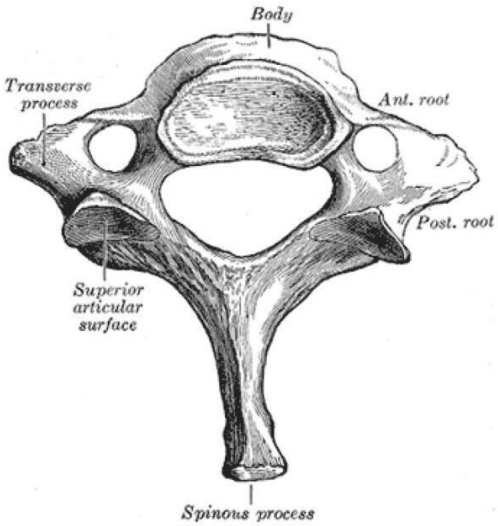
Atypical Cervical vertebrae Atlas (C1)



Atypical Cervical Vertebrae Axix (C2)

Atypical Vertebrae C7 – Vertebra Prominens

C7 possesses the standard cervical vertebral features but has some distinct features:
1. Spinous process ends in a rounded tubercle and is not bifid
2. C7 transverse foramina are small, and do not transmit the vertebral artery
3. C7 anterior tubercle is small, and is the site of attachment for scalenus minimus and suprapleural membrane
4. C8 nerve, which does not have an associated cervical vertebra, exits in the C7-T1 vertebral foramen below C7



Atypical Cervical Vertebrae – Vertebra Prominens (C7)

PRACTICAL 2

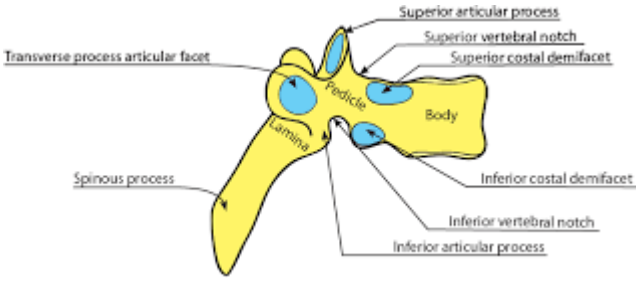
Aim: To study and identify thoracic vertebrae

Theory: The thoracic spine is the second segment of the vertebral column, located between the cervical and lumbar vertebral segments. It consists of twelve vertebrae, which are separated by intervertebral discs. Along with the sternum and ribs, the thoracic spine forms part of the thoracic cage. This bony structure helps protect the internal viscera – such as the heart, lungs and oesophagus.

Learning Outcome: At the end of the practical student can able to identify different thoracic vertebra

Distinguish Features of Typical Thoracic Vertebra [T2 – T8]

The thoracic vertebrae have four features which distinguish them from other vertebrae:
Vertebral body is heart shaped.
Presence of demi-facets on the sides of each vertebral body – these articulate with the heads of the ribs.
Presence of costal facets on the transverse processes – these articulate with the tubercles of the ribs. They are present on T1-T10 only.
The spinous processes are long and slant inferiorly. This offers increased protection to the spinal cord, preventing an object such as a knife entering the spinal canal.
Superior and Inferior Costal Facets
The superior and inferior costal facets are located on the sides of each vertebral body. They consist of cartilage lined depressions, which articulate with the heads of the ribs. The superior facet articulates with the head of the adjacent rib, and the inferior facet articulates with the head of the rib below
In the majority of the vertebrae (T2-T8) these facets are demi-facets. There are some atypical vertebrae that possess whole facets.



Lateral view of Typical Thoracic Vertebra

Atypical Vertebrae of thoracic T1, T9. T10, T11, T12

The atypical thoracic vertebrae display variation in the size, location and number of their superior and inferior costal facets.

T1 – Superior facet is not a demifacet, as this is the only vertebrae to articulate with the 1st rib.

T9- A single pair of demifacet located in upper part of the body of vertebra and no demifacet in lower part.

T10 – A single pair of whole facets is present which articulate with the 10th rib. These facets are located across both the vertebral body and the pedicle.

T11 and T12 – Each have a single pair of entire costal facets, which are located on the pedicles.

PRACTICAL 3

Aim: To study and identify Lumber vertebrae

The lumbar spine is the third region of the vertebral column, located in the lower back between the thoracic and sacral vertebral segments.It is made up of five distinct vertebrae, which are the largest of the vertebral column. This supports the lumbar spine in its main function as a weight bearing structure.

Learning Outcome: At the end of the practical student can able to identify different Lumber vertebra

Distinguish Features of Typical Lumber Vertebra [L1 to L4]

Although the lumbar vertebrae lack some of the more distinctive features of other vertebrae, there are several characteristics that help to distinguish them.

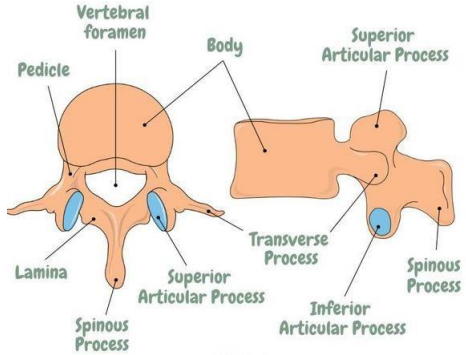
The vertebral bodies are large and kidney-shaped. They are deeper anteriorly than posteriorly, producing the lumbosacral angle (the angle between the long axis of the lumbar region and that of the sacrum). The vertebral foramen is triangular in shape.

Other features of a typical lumbar vertebrae:

- **Transverse processes** are long and slender.
- **Articular processes** have nearly vertical facets.
- **Spinous processes** are short and broad.
- **Accessory processes** can be found on the posterior aspect of the base of each transverse process. They act as sites of attachment for deep back muscles.
- **Mammillary processes** can be found on the posterior surface of each superior articular process. They act as sites of attachment for deep back muscles.

Distinguish Features of Atypical Lumber Vertebra L5

The fifth lumbar vertebrae, L5, has some distinctive characteristics of its own. It has a notably large vertebral body and transverse processes as it carries the weight of the entire upper body.



Typical Lumber Vertebra

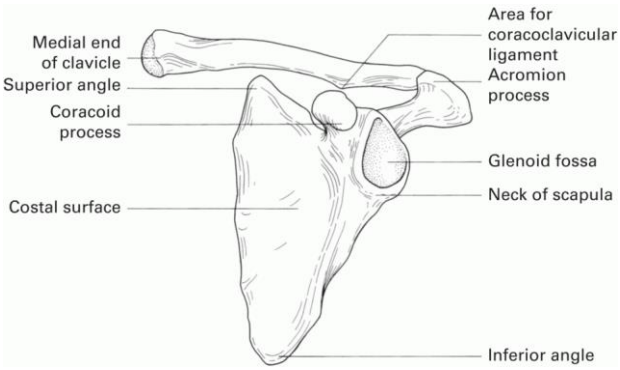
PRACTICAL 4

Aim: To identify and palpate bony prominence of upper limb through surface anatomy

Learning outcome: At the end of practical students can able to palpate from the surface of the skin different bony prominence of upper limb

The subcutaneous border of the *clavicle* can be palpated along its entire length.

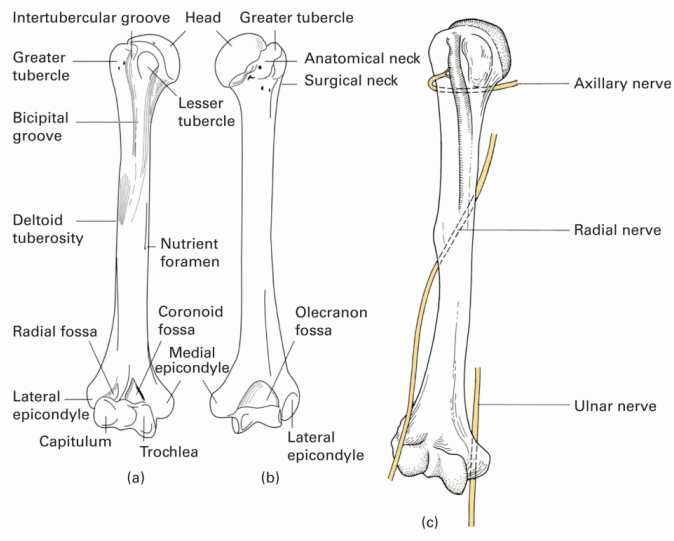
The *acromion process* forms a distinct bony edge at the lateral extremity of the *scapular spine*. It lies immediately above the smooth bulge of the *deltoid muscle*, which itself covers the *greater tubercle of the humerus*. Less easily identified is the *coracoid process* of the scapula, lying immediately below the clavicle at the junction of the middle and outer thirds, and covered by the anterior fibres of the deltoid.



Bony landmark for scapula and clavicle

The medial border of the scapula can be both seen and felt. Abduction of the arm is a complex affair made up of abduction at the shoulder joint, depression at the sternoclavicular joint and rotation of the scapula; the last two are readily confirmed by self- palpation.

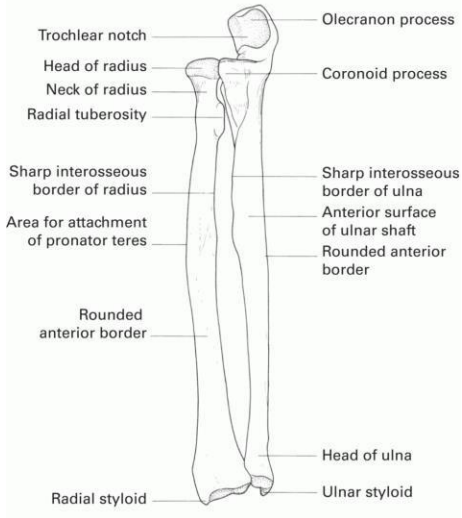
With the shoulder abducted, the *head of the humerus* can be felt at the apex of the axilla.



Bony landmark of humerus

At the elbow, the three bony landmarks are the *olecranon process* and the *medial* and *lateral epicondyles*. A supracondylar fracture lies above these points, which therefore remain in their triangular relationship to each other; in dislocation of the elbow, however, the olecranon comes to lie more or less in line with the epicondyles

A hollow in the posterolateral aspect of the extended elbow distal to the lateral epicondyle; this lies over the *head of the radius*, which can be felt to rotate during pronation and supination.



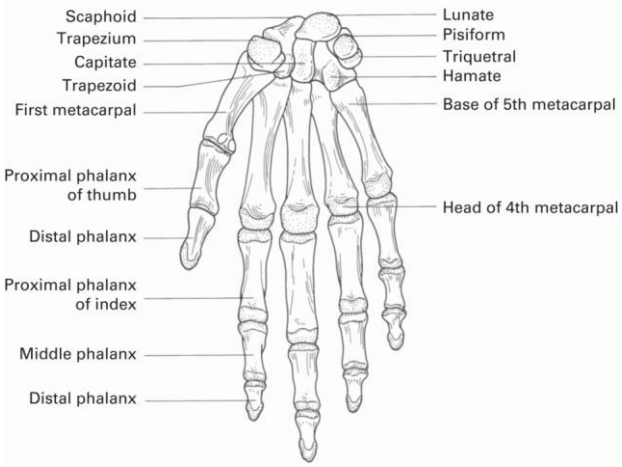
Bony land mark of Radius and Ulna

The posterior border of the *ulna* is completely subcutaneous and crossed by no named vessels or nerve; it can therefore be exposed surgically from end to end without danger.

At the wrist, the *styloid processes* of the radius and ulna can be felt; the former extends more distally. The radial styloid lies in the floor of the ‘anatomical snuffbox’, while the ulnar styloid

can be felt (and usually seen) on the dorsal aspect of the *head* of the ulna. The *dorsal tubercle of Lister* is palpable on the posterior aspect of the distal end of the radius.

In the palm of the hand, palpate the *pisiform* at the base of the hypothenar eminence. *Flexor carpi ulnaris* is inserted into it and when this tendon is relaxed by flexing the wrist the pisiform can be moved a little from side to side. The *hook of the hamate* can be felt by deep palpation just disto-radial to the pisiform. The *scaphoid* is felt at the base of the thenar eminence and also within the anatomical snuffbox, where there is characteristic tenderness when this bone is fractured. In a thin subject, the pisiform and the tubercle of the scaphoid can be seen as bulges when the wrist is extended.



Bony landmark of hand

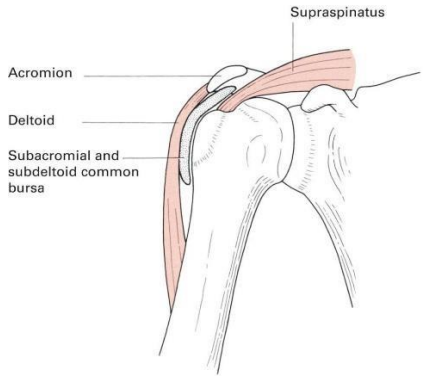
PRACTICAL 5

Aim: To identify and palpate soft tissue of upper limb through surface anatomy

Learning outcome: At the end of practical students can able to palpate from the surface of the skin different soft tissues like muscle, artery, nerve etc tendon, of upper limb.

The anterior fold of the axilla is formed by the *pectoralis major*, and the posterior fold of the axilla by the *teres major* and *latissimus dorsi*. The digitations of *serratus anterior* can be seen in a muscular subject on the medial axillary wall.

In the upper arm the *deltoid* forms the smooth contour of the shoulder. The *biceps* and *brachialis* constitute the bulk of the anterior aspect of the arm, and the *triceps* its posterior aspect. The tendon of biceps is easily felt, and often seen, at the elbow when this is flexed to a right angle. Immediately medial to this, palpate the pulse of the brachial artery. Firm pressure immediately medial to this will, in turn, produce paraesthesiae in the hand as the median nerve is palpated.



Soft tissue surface anatomy of upper part of upper limb

When the forearm is flexed against resistance, the *brachioradialis* presents prominently along its radial border.

At the wrist it is convenient to commence at the radial pulse. The tendon medial to this is that of the *flexor carpi radialis*, then *palmaris longus* (which may be absent), then the cluster of tendons of *flexor digitorum superficialis*. The tendon of *flexor carpi ulnaris* lies most medially, inserting into the pisiform; the ulnar pulse can be felt just to the radial side of this tendon.

On the dorsal aspect of the wrist the anatomical snuffbox is bordered by the tendons of *abductor pollicis longus* and *extensor pollicis brevis* laterally and that of *extensor pollicis longus* medially (i.e., towards the ulnar border) – the last can be traced to the base of the terminal phalanx of the extended thumb. The tendons of extensor digitorum are seen in the extended hand passing over the dorsal aspects of the proximal phalanges of the fingers.

1. The *axillary nerve* is related closely to the surgical neck of the humerus 5 cm (2 inches) below the acromion process.
2. The *radial nerve* crosses the posterior aspect of the humeral shaft at its mid- point.

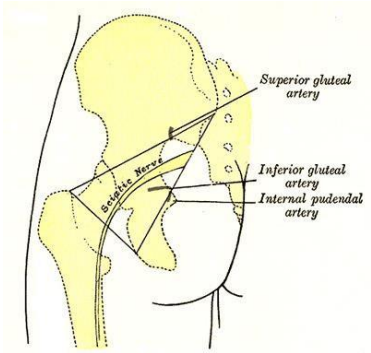
3. The *posterior interosseous branch* of the radial nerve is located by Henry's method as it winds round the radius. Place three fingers along the lateral aspect of the upper end of the radius; the uppermost finger lies on the radial head (feel it rotate on pronation and supination), and the lowermost lies over the nerve.
4. The *median nerve* in the forearm lies, as its name suggests, in the median plane; its area of distribution in the hand is thus anaesthetized if local anaesthetic is injected exactly in the midline at the wrist.
5. The *ulnar nerve* at the wrist lies immediately medial to the ulnar pulse. In the hand, it passes on the radial side of the pisiform and then lies on the hook of the hamate. If you press with your fingernail just lateral to the pisiform bone, you will experience tingling in your ulnar two fingers.

PRACTICAL 6

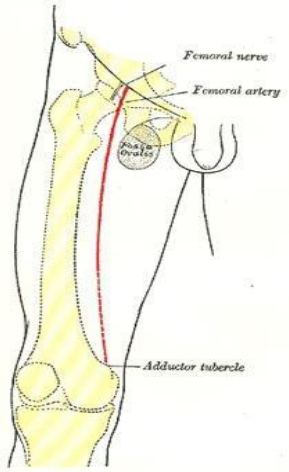
Aim: To identify and palpate bony prominence of lower limb through surface anatomy

Learning outcome: At the end of practical students can able to palpate from the surface of the skin different bony prominence of lower limb

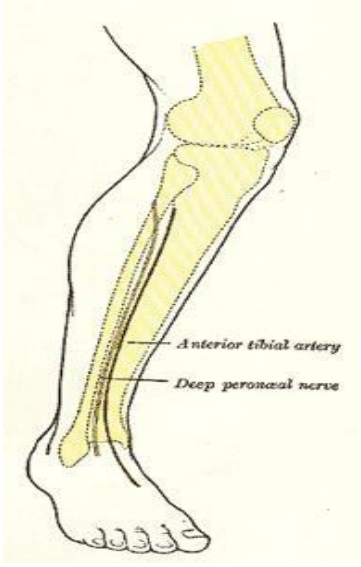
The anterior superior iliac spine is at the level of the sacral promontory—the posterior at the level of the spinous process of the second sacral vertebra. A horizontal line through the highest points of the iliac crests passes also through the spinous process of the fourth lumbar vertebra, while, as already pointed out the transtubercular plane through the tubercles on the iliac crests cuts the body of the fifth lumbar vertebra. The upper margin of the greater sciatic notch is opposite the spinous process of the third sacral vertebra, and slightly below this level is the posterior inferior iliac spine. The surface markings of the posterior inferior iliac spine and the ischial spine are both situated in a line which joins the posterior superior iliac spine to the outer part of the ischial tuberosity; the posterior inferior spine is 5 cm. and the ischial spine 10 cm. below the posterior superior spine; the ischial spine is opposite the first piece of the coccyx. With the body in the erect posture the line joining the public tubercle to the top of the greater trochanter is practically horizontal; the middle of this line overlies the acetabulum and the head of the femur.



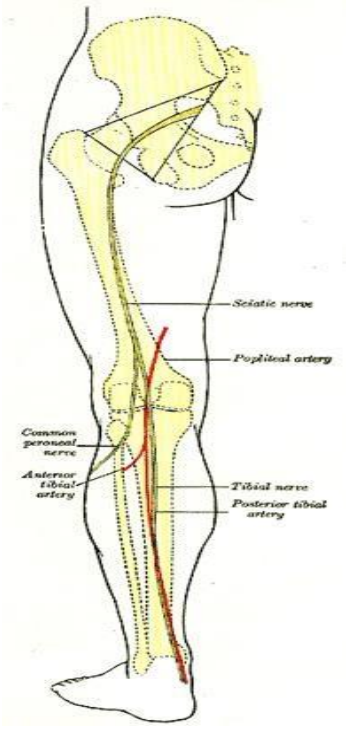
Left gluteal region, showing surface markings for arteries and sciatic nerve.



Front of right thigh, showing surface markings for bones, femoral artery and femoral nerve.



Lateral aspect of right leg, showing surface markings for bones, anterior tibial and dorsalis pedis arteries, and deep peroneal nerve.



Back of left lower extremity, showing surface markings for bones, vessels, and nerves.

A line used for clinical purposes is that of Nélaton, which is drawn from the anterior superior iliac spine to the most prominent part of the ischial tuberosity; it crosses the center of the acetabulum and the upper border of the greater trochanter. Another surface marking of clinical importance is **Bryant's triangle,** which is mapped out thus: a line from the anterior superior

iliac spine to the top of the greater trochanter forms the base of the triangle; its sides are formed respectively by a horizontal line from the anterior superior iliac spine and a vertical line from the top of the greater trochanter.

Articulations. —The posterior superior iliac spine overlies the center of the **sacroiliac articulations.** The **hip-joint** may be indicated, as described above, by the center of a horizontal line from the pubic tubercle to the top of the greater trochanter; or more generally, it is below and slightly lateral to the middle of the inguinal ligament.

The **knee-joint** is superficial and requires no surface marking. The level of the **ankle-joint** is that of a transverse line about 1 cm. above the level of the tip of the medial malleolus. If the foot be forcibly extended, the head of the talus appears as a rounded prominence on the medial side of the dorsum; just in front of this prominence and behind the tuberosity of the navicular is the **talonavicular joint.** The **calcaneocuboid joint** is situated midway between the lateral malleolus and the prominent base of the fifth metatarsal bone; the line indicating it is parallel to that of the **talonavicular** joint.

The line of the **fifth tarsometatarsal joint** is very oblique; it starts from the projection of the base of the fifth metatarsal bone, and if continued would pass through the head of the first metatarsal. The lines of the **fourth** and **third tarsometatarsal joints** are less oblique. The **first tarsometatarsal joint** corresponds to a groove which can be felt by making firm pressure on the medial border of the foot 2.5 cm. in front of the tuberosity of the navicular bone; the position of the **second tarsometatarsal joint** is 1.25 cm. behind this. The **metatarsophalangeal joints** are about 2.5 cm. behind the webs of the corresponding toes.

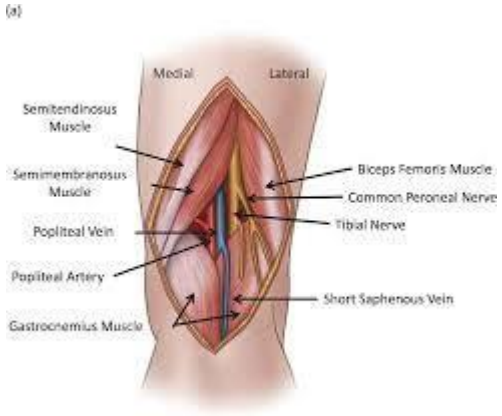
PRACTICAL 7

Aim: To identify and palpate soft tissue of lower limb through surface anatomy

Learning outcome: At the end of practical students can able to palpate from the surface of the skin different soft tissues like muscle, artery, nerve etc tendon, of lower limb.

The **femoral triangle** is bounded above by the inguinal ligament, laterally by the medial border of Sartorius, and medially by the medial border of Adductor longus. In the triangle is the fossa ovalis, through which the great saphenous vein dips to join the femoral; the center of this fossa is about 4 cm. below and lateral to the pubic tubercle, its vertical diameter measures about 4 cm. and its transverse about 1.5 cm. The femoral ring is about 1.25 cm. lateral to the pubic tubercle.

The **adductor canal** occupies the medial part of the middle third of the thigh; it begins at the apex of the femoral triangle and lies deep to the vertical part of Sartorius. The **popliteal fossa** is bounded: above and medially by the tendons of Semimembranosus and Semitendinosus; above and laterally by the tendon of Biceps femoris; below and medially by the medial head of Gastrocnemius; below and laterally by the lateral head of Gastrocnemius and the Plantaris.

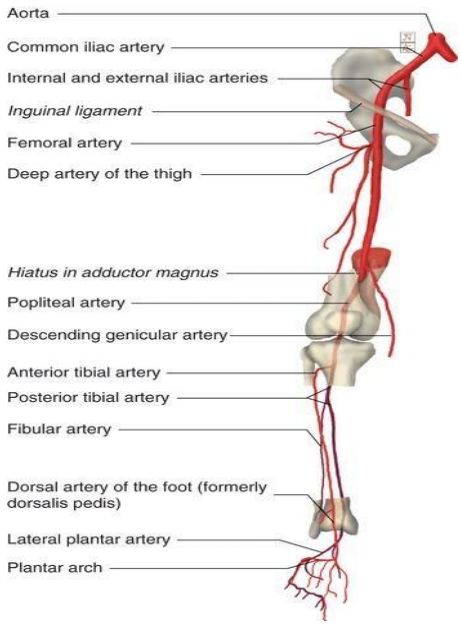


Back of Right lower extremity around knee showing surface markings for muscle, vessels, and nerves

Mucous Sheaths. —The positions of the mucous sheaths around the tendons about the ankle-joints are sufficiently.

Arteries. —The points of emergence of the three main arteries on the buttock, viz., the superior and inferior gluteals and the internal pudendal. With the femur slightly flexed and rotated inward, a line is drawn from the posterior superior iliac spine to the posterior superior angle of the greater trochanter; the point of emergence of the **superior gluteal artery** from the upper part of the greater sciatic foramen corresponds to the junction of the upper and middle thirds of this line. A second line is drawn from the posterior superior iliac spine to the outer part of the ischial tuberosity; the junction of its lower with its middle third marks the point of emergence of the **inferior gluteal** and **internal pudendal arteries** from the lower part of the greater sciatic foramen. The course of the **femoral artery** is represented by the upper two-thirds of a line from a point midway between the anterior superior iliac spine and the symphysis pubis to the adductor tubercle, with the thigh abducted and rotated outward; the **profunda femoris** arises from it about 1 to 5 cm. below the inguinal ligament. The course of the upper part of the **popliteal artery** is indicated by a line from the lateral margin of Semimembranosus at the junction of the

middle and lower thirds of the thigh, obliquely downward to the middle of the popliteal fossa; from this point it runs vertically downward for about 2.5 cm. or to the level of a line through the lower part of the tibial tuberosity. The line indicating the **anterior tibial artery** is drawn from the medial side of the head of the fibula to a point midway between the malleoli; the artery begins about 3 cm. below the head of the fibula. The **dorsalis pedis artery** is represented on the dorsum of the foot by a line from the center of the interval between the malleoli to the proximal end of the first intermetatarsal space.



Lower limb artery supply

The course of the **posterior tibial artery** can be shown by a line from the end of the popliteal artery, *i. e.,* 2.5 cm. below the center of the popliteal fossa, to midway between the tip of the medial malleolus and the center of the convexity of the heel; its main branch, the **peroneal artery,** begins about 7 or 8 cm. below the level of the knee-joint and follows the line of the fibula to the back of the lateral malleolus. The **medial** and **lateral plantar arteries** begin from the end of the posterior tibial; the medial extends to the middle of the plantar surface of the ball of the great toe, the lateral to within a finger's breadth of the tuberosity of the fifth metatarsal bone; from this latter point the **plantar arch** crosses the foot transversely to the proximal end of the first intermetatarsal space.

Veins. —The line of the **great saphenous vein** is from the front of the medial malleolus to the center of the fossa ovalis; the **small saphenous vein** runs from the back of the lateral malleolus to the center of the popliteal fossa.

Nerves. —The course of the **sciatic nerve** can be indicated by a line from a point midway between the outer border of the ischial tuberosity and the posterior superior angle of the greater trochanter to the upper angle of the popliteal fossa. The continuation of this line vertically through the center of the popliteal fossa represents the position of the **tibial nerve,** while the **common peroneal nerve** follows the line of the tendon of Biceps femoris. The lines for the **deep peroneal**

nerve and the continuation of the **tibial nerve** correspond respectively to those for the anterior and posterior tibial arteries.

Lower limb nerve supply distribution