HBS2ALT: Sample Notes

Gluteal Osteology and Overview

Bony features of the gluteal region correspond to those of the posterior pelvis, particularly the surface of the ilium and ischium
- Iliac Crest → from ASIS to PSIS
- Ischium: Greater Sciatic Notch, Ischial Spine, Lesser Sciatic Notch and Ischial Tuberosity

Ligaments
1. *Posterior Sacroiliac Ligament.* Function: Stabilises the SIJ

2. *Sacrotuberous Ligament*: Posterior/Lateral Sacrum, Coccyx, SIJ to Ischial Tuberosity

3. *Sacrospinous Ligament:*/Posterior/Lateral Sacrum to Ischial Spine

- Broad structure of ligament 2&3 allows muscles to attach. (Most notably gluteus maximus)

Gluteal Region Surface Anatomy
- Exists from level of the iliac crest superiorly to Gluteal Folds inferiorly.
- Exists from intergluteal/natal/gluteal cleft medially to the greater trochanter laterally.

Skin:
- coarse and thick particularly in males

Adipose
- hypodermis (formerly known as superficial fascia). Characteristic shape of buttocks is largely due to the pad of adipose tissue in the gluteal region. Both males and females deposit adipose in the gluteal region. This deposition can be highly variable between genders.

Deep Fascia
- Fascia Lata- deep fascia of the gluteal region and thigh→ Continuation of the fascia of the thigh (also called the fascia lata). Encircles the thigh and covers the gluteal region. Attaches to bones prominances and also encloses the gluteus maximus and tensor fascia lata muscles, both muscles insert into the iliotibial tract.
- Iliotibial tract (ITT) is presented as a lateral thickening of the fascia lata, as it extends laterally from the ilium to the tibia.
- Although its superficial, it blends with the lateral intermuscular septum (IMS) of the thigh.
- The lateral intermuscular septum attaches to the linea aspera on the posterior femur.

Bursa
- Pouch of synovial membrane filled with synovial fluid. To reduce the friction between 2 structures that slid upon each other.
- Many bursas around the hip region. Two bursa to be mindful of:

Trochanteric Bursa (TB)	Located between the iliotibial tract and the greater trochanter. Functions to lubricate the sliding of the iliotibial tract over the greater trochanter.
Iliopsoas Bursa	Located between the iliopsoas muscle and hip joint capsule. Acts to

	reduce the friction between the iliopsoas rubbing on the anterior part of the hip joint capsule.

Concepts of muscle action at joints
- Muscle must cross a joint to act at the joint
- Two factors contributing to the efficiency of movement: (1) Muscle size (2) Mechanical advantage/moment-arm.

(1) Muscle Size
- Larger the muscle → greater myofilaments → greater cross-sectional area → greater force generated (e.g. gluteus maximus (posterior to hip joint - thigh extensor) has a larger cross-sectional area than iliopsoas and rectus femoris (hip flexor)). Gluteus maximus extends the thigh posteriorly while propelling the trunk anteriorly as we walk.

(2) Mechanical Advantage
- Force generated by a lever. Muscles inserting further away from a joint will have a greater mechanical advantage/i.e. moment arm.

Muscle Location
- Flexors cross joints anteriorly
- Extensors cross joints posteriorly
- Adductors cross joints medially
- Abductors cross joints laterally
- Rotators cross joints horizontally and/or obliquely

*Note: below the knee flexors cross joints posteriorly and extensors cross joints anteriorly

Concepts of Nerve Supply
- Hiltons Law: Nerve that supplies a joint will supply muscles crossing that joint and skin overlying the muscle insertion. Therefore, the nerve should have an articular branch (for the joint), a muscular branch (for muscle) and cutaneous branch (for skin).

Nerves in the Gluteal Region
1. Femoral Nerve (anterior) → rectus femoris (only quadriceps muscle that crosses the hip anteriorly) and pectineus (an adductor)

2. Obturator nerve (medial) → adductor muscle group and lateral rotators (e.g. obturator externus)

3. Superior Gluteal nerve (posterosuperior) → abductors (gluteus medias and minimums). Doesn't supply the cutaneous region above the muscles. Cutaneous region are supplied by nerves of posterior primary rami (dorsal rami).

Superficial Muscles of the Gluteal Region

Tensor Fascia Lata

Origin	ASIS, Upper surface of Iliac Crest
Insertion	Iliotibial Band (ITB)
Innervation	Superior Gluteal Nerve (L4-S1)

Orientation/Action	- Antero-vertical <u>Actions (as an agonist)</u> - Tightens the fascia lata, therefore allowing the muscles in the thigh to contract more efficiently. Stabilises the knee joint in extension (assisting the gluteus maximus to extend the hip) - WEAK abductor and medial rotator of the hip - If the hip flexor (iliopsoas) is damaged, then TFL acts as a weak hip-flexor

Gluteus Maximus

Origin	Gluteal surface of the ilium, PSIS lumbar fascia, sacrum, sacrotuberous and sacrospinous ligament
Insertion	(Deep fibre insertion) Gluteal Tuberosity of the femur (Superficial part) iliotibial tract
Innervation	Inferior gluteal nerve (L5, S1, S2) – Dorsal Division of Anterior Rami
Orientation/Action	Posterior/Vertical → ex tension (climbing, walking to propel trunk anteriorly), standing up from squats) - Lateral Rotator: as fibres cross obliquely and insert onto the gluteal tuberosity and ITT - Strong Anti-gravity muscle (contracts eccentrically) to hold trunk up if it is falling anteriorly into flexion - Postural muscle that supports the trunk in standing and sitting
Blood Supply	- Inferior and Superior Gluteal Artery & Vein (due to its large size)

Gluteus Medius

Origin	Alar of posterior ilium, between the posterior and anterior gluteal lines
Insertion	Greater Trochanter of Femur
Innervation	Superior Gluteal Nerve (L4, L5, S1) - Dorsal Division of Anterior Rami
Orientation **Action**	Posterior Oblique fibres → Lateral Rotation Lateral fibres → Abduction Anterior fibres → Medial Rotation
Blood Supply	Superior Gluteal Artery and Vein

Gluteus Minimus

Origin	Between anterior and inferior gluteal line
Insertion	Grater trochanter of the femur
Innervation	Superior Gluteal Nerve (L4-S1) - Dorsal Division of Anterior Rami
Orientation **Action**	Lateral Fibres → Abduction Anterior Fibres (insert at the anterior surface of the greater trochanter) → Medial rotation

- tendon of both the gluteus medias and gluteus maximus cross the hip-joint laterally, therefore they are strong abductors.
- neurovascular bundle is located between gluteus medias and minimums
- stabilise the pelvis by working on the contralateral side. When a limb is lifted the pelvis

drops on the same side (ipsilateral side). The gluteus minimum and medias contract on the opposite side to lift the pelvis, therefore preventing the drop.

Deep Gluteal Muscles - Lateral Rotators

Piriformis

Origin	Between the anterior sacral foramina
Insertion	Posterior to the hip joint on the upper margin of the Greater Trochanter (via the Greater sciatic foramen)
Innervation	Dorsal Division of Anterior Rami of L5 - S2
Orientation/Action	When Knee is Extended → Lateral Rotation When Knee is Flexed → Abduction

Tricep Coxae Group (tendon of the 3 muscles are combined to a common insertion, and they function as a group)

1. **Obturator Internus**

Origin	Medial surface of the obturator membrane, adjacent bone of the obturator foramen
Insertion	Medial surface of the superior margin of the greater trochanter below the insertion of piriformis. It's main muscle belly lies in the obturator foramen.
Innervation	Nerve to obturator internus → Ventral division of the Anterior Rami of L5 & S1
Orientation/Action	When femur is Extended → Lateral Rotation When femur is Flexed → Abduction @ hip joint

- tendon of OI lies between the superior and inferior gemellus

2. Superior Gemellus

Origin	External surface of Ischial Spine (superior to obturator internus)
Insertion	Medial side of Greater Trochanter (with the tendon of OI)
Innervation	Nerve to Obturator Internus → Ventral division of the Anterior Rami of L5 & S1
Orientation/Action	When femur is extended → Lateral Rotation When femur is flexed → Abduction

3. Inferior Gemellus

Origin	Upper aspect of the ischial tuberosity
Insertion	Medial side of Greater Trochanter (with the tendon of OI)
Innervation	Nerve to Quadratus Femoris → Ventral division of Anterior Rami of L5, S1
Orientation/Action	When femur is extended → Lateral Rotation When femur is flexed → Abduction

Quadratus Femoris (most inferior of lateral rotators)

Origin	Lateral aspect of the ischium, anterior to the ischial tuberosity

Insertion	Quadrate tubercle on the Inter-trochanteric crest (Posterior to the hip joint)
Innervation	Nerve to Quadratus femoris → Ventral division of Anterior Rami of L5, S1
Orientation/Action	Lateral Rotation (Hip)

Obturator Externus (muscle of medial thigh)

Origin	External surface of obturator membrane
Insertion	Trochanteric Fossa
Innervation	Obturator Nerve – Dorsal division of anterior Rami of L3, L4
Orientation/Action	Lateral Rotation

Lateral Rotators – accessory actions
- rotator cuff at the hip joint
- help stabilise the hip

Dynamic Ligaments → act as ligaments to attach to bones, but are not passive structures (I.e. they must use energy and contract to perform this

Hip Joint

Hip Joint
Histological classification: Synovial
Functional classification: Ball (head of femur) and Socket (acetabulum)
Articulating Surfaces → acetabulum (coxal) and head of femur (femoral)
Triaxial → 3 Degrees of Movement → being a ball-socket joint it allows for movement in the following planes: 1. Sagittal (extension/flexion), 2. Coronal (Adduction/Abduction) and 3. Horizontal (Medial/Lateral Rotation)
- 2/3 of the spherical head sits inside the acetabulum

Acetabulum
- Crescentic lunate surface → the only articular surface of the acetabulum and it surrounds the acetabular fossa (rough and non-articular). It is lined by hyaline cartilage. Inferior horns of acetabulum terminate just lateral to the acetabular notch

Ligaments
1. Acetabular Labrum → acts as a 'lip'. Deepens the articulation of the hip joint, allowing the acetabulum to more of the femoral head.

2. Transverse Acetabular Ligament → bridges the articular notch and attaches the two inferior horns of the acetabulum.

3. Acetabular Fat Pad → Covering the acetabular fossa. The fat pad is covered with a layer of synovial membrane.

4. Ligamentum Teres → attaches the fovea capitis (of the femoral head) to the labrum, inferior horns of the acetabulum, transverse acetabular ligament. Sits inside the acetabulum. Supplied by the branch of obturator artery

Femoral Head

- Lined by hyaline cartilage. Articular Margin of the head of the femur is where the synovial membrane attaches
- Fovea Capitis (the origination of ligamentum Teres)

Femoral Neck
- Acts as a strut to increase ROM and leverage of muscle

Synovial Membrane
- Surrounds coxofemoral joint by attaching the articular margin of the head of the femur and the articular margin of acetabulum (articular margin is superficial and lateral to the acetabular labrum).

5 Features of all Synovial Joint
1. Hyaline Cartilage → offers smooth surface so that the articular surfaces can rub together. When the hyaline cartilage wears away, arthritis appears.

2. Synovial Membrane → produces synovial fluid

3. Synovial Fluid → fills joint cavity and acts as the lubricant

4. Joint Cavity → safe between bones. Allows synovial joints to have an extended ROM.

5. Capsule and Ligaments → Surrounds the whole joint and helps attach the two bones together.

Capsular Ligaments of the Hip Joint (Named as they are thickenings of the hip-joint capsule)

1. Iliofemoral (IF)	- 'Y' shaped - strongest of the capsular ligament - (Anteriorly) Attaches the iliac bone to inter-trochanteric line of the femur. Function → Prevents posterior extension of the trunk due to LOG lying posteriorly and limits extension at 10-15 degrees. And also limits extension of the leg.
2. Ischiofemoral (ISF)	- attaches between the pubic bone and neck of the femur
3. Pubofemoral (PF)	** Doesn't attach to the inter-trochanteric crest.

- LOG runs posterior to hip joint, therefore there is a natural tendency for the trunk to roll posteriorly. To combat this, there is iliofemoral ligament. It prevents the trunk rolling posteriorly.

Stability at the Hip Joint
1. Congruency → how well the two articulating surfaces fit together and the amount of contact between the two articulating surfaces.
2. Strong Ligamentous Support → #3 main ligaments of the hip joint = Iliofemoral,

Pubofemoral and Ischiofemoral.

Close Packed Position
- Bones are at the most congruent and the principal ligaments are under maximum tension. However, this is not the case with the hip. There are different positions for congruency and the closed-pack position for the hip.

1. Closed-pack position of the hip joint → extension and medial rotation. This is so because the stabilising ligaments come under maximum tension. Ligaments tighten up due to the spiral arrangement of the fibres. Ischiofemoral ligaments' fibres tightens up during medial rotation.

2. Most congruent position → when the hip is flexed, abducted and laterally rotated (e.g. sitting on a horse). Head of femur and lunate surface of the acetabulum have greatest contact.

3. Least Stable Position → Flexed, adducted and laterally rotated (similar to sitting cross-legged)