

THE HIP JOINT

- Hip joint is surrounded by proximal parts of the thigh musculature and gluteal region.
- Like the shoulder joint, the hip joint is:
 - Ball and socket
 - Synovial joint
- Lower limb must be mobile & weight bearing (Δ must also be stable)
- Δ hip joint compromises some mobility for stability
- *Articular surfaces:*
 - Acetabulum (of innominate)
 - Head of femur

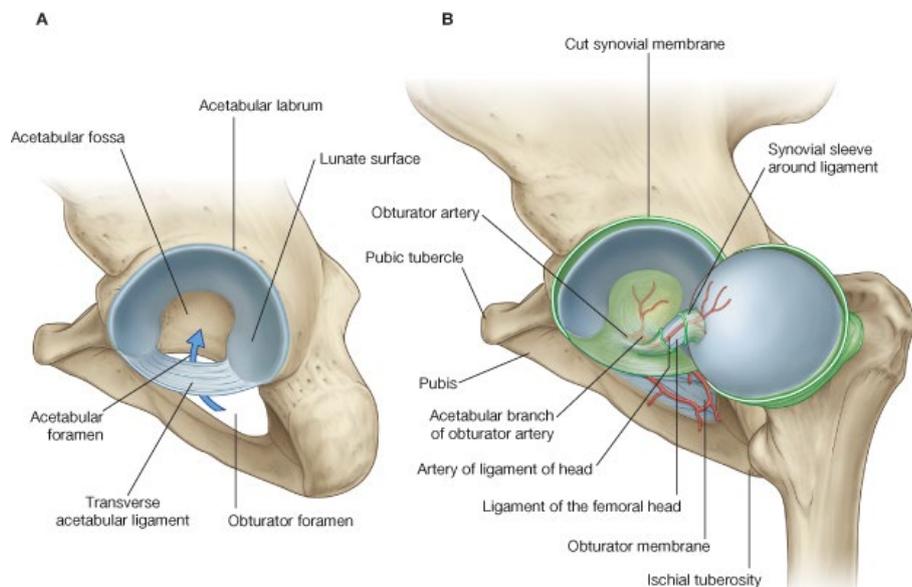
Head of the femur

- **Head of the femur** is spherical and covered with articular cartilage
- Circumference of femoral neck < femoral head
- (contrast: circumference of humerus anatomical neck > humerus head)
- Δ femoral neck is +susceptible to fracture
- Centre of femoral head is a small pit – dotted with several holes in dry specimen, through which nutrient arteries enter to supply the bone.



Acetabulum

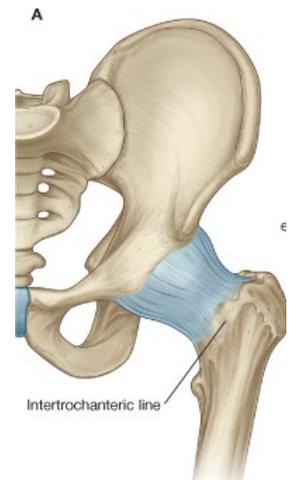
- Formed from ilium, pubis & ischium
- Ossification of the triradiate cartilage separating these bones is complete by the end of puberty.
- **Labrum acetabulare** is a fibrocartilaginous rim which surrounds the acetabulum, deepening it.
- Near the obturator foramen, the acetabulum is deficient – forming the **acetabular notch**.
- In the region of the acetabular notch, the circle of the labrum is completed by the **transverse ligament**.



- Branch of the obturator artery – the **artery of the ligament of the head of the femur** - supplies nutrition to the femoral head by passing through the acetabular notch.
- This artery travels beneath the transverse ligament to the pit of the femoral head (fovea).
- It is surrounded by condensation of fibrous tissue – the **ligament of the head of the femur**
- This ligament has no role in strengthening the hip joint

Fibrous capsule of the hip joint:

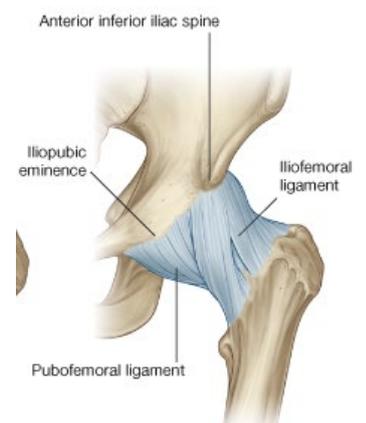
- Very strong – responsible for much of hip joint strength.
- Fibres pass from:
 - Circumference of acetabulum
 - → femoral neck
- On the front it passes to intertrochanteric line
- On the back it passes half-way to the intertrochanteric crest
- Some fibres pass in circular fashion around the capsule – band called the **zona orbicularis**.



- Fibrous capsule is strengthened at several points to form ligaments:

➤ Front of capsule: **iliofemoral ligament**

- Proximal insertion: anterior inferior iliac spine + labrum
- Distal insertion: intertrochanteric line on front of femur
- Centre of ligament is thin – gives an inverted 'Y' thickened region
- One of strongest ligaments in body.



➤ Lower capsule: **pubofemoral ligament**

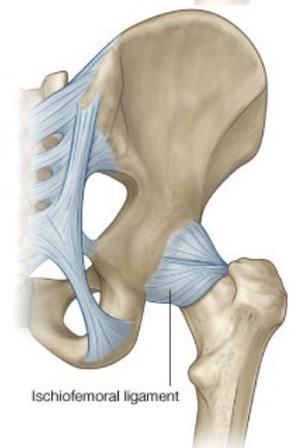
- Proximal insertion: pubic bone
- Distal insertion: lowermost part of intertrochanteric line

➤ Back of capsule: **ischiofemoral ligament**

- Not as strong
- Proximal insertion: ischium below the acetabulum
- Distal insertion: neck of femur

➤ **Retinacular fibres** run from where the capsule inserts into neck of femur → to the head.

➤ Retinacular fibres provide support to blood vessels (like the ligament of the head of the femur).



BLOOD SUPPLY TO THE FEMORAL HEAD & NECK:

- Most blood supply to femoral head and neck comes from:
 - **Medial & lateral circumflex arteries** (from profunda femoris)
- Also a contribution from:
 - **Superior gluteal artery**
 - **Inferior gluteal artery**

- **1st perforator of profunda femoris**
- Form 2 anastomosis:
 - **Trochanteric anastomosis**
 - **Cruciate anastomosis**
- Retinacular fibres protect these vessels as they pass along the femoral neck.
- They enter the bone at various points along the neck.
- Also some blood supply from:
 - **Artery of the ligament of the head of the femur**
- This is a branch of the **obturator artery** which passes through acetabular notch/foramen, deep to the transverse ligament, protected by the ligament of the head of the femur.
- Artery of the ligament of the head of the femur passes to the femoral head where it supplies the bone – producing the pit (fovea) & foramen in the head of the femur.

HIP JOINT 3

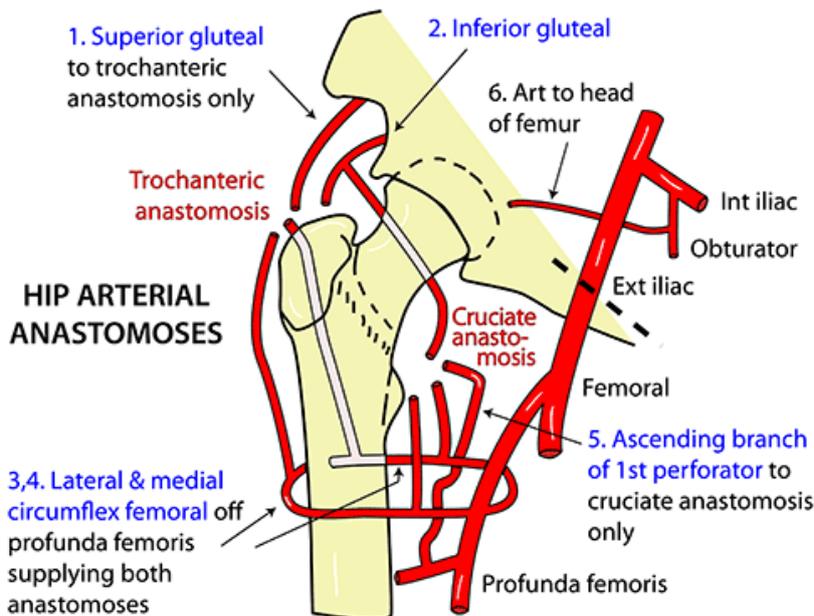
CAPSULE

Strong ++

Anterior: Covers whole neck to intertrochanteric line

Posterior: Covers neck half way to intertrochanteric crest

Reflects: Back as retinaculum which carries the blood supply



HIP ARTERIAL ANASTOMOSES

2 ANASTOMOSES

Trochanteric (at greater trochanter):

Descending superior gluteal

Inferior gluteal

Ascending branches of medial & lateral circumflex femoral

Cruciate (at lesser trochanter):

Transverse branches of medial & lateral circumflex femoral

Descending branch of inferior gluteal

Ascending branch of 1st perforating artery

Mnemonic:

Upper anastomosis does not receive branch from lowest artery,

lower anastomosis does not receive branch from highest artery.

Most blood to femoral head = external iliac

Artery of ligament of head of femur = obturator (internal iliac)

Synovial membrane of the hip joint:

- SM lines non-articular surfaces of the hip joint (see green in above diagram):
 - Lines the capsule
 - Covers fat-pad in central deep part of acetabulum
 - Gives tubular investment to ligament of the head of the femur

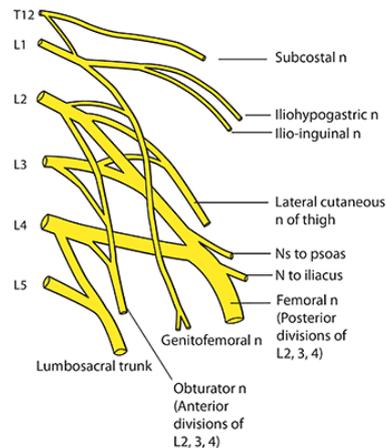
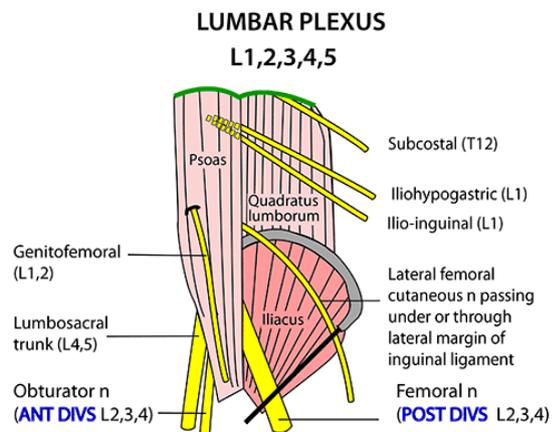
What gives the hip joint strength and stability?

- Deep **labrum acetabulare** – keeps femoral head in the acetabulum
- **Ligaments (ileofem, pubofem, ischiofem)** surrounding the joint
- **Surrounding muscle mass**, pulling the head of femur into the acetabulum (gluteal, ileopsoas)
- **Oblique neck of femur** – stops dislocation on standing up, as force is transmitted to the acetabulum.

NERVES AROUND HIP:

LUMBAR PLEXUS: L1,2,3,4,5

- **Iliohypogastric (L1)**
- **Ilioinguinal (L1)**
- **Lateral femoral cutaneous nerve**
- **Genitofemoral (L1,2)**
- **Anterior L2,3,4 = obturator**
- **Posterior L2,3,4 = femoral**
- **Lumbosacral trunk (L4,5)**



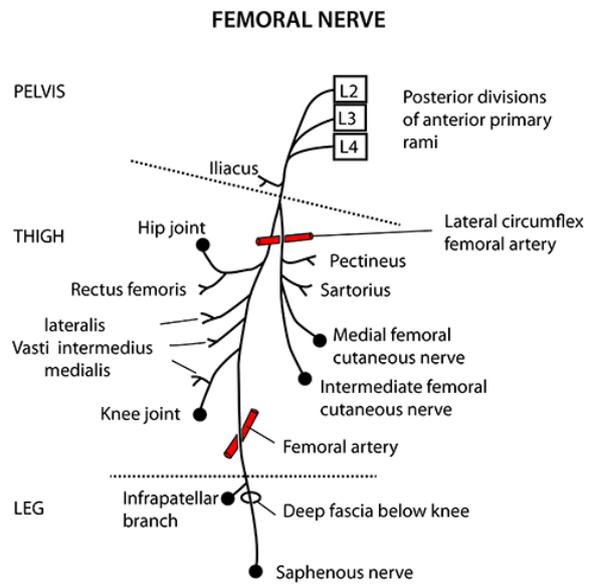
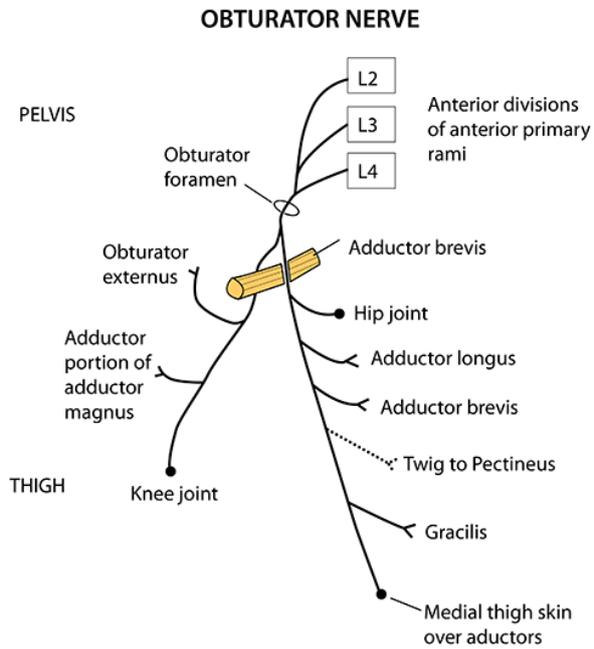
OBTURATOR NERVE: L2,3,4 ant div

- **Anterior + posterior divisions** around adductor brevis
- **Supply adductors of hip (except pectineus)**
- **Skin over medial thigh**

FEMORAL NERVE: L2,3,4 post div

- Splits around lateral circumflex femoral artery
- **Iliopsoas**
- **Quadriceps femoris**
- **Pectineus (adductor)**
- **Sartorius**

- **Medial + intermediate femoral cutaneous nerves**
- **Goes on to form saphenous nerve**



LUMBOSACRAL PLEXUS: L4,5 + S1,2,3,4,5

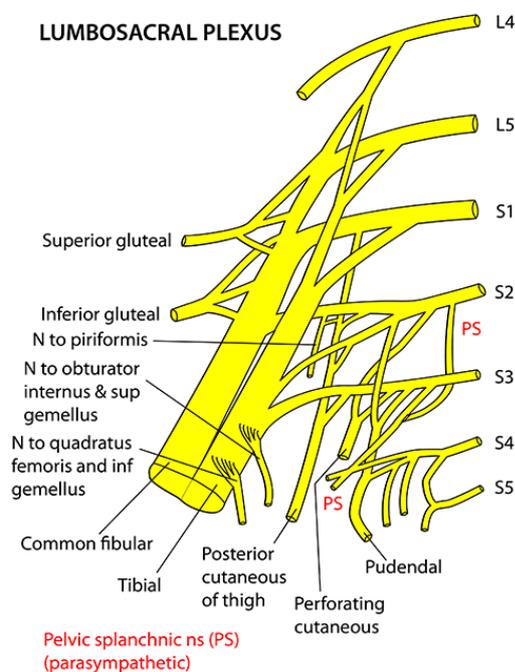
- 6 branches (6Ps)
- Anterior division
 - o Lateral rotator muscles
 - Nerve to quadrator femoris
 - Nerve to obturator internus
 - o Tibial division of sciatic nerve
- Posterior division
 - o Superior + inferior gluteal nerves
 - o Common fibular division of sciatic nerve

SACRAL PLEXUS

L4,5,S1,2,3,4,5

Lies on piriformis on posterior wall of pelvis, deep to the vessels & covered by parietal pelvic fascia

LUMBOSACRAL PLEXUS



6 BRANCHES OFF THE SACRAL ROOTS BEFORE THEY DIVIDE INTO ANTERIOR & POSTERIOR DIVISIONS

They all begin with the letter "P"

1. Posterior femoral cutaneous nerve (S1,2,3)
2. Pudendal nerve (S2,3,4)
 - (1 & 2 - leave via greater sciatic foramen)
3. Perforating cutaneous nerve (S2,3)
 - (3 - perforates sacrotuberous ligament)
4. Nerve to piriformis (S1,2)
5. Perineal branch of S4 (to levator ani)
6. Pelvic splanchnics (S2,3,4)
 - Parasympathetic motor to bladder, hind gut, erection.
 - Sensory for distension & pain of bladder, lower uterus, lower colon & rectum
 - (4,5,6 - all remain in pelvis)

FROM ANTERIOR DIVISIONS

- Nerve to quadratus femoris (L4,5,S1)
- Nerve to obturator internus (L5,S1,2)
- Tibial portion of sciatic nerve (L4,5,S1,2,3) (see sciatic nerve in leg section)

FROM POSTERIOR DIVISIONS

- Superior gluteal (L4,5,S1)
- Inferior gluteal (L5,S1,2)
- Common fibular portion of sciatic nerve (L4,5,S1,2) (see sciatic nerve in leg section)

Pelvic splanchnic ns (PS)
(parasympathetic)

NOTES ON SACRAL PLEXUS AND SCIATIC NERVE

There are six nerves that arise from the roots
of the sacral plexus that have the letter "P"

Piriformis, nerve to:	S1,2	Remains in pelvis to supply this muscle
Posterior femoral cutaneous nerve:	S1,2,3	Leaves pelvis via greater sciatic foramen
Perforating cutaneous nerve:	S2,3	Leaves pelvis via greater sciatic foramen
Pudendal nerve:	S2,3,4	Leaves pelvis via greater sciatic foramen
Pelvic splanchnic (parasympathetic) nerves:	S2,3,4	Remains in pelvis to supply pelvic organs
Perineal branch of S4:	S4	Remains in pelvis to supply levator ani

3 nerves remain in the pelvis & 3 exit via the greater sciatic foramen

SCIATIC NERVE

Anterior division

Tibial to flexors (L4,5,S1,2,3)
Nerve to obturator internus (L5,S1,2)
Nerve to quadratus femoris (L4,5,S1)

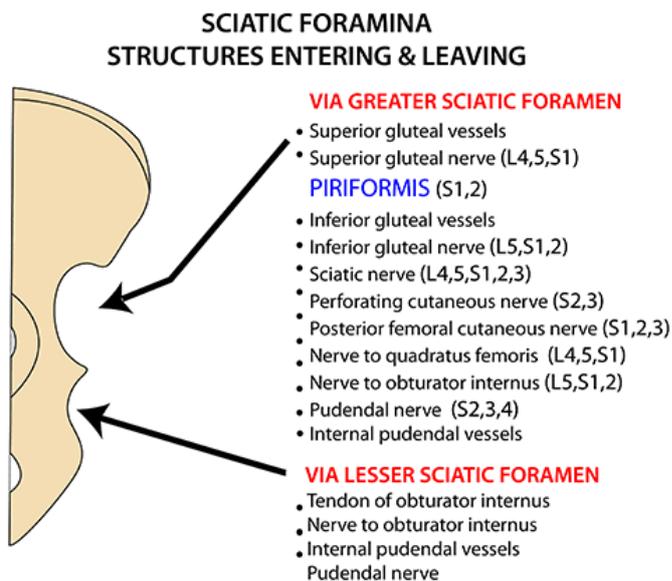
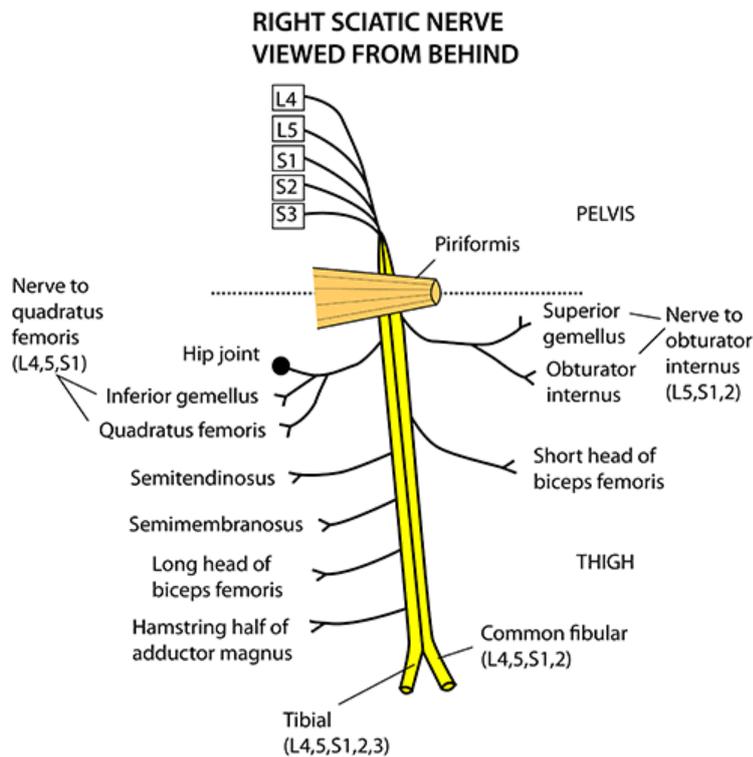
Posterior division

Common fibular to extensors
Superior gluteal (L4,5,S1)
Inferior gluteal (L5,S1,2)

SCIATIC NERVE: L4,5 + S1,2,3

Arises from lumbosacral plexus

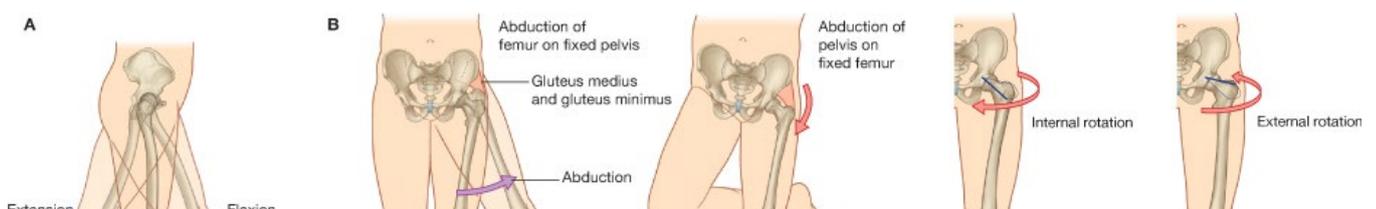
- **Posterior compartment of thigh (knee flexors):**
 - **Biceps femoris**
 - **Semitendinosus**
 - **Semimembranosus**
 - **Lowermost part of adductor magnus**
- Most of it is tibial branch
- Common fibular part does:
 - Short head of biceps femoris



Obturator internus + pudendal stuff goes out the greater sciatic foramen and back in through lesser sciatic foramen (+ pudendal stuff which has just left the greater sciatic foramen)

MOVEMENT OF THE FEMUR:

- At the hip joint, the femur can:
 - Extend
 - Flex
 - Abduct
 - Adduct
 - Circumduction (combination of the above)
 - Lateral & medial rotation (in the long axis)



- **Flexion** : full flexion brings the knee up to the abdomen
 - Action of **iliopsoas** muscle
- **Extension** of the hip joint is limited by the iliofemoral ligament
 - Action of the **gluteus maximus**
- **Abduction**: not often used, but the muscles of abduction are important in stabilising the leg when walking / standing on one leg:
 - Action of **gluteus medius & minimus**
- **Adduction**:
 - Hip can be adducted so one leg crosses over the other
 - Adductor muscles pull trunk over the stance leg when walking
 - Action of muscles on inside of thigh
- **Lateral rotation**:
 - Action of small lateral rotators on back of hip joint
- **Medial rotation**:
 - Limited by spiralling of fibres of capsule during this movement.
 - Action of **anterior fibres of gluteus medius & minimus** (the stabilisers of the femur).
 - Action of **iliopsoas** when the thigh is flexed.
 - Action of **tensor fasciae latae**
 - (Adductor group also assists in medial rotation)

IMPORTANT STRUCTURES SURROUNDING THE HIP JOINT:

- Hip joint is surrounded by muscle
- In front: **femoral artery & femoral nerve**
- Behind: **sciatic nerve**

APPLIED ANATOMY OF THE HIP JOINT:

- Hip joint + proximal femur are often involved in injury & bone disease.

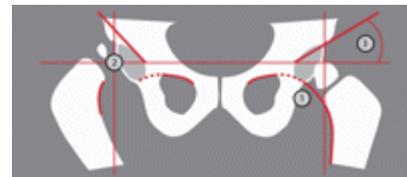
CDH

- Congenital dislocation of hip joints at birth – known as **CDH**

- Tested at birth by abducting the flexed leg of the baby
- If CDH, audible “click” as head slips into socket on abduction.

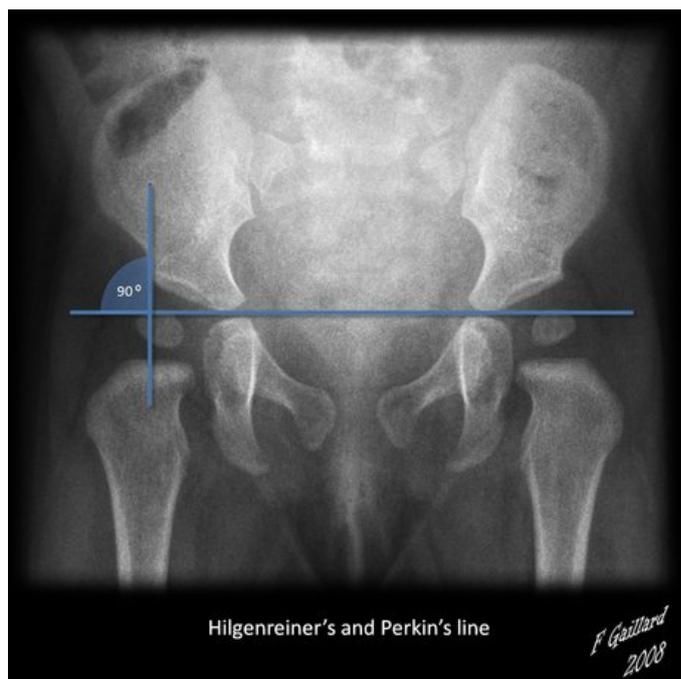
Determining CDH on radiograph before epiphysis has formed:

- Head of femur is cartilaginous in 1st year of life Δ doesn't appear on radiographs
- But can detect a CDH joint by drawing **Shenton's line** on a radiograph.
- Shenton's line:
 - Upper border of obturator foramen
 - \rightarrow lower border of neck of femur
- Normally a direct, uninterrupted curved line
- In CDH the line is broken



Determining CDH on radiograph after epiphysis has formed:

- Epiphysis of head of femur appears by age of 1 year – but is small & slow to appear if CDH.
- By 9 months, when epiphysis has appeared, CDH is determined on radiograph by drawing **Perkin's lines**:
 - One line: horizontally through centres of acetabulae
 - Two lines: vertically at outer lip of acetabulae
- Normal: epiphysis for head of femur lies *below horizontal and internal to vertical lines*
- CDH: epiphysis of femoral head is displaced *upwards and outwards*.



Perthes' disease:

- Bony degeneration of head of femur
- Occurs between ages of 5-10 years
- Perhaps due to trauma interrupting blood supply to growing head
- Usually degeneration is followed by recovery
- Treatment: hold hip in rested position & await recovery

Slipped epiphysis:

- Between age of 10-15 years, head of the femur has not yet fused with the shaft
- If child falls during this time, they may fracture the femur across the growth disc.

- Called a slipped epiphysis
- If not replaced, union will result in deformed femoral head & neck, and osteoarthritis later in life.

Old age:

- Fractures dominate in:
 - Femoral neck
 - Intertrochanteric region
- Fracture across femoral neck can disrupt blood supply to femoral head – head dies and becomes necrotic.
- Fractures of the above regions are often fixed with metal pins / plates

- **Osteoarthritic disease** is often seen on radiographs of older people:
 - Loss of joint space (due to loss of articular cartilage)
 - Osteophytes – irregular/spiked bony margins
 - Change in bone density near articulation.