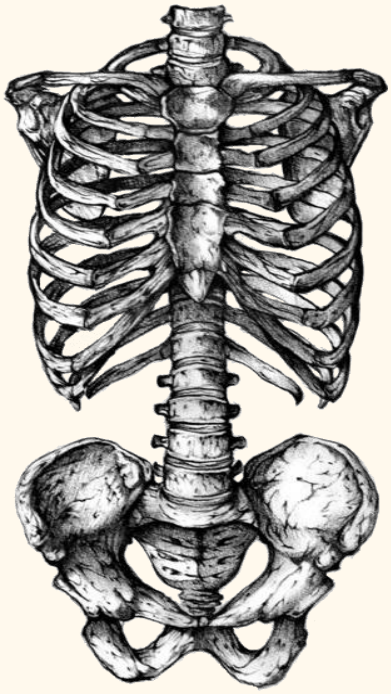
434 Orthopedics Team

L4- Common Pediatric Hip Problems



Source:

Team 433 and doctor note and slide

Done by : Ahlam sallam

Objectives:

- To be able to outline the clinical features; to specify the symptoms and signs; to outline the assessment and investigations; to propose a differential diagnosis and; outline the principles of management of pediatric patient with conditions including Hip Conditions:-
- Slipped Capital Femoral Epiphysis (SCFE)
- Developmental Dysplasia of the Hip (DDH)

Nomenclature:

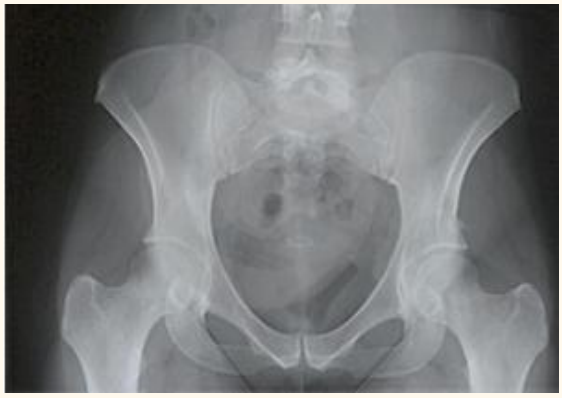
CDH: Congenital Dislocation of the Hip (this is an old name but it's still acceptable to use in the medical filed) →examination there is actual dislocation.

DDH: Developmental Dysplasia of the Hip →examination is normal until baby start to walk

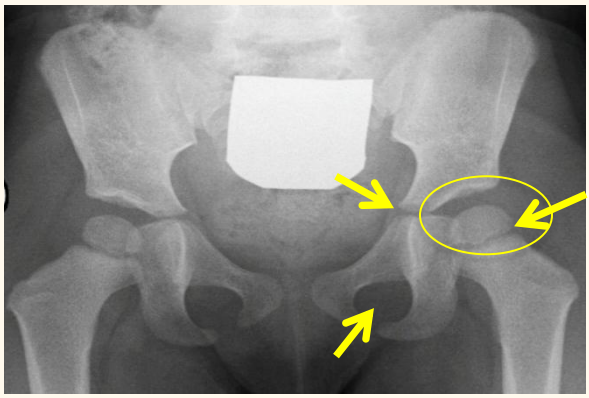
1. Introduction to Pediatric Orthopedics:

Normal Pelvis:

Adult



child



Yellow arrow
*Femoral head ossific nucleus or center immature
*Growth plates

** You can see that there is different in size, the space between the joints and the connection between head of femur to the neck!!

Pediatric Hips Dislocation

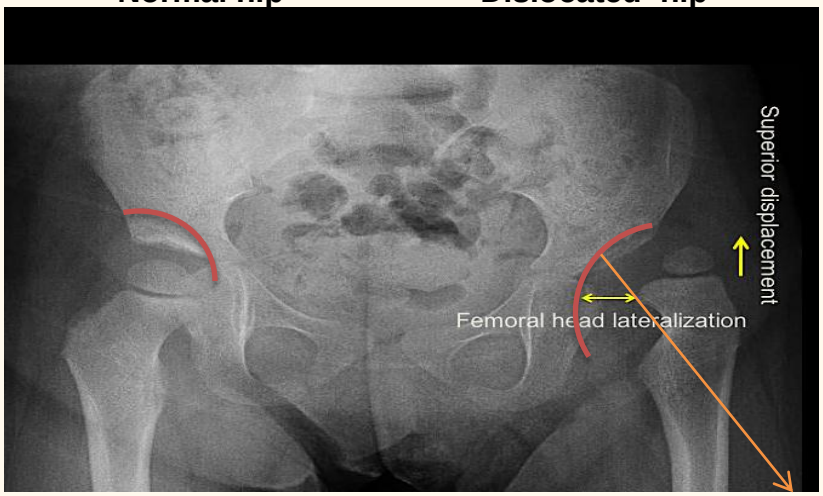
Types:

- **Idiopathic** → isolated pathology **common**
- **Teratologic:**
  - *Neurologic → as: patient with cerebral Palsy or Myelomeningocele (a neural tube defect in which the bones of the spine do not completely form)
  - *Muscular → as: Arthrogryposis
  - *Syndromatic → as: Larsen syndrome (It is a rare skeletal dysplasia characterized by congenital dislocation of large joints, foot deformities, cervical spine dysplasia, scoliosis, spatula-shaped distal phalanges and distinctive craniofacial abnormalities, including cleft palate)
- **Miscellaneous:**
  - *Complication to hip septic arthritis **(femoral head dislocate due pus pushing)**
  - *Traumatic (dash board injury)

*Note: delivery in its self (OBGY Dr.) does not dislocate a hip.

- Teratologic usually in the 1st trimester.
- DDH occurs in the 3rd trimester.

Normal hip **Dislocated hip**



DDH pathology is of 2 components:

1- Femoral head position **(The yellow arrows)**
2- Acetabular development **(The red lines)**

X-Ray Note:

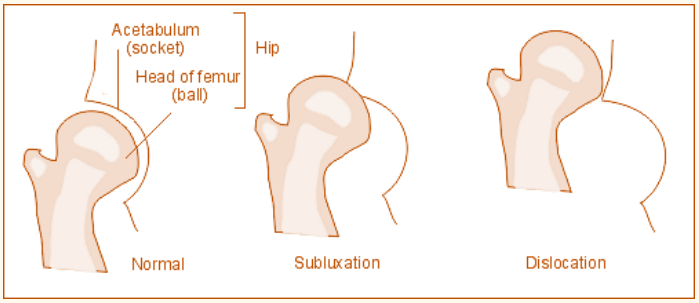
- The head of femur is not articulating/attached to the acetabulum
- The acetabulum is shallow (dysplastic acetabulum) not curved (cannot hold the head).

What is DDH?

DDH describes a spectrum of conditions related to the development of the hip in infants and young Children. It encompasses abnormal development of the acetabulum and proximal femur and Mechanical instability of the hip joint. (It's the relationship between the acetabulum and the head of femur NOT like the SCFE epiphysis and the neck of femur)

✓ DDH is not due to an injury during delivery (not congenital) because even when there is an insult of any kind, it will cause fracture before causing dislocation.

Patterns of Disease:



1- Dislocated: There is a complete loss of contact between the femoral head and the acetabulum.
2- Dislocatable: high risk of dislocation. The femoral head is reduced (i.e. within the Acetabulum) at rest, but can dislocate in other positions [ex: walking] or with examination maneuvers. This is a hip with instability.
3- Sublaxated: The femoral head is partially outside of the acetabulum but remains in contact
4- . Acetabular Dysplasia: The acetabulum is shallow and "dish shaped" rather than "cup Shaped". The upper portion (roof) of the acetabulum is obliquely inclined outward rather than having the normal horizontal orientation.

MCQ

Causes: → (Multi-focal, but mostly UNKNOWN)

Normal hip joint development depends upon normal contact between the acetabulum and the femoral head promoting mutual induction. Abnormal development is a result of abnormal contact, which may result from multiple factors, which are as follow:

- **Hormonal:**

✓ Relaxin: (Is secreted during the 3rd trimester to relax the Sacroiliac joint & symphysis pubis leading to enlargement of the pelvis. However, a Female fetus also has Receptors to relaxin>> this will lead to widening of the hip joint capsule>> pushing femoral head up & thus, it is more Common in girls than in boys!)

✓ Oxytocin

- **Familial**: Ligament Laxity disease.

- **Genetics:** Female x4-6 and twins é 40%.

- **Mechanical cause : (in osce can come as history station slide 4 and 5)**

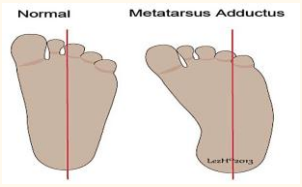
Pre-Natal: * Breach , *Oligohydrominus (=Low Amniotic Fluid Index), *Primigravida (= first pregnancy) , Twins: 1-torticollis (a twisted neck in which the head is tipped in on side. When you find Torticollis you need to check the hip, femur and foot deformity and neck deformity), 2- Metatarsus Adductus.

- ✓ **Q: How do these factors cause DDH?** By the 11th week of gestation, the hip joint is fully formed. The femoral Head is spherical and deeply set within the acetabulum. However, the femoral head grows at a faster rate than the acetabulum, so that by the end of gestation the femoral head is less than 50 percent covered by the acetabular roof. During the final four weeks of gestation, the hip is vulnerable to mechanical forces, such as adduction, that direct the femoral head away from the central portion of the acetabulum . Conditions that limit fetal mobility, including breech positioning, accentuate these mechanical forces. This results in eccentric contact between the femoral head and the acetabulum.

Post-Natal: Swaddling, Strapping: ligamentous laxity at that age makes the developing hip

- ✓ susceptible to other external mechanical forces. Positioning with the hips extended (e.g., swaddling) can result in eccentric hip joint contact as the femoral head glides within or moves outside of the acetabulum.

Torticollis



Metatarsus Adductus

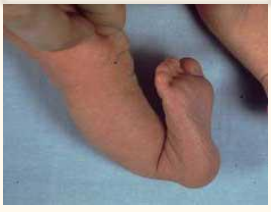

Swaddling


This's healthier

High Risk Infants:

- ✓ Parents who are relatives (consanguinity)
- ✓ Positive family history: x10
- ✓ 1ST child
- ✓ Breach presentation: x5-10
- ✓ Oligohydrominus
- ✓ twins: 40%(IVF increase the risk of multiple parity)
- ✓ A baby girl: x4-6 (Apley's say it's x7)
- ✓ Torticollis: CDH in 10-20% of cases
- ✓ Foot deformities:
  *Calcaneo-valgus
  *Metatarsus adductus

Calcaneo-valgus foot



hyper-extension of the knee

- ✓ Knee deformities:
  *hyper-extension and dislocation

When risk factors are present, the infant should be reviewed:
1- Clinically 2- Radiologically

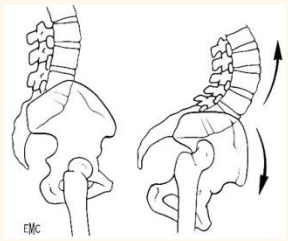
An observant mother would come to you saying that she noticed one of the following on her baby:

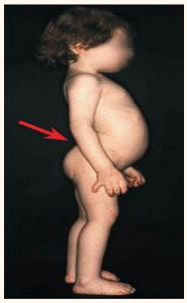
- ✓ Legs of different lengths.
- ✓ Uneven skin folds on the thigh.
- ✓ Less mobility or flexibility on one side
- ✓ Limping, toe walking, or a waddling, duck-like gait

*Difficulty in applying the diaper because of limited abduction.

Clinical Examination:

- ✓ Before starting the examination, make sure that the infant is:
  Quiet, In NO pain, Comfortable.





1st: Look: (Anterior and posterior)

- ✓ External rotation of the leg.
- ✓ Lateralized contour.
- ✓ Shortening of the leg (if unilateral DDH)
- ✓ Asymmetrical skin folds (if unilateral DDH)
- ✓ Abnormally wide perineal gap (if **Bi**lateral dislocation)
- ✓ Lumber lordosis (if have 6 weeks baby in clinic and doctor ask what positive physical signs of DDH do not say lumber lordosis unless the child walk and standing say the other sign

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*Contrary to popular belief, late walking is not a marked feature; nevertheless, in children who do not walk by 18 months dislocation must be

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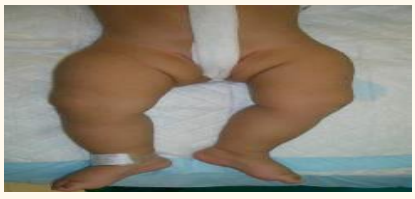
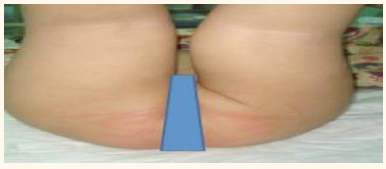
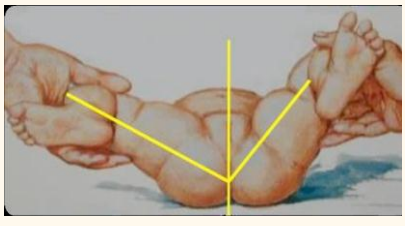
*** Most accurate way is:** to check the buttock creases, if it is asymmetrical it highly suggests DDH.





2nd: Move:
-Limited abduction



MCQ

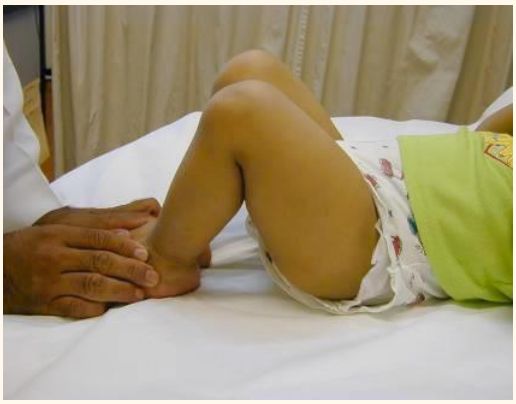
3rd: Special test :(depending on the age):

- Galiazzi sign →(test assess what is the shorter femur or tibia it could be combination confirmed by x-ray)
- **Ortolani and Barlow test** → only till 4-6 m of age (you can't do it for babies older than 6 month!!)
- Hamstring Stretch test→ (Hamstring muscle origin from iscial tuberosity to upper boarder of the tibia cross to joint and take the stability from the whole length flex your hip 90 degree and knee 90 degree there normal tension but in positive test no tension feel so for reach maximum tension I will reach full extension)

- **Trendelenburg Test** → In walking-aged children with unilateral DDH
- Limping:

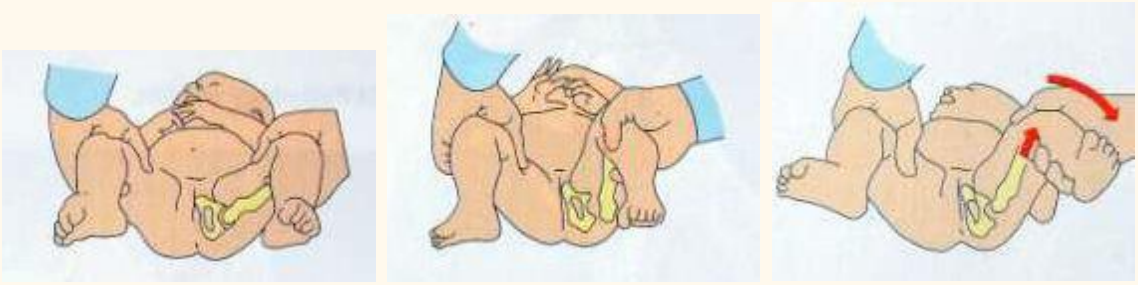
  *Unilateral → one sided limping
  *Bilateral → waddling gait (Trendelenburg gait)

1. Galiazzi Sign: It is performed by flexing the infant's knees when he is lying down so that the feet touch the surface and the ankles touch the buttocks. If the knees are not level then the test is positive indicating a potential congenital hip malformation



2. Ortolani Test: "for dislocated hip only"

The baby's thighs are held with the thumbs medially and the fingers resting on the greater trochanters; the hips are flexed to 90 degrees and gently **abducted**. Normally there is smooth abduction to almost 90 degrees. In congenital dislocation the movement is usually impeded, but if pressure is applied to the greater trochanter there is a soft 'clunk' as the dislocation reduces, and then the hip abducts fully (the '**jerk of entry**'). If abduction stops halfway and there is no jerk of entry, there may be an irreducible dislocation.

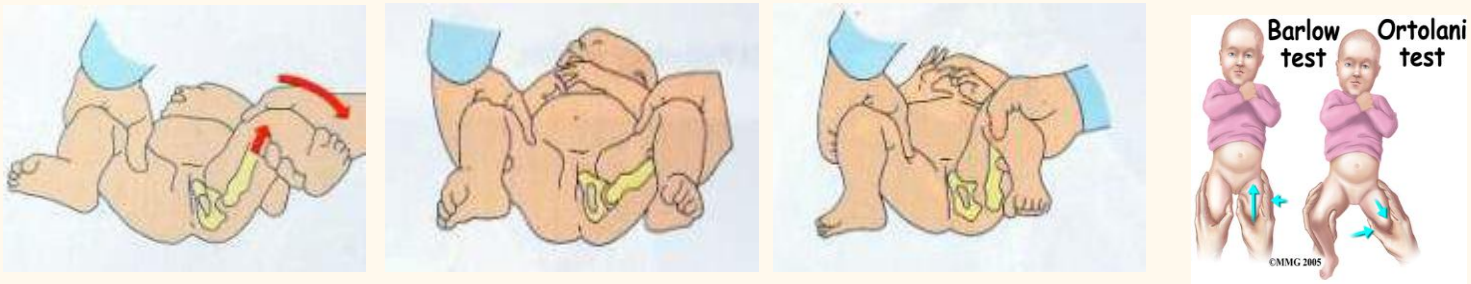


3. Barlow Test: "for dislocatable hip"

∗Examiner's thumb is placed in the groin.

∗Pull and **adduct**

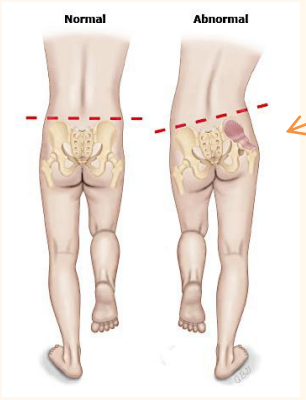
∗ **if the hip can be popped out of socket with this maneuver - the test is considered positive**



4. Trendelenburgh's Test:

Inability to maintain the pelvis horizontally while standing on the ipsilateral leg.

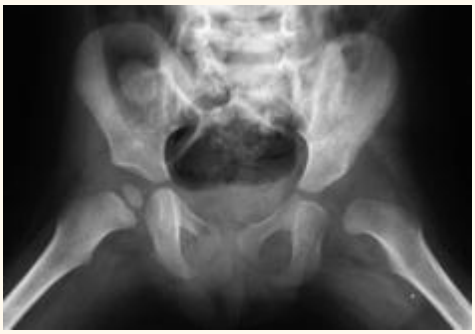
Normally, the pelvis stays level when a patient stands on one leg. When standing on the affected leg, the pelvis tilts downward toward the unaffected side (as pictured in the abnormal patient above) because of gluteal muscle weakness on the affected side (right side in abnormal patient above).



Physical Examination of DDH:

https://www.youtube.com/watch?v=FJgj2-

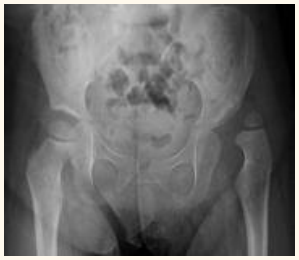
Investigations

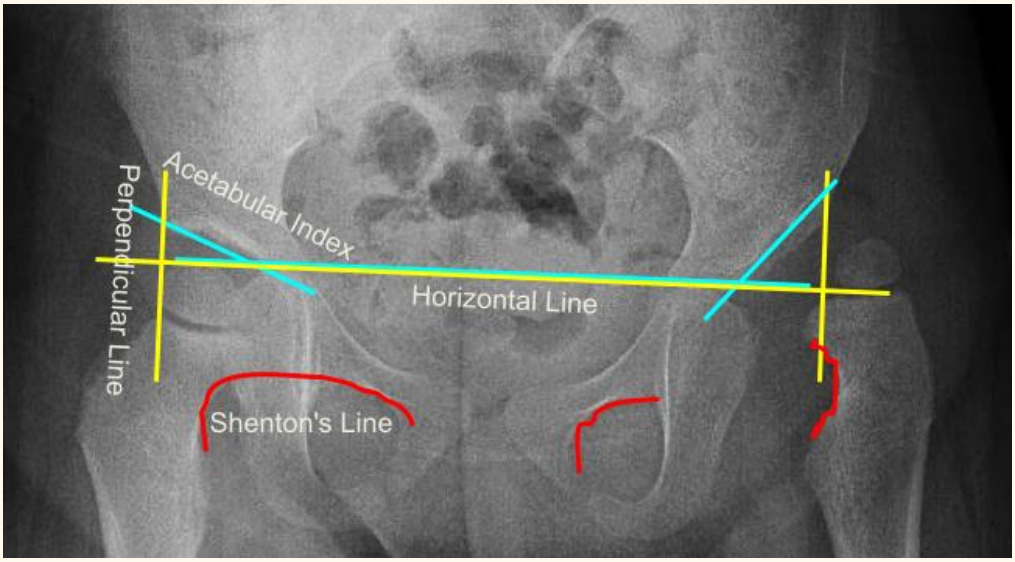
Age	Age 3 weeks -3 months old	> 3months old	> 6 months
Method of choice	**U/S**	**X-Ray** Pelvis AP + Abduction	**X-Ray**
Why/Why not?	*X-Ray is not used for this age; Because the acetabulum & femoral head are largely (or entirely) cartilaginous and therefore not visible on x-ray. *We do X-Ray after 3 weeks to give time to the body to get rid of the Relaxin hormone. it will be truly positive or truly negative.	Abduction View 	*Is when ossification centers normally appears (5-6m) of age *If delayed or did not appear it's one of the signs of DDH.

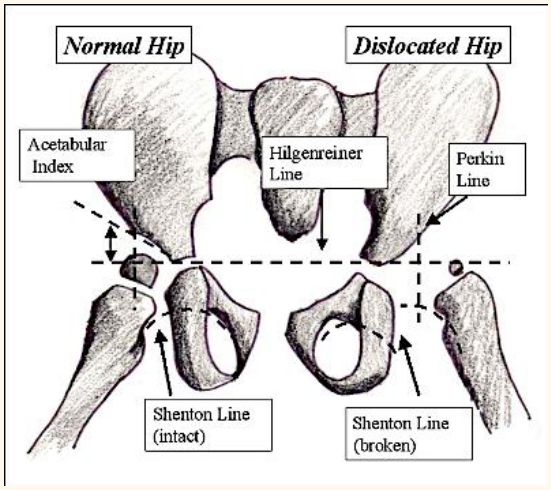
Radiology:

Five radiological signs of DDH: (See the next page for further explanation)

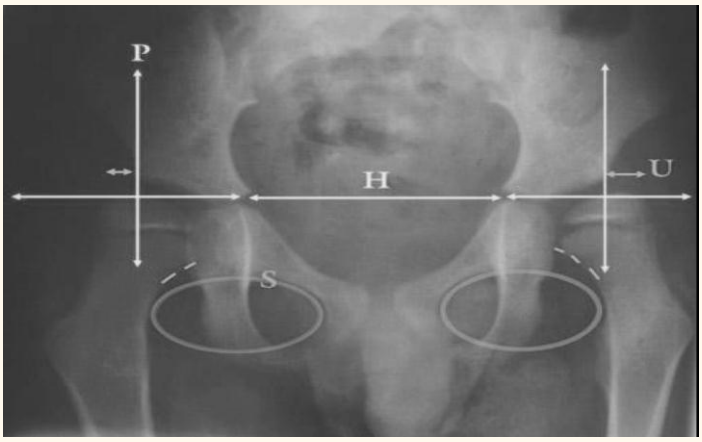
- Disrupted Shenton's line
- Wide acetabulum angel on Hilgeniner's line
- Shallow acetabulum
- Head of femur located on the top outer quadrant when Perkin's line is drawn
- Ossification center/head of femur is smaller than the one in the other limb.







- Red: **Shenton Line** (disrupted in DDH) {MOST important ONE}
- Blue: **Hilgenreiner's line** (a horizontal line drawn between the two triradiate cartilage centers of the hips defines a horizontal planne and an approximation to flexion axis of the hips). Notice the angle marking the acetabulum.
- Yellow: **Perkin's Line** : it drawns vertically and perpendicular to hilgenreiner's line starts at lateral acetabulum
- Hilgenreiner's Line + Perkin's Line form four quadrants. In normal limb, the head of femur is found in the bottom inner quadrant, unlike the affected limb, where the head is in the top outer quadrant.



*H = a horizontal line drawn between the two triradiate cartilage centers of the hips defines a horizontal planne and an approximation to flexion axis of the hips. Hilgenreiner's Line

* P = a perpendicular line to the horizontal line drawn at the edge of the boney part of the socket (there's more in cartilage that can't be seen). Perkin's Line

*The center of the femoral head ought to be well within the lower inner quadrant of the crossing of those two lines.

*S = an oval that traces the lower pubis contour, ought to smoothly continue on to trace the lower edge of the neck of the femur. Shenton's Line. In this case, Shenton's line is off and discloses that the femur is migrating upward as these shallow hip sockets do not satisfactorily contain the ball in the sockets.

Management:

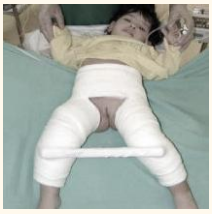
1-Aim:

- **A concentrically, reduced, stable, painless, mobile hip joint:**
- Obtain concentric reduction REDUCE
- Maintain concentric reduction STABELIZE
- In a non-traumatic fashion SAFELY
- Without disrupting the blood supply to
- femoral head (to avoid 2ndry AVascular Necrosis)
- **This is why** →Refer to pediatric orthopedic clinic
- **Parent's educations is of high importance.**

2- Treatment in General:

- Method depends on age.
- The earlier started, the easier, better the results and non operative method
- Should be detected EARLY
- Could be surgical or non-surgical
- **If not treated:** OA, Stiffness, Pain,
  - Limping, Spine problems, Difficult life.

3- Treatment options:



1- Hip Spica (H.S)

- From the nipple to the ankle with an opening to perianal area
- child can only semi-sit

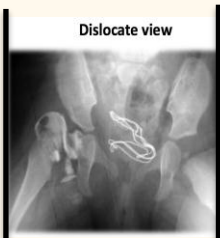
2- Broom Stick Cast (B.S)

- **the child can sit and** walk with it

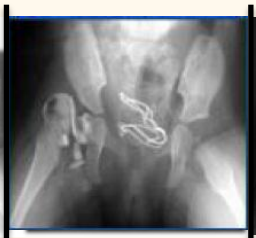
3- Pavlik haris

4Abduction splint

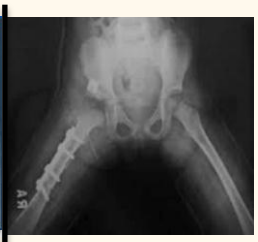
The object of splint-age is to hold the hips somewhat flexed and abducted; extreme positions are avoided and the joints should be allowed some movement in the splint.



5- Hip Arthrogram Guided Reduction



6- Open Reduction & Acetabuloplasty



7- Open Reduction & Acetabuloplas & Femoral Shortening

Maximum to start →6m of age, if older use other method Is kept on for 6w continuous, then use a rigid abduction splint This is to achieve stable reduction. It's a dynamic splint.

Abduction splint it's a rigid splint used to maintain the reduction & wait for improvement of the acetabular cover to be < 30° & with concavity

In open Reduction in babies 3-6 m, the psoas tendon is divided; obstructing tissues (redundant capsule and thickened ligamentum teres) are removed and the hip is reduced.

4- Treatment According To Age:

- **Birth – 6m**
  - In OPD: reduce + maintain with Pavlik harness 6w, then abduction splint
  - In OPD if unreducible: treat as 6-12m
- **6-12 m:**
  - GA + arthrogram closed reduction + H.S 6w, then B.S for months open reduction if not return back.
- **12 - 18 m:(this period have great potential remolding after that it will be low)**
  - GA + open reduction + H.S 6w, then B.S cast for months
- **18 – 24 m:**
  - GA + open reduction + acetabuloplasty (after 18 month) + H.S 6w, B.S 6w
- **2-8 years:**
  - GA + open reduction + acetabuloplasty + femoral shortening + H.S 6w, B.S 6w
- **Above 8 years:**
  - GA +open reduction + acetabuloplasty (advanced) + femoral shortening

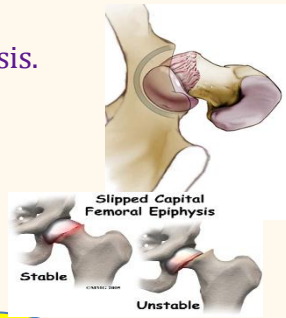
late Complications (If left untreated):

- Severe hip and/or back pain.
- Early hip arthritis
- Leg Length Discrepancy (LLD)
- Pelvic inequality
- Early Lumbar spine degeneration
- Secondary scoliosis

2nd: Slipped Capital Femoral Epiphysis

Where?

- At level of growth plate [Physis] (separating the epiphysis from the metaphysis.
- it is Salter Harrison type 1 fracture (through the growth plate)
- So it is an emergency



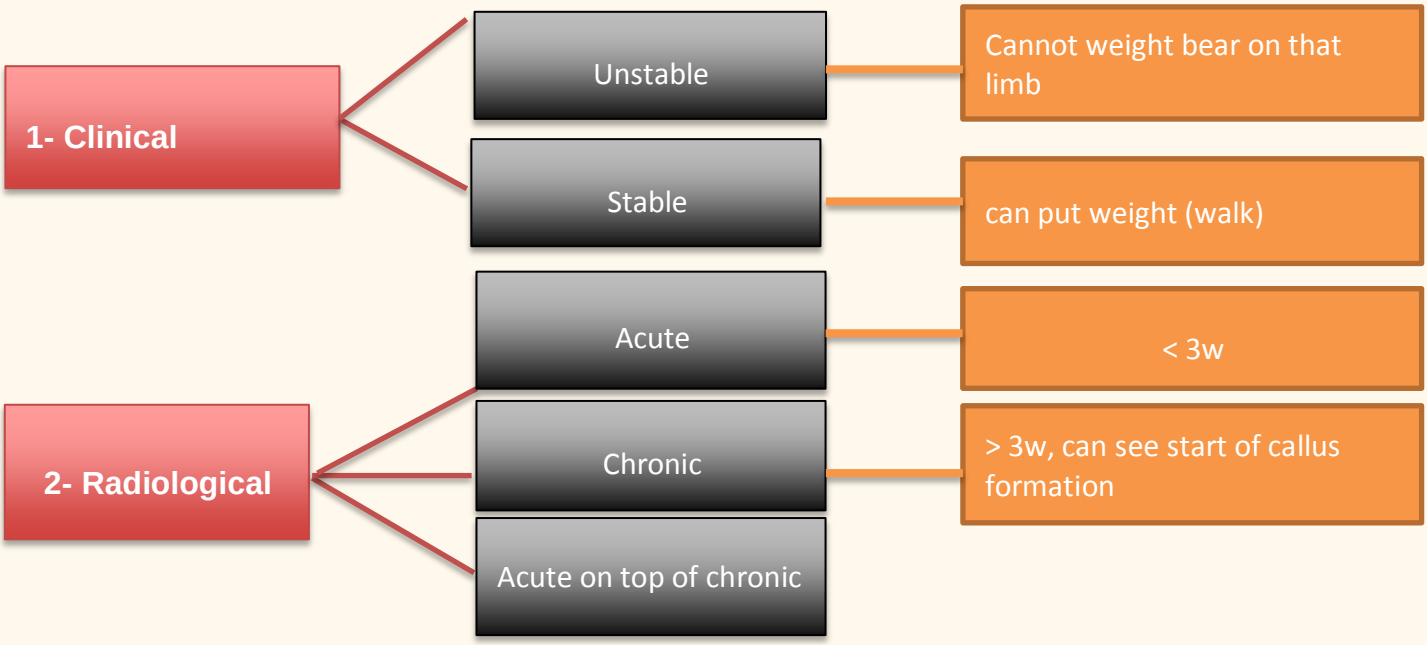
Why(causes) ?

1- Hormonal (hypothyroidism, low growth hormone and hypogonadism)
2- Metabolic (renal osteodystrophy).
3- Mechanical, obesity(usually)!!
4- Trauma (a minor trauma)
5- Unknown

MCQ: in SCFE we should order thyroid and growth and gonad hormone

Whom?

∗**8-12 year old :** In males, obese and black.
∗**20 - 25 %** chance that the other hip will be affected. And even when only one hip is affected, within **18m** the other hip will get affected



Hx:

- **Pain→**hip, anterior thigh, **knee** (radiating through the **obturator nerve** that crosses 2 joints, so with any knee pain, do hip workup)

If the child stops playing, take it **seriously,** because playing is number 1 priority to them

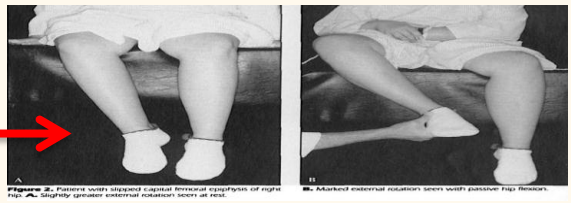
- Duration of C/O (more or less than 3w)
- **Gait →** painful or painless

Limping (painful)

- **Trauma →** Major ? Minor? or no Hx of it ?
- Any known hormonal or metabolic illnesses

PEx:

Hip PEx in ER:



- External Rotation
- With hip flexion the limb goes in **spontaneous external rotation**
- Limited internal rotation & Abduction
- Painful Range of Motion (Usually)
- Painful Limping
- Gait →can or cannot (antalgic) weight bear on affected limb

How can you know if the patient is faking it? If the patient stands on (limp to) the leg that he claims to be the cause of the pain.

- Thigh muscle wasting (disuse): especially in chronic cases (>3 Weeks)

Investigation:

MCQ

1- X-Ray Of Pelvis: AP standing & frog lateral → (ask the patient to external rotate, abduct and flex the hips)

- See the actual slip of the neck
- Positive "Klein Line" (As in Calvin Klein)
- Wide physis →pre slip phase

2- **X-Ray Of Knee:** normal

3- **MRI:** If not clear on X-Ray and still in doubt. It will look like a melted Ice-cream

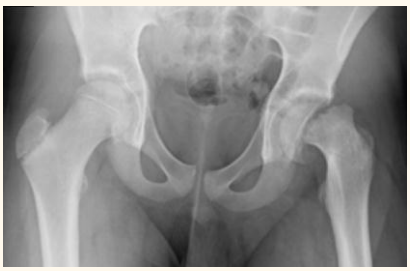
Severity:

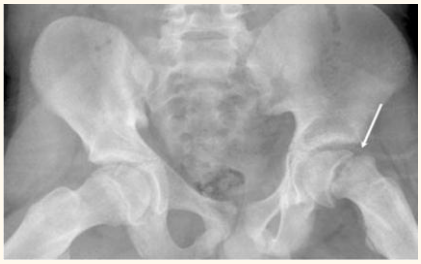
-Depends on degree of slip
-The metaphysis is divided to 3 (1/3)
-The more the slip the worsted the severity.

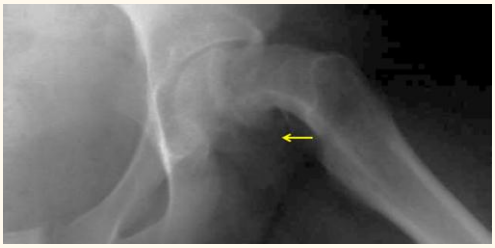
AP View

Frog lateral View

Chronic SCFE



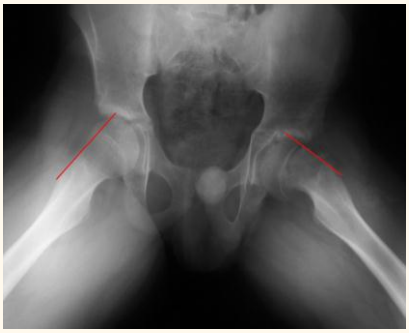


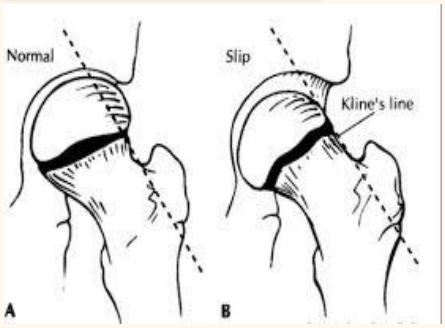


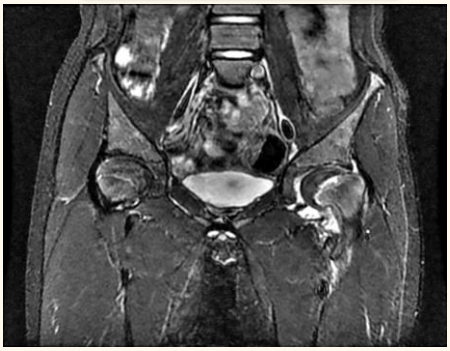
Kline's Line

Kline's Line

MRI







AP view: Left side → x- ray the relation of the acetabulum to epiphysis is maintain but the femoral move due the eternally rotate which move back so we see the lesser trochanter more prominent because it medial became and the greater it disappear back

Kline line: Normally If I draw the along the neck of femur It will cross the epiphysis positive Kline line if not cross the epiphysis or even it cross it the epiphysis but still there different that mean chronic slipping

Treatment

*Refer to orthopedics as emergency case.
*Aim → prevent further slippage & fuse the physis.
Fusion of the growth plates will not usually cause leg length discrepancy, because the growth happens around the knees
*Protected weight bearing for 3-4 weeks then full weight bearing and No sport for 6 months.

1-Acute SCFE:

Emergency **in-situ** paining (no reduction done, if you do you will destroy the growth plate)
*Using 1 or 2 (6mm which is larger than the adult size, to anchor it) screws
*Pin threads pass the physis & stops 5mm before the articular surface to prevent "Chondrolysis"
*Do hormonal essay → if any abnormality refer to endocrine

2- Chronic SCFE:

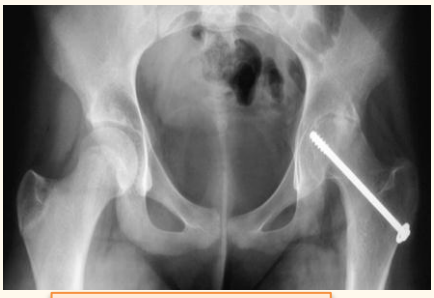
***Salvage corrective osteotomies.**

Complications

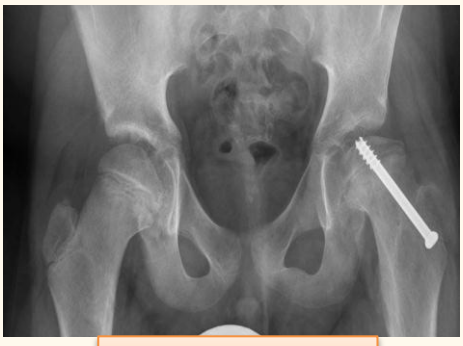
* Chondrolysis →that causes early hip OA
*Femoral AVN
*Stiff hip joint
*Pelvic obliquity
***If not treated**:
- coxa vara
- coxa valga

Late Complications

*Femoral Acetabular Impingement (FAI)
*Premature (early) hip
*Leg Length Discrepancy (LLD)
* Pelvic inequality
*Early Lumbar spine degeneration



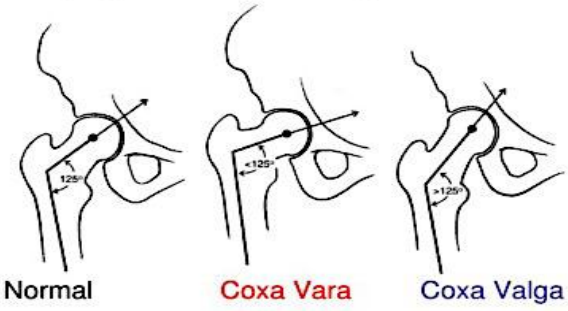
Chondrolysis

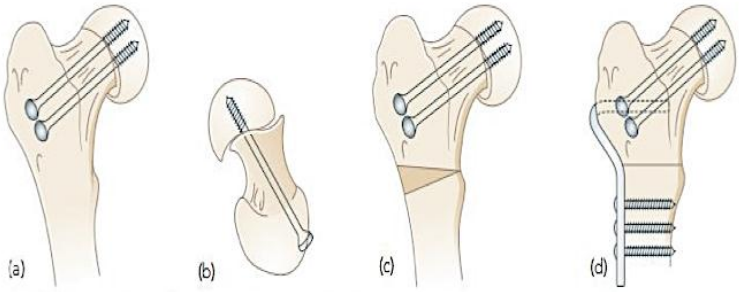


AVN

The typical inclination angle is 125 degrees.

- Coxa vara (less than 125 deg)
- Coxa valga (greater than 125 deg)



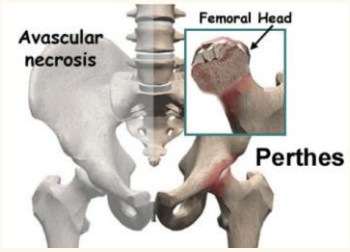


19.20 Slipped epiphysis - treatment (a,b) In this case slipping was minimal so no reduction was attempted, but further slipping was prevented by pinning the epiphysis in that position. (c,d) In more severe degrees of slip, the epiphysis should be fixed without attempting reduction and then, at a later stage, a complex compensatory osteotomy (d) can be performed to restore the normal position of the limb.

3rd: Perthe's Disease (Legg Calvé Perthes Disease):

Definition:

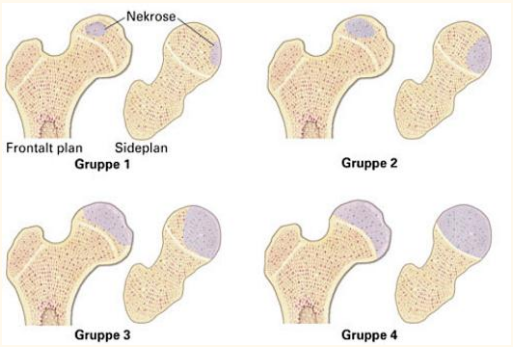
It is the decrease of vascularity of head of the femur (Avascular Necrosis) of an **unknown** cause. So, if a patient with Sickle Cell Anemia has femoral AVN, It is **NOT** Perth's disease.



*__It affects children__ 4-8 years of age (Younger than SCFE)
* More in males, obese.
*Bilateral in 10 – 12% of patients

Theories of its causes:

∗Minor trauma (hyperactive child)
∗Arterial-Venous malformation
∗Virus infection (Upper Respiratory Tract infection)
∗**Most agree** → its multifactorial

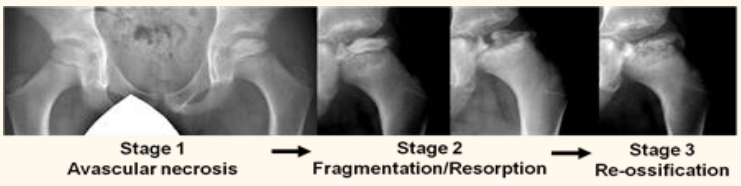


Severity:

Severity of the disease depends on:
∗The amount of femoral head involvement
∗The more the head involvement, the more severe the condition and the worse the outcome.

Stages: (weeks-years per stage):

1- Vasculitis (Acute phase)
2- Fragmentation (because of the synovial fluid go inside the bone)
3- Re-Ossification (Healing)
4- Re-Ossified (Healed)

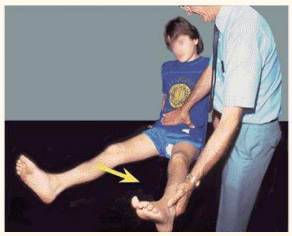


History:

∗**Pain** →hip, anterior thigh, knee
∗**Antalgic gait**
*C/O since weeks to months
∗ **Trauma** → minor? None?
∗ **URTI:** few weeks earlier (Very important to ask about!!)
∗ The usual presentation: Hx of minor trauma few months ago with initial antalgic gait and pain, now pain is better but still limping

- Ask about the activity of the child, did it decrease?

Physical Examination:

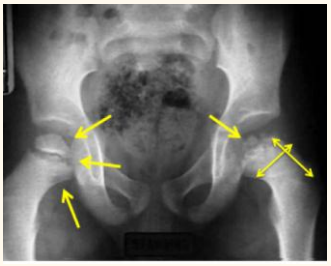


- Antalgic or limping gait
- Restricted hip ROM in all directions, esp. with more sever head involvement
- Worse restriction for → internal rotation & abduction
- Knee → normal
- Thigh muscle wasting (disuse)

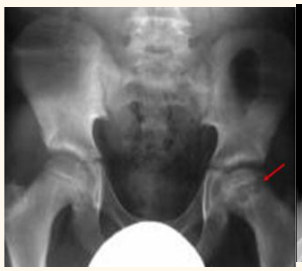
Investigation:

∗**Knee X-Ray:** normal.
* **Pelvis X-Ray** "AP standing & frog lateral": decreased head size (irregular shape). If early: X-ray might not show anything.
∗ **MRI:** for unusual presentations **and** in vary early stages even before classical X-Ray changes show up.

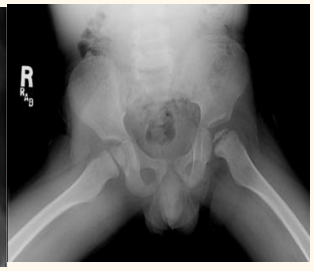
Ossification nucleus is destroyed and damaged · Femoral head collapse is due to necrosis (AVN) >>> then it will re-vascularize (the blood is full of calcium) >> so it will heal maintaining this collapsed shape usually · Usually it doesn't go back to normal but in some cases it does; therefore, the outcome is unpredictable.



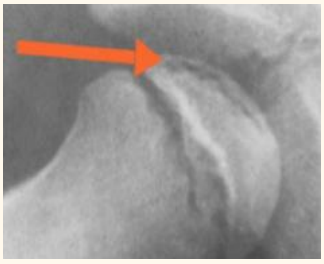
AP standing X-Ray
• **Findings:** the epiphysis is fragmented, the neck is short, and the growth plate is radiolucent



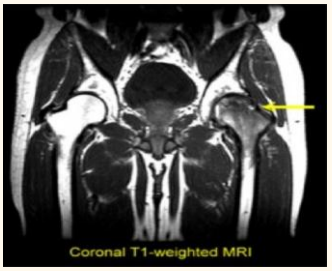
AP Standing X-Ray
•**Findings:** Metaphyseal cysts, wide Neck of femur and shorter



Frog Lateral X-Ray
• **Findings:** saucer Sign (the head of the Femur looks like a flying saucer)



Frog Lateral X-Ray
• **Findings: Subchondral Fracture**, one of the 1st signs, best seen in Frog lateral

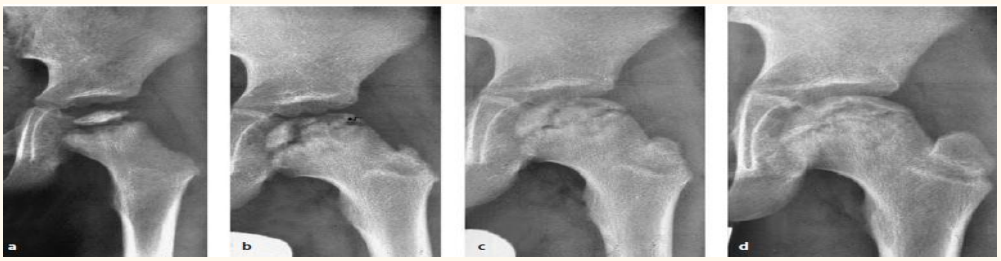


MRI
• Decreased Head Vascularity (right femur)

Prognosis:

∗**< 6 years of age:** Good prognosis (heals well).
Usually conservative treatment (very close observation, every 4 weeks)
I∗**6-9 years of age:** Various outcomes:
Majority of patients present in this age group
∗ **> 9 years of age:** Usually **bad** prognosis.
*Needs surgical treatment (may be >1 operation).

At 3y of age 5y 7y 9y



Treatment:

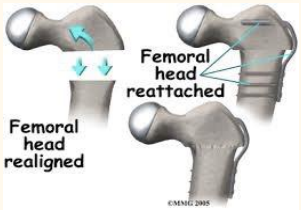
- Vary controversy, depending on → age, stage & classification.
- Refer to pediatric orthopedics as an **urgent** case.
- **Aim** → to have a painless, contained, mobile hip joint
- **Basic Guidelines:**
  - **Pain relief** → admit, skin traction few days, analgesia
  - **Increase hip ROM** →Physiotherapy, mobilize Partial Weight Bearing or Non Weight Bearing (we usually encourage mobility of children, but **not** in this case because we want to limit the amount of collapse)
  - **Keep hips abducted:**
- So head will mold better in the acetabulum, and less body weight on the femoral heads.
- By → abduction splint or casting (or Spica cast)
  - **While keeping the head contained:**
- Do containment osteotomy in the fragmentation stage.
- If came in late re-ossification stage wait till heals then do salvage surgery (Because you are dealing with a complication)
  - Tight hip adductor **is a complication that you have to relieve it**
- **How to brings that head inside?** You either increase the size of the head cover **(Pelvic osteotomy)** or cut some of the head & force it inside **(Femoral osteotomy)** or **Both.**

Splint abduction

Broom stick cast

Frame -walker

Full weight bearing with crutches



Femoral osteotomy

Pelvic osteotomy

Complications:

- ✓ Abduction hinge →may need Chelectomy.
- ✓ Heals in coxa →magna (big), brevia (short), plana (wide).
- ✓ Stiff hip joint.
- ✓ Pelvic obliquity.
- ✓ Early hip OA.
- ✓ Early Lumbar spine degeneration.

• Late Complications:

- ✓ Early arthritis.
- ✓ leg length discrepancy (LLD).
- ✓ Pelvic inequality.
- ✓ Early Lumbar spine degeneration.