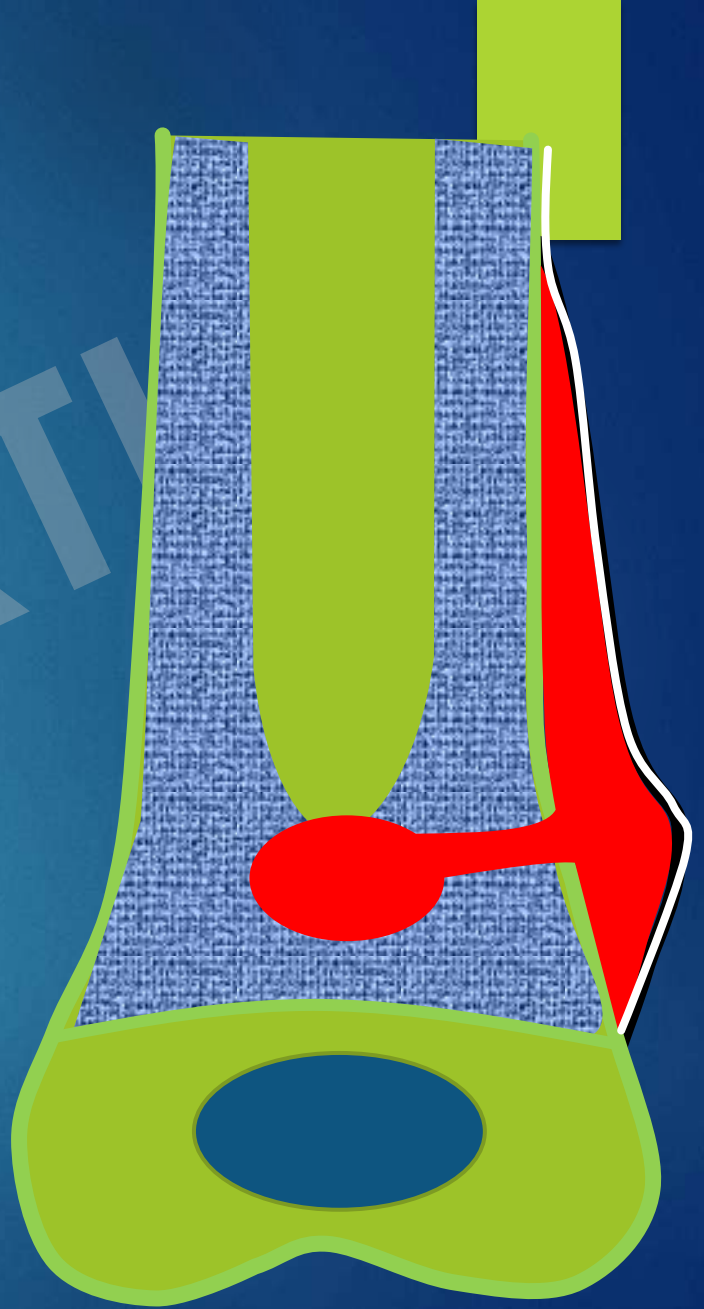
Pediatric Musculoskeletal Infections: 2



Shalin Shah
MS Ortho; DNB Ortho;
Fellowship in Paediatric Orthopaedics

BJ Wadia, Mumbai

Orthokids A'bad

Pediatric Musculoskeletal infections

- Acute and Chronic osteomyelitis
- Septic Arthritis and its sequalae

Today's lecture

- Septic Arthritis
  Diagnosis
  Criteria
  Treatment
  Sx Video

- Sequalae
  Presentation
  Classification
  Surgical options

Septic arthritis

"Acute infection of the synovial joints leading to inflammation and destruction of the affected joint structures, Cartilage;
With a potential to extend into metaphysis."

Septic Arthritis

- More common than Osteomyelitis in infancy and childhood

(Can occur concurrently)

- M/C Hip > Knee

- Multiple joint ~5% cases

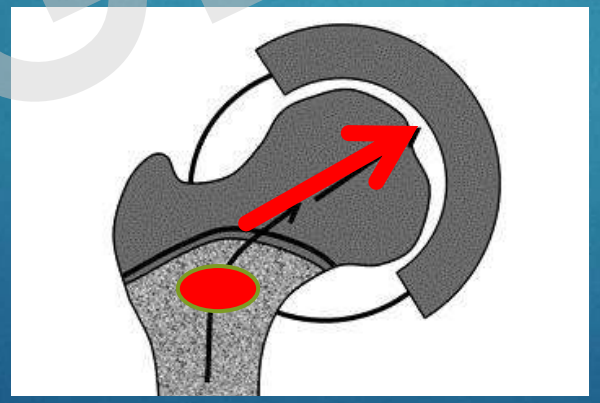
- < 5 years 75%
- < 2 years 50%

Organism

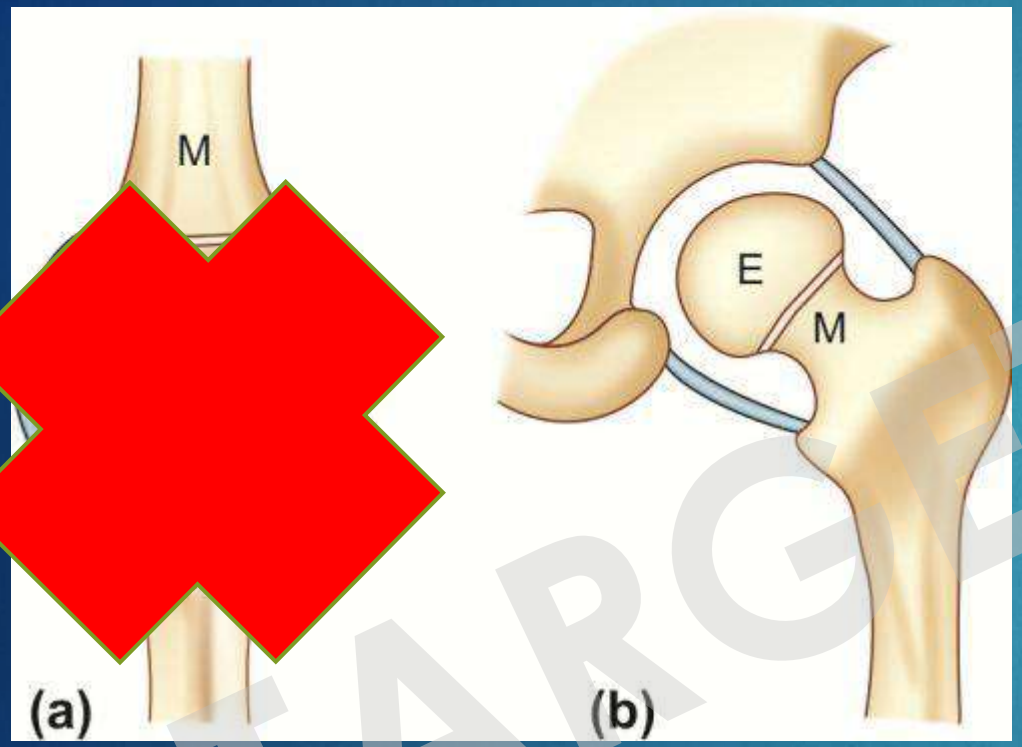
- Most common Staphylococcus Aureus
- Others:
  Group A, B Streptococci
  Strep Pneumoniae
  H. Influenza
- Neonate: Enterococci; Strep; Fungal
- MRSA: HA and CA

Pathomechanism

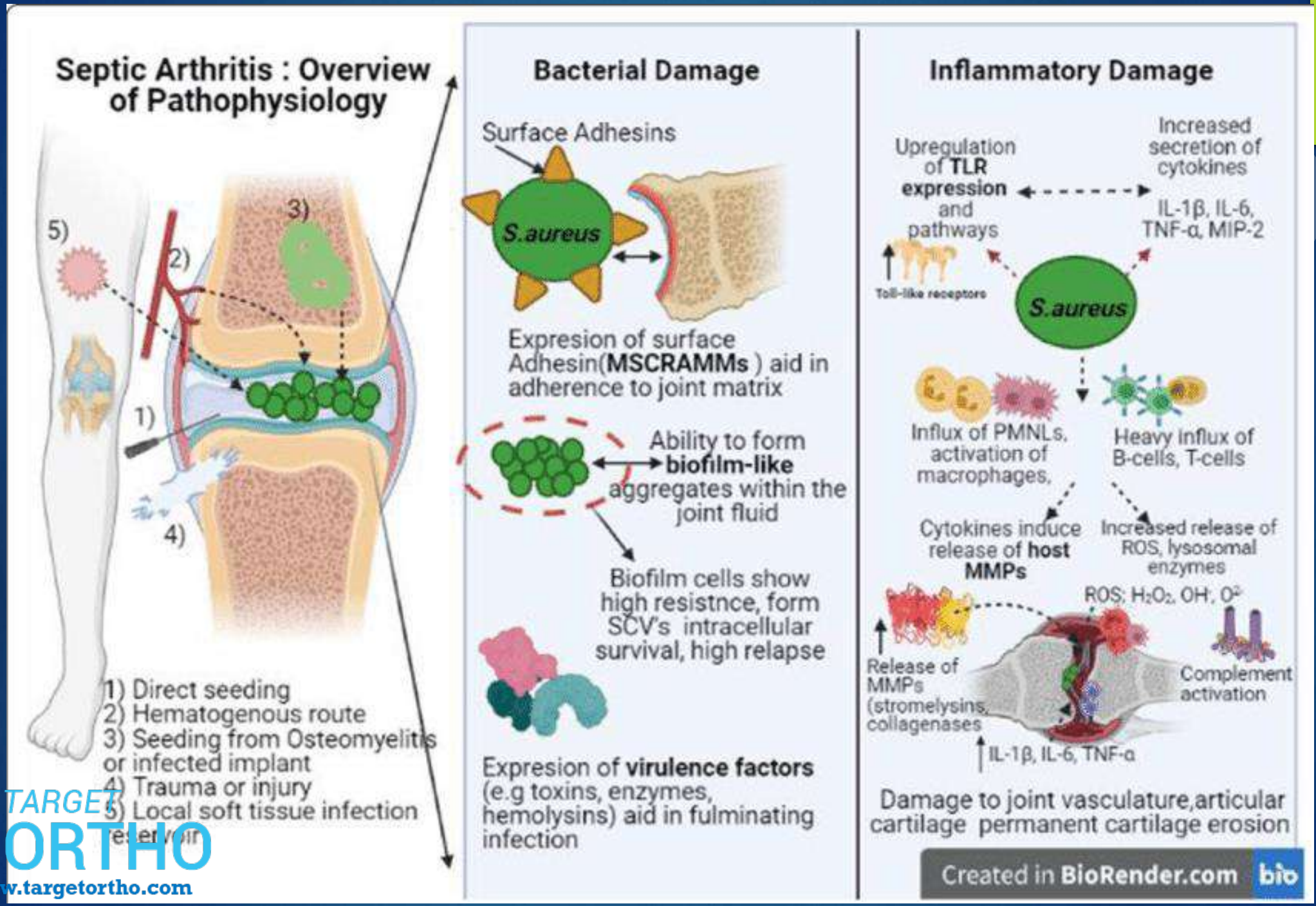
- Bacteria reach from
  - Hematogenous
  - Direct seedling
  - Adjacent location



Children < 18 months :
Transphyseal Spread to joint



1. Shoulder
2. Hip
3. Ankle
4. Elbow



Pathomechanism

Bacteria and Activated Polymorphs

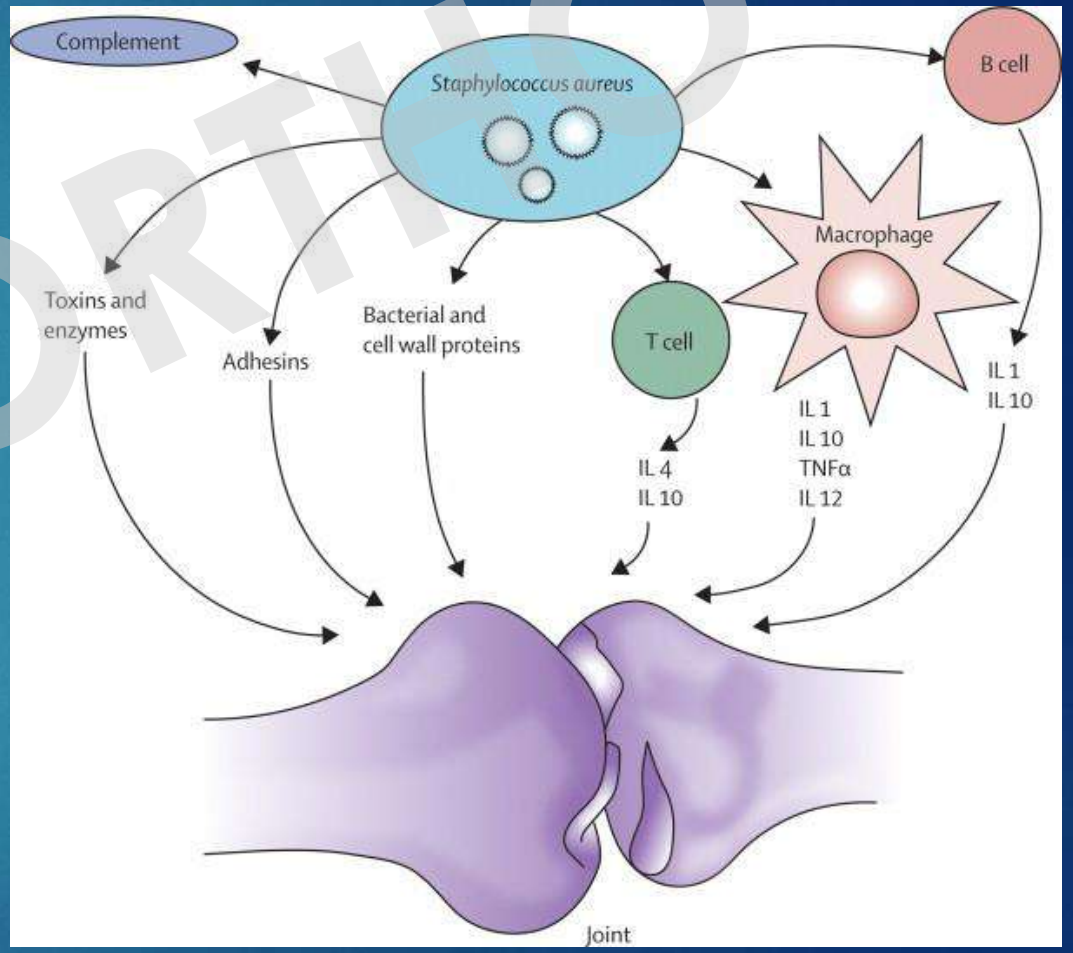
↓

Potent Proteolytic enzymes

"Matrix Metallopreoteinases"

↓

Degradation of Hyaline cartilage and depletion of collagen and GAGs.



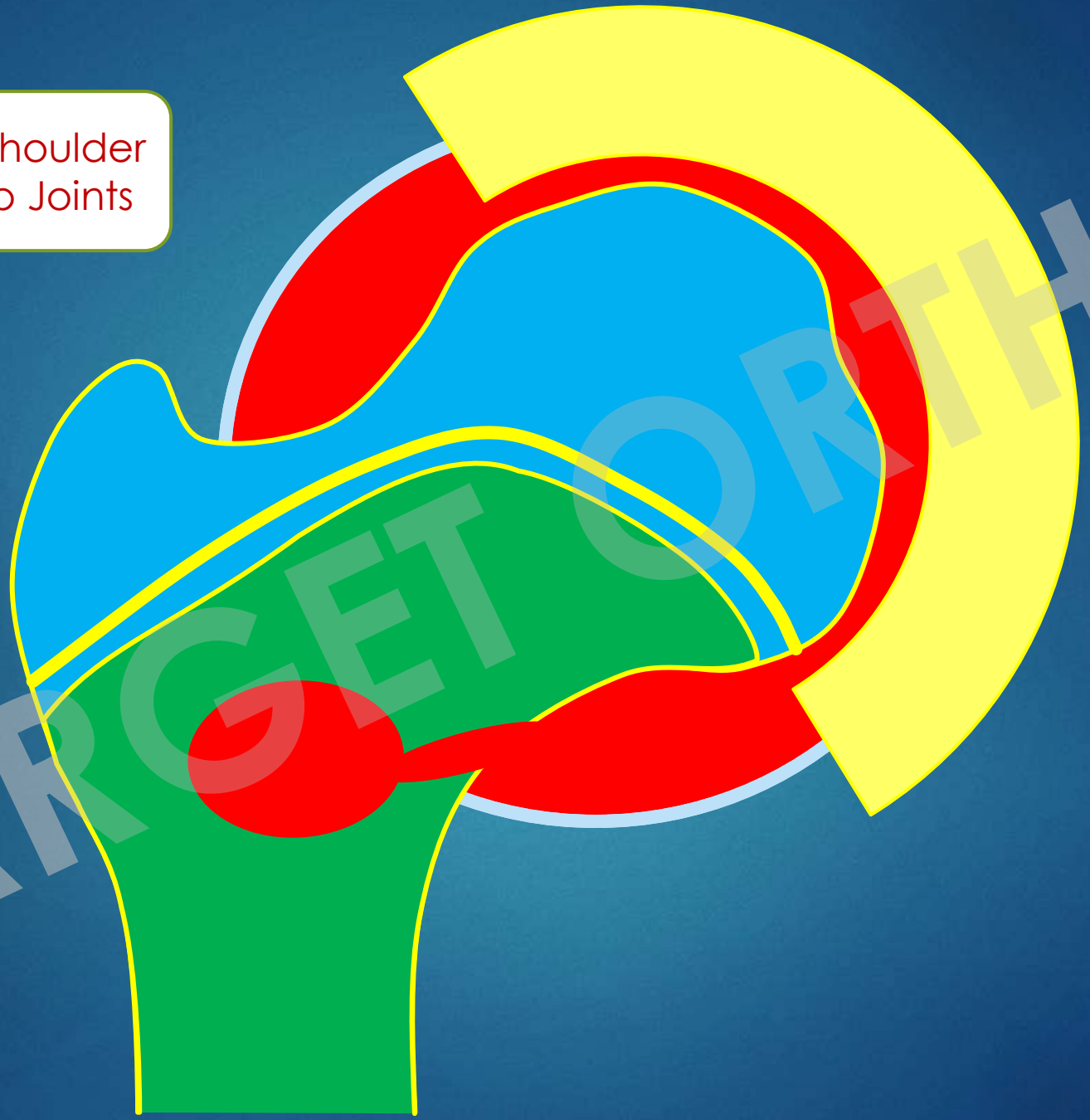
Is it a surgical emergency?

- **Yes!!**

- Cartilage degradation begins within 8 hours of colonisation

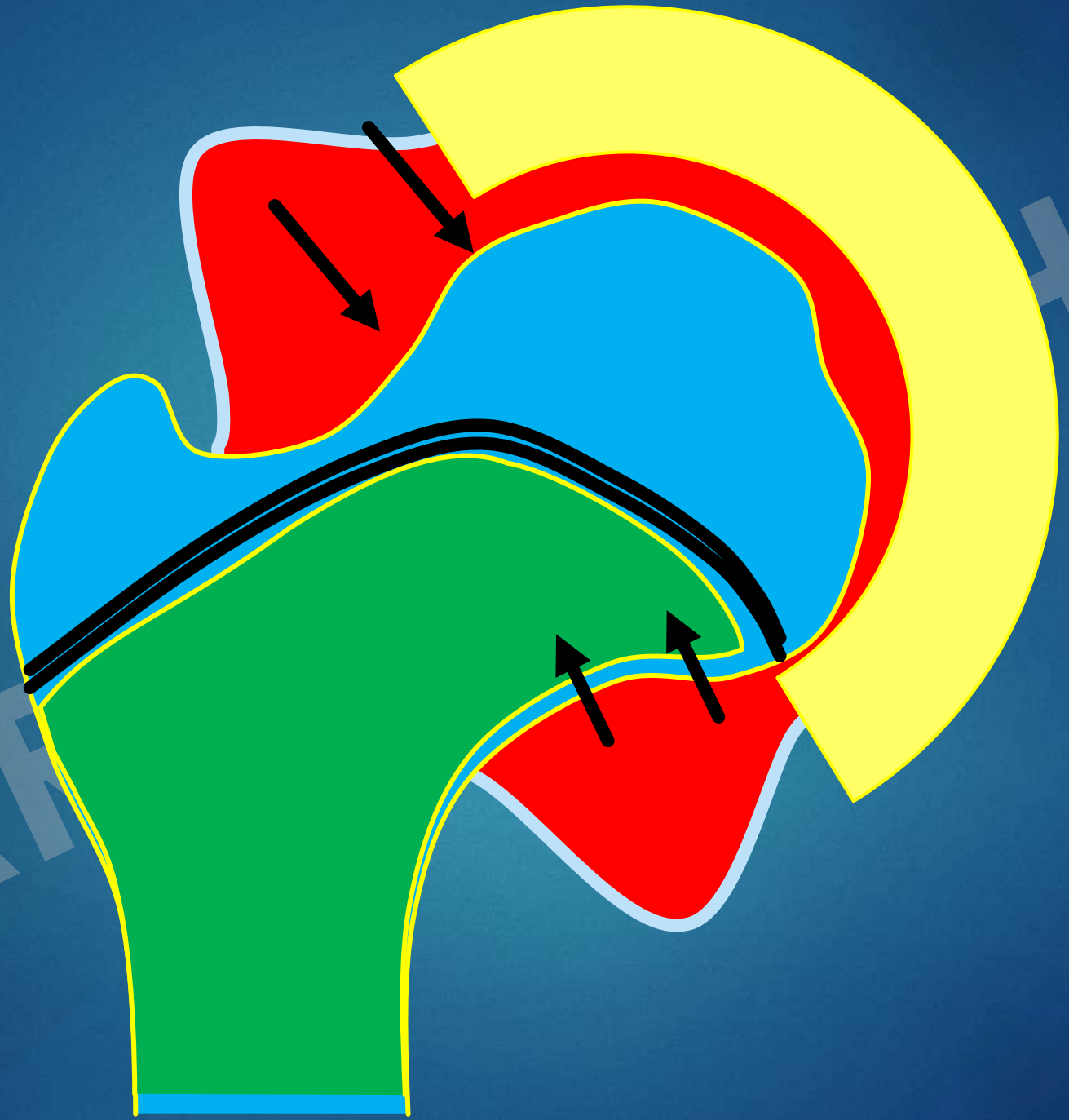
Issues

Hip & Shoulder – Deep Joints



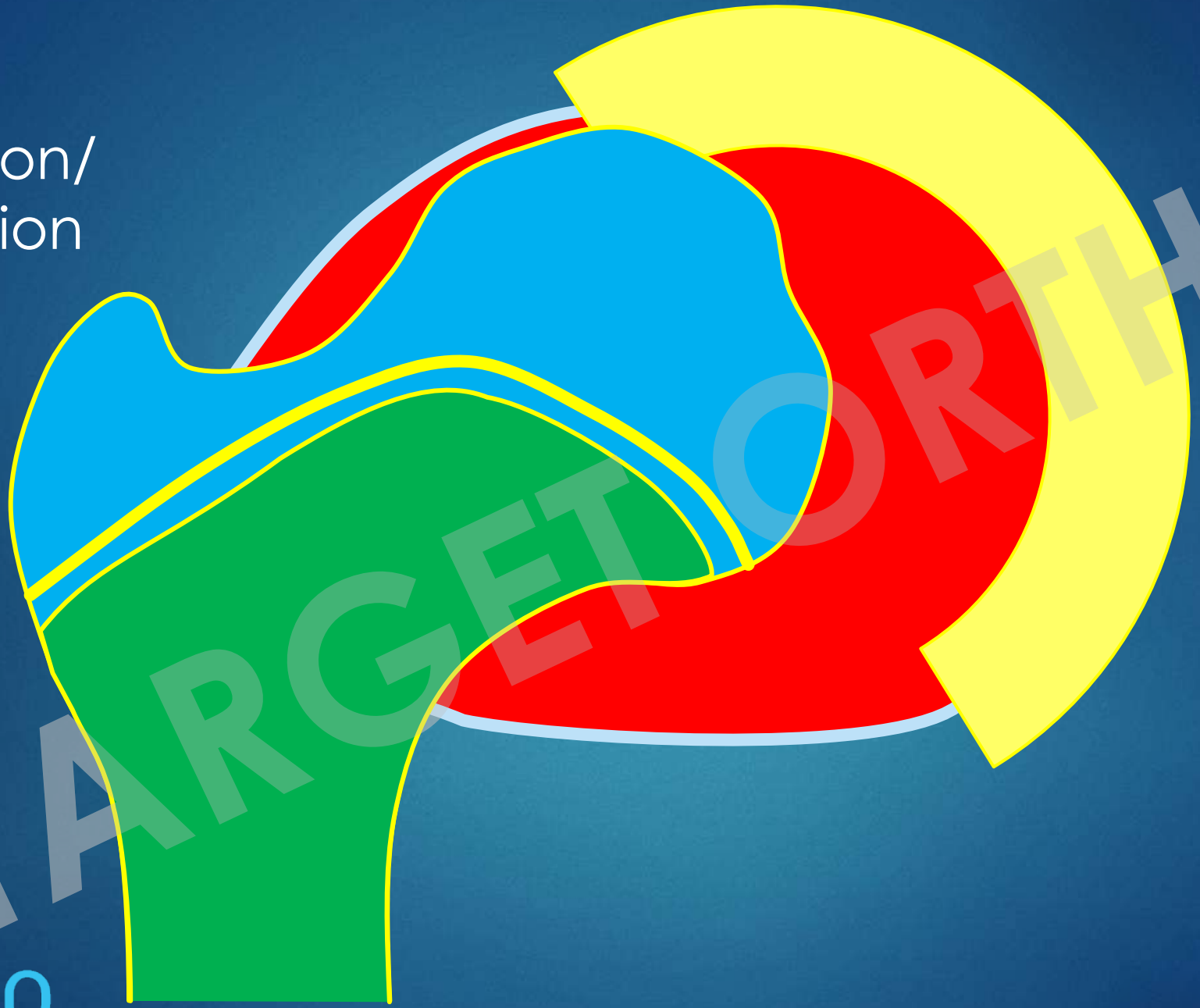
Blood supply affection

Damage to Growth plate



1. Blood supply affection

Joint dislocation/ Destruction



1. Blood supply affection
2. Damage to Growth plate
3. Joint dislocation/ Destruction

Diagnosis

- History of NICU admission
- Long term IV antibiotic
- Decreased feed
- Immunocompromised

Diagnosis

- **Irritable**
- **Pseudoparalysis**
- Failure to thrive
- Fever

Diagnosis

- Irritable
- Pseudoparalysis
- Failure to thrive
- Fever
- **Position of joint**

Diagnosis

Raised:

- Total Count
- CRP
- ESR

- Gram staining
- Culture (60%) PCR (75%)

Differential Diagnosis

- transient synovitis
- osteomyelitis
- JRA
- JIA
- Lyme Disease

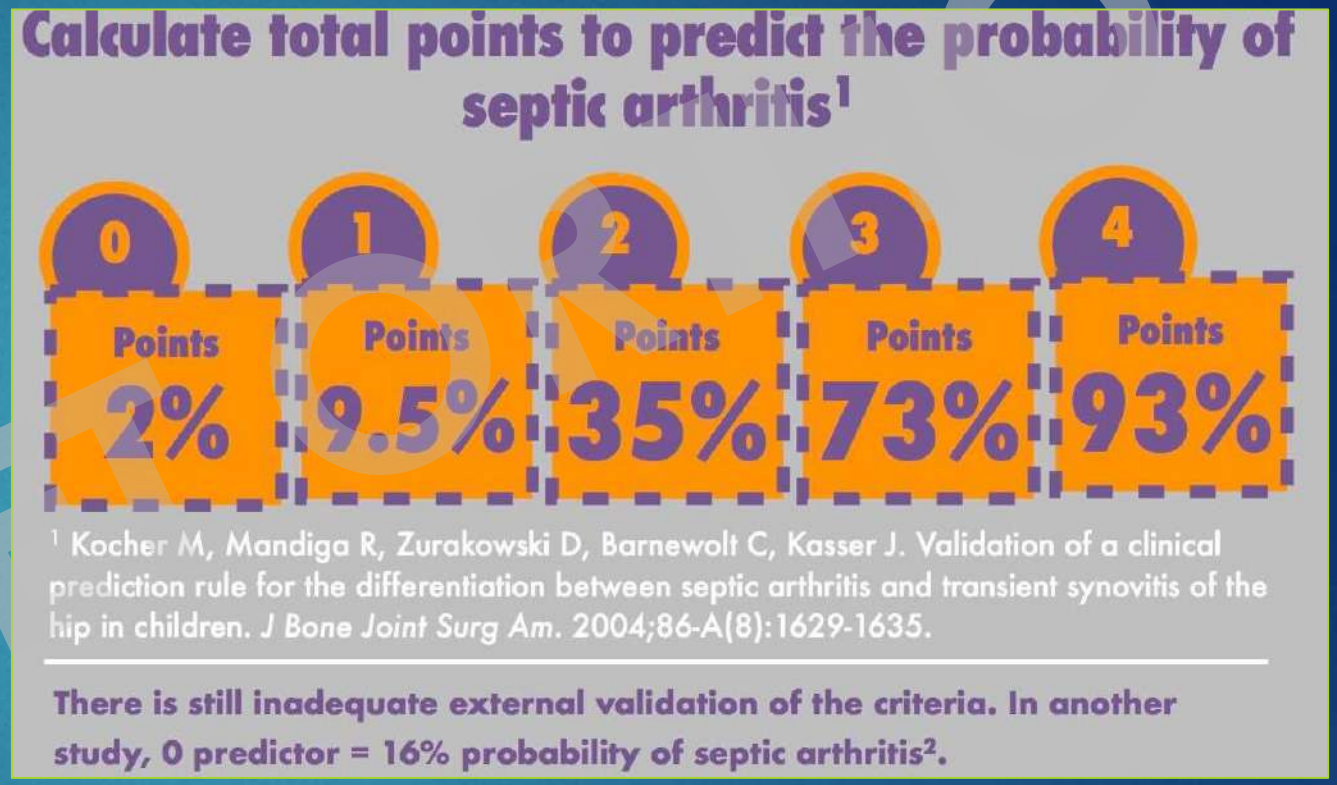
Which of the following are Kocher's criteria

1. CRP> 6 ; WBC > 11000; Inability to bear weight; ESR >40
2. CRP> 6 ; WBC > 12000; Inability to bear weight; Fever
3. ESR > 40; WBC > 11000; Inability to bear weight; Fever
4. ESR >40; Fever ; WBC > 12000; Inability to bear weight;

Diagnosis

- Kocher's Criteria

- Inability to bear weight
- History of fever (>38.5* C)
- ESR >40 mm/ hr
- WBC > 12000 / mL



Most reliable???

- 1. Fever
- 2. CRP
- 3. ESR
- 4. Inability to bear weight

Caird et al

J Bone Joint Surg Am. 2006 Jun;88(6):1251-7. doi: 10.2106/JBJS.E.00216.

Factors distinguishing septic arthritis from transient synovitis of the hip in children. A prospective study

Michelle S Caird [1], John M Flynn, Y Leo Leung, Jennifer E Millman, Joann G D'Italia, John P Dormans

- Fever : best predictor
- 2nd elevated C-reactive protein level,
- 3rd elevated ESR ,
- 4th refusal to bear weight
- 5th elevated WBC.
- CRP level of >2.0 mg/dL (>20 mg/L) was a strong independent risk factor

Imaging

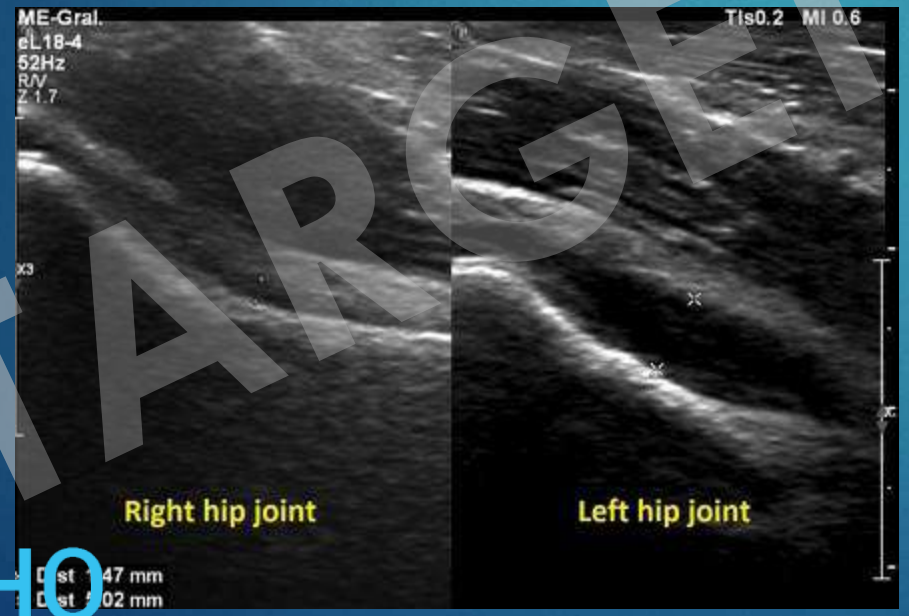
- **Radiograph**

Joint space widening

Bony involvement

Imaging

- Ultrasonography
- MRI

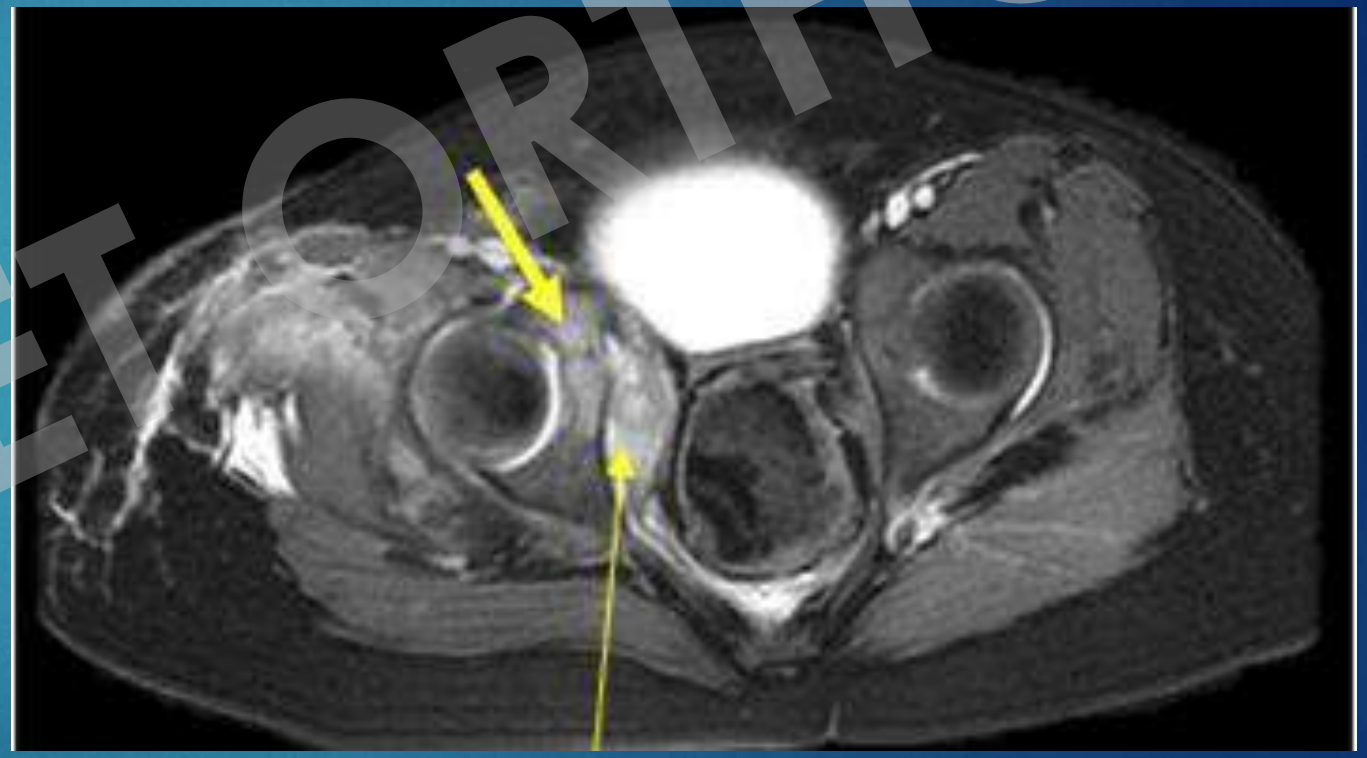


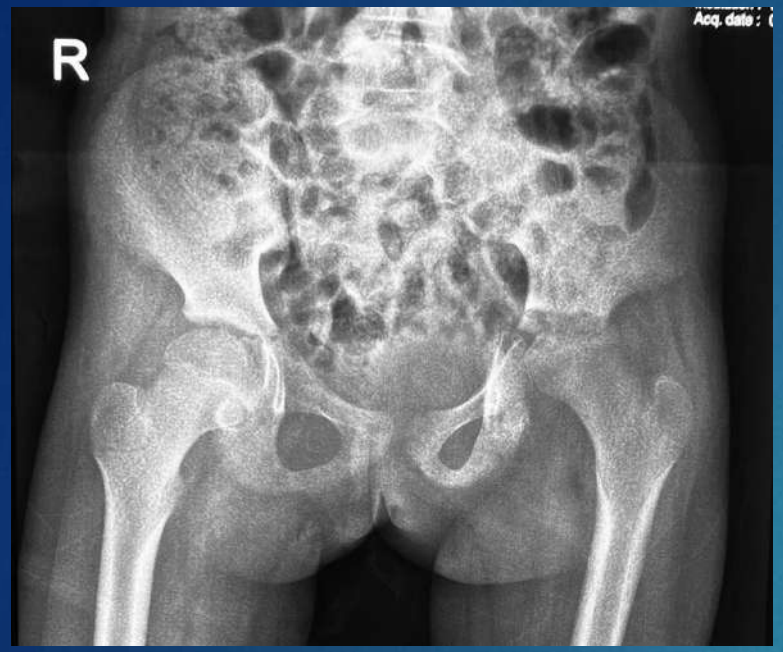
Obturator internus abscess

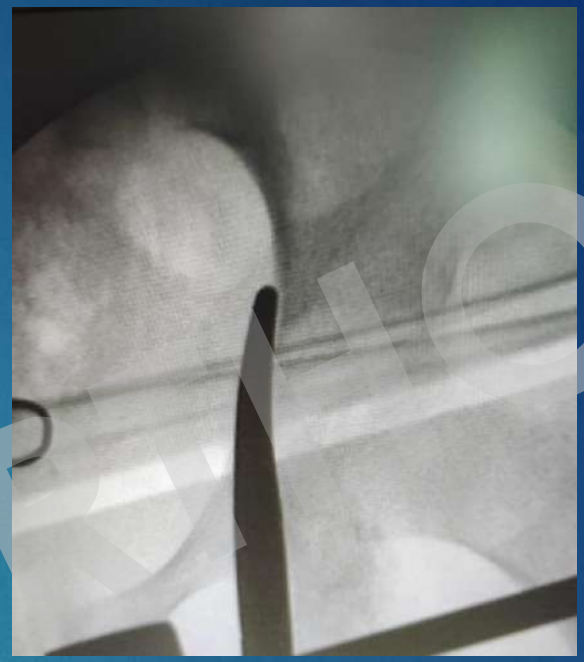
Obturator internus muscle (OIM) abscess

Uncommon entity

Mistaken for septic arthritis of the hip.







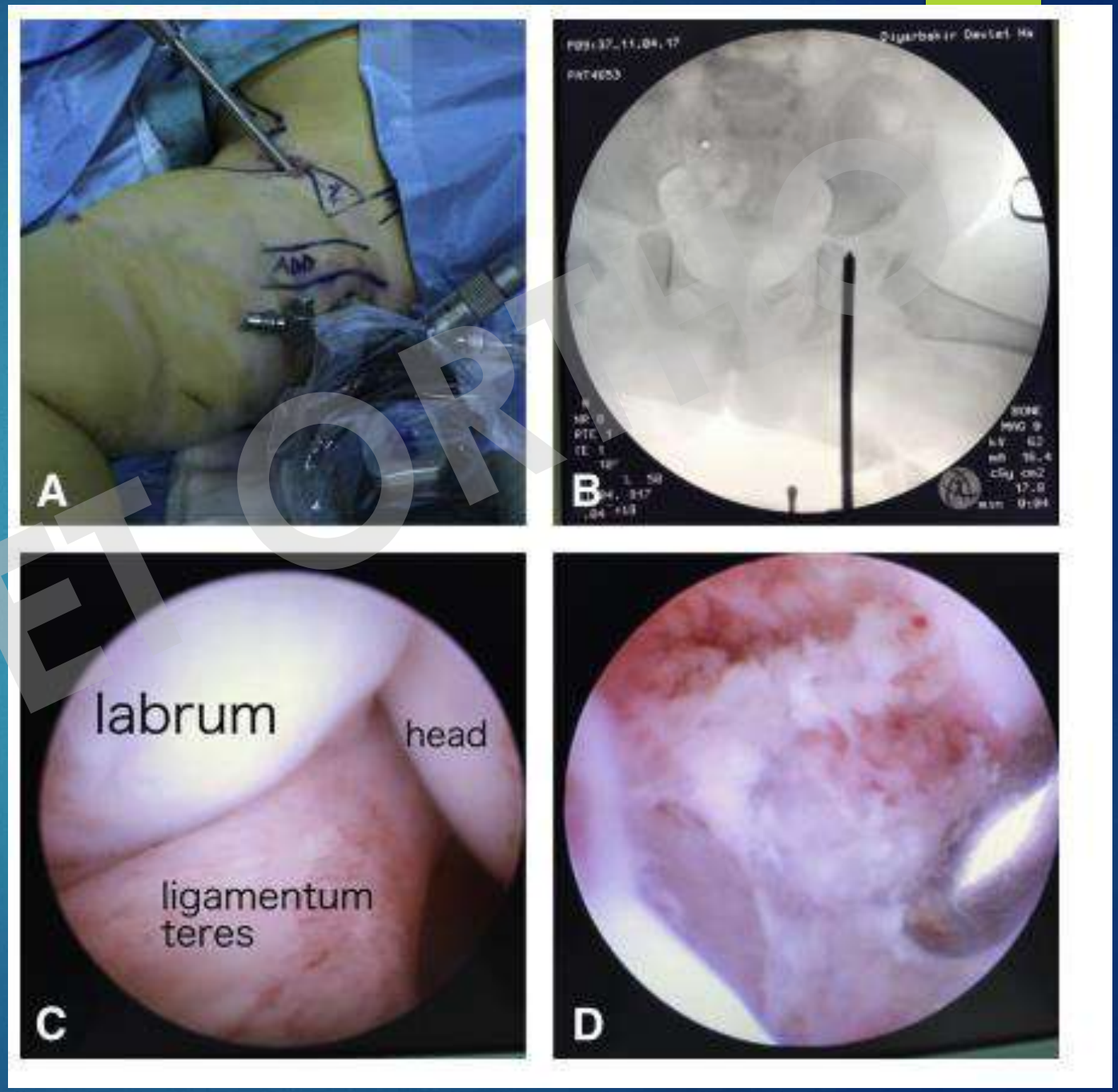
Aim of Sx

- **Blood supply affection**
  Reduction of intraarticular pressure
- **Prevent Damage to Growth plate**
  Early bacterial load reduction
- **Control and eradicate infection**
  Debridement and IV AMA
- **Joint dislocation/ Destruction**
  Draining the joint

Neonate with pseudoparalysis + Tenderness over joint	**1 day h/o acute pain + ¾ of Kocher +ve + Superficial joint affecrion + C-A**	**1 day h/o acute pain + ¾ of Kocher +ve + Hip joint affecrion (CA) + Any joint affection HA**	**>1 day history + ¾ of Kocher +ve + Any joint affecrion + CA Or HA**
IV AMA + Arthrotomy, Lavage + Cast immobilization	IV AMA + Careful monitoring	IV AMA + Arthrotomy, Lavage + Cast immobilization	IV AMA + Arthrotomy, Lavage + Cast immobilization

Recent Advance

2019 JOA	15 pt, All
1993 Chung et al	9 Pt, All
Kim et al	8 Pt, All
Nusem et al	6 pt, All
Fernandez et al	23pt , 22 exc., 3 OM repeat
Cappera et al	12 pt, 11, 2 repeat



Take home message…

- High index of suspicion
- Appropriate imaging
- Aggressive treatment to prevent sequale

Sequalae of septic Hip

- The degree of damage and eventual outcome is difficult to predict.
- Clinical symptoms may appear after several years.

Badgley et al

113 Hips; JBJS 1936

- 83 Cx and Sequalae
- 23 functional Jt
- 7 Hips Normal
- 8 died
- 8 Sequalae

ARCHIVE

STUDY OF THE END RESULTS IN 113 CASES OF SEPTIC HIPS

BADGLEY, CARL E.; YGLESIAS, LUIS; PERHAM, W. S.; SNYDER, C. H.

Author Information

The Journal of Bone & Joint Surgery: October 1936 - Volume 18 - Issue 4 - p 1047-1061

- 14 died

Thomas Smith

21 Hips

(19 segments)

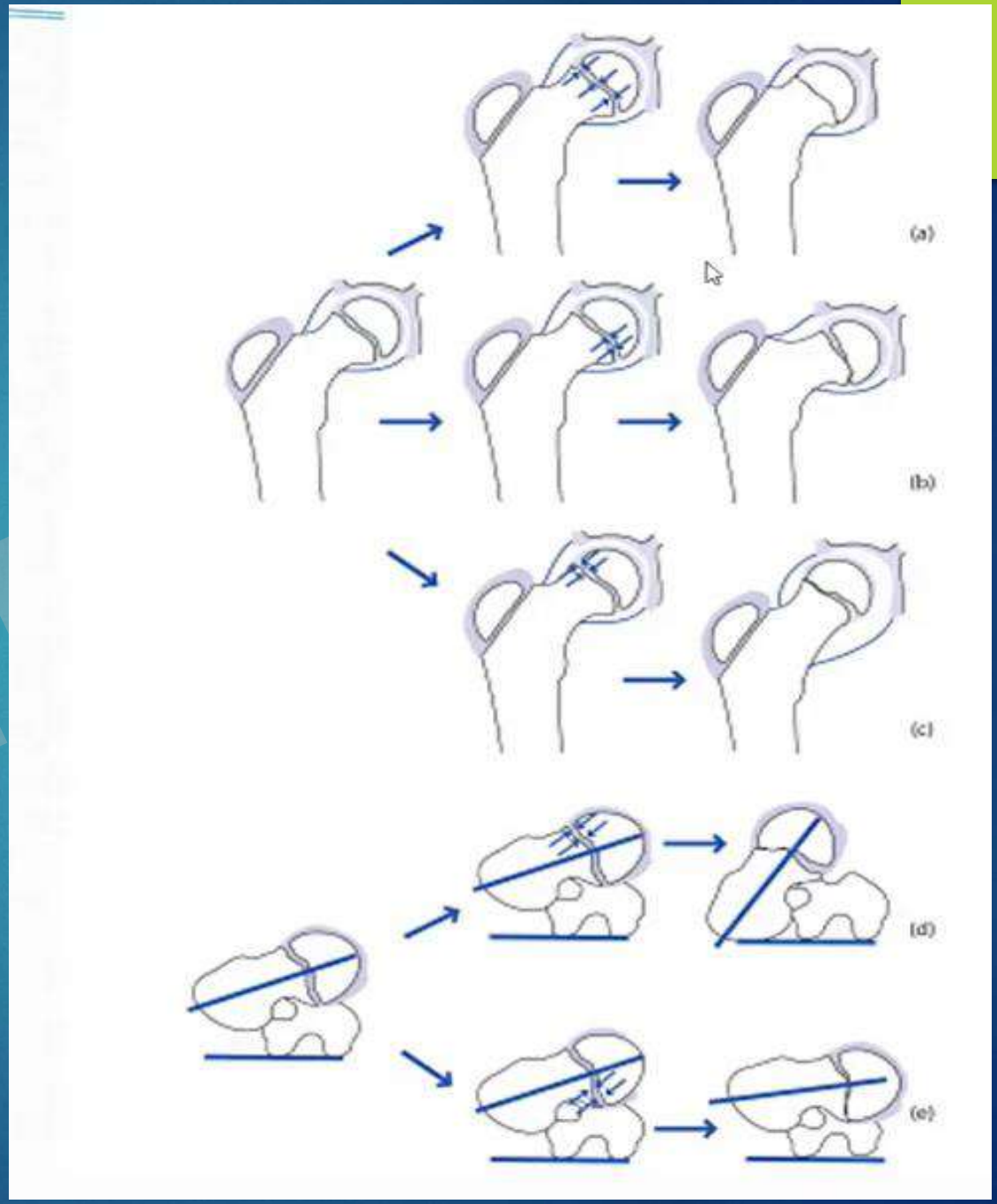
Complaints

Presenting Symptom
Asymptomatic
Pain
Stiffness
LLD
Limp
Deformity
Back, Knee, C/L Hip problem
Emotional

Possible Pathoclinical Manifestation

Acetabulum	Epiphysis/ Physis	Neck	Trochanter	Proximal Femur	Systemic
Erosion	AVN	Fracture	Overgrowth	Osteomyelitis	Death
Late degeneration	Growth Arrest	Osteomyelitis	Growth Arrest	Path Fracture	Multi Joint sepsis
Dysplasia	Chondrolysis	Pseudoarthrosis			Multi organ involvement
Osteomyelitis	Breva/Magna	Vara/ Valga			Late compensatory affection
	Late degeneration				

- Coxa Breva
- Coxa Vara
- Coxa Valga
- Femoral anteversion
- Femoral retroversion



Older children

- Premature fusion of Triradiate: Acetabular dysplasia
- Bony Ankylosis

Outcome related to

- Age of affection
- Duration before intervention
- Organism
- Immunity of child
- Interventions

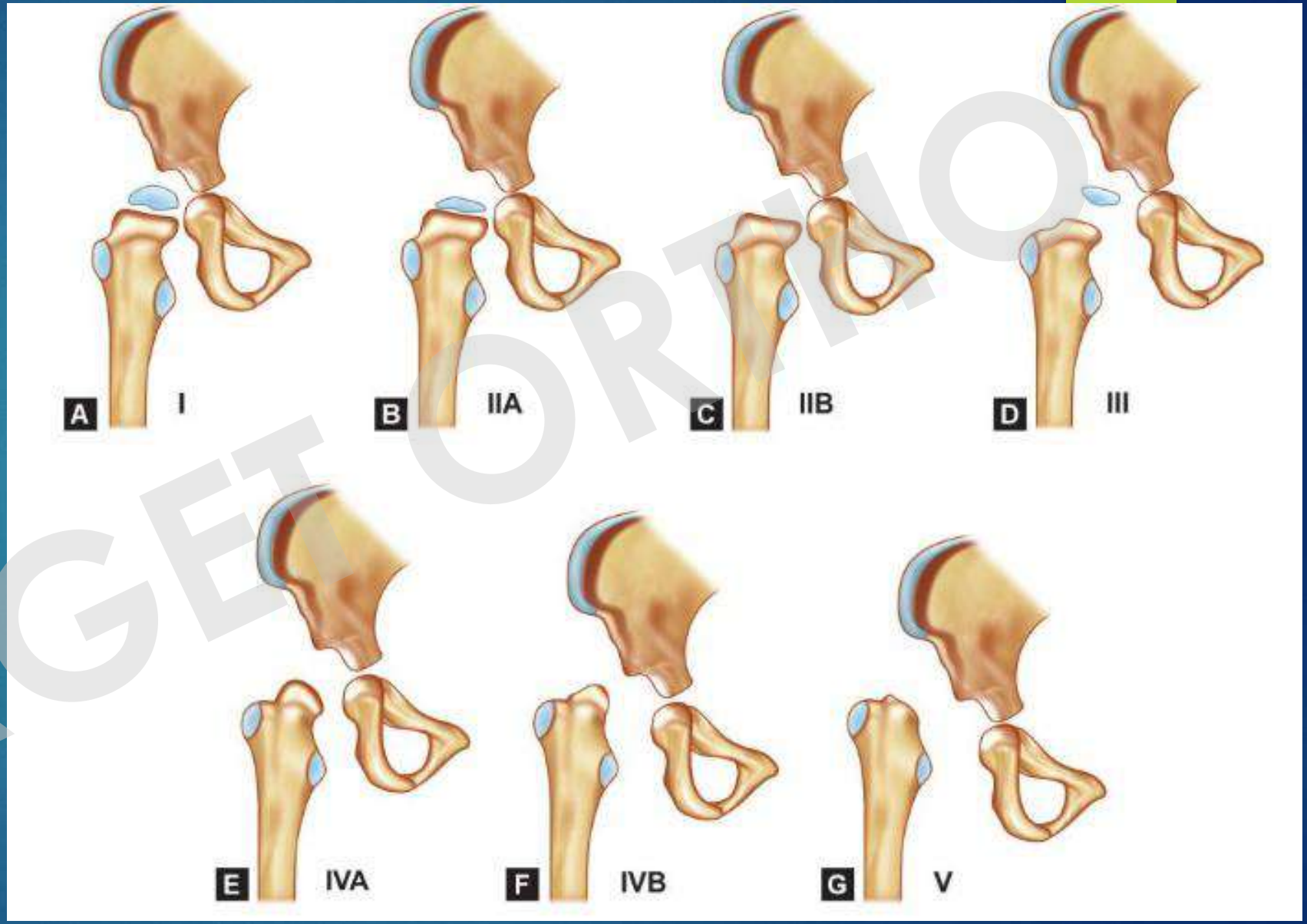
Classifications:

- Hunka
- Choi
- Forlin and Milani
- Johari's

Hunka

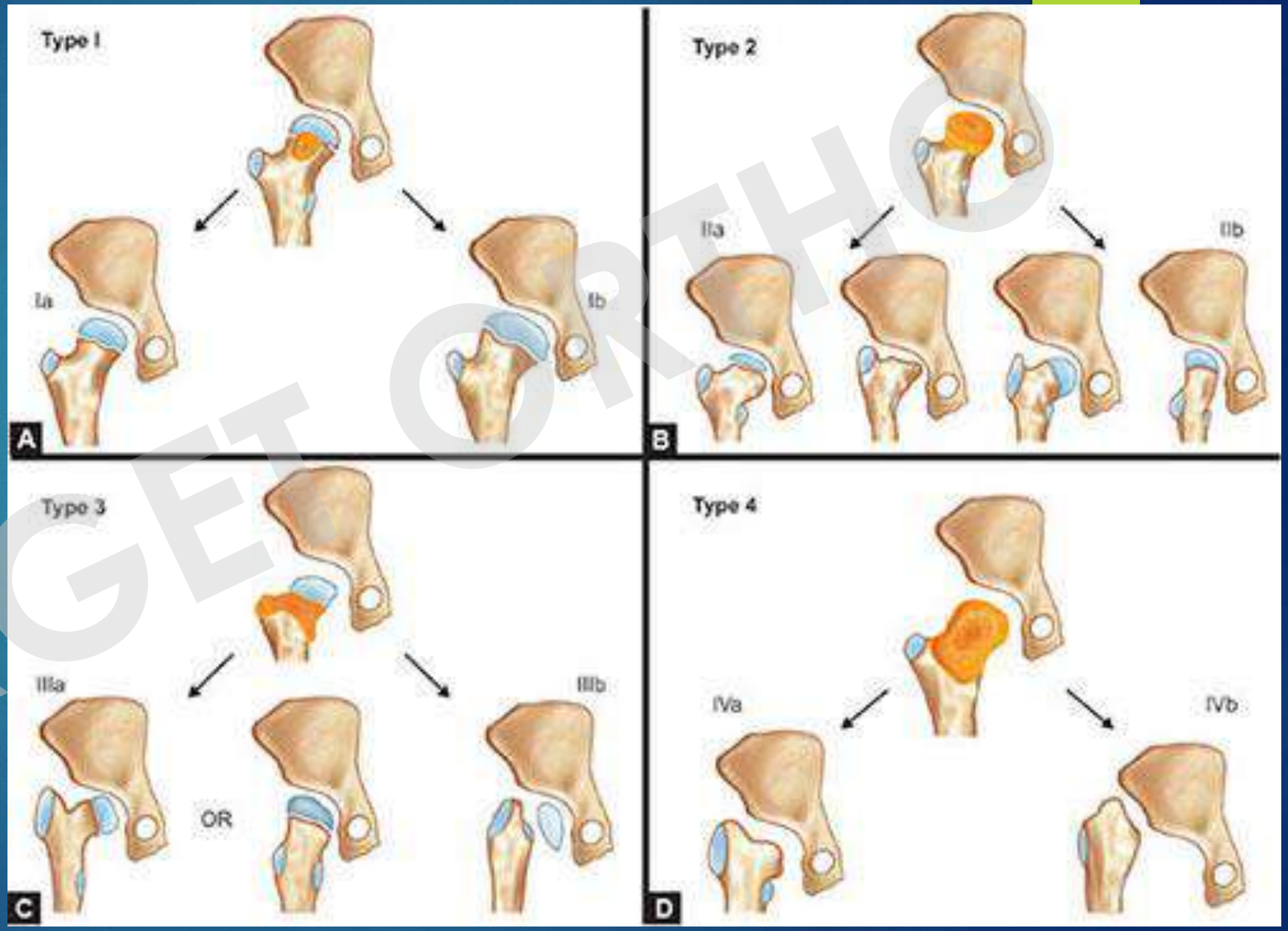
10 Cases
11 Year follow up

Type	Affection
I	Minimal/ No
II a	Head/ Epiphysis
II b	Premature fusion of physis
III	Pseudoarthrosis
IV a	Destruction with Stable neck
IV b	Destruction with unstable neck
V	Destruction with dislocation



Choi

34 Cases
Long term follow up



Forlin and Milani

41 Cases
Long term follow up

Instability and Proximal femur involement

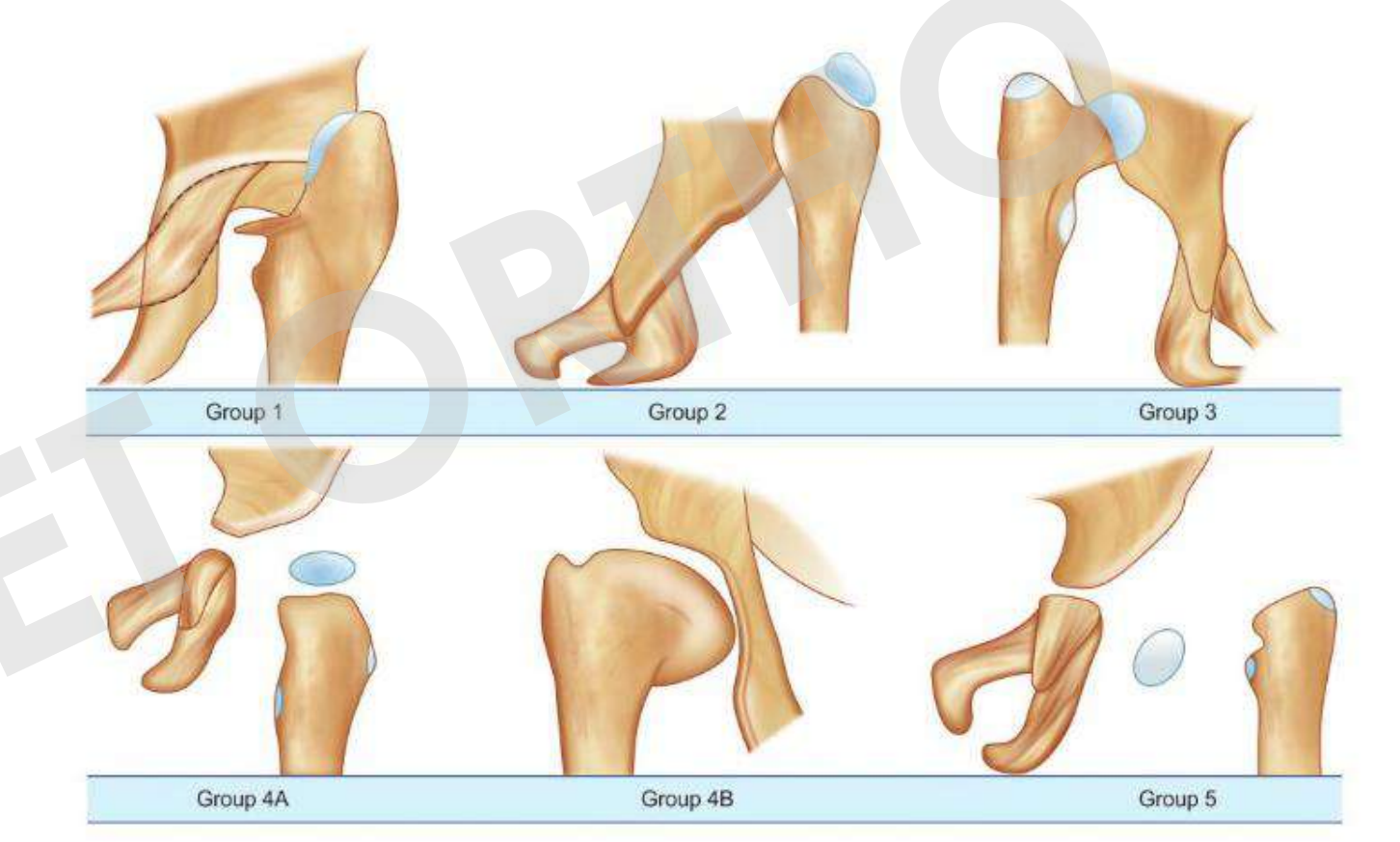
Grade	Fem Head	Type	Head
Grade 1	Locat	A	Total/ Part +nt
Grade 1	Locat	B	Head –nt
Grade 2	Disloc	A	Total/ Part +nt
Grade 2	Disloc	B	Head -nt

Figs 7-4A to D: Forlin and Milani classification

Johari

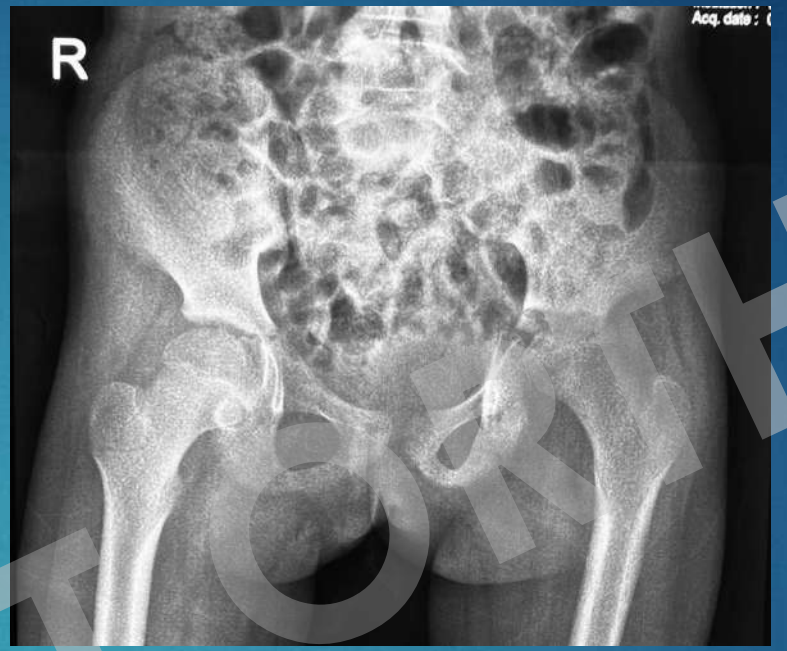
63 Hips

Group	Descrip	Stability
1	Loss of CFE/ Neck +nt Meta Spike	Stable
2	Loss of CFE/ Neck	Unstable
3 A	Dislocan CFE +nt	Unstable
3 B	Subluxation CFE +nt	Unstable
4	AVN; Coxa vara/ Valga; Breva; Trochanter	Stable
5	Pseudoarthrosis	Stable/ Unstable



Management

- Active infection: Debridement



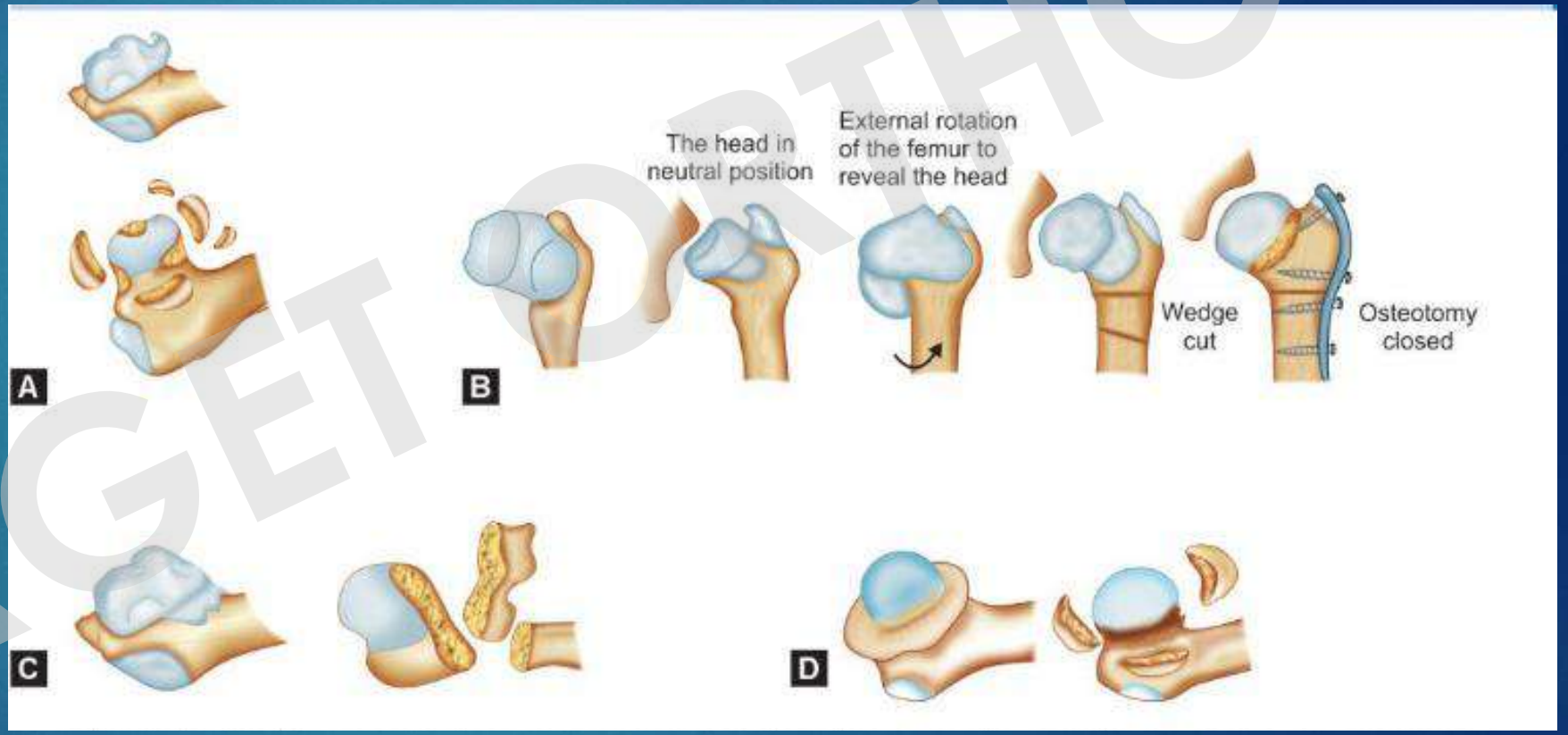
- Dislocation Reduction : Spica/ Brace/ Open reduction

Aims of treatment

1. Cephalic coverage/ Congruity
2. Correction of LLD
3. Improving abductor insufficiency
4. Correction of malalignment and deformities
5. Stability hip

1. Cephalic coverage/ Congruity

- Abduction cast
- Traction
- Osteochondroplasty

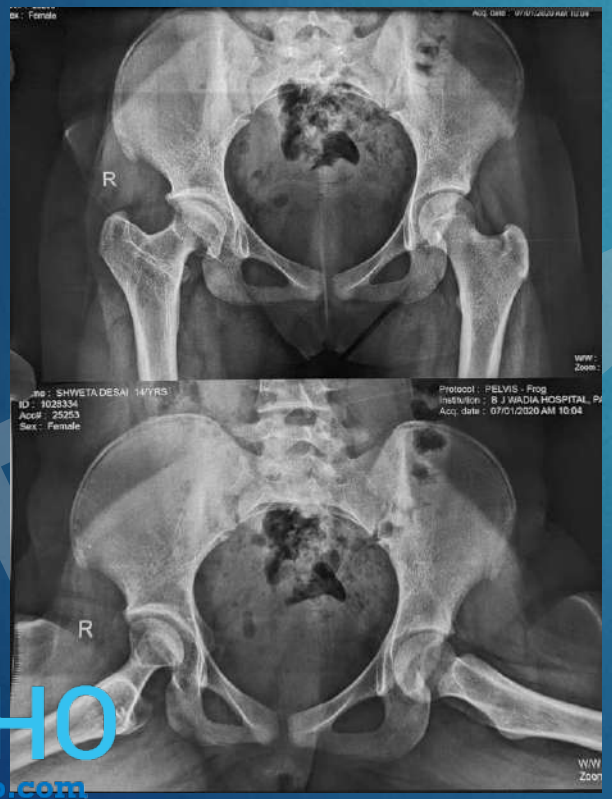


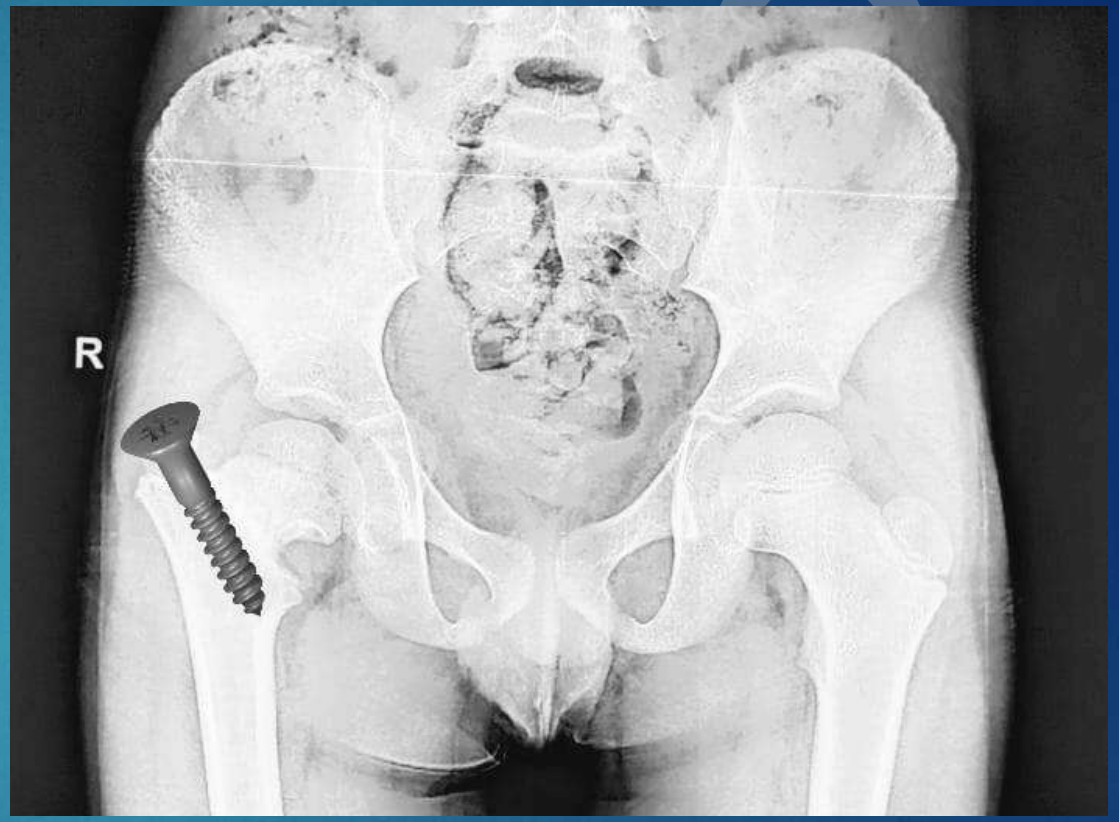
2. Correction of LLD

- Shoe raise
- Contralateral epiphysiodesis
- Ipsilateral lengthening

3. Improving abductor insufficiency

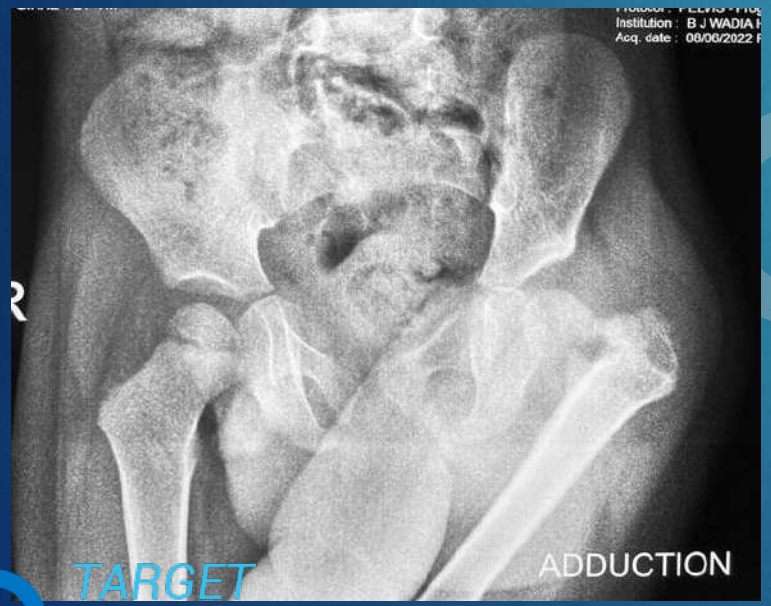
- GT Epiphysiodesis (<7 Years)
- GT advancement

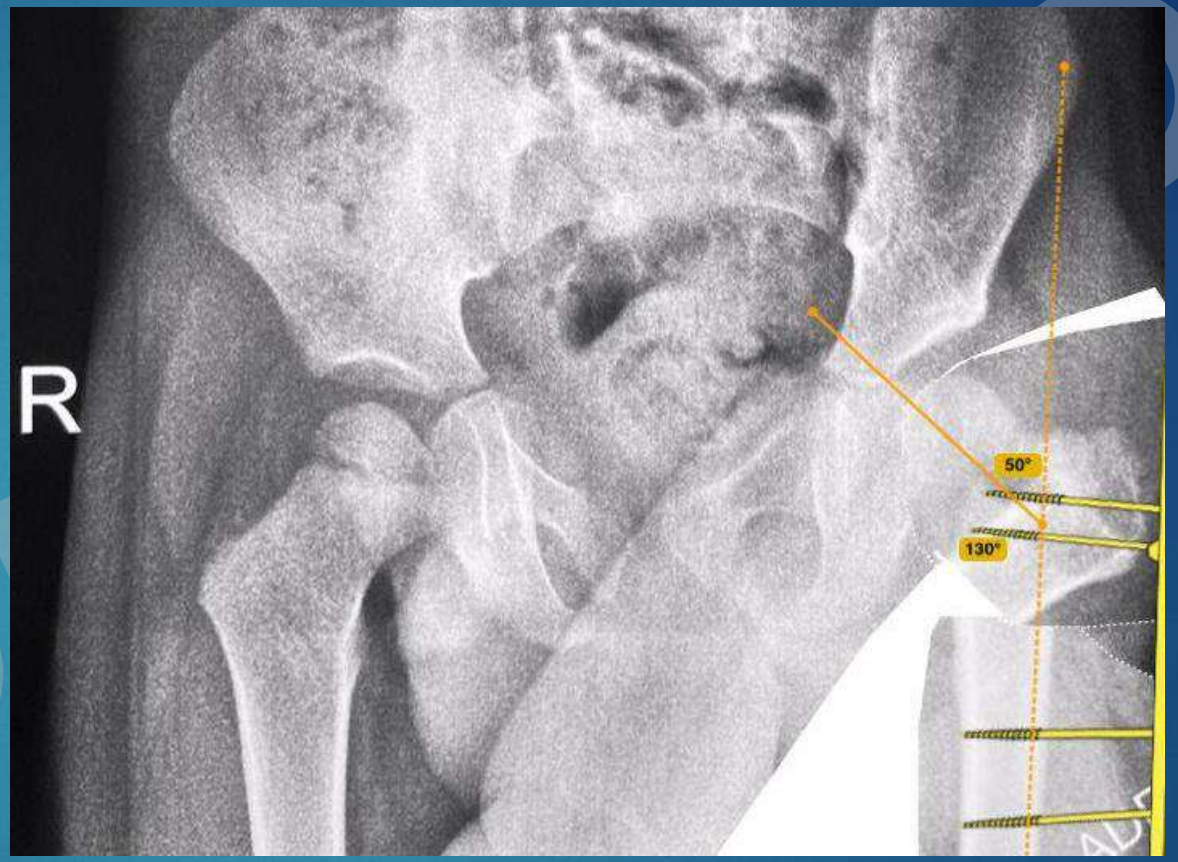




4. Correction of malalignment and deformities

- Pelvic and femoral osteotomies

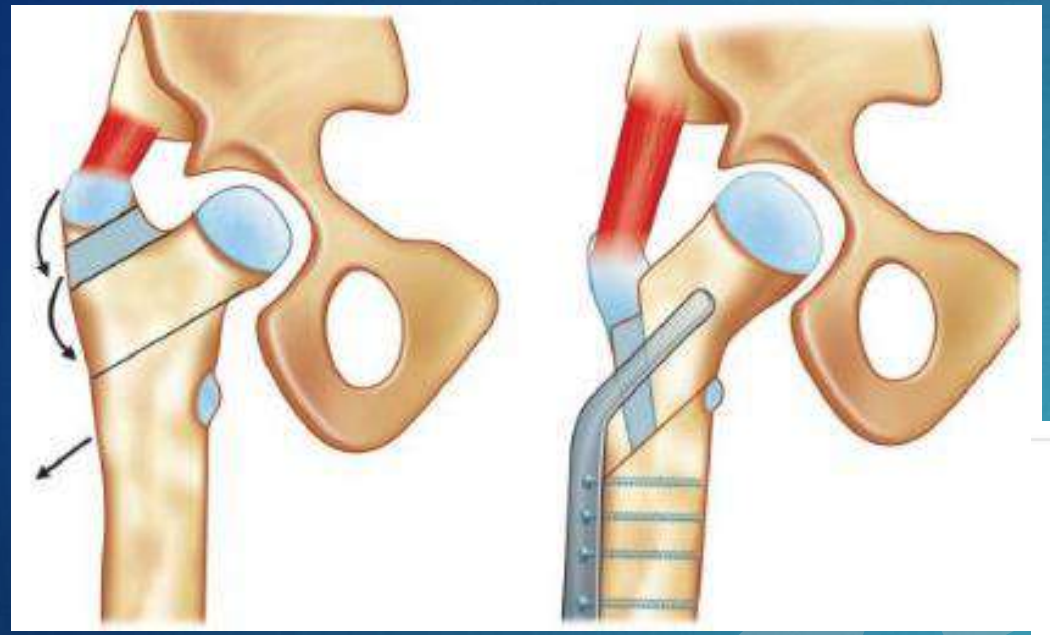




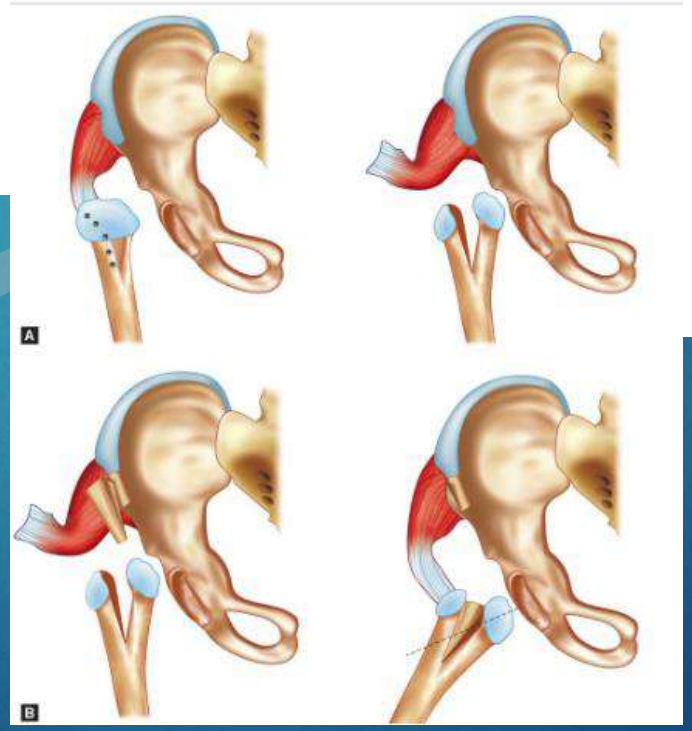
5. Instability and coverage

- Pelvic / Femoral osteotomies

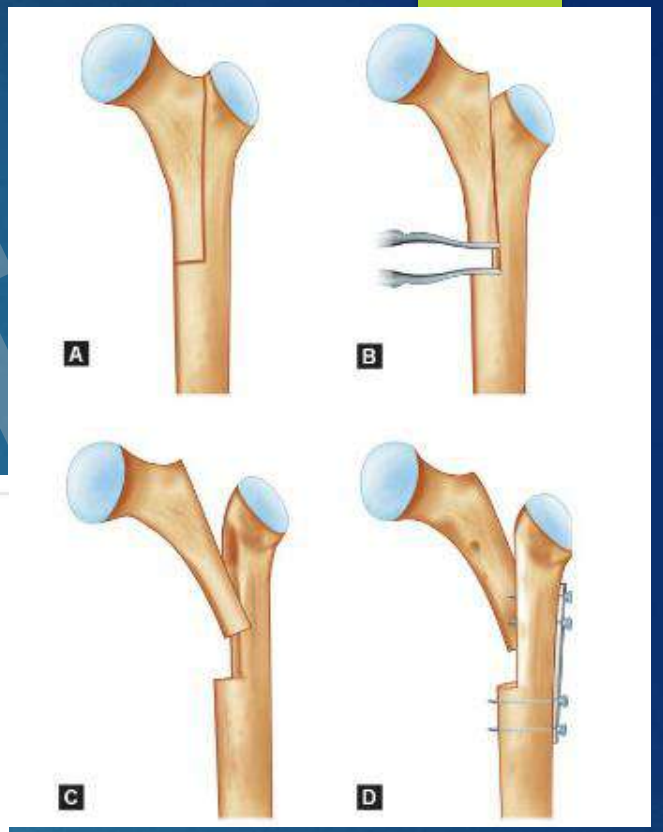
Neck reconstruction



Hasler and Morscher

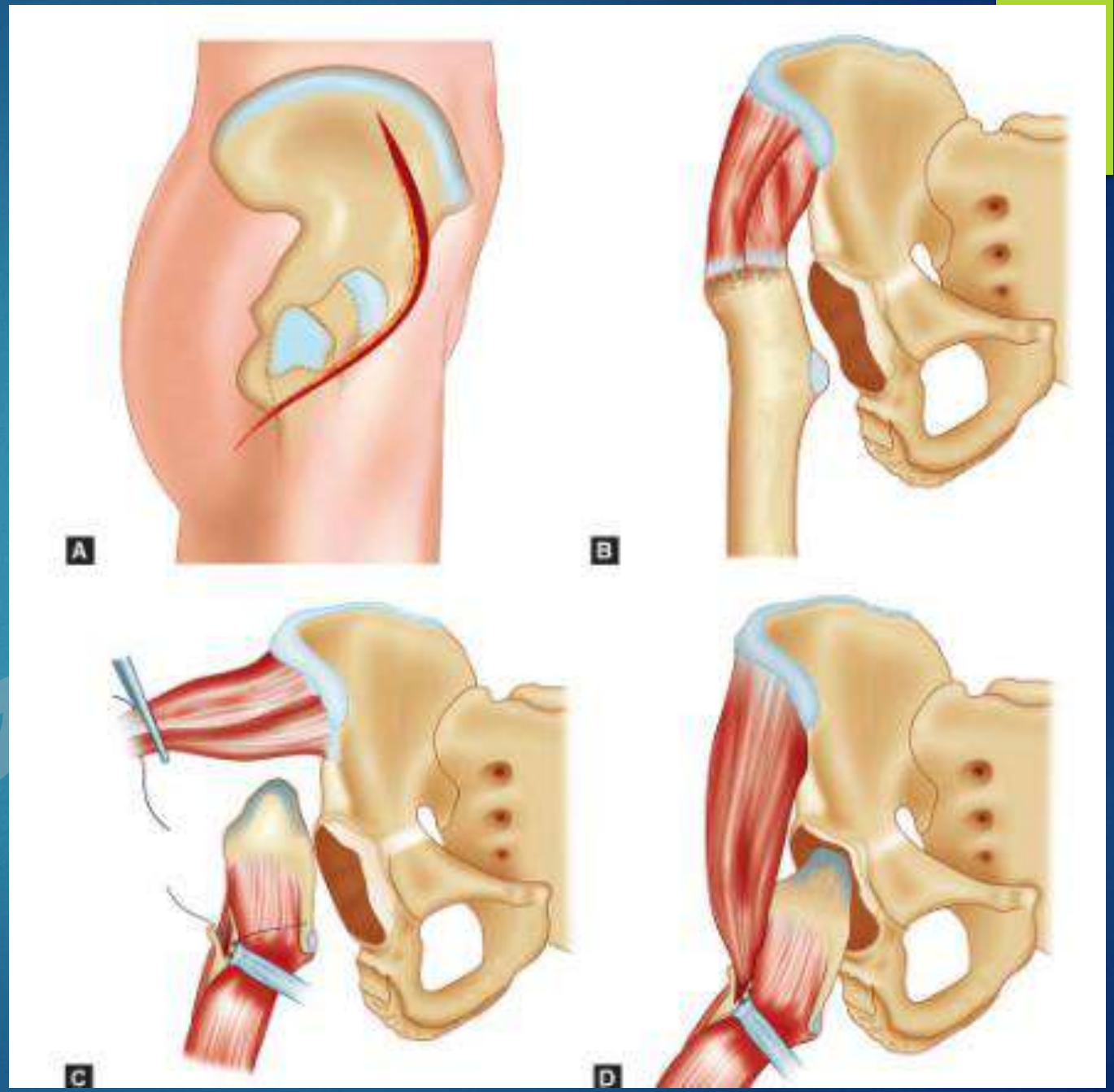


Modified Harmon



Papasivolau

Trochanteirc arthroplasty



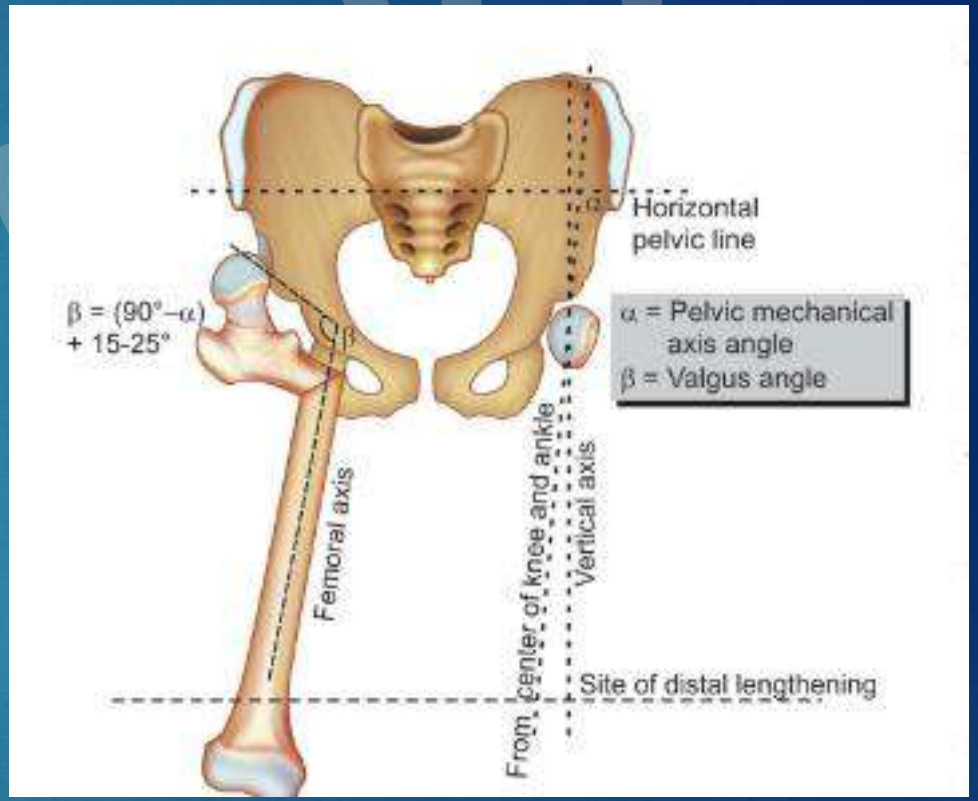
Ilizarov Hip Reconstruction

- **Addresses three issues in one go:**

  Abductor lurch; LLD; Hip Instability

- **Consists of :**

1. Acute Proximal femur Pelvis support osteotomy
2. Distal femur varus osteotomy
3. Gradual Lengthening

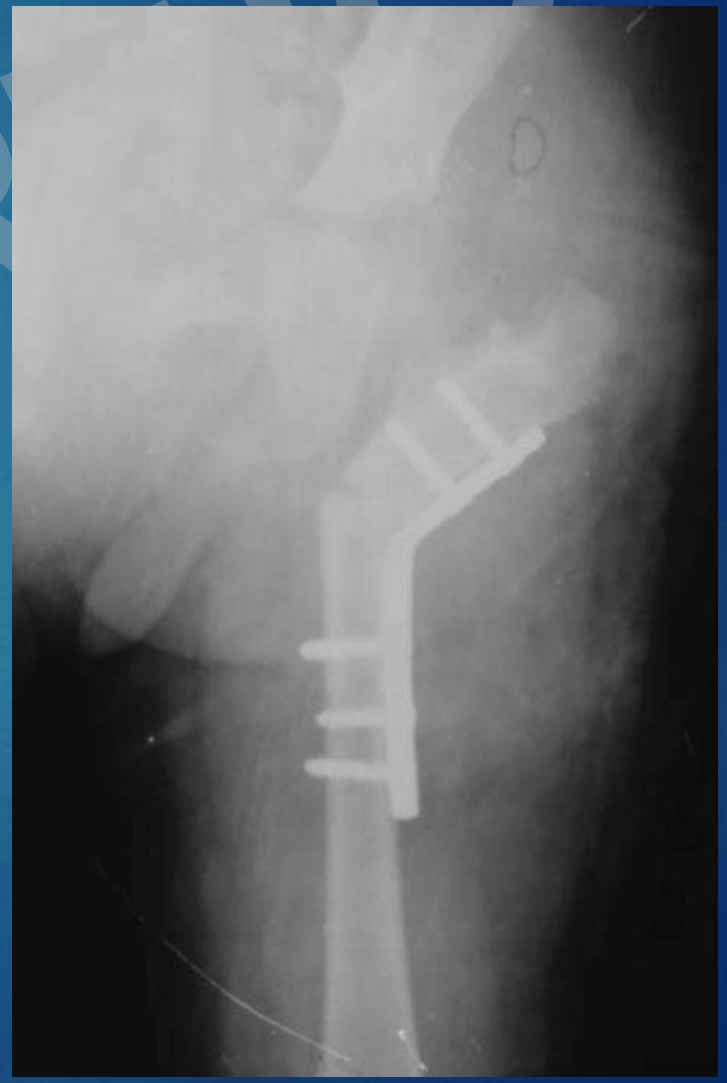


- Salvage of unsalvageable hips where *arthrodesis or arthroplasty not appropriate*

- Aims:
  - Reduce limp
  - Energy-efficient gait
  - Equalise LL

Principles

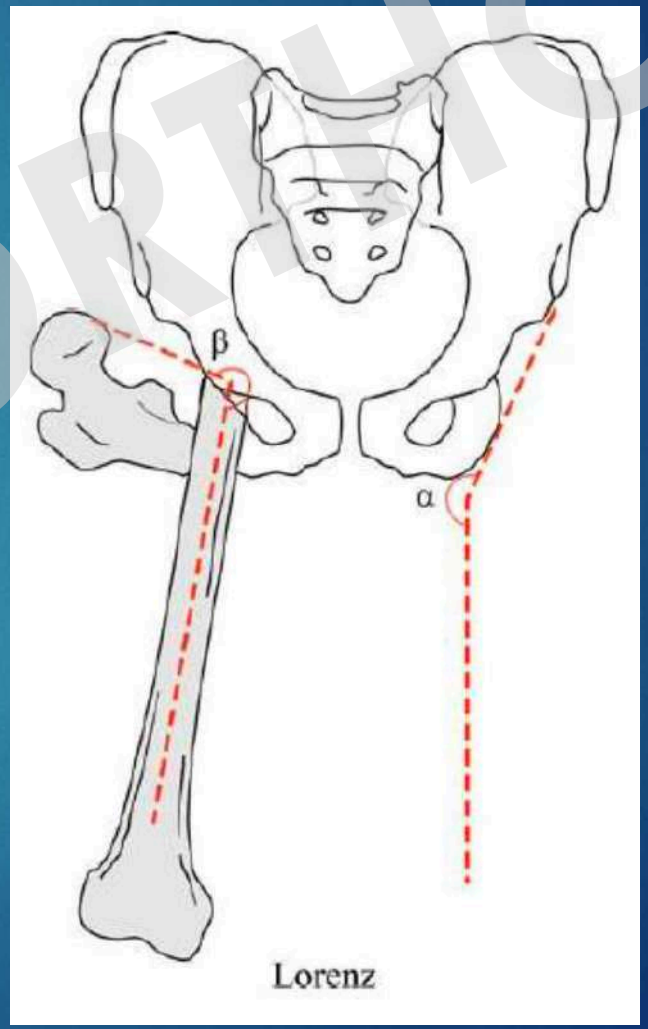
- Proximal femur valgus osteotomy
- Increase contact area between proximal femur and pelvis
- Increase femoro-pelvic stability
- Eliminates hip adduction and pelvis drop in stance
- Displace hip COG medially
- Improve abductor biomechanics



Historical aspects

Lorenz (1919)

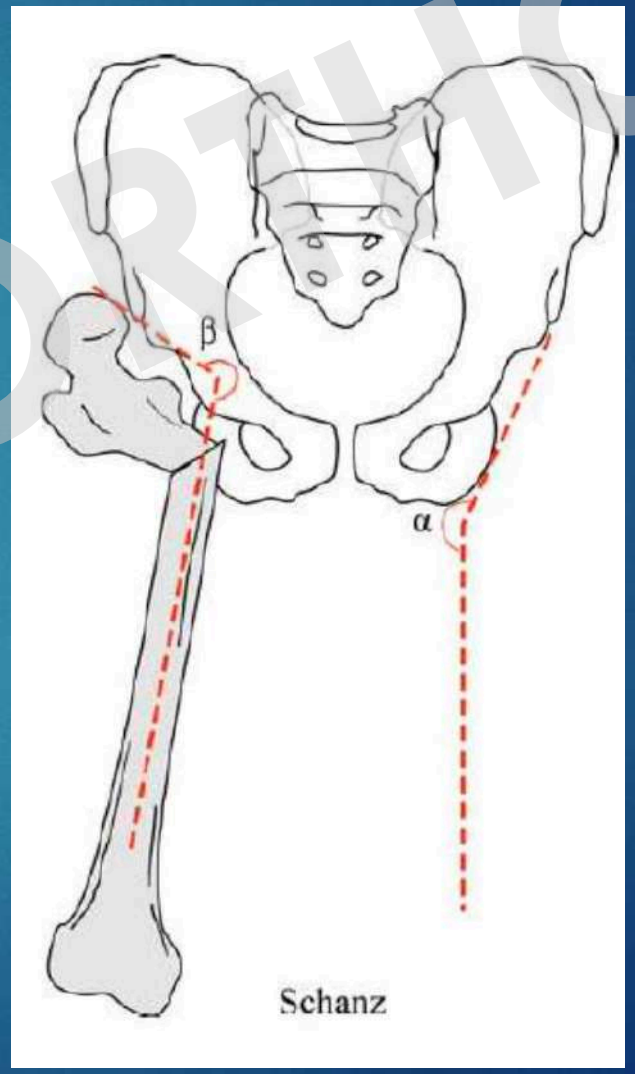
- Subtrochanteric osteotomy
- Distal fragment
  - Proximal
  - Medial
- Decreased ROM



Historical aspects

Schanz (1922)

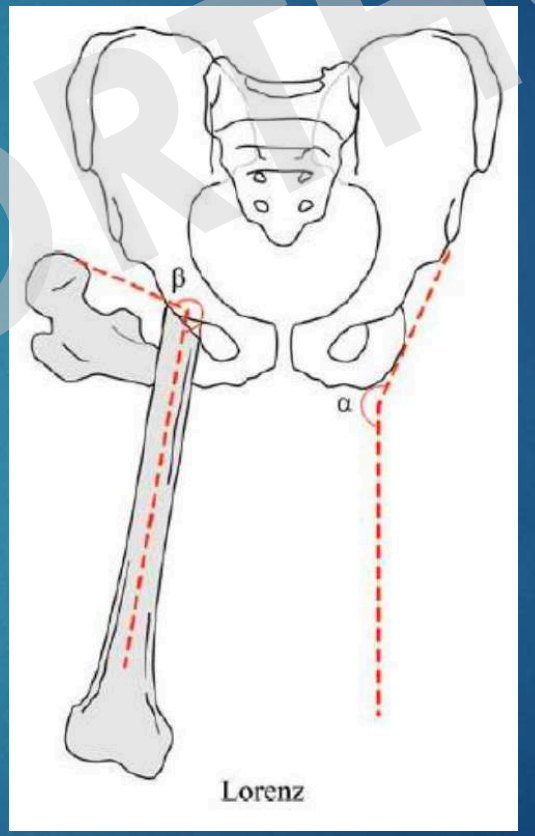
- Subtrochanteric osteotomy
- Distal fragment
  - Valgus
  - Extension

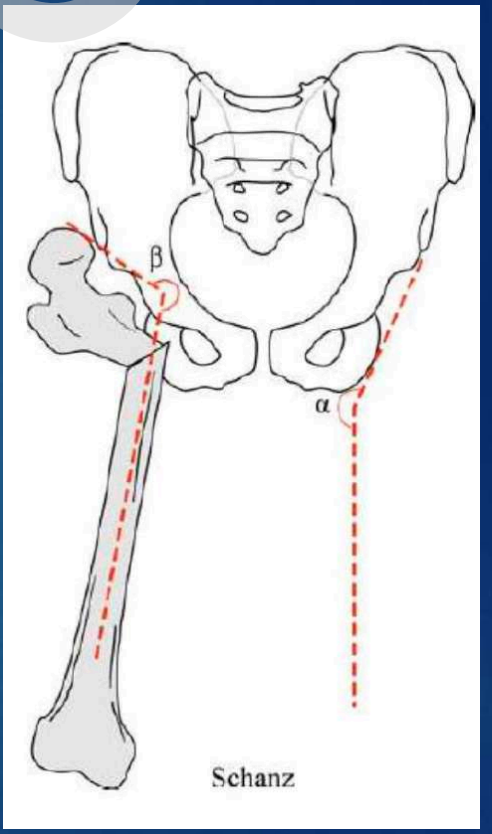


Historical aspects

Milch (1922)

- Concept of
  - Pelvic inclination angle (α)
  - Angle of osteotomy ($\mathcal{B}$)
- Angle of osteotomy should be as close to pelvic inclination angle to maintain maximum ROM
- Recommended POA 210 to 240



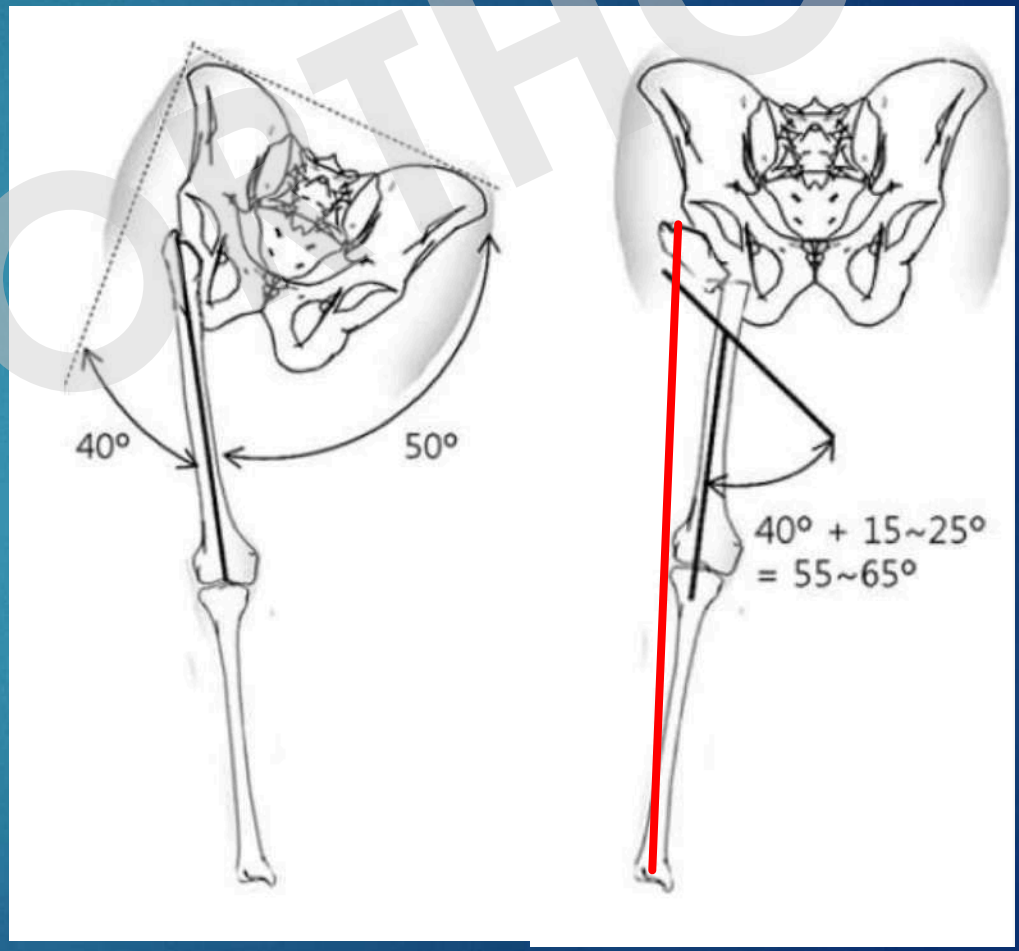


Problems: Technical

- Optimal angle may be difficult to achieve
- Too low angle:
  - Insufficient improvement of hip biomechanics
  - LLD cannot be addressed
- Angle can remodel, especially if done in pre-adolescent children

Problems with traditional PSO

- Mech axis of LL through lateral comp., valgus moment at knee, long term lateral comp. OA
- Pelvic obliquity
- On attempted hip adduction to bring limbs parallel, impingement pain in groin

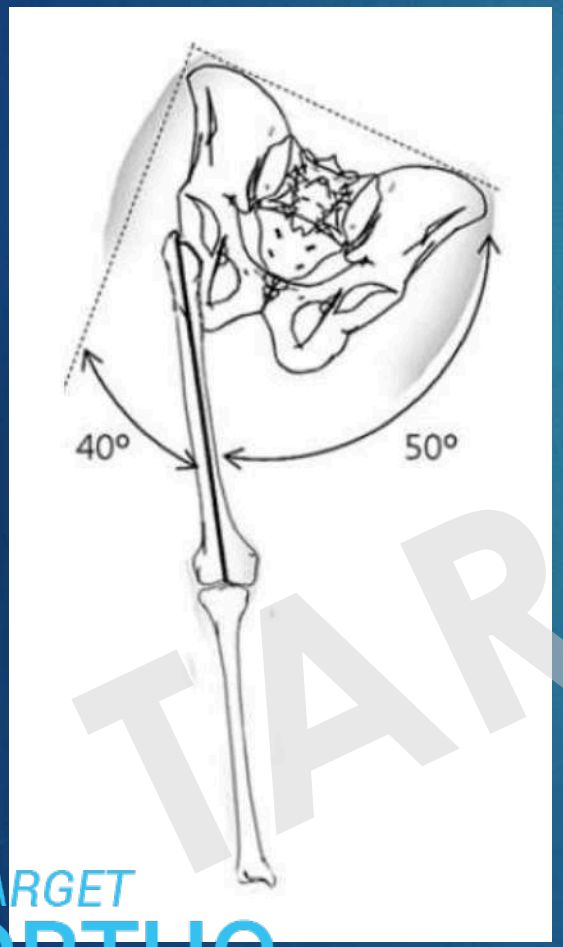


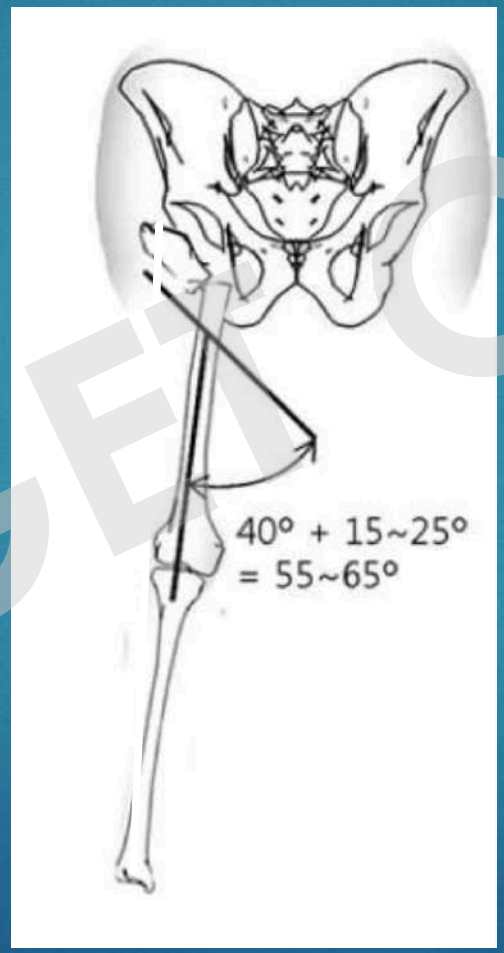
Ilizarov Hip Reconstruction

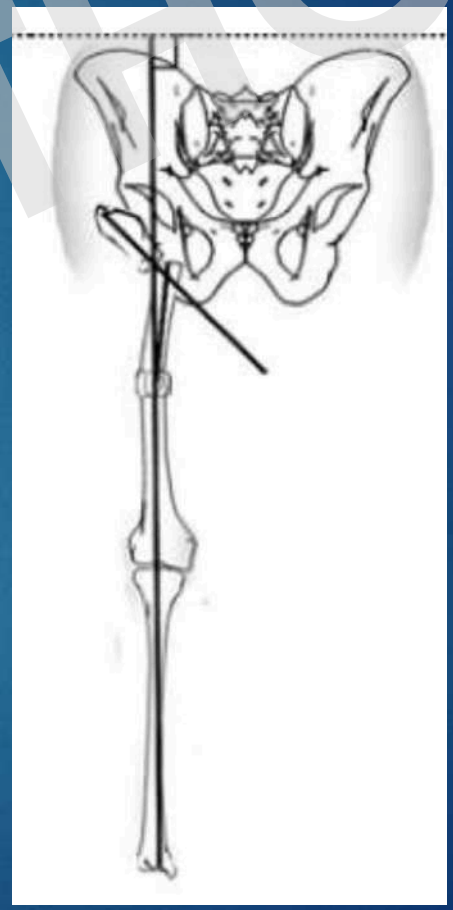
- Ilizarov (1988) added a distal femur osteotomy

- Distal femur osteotomy
  - Varus
  - Lengthening

Ilizarov Hip Reconstruction

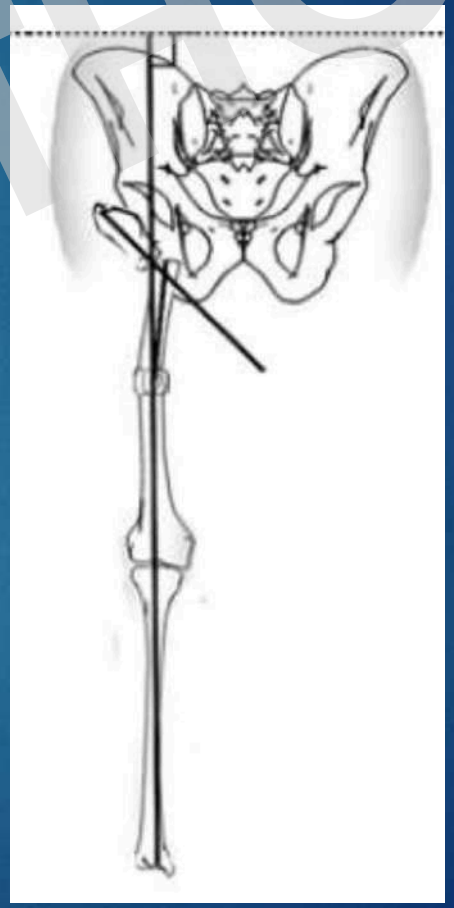






Ilizarov Hip Reconstruction

- Mech. Axis of lower limb now passes through knee joint centre
- This allows bringing both lower limbs parallel without the need to adduct hips, thus eliminates groin impingement



Indications

- **Hip Instability**:
  - DDH: neglected, unsuccessfully treated
  - Traumatic hip dislocation with instability
  - Paralytic or spastic dislocation (post poliomyelitis, cerebral palsy, muscular dystrophy)
- **Femoral head and neck absence**: partial or total
  - Severe sequelae of septic arthritis (Choi type IV)
  - Skeletal dysplasia (SED, Morquio, etc.)
  - Severe AVN

Relative contra-indications

- Children < 12 years age (remodels rapidly)
- Young adults (THR may be better)
- Chronic paralytic hip dislocations

Planning

- Proximal femur osteotomy:
  - Level of osteotomy
  - Degree of valgus
  - Degree of rotation
  - Degree of extension

- Distal femur osteotomy
  - Level of osteotomy
  - Degree

Planning

- Clinical

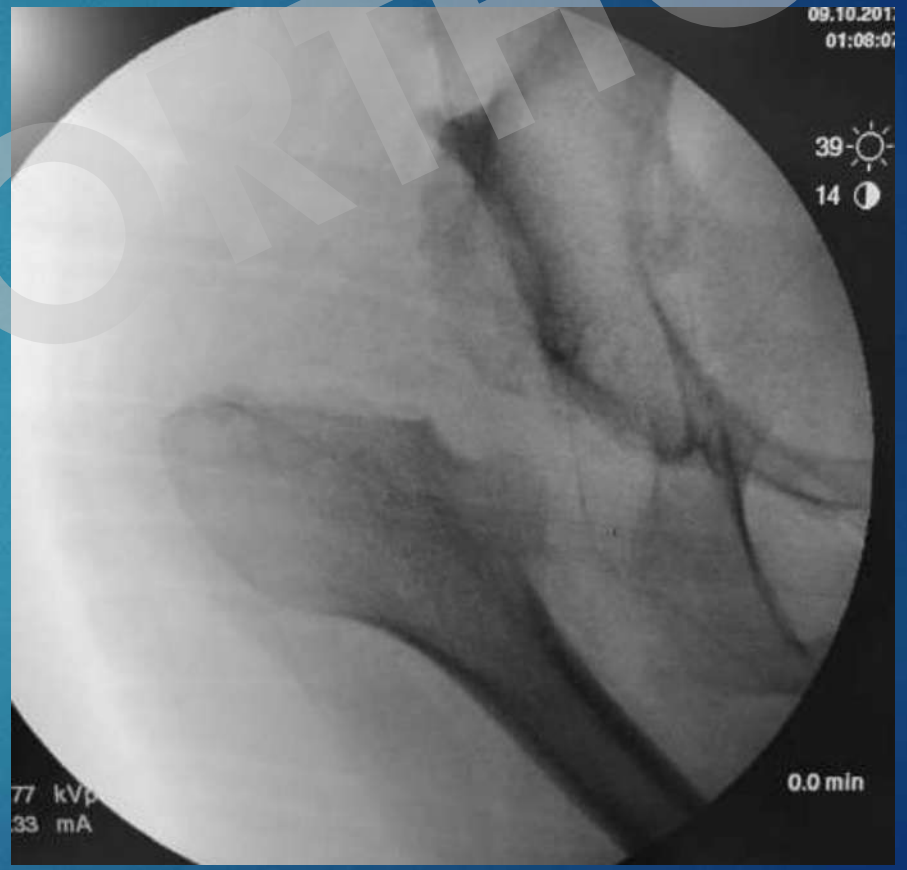
- Radiological

IHR: clinical planning

- Abduction-adduction range
  - Maximum adduction

    Can be assessed by flexing the hip across the contra-lateral hip

  - Adduction contracture if any



IHR: clinical planning

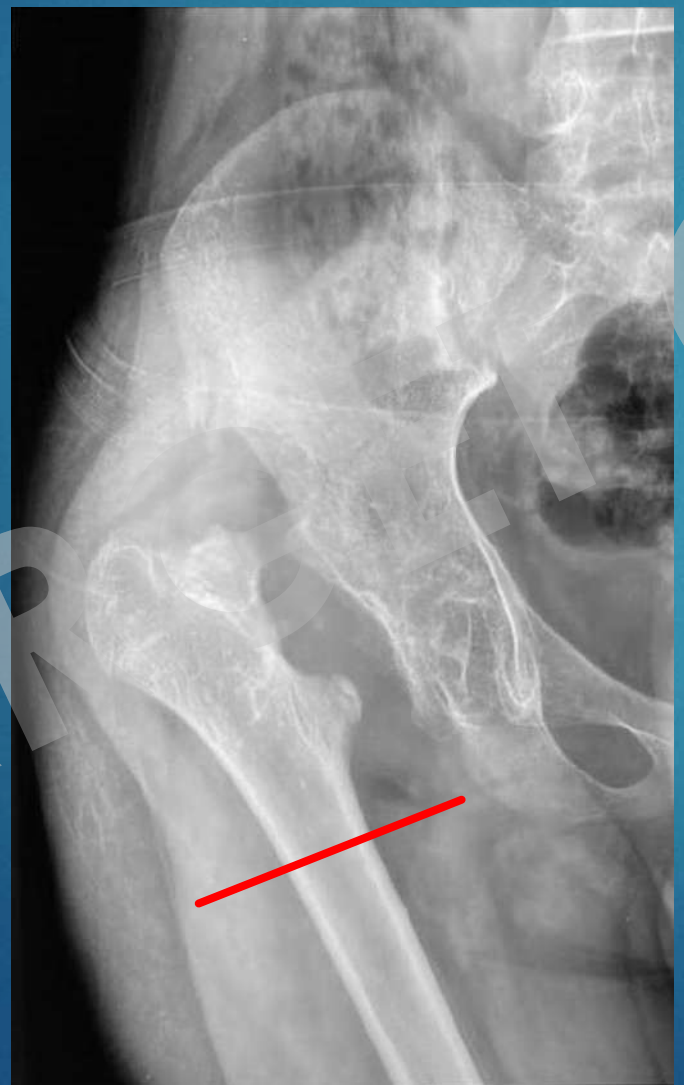
- Rotational alignment
  - Assess Foot Progression Angle (FPA)
  - Assess limb rotation in hip adduction

- Fixed Flexion Deformity (FFD)
  - Thomas test

X-ray planning: PBH

Adduction view, Scannogram

Step 1: Level of PFO



Step 2: Draw prox. fragment axis and outline of proximal fragment

Step 3: Maximally adduct prox. fragment

Step 4: Draw middle fragment axis

Valgus angle =
Max. adduction + 15 to 25 degrees (Paley)

Overcorrection offsets loss of correction due to remodelling

In this case,
Valgus angle = 35 + 15 = 50

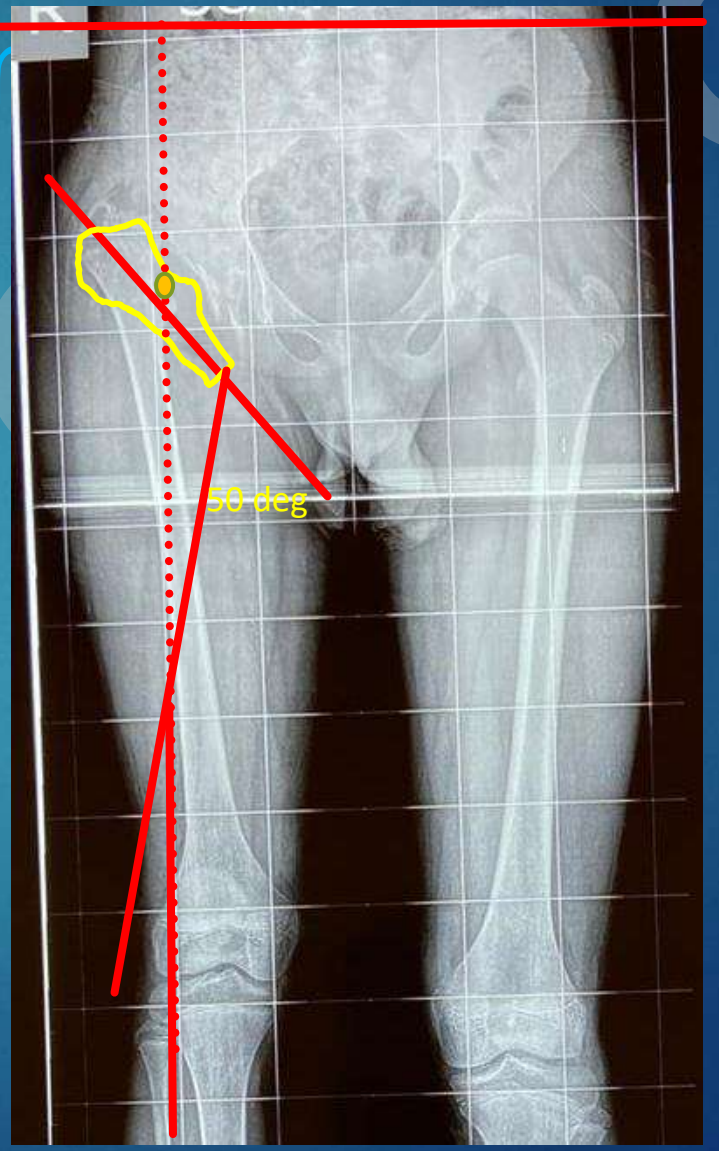
Step 5: Limb mech axis: draw horizontal axis

Join superior most points of iliac crests

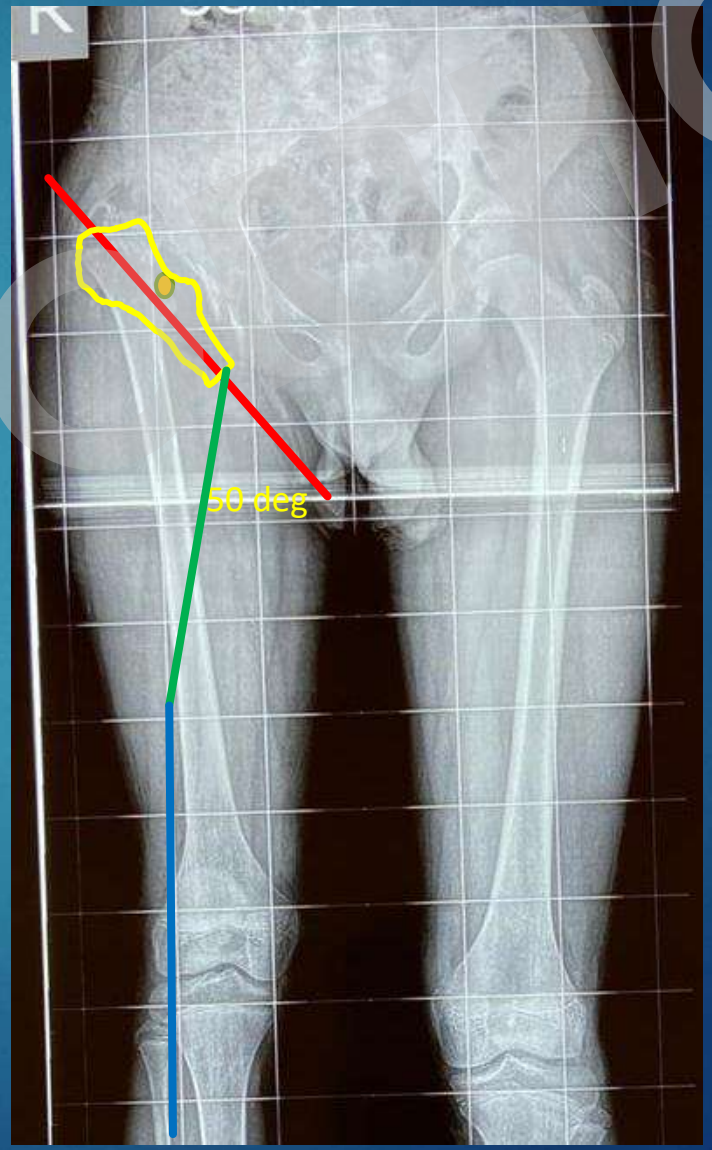
Step 6: Limb mech axis: line perpendicular to horizontal line passing thru acetabulum centr

Intersection of mech axis and middle fragment axis is the level of varus osteotomy

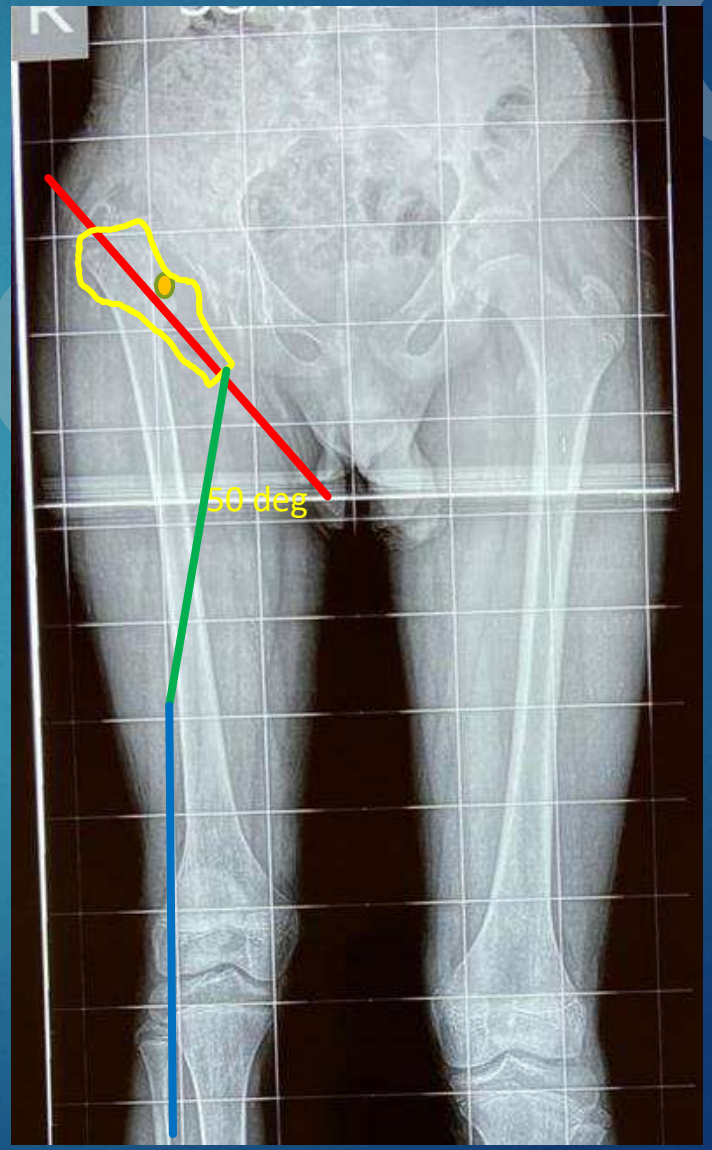
Angle between mech axis and middle fragment axis is the varus angle



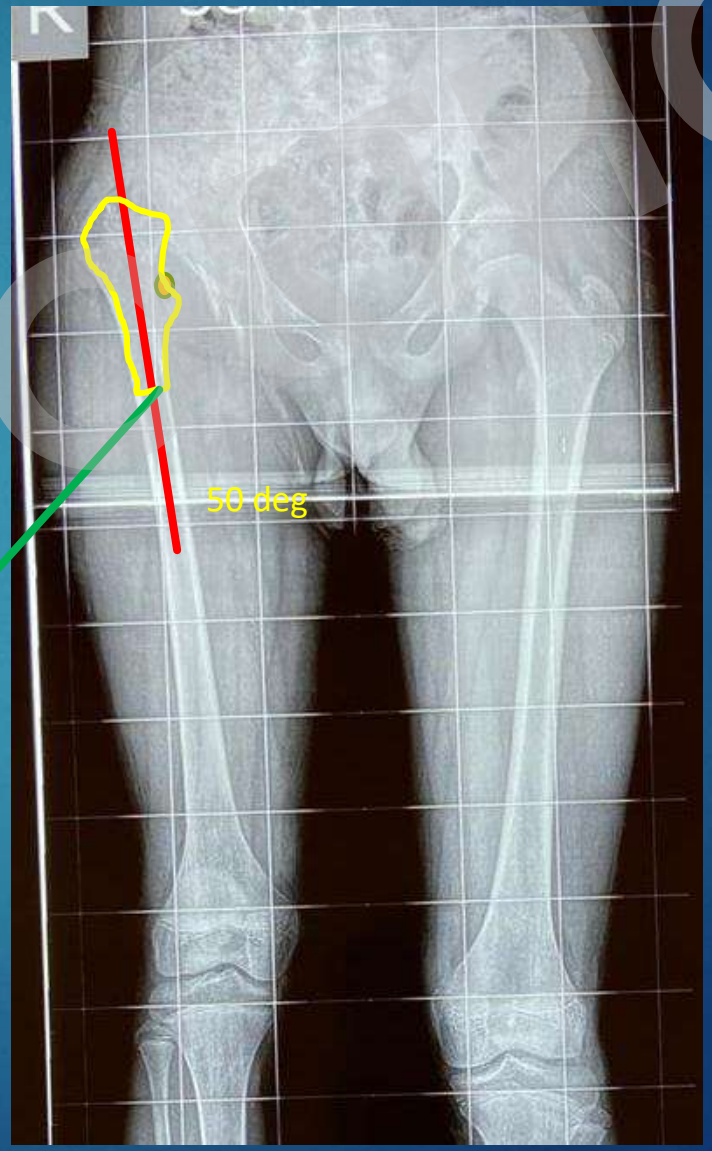
Step 6: Axes of prox, middle, distal fragments



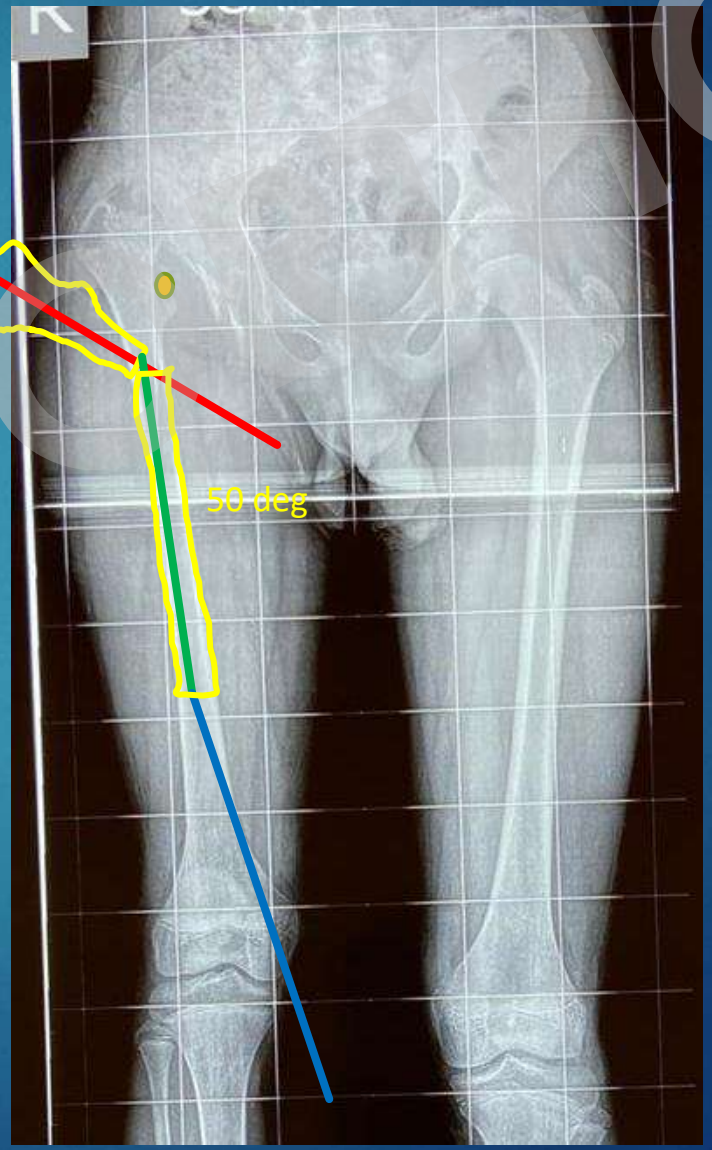
Step 7: Draw bony outlines



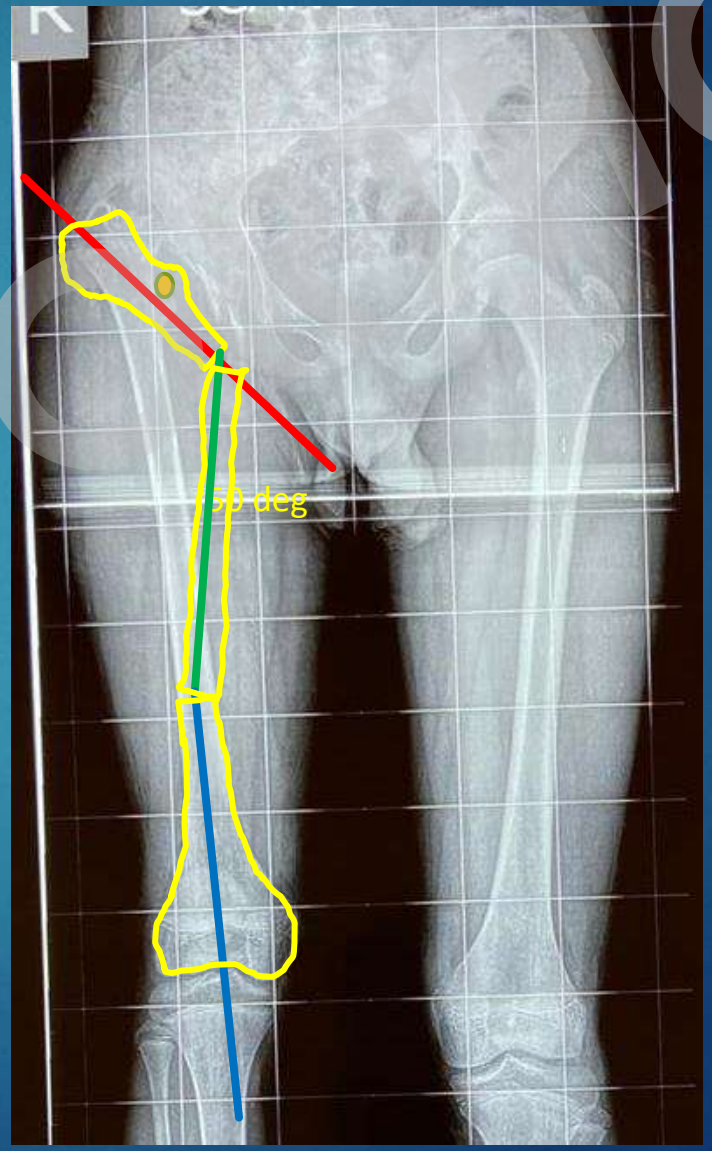
Step 7: Draw bony outline



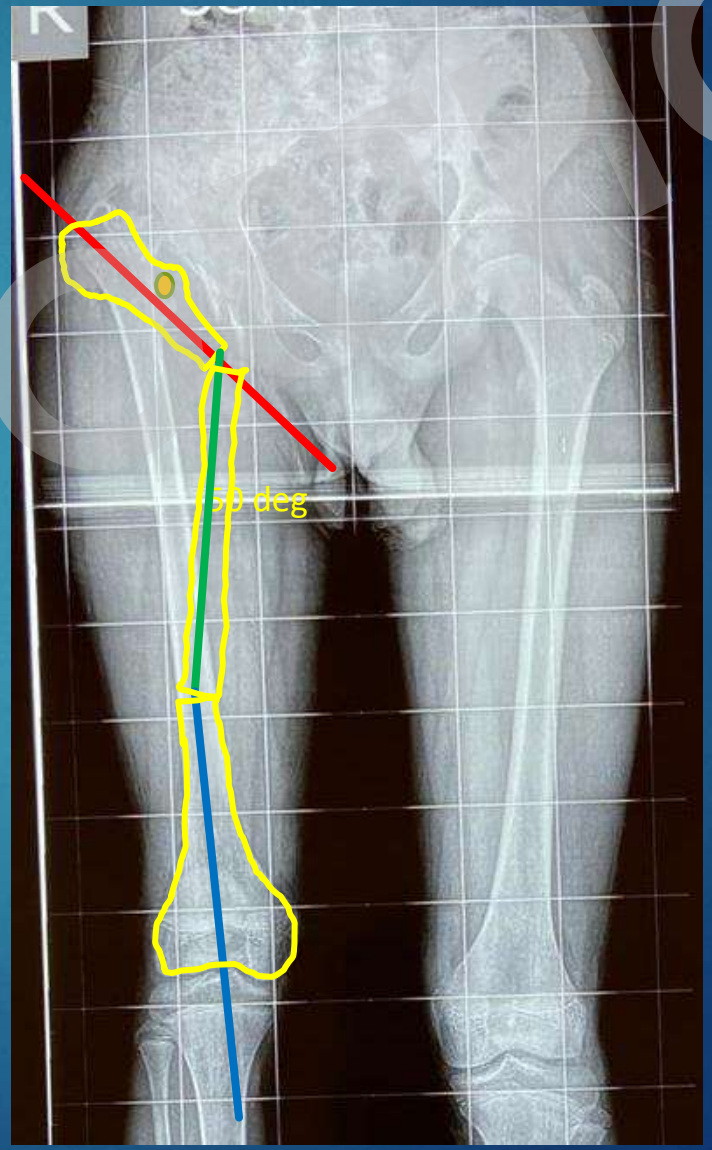
Step 7: Draw bony outline



Step 7: Draw bony outline



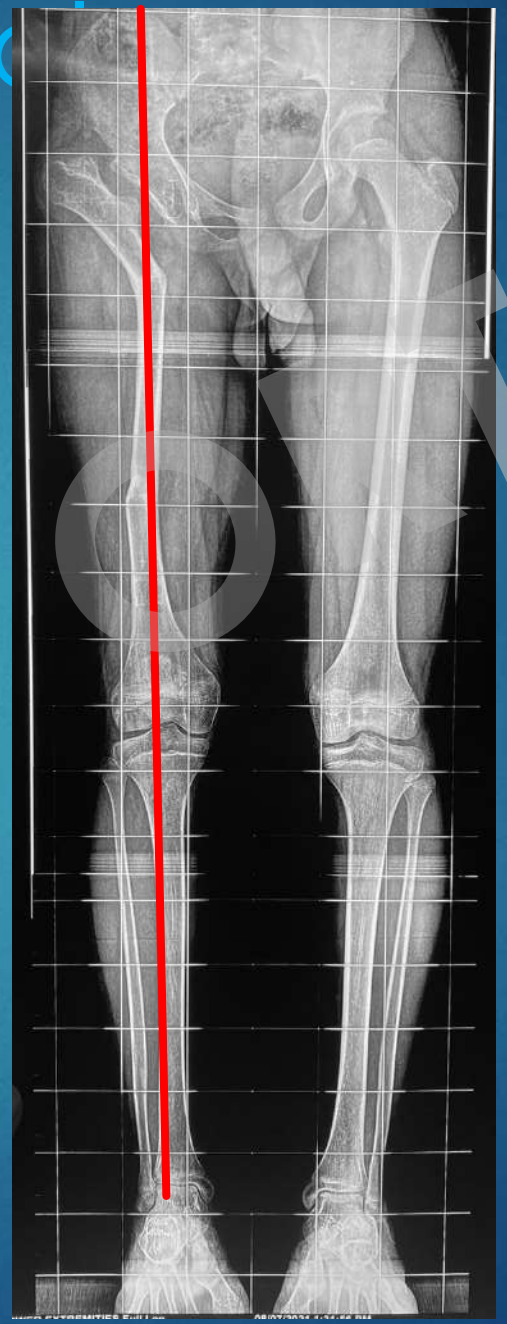
Step 8: Maximally adduct proximal fragment



Mechanical axis align

Surgery: Mono-lateral external fixator

Surgery: Mono-latera
external fixator



Summary Planning

(1) Proximal osteotomy

- a. level: in adduction view, level where femur abuts against ischial tuberosity
- b. Valgus: maximum adduction + 15 degrees
- c. Extension: amount of hip FFD (if any)
- d. Internal rotation: amount of external rotation when hip is in maximum adduction

(2) Distal osteotomy

- a. Level: intersection of proximal and distal axis (proximal axis: drop perpendicular line joining superior borders of iliac crests passing through centre of acetabulum; distal axis: line joining centre of ankle and knee joints extended upwards)
- b. Varus: angle between proximal and distal axis
- c. Lengthening to be done: equal to lld

Thank You