Slipped Capital Femoral Epiphysis (SCFE)

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SLIPPED CAPITAL FEMORAL EPIPHYSES

- Introduction and Definition
- Epidemiology and Risk Factors
- Classification
- Pathogenesis
- Signs and Symptoms
- Diagnosis
- Investigations
- Management Modalities
- Complications
INTRODUCTION

The capital femoral epiphysis is somewhat unique. It is one of the few epiphyses in the body that is inside the joint capsule. (The joint capsule is the tissue that surrounds the joint.)
DEFINITION

Slipped upper femoral epiphysis" term refer to slippage of the overlying epiphysis of proximal femur posteriorly and inferiorly due to weakness of the growth plate in relation to metaphysis.

Most often, it develops during periods of accelerated growth, shortly after the onset of puberty.

The femoral epiphyses maintains its relation with acetabulum, it’s the femoral neck and shaft upward and anterior movement on epiphyses thus epiphyses displaces relatively posterior
SCFE

- Posterior and Medial displacement of the femoral capital epiphysis on the femoral neck through sudden or gradual deformation of the sub-capital growth plate
Femoral Neck Deflection

Neck moves LATERAL and VENTRAL creating Retroversion
EPIDEMIOLOGY AND RISK FACTORS

- 2–3/100000
- Most common in adolescent period with rapid growth plate (boys aged 10–16 y, girls aged 12–14 y)
- Very early onset [<10yrs] and late onset [>16] should be evaluated for endocrine disorders
- Male : Female is 2.4 : 1
- Obesity is a risk factor because it places more shear forces around the proximal growth plate in the hip at risk.
- Bilateral slippage is common of which 2nd slip is about 12–18 months later to 1st (left hip is more common than right)
- L>R, bilateral in 25–40%
ETIOLOGY–MULTIFACTORIAL

1. Local trauma, obesity

2. Endocrine disorders (e.g. primary or secondary hypothyroidism, adiposogenital dystrophy (hypogonadal male)

3. Deficiency or increase of androgens.

4. Acute trauma

5. Growth hormone deficiency

6. ATYPICAL SCFE associated with renal failure, radiation therapy
CLASSIFICATION

- **CLINICAL CLASSIFICATION**
  - Acute
  - Chronic
  - Acute on chronic

- **FUNCTIONAL CLASSIFICATION**
  - Stable
  - Unstable

- **MORPHOLOGICAL CLASSIFICATION**
  - Mild
  - Moderate
  - Severe
CLINICAL CLASSIFICATION

SYMPTOMS

X-RAY

<2WKS

displaced epiphyses

no remodelling

>2WKS

remodelling and

healing noted

ACUTE ON CHRONIC SLIPS

Symptoms lasting longer than 1mth and recent sudden exacerbation pain after trivial trauma
This classification scheme is unreliable because many children and parents cannot remember the exact duration of symptoms.
FUNCTIONAL CLASSIFICATION (LODER)

1. "Stable" SCFEs allow the patient to (walk) with or without crutches (walking aids).

2. "Unstable" SCFEs do not allow the patient to ambulate at all regardless of duration of symptoms; these cases carry a higher rate of complication, particularly of AVN.
MORPHOLOGICAL CLASSIFICATION

AP VIEW – 145°
LATERAL VIEW – 170°

FROG LEG LATERAL POSITION –
- Best shows posterior slippage and subtle slipping also
- Normally 10° posteriorly
- Increases in slippage
MORPHOLOGICAL CLASSIFICATION
(Grading Severity of SCFE according to AP and Lateral X-rays)
PRESLIP—irregularity, widening, and indistinctness of physes

Grade I
Grade II
Grade III

Change in apposition, AP projection

Mild 0–1/3
Moderate 1/3–2/3
Severe 2/3–complete

Slip angle, true lateral projection

Mild 0–30°
Moderate 30°–60°
Severe 60°–90°
PATHOLOGY

- Microscopically characteristic changes in PROLIFERATIVE and HYPERTROPHIC ZONES of epiphyses
  - chondrocytes number decrease
  - collagen fibres and Matrix are increased
PATHOLOGY

Reserve Zone
(Gaucher's, diastrophic dysplasia)

Proliferative Zone
(Achondroplasia)

Hypertrophic Zone
(SCFE, Rickets, SED, MED)

Spongiosa
(Comer fracture, Scurvy)
1. **Pain** in the groin and around the knee.
2. **Antalgic Limp** (intermittent).
3. **Shortening** of the affected limb (1–2 cm).
4. The limb is in **external rotation**.[frog leg position]
5. **Flexion, abduction, medial rotation** are limited
6. **External rotation, adduction** are increased.
7. The presence of **hip flexion contracture** points towards the possibility of chondrolysis.
8. **Axis deviation** – pathognomonic – when hip is flexed, the limb goes into external rotation
Combination of clinical suspicion & radiological investigation

20–50% of SCFE are missed or misdiagnosed on their first presentation to a medical facility.

This is because the common symptom is knee pain. This is referred pain from the hip. The knee is investigated and found to be normal.

In acute cases it is essential to differentiate between SCFE and type 1 epiphseal as most of the time both come with history injury/trauma.

SCFE pt has prodromal pain in groin, thigh or knee. insidious onset whereas in type 1 epiphysal pt is normal acute pain associated with high energy trauma.
# Differentiation between SCFE and PERTHE’S

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<tr>
<th>SCFE</th>
<th>PERTHE’S DISEASE</th>
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<tr>
<td>Usually occurs in 10–14yrs age late onset in 14–16yrs</td>
<td>Usually in 4–7yrs age late onset in 7–10yrs age</td>
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<td>Thin and tall adolescents or short and obese individuals</td>
<td>Occurs in normal child</td>
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<td>Presents as pain with slippage and limping noted at later stage</td>
<td>Initially the child limps and then at later stages complaints of pain</td>
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<td>Limb never has fixed flexion deformity It may be in hyperextension state</td>
<td>Fixed flexion deformity is usually noted</td>
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INVESTIGATIONS

- X-RAYS–AP VIEW–thretowan’s sign[kleins line]
  - steel metaphysel blanch sign
  - sham’s sign
  - capner’s sign
  - widening of growth plate
  - decrease of epiphyseal height

- X-RAY–frog-leg [lowenstein] lateral view
- CT–SCAN
- MRI SCAN
A.P. VIEW–
Posterior, inferior, and medial translation of epiphyses

LATERAL VIEW–
to measure lateral epiphyseal shaft angle
TRETHOWAN’S SIGN

- In normal hip a line drawn tangential to superior femoral neck (Klein’s line) intersects a small portion of lateral capital epiphyseal.
- In posterior displacement of epiphyses, the line doesn’t intersect.
In AP VIEW–crescent-shaped area of increased density overlying the metaphysis adjacent to the physis

This increased density is due to the overlapping of the femoral neck and the posteriorly displaced capital epiphysis
SHAM’S SIGN

- In the normal hip the inferiomedial femoral neck overlaps the posterior wall of the acetabulum producing triangular radiographic density.
- With displacement of capital epiphysis this dense triangle is lost because this portion of the femoral neck is located lateral to the acetabulum.
CAPENERS SIGN

In pelvic AP view in the normal hip, the posterior acetabular margin cuts across the medial corner of the upper femoral metaphysis.

With slipping, the entire metaphysis is lateral to the posterior acetabular margin.
LATERAL VIEW

- Very early slips may appear to be normal in AP VIEW but may be clearly noted in lateral view.

CHRONIC CASE OF SCFE X-RAY

- Reactive bone formation along superolateral aspect of neck.
- Bone remodelling and broadening of neck resulting in PISTOL GRIP like appearance[hordons hump]
USG
- Early detection of early slips
- Joint effusion
- Step between the femoral neck and the epiphysis created by slipping
- Absolute displacement of 6 mm
- <2 mm of joint space is diagnostic of a slipped epiphysis

CT
- For measurement of upper femoral neck anteversion or true retroversion & head-neck angle
- To assess penetration of the hip joint by fixation devices
- To confirm closure of the proximal femoral physis
- For planing of reconstructive osteotomy of femur

MRI
- To assess AVN
COMPLICATIONS

1. Avascular necrosis.
2. Chondrolysis.
3. Osteoarthritis.
4. Coxa vara (is a deformity of the hip, whereby the angle between the ball and the shaft of the femur is reduced to less than 120 degrees).
5. Slipping of the opposite hip $\approx 20\%$ to $50\%$ of cases
GOALS OF TREATMENT

- Prevent further slippage so to avoid complications like osteonecrosis, chondrolysis and osteoarthritis
- Stimulate early physeal closure
- Reduction of epiphyseal displacement
- Any child with SCFE and open epiphyses
  - without stabilisation it progresses
- In a patient with closed physes
  - functional limitations
  - unacceptable gait
  - cosmetic deformity
MANAGEMENT

- Conservative management—rest and traction
- Closed manipulative reduction
- Operative management
  - In situ pinning
  - ORIF
  - BONE PEG Epiphysiodesis
  - Osteotomy
  - reconstruction by—Arthroplasty
    - Arthrodesis
    - Cheilectomy
Conservative Treatment of SCFE

- Hip Spica for 12 weeks
- Complications
  - Recurrent slipping after cast removal
  - Chondrolysis (from 19% to 76%),
  - Avascular necrosis of the femoral head (7%),
  - Skin ulcers (16%), and
  - Psychosocial complications
Manipulative Reduction

- Only for acute and acute on chronic severe slips
- Within 24 hours of slip
- **High risk of ischemic necrosis of head**
- So, manipulate only acute severe slips that may be technically difficult or impossible to pin in situ.
- Alternatively gradual reduction by skin traction and internal rotation over 3 – 4 days.
OPERATIVE TREATMENT

- Grade 0 and I – in situ stabilization
- Grade II – in situ stabilization or inter & subtrochanteric femoral osteotomy
- Grade III – subcapital femoral neck osteotomy, inter & subtrochanteric femoral osteotomy
Percutaneous and open in situ pinning

- Percutaneous pinning

- Open pinning
  - when closed reduction pinning fail

- Generally 2 cannulated screws for acute (unstable) slips
- 1 screw for chronic stable slips.
Stabilisation
Stabilisation

Screw Placement

[Images of medical scans showing bone structures and screws]
Stabilisation
In Situ Pinning

Adverse affects attributed to unrecognized pin penetration:

• Joint sepsis
• Localised acetabular erosions
• Synovitis
• Post operative hip pain
• Chondrolysis
• Late degenerative osteoarthritis
Prophylactic Pinning Of The Contra-lateral Hip

• Pin if symptoms are present

• Pin if there is known metabolic/endocrine disorders

• Pin if Follow up is unreliable
EPIPHYSIODESIS
(Percutaneous Allograft Technique)
Bone Peg Epiphysiodesis

- Not done now a days because of associated postoperative complications:
  - Osteonecrosis
  - Chondrolysis
  - Infection
  - Thigh hypesthesias
  - Heterotopic ossification

- After bone peg epiphysiodesis of acute slips, spica cast immobilization may be necessary for 6 weeks or more to prevent further slipping
OPEN REDUCTION

If there is a severe acute or chronic slip which cannot be reduced by closed methods then open reduction is indicated to prevent early degenerative joint changes.
OSTEOTOMY

• Because moderately or severely displaced chronic slips produce permanent irregularities in the femoral head and acetabulum, some form of realignment procedure often is indicated to restore the normal relationship of the femoral head and neck and possibly delay the onset of degenerative joint disease

• Two basic types of osteotomies:
  ◦ Closing wedge osteotomy through the femoral neck, usually near the physis to correct the deformity.
  ◦ Compensatory osteotomy through the trochanteric region to produce a deformity in the opposite direction
Four femoral neck osteotomies are described:

(1) the technique of Fish,

(2) the technique of Dunn just distal to the slip,

(3) the base of the neck technique of Kramer et al., and

(4) the technique of Abraham et al.

(5) Compensatory osteotomies in the trochanteric region and partial cheilectomy to reduce deformity also are described

(6) 1 and 2 in open epiphyses
CHEILECTOMY

When a prominence on the anterosuperior aspect of the femoral neck blocks internal rotation or abduction by impinging against the acetabulum

Simple resection of the prominence removes the obstruction and improves motion
COMPLICATIONS

SCFE Osteonecrosis

- Rare in untreated SCFE
- Results from interruption of the retrograde blood supply by
  - Intrution in blood suply of epiphysis due to tamponade effect of the heamarthrosis secondary to acute hemorrhage within the capsule
  - Increase with severity of slip
  - Increase in acute, unstable slips
  - Increases with forcefull repetitive manipulation,
  - Pin placement in superior quadrant
  - Osteotomy of femoral neck
AVN

- **DIAGNOSIS:**
  - Early postoperative bone scan has excellent sensitivity and predictive value

- **TREATMENT**
  - Remove metal work
  - Maintain ROM
  - Realignment
  - Shelf acetabuloplasty
  - Arthrodesis/THR
SCFE Chondrolysis

Dissolution of articular cartilage with joint stiffness and pain

Causes:

• Persistent pin penetration
• After trochantric osteotomy, open reduction, femoral neck osteotomy
• Ischemia, excessive pressure
Bone scan in Chondrolysis
DIAGNOSIS

• Joint space of less than 3mm wide (normal 4 to 6 mm)
• Decrease range of motion at hip joint

TREATMENT

• Bed rest
• Traction
• Salicylates
• NSAIDs drugs
• Intra-articular cortisone injections
• Surgical manipulation in form of: Subtotal circumferential capsulectomy
• Continuous passive motion and physical therapy
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