Slipped Capital Femoral Epiphysis
SCFE

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In a person with an open femoral physis, mild trauma shifts the femoral head in relation to the femoral neck.

- **Femoral head** slips posteriorly and medially.

http://www.packardchildrenshospital.org/health/orthopaedics/scfe.htm
Simplified Concept of SCFE
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Open physis

Slipped physis
Epidemiology

- Incidence 30/100,000
- Age: 10 - 15 yrs
- Boys > girls
- Blacks > whites
- More common in overweight children
History and Differential Diagnosis

- Ernst Mueller, 1889
  - Described it pathologically using dissected specimens
  - “There occurs in young individuals aged 14-18, without trauma to the hip, a limp, a weariness, and gradual shortening of the affected limb”

- Distinguished by Mueller from other hip disorders of the young
  - Congenital Hip Dysplasia
  - Legg-Calve-Perthes disease
  - Can be related to renal osteodystrophy, especially if bilateral
Radiologic Studies

- Plain Film Projections
  - Posterior-Anterior
  - Frog-leg Lateral
- CT
  - May resolve finer anatomy
    (Guzzanti V, Falciglia F, 1991)
- MR
  - Most sensitive for small changes in soft tissues
    (Umans H, et al. 1998)
- But diagnosis is still most often made on plain film
- Essential to recognize
Radiographic Findings

• It’s easy when the findings are clear…

http://www.aafp.org/afp/980501ap/loder.html
Radiographic Findings in SCFE

- **Klein’s Criteria (1951)**
  - Earliest: Widened and irregular growth plate, compared to contralateral hip
  - Increased lucency medially
  - Angulated contour of femoral head, then becomes rounded with adaptation
  - Periosteal proliferation at inferior, posterior margins and further slippage create “crow’s beak”

- **Klein’s Line**
  - Line drawn along superior border of femoral neck should cross at least a portion of the femoral epiphysis (Klein, 1951)
  - Most sensitive indicator of a mild slip on plain film

**Classification**
- Grade I: displacement of epiphysis less than 30% of width of femoral neck
- Grade II: slip between 30%-60%
- Grade III: includes slips of greater than 60% the width of neck
Klein’s Line

Klein’s line demonstrates slipped femoral head on right, normal on left.

Courtesy of Dr. Carlo Buonomo, Children’s Hospital, Boston
Importance of the Frog Leg:
Patient DG: Is There a Slip?

Courtesy of Dr. Carlo Buonomo, Children’s Hospital, Boston
Patient DG: Frog Leg

Klein’s line demonstrates slipped femoral head bilaterally

Courtesy of Dr. Carlo Buonomo, Children’s Hospital, Boston
Comparison Patients

• Now it’s time to practice finding SCFE in other patients
• For each, identify whether there is a slip on the right side, the left side, or both sides
Patient JB: 15 year old boy
Is the Slip on the Right, the Left, Or Bilateral?

Courtesy of Dr. Carlo Buonomo, Children’s Hospital, Boston
Patient JB: Frog leg view

Is the Slip on the Right, the Left, Or Bilateral?

Klein’s line demonstrates slipped femoral head bilaterally

Courtesy of Dr. Carlo Buonomo, Children’s Hospital, Boston
Patient MC
Is the Slip on the Right, the Left, Or Bilateral?

Klein’s line demonstrates slipped femoral head on right

Courtesy of Dr. Carlo Buonomo, Children’s Hospital, Boston
Patient KG: 11 year old girl
Is There a Slip?
Sometimes Klein’s Line is Equivocal

Courtesy of Dr. Carlo Buonomo, Children’s Hospital, Boston
Patient KG: Frog leg view
Is the Slip on the Right, the Left, Or Bilateral?

Courtesy of Dr. Carlo Buonomo, Children’s Hospital, Boston
When Klein’s Line Fails, Try Capener’s Sign

- On PA, ischium and femoral head overlap to yield crescent of double density
- SCFE reduces overlap area
- Sometimes more sensitive than Klein’s line alone

Courtesy of Dr. Carlo Buonomo, Children’s Hospital, Boston
Patient KG: Capener’s Sign
Is the Slip on the Right, the Left, Or Bilateral?

Capener’s sign suggests slipped left and normal right.
Patient MG: Is the Slip on the Right, the Left, or Bilateral?

Capener’s sign suggests **slipped right** and **normal left**.
Patient MO: Is the Slip on the Right, the Left, or Bilateral?

Courtesy of Dr. Carlo Buonomo, Children’s Hospital, Boston
Patient MT: Is the Slip on the Right, the Left, or Bilateral?

Klein’s line demonstrates slipped left and normal right.

Courtesy of Dr. Carlo Buonomo, Children’s Hospital, Boston
**Patient RW: Is the Slip on the Right, the Left, or Bilateral?**

Klein’s line demonstrates slipped left and normal right.

Courtesy of Dr. Carlo Buonomo, Children’s Hospital, Boston
Patient SP: Is the Slip on the Right, the Left, Or Bilateral?

Klein’s line demonstrates slipped right and normal left.
Complications

- If undetected, SCFE has disabling sequelae

- Acute cartilage necrosis (chondrolysis)
- Avascular Necrosis (AVN)
- Deformity as bones grow

Time
Tenuous Blood Supply of Femoral Head

- Arterial supply to the head of the femur is from the medial and lateral circumflex arteries, distally, and from the foveal artery in the ligamentum teres, proximally
- All three are threatened by SCFE
  - Shift of the femoral head in relation to the femoral neck can shear the circumflex arteries
  - The displacement of the femoral head within the acetabulum often shears or damages the ligamentum teres
- The result is avascular necrosis of the femoral head
Progression of AVN 
in a Sickle-Cell Patient

- This patient does not have SCFE, but the pathologic changes of AVN would look similar to those pictured here.

http://gait.aidi.udel.edu/res695/homepage/pd_ortho/educate/clincase/clcsimage/sickle1.jpg
Treatment by Femoral Head Fixation

• If detected early, standard-of-care treatment for SCFE is fixation of the femoral head.
Early Detection Leads to Better Outcomes

- It is crucial to detect even subtle indication of SCFE because early detection leads to much better long-term outcome

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(Cowell, 1966)
Summary

- Devastating if missed, essential to recognize
- Diagnosis is still most often made on plain film
- When SCFE is in question, get a frog leg
- Look for Klein’s line and Capener’s sign
References

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