



# **Slipped Capital Femoral Epiphysis**

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# General

- Most common hip disorder in adolescents
- Represents a combination of mechanical and constitutional factors involving the rapidly growing physis in the proximal femur
- Involves the dislocation of the femoral head posteriorly and inferiorly relative to the femoral neck while remaining articulated with the acetabulum.
- Accurate diagnosis and immediate treatment are paramount in avoiding significant morbidity associated with untreated cases, most importantly avascular necrosis of the hip.

# Epidemiology

- Most common group is growing adolescent males between 10-17 year of age (average age of 12)
- Can occur in females, although much less prevalent (average age of 12)
- Male:female 2-4:1
- Affects the left hip more commonly than the right
- Can become bilateral in 20-50% of cases; rarely simultaneous in presentation
- Can occur during growth hormone therapy

# Epidemiology

- Endocrine abnormalities should certainly be considered when a child presents with bilateral SCFE.
- Rarely before 11 in males and 9 in females, and when it does suggests other underlying processes such as hypothyroidism, delayed growth and bone age, panhypopituitarism, gonadal conditions, and renal osteodystrophy

# Pathophysiology

- The proximal physis of the femur changes position from horizontal to oblique during preadolescence and adolescence.
- This change redirects the stress on the plate from compression to shear forces.
- This **normal** anatomic change along with rapid growth or weight gain can put excessive shearing forces across the plate resulting the the Salter-Harris type of fracture along the growth plate.

# Pathophysiology

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- The femoral head then dislocates posteriorly and inferiorly, while the femoral neck and shaft extends and externally rotates
- The fracture is not usually associated with acute trauma rather is a chronic process associated with microfracture at the physis.



# Classification

- Stable (chronic) – allows for weight bearing, may have prolonged symptoms, and may have been minimal in injury
- Unstable (acute) – acute physeal injury, too painful and unstable to allow weight-bearing. Risk for malunion and AVN
- Acute on chronic - third category of patients who have had a stable slip for a variable period of time that is suddenly complicated by an acute physeal separation superimposed on a more chronic and more stable physeal deformation.



# Slipped Capital Femoral Epiphysis



# History

- Knee pain is a common presenting symptom. Occurs as referred pain via the obturator nerve. Can lead to a delay in diagnosis if clinician fails to consider the hip as an etiology
- Medial thigh pain
- Hip or groin pain
- Limp
- Decreased ROM
- Sxs < 3 weeks are considered acute

# History

- Symptoms are often vague, and pain may not be present at all.
- If there is any complaint, usually an aching discomfort
- Typically worse with physical activity.

# Differential Diagnosis

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- Femoral head AVN
- Femoral neck fracture
- Femoral neck stress fracture
- Femur injury
- Groin injury
- Osteitis Pubis
- Knee injury
- Chronic developmental hip dysplasia
- Femoral hernia
- Legg-Calve-Perthes disease
- Neoplastic processes
- Septic joint
- Synovitis

# Physical Exam

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- A limp in gait can be present
- Acutely, the hip can lie in extension, adduction, and external rotation. Any movement, active or passive, is usually painful.
- In a chronic slip, little or no discomfort will occur during active or passive motion of the affected hip. Hip flexion is usually limited. At the end of hip flexion, the femur can drift into external rotation as the prominent anterior femoral neck abuts against the anterior acetabulum.

# Diagnostic Imaging

- Plain films: MUST have AP and lateral views
  - Widening and blurring of the proximal femoral physis is an early sign, even before the proximal femoral epiphysis begins its characteristic posterior tilting
  - Obvious discontinuity between the anterosuperior portion of the femoral neck and the anterolateral corner of the capital femoral epiphysis is commonly seen

# Imaging: Plain Films

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- Degree of slippage:
  - Type I slippage is less than 33% displacement.
  - Type II slippage is between 33% and 50% displacement.
  - Type III slippage is greater than 50% displacement.





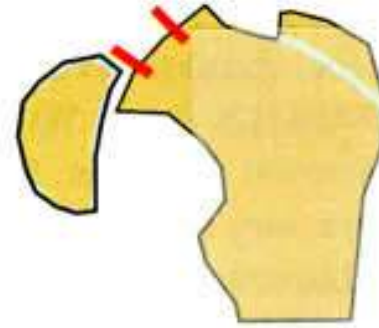
**Mild**

0–1/3



**Moderate**

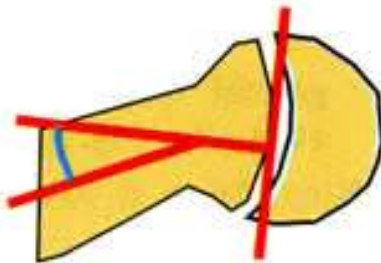
1/3–2/3



**Severe**

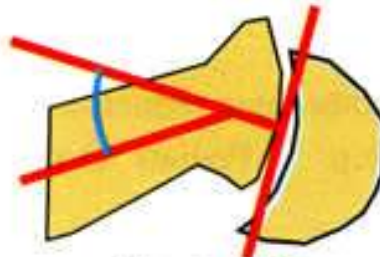
2/3–complete

**Change in apposition, AP projection**



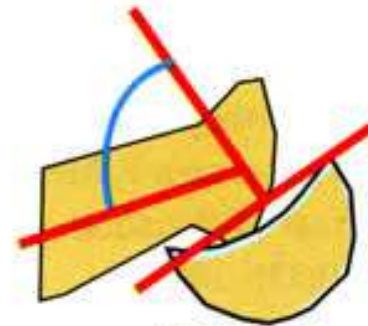
**Mild**

0–30°



**Moderate**

30°–60°



**Severe**

60°–90°

**Slip angle, true lateral projection**

# Imaging: Plain Films

- AP Films: A Klein line is a line drawn along the superior border of the femoral neck that would normally pass through a portion of the femoral head. If not, slipped capital femoral epiphysis is diagnosed.

Normal



A

Slip



B

Kline's line



Klein Line



Klein Line



Klein Line

# Imaging: Plain Films

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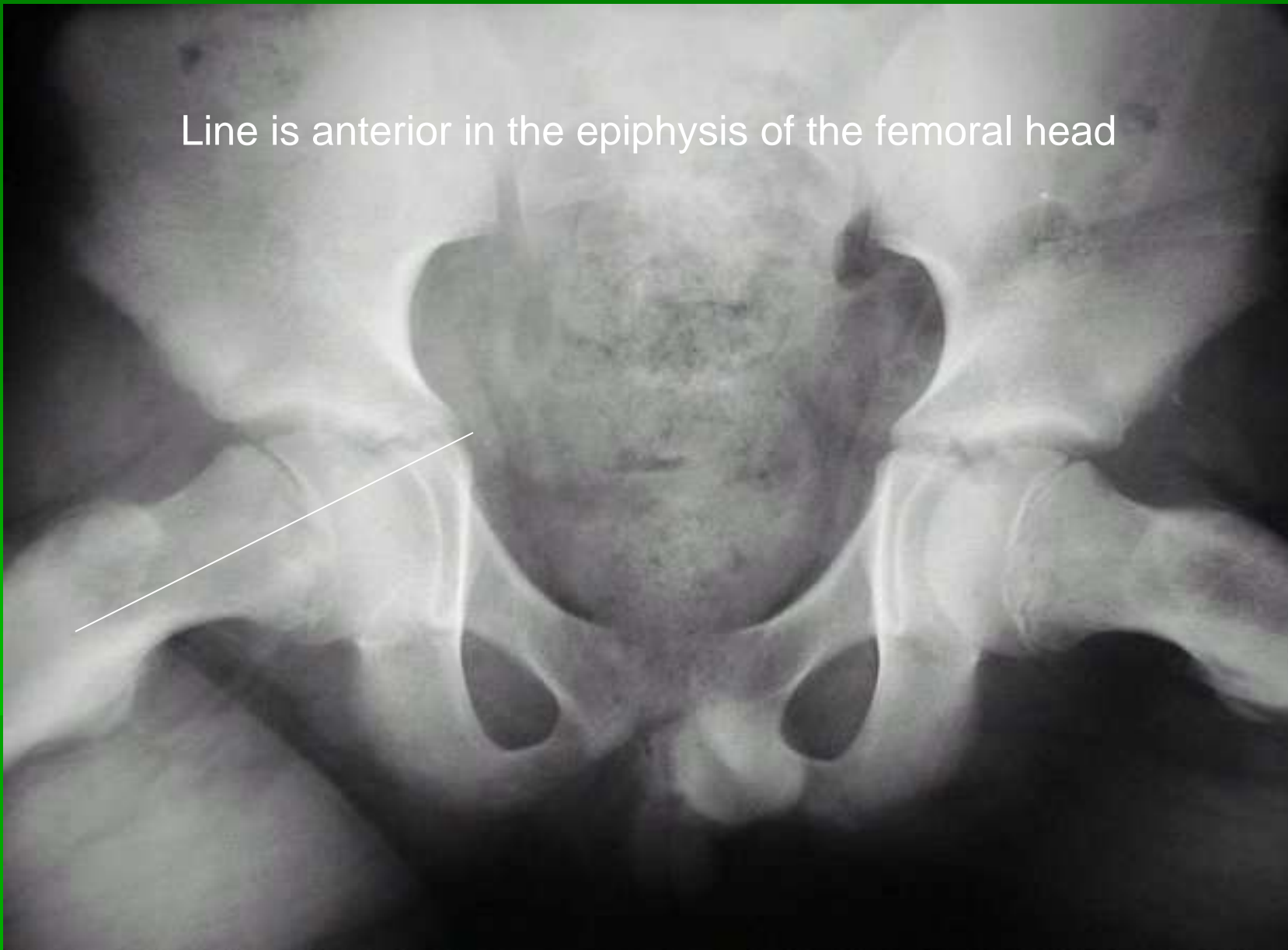
- Frog-leg views: A straight line through the center of the femoral neck proximally should be at the center of the epiphysis. If not, and the line is anterior in the epiphysis, it is likely an SCFE





Line is anterior in the epiphysis of the femoral head

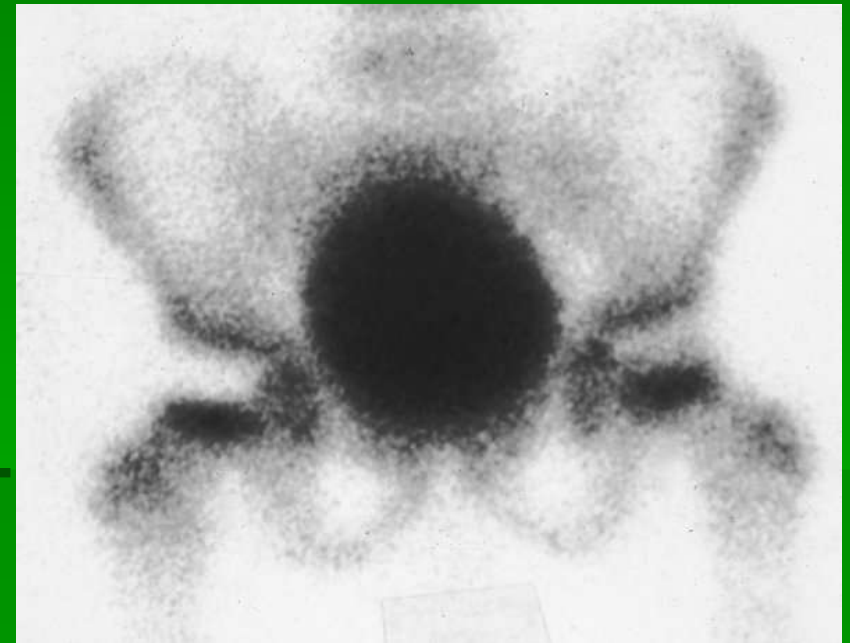
Line is anterior in the epiphysis of the femoral head



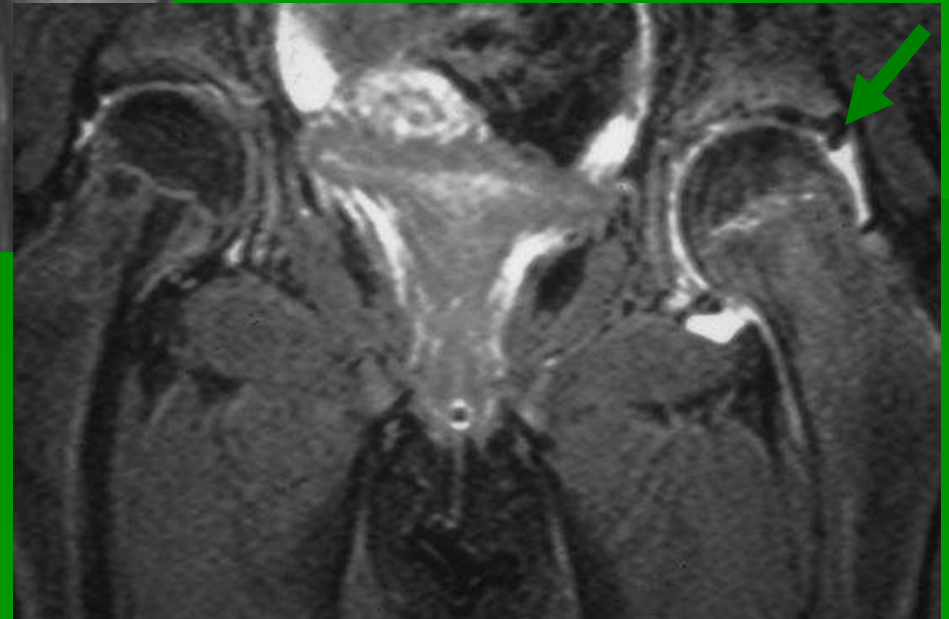
# Advanced Imaging

- Bone scans can show increased uptake at the femoral neck
- MRI can show epiphysis changes in the early stage
- Advanced imaging studies not routinely used, however can aid in confirming the diagnosis. Can also aid in the measurement of the severity of the injury

# Bone Scan



# MRI – mild SCFE

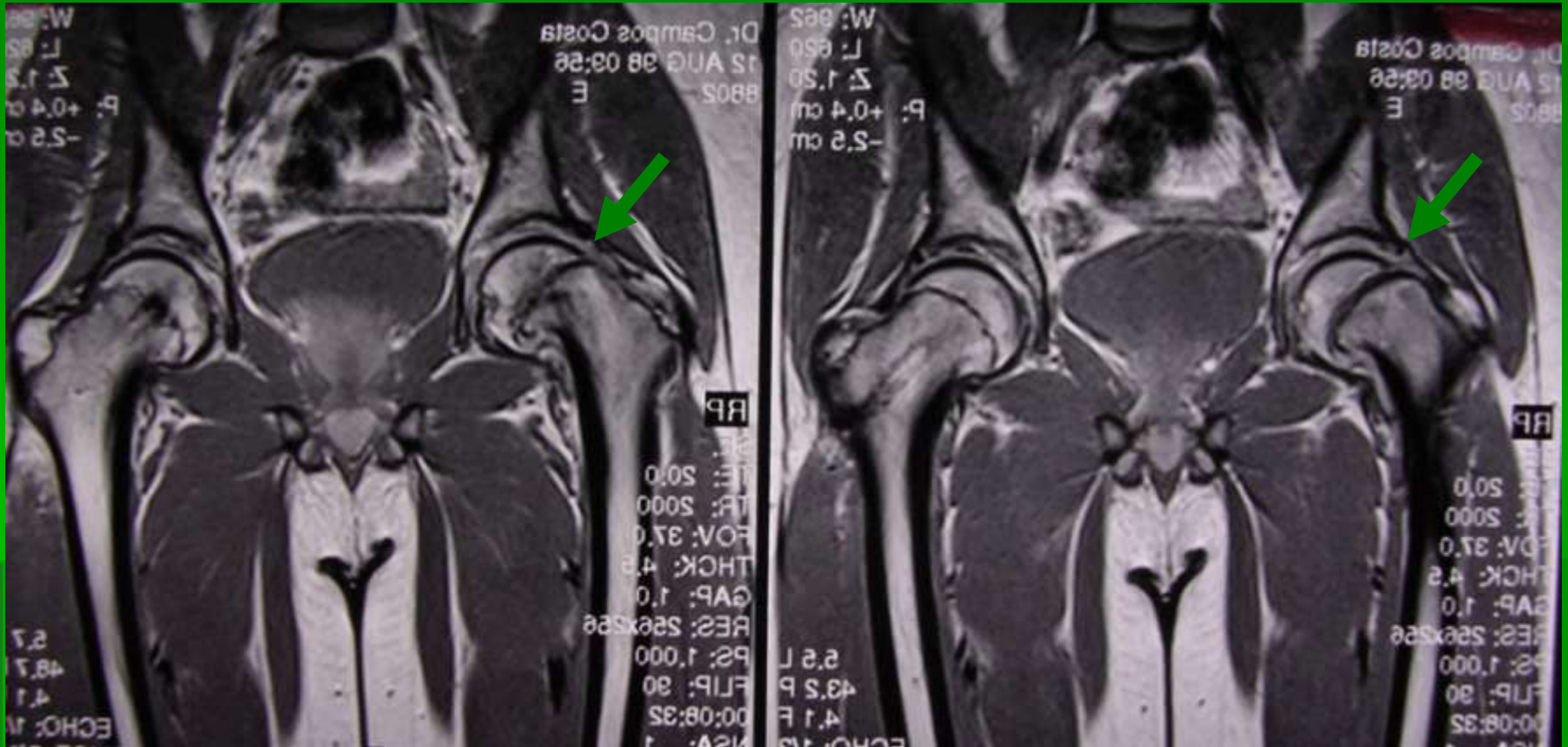


# MRI – severe SCFE





# MRI - moderate





# Advanced Imaging

- A report in the European Journal of Radiology suggests that pretreatment MRI in established cases of SCFE has a role with prognostic implications for the treatment approach and outcome of this condition. The investigators noted that synovitis, periphyseal edema, and joint effusion are regular features of SCFE; however, "the clinical history and findings are unreliable for the **classification** of SCFE," and "radiographs underestimate the severity of SCFE. MRI can potentially identify unstable, reducible slips. If the mode of surgical treatment depends on the particular nature of the SCFE then MRI contributes to surgical decision-making." [5]

# Laboratory Evaluation

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- ROUTINE hormonal screening is NOT indicated in children with SCFE
- Workup can be initiated however in cases if ATYPICAL presentations arise, such as age  $< 10$  or  $> 16$ , or presentation with short stature (implication of underlying congenital disease)

# Treatment



VS.



# Treatment

- Casting has fallen out of favor due to high rate of AVN and chondrolysis, as well as difficulty in application and maintenance of casts
- Classification:
  - Acute (< 3w) vs chronic (> 3w) vs acute on chronic (> 3w but acute change)
  - Stable (wt bearing) vs unstable (non weight bearing)
  - Radiographic classification (Type I, II, III)
- Usually immediate ORIF

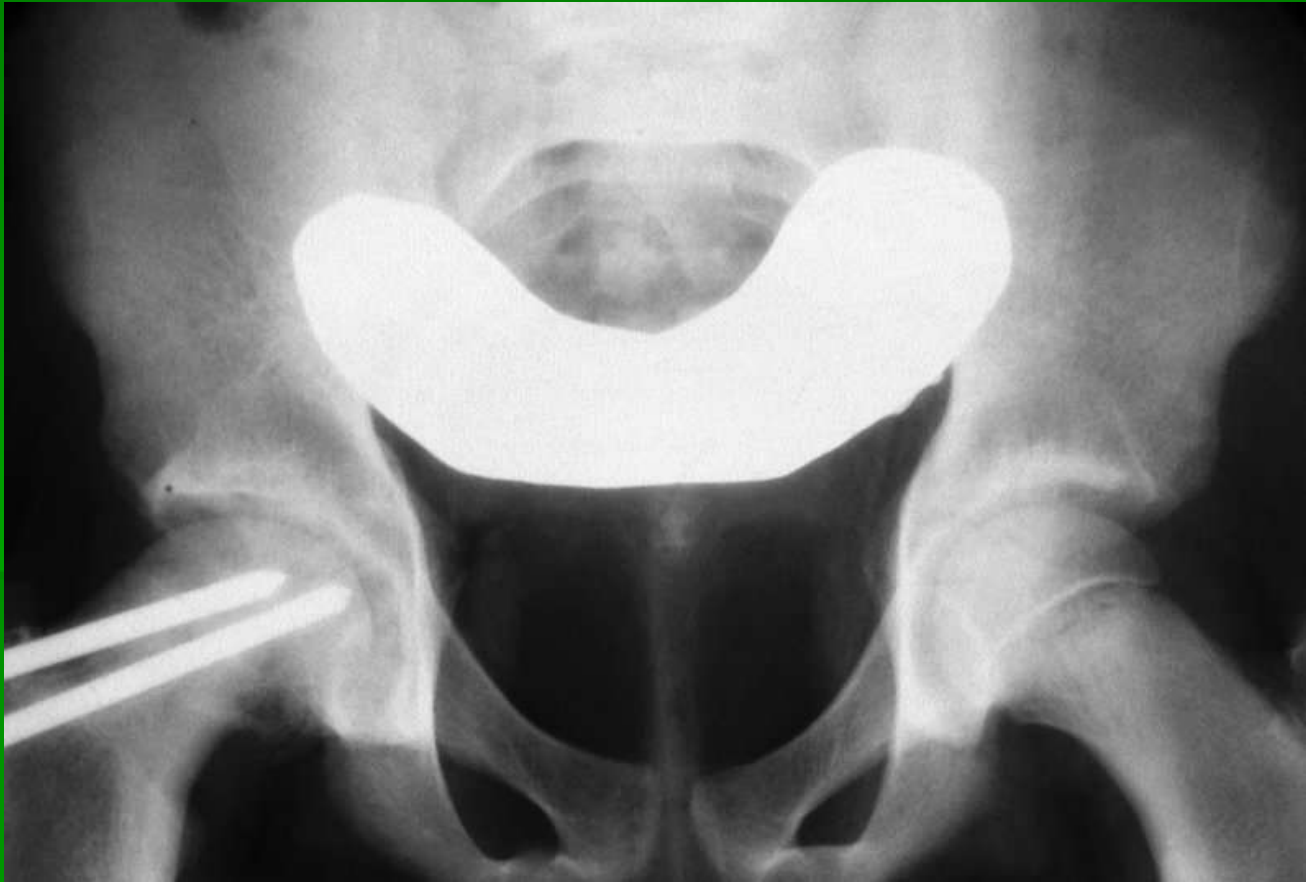
# Treatment

- If the angle of the slip is  $>45$  degrees can consider a bone realignment procedure to avoid significant risk to OA from anterior impingement and dysfunction in the form of limitation of flexion and severe external rotation deformity

# Pre-op



# Post Op





# Treatment

- Prophylactic pinning of the contralateral asymptomatic hip is controversial.
- May be considered in patients  $< 10$  or with endocrinopathies that place them at higher risk for bilateral involvement
- Also may be considered in patients / families that are unreliable, as close follow-up for monitoring the unaffected hip is of utmost importance
- In Europe the majority of cases receive prophylactic fixation of the unaffected hip

# Follow Up

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- Limited weight bearing 6-8 weeks
- PT/rehab
- Return to play when pain free and full strength
- Some say no return until physis has closed

# Complications

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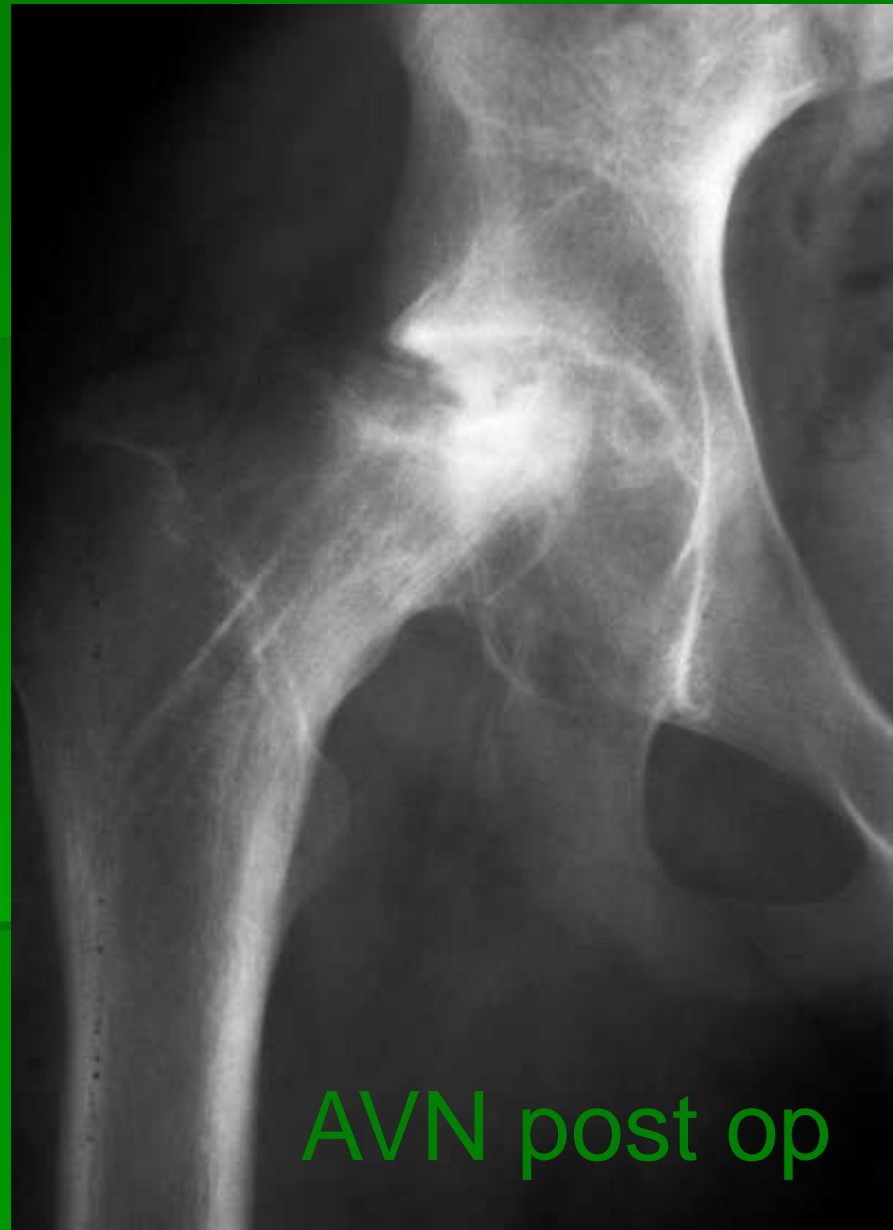
- Can arise from disease process or treatment
- Osteoarthritis from untreated deformity
- AVN – up to 47% in unstable cases
  - ?vascular compromise from initial injury vs. forceful reduction at time of surgery
- Chondrolysis (treated or untreated)
- Surgical complications (infection, loss of fixation, outgrowing screws)



Old SCFE AP view, 88 y/o male



Old SCFE frog view, 88 y/o male



AVN post op

# References

1. DeLee: DeLee and Drez's Orthopaedic Sports Medicine, 2nd ed, Saunders 2002
2. <http://emedicine.medscape.com/article/91596-overview>
3. [http://www.wheelessonline.com/ortho/slipped\\_capital\\_femora\\_l\\_epiphysis](http://www.wheelessonline.com/ortho/slipped_capital_femora_l_epiphysis)
4. Radiology of adolescent slipped capital femoral epiphysis: measurement of epiphyseal angles and diagnosis. Oper Orthop Traumatol. 2007 Oct;19(4):329-44.
5. Tins B, Cassar-Pullicino V, McCall I. The role of pre-treatment MRI in established cases of slipped capital femoral epiphysis. Eur J Radiol. 2009 Jun;70(3):570-8.