

Slipped Capital Femoral Epiphysis: Early Intervention Lessens Risk of Hip Abnormalities in Adulthood

by Stephen Sundberg, M.D.

Introduction

Slipped capital femoral epiphysis (SCFE) is the most commonly identified hip problem in youth ages 12 to 16. SCFE occurs when there is a shift in the position of the capital femoral epiphysis on the femoral shaft (see Figure 1). The shift can occur in a chronic fashion or as an acute slip. SCFE usually occurs during a period of accelerated growth shortly after the onset of puberty. On occasion, the condition occurs in younger children.

SCFE alters the shape of the proximal femur. The alteration — depending on how extensive the deformity is — can cause arthritis in a significant number of people. Research studies examining the etiology of arthritis in adults show that a substantial number of people have joint changes consistent with SCFE. Therefore, it is important to identify and treat SCFE early in an effort to reduce the risk of children developing a severe deformity or osteonecrosis (ON). ON is a devastating complication that can occur when a sudden, unstable slip of the growth plate occurs. See *Secondary Complications*, Page 3.

In this article, we will discuss SCFE and its:

- Etiologies
- Common symptoms
- Physical-exam markers
- Diagnosis criteria
- Treatment
- Secondary complications

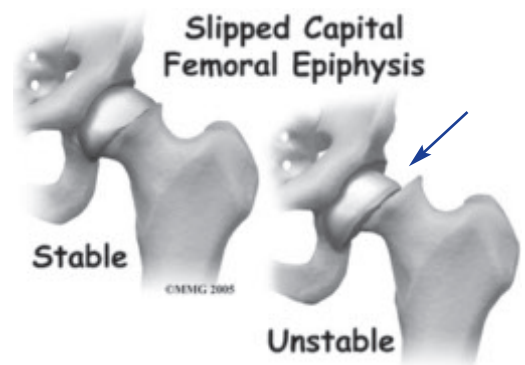
SCFE Classifications and Symptoms

Classifying SCFE is important, because doing so helps determine treatment decisions. The Loder classification, which we use at Gillette, classifies SCFE by whether the slip is *stable* or *unstable*. SCFE is classified as stable when a person is able to bear weight on the affected extremity. When weight bearing is not possible, the slip is classified as unstable (see Figure 1).

Children who have stable slips generally complain of persistent groin, thigh or knee pain for weeks or months. During that time, patients remain ambulatory; however, they frequently limp. When an unstable slip develops, there is likely a sudden onset of pain.

Approximately 85 percent of SCFE cases are chronic. In such cases, children often do not recall a specific history of injury. Because their complaints are oftentimes low-grade and somewhat insidious, families typically do not seek medical attention until the child has experienced episodic pain and limping for weeks to months; the average duration of symptoms is five months. Bilateral slips occur in 25 percent of people.

Figure 1



In the unstable SCFE illustration, the arrow points to the displacement of the epiphysis of the femur.

Image courtesy of Medical Multimedia Group LLC
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Unstable slips have a more urgent acute presentation. Because of the abrupt change in the alignment of the proximal femur, disruption of the blood vessels to the capital femoral epiphysis can occur. As a result, ON can develop. There are rare reports of ON in children who have stable slipped epiphyses.

Demographics

Elevated body weight might well be the single most important factor in the etiology of SCFE. More than 60 percent of adolescents with SCFE are above the 90th percentile for weight. Boys are twice as likely as girls to have SCFE, and the incidence is higher in certain populations, such as Polynesians.

There is evidence that when a mechanical overload (e.g., an overweight child) occurs on the rapidly growing physis, a gradual or acute slippage through the proximal femoral growth

plate takes place. Such a shift could occur over days, weeks or months, or it might suddenly displace, resulting in an acute unstable slip.

During a child's accelerated growth phase, the growth plate is wider and somewhat weaker than at other times during childhood. During this phase, the orientation of the proximal femoral growth plate also changes, becoming increasingly oblique and assuming a more vertical relationship to the proximal femur. As a result, forces that traditionally compress the growth plate develop increased shear forces across the plate. Such shearing makes the growth plate less able to resist shear stresses, and the plate becomes vulnerable to failure. If SCFE occurs in children under age 12, or in children who are slim, one might consider the presence of an endocrinopathy, such as hypothyroidism or renal disease.

Diagnosis

If adolescents ages 12 to 16 complain of groin, thigh or knee pain — particularly if they are overweight — evaluate for SCFE, especially if the symptoms have been present for weeks to months.

Typically, a physical examination will suggest the presence of SCFE, even before one obtains X-rays. Adolescents with SCFE often walk with an externally rotated foot on the involved side and demonstrate a Trendelenburg gait (an abnormal gait caused by weakness of the abductor muscles of the lower limb, gluteus medius and gluteus minimus). On the exam table, passive flexion of the hip results in the hip falling into a position of external rotation. In a prone position, an adolescent with SCFE has markedly limited internal hip rotation, which often results in groin or thigh pain.

Radiographs

The earliest radiographic abnormality is widening of the growth plate on the affected side, which occurs before a slippage of the growth plate (see Figure 2). As the slip begins to develop, the height of the epiphysis on the anteroposterior (AP) X-ray begins to diminish, a situation some observers describe as the “setting sun” sign.

X-rays will typically confirm a slipped epiphysis. In stable SCFE cases, obtain an AP X-ray of the pelvis and a frog lateral view and/or lateral image of each proximal femur. With a potentially unstable slipped epiphysis, obtain an AP X-ray of the pelvis. If you suspect an unstable slip, do not move the affected limb. Such movement could further damage the relationship between the proximal femur and epiphysis, leading to further disruption of the blood supply.

Lateral X-rays show a posterior translation of the capital femoral epiphysis relative to the femoral neck and shaft. One might note a loss of the normal concavity along the anterior aspect of the femoral neck, which results in the development of a bump or prominence. In a long-standing deformity, the body attempts to stabilize the slipped growth plate with remodeling of the posterior aspect of the femoral neck. A small portion of the capital femoral epiphysis should extend above the Klein's line on the AP X-ray. Klein's line is a radiographic line that providers draw with an X-ray pencil along the superior aspect of the femoral neck. If the epiphysis rests below the Klein's line (as illustrated in Figure 2), SCFE is likely present.

Figure 2



A) X-ray demonstrates an abnormal femoral epiphysis; Klein's line is abnormal.



B) X-ray shows a normal femoral epiphysis with a normal Klein's line.

In some cases, an MRI scan or a SPECT bone scan might allow one to identify physeal irregularity consistent with an SCFE.

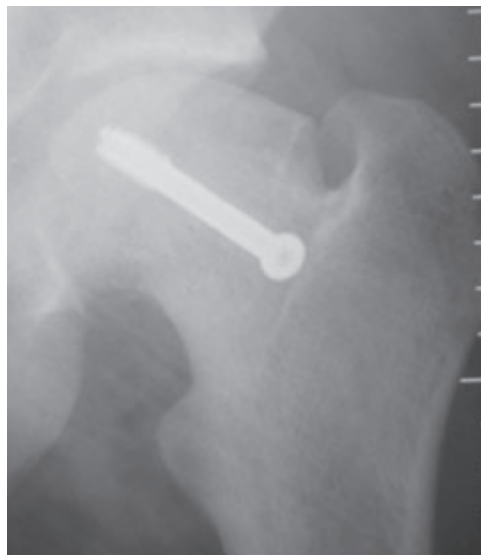
Treatment

The goal of SCFE treatment is to prevent further slippage. Immediate treatment is necessary to prevent a chronic but stable slipped epiphysis from suddenly becoming unstable, resulting in the development of ON.

When adolescents are diagnosed, they should see an orthopaedic surgeon immediately. Upon diagnosis — as a precaution to prevent falling — children typically are placed on crutches or given a wheelchair. A fall could result in a stable slip becoming unstable and causing severe long-term consequences.

Surgery for SCFE typically occurs shortly after diagnosis. When an adolescent has a stable slip, the surgeon places a screw (see Figure 3) across the proximal femoral growth plate to stabilize it. The screw stabilizes the epiphysis and reduces the chance that a further slip could occur. If an unstable slip occurs, the surgeon might aspirate the joint or open the hip capsule to reduce the tamponade effect of hematoma that is present in the joint. Hematoma within the joint might increase the risk of developing ON. There is debate regarding treating the contralateral hip.

Figure 3



This stable SCFE has been treated with single-screw fixation to prevent additional slippage.

In the presence of an endocrinopathy, renal disease or SCFE in a child under age 12, the surgeon might recommend pinning of an asymptomatic opposite hip. In an older child with isolated SCFE, pinning of the involved hip is typically undertaken with observation of the other hip. The majority of children must limit their activities for six to 12 weeks, until early physeal stabilization occurs. Removal of the screws is rarely required.

Secondary Complications

The most severe and most feared complication of an unstable SCFE is the development of ON. If the blood supply to the proximal femur is lost, treatment options are extremely limited. The proximal femoral epiphysis typically collapses because of the development of early arthritis. Potentially promising treatment options include the use of bisphosphonates or procedures, such as free vascularized fibular grafting, in an attempt to re-establish blood supply.

Chondrolysis is a rare complication in which the joint space rapidly narrows after pinning of a slipped epiphysis. In the past, multiple pins were used to stabilize the slipped epiphysis, and some believe that penetration of the femoral head pin resulted in chondrolysis. With current techniques of single screw placement, chondrolysis occurs rarely.

Summary

SCFE is not uncommon. It occurs during the phase of rapid adolescent growth, particularly in individuals who are overweight. Prompt identification and treatment are important factors in reducing the likelihood of a progressive deformity developing. A progressive deformity can predispose an adolescent to an increased risk of arthritis as an adult. Early intervention is critical to reduce the risk that an acute slip will develop and ON will occur.

Did You Know?

In northern regions, such as Minnesota, there is a statistically significant increased risk of people presenting with slipped capital femoral epiphysis during the late summer and early fall. Why? One theory is that lack of sun exposure during the previous winter leads to diminished vitamin D absorption. That, in conjunction with rapid growth, leads to an increased weakness within the physis. Children then develop slippage of the growth plate during the summer months and present to their pediatrician, family practitioner or orthopaedist in the late summer or early fall — often with a three- to five-month history of hip pain.

Author's PROFILE



Stephen Sundberg, M.D., specializes in pediatric orthopaedics at Gillette Children's Specialty Healthcare, where he is program medical director of the Center for Pediatric Orthopaedics.

Sundberg graduated from the University of Minnesota Medical School and completed an orthopaedic residency at Mayo Clinic in Rochester, Minn. He completed a pediatric orthopaedic fellowship at Adelaide Children's Hospital in Adelaide, Australia. Sundberg began working at Gillette in 1986 and is a member of Pediatric Orthopaedic Associates. He is certified by the American Board of Orthopaedics.

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