

# Slipped Capital Femoral Epiphysis: Don't Miss This Pediatric Hip Disorder

**Erin S. Hart, RN, MS, CPNP**  
**Brian E. Grottkau, MD**  
**Maurice B. Albright, MD**

Slipped capital femoral epiphysis (SCFE) is an acquired disorder of the hip in adolescent and preadolescent children. A SCFE represents the separation of the proximal femoral epiphysis (head of the femur) through the growth plate from the remainder of the femur. The epiphysis is located at the top of the femur and is connected to the metaphysis through the physis (growth plate). In a patient with a SCFE, the head of the femur remains firmly located in the acetabulum, and the neck of the femur slips anteriorly (see Figures: “X-rays of Acute Unstable SCFE, Right Hip”).<sup>1</sup> This slippage occurs when the shearing stress exerted on the femoral head is greater than the resistance provided by the intrinsic mechanical stability of the growth plate.

A SCFE is the most common orthopaedic hip condition affecting adolescents, but the diagnosis is frequently delayed or missed due to its often subtle presentation. This delay can result in a less-favorable, long-term prognosis. The condition needs to be considered in any child presenting with a limp and/or hip, thigh, or knee pain.<sup>2</sup>

## ■ Causes of SCFE

Most pediatric orthopaedic surgeons agree that a combination of mechanical and constitutional factors likely contribute to SCFE. A multifactorial etiology is likely, including local trauma, obesity resulting in mechani-

cal overload of the maturing growth plate, inflammatory factors, and endocrinologic factors.<sup>3</sup> While the majority of cases are idiopathic, SCFE may also be associated with endocrine disorders (hypothyroidism, growth hormone administration), renal osteodystrophy, or previous radiation therapy.<sup>4</sup>

Excessive weight and retroversion of the femur combine to result in increased mechanical stresses on the

the onset of menarche. Patients with SCFE are usually male, with a male-to-female ratio of approximately 2.5:1.<sup>6</sup> There is also a higher incidence in Pacific Islander (Polynesian) and African-American children.<sup>7</sup>

Numerous studies have shown that SCFE will occur bilaterally in approximately 25% to 40% of cases.<sup>8</sup> The most significant risk factor for SCFE is obesity. Nurse practitioners

*The diagnosis of SCFE is based on symptoms, physical examination, and radiographic studies.*

growth plate. Manoff et al.<sup>5</sup> revealed that 81% of adolescents with a SCFE had a body mass index above the 95th percentile. The increased stress across the physis caused by obesity combined with the preadolescent and adolescent growth spurt can cause disruption through the weakest portion of the growth plate. This weak section of the physis is known as the hypertrophic zone, and it has been shown to be larger and weaker as the body prepares for its final longitudinal growth spurt.<sup>3</sup> A SCFE never occurs once the growth plate has fused.

## ■ Who is the Typical Patient?

Slipped capital femoral epiphysis affects approximately 2 to 10 adolescents/100,000 in the United States.<sup>1</sup> It usually occurs in early adolescence during a rapid growth spurt, peaking at age 10 to 13 years in females and 12 to 16 years in males.<sup>1</sup> The disorder will very rarely occur in females after

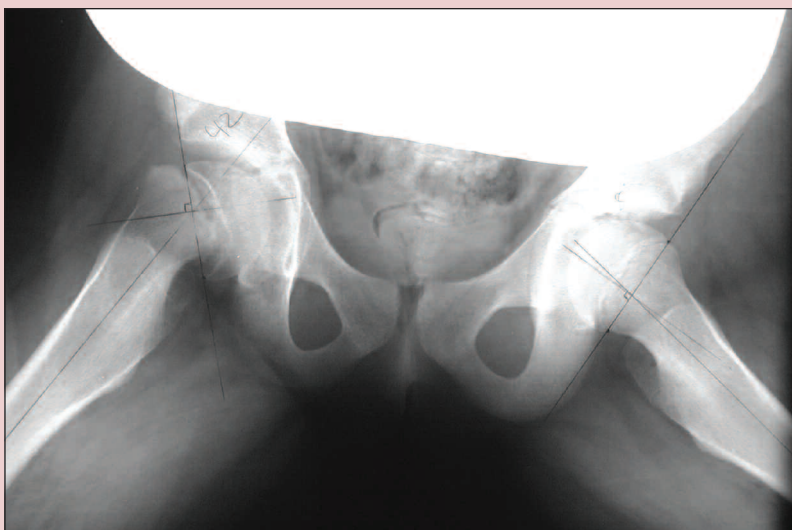
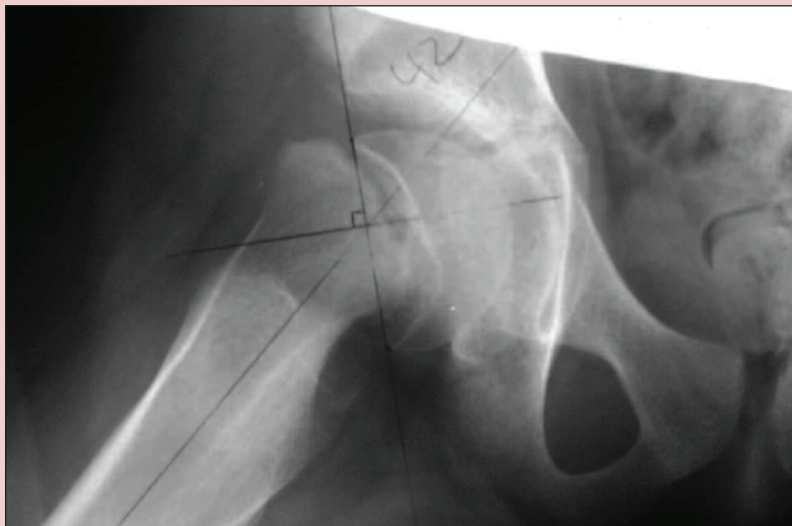
(NPs) need to advocate and teach both patients and parents the importance of maintaining a normal body weight, implementing lifestyle modifications, and staying active. With the substantial increase in childhood and adolescent obesity, there is genuine concern that the number of SCFE cases will also increase.

It is important to note, however, that SCFE can also occur in children who are younger and thin, and do not have any of the classic risk factors. These individuals will frequently have bilateral SCFE and should be thoroughly evaluated for associated endocrine abnormalities such as hypothyroidism, panhypopituitarism, and renal osteodystrophy.

## ■ Diagnosis

The diagnosis of SCFE is based on symptoms, physical examination, and radiographic studies. Patients with SCFE usually present with pain in the

## X-rays of Acute Unstable SCFE, Right Hip



affected hip, groin, thigh, or knee. It is important to note that hip pain is often referred to the knee due to the sensory distribution of the obturator and femoral nerves. Approximately 15% of patients with SCFE report pain only in the distal thigh and medial knee.<sup>3</sup> Most patients with a stable SCFE can bear weight on the affected leg, but parents will often note limping or gait abnormalities. A vague history of antecedent trauma can often be elicited and calls attention to the limp and pain. As the epiphysis continues to slip, the patient will often de-

velop more pronounced limping and external rotation of the toes when walking. Due to increased fluid in the hip joint, there will also be decreased range of motion when compared to the contralateral unaffected hip.

One of the classic physical examination findings in patients with SCFE is obligatory external rotation and abduction of the hip with attempts at flexion while examining the child on a table.<sup>1</sup> Patients with a chronic slip may also have mild atrophy of the thigh and gluteal muscles due to long-term symptoms and disuse.

A patient with an unstable SCFE will often present much differently. These children will usually have a similar vague history of groin, thigh, or medial knee pain. However, they will then report a sudden exacerbation after a sports-related trauma, a minor fall, or trip down stairs. Patients with an unstable SCFE are unable to bear weight on the affected leg, with or without crutches.<sup>9</sup> The suspected diagnosis can then be confirmed with anteroposterior (AP) and frog lateral pelvis X-rays. Although the frog leg lateral X-ray is helpful in confirming the diagnosis, it should be avoided in any patient with a suspected unstable slip. Occasionally, when there is a high index of suspicion for SCFE but the X-ray findings appear normal, a magnetic resonance imaging scan will demonstrate bone edema around the growth plate suggesting a “preslip”.<sup>10</sup>

### ■ Classification

Most pediatric orthopaedic specialists classify a SCFE based on the duration of symptoms and the magnitude of the slip on X-ray.<sup>8</sup> The condition has traditionally been classified as acute (symptoms less than 3 weeks duration), chronic (symptoms greater than 3 weeks duration), or acute on chronic (recent exacerbation of symptoms previously present for more than 3 weeks). Radiographically, the slippage can be classified as mild (less than 33% slippage of the epiphysis or less than 30-degree slip angle), moderate (33% to 50% slippage of the epiphysis or 30- to 60-degree slip angle), or severe (greater than 50% slippage of the epiphysis or greater than 60-degree slip angle). (See Figure: “Model of SCFE.”)

More recently, SCFE has been classified as either stable or unstable.<sup>11</sup> Patients with a stable slip are able to ambulate with or without crutches, while those with an unstable slip cannot. More than 90% of all cases are chronic and stable slips.<sup>1</sup> A stable

SCFE can usually be treated electively, with a relatively low incidence of acute complications. If the patient is unable to walk (even with crutches), the slip is considered unstable. Unstable slips are the equivalent of a hip fracture and need to be treated immediately to avoid potential complications.

### ■ Treatment

The goal of treatment for SCFE is to prevent further slippage and to stabilize the epiphysis. Early diagnosis of SCFE provides the best chance to achieve these treatment goals. Any patient with suspected or known SCFE needs to use either crutches or a wheelchair. The patient and parents need to be educated about the importance of not putting weight on the affected leg to prevent the chance of further slippage and complications. The

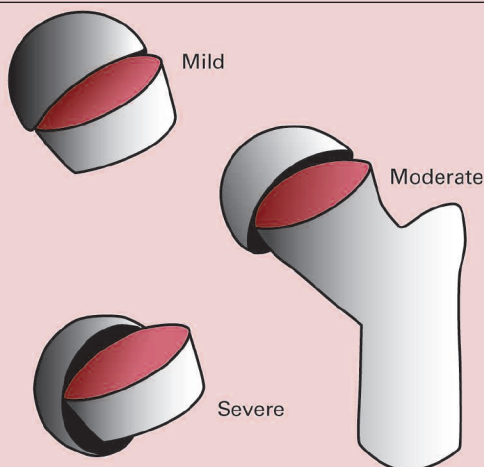
NP should also ensure proper treatment or referral. These patients should be referred either directly to a pediatric orthopaedic surgeon or to the emergency department for definitive management.

The standard treatment for a stable SCFE is commonly referred to as in situ percutaneous pinning and involves the surgical placement of a single cannulated screw through the femoral neck into the central aspect of the proximal femoral epiphysis. The procedure uses radiographic guidance (fluoroscopy) through a very small incision with minimal risk of blood loss or wound complication.<sup>11</sup> The surgeon will not forcibly attempt to reduce the slip during surgery due to the high rate of associated complications (avascular necrosis). The objective of surgery is to prevent further

slippage by transfixing the epiphysis and promoting closure of the growth plate. If the slippage is more severe or unstable, however, a more involved procedure or corrective osteotomy may be necessary.<sup>9</sup>

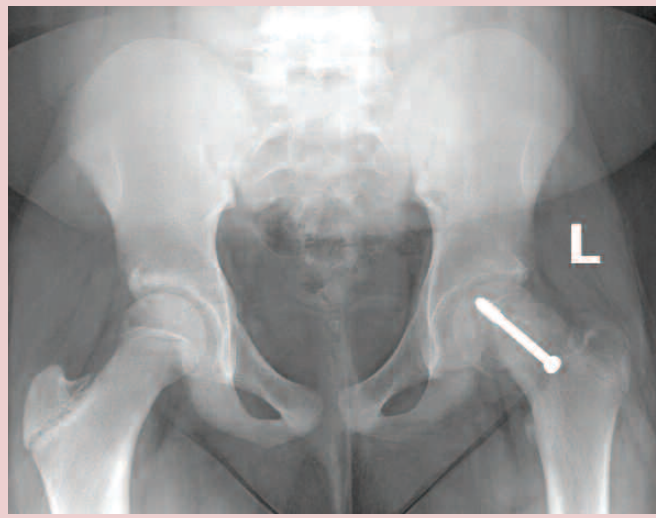
Because of the 25% to 40% incidence of developing a contralateral SCFE,<sup>8</sup> some pediatric orthopaedic surgeons prophylactically pin both hips. Most contralateral slips develop within 6 to 12 months of the index hip.<sup>12</sup> A study done by Kocher et al.<sup>13</sup> however, found that prophylactic in situ pinning for potential contralateral SCFE carried excessive iatrogenic risk for most patients. They recommend a shared decision-making process between the surgeon and patient/parents where both outcome probabilities and family preferences are considered. At the present time, most orthopaedic

## Model of SCFE



Source: Rab GT. The geometry of slipped capital femoral epiphysis. *J Ped Ortho*. 1999;19(4):419-424. Reprinted with permission.

## AP Pelvis X-Ray After Left Percutaneous Pinning



surgeons monitor the uninvolved hip over time until skeletal maturity rather than initial prophylactic pinning.

Primary care clinicians need to ensure that the patient receives proper care and follow-up visits after surgery. Often, the patient will have no pain and will not return for follow-up visits. These patients are at risk for further injury, including a missed contralateral SCFE. Teaching should include the importance of following postoperative restrictions, giving anticipatory guidance/expectations, and emphasis on close orthopaedic follow-up visits.

### ■ Postoperative Care

Following percutaneous pinning for a SCFE, the patient is usually required to be partial or nonweight bearing for 6 to 8 weeks. Casting and/or bracing for SCFE is not necessary postoperatively. Routine wound care is needed for the first 1 to 2 weeks after surgery.

The NP must ensure that the patient has been taught how to use crutches/wheelchair prior to discharge home. It is imperative that the patient is able to safely and comfortably ambulate with these restrictions to avoid potential complications and further injury. The surgeon may choose to ad-

mit the patient to the hospital once the diagnosis is confirmed. Postoperative outpatient orthopaedic follow-up visits and radiographs are generally needed at 6 weeks, 3 months, 6 months, and 1 year (see Figure: “AP Pelvis X-Ray After Left Percutaneous Pinning”). At the initial postoperative visit, the incision should be inspected for any evidence of infection (redness, purulence, drainage). In general, sports are restricted for approximately 3 to 6 months after a percutaneous pinning. However, if the slip was unstable or severe, the patient may require a longer recovery time away from sports/activities. Once physical closure has occurred, running and contact sports can be resumed.<sup>11</sup> Removal of the cannulated screw is not usually recommended unless the patient develops complications.

### ■ Importance of Treatment

An unrecognized SCFE or delay in diagnosis can result in more significant slippage of the proximal femoral physis. Numerous studies suggest that the more severe a SCFE, the more abnormal the mechanics of the hip become and the more rapidly the hip wears out resulting in precocious de-


generative arthritis. This translates into total hip replacements at younger ages. Total joint surgeons estimate that as many as 80% of their hip replacement patients under 50 years of age suffered from an undiagnosed or unrecognized SCFE.<sup>9</sup>

The majority of patients who present with a stable SCFE and undergo percutaneous pinning do not develop any long-term complications. With early recognition and timely intervention, the long-term prognosis is excellent, however, the true incidence of late-onset arthritis is not known. Because the surgical techniques and fixation methods used today are far superior to those used in the current long-term studies, the true incidence of late onset arthritis is not known.

The two most severe complications of SCFE are avascular necrosis (AVN) and chondrolysis. Avascular necrosis refers to the loss of blood supply to the proximal femoral physis resulting in death of that portion of the bone. It is the most serious complication of SCFE and is more likely to occur if the slip is severe or unstable. Patients with AVN will often develop more rapid arthritic deterioration of the hip, requiring further

surgical intervention.<sup>14</sup>

Chondrolysis is often referred to as acute cartilage necrosis. It represents a loss of articular cartilage and can be seen in both treated and untreated SCFE. It occurs in approximately 5% to 7% of all children with a SCFE, even before treatment.<sup>15</sup> Similar to other early arthritis and AVN, chondrolysis is also more common in severe and/or unstable slips. Clinically, patients with chondrolysis of the hip will usually complain of pain and have decreased range of motion. A loss of articular cartilage width can be seen on X-rays. Treatment generally involves improving pain and motion. Approximately 50% of patients with chondrolysis related to SCFE will improve regardless of treatment. In other children, however, chondrolysis may progress to such severe pain and

contracture that hip arthrodesis or replacement is necessary.<sup>11</sup> 

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#### ABOUT THE AUTHORS

**Erin Hart** is a Pediatric Orthopaedic Nurse Practitioner at Massachusetts General Hospital in Boston, MA. **Brian E. Grottkau** is the Chief of Pediatric Orthopaedics at Massachusetts General Hospital, and **Maurice B. Albright** is an Associate Pediatric Orthopaedic Surgeon in the same practice.