

Slipped capital femoral epiphysis: a report of two cases

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Two cases of slipped capital femoral epiphysis are presented. Both were eventually treated by pinning in situ, after going undiagnosed for some time. The clinical presentation, radiographic findings, and proposed pathogenesis of this disorder are reviewed. (JCCA 1989; 33(3): 130-134)

KEY WORDS: hip joint, hip pathology, slipped capital femoral epiphysis, chiropractic, manipulation.

Deux cas d'épiphysiolyse sont présentés. Les deux après être restés non diagnostiqués pendant un certain temps, ont été éventuellement traités par l'insertion d'une broche in situ. La présentation clinique, les constatations radiographiques et la pathogénie de l'affection sont examinées. (JCCA 1989; 33(3): 130-134)

MOTS CLÉS: hanche, diagnostique différentiel, chiropractie, manipulation.

Introduction

A painful hip or limp in a child presents a diagnostic challenge. A diversity of disorders involving other regions of the lower extremity, or lumbar spine, may refer pain to the hip or buttock. Conversely, true hip pathology may present with no discomfort locally, yet refer pain to the knee or medial thigh. An awareness of the characteristics of various pediatric disorders and their age of presentation greatly facilitates early diagnosis, which is important in minimizing the risk of permanent disability.

In the adolescent age group, slipped capital femoral epiphysis (SCFE) is the most common hip disorder and must be considered in the differential diagnosis of buttock, thigh, and knee pain. This paper presents two cases of SCFE that were not diagnosed at the initial examination. One patient underwent several months of chiropractic manipulations for an incorrect diagnosis of sacroiliac syndrome.

Case one

A 12-year-old female presented to the Orthopaedic Outpatient Service at the University Hospital with a three-month history of

buttock and groin pain. Her mother had noticed a limp one month earlier and had taken her to the family doctor. An antero-posterior radiograph of the pelvis was interpreted as normal (figure 1). A second opinion was sought after the patient continued to experience difficulty.

On examination, the child was slightly overweight and walked with the right leg externally rotated. Hip flexion was decreased to 100 degrees with only five degrees of internal rotation. The leg assumed a position of external rotation when the patient relaxed supine on the examination table.

A frog-leg radiographic view of the pelvis revealed a right slipped capital femoral epiphysis with associated widening and irregularity of the growth plate (figure 2).

The femoral head was pinned in situ during surgery. On examination ten weeks later the hip was fixed in 20 degrees of external rotation. Abduction was limited to 35 degrees. The right leg was five millimeters shorter than the left, and there were radiographic signs of early growth plate fusion. The patient was advised to return if any pain developed on the opposite side.

Case two

A 12-year-old male attended his family physician because of left-sided hip and groin pain. This had begun several weeks previously, and although he could not identify a precipitating event, the pain was becoming worse with time. An anteroposterior radiograph of the pelvis was interpreted as normal (figure 3). The child was placed on analgesic medication without further investigations. However, the pain did not subside, and after

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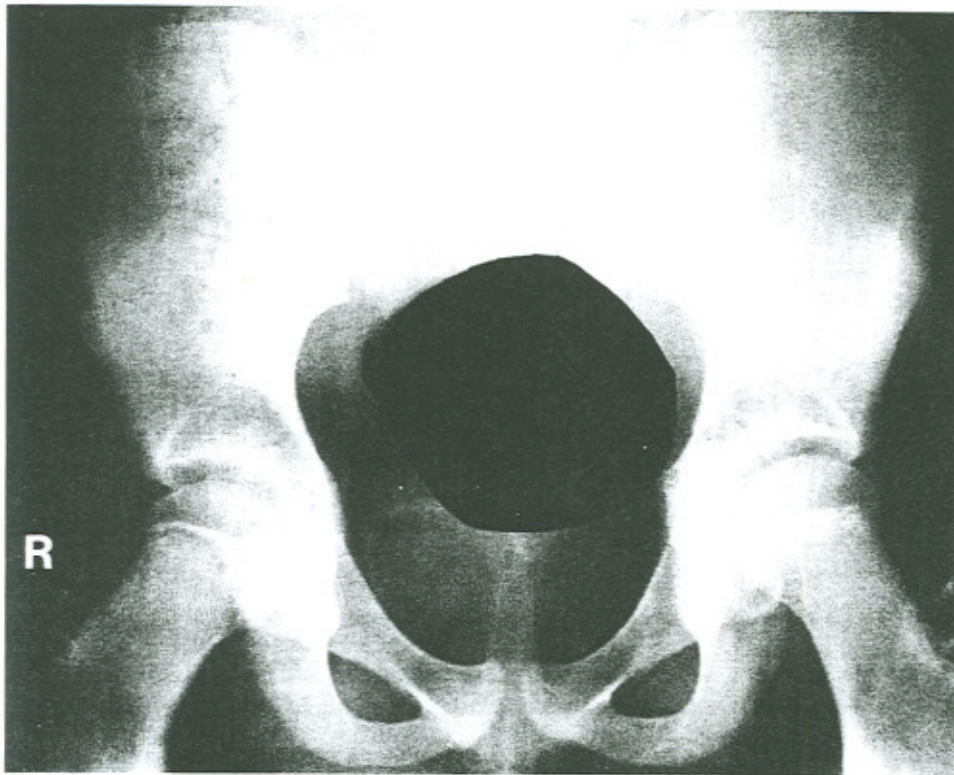


Figure 1 An anteroposterior radiograph of the pelvis of a 12-year-old female patient which was interpreted as normal.

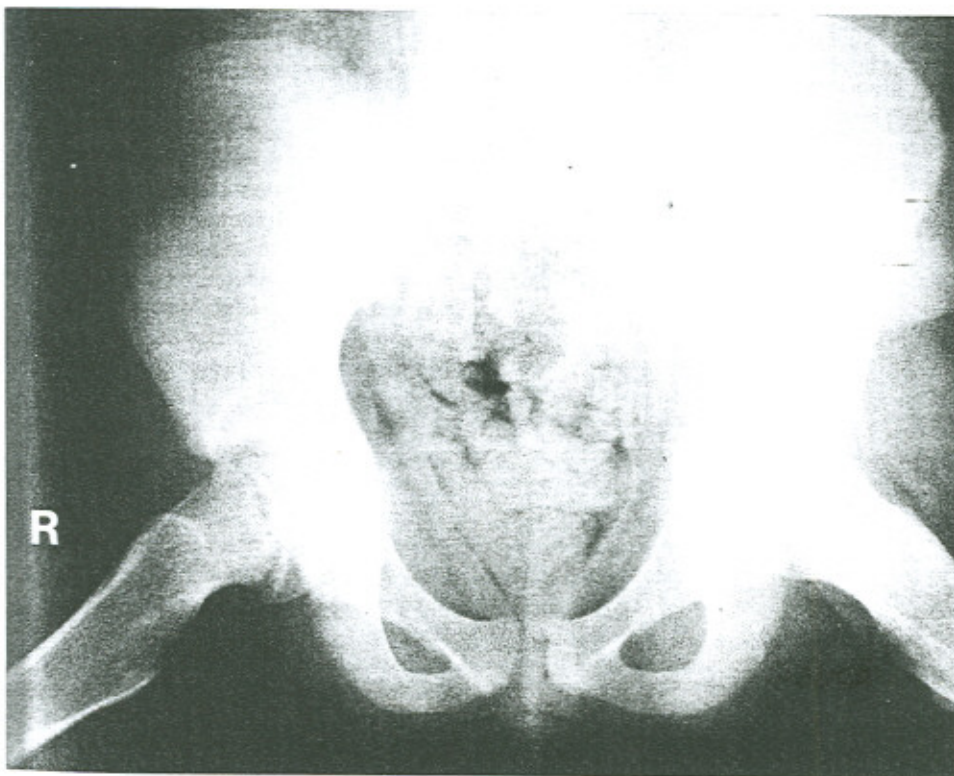


Figure 2 The frog-leg view taken one month after the initial radiograph reveals a posteromedial slip of the right femoral capital epiphysis.

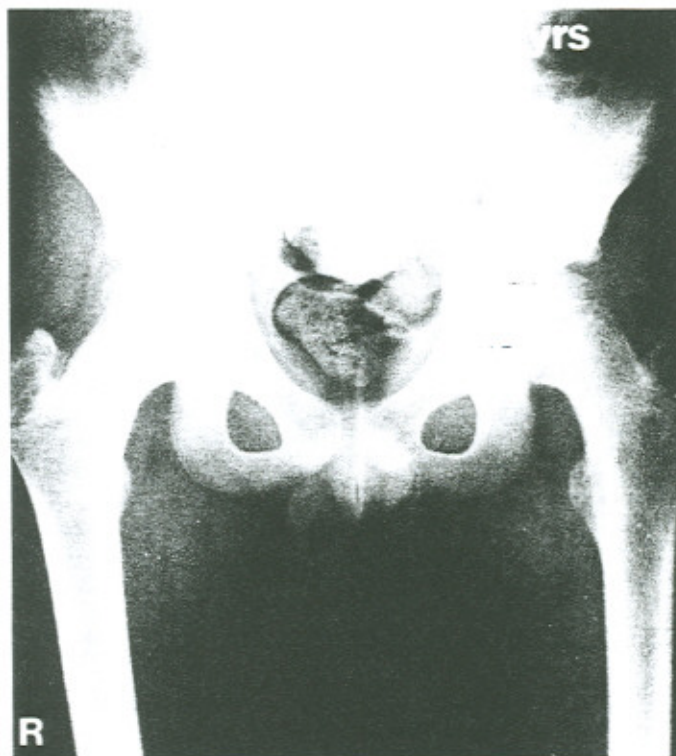


Figure 3 An anteroposterior pelvic radiograph of a 12-year-old male which was initially interpreted as normal. However, when both sides are compared, a partial slip of the left femoral epiphysis is evident. Also note the blurred and widened metaphyseal margin on that side.

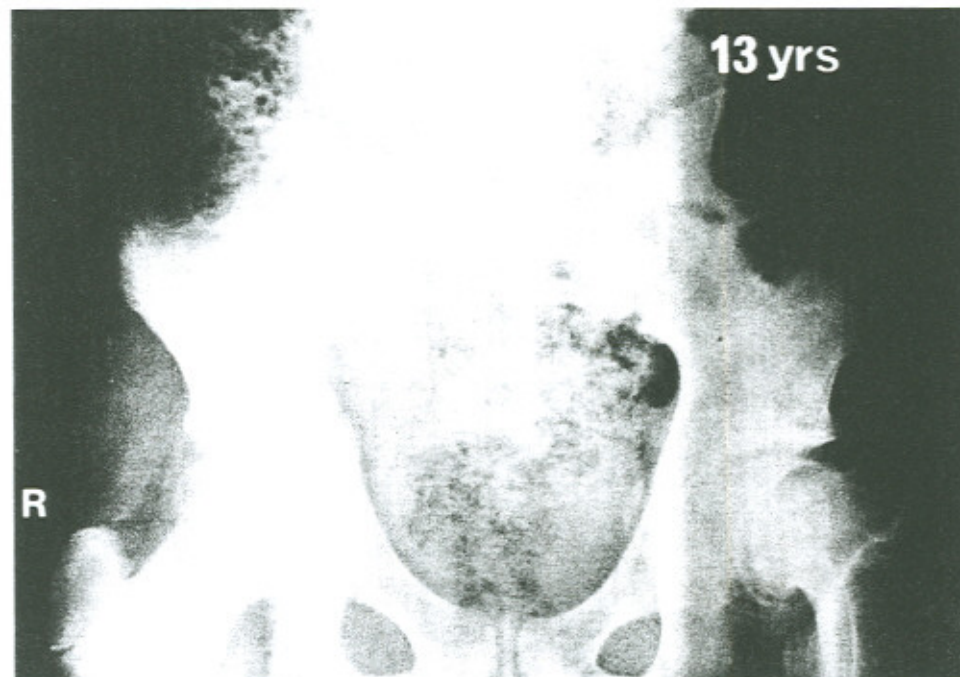


Figure 4 An anteroposterior pelvic radiograph of the same child in figure 3 taken one year later. There is an advanced slip of the left capital femoral epiphysis.

three more weeks his parents took him to a chiropractor, who diagnosed him as having a left-sided sacroiliac syndrome. He underwent manipulations to the sacroiliac joint for approximately one year, without much improvement. The mother then demanded a third opinion on the problem.

On examination, the child was somewhat overweight and walked with an obvious limp, favouring the left side. He displayed a Trendelenburg gait and held the left leg in external rotation. There was a 15 degree flexion contracture of the painful hip. Passive movement in external rotation or abduction was restricted to a few degrees. Palpation around the left hip joint increased his discomfort.

An anteroposterior radiograph revealed an obvious slip of the left capital femoral epiphysis (figure 4). In reviewing the original film from one year earlier, a partial slip could be seen in the left hip (figure 3).

The femoral head was pinned in situ during surgery. Three months later the hip was pain-free, but remained externally rotated and globally restricted in movement.

Discussion

Epidemiology

The three most common causes of hip pain or limp in children are congenital dislocation of the hip (CDH), Legg-Calve-Perthes' disease (LCPD), and slipped capital femoral epiphysis (SCFE). CDH is a disorder of infancy and LCPD peaks at four to eight years of age. SCFE is a disorder of the adolescent growth spurt, with males typically presenting at 13 or 14 years of age

and females at 11 to 12 years of age. It is defined as a posterior or posteromedial slip of the proximal femoral epiphysis on the metaphysis. The epiphysis usually slips posteriorly before it migrates medially.

The incidence of SCFE has been estimated at between 0.71 to 3.41 per 100,000.^{1,2} Males are affected two to three times more often than females, and blacks are affected more often than whites.^{3,4} There is some evidence of familial aggregation and of seasonal distribution, which peaks in the spring and summer.¹ The left side is affected almost twice as often as the right in males, while in females the left and right sides are affected equally.^{3,5} SCFE occurs bilaterally in up to 25 percent of cases, with the second slip following the first within a year.^{2,6,7} For this reason, careful evaluation of the asymptomatic hip is mandatory.

Pathogenesis

The pathogenesis of SCFE is not fully understood. During the adolescent growth spurt, there is rapid growth and widening of the zone of hypertrophied cartilage cells adjacent to the epiphyseal plate. It is through this layer that the actual separation between the epiphysis and the metaphysis usually takes place.¹ Animal experiments have shown that a minimal amount of force is required to separate the epiphysis when the growth plate is in this widened state.⁸ In addition, the epiphyseal plate changes from a horizontal position to a more oblique plane during the growth spurt.

The current hypothesis for the pathogenesis of SCFE is that the slip occurs as a direct result of increased vulnerability of the growth plate to shear forces as the plate widens and changes from a horizontal to a more oblique position during the growth spurt.³ This proposed mechanism is supported by an increased incidence of SCFE in children who combine slower than average maturation with obesity.⁹ These children spend more time with a widened epiphyseal plate which is subjected to the increased shear forces of their superincumbent weight. Some past studies have emphasized the role of direct trauma in the pathogenesis of SCFE. However, even though violent trauma, such as a motor vehicle accident, can cause an acute slip, the vast majority of cases develop insidiously.¹

Diagnosis

The child presenting with SCFE is typically a pubescent male complaining of a limp.⁶ He may be short and obese, and a history of trauma is not usually present. While buttock, trochanteric, or groin pain are commonly present, 25 percent will have thigh or knee pain alone.² The child walks with the hip externally rotated and may demonstrate a Trendelenburg gait.³ On examination, there is usually tenderness around the hip with varying degrees of limitation of flexion, internal rotation, and abduction. In long-standing cases, there may be leg-length shortening on the affected side. Table 1 summarizes the clinical signs and symptoms which commonly accompany SCFE.

The radiographic changes indicating SCFE are characteristic,

but subtle in the early stages. The hip is one of the few areas of the body where at least two views of the joint (preferably at right angles) are not routinely imaged. This is unfortunate, since a single anteroposterior view may not reveal the abnormality, thereby delaying diagnosis and treatment. Since the epiphysis initially slips posteriorly, a lateral view that includes both hips is mandatory. This can be achieved by taking a true lateral exposure or an anteroposterior view with the limbs in the frog-leg position.

Table 1

Clinical Signs and Symptoms of SCFE
Obese body build
Pain in the buttock, thigh, groin, or knee
Trendelenburg gait
Externally rotated limb
Limited internal rotation and abduction
Shortening of the limb
Flexion contracture

Both radiographic views of the hip must be carefully observed, not only for comparison, but remembering that bilateral slips can occur. The earliest radiographic changes include widening of the growth plate, blurred metaphyseal margins, and a decrease in the epiphyseal height.^{10,11} These changes may be seen on either the anteroposterior or lateral radiograph. At this stage the pure posterior slip will not be easily visualized on the anteroposterior film, but may be detected on the frog-leg projection, as in our first case. As the slip progresses, Klein's line becomes the most diagnostically useful measurement. This line, drawn tangentially along the lateral femoral neck, normally extends through a small portion of the lateral epiphysis (figures 5 and 6). Failure to intersect any portion of the epiphysis is highly suggestive of SCFE.^{11,12} Table 2 summarizes the radiographic features of SCFE.

Table 2

Radiographic findings in SCFE
Widened growth plate
Decreased epiphyseal height
Blurred metaphyseal margin
Abnormal Klein's line
Coxa vara deformity

Treatment

Early detection and treatment of SCFE is essential, since severity and chronicity of the slip determine the prognosis. The most severe complication is avascular necrosis of the femoral head.

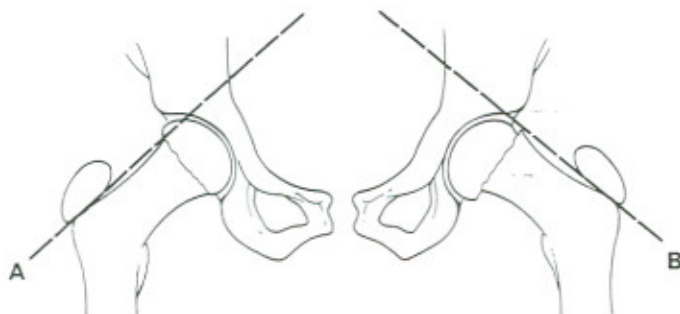


Figure 5 An illustration of the pelvis demonstrating Klein's line. On the normal side (A), Klein's line intersects a portion of the femoral epiphysis. On the side of the slip (B), the line does not intersect any portion of the epiphysis.

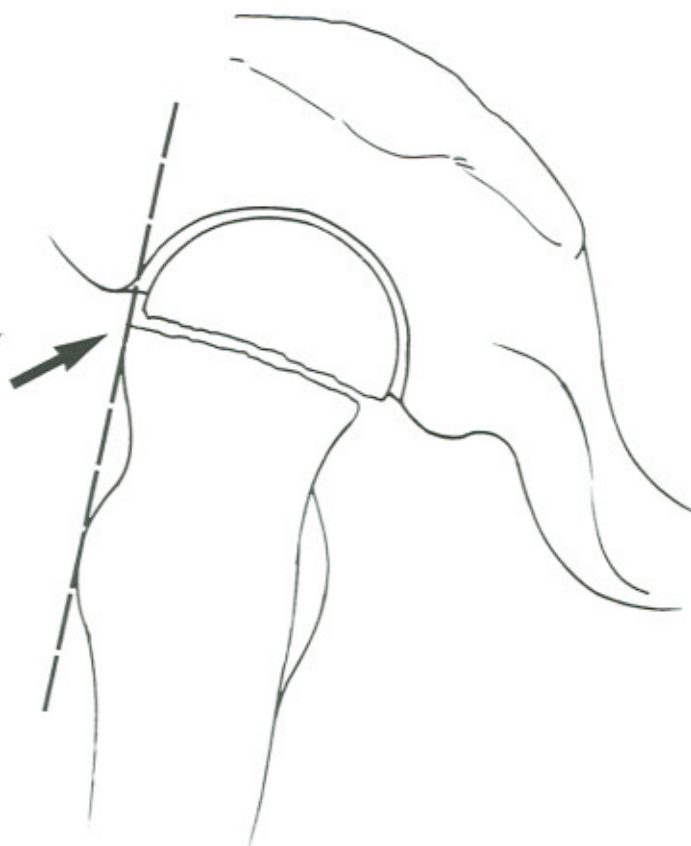


Figure 6 Often the frog-leg view of the pelvis demonstrates the slip to a better advantage. On this close-up illustration of the frog-leg view, Klein's line helps to delineate the degree of the slip (arrow).

Other complications include chondrolysis over the femoral head and a coxa vara deformity. The most frequent complication is degenerative joint disease, but it may not become evident until several years later.¹⁰ The treatment of choice for SCFE is pinning in situ. Other treatments, including surgical manipulation, open reduction, and osteotomy of the femoral neck, may result in avascular necrosis in as many as 35% of cases.² With in situ fixation, the incidence of this serious complication is reduced to 1.5 percent.²

Conclusions

Slipped capital femoral epiphysis requires early diagnosis and treatment if debilitating sequela are to be avoided. This condition must be considered in any adolescent with unexplained hip, thigh, or knee pain. When SCFE is suspected, radiographic studies should include an anteroposterior view of the pelvis and a frog-leg or lateral projection of both hips.

Acknowledgements

We would like to acknowledge the expert assistance of Mr. David Geary and Ms. Robin Currie of the Departments of Medical Art and Medical Photography at the University Hospital. Financial assistance for the preparation of this manuscript is gratefully acknowledged from the Chiropractors' Association of Saskatchewan and the Canadian Memorial Chiropractic College.

References

- 1 Kelsey JL. Epidemiology of slipped capital femoral epiphysis: a review of the literature. *Pediatrics* 1973; 51: 1042-50.
- 2 Swiontkowski MF, Gill EA. Slipped capital femoral epiphysis. *American Family Physician* 1986; April: 167-71.
- 3 Chung SMK. Diseases of the developing hip joint. *Pediatric Clinics of North America* 1986; 33: 1457-73.
- 4 Deluca SA, Rhea JT. Slipped femoral epiphysis. *American Family Physician* 1984; April: 159.
- 5 Gross RH. Hip problems in children. *Postgrad Med* 1984; 76: 97-104.
- 6 McBeath AA. Some common causes of hip pain. *Postgrad Med* 1985; 77: 189-98.
- 7 Resnick D. *Diagnosis of bone and joint disorders*. Philadelphia: WB Saunders, 1981; 968-72.
- 8 Morscher E. Strength and morphology of growth cartilage under hormonal influence of puberty. *Reconstr Surg Trauma* 1968; 10: 171-83.
- 9 Kelsey JL, Acheson RM, Keggi KJ. The body build of patients with slipped capital femoral epiphysis. *Am J Dis Child* 1972; 124: 276-81.
- 10 Yochum TR, Rowe LJ. *Essentials of skeletal radiology*. Baltimore: Williams and Wilkins, 1987; 465-68.
- 11 Alexander JE, FitzRandolph RL, McConnell JR. The limping child. *Curr Probl Diagn Radio* 1987; 16: 229-70.
- 12 McRae R. *Clinical orthopaedic examination*. 2nd ed. New York: Churchill Livingstone, 1983; 103-27.