

Slipped Upper Femoral Epiphysis: A Case of Missed Diagnosis

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A slipped upper femoral epiphysis (SUFE) is a known hip disorder in adolescents in which the proximal femoral epiphysis slips and displaces relative to the metaphysis. We report an obese 12-year-old boy who presented with acute pain in the left hip after a fall. He was otherwise healthy with no prior joint pain. Pelvic radiography was misread twice before a second fall led to a severe SUFE. (*Chang Gung Med J 2011;34(6 Suppl):13-6*)

Key words: slipped upper femoral epiphysis (SUFE), hip pain, missed SUFE, severe SUFE

A slipped upper femoral epiphysis (SUFE), also known as a slipped capital femoral epiphysis is a known hip disorder in adolescents in which the proximal femoral epiphysis slips and displaces relative to the metaphysis. The outcome and prognosis of this condition depends on early detection, hence preventing progression to a severe slip.⁽¹⁾ This seems to be quite a challenge when up to 20% of children are affected by musculoskeletal pain at some time in their lives, with the majority of them having only minor or benign disorders.⁽²⁾ As a result, a diagnosis can be missed or delayed especially when there is a lack of an impressive history and physical findings or even when a radiograph is misread by inexperienced personnel.⁽³⁾ This case report illustrates a missed diagnosis at the initial presentation, leading to progression of the slip.

CASE REPORT

A 12-year-old Indian boy presented after a fall while playing at school two weeks prior to this admission. During this incident, another boy fell onto his left hip while he was on the ground. He was

not able to walk following the incident and had experienced left hip pain since then. The pain was persistent, and he refused to bear weight on his left leg.

His mother brought him to the accident and emergency department but he was discharged home twice within a week. Blood investigations showed no elevation of the white cell count or other infective markers such as the erythrocyte sedimentation rate. On both occasions a pelvic radiograph was obtained and diagnosed as normal (Fig. 1).

Apart from being obese, the boy had no significant medical history prior to the incident. The mother did not recall any complaints of hip pain before the fall, and he had no episodes of feeling unwell or fever. The boy also denied other joint pain or night pain, stating that the left hip pain was localized and worse with movement.

A week after the first incident, the boy had another fall at home as he struggled to keep his balance with the persisting hip pain. The pain was exacerbated after the fall and this brought him to the hospital for the third time. However, this time the pelvic radiograph revealed a severe slip of the proximal epiphysis of the left femur (Fig. 2).

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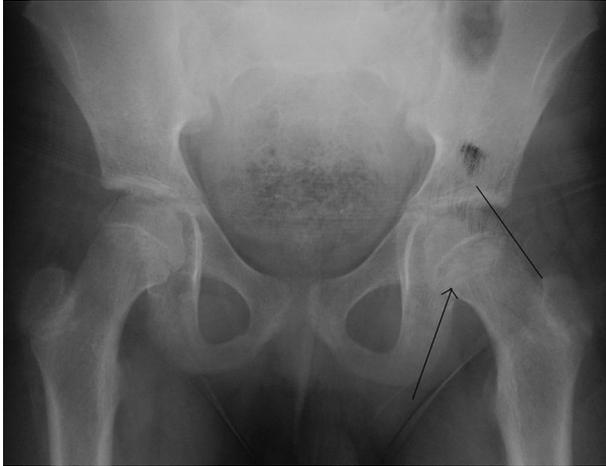


Fig. 1 A missed diagnosis. The epiphysis is flush with Klein's line and there is double density at the level of the metaphysis (Steel's sign), marked with an arrow.



Fig. 2 Progression of slip after the diagnosis was missed. A moderate to severe slip, with the head located posterior and inferior in relation to the metaphysis.

On examination, the hip joint was not warm or inflamed. The left leg was flexed and externally rotated and the hip range of motion was restricted because of pain. The child was unable to stand or walk.

A single, cannulated screw was inserted two days later (Fig. 3).

DISCUSSION

SUFE a common condition in adolescents, and the term is a misnomer as the metaphysis component actually displaces upward and outward while the epiphysis remains in the acetabulum, held by the ligamentum teres.⁽⁴⁾ Its incidence varies with age, sex and racial group. In boys, this problem is mostly



Fig. 3 In situ pinning has been performed.

occurs between the ages of twelve and fifteen years compared to ten and thirteen years in girls.^(4,7) The overall incidence of SUFE is 10.08 per 10000 adolescents.⁽⁶⁾ There is a male/female predominance of 3:2, with the left hip being more involved than the right at the same ratio.⁽⁶⁾ Blacks appear to be at higher risk, having an incidence of 6.68 and 7.79 per 10000 females and males, respectively.⁽⁶⁾ This is thought to be related to a higher mean body weight and deeper acetabulum compared with other racial groups.⁽⁴⁾

Up to 50% of patients with SUFE are over the 95th percentile of weight for age.^(4,6) With increasing obesity, the age of onset decreases. In unilateral involvement of the hip, 60% of cases are left sided.^(4,6) If bilateral involvement occurs, it is likely to be seen within 18 months of unilateral presentation.^(4,5) In these cases, the age of onset is usually younger than in patients with unilateral involvement. Bilateral involvement at presentation happens in 50-60% of cases, with the highest prevalence in blacks.^(4,6)

SUFE can be classified by onset of the disorder, magnitude of the slip or the stability at presentation.^(4,6) However, the former may be inaccurate and does not help in regard to prognosis. Avascular necrosis (AVN) is a known complication and has been found to be consistent with an unstable hip; therefore stability at presentation is very significant. Some series reported up to a 50% prevalence of AVN following an unstable slip compared with nearly 0% in stable SUFE.⁽⁴⁾ It can be classified clinically, simply by the ability of the child to walk (stable) or not

(unstable), or by ultrasonography where the presence of effusion and absence of metaphyseal remodeling means an acute event has occurred and the hip is unstable.⁽⁴⁾ The initial displacement causing surrounding vascular injury is thought to associate an unstable slip with AVN.^(5,6)

It is clear that missing a stable slip at the earliest presentation can prove to be costly, which was highlighted by the present case. An obese child with a trivial fall who refuses to walk actually fits the picture of an unstable slip. It is quite unfortunate that the diagnosis was missed. A case review by Kocher et al revealed that the median delay in diagnosis of acute on chronic unstable slips was 6.5 weeks with a median duration of unstable status of 0.6 weeks.⁽¹⁾ This might be because other common pathologies of the hip in children are considered first, such as septic arthritis or transient synovitis, which actually occurs in children younger than this patient. With the absence of fever or an ill-looking appearance and a normal blood investigation, a child can easily be diagnosed with the latter. The diagnosis might be detected earlier if a proper hip examination is performed. A child with an unstable slip usually mimics the symptoms of a hip fracture, and indeed some may consider SUFE as a type of Salter-Harris type I fracture.⁽⁴⁾ The child resists any attempts to move the lower extremity, and it is held in a flexed and externally rotated manner, as demonstrated in this case report. If the slip is stable, range of motion might be still preserved except for internal rotation, partly due to inflammation of the joint and posteroinferior slippage of the femoral head in relation to the metaphysis.⁽⁴⁾ Other possible causes of hip pathology in this child included Perthes disease and neglected developmental hip dysplasia. Perthes is more common in patients between 4 and 8 years old. In both diseases, patients would be more likely to present with an antalgic or Trendelenburg gait, rather than refusing to walk. Abduction of the hip is usually affected.

Examination findings are then correlated with appropriate radiographs. There are few findings that help in diagnosing SUFE; an anteroposterior radiograph may show a metaphyseal blanch sign of Steel and Klein's line. The metaphyseal blanch sign of Steel is a double density seen at the level of the metaphysis on an anteroposterior radiograph; the double density reflects the posterior cortical lip of

the epiphysis as it is beginning to slip posteriorly and is radiographically superimposed on the metaphyseal density.^(3,4,6) Klein's line is drawn on a radiograph along the anterior or superior aspect of the femoral neck; the epiphysis should normally intersect this line.^(3,4,6) In an early slipped capital femoral epiphysis, the epiphysis is flush with or even below this line. A frog-leg lateral radiograph is another option when the diagnosis is doubtful, but was probably not suitable in this case as the child was in severe pain. Some prefer a true lateral view as there is a concern about further displacement of the epiphysis with a frog-leg position.

Both hips need to be visualized to allow comparison between sides and because of the high incidence of bilateral disease. When the other hip is affected or not measured, the femoral head shaft angle of the affected hip is calculated from normal values for this angle.⁽⁶⁾ One researcher considered the normal values to be 145° on the anteroposterior view and 10° on the posterior on a frog leg lateral.⁽⁶⁾ The severity of the slip can be measured by the slip angle of Southwick, where the epiphyseal-shaft angle is measured on a frog-leg lateral radiograph. Slip angles of less than 30 degrees are considered mild (grade 1); those of 30 to 50 degrees, moderate (grade 2); and those of more than 50 degrees, severe (grade 3).^(4,6) The greater the degree of slip the higher the probability of AVN. Even though radiography and the clinical history are enough to diagnose SUFE, magnetic resonance imaging (MRI) is useful if readily available. Osteopenia and remodeling can be detected by MRI, which suggest chronicity of the disease. MRI can also directly demonstrate instability if the physis and periosteal sleeve are disrupted.⁽⁸⁾

Treatment of SUFE is largely dependent on whether the slip is stable or unstable, the severity of the slip and also the onset of symptoms. In most stable cases, pinning in situ is adequate. These cases are usually grade 1 and 2 slips, and pinning with a single cannulated screw without manipulation is enough on the basis of proximal femur remodeling despite non-anatomical reduction.^(4,9,10) The main goal of treatment is to prevent further slips. Further goals would be to avoid complications such as AVN and chondrolysis. These complications are more notorious in unstable cases with a more severe degree of displacement.^(4,6,9,10) Long term studies have shown that degenerative arthritis is a predictable outcome in these cases.⁽⁵⁾

Hence, the implication of missing the diagnosis leading to progression to a severe slip is profound.⁽¹⁾

The timing of intervention is relevant to the outcome. Two case series showed contrasting results. Peterson et al found that in 91 acute slips, the rate of AVN was 7% for reductions performed within less than 24 hours of presentation and 20% if treatment was delayed beyond this time.^(7,9) Loder et al noted that 87.5% of patients treated within 48 hours of onset of symptoms developed AVN but only 32% did so if treated after 48 hours.⁽⁴⁾ However, Loder et al did acknowledge that the true cause-and-effect relationship between the timing of intervention and the development of AVN could not be determined.

In the present case, the slip was moderate to severe, and was treated with *in situ* pinning 2 days after the second fall. The child had an acute, unstable but mild slip which was missed, and had progressed to a more severe slip after the second fall. The question which arose now was the best timing of intervention. Should the first fall or second be considered the onset of symptoms? Uglow et al suggested a treatment algorithm which proposed that pinning either *in situ* or manipulation be done in severe slips occurring within less than 24 hours of presentation whereas if the patient presents later than that, an osteotomy is preferred to pinning following a period of skin traction.⁽⁷⁾ So pinning *in situ* might have helped this child if the diagnosis had not been missed on the first presentation. Arguably, an osteotomy might be preferred by some individuals to address a recent acute, severe slip occurring after a second fall. Phillips et al suggested early intervention, rather than delayed as in this case. He looked retrospectively at 100 patients treated by various methods e.g. multiple pins (most of the cases), screws, a proximal osteotomy and Smith-Petersen nails and found that 14 of them were unstable and had been treated within 24 hours of symptoms.⁽⁹⁾ None of the unstable slips developed AVN. In the present case, a single screw was used for fixation. Increasing the number of screws is related to a higher risk of injuring the lateral epiphyseal vessels and also joint protrusion.⁽⁴⁾ The role of primary osteotomy has not been well defined and the current recommendation is to perform an *in situ* fixation.⁽⁶⁾

Conclusion

Acute painful joints are quite common in ado-

lescents. A history of trauma and inability to walk in an otherwise a healthy child should trigger further investigation and the patient should be referred to more experienced personnel when the diagnosis is uncertain. A chronic, mild slip can be misleading, because the child can present with referred pain to the knee, groin or thigh.^(1,3) A proper hip examination and appropriate radiographs are important, but the clinician must be aware of the condition beforehand. A delayed diagnosis is associated with greater severity of the slip, with a higher risk of short term complications and a poorer long-term hip outcome than with a prompt diagnosis.⁽¹⁾ Increasing physician awareness of this condition and the implications of missing a diagnosis are crucial.

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