Bilateral slipped capital femoral epiphysis: A case report and review of literature

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ABSTRACT

Slipped capital femoral epiphysis (SCFE) is a common adolescent problem in the western populations but it is extremely rare in the Asian regions. We report a case management of a teen age boy (16 years old at the time of operation) with bilateral SCFE. After fall injury, the boy sustained SCFE on the left side and was treated. Again after six months with trivial injury he got SCFE on the right side. In both cases the boy was managed by closed reduction and percutaneous cannulated cancelleous screws fixation under c-arm fluoroscopy control. The cannulated screws were removed after one year of insertion confirming of a good fusion in plain x-ray films. During the regular follow up of up to one year the patient had good hip functions and other daily activities. The patient lost to follow up for about three years and suddenly presented to us with restricted hip joints movements and other activities. The x-ray showed tilted pelvis, reduced, incongruent hip joint spaces with malunited femoral physis, widened neck and tilted femoral head along with visible physeal scan on both sides. The patient and patient party are still satisfied with these results and reluctant to go for further surgical intervention.

Keywords: Epiphyses slipped, closed reduction, avascular necrosis, cannulated cancelleous screw.

INTRUDUCTION

Slipped capital femoral epiphysis (SCFE) is an adolescent disorder that has been implicated as a cause of adult osteoarthritis of the hip.[1,2] Although the current terminology refers to slippage of the epiphysis portion of the proximal femur, the epiphysis actually held within the acetabulum and the metaphysis that displaces anteriorly and proximally relative to the femoral head. This causes an acquired retroversion of the proximal femur, resulting in the typical clinical presentation of a shortened, externally rotated lower extremity. In most patients, there is an apparent varus relationship between the head and the neck, but occasionally the slip is into a valgus position, with the epiphysis displaced superiorly in relation to the neck.[3,4] The physiolysis in SCFE differs from that seen in traumatic physeal fracture; histological studies have shown that the separation in SCFE is through a widened zone of hypertrophy, which has become weakened by alteration in chondrocyte maturation and endochondral ossification.[5,6] The goals of treatment are aimed at avoiding the complications of osteonecrosis and chondrolysis, preventing further slips, and promoting physeal closure.

Although the western literature shows the high incidence of SCFE but not commonly encountered disease in our region. Here we present a case of bilateral SCFE treated with closed reduction and percutaneous cannulated cancelleous screws fixation under c-arm fluoroscopy control. The patient attended the regular follow up for one year after removing the implants and lost for follow up and again suddenly presented to us after a gap of three years.

CASE REPORT

A 16 year old boy presented at the Emergency Department with the history of fall and complaining pain, unable to move left hip joint. No history of head injury and other injuries on extremities or open wounds. On examination, the patient was thin built, tall, large limbs, left lower limb no obvious shortening, on mild abduction and externally rotated. Left hip range of motion (ROM) was very painful. His distal neuro-vascular status was intact. Roentgenogram image of anteroposterior (AP) and lateral view, the figure (Fig.) on number one, showed SCFE type II, moderate.[31]

Baseline investigations were done which was within normal limit, and close reduction internal fixation (CRIF) with two 6.5 mm cannulated cancelleous screws (CCS) was performed (Fig. 2). The post operative period was uneventful and discharged on fifth postoperative day. Non weight bearing crutch walk (NWBCW) was started from third post operative day. The patient came on regular follow up and based on clinico-radiological evidence of union full weight bearing walk was advised.

About six months later the patient sustained trivial injury and complained pain on right hip region and was brought to Emergency Department. On examination, the right

Fig. 1. AP view of pelvic and lateral view showing SCFE on left side of hip.

Fig. 2. After fixation with 6.5 mm CCS, x-ray of pelvic AP view and lateral view of left hip.

hip region was very painful; range of motion of the joint restricted, right lower limb was abducted, externally rotated with mild shortening. X-ray showed SCFE with type II, moderate [31](Fig. 3). After doing baseline investigations, CRIF with two 6.5 mm CCS was done on right side of hip under c-arm fluoroscopy (Fig. 4). The patient was encouraged NWBC and was discharged on fifth postoperative day. The patient came to regular follow up and based on clinico-radiological evidence of union full weight bearing walk was advised.

After about one year of operation the screws of left side were removed (Fig. 5) and the screws of right side were removed after eleven months of surgery (Fig 6). The patient came on regular follow up of up to six months after removal surgery of second time. At that time the patient was able to walk without support and no radiological evidence of avascular necrosis of femoral head was noticed. Bilateral hip ROM was still restricted and the boy was not able to squat.

After the gap of three years the boy presented suddenly to us. The general condition of the patient was good. Bilateral hip ROM still restricted, pain on the groin regions, unable to walk fast, squat and sit on the floor. The x-ray showed tilted pelvis, reduced, incongruent hip joint spaces with malunited femoral physis, widened neck and tilted femoral head along with visible physeal scan on both sides. (Fig.7). The outcome is not good with severe restriction of his daily activities. The patient and patient party are still satisfied with these results and reluctant to go for further surgical intervention.

DISCUSSION

The western literature shows the high incidence[7] of SCFE but not commonly encountered disease in Asian populations.[8,9] Every geographical location male predominance is reported and early in the twentieth century, 90 percent of the children with the disorder were boys but more recently male predominance has decreased to 60 percent.[10] The majority of the children are obese; at least 50 percent of the children with the disorder are over the ninety-fifth percentile for weight according to age.[11,12] The reported bilateral prevalence is of 18 to 50 percent.[12]

Multiple theories have been proposed for the etiology of idiopathic SCFE, and it is likely a result of both biomechanical and biochemical factors. [13] The combination of these factors results in a weakened physis with subsequent failure. Mechanical factors associated with the disorder are obesity,[11,12] increased femoral retroversion,[14,15,16] and increased physeal obliquity.[17] Obesity increases the shear stress across the physis. Obesity is also associated with femoral retroversion, with anteversion averaging 10.6 degrees in adolescents with normal weight but only 0.40 degree in obese adolescents.[15] This femoral retroversion increases the stress across the physis and the combination of mechanical forces resulting from femoral retroversion, increased physeal slope is enough to cause a SCFE.[14]

Biochemical factors are also likely involved as it is a disease of puberty,[18] when many hormonal changes occur; this raises the possibility of an association between the disorder and endocrine function.[19] The increased prevalence of SCFE in children who have hypothyroidism, who are receiving growth hormone supplementation, or who have hypogonadism also suggests an association between the disorder and endocrine dysfunction. Rapid longitudinal growth occurs during puberty in response to growth hormone. This is due to the increased physiological activity of the physis and is associated with widening of the physis.[19] Decreased physeal strength occurs at puberty; the cause is not clear, but it may be due to the increased cartilage width of the zones of hypertrophy and to provisional calcification.[20] The effects of the gonadotropins on the physis may explain the male predominance of SCFE; estrogen reduces physeal width and increases physeal

Fig. 3. X-ray of AP of pelvic and lateral view of right side of hip showing SCFE.

Fig. 4. X-ray of pelvic with both hip joints AP view and lateral view of right hip after fixation with 6.5 mm CCS, bilateral hips are fixed with CCS.

strength, whereas testosterone reduces physeal strength.[21] This probably also accounts for the fact that the disorder is extremely rare in girls after menarche.[22]

SCFE is classified according to both the clinical nature and the magnitude of the disorder. The traditional clinical categories are pre-slip, acute, chronic, and acute-on-chronic. [23,24,25] In the pre-slip stage, patients usually complain of weakness in the leg, limping, or pain in the groin or the knee on exertion. Prolonged standing or walking may produce these symptoms. On examination, the most positive finding is lack of internal rotation and on radiographs, there may be generalized osteopenia of the hemipelvis and the proximal part of the femur in patients who limp or who have limited their activity. There may be widening and irregularity of the physis.[26]

An acute SCFE is an abrupt displacement through the proximal physis in which there was a preexisting epiphysiolysis.[27] Ten to 15 percent of SCFE have been acute in most large series.[28] The clinical criteria for an acute SCFE include duration of symptoms of less than three weeks and demonstration of an external rotation deformity, shortening, and marked limitation of motion secondary to pain on physical examination.[29] In general, the greater the amount of slip, the more the motion is restricted.

Chronic SCFE are the most common and account for 85 percent of all slips.[28] Patients with a chronic slipped capital femoral epiphysis present with pain in the groin, thigh, and knee that varies in duration, often ranging from months to years. They may have a history of exacerbations and remissions of the pain and limp. Physical examination demonstrates an antalgic gait, with loss of internal rotation, abduction, and flexion of the hip.[30] In more severe cases, patients have a limb-length discrepancy and a natural positioning of the lower extremity in external rotation. As the hip is flexed, the lower extremity spontaneously moves into a position of increased external rotation. An acute-on-chronic SCFE is one associated with chronic symptoms initially and with subsequent development of acute symptoms as well as a sudden increase in the degree of slip.[29]

Fig. 5. X-ray of pelvic with both hip joints AP: After removal of CCS on left hip, good union seen.

The traditional classification depends on the memory of the child or parent, or both, and may be inaccurate; it also does not give a prognosis with regard to the potential for avascular necrosis.[29] Based on the radiographic frog leg view the classifications are mild (displacement of epiphysis is less than 33 percent of metaphyseal width), moderate (displacement is between 33 to 50 percent) and severe (displacement more than 50 percent).[31] The clinical classification depends on the ability of the child to walk.[32] The SCFE is considered stable when the child is able to walk with or without crutches, and it is considered unstable when the child cannot walk with or without crutches. The radiographic classification depends on the presence or absence of a hip effusion on ultrasonography.[33,34] If the ultrasound demonstrates the absence of metaphyseal remodeling and the presence of an effusion, an acute event is likely to have occurred and the disease is considered unstable. If the ultrasound demonstrates metaphyseal remodeling and the absence of an effusion, an acute event has not occurred and the disease is considered stable.

The epiphysis typically slips posteriorly and as such is often seen only on a lateral radiograph in the earlier stages.[30] Other helpful radiographic signs are the metaphyseal blanch sign of Steel[35] and Klein's line.[36] 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. 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.[36]

Fig. 6. X-ray of pelvic with both hip joints AP: After removal of CCS on right hip, good union had seen on both hips.

Fig. 7. Pelvis with both hips AP and bilateral hips lateral view: shows tilted pelvis, reduced and incongruent hip joint spaces with malunited femoral physis, widened neck and tilted femoral head along with visible physeal scan on both sides.

The most important priority in the management of a patient with a SCFE is to prevent progression of the slip and avoiding the complications of avascular necrosis and chondrolysis.[37] The current treatment methods for a patient with a stable (chronic) SCFE include: **(1)** immobilization in a hip-spica cast[38] **(2)** in situ stabilization with single or multiple pins or screws[39,40] **(3)** open epiphyseodesis with iliac crest or allogeneic bone graft[41,42] **(4)** open reduction with a corrective osteotomy through the physis and internal fixation with use of multiple pins[43,44] **(5)** compensating base-of-neck osteotomy with in situ stabilization of the slipped capital femoral epiphysis with use of multiple-pin fixation[45] and **(6)** intertrochanteric osteotomy with internal fixation.[46]

The treatment of an unstable SCFE (acute or acute-on-chronic) is similar to that of a stable but is considerably more controversial. The role of immediate reduction compared with delayed reduction is controversial, as is the role of preoperative traction. Loder[32] compared the results of treatment in 25 hips that had a stable SCFE with those in thirty hips that had an unstable SCFE. The result was satisfactory in 96 percent of the 25 hips that had a stable and in 47 percent of the 30 hips that had an unstable. Lim[47] recommended straight leg traction for six weeks followed by in situ screw fixation without manipulation, due to a higher avascular necrosis risk for unstable SCFE.

Avascular necrosis (AVN) is a serious complication of SCFE and the treatment is difficult.[48] The complication of AVN is rare in patients with a stable SCFE, but frequent in patients with an unstable SCFE.[32] The factors responsible for the development of AVN are an acute unstable SCFE, over reduction, attempts at reduction of the chronic component of an acute-on-chronic SCFE, placement of pins in the superolateral quadrant of the femoral head, and femoral neck osteotomy.[49,50] The reported incidence varies from three to 47 percent of patients and all cases of AVN after SCFE are radiographically apparent within one year.[51] The treatment of AVN is not rewarding for the patient and the clinician. NWBCW, ROM exercises, and anti-inflammatory medication may help to minimize symptoms. An internal fixation device that protrudes into the hip joint should be backed out of the joint or removed, if the physis is closed minimize symptoms and epiphyseal collapse. In severe cases, a hip arthrodesis or joint arthroplasty may be needed.[29]

Chondrolysis, the etiology is still unknown, is another major complications of SCFE and its prevalance increases with the increasing severity, is reported incidence of five to seven percent.[52] The diagnosis is confirmed by radiographs that demonstrate a decrease in the width of the joint space of greater than 50 percent compared with the uninvolved side or, in patients who have bilateral involvement, a joint space of less than three millimeters. The prognosis and the treatment are as of AVN.[29]

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