



## Arthroscopically assisted reduction of an unstable severe slipped capital femoral epiphysis : A case report

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Slipped capital femoral epiphysis (SCFE) is considered to be one of the most common disorders of the hip in children and adolescents. If left untreated, it may lead to progressive deformity, pain and decreased range of motion, and predisposes to early onset degenerative arthritis. Surgical treatment is advised, with *in situ* pinning across the physis being the gold standard for stable slips. Closed or open reduction can be considered in unstable or severe types. We report the arthroscopically assisted reduction of an unstable severe SCFE, followed by cannulated screw fixation. A follow-up of 2.5 years shows an excellent clinical and acceptable radiological outcome. Our case demonstrates that arthroscopically assisted reduction of a slipped capital femoral epiphysis is feasible. Although the technique is technically challenging and requires familiarity with arthroscopy of the hip, it has some clear benefits as compared with both closed and open reduction techniques. Arthroscopically assisted reduction may therefore be a safe and effective treatment in unstable, severe SCFE.

**Keywords :** slipped capital femoral epiphysis; SCFE; arthroscopic reduction; AVN.

### INTRODUCTION

Slipped capital femoral epiphysis (SCFE) is a relatively rare condition, but it is considered to be one of the most common disorders of the hip in children and adolescents. SCFE mainly occurs between the ages of 10-16 years (12 years for girls

and 13.5 years for boys), and the overall incidence rate is approximately 11 per 100.000 children per year. The occurrence rate is significantly higher in boys (13.35 per 100.000) than in girls (8.07 per 100.000) (5). There is an increased risk in children who are obese, as well as in medical conditions such as hypothyroidism, growth hormone deficiency, pituitary tumours, craniopharyngioma, Down syndrome, renal osteodystrophy, and adiposogenital syndrome (11). Patients whose presentation is atypical, particularly patients younger than 10 years, should be screened for endocrine disease.

One-fifth of patients have a bilateral slip at presentation, and up to 43% may develop a contralateral slip before the end of growth (7). The majority of patients who develop contralateral slips do so in the first 18 months after initial presentation.

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Three distinct modes of patient presentation have been noted : (1) chronic, with symptoms present for more than 3 weeks ; (2) acute, with symptoms present for fewer than 3 weeks ; and (3) acute on chronic, with patients experiencing an acute exacerbation of their chronic symptoms. SCFE is considered to be stable when the child is able to walk with or without crutches, and unstable if he/she cannot do so. Instability has a profound effect on the eventual clinical result : unstable slips have a reported rate of avascular necrosis (AVN) of 47%, while stable slips show virtually no AVN (8). This may be explained by disruption of the blood supply to the femoral epiphysis, at the time the slip becomes unstable.

Radiologically, SCFE can be classified according to the epiphyseal-shaft angle (slip angle of Southwick) into mild ( $< 30^\circ$ ), moderate ( $30\text{-}50^\circ$ ) and severe ( $> 50^\circ$ ) (1). Mild and moderate slips have an excellent long-term prognosis when treated with *in situ* pinning, whereas severe slips are associated with a more rapid decline in hip function over time (2).

The goal of treatment in SCFE is to stabilize the epiphysis and prevent further displacement while avoiding complications, most notably AVN and chondrolysis. Treatment of stable slipped epiphysis is surgical, with stabilization across the physis by *in situ* pinning being the gold standard. However, reduction of the slipped epiphysis can be required in unstable or severe SCFE, in order to improve alignment and facilitate stabilization by screw fixation.

Closed reduction can be attempted by positioning the patient's affected limb in slight flexion and internal rotation on the fracture table. It appears that

closed reduction of the acute, unstable slip does not increase the rate of AVN (9). As an alternative to closed reduction, an open surgical reduction can be considered. Both closed and open techniques have downsides : attempted closed reduction does not always restore anatomical alignment, whereas open reduction is more invasive and leads to a prolonged operative time and increased blood loss. As an alternative, we present a case of arthroscopically assisted reduction of an unstable severe SCFE, followed by cannulated screw fixation.

### CASE REPORT

In January 2008, a 12-year-old girl was referred to our clinic because of a progressive limp and right groin pain, that had been present for 2 months. There was no history of trauma, and there were no underlying illnesses. On physical examination, the patient presented with an external rotation deformity of the right hip, and difficulty to fully weightbear on the affected leg. Standard radiographs showed a severe slipped capital femoral epiphysis of the right hip, with a Southwick angle of  $69^\circ$  (Fig. 1).

After obtaining informed consent, an arthroscopically assisted reduction, followed by cannulated screw fixation, was performed. General anaesthesia was administered, and the patient was positioned on a fracture table. An image intensifier was used to locate the hip joint. The joint was punctured in a sterile fashion to resolve the natural vacuum, allowing for distraction of the joint using traction on the fracture table. Both an anterolateral and a modified anterior portal were created. The joint was visual-



**Fig. 1.** — Pre-operative anteroposterior and lateral radiographs showing a severe slipped capital femoral epiphysis of the right hip, with a Southwick angle of  $69^\circ$ .



**Fig. 2.** — Post-operative anteroposterior and lateral radiographs at final follow-up (30 months) showing a congruent hip joint and a closed physis. A residual cam lesion is present, but there are no obvious signs of early onset degenerative arthritis or avascular necrosis (AVN).

ized, using a standard 5.5 mm scope, through the anterolateral portal. The severe slip was identified and the physis was repositioned to its anatomical position by manually pulling the physis using a meniscal clamp through the modified anterior portal. A visual and fluoroscopic check of the reduction was performed. A lateral stab incision was made, and under fluoroscopic guidance a guide pin was drilled, to reach the subchondral bone of the femoral head. The guide pin was overdrilled and the physis was fixed with a single 6.5 mm diameter cannulated lag screw. There were no complications from the surgery, and more specifically of the arthroscopic technique.

Postoperatively, weight bearing was not allowed for 6 weeks. Range of motion exercises were initiated from the first postoperative day. The patient was able to return to her normal activities after 3 months.

The patient was seen at our clinic, at a final follow-up of 30 months. She experienced no pain or discomfort in the operated hip, nor did she report any limitations in her activities of daily living, including recreational and sports activities. On questioning, the patient reported the necessity to externally rotate the hip to achieve deep flexion. Both the Harris Hip and WOMAC Scores showed an excellent result of 96 points, out of a maximum of 100. Range of motion was unremarkable, with a symmetric hip flexion of 120°, internal rotation of 60°, external rotation of 40° and abduction of 45°. Standard radiographs showed a congruent hip joint.

The physis had closed. A residual cam lesion was present, but there were no obvious signs of early onset degenerative arthritis or avascular necrosis (AVN) (Fig. 2).

## DISCUSSION

For stable and mild types of SCFE *in situ* pinning is the gold standard. In unstable or severe types of SCFE, reduction of the slip can be considered for the following reason : it is important to avoid exiting the femoral neck posteriorly near the blood supply and then reentering the epiphysis. It is also best to avoid the posterior, superior quadrant of the head as intraosseous blood supply is richest in this area and screw placement can have a deleterious effect on the vascularity of the epiphysis. The greater the degree of slipping, the more anterior the entry site for pinning will have to be to prevent poor screw placement. Technically, the goal is a single screw perpendicular to the physis, three to five intraepiphyseal threads past the growth plate, yet with the tip not within 2 mm of the articular surface, in the exact center of the epiphysis. This is not always possible without reducing the femoral head. However, many clinicians favour the potential risk of malplacement of the screw over disturbance of the blood supply by attempting closed or open reduction.

Rhoad *et al* reported a study of 10 unstable slips that underwent operative reduction after bone scanning had been done. None of the four hips with

normal bone scans developed AVN even though three were reduced from grade III to grade I slips. Six other hips had pathological changes on the pre-treatment bone scans, and five developed AVN, implying that the vascular status of the epiphysis may have already been determined at the time of presentation (10).

In severe, unreduced SCFE, residual deformity may persist, leading to disabling limitation of flexion and external rotation deformity. This may cause disturbance in sitting and other flexion activities as well as in gait. The associated femoroacetabular impingement (3,6) can lead to pain, stiffness and osteoarthritis. The impingement can be relieved and the hip motion improved at the time of initial treatment by anatomically reducing the slip (4). Attempted closed reduction of a SCFE does not always result in an acceptable restoration of the anatomical alignment. Unfortunately, open reduction also has some limitations, mainly due to the prolonged operative time and increased intraoperative blood loss.

Our case demonstrates that arthroscopically assisted reduction of a slipped capital femoral epiphysis is feasible. A follow-up of 2.5 years showed an excellent clinical and acceptable radiological outcome. Although the technique is technically challenging and requires familiarity with arthroscopy of the hip, it has some clear benefits as compared to both closed and open reduction techniques. Arthroscopic reduction allows for a direct visual assessment of the repositioning of the physis, whereas in closed reduction one has to rely merely on fluoroscopic imaging. Compared to open reduction techniques, arthroscopy is minimally invasive, enabling the surgeon to achieve reduction, while minimizing the possible perioperative risks.

Arthroscopically assisted reduction may therefore be a safe and effective alternative to both closed or open reduction in unstable, severe SCFE.

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