



Moderate to severe slipped capital femoral epiphysis treated by surgical hip dislocation and subcapital realignment of epiphysis - case series

SENTHIL S

Department of Orthopaedic Surgery, MADRAS MEDICAL COLLEGE AND GOVERNMENT GENERAL HOSPITAL

Abstract : ABSTRACT Background Slipped capital (upper) femoral epiphysis SCFE is a condition where the femoral epiphysis slips off of the proximal femoral neck. The deformity causes reduced range of motion and severe femoroacetabular impingement. Traditional methods of correction have the consequence of recurrence of slippage, anatomic realignment being not achieved, and development of secondary osteoarthritis. Subcapital realignment of epiphysis involves surgical dislocation of hip and developing soft tissue flap consisting of retinaculum and external rotator muscles, which allows anatomic reduction of epiphysis, preservation of perfusion of epiphysis and fusion of growth plate. Aim of study Purpose of study was to focus on outcome of moderate to severe slipped capital femoral epiphysis treated by safe surgical dislocation of hip and subcapital realignment of epiphysis. Materials and methods Seven hips of 5 patients were surgically treated through approach of Ganz surgical hip dislocation and subcapital realignment of epiphysis. Patients were investigated with x-ray pelvis - anteroposterior view and frog leg lateral view. Post operatively passive mobilisation and abductor strengthening exercises were performed, gradual weight bearing allowed after 8 weeks. Operative results were followed up by periodic radiographs. Results Patients were followed for an average of 10 months (range, 3 to 18 months). Improvement in abduction and internal rotation were noted, have been able to walk without crutches with no obvious limp. No occurrence of avascular necrosis of femoral head. Patients were satisfied with the function of hip joint. Conclusion Application of Ganz surgical dislocation of hip and subcapital realignment of epiphysis in treatment of moderate to severe SCFE is a valid alternative method. With this method anatomic realignment is achieved, blood supply is preserved, femoroacetabular impingement is corrected and osteonecrosis of femoral head is prevented. Keywords Slipped capital femoral epiphysis, Ganz surgical dislocation, Subcapital realignment, Osteonecrosis

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ABSTRACT:

Background: Slipped capital(upper) femoral epiphysis[SCFE] is a condition where the femoral epiphysis slips off of the proximal femoral neck. The deformity causes reduced range of motion and severe femoroacetabular impingement. Traditional methods of correction have the consequence of recurrence of slippage, anatomic realignment being not achieved, and development of secondary osteoarthritis. Subcapital realignment of epiphysis involves surgical dislocation of hip and developing soft tissue flap consisting of retinaculum and external rotator muscles, which allows anatomic reduction of epiphysis, preservation of perfusion of epiphysis and fusion of growth plate. Aim of study: Purpose of study was to focus on outcome of moderate to severe slipped capital femoral epiphysis treated by safe surgical dislocation of hip and subcapital realignment of epiphysis. Materials and methods: Seven hips of 5 patients were surgically treated through approach of Ganz surgical hip dislocation and subcapital realignment of epiphysis. Patients were investigated with x-ray pelvis - anteroposterior view and frog leg lateral view. Post operatively passive mobilisation and abductor strengthening exercises were performed, gradual weight bearing allowed after 8 weeks. Operative results were followed up by periodic radiographs. Results: Patients were followed for an average of 10 months (range, 3 to 18 months). Improvement in abduction and internal rotation were noted, have been able to walk without crutches with no obvious limp. No occurrence of avascular necrosis of femoral head. Patients were satisfied with the function of hip joint. Conclusion: Application of Ganz surgical dislocation of hip and subcapital realignment of epiphysis in treatment of moderate to severe SCFE is a valid alternative method. With this method anatomic realignment is achieved, blood supply is preserved, femoroacetabular impingement is corrected and osteonecrosis of femoral head is prevented. Keywords: Slipped capital femoral epiphysis, Ganz surgical dislocation, Subcapital realignment, Osteonecrosis

Introduction

Slipped capital(upper)femoral epiphysis is a condition where the femoral epiphysis slips off of the proximal femoral neck, often leads to posteroinferior displacement and retroversion of the femoral head relative to the femoral neck. The deformity causes reduced range of motion and severe femoroacetabular impingement. Impingement in SCFE has been associated with damage of the acetabular cartilage leading to early onset of osteoarthritis[1,2]. Severity of slippage correlates with poor long-term clinical outcome scores and radiographic evidence of osteoarthritis. There is a potential role for realignment procedures that can safely restore the mechanical alignment and the femoral head-neck contour. Realignment procedures described for moderate and severe slips are at subcapital, basicervical, intertrochanteric and subtrochanteric levels [3,4,5,6]. The risk of necrosis has been described as almost reciprocally proportional to the distance of correction from the physis, realignment procedures at the level of the deformity (ie, subcapital level) can result in anatomic or near anatomic restoration of the proximal femur. Despite this, osteonecrosis reportedly occurs with an incidence of 10% to 100% and the combination of osteonecrosis and chondrolysis up to 42%[7,8,9,10]. However understanding of the proximal femoral anatomy and blood supply suggests the challenges are mostly technical and can be solved with improved surgical technique. Based on this subcapital realignment combined with the surgical hip dislocation approach that allows the development of an extended retinacular soft tissue flap is advocated. It provides extensive subperiosteal exposure of the circumference of the femoral neck, which facilitates trimming of the femoral neck and hence safe reduction of the femoral head [11,12]. The primary aim of our study was to demonstrate that the technique of subcapital realignment is feasible and reproducible and will restore hip anatomy and function.

Materials and Methods

Seven hips of 5 patients with one unilateral and four bilateral affection were treated using the Ganz surgical hip dislocation approach and subcapital realignment of physis during the period of June 2014-Nov 2015 were the subjects of this study. In two cases of bilateral presentation one hip was not operated in one and other underwent insitu pinning due to mild slip were excluded from the study. The average age at the time of surgery was 13.5 years. All patients were male and of moderate to severe SCFE in the age group between 10-16 years. Patients were followed for an average of 10 months (range, 3 to 18 months).

Table 1 Patient demographics

S.No	Age/Sex	Presentation	Side	Duration of symptoms	Slip angle	Severity	Stability
1	12/M	Unilateral	Lt	5 Months	45 degrees	Moderate	Stable
2	16/M	Bilateral	Lt	8 Months	80 degrees	Severe	Unstable
3	14/M	Bilateral	Rt	14 Months	36 degrees	Moderate	Unstable
4	14/M	Bilateral	Lt	12 Months	43 degrees	Moderate	Unstable
5	18/M	Bilateral	Rt	5 Months	45 degrees	Moderate	Unstable
6	16/M	Bilateral	Lt	6 Months	54 degrees	Moderate	Stable
7	15/M	Bilateral	Lt	7 Months	48 degrees	Moderate	Unstable

The hip joint was approached as described by Ganz et al[13]. The patient was prepared and draped in the lateral decubitus position. Gibson approach adopted and skin incision was made, and the fascia lata was split in line with the incision. A greater trochanter flip osteotomy was made, and the greater trochanter was retracted anteriorly along with the vastus lateralis and the gluteus medius. The interval between the gluteus minimus and the tendon of the piriformis was developed, and the gluteus minimus was retracted superiorly to expose the capsule. A z-shaped capsulotomy was made protecting the lateral retinacular arteries, and the hip joint was subluxated or dislocated anteriorly by flexion-external rotation-adduction. The epiphyseal perfusion was checked either by

drilling a 2-mm hole in the anterior femoral head and ensuring the continuous bleeding[14]. The retinacular flap was raised after the trimming of posterosuperior portion of the stable greater trochanter down to the level of the femoral neck. The resulting soft tissue flap consisting of the retinaculum and external rotators held the vessels supplying the epiphysis[11,15]. Using a curved 10-mm wide chisel, the epiphysis was gradually separated from the metaphysis by carefully levering the inserted instrument, resection of a posteromedial callus bridge in flexionexternal rotation can facilitate the separation of the head. the callus sitting on the surface of the posterior neck was removed with a straight chisel. With the other hand, the surgeon removed residual tissue of the growth plate using a small curette. In cases with femoroacetabular impingement, osteochondroplasty was performed, contouring the head and neck junction following the normal femoral head contour and making the head-neck offset. Elimination of impingement was confirmed by dynamic assessment of the impingement.

The epiphysis is then reduced to corrected position and guide wire inserted from lateral cortex upon which a 6.5 mm cannulated cancellous screw was fixed. The head is then reduced confirming the bleeding from femoral head and capsule was closed loosely to avoid strangulation of the femoral head blood supply[16]. The trochanteric osteotomy was fixed with two to three 3.5-mm screws. During the hospital stay Indomethacin 75mg/day was given for 3 weeks. Continuous Passive Mobilisation and abductor strengthening exercises were advised for 6 weeks. The patients were initially touchdown weightbearing for 6 to 8 weeks. Physical therapy for non weight bearing walking training and gentle range of motion were initiated immediately. We obtained radiographs at 4 weeks to determine whether touchdown weightbearing should be continued for another 4 to 5 weeks or whether weightbearing could be gradually increased. Full weightbearing was allowed after healing of the trochanteric osteotomy and femoral neck usually 8 to 10 weeks. Healing was judged by the blurring of the trochanteric osteotomy line and the proximal femoral physis. Continued healing of the femoral neck and progress of rehabilitation were re-evaluated 12 to 14 weeks after surgery. Thereafter, normal activities were permitted. Implant removal was scheduled for 6 months to 1 year after surgery. At followup, the range of motion for both hips was recorded with special emphasis on internal and external rotation in flexion of 90°. We used pre- and postoperative anteroposterior pelvic radiographs, and crosstable or frog lateral radiographs to determine the amount of slippage. A slip angle less than 30° was estimated as mild, between 30° and 50° as moderate, and greater than 50° was classified as severe. Postoperative clinical outcomes were assessed using the Harris hip score[17].

Results

Patients were followed for an average of 10 months (range, 3 to 18 months). Patients were subjected to radiographs at 4 weeks,8 weeks,12 weeks and thereafter six monthly. Femoral head necrosis did not occur. One hip had to undergo implant exit because of hardware migration at 14 months. No other complications were seen. Abduction and internal rotation improved with an average of 30 and 20 degrees respectively. Postoperative hip function was good with near normal range of motion (Table- 2). The mean postoperative hip flexion, flexion internal rotation, and flexion external rotation were 103.5 degrees(range, 80–120), 34 degrees (range, 10–45), and 48.5 degrees(range, 30–60), respectively. Short-term postoperative clinical outcomes were near normal.

Table 2: Results

S.No	Follow up (Months)	Slip correction (Degrees)	Range of Movements			Outcome
			Flexion	External Rotation	Internal Rotation	
1	8 months	40 degrees	120	55	45	Good
2	7 months	56 degrees	110	80	40	Excellent
3	16 months	36 degrees	100	45	35	Good
4	13 months	39 degrees	80	30	10	Fair
5	8 months	43 degrees	110	50	35	Good
6	5 months	50 degrees	105	45	30	Good
7	3 months	43 degrees	100	55	45	Excellent



Case illustration



Pre op AP view



Pre op frog leg lateral view



post op



post op external rotation

post op internal rotation

Discussion

Moderate to severe slipped capital femoral epiphysis frequently leads to premature osteoarthritis resulting from femoroacetabular impingement. Correction at the site of deformity is the best to minimize the risk of or delay the appearance of osteoarthritis. However, reorientation of the femoral head with an osteotomy has traditionally been associated with high rates of osteonecrosis. Our primary aim was to determine whether this capital realignment technique was feasible and repeatable and would restore hip anatomy and function and provide good short-term outcome while avoiding osteonecrosis. To reduce the risk for osteonecrosis of the epiphysis during capital reorientation, tension of the posterolateral retinaculum, containing the end branches of the medial femoral circumflex artery, is reportedly reduced by cuneiform wedge resection of varying size and location. This allows mobilization of the epiphysis within the growth plate as well as complete callus resection of the neck without stretching the retinaculum. The dislocation of the head allows manual fixation of the epiphysis while curettage of the residual growth plate is performed, as well as manual reduction of the epiphysis onto the metaphysis under visual control of the retinaculum. Like with any single cohort study, there are major limitations, among which is lack of a comparison group. Without a truly randomized long-term study, it would be difficult to compare outcomes after various surgical treatment methods such as in situ pinning, capital realignment, and intertrochanteric osteotomy. Furthermore, this technique allows restoration of the proximal femoral anatomy with complete correction of the slip angle and head-neck offset. It does not result in the creation of secondary deformities. Unlike the cuneiform osteotomies [18], which require substantial femoral neck shortening to ensure tension-free correction of the femoral epiphysis Full hip motion was restored and in the short term resulted in pain-free and fully functioning hips. Even in the clinically stable SCFE, a surprising number of physes was mobile on direct inspection during surgery.

In the case of moderate to severe clinically unstable SCFE, the rate of osteonecrosis with in situ pinning is high ranging from 10% to 40% [19]. It is the unstable SCFE in which direct visualization of the femoral head blood supply and careful dissection of the femoral neck periosteum through the surgical dislocation approach may theoretically decrease the rate of osteonecrosis. Therefore, we believe the unstable SCFE is the most important indication for this procedure. However, even in the clinically stable SCFE, often the physis is quite mobile suggesting the capital reduction procedure could be readily performed without major technical difficulties. Our data suggest capital realignment of SCFE with open physes through the surgical dislocation approach can be performed with low complication rates. We believe the technique is most appropriate for moderate to severe SCFE and especially for unstable SCFE. This procedure

Restores the proximal femoral anatomy and although we do not have long-term results, we assume restoration of normal anatomy would lead to good long-term outcomes.

Conclusion

Application of Ganz surgical dislocation of hip and subcapital realignment of epiphysis in treatment of moderate to severe SCFE is a valid alternative method. With this method anatomic realignment is achieved, blood supply is preserved, femoroacetabular impingement is corrected and osteonecrosis of femoral head is prevented.

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