Case Report

Treatment of unstable slipped capital femoral epiphysis with a modified Dunn's procedure-a case report

Kaul R.[1], Singh C.M.[2], Thakur K.[3]

[1]Dr. Rajiv Kaul, Senior Resident, Department of Orthopaedics, Military Hospital Kirkee, [2]Dr. Chander Mohan Singh, Associate Professor, Department of Orthopaedics, Armed Forces Medical College, Pune, [3]Dr. Kamparsh Thakur, Senior Resident, Department of Orthopaedics, Armed Forces Medical College, Pune, Maharashtra, India.

Corresponding Author: Dr. Chander Mohan Singh, Associate Professor, Department of Orthopaedics, Armed Forces Medical College, Pune, Maharashtra, India. E-mail: cmsingh@gmail.com

……...

Abstract

Slipped Capital Femoral Epiphysis (SCFE) is a relatively common disease of adolescents with drastic consequences in adult life if managed inappropriately. A number of surgical techniques are described to reposition the proximal femoral epiphysis and are frequently associated with a high rate of femoral head osteonecrosis. The modified Dunn's procedure has been shown to be safe and effective in treating unstable SCFE. The incidence of development of osteonecrosis is dramatically reduced by carefully preserving the posterior periosteal sleeve, thereby maintaining the vascularity to the head. We have performed this procedure in a 21-year-old male with bilateral, sequential, unstable SCFEs and achieved a satisfactory functional outcome at the end of one year.

Keywords: Unstable, Slipped capital femoral epiphysis, Modified Dunn's

……...

Introduction

Slipped capital femoral epiphysis (SCFE) is one of the commonest adolescent hip disorders [1]. It is defined as a posterior and inferior slippage of the proximal femoral epiphysis relative to the metaphysis that occurs through the hypertrophic zone of the physis [2]. The usual direction of displacement is an anterior and superior translation of the proximal femoral metaphysis (neck) relative to the epiphysis. The incidence of the disease is higher in males, in obese children and is commonly associated with the pubertal growth spurt. A stable SCFE, as defined by Loder, is one where the child can walk, with or without support and an unstable SCFE is one where the child cannot walk, with or without support [3]. Unstable SCFE's comprise almost 5% of all SCFE's [2]. An inevitable complication of unstable SCFE's is the development of avascular necrosis (AVN) which nearly always results in degenerative changes in adult life. The incidence of AVN in unstable slips ranges from 3 to 47% [4, 5, 6]. Bilateral unstable SCFEs are relatively rare, accounting for only 5% of all unstable SCFEs [4]. We report the case of a 21-year-old male with sequential, bilateral, unstable SCFEs, one of which managed with a modified Dunn's procedure. The clinical importance of a timely surgical intervention and its benefits are hereby highlighted in this case report.

Case Report

A 21-year-old male presented to our tertiary care orthopaedic center in Pune, Maharashtra, in 2016, with acute onset pain in the right hip and inability to walk following a trivial slip and fall. On examination, the individual was tall and thin with features of hypogonadism such as sparse body hair, a high-pitched voice and small testicles.

The affected limb was shortened and externally rotated. All movements of the hip were painfully restricted, especially abduction and internal rotation. Standard AP and frog leg lateral radiographs revealed a posteriorly displaced epiphysis with asymmetrical Klein's lines. The individual initially underwent an attempt at closed reduction and percutaneous fixation which was

Manuscript Received: 26th August 2019
Reviewed: 4th September 2019
Author Corrected: 11th September 2019
Accepted for Publication: 17th September 2019

unsuccessful; hence an open reduction including a subcapital closing wedge osteotomy (12 mm; based antero-superiorly) was done through the posterior approach and the epiphysis fixed using two 4.5 mm Herbert screws. The individual was kept on close follow-up for a contralateral slip, which occurred a year later, again following a minor injury. Just as in the first episode, he had severe pain and inability to bear weight on the left lower limb. Radiographs and a CT scan revealed a postero-inferiorly displaced epiphysis with a positive Trethowan's sign and a Southwick's angle of 50°. [7] He underwent an open reduction of the femoral capital epiphysis after a surgical dislocation of the hip through an anterior approach using a modified Dunn's procedure [8, 9, 10].

Figure 1: X-rays of initial dislocation and fixation

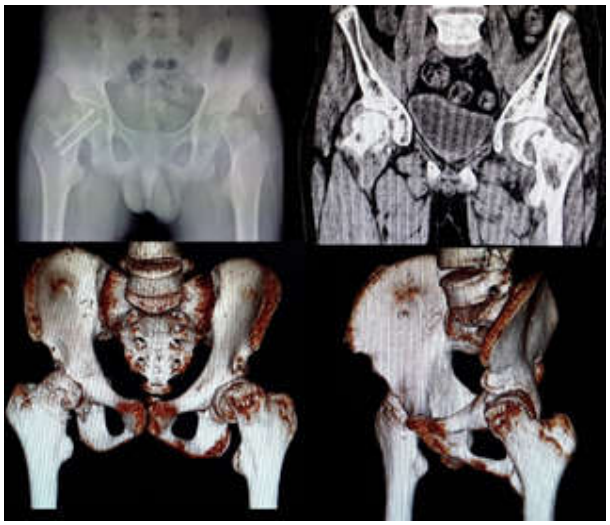

Figure 2: X-ray and CT scan of contralateral slip.

Surgical technique: A longitudinal incision was made from the ASIS curving inferiorly in the direction of the lateral patella for 8 cm. The superficial plane of dissection ran between the sartorius and tensor fasciae lata, through the subcutaneous fat (avoiding the lateral femoral cutaneous nerve) and continued between the rectus femoris and gluteus medius. On retraction of the rectus femoris and iliopsoas medially and gluteus medius laterally the hip capsule was exposed and incised with a T-shaped capsular incision to dislocate hip anteriorly.

A curved osteotome was used to identify the plane of the slip following which the postero-lateral periosteum was released by carefully peeling the periosteum from the femoral neck, avoiding damage to the retinacular vessels. After realignment, epiphyseal fixation was performed using two guide wires which were inserted antegrade through the articular surface and retrieved posteriorly through the trochanteric region.

These were replaced with two 6.5 mm partially threaded cannulated cancellous screws to achieve a stable fixation of the capital epiphysis. The patient was advised restricted weight bearing for 6 weeks followed by a gradual return to normal activities.

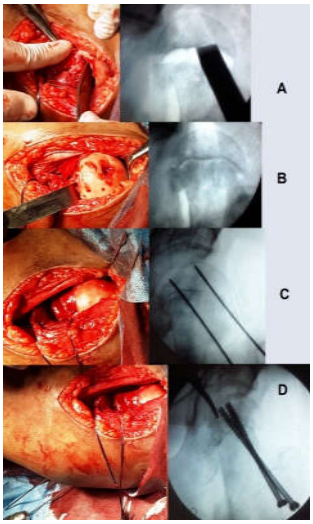

Figure 3: (A-D): Identifying the plane of slip, Repositioning of epiphysis, Provisional fixation with 2 guide wires, Final fixation.

Figure 4: Post-op X-rays of left hip.

Figure 5: Follow up X-ray at 1 year.

The patient was evaluated clinico-radiologically at 3, 6- and 12-months post-op. His Harris Hip Scores at 12 months were 64 for the right and 80 for the left hip.

There were no signs of re-displacement of the epiphysis on X-rays, however there were signs of collapse and loss of sphericity of the right femoral head as compared to the left, which continued to bear a congruent relationship to the acetabulum. The patient was pain free, had a normal gait and was able to carry out his daily activities without any difficulty.

Figure-6: Functional outcome at 1 year.

Discussion

In 1964, Dunn presented a technique of subcapital reorientation through a posterior approach with a trochanteric osteotomy, named after him, with a risk of avascular necrosis of 4% [11]. However, callus formation occurred at the posterior aspect of the femoral neck, resulting in shortened retinacular vessels. During reduction of the epiphysis, these vessels were likely to undergo stretching and subsequent occlusion, thereby leading to AVN. With careful subperiosteal preparation of the retinacular vessels and resection of the newly formed callus along with some neck shortening, the chances of AVN were reduced.

This theory eventually led to the development of a modified Dunn's technique in which a subcapital reorientation through a surgical dislocation of the hip was performed with development of a retinacular soft-tissue flap [12]. Over the years, the technique has widely been used in the treatment of unstable slips with satisfactory outcomes.

In a study by Huber et al., a modified Dunn osteotomy with a surgical hip dislocation was performed in 30 hips in 28 patients with slipped capital femoral epiphysis. The functional outcome was excellent in 28 hips and anatomical or near-anatomical reduction was achieved in all cases.

AVN developed in only one of the 30 hips. [13]. In another similar study by Persinger et al., 31 hips in 30 patients with unstable SCFE's were treated via the modified Dunn's procedure with a focus on timing of surgical intervention, postoperative complications, and radiographic results. The mean postoperative slip angle measured 2.5° (range, +19° to -9.4°).

Complications included AVN in 2 cases (6% of total cases), mild heterotropic ossification in 3 cases and hardware symptoms in 2 cases [14]. In a retrospective analysis of 23 patients with slipped capital femoral epiphysis, by Slongo et al., a modified Dunn's procedure that included a surgical dislocation of the hip, showed excellent results in 21 patients with respect to hip function and radiographic parameters. 3 patients developed complications including 1 case of AVN [9].

The proposed etiologies for the development of AVN include vascular kinking, vascular tamponade resulting in increased intra-capsular pressure within the hip joint and avulsion of the retinacular vessels [14]. The use of the modified Dunn osteotomy, which entails a capsulotomy and surgical hip dislocation, can address the deformity as well as provide a direct decompression of the femoral epiphysis thereby minimizing the chances of AVN [15-17]. The present case study confirms the fact that repositioning the epiphysis and restoration of normal or near normal proximal femoral anatomy in SCFE is possible with a low risk of AVN.

Conclusion

The modified Dunn's technique is a versatile approach, in which epiphyseal perfusion as well as stability can be inspected directly, and intra-articular pathology can be evaluated and addressed concurrently [15]. In most cases the epiphysis can be repositioned without shortening the femoral neck thereby restoring the proximal femoral anatomy and range of motion.

By careful preservation of the posterior periosteal sleeve, the occurrence of AVN can be reduced. Lower rates of AVN also occur in patients treated within 24 hours of the acute event [16,17]. Based on our experience, this method is strongly advocated in the treatment of acute, severe, unstable slips, provided the surgery is done early and performed meticulously.

References

1. Kelsey JL, Keggi KJ, Southwick WO. The incidence and distribution of slipped capital femoral epiphysis in Connecticut and Southwestern United States. JBJS. 1970; 52(6):1203-1216.

2. Otani T, Futami T, Kita A, Kitano T, Saisu T, Satsuma S, et al. Treatment for unstable slipped capital femoral epiphysis: Current status and future challenge in Japan. J Orthop Sci. 2016;21(6):847-851. doi: 10. 1016/j.jos.2016.07.024. Epub 2016 Sep 6.

3. Loder RT, Richards BS, Shapiro PS, Reznick LR, Aronson DD. Acute slipped capital femoral epiphysis: the importance of physeal stability. J Bone Joint Surg Am. 1993;75(8):1134-1140. doi:10.2106/ 00004623-199308000-00002

4. Peterson MD, Weiner DS, Green NE, Terry CL. Acute slipped capital femoral epiphysis: the value and safety of urgent manipulative reduction. J Pediatr Orthop. 1997;17(5):648-54. doi:10.1097/00004694-199709000-00013

5. Rattey T, Piehl F, Wright JG. Acute slipped capital femoral epiphysis. Review of outcomes and rates of avascular necrosis. J Bone Joint Surg Am. 1996;78 (3): 398-402. doi:10.2106/00004623-199603000-00011

6. Rhoad RC, Davidson RS, Heyman S, Dormans JP, Drummond DS. Pretreatment bone scan in SCFE: a predictor of ischemia and avascular necrosis. J Pediatr Orthop. 1999;19(2): 164-168. doi:10.1097/00004694-199903000-00006

7. Griffith MJ. Slipping of the capital femoral epiphysis. Ann R Coll Surg Engl. 1976;58(1):34-42.

8. Sankar WN, Vanderhave KL, Matheney T, Herrera-Soto JA, Karlen JW. The modified Dunn procedure for unstable slipped capital femoral epiphysis: a multicenter perspective. J Bone Joint Surg Am. 2013;95(7):585-591. doi: 10.2106/JBJS.L.00203.

9. Slongo, T, Kakaty, D, Krause, F. Treatment of slipped capital femoral epiphysis with a modified Dunn procedure. J Bone Joint Surg Am. 2010;92(18): 2898-2908. doi: 10.2106/JBJS.I.01385

10. Schweitzer D, Klaber I, Zamora T, Amenábar PP, Botello E. Surgical dislocation of the hip without trochanteric osteotomy. J Orthop Surg (Hong Kong). 2017; 25 (1):2309499016684414. doi: 10. 1177/ 2309499016684414.

11. Dunn DM. The treatment of adolescent slipping of the upper femoral epiphysis. J Bone Joint Surg. British volume. 1964;46(4):621-629.

12. Leunig M, Slongo T, Ganz R. Subcapital realignment in slipped capital femoral epiphysis: surgical hip dislocation and trimming of the stable trochanter to protect the perfusion of the epiphysis. Instr Course Lect. 2008;57:499-507.

13. Tannast M, Jost LM, Lerch TD, Schmaranzer F, Ziebarth K, Siebenrock KA. The modified Dunn procedure for slipped capital femoral epiphysis: the Bernese experience. J Children's Orthopaed. 2017;11 (2):138-146. doi: 10.1302/1863-2548-11-170046

14. Huber H, Dora C, Ramseier LE, Buck F, Dierauer S. Adolescent slipped capital femoral epiphysis treated by a modified Dunn osteotomy with surgical hip dislocation. J Bone Joint Surg Br. 2011;93(6):833-838. doi: 10.1302/0301-620X.93B6.25849.

15. Persinger F, Davis RL 2nd, Samora WP, Klingele KE. Treatment of Unstable Slipped Capital Epiphysis Via the Modified Dunn Procedure. J Pediatr Orthop. 2018;38(1):3-8. doi: 10.1097/BPO.0000000000000737.

16. Parsch K, Weller S, Parsch D. Open reduction and smooth Kirschner wire fixation for unstable slipped capital femoral epiphysis. J Pediatr Orthop. 2009;29 (1):1-8. doi: 10.1097/BPO.0b013e31818f0ea3.

17. Phillips SA, Griffiths WE, Clarke NM. The timing of reduction and stabilisation of the acute, unstable, slipped upper femoral epiphysis. J Bone Joint Surg Br. 2001; 83 (7): 1046-1049.doi:10.1302/0301-620x. 83b7. 11640

.....

How to cite this article?

Kaul R, Singh C.M, Thakur K. Treatment of unstable slipped capital femoral epiphysis with a modified Dunn's procedure-a case report. Surgical Update: *Int J surg Orthopedics.* 2019;5(4):234-238.doi:10.17511/ijoso.2019.i04.01

.....