Radiological Outcome of Shelf Osteotomy in Legg Calve Perthes Disease

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ABSTRACT

Background: Management of Perthes disease has many controversies. The main goal of treatment is to recover the femoral head in normal shape and to reduce pain and stiffness, to improve range of motion, prevent extrusion and collapse of head, and prevent subsequent deformity. The aim of our study is to assess the early radiological outcome of Shelf osteotomy in patients with legg calve Perthes disease

Methodology This case series was conducted at the Department of Orthopedics Surgery, Khyber Teaching hospital, Peshawar, in the period from February 2022 to Jan 2023. Twenty cases were included in the study. Clinical evaluation was done by using Modified Sundt criteria. Radiological parameters were followed up at 6 month.

Results: A total of 20 cases were analyzed, out of which 16 patients were males (80%) and four were females (20%). The mean age at onset of disease was 8.5 years (range: 8 years to 10 years). Pre-operatively, two (10%) patients were on the initial stage and 18 (90%) patients were on the fragmentation stage (12 (60%) cases classified as lateral pillar group B and 6(30%) cases classified as group B/C). Patients were followed up for 6 months. Clinically, 15 cases (85%) were found as good according to modified Sundt criteria, 4 cases (15%) were found as fair and one was found as poor. All the radiological parameters improved significantly.

Conclusion: We recommend shelf acetabuloplasty for the management of early stages of LCPD in patients with onset of the disease over eight years. This protocol of management yields favorable clinical and radiological results.

Keywords: Legg–Calvé-Perthes disease, Spitzy shelf acetabuloplasty, Sundt Criteria

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INTRODUCTION

Legg-Calvé-Perthes disease (LCPD) is a condition in which there is unilateral or bilateral necrosis of femoral head.[1] It passes through different stages and it affects the range of motion of hip joint.[2] LCPD is caused by multiple etiological factors that lead to a final common pathway.[3] It passes through different stages. The biologic sequelae contain a chain of events which ultimately leads to revascularization.[4] Initially, the femoral head weakens and it is prone to collapse followed by its shape change and flattening to varying degrees until skeletal matuarity.[2,5]

The ideal objective of treatment in LCPD is to get a spherical femoral head with good coherence to avert the beginning of osteoarthritis after skeletal maturity is attained. Regardless of treatment option offered, it was found that patients less than 5 years of age with a good remodeling capacity had excellent prognosis.[6] Surgical treatment methods depend on containing the femoral head within the acetabulum during the period of biological plasticity. Different treatment methods have been used including bracing, Petrie cast, femoral osteotomies and pelvic osteotomies.[5]

Containment treatments for LCPD will prevent deformation of vulnerable femoral head and

congruent joint during the repair period if applied earlier. This will lead to decreased risk of formation of degenerative joints. Surgical treatment methods are more favourable for older children with more severe LCPD and non-operative containment options, like motion therapy, weight relief, and abduction splints, are more suitable for younger patients.[7]

Shelf acetabuloplasty is used as a salvage procedure in late LCPD, while its use is also supported for containment of extruded hips in earlier stages of the disease. It stabilizes acetabular labrum and it is also known to have a stimulatory effect on acetabular growth.[8,9] The aim of this study was to evaluate the clinical and radiological outcomes of Spitzy shelf acetabuloplasty as containment treatment in early stages of Legg–Calvé- Perthes disease excluding cases with hinge abduction.

METHODOLOGY

This case series was conducted at the Department of Orthopedics Surgery, Khyber Teaching hospital, Peshawar, during Feb 2022 to Jan 2023. Twenty cases were included in the study. Patients with active LCPD in fragmentation stage with onset of disease above the age of eight years and classified as Herring lateral pillar group B or B/C and patients with active LCPD in initial stage with onset of disease above the age of eight years if they develop loss of abduction or lateral extrusion of capital femoral epiphysis were included in the study. Active LCPD with onset of disease below the age of eight years, active LCPD classified as Herring lateral pillar group A or C, cases with hinge abduction, and cases with healing or healed LCPD were excluded. Clinical history was analyzed by asking about onset of complaint, analysis of pain, and limp if found. Clinical examination was done to assess range of movement, presence of flexion deformities, any tender points and shortening if present. All cases were assessed radio-graphically by taking pre-operative pelvis AP view with both hip joints and frog lateral X-ray views to assess for Herring lateral pillar classification.[10] The technique of shelf acetabuloplasty was modified from that described by Spitzy.[11] Patients were regularly followed up to assess for clinical and radiographic parameters at 2 weeks for wound healing, at 3 months for cast removal and at 6 months for radiological outcome. Functional outcomes were determined using modified Sundt criteria[4] as Good if no pain and full range of movement, fair if restricted range and/or occasional pain and as poor if pain and hip motion were significantly restricted.

Radiographic assessment were done at pre-op and compared with x rays at sixth month post-op for Center edge angle of Wiberg (CEA), Acetabular index, neck shaft angle, femoral head coverage and Reimer's index. Data was analyzed by using SPSS version 22. Quantitative data like age, CEA, acetabular index, neck shaft angle, femoral head coverage and Reimer's index were presented by mean ±SD. Qualitative data like gender and modified Sundt criteria were presented by frequency and percentages. P-value ≤0.05 was considered as significant.

RESULTS

A total of 20 patients were included in the study, out of which 16 (80%) were male and 4 (20%) were female. Patients were in the age range of 8 to 10 years; with the mean age at the onset of disease was 8.5 years. Pre-operatively, two (10%) patients were on the initial stage and 18 (90%) patients were on the fragmentation stage i.e.12 (60%) cases were classified as lateral pillar group B and 6 (30%) cases classified as group B/C).

At the final follow up, 15 cases (85%) were found as good according to modified Sundt criteria, 4 cases (15%) were found as fair and one was found as poor. Two cases were complicated with mild superficial wound infection which improved with conservative treatment (IV cefoperazone and daily dressings for one week). Two other cases had transient lateral femoral cutaneous nerve neurapraxia which improved after approximately 3 months.

The radiological outcome of 15 cases improved, 4 cases remained the same and only one case has progressed to poor outcome during follow up at 6 months shown in table 1.

Table 1. Descriptive analysis of Radiographic parameters pre-operatively and Post-operatively at 6 month

Measure	Pre-operative		Post-Operative		P value
	Mean	Standard Deviation	Mean	Standard Deviation	
Center edge angle of Wiberg	18.82	4.56	43.1	9.89	<0.0001
Acetabular index	24.10	7.27	10.96	7.46	<0.0001
Neck Shaft angle	140.16	10.71	120.05	14.9	<0.0001
Femoral head coverage	58. 21	8.31	75.11	13.6	<0.0001
Reimer's index	40.55	6.32	24.81	13.92	<0.0001

DISCUSSION

LCPD is an idiopathic juvenile type of ischemic femoral head osteonecrosis that commonly occurs between age of 4 and 8 years. The underlying etiology has remained elusive. The disease is more common in boys than girls. Young patients can develop arthritis if left untreated. There is no standardized protocol to treat LCPD. The current goal of LCPD treatment focuses on mechanical protection of the femoral head to prevent the femoral head deformation which maintains the plastic epiphysis in the acetabulum and can be done either by noninvasive or surgical techniques.[7,12] Various surgical options have been used in LCPD including proximal femoral osteotomy, Salter innominate osteotomy, triple pelvic osteotomy, Chiari osteotomy and shelf acetabuloplasty.[1] Shelf acetabuloplasty is used as salvage procedure in late LCPD to provide relief from This prospective case series was aimed to evaluate the clinical and radiological outcomes of Spitzy shelf acetabuloplasty for patients with LCPD above eight years of age at diagnosis in early active stage of the disease excluding those cases with hinge abduction. In our study we have found that the disease is mostly present in young boys (80%) as compared to girls (20%) which are consistent with international studies. Carsi et al. has found this disease in 77.2% males and 22.8% in females.[13] Our patients were in the age range of 8 to 10 years; with the mean age at the onset of disease was 8.5 years. Other studies have been done on patients presenting with onset of disease at 9.3 years of age.[14] It has been found that if onset of disease occurs after 9 years and with the lateral pillar B group or C group get a poor outcome. So age of onset after 9 years is a poor prognostic indicator in Perthes's disease.[15]

In our study, 15 cases (85%) were found as good according to modified Sundt criteria, 4 cases (15%) were found as fair and one of the case was found as poor. In a study by Huang et al., surgical treatment of severe Perthes's disease was studied and comparison was done between tripe osteotomy and sheif acetabuloplasty. The results has shown that 79% of 14 patients had satisfactory outcome i.e. 5 were good, 6 were fair, and 3 poor in the triple osteotomy group, while 100% of 14 patients i.e. two were good, 12 were fair in the shelf augmentation group. These results are similar to our study.[16] Radiological outcome of patients were compared pre operatively and then taken at 6 months. Our study has revealed that CEA has increased from a mean of 18.82 to 43.1 degrees (P<0.0001). Acetabular index decreased from a mean of 24.10 to 10.96 degrees (P<0.0001). Neck shaft angle decreased from mean of 140.16 to 120.05 degrees (P<0.0001). Femoral head coverage has increased from mean of 58.12 to 75.11(P<0.0001) and Reimer's index has decreased from 40.55 to 24.8(P<0.0001). In a study by Wen Chao et al., had shown similar findings as we have in our study, The CE angle, Sharp angle, medial joint space ratio, epiphysis height ratio, and percentage of acetabular coverage were significantly improved by shelf acetabuloplasty ($P<0.001$).[6] Shelf acetabuloplasty has shown better outcome, as compared to non operative treatment, in patients over eight years of age at onset of the disease. Results of Spitzy shelf acetabuloplasty were found to be superior to Salter innominate osteotomy in the age group above eight years. A retrospective study was done by Kuwajima et al., of over 90 patients found better outcome in patients over 6 years of age after acetabuloplasty.[17] Our study has also shown good results after shelf acetabuloplasty, however more studies are required at local level to compare the results with other technique

CONCLUSION

We recommend shelf acetabuloplasty for the management of early stages of LCPD in patients with onset of the disease over eight years. It has better results than non-operative treatment and other operative procedures in patients over 8 years of age at onset of the disease. It is better to start the treatment early before significant femoral head deformity happens because once femoral head collapse occurs, it is rarely regained.

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REFERENCES

1. Rodríguez-Olivas AO, Hernández-Zamora E, Reyes-Maldonado E. Legg-Calvé-Perthes disease overview. Orphanet J Rare Dis. 2022; 17(1):125.
2. Herring JA, Kim HT, Browne R. Legg-Calvé-Perthes disease: part II: prospective multicenter study of the effect of treatment on outcome. JBJS. 2004; 86(10):2121-34.
3. Kim HK, Herring JA. Pathophysiology, classifications, and natural history of Perthes disease. Orthop Clin N Am. 2011; 42(3):285–295.

4. Hsu JE, Baldwin KD, Tannast M, Hosalkar H. What is the evidence supporting the prevention of osteoarthritis and improved femoral coverage after shelf procedure for Legg-Calvé-Perthes disease? Clin Orthop Relat Res. 2012;470(9):2421-30.
5. Wright DM, Perry DC, Bruce CE. Shelf acetabuloplasty for Perthes disease in patients older than eight years of age: an observational cohort study. Journal of Pediatric Orthopaedics B. 2013;22(2):96-100.
6. Li WC, Xu RJ. Lateral shelf acetabuloplasty for severe Legg-Calvé-Perthes disease in patients older than 8 years: A mean eleven-year follow-up. Medicine (Baltimore). 2016; 95(45):5272.
7. Maleki A, Qoreishy SM, Bahrami MN. Surgical Treatments for Legg-Calvé-Perthes Disease: Comprehensive Review. Interact J Med Res. 2021 May 3;10(2):e27075.
8. Vukasinovic Z, Spasovski D, Vucetic C, Cobeljic G, Zivkovic Z, Matanovic D. Triple pelvic osteotomy in the treatment of Legg-Calve-Perthes disease. International orthopaedics. 2009; 33(5):1377-83.
9. Bursal A, Erkula G. Lateral shelf acetabuloplasty in the treatment of Legg–Calvé Perthes disease. Journal of Pediatric Orthopaedics B. 2004;13(3):150-2.
10. Kollitz KM, Gee AO. Classifications in brief: the Herring lateral pillar classification for Legg-Calvé-Perthes disease. Clin Orthop Relat Res. 2013; 471(7):2068-72.
11. Holm AGV, Reikerås O, Terjesen T. Painless period after Spitzy shelf operation for residual hip dysplasia-A long-term study of 47 children and young adults. J Orthop. 2018;15(1):196-200.
12. Xiao YB, Du W, Wu PF, Qing LM, Yu F, Tang JY. Pedicled iliac bone flap grafting in the treatment of late presentation Legg-Calvé-Perthes disease. Front Surg. 2023; 10:926109.
13. Carsi B, Judd J, Clarke NM. Shelf acetabuloplasty for containment in the early stages of Legg-Calve-Perthes disease. J Pediatr Orthop. 2015 ;35(2):151-6.
14. Caldaci A, Testa G, Dell'Agli E, Sapienza M, Vescio A, Lucenti L, Pavone V. Mid-Long-Term Outcomes of Surgical Treatment of Legg-Calvè-Perthes Disease: A Systematic Review. Children (Basel). 2022 27;9(8):1121.
15. Grzegorzewski A, Szymczak W, Sibiński M, Borowski A, Synder M. Choroba Perthesa po dziewiatym roku zycia w chwili zachorowania [Perthes disease with onset after nine years of age]. Chir Narzadow Ruchu Ortop Pol. 2006; 71(6):447-52.
16. Huang MJ, Huang SC. Surgical treatment of severe perthes disease: comparison of triple osteotomy and shelf augmentation. J Formos Med Assoc. 1999; 98(3):183-9.
17. Kuwajima SS, Crawford AH, Ishida A, Roy DR, Filho JL, Milani C. Comparison between Salter's innominate osteotomy and augmented acetabuloplasty in the treatment of patients with severe Legg-Calvé-Perthes disease. Analysis of 90 hips with special reference to roentgenographic sphericity and coverage of the femoral head. J Pediatr Orthop B. 2002; 11(1):15-28.