

Closed reduction with adductor tenotomy as the method of choice for Developmental Dysplasia Hip: A Retrospective cross-sectional study

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Abstract

Aim: To assess the radiographic and clinical evaluations of patients who have developmental hip dysplasia and received adductor tenotomy and closed reduction as treatment.

Study Design: Retrospective Cross sectional study

Place and duration: This Study was conducted in Peoples University of Medical & Health Sciences Nawabshah, Pakistan from 2018 to 2019

Methodology: The study was performed on 35 individuals with hip dysplasia, who were treated with adductor tenotomy, Spica cast and closed reduction in Peoples University of Medical & Health Sciences Nawabshah, Pakistan during the year of 2018 to 2019. Inclusion criteria had patients who have a diagnosis of developmental hip dysplasia and are under the age of 2 years. Exclusion criteria had patients who were suffering from disease of connective tissue, acetabulum dysplasia because of specific syndrome, and secondary dislocation because of the previous infection. After surgery, the severity of injuries associated with the subluxation and dislocation of hip joint and hip congruity was evaluated. Radiographic results were observed according to the McKay, Tonnis grading, Severin, and acetabular indices.

Results: It was identified that the preoperative mean acetabular index was dropped from 38.54 ± 2.42 to $26.5 \pm 1.98^\circ$ within two years. According to McKay criteria 57% patients were in the excellent category, and 37% were in the good category. Similarly, 80% patients were graded as Class I and 14% patients were graded as Class II according to the Tonnis grading. It was also observed that femoral head osteonecrosis was present in 2 cases, gait abnormalities in 3 cases, and difficulty in sitting was observed in 5 cases.

Conclusion: It was concluded that closed reduction with adductor tenotomy is very successful for the treatment of patients with developmental hip dysplasia.

Keywords: Developmental hip dysplasia, Spica cast, adductor tenotomy, closed reduction

Introduction

Developmental dysplasia of the hip is one of the very important reason due to which a child develops a disability in their body. This dysplasia accounts for almost 29% primary hip replacements in the people ranging from newborns to the people aging 60 years old.¹ In many European countries, it is a routinely medical practice that the newly born babies have to undergo the process of ultrasonography, because of the recent developments in the ultrasound imaging. The disability i.e. the developmental dysplasia of the hip ranges from mildly dysplastic hip which is somewhat stable and concentrically located to the one which severely dislocated and dysplastic.² During the later period of infancy or early period of childhood, severe dysplasia is clinically manifested, however, mild dysplasia is never manifested clinically or in some cases it becomes clinically apparent during the adulthood. It is observed that in the case of a dysplastic hip which is stable and considered as mild dysplasia, the femoral head remains stable but the acetabulum is dysplastic. However, in the case of severe dysplasia, the acetabulum and the femoral head are completely or partly displaced from one another resulting in a subluxated or dislocated hip.³

There are multiple environmental and genetic factors that act as external or internal factors which influence the development of hips in the body. Usually it is the left hip which is affected most often.⁴ It is suggested that high heritability has a coherence with a strong genetic susceptibility, however, it does not indicate the disease progression and its severity. The risk of developing hip dysplasia is increased 5% when there is a sibling already having the deformity.⁵ Breech presentation during the vaginal deliveries also increases the risk of hip dysplasia up to 17 folds, whereas during the caesarean section, a 7 fold increased risk is observed. The factors which influences the developmental hip dysplasia include decreased hip dislocation resistance, laxity of connective tissues, shallow acetabulum, breech presentation, large gestational age, oligohydramnios, multiple pregnancies, and position of infants during pregnancy and in infancy.⁶

Treatment of hip dysplasia differs according to the extent at which the hip is deformed and the age of individual. Diagnosis is often done by either clinical examination, ultrasonography, or radiography.⁷ Like any other disability, early diagnosis of the hip dysplasia is recommended because late diagnosis can result in tip walking and limping. Treatments during the early stage are done by non-surgical methods. To treat congenital hip dysplasia Spica cast and closed reduction with or without adductor tenotomy are recommended.⁸ A surgical technique that is being used as standard for many years is the adductor tenotomy without obturator nerve neurectomy. Multiple studies have reported the consequences of closed reduction techniques, however there is a very little information about the soft tissue release and the maintenance of postoperative case as a reduction technique which is acceptable.⁹ The current study was conducted to identify the outcomes of closed reduction and adductor tenotomy which is followed by Spica Casting to treat hip dysplasia.

Methodology

The current retrospective study was conducted with the permission of the ethical committee of Peoples University of Medical & Health Sciences Nawabshah, Pakistan. The study included children who were under the age of 2 years, and were suffering from the developmental hip dysplasia. It was also considered among the people who were included in this study, that they must have received their treatments of hip dysplasia by adductor tenotomy and closed reduction from 2017 to 2019. Program executor was used to confirm the diagnosis of hip dysplasia. Demographic data and clinical evaluation of the patients were also recorded. General anesthesia was given under sterile conditions via skin incision, and it was made sure that all the patients had undergone through a standard surgical procedure. To identify the adductor longus' origin, and incision of 1.5 cm was made in the groin. It was made sure that a 0.5 to 1 cm cut was made in the direct surgery to find

and release both tendons from their origin present in the adductor longus muscle. The direct surgery is followed by the process of closed reduction. For certain cases which are unstable, the safe zone is determined by using a pin. To stabilize the hip joint maintaining the 40-45° abduction and 95° flexion, Spica cast was used. Pads, Spica cast, and soft roll were used to cover pelvis, limbs, and abdomen.

Reduction was observed during the follow up by evaluating them during 2nd and 4th week, and then after every 6 months in two years, and all the data was recorded. After 8-12 weeks, the plaster was removed. It was also noted that the patients must have their proper safe zone i.e. 20-45° abduction and the reduction feasibility to treat subluxation and dislocation of hip joints in the patients of ages ranging from 6 months to 2 years and have a diagnosis of hip dysplasia. Exclusion criteria included age more than 2 years, having diseases of connective tissue, hip joint infections, have femoral head avascular necrosis, acetabulum dysplasia with a specific syndrome, and the CP presence.

Clinical evaluation was done according to the following criteria; Very good meaning that the joint is stable, without limping and pain, with a negative Trendelenburg marker and have full range of motions of hip. Good meaning that the joint is stable, somewhat limping is observed with a mild limitation in the movement. Moderate meaning that the joint is stable, have no pain but with a positive Trendelenburg marker and a very restricted hip movement. Fair meaning the joint is unstable; existence of pain can vary and the Trendelenburg marker is positive.

For radiographic evaluation, severin classification was used. For all cases, preoperative radiographs were observed. Acetabular index (AI), and hip subluxation or dislocation was recorded on the basis of Tonnis classification system and hip joint congruity. For the determination of severity of dislocation and AI, using the Tonnis classification system as a base, a postoperative radiograph was used. The radiographic results were also examined. To assess the femoral

osteonecrosis presence, the hip joint congruity was recorded based on severin classification system. If complication other than these were present, they were also recorded, and lastly the radiographic results were recorded according to the McKay's clinical criteria. For statistical analysis, SPSS version 22 was used, and a p-value < 0.05 was considered significant.

According to Tonnis rating system it was labeled as Grade 1 when; Capital femoral epiphysis medial to Perkin's line. Grade II; Capital femoral epiphysis medial to Perkin's line, but below the level of the superior acetabular rim. Grade III; Capital femoral epiphysis at the level of the superior acetabular rim and Grade IV; Capital femoral epiphysis above the level of the superior acetabular rim

Results

In the present study, 35 patients were included in which 5 were male, and 30 were female i.e. 14.2% and 85.71% with developmental hip dysplasia, and had gone through the adductor tenotomy with the Spica casting and closed reduction. The mean age of the patients was 18 ± 3.06 months at the time of surgery and was 43 ± 8 months at the time of evaluation. Lastly, among the 30 patients it was found out that 20% had left, 7% had right and 9% had bilateral hips affected. It was also found that the mean value of preoperative acetabulum index was 38.54 ± 2.42 which at the time of evaluation decreased to $30.2 \pm 3.17^\circ$ after a year and after two years it decreased to $26.5 \pm 1.98^\circ$. Generally, AI decreased to $27 \pm 1.34^\circ$ in the patients. The clinical evaluation which was based upon the McKay's criteria, their clinical progress was recorded and described in Table 1.

On the basis of Tonnis rating, the lateral subluxation and dislocation rate of hip joint was evaluated before treatment. The clinical results exhibited quite a significant improvement before and after the surgery as given in table 2.

Before and after the surgery, radiographic results were also compared according to the Severin division criteria, and a clinically significant improvement was observed here as well as described in table 3. Femoral head osteonecrosis was observed in 2 cases, gait abnormalities in 3 cases, and in 5 cases difficulty in sitting was observed. It was noted that all these complications were observed in the females.

Table 1: Clinical evaluation according to the McKay's criteria

In the last follow up n (%)	Before Surgery n (%)	Grade
20 (57.1)	-	Excellent
13 (37.1)	-	Good
1 (2)	15 (42.8)	Fair
1 (2)	19 (54.2)	Poor

Table 2: Hip dislocation rate on the basis of Tonnis grading

In the last follow up n (%)	Before Surgery n (%)	Grade
28 (80)	-	Class I
5 (14.2)	-	Class II
2 (5.7)	16 (42.8)	Class III
1 (2.8)	20 (57.14)	Class IV

Table 3: Radiographic results according to severin classification

In the last follow up n (%)	Before Surgery n (%)	Grade
23 (63.8)	-	Class Ia
9 (25)	-	Class Ib
3 (8.3)	-	Class II
1 (2.7)	-	Class IVa
-	20 (57.14)	Class IVb
-	16 (42.8)	Class V

Discussion

In the current study, 35 patients were diagnosed with hip dysplasia out of which 5 were males, and 30 were females and were treated by closed reduction with adductor tenotomy and Spica cast. It was observed that the preoperative acetabulum index was 38.54 ± 2.42 which at the time of evaluation decreased to $30.2 \pm 3.17^\circ$ after a year and after two years it decreased to $26.5 \pm 1.98^\circ$. These results coincided with the results of Sarnak et al where they have also observed 25° AI.¹⁰ A

clinical study which includes the McKay's criteria reported 18 cases categorized as very good and 12 as good which was the indication that the subjects have clinically progressed. Our results were not consistent with the study conducted by Tennet et al, which was based on the Tonnis grading system because according to Tennet's study most of the displacements of class IV did not respond after closed reduction.¹¹ This difference could be due to the large sample size as compare to our study. Similarly, our results of Severin criteria were also similar with the results observed by Tennet et al., in which the majority of patients i.e. 87% were treated by closed reduction technique belongs to Class I. Although due to small sample size there were only 2 cases of femoral head osteonecrosis, which was quite less as compared to other studies such as Tennet and Barakat et al., where the sample size was quite large and the follow up period was long as well.

Limitations

One of the major limitations in this study was the inaccessibility of all patients to go through follow up. Also, some patients were reluctant take part in the study and 2 years of follow up led to a very small sample size.

Conclusion

It was concluded at the end of this study that closed reduction at the age of two years or less than two years is very successful for the remodeling of femoral head and acetabulum. It was also identified that the complications of avascular necrosis after the surgery was very low.

Conflict of interest:

None:

Funding Source:

None

Permission:

It was taken from the ethical review committee of the institute

References

1. Shipman SA, Helfand M, Moyer VA, Yawn BP. Screening for developmental dysplasia of the hip: a systematic literature review for the US Preventive Services Task Force. *Pediatrics*. 2006; 117(3):e557-76.
2. Dezateux C, Rosendahl K. Developmental dysplasia of the hip. *The Lancet*. 2007; 369(9572):1541-52.
3. Henrigson B, Norberg I, OLSSONS SE. On the etiology and pathogenesis of hip dysplasia: a comparative review. *Journal of Small Animal Practice*. 1966; 7(11):673-88.
4. Fries CL, Remedios AM. The pathogenesis and diagnosis of canine hip dysplasia: a review. *The Canadian Veterinary Journal*. 1995; 36(8):494.
5. Loder RT, Skopelja EN. The epidemiology and demographics of hip dysplasia. *International Scholarly Research Notices*. 2011; 2011.
6. Muhammad Faraz Jokhio, Najeeb ur Rehman, Niaz Hussain Keerio, Ajmal khan Selro, Imran khan Maher, Raheel Akber Baloch, & Syed Shahid Noor. (2021). Study to determine the Results of Femoral Shaft Fractures among Children managed with Immediate Hip Spica Cast. *International Journal of Research in Pharmaceutical Sciences*, 12(3), 1956-1960. <https://doi.org/10.26452/ijrps.v12i3.4799>
7. Kotlarsky P, Haber R, Bialik V, Eidelman M. Developmental dysplasia of the hip: What has changed in the last 20 years? *World journal of orthopedics*. 2015; 6(11):886.

8. Bracken J, Tran T, Ditchfield M. Developmental dysplasia of the hip: controversies and current concepts. *Journal of paediatrics and child health*. 2012; 48(11):963-73.
9. Spiegel DA, Flynn JM. Evaluation and treatment of hip dysplasia in cerebral palsy. *Orthopedic Clinics*. 2006;37(2):185-96.
10. Sankar WN, Gornitzky AL, Clarke NMP, Herrera-Soto JA, Kelley SP, Matheney T, et al. Closed Reduction for Developmental Dysplasia of the Hip: Early-term Results From a Prospective, Multicenter Cohort. *J Pediatr Orthop*. 2019; 39:111-8.
11. Tennant SJ, Eastwood DM, Calder P, Hashemi-Nejad A, Catterall A. A protocol for the use of closed reduction in children with developmental dysplasia of the hip incorporating open psoas and adductor releases and a short-leg cast. *Bone Joint J*. 2016; 98-B: 1548-53.