

Closed Reduction for Developmental Hip Dysplasia in Lately Diagnosed Walking Age Children

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Abstract

Aim: The aim of the study was to assess the success and possible complications of closed reduction (CR) treatment of developmental hip dysplasia (DHD) in late-diagnosed children and explores its relation to the acetabular index (AI) measurement prior to treatment. **Patients and Methods:** Twenty-three consecutive patients with dislocated hips, 16 unilateral and 7 bilateral (30 hips), were retrospectively included in the study. They were admitted to the specialist pediatric orthopedic unit of the University Hospital (Tripoli Medical Center) in Tripoli, Libya. There were 21 females and 2 males with an average age at diagnosis of 17 months (range from 14 to 31 months). Their average follow-up period was 3 years (2–5 years), and none of them received treatment prior to diagnosis. All patients received prior inpatient skin traction for at least 2 weeks followed by CR with soft tissue release (adductor tenotomy), hip spica applied and maintained for an average of 3 months. Patients who had a failure of reduction or resubluxation at follow-up went for open reduction and a reconstruction procedure. **Results:** CR was successful in 27 hips (90%), failed in 3 (10%) other, the average age of the successful reduction group was 20.5 months, while that of the open reduction group, it was 23 months ($P = 0.25$). The average AI of the CR group was 39.0° , while that of the open reduction group, it was 42.7° ($P = 0.15$); 6.7% of patients with an AI of $<40^\circ$ had a failure of CR, while 16.7% of an AI of $>40^\circ$ had a failure of CR of the hip ($P = 0.46$). No complications of treatment were recorded at follow-up. **Conclusion:** Staged CR of DHD in older children in the hands of experienced specialists is still a valid means of their treatment, especially in developing countries with limited resources. There is a relatively higher failure rate of CR, the older the child is and the higher the AI.

Keywords: Children, closed reduction, developmental hip dysplasia, open reduction

INTRODUCTION

Most authors agree that early treatment of children with dislocatable or dislocated hips (at age between 0 and 6 months) with bracing is associated with better development and stability of the hip and lowers the need for hip reconstruction operation in future.^[1-3] For that reason, several screening programs were instituted in many countries and the past few decades showed a progressive drop in the age at diagnosis, hence better treatment. Data in our country on the average age of children at diagnosis of developmental hip dysplasia (DHD) are largely unavailable, in our experience at the Tripoli Medical Center, we noticed the drop in the age at diagnosis, but we still treat children diagnosed at walking age.^[1]

Early treatment of DHD with bracing (Pavlik Harness) is associated with excellent outcome,^[4] however, the older the child is, the more difficult to maintain the reduction and the higher the need for open procedure. Most authorities agreed

that Pavlik Harness treatment is not convenient with the larger child above 8 months old, associated with higher subluxation rates as well as femoral head osteonecrosis rates. Other methods of treatment are used including traction, closed reduction (CR) and soft tissue release with immobilization in hip spica. Open procedures and reconstruction are used mostly for the age of 18 months and older. CR with soft tissue release (e.g., adductor tenotomy) was reported to be successful in about 93% of cases, for the younger child (<1 year of age).^[1,8] Luhmann *et al.* reported that the frequency of reconstruction procedures in

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children <18 months was 20%, while in those above or equal to 18 months of age, it is 74%.^[5-7] We present our experience over a 2 years period in the management of DHD in children older than 13 months of age at time of diagnosis and discuss the predictability of age and the acetabular index (AI) at the time of diagnosis with the need for an open procedure.

PATIENTS AND METHODS

Clinical records and radiographs of all children diagnosed of DHD presented to our clinic at the Tripoli Medical Center over a 2 years period were collected. Only patients who were diagnosed late at an age of 12 months and above, received no previous treatment, and followed up for a period of at least 2 years postintervention were included in this study. Patients with associated deformities or acquired dislocations were excluded from the study.

A total of 25 patients who fulfill the criteria were identified, 2 were excluded due to loss of follow up, and 23 patients (30 hips) were included. The average age at operation was 20.7 ± 5.1 months (range 14–31 months), there were 21 girls and 2 boys. Eleven patients had the left hip affected, 5 had the right, and 7 with bilateral hip dislocations.

Each child presented to the clinic was fully examined for other abnormalities and associated disorders; standardized radiographs of the pelvis were taken at presentation, postoperative, and final follow-up; and AI as well as pelvic lines was estimated by the authors and a radiologist.

All patients underwent a period of skin traction (inpatient) for 2–3 weeks in abduction after which CR under general anesthesia was done, percutaneous adductor tenotomy was performed in all patients. All procedures were done by an experienced pediatric orthopedic surgeon. Postreduction fluoroscopy/arthrography was done, and hip spicae were applied with the hip in abduction and slight internal rotation, success or failure was recorded.

Patients were kept in an abduction hip spica for an average of 3 months then kept in a removable brace for 5 months. They were followed up with regular out patient clinic appointments for an average of 3 years (2–5 years). Failure of the procedure is recorded if maintenance of reduction could not be achieved. Patients then underwent open reduction and either reconstruction procedure or femoral osteotomy to maintain femoral head containment.

Data were analyzed using MS Excel statistical package. *T*-test was used for the difference between means, *z*-test for variance analysis, and Chi-square test for between-group difference.

RESULTS

The average age at diagnosis of these children in the outpatient clinic was 17 months (range: 13–31 months), none of them received treatment before presentation.

Out of the 30 hips affected, CR was successful in 27 hips (90%), [Figure 1].

The average age of patients in the successful closed treatment group was 20.5 months, while that of the failed group, it was 23.2 months, ($P = 0.248$), it is noticed that all patients that went to open reduction were above 20 months of age. The acetabular angle was calculated from standard anteroposterior radiographs of the pelvis.

Acetabular index

All patients had an initial AI of more than 30° . The mean AI ($\pm$ standard deviation) of the successful reduction group was $39.0^\circ \pm 4.3^\circ$, while the AI of the open reduction group was $42.7^\circ \pm 4.5^\circ$; $P = 0.16$. A total of 16 hips had an AI of 40° or less, 1 (6.7%) went for open reduction. Fourteen hips had an AI of $>40^\circ$, 2 (16.7%) went for open reduction, $P = 0.46$ [Table 1].

There were no associated deformities or conditions in any of the patients and in the period of follow-up, there were no complications, especially of avascular necrosis of the head of the femur. According to the modified McKay classification,^[8,9] functional results were excellent in 18 hips (60%), good in 10 (33%), and fair in 2 (7%).

DISCUSSION

Concentric reduction of the femoral head in the acetabulum until skeletal maturity is the long-term goal of treatment of developmental dysplasia of the hip. This concentric reduction of the femoral head is probably the primary factor in the normal development of the hip, many other factors are also involved.^[10] When recognized early, correction of the deranged anatomy must be done if coxarthrosis is to be prevented. Concentric hip motion and normal muscular function are essential for proper development of the joint. A reciprocal relation exists between the development of the proximal femur and the acetabulum. Structural abnormality of either eventually leads to joint dysfunction,^[11] Lindstrom *et al.*^[12] demonstrated that earlier treatment led to the best acetabular development; unfortunately, the age beyond which a dysplastic hip cannot be expected to return to within the normal range is unknown.^[11,12]

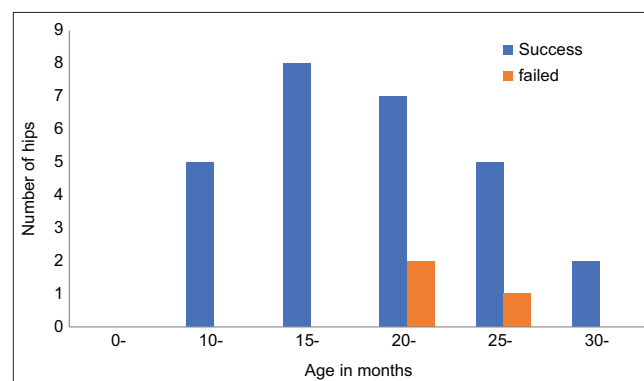


Figure 1: Age distribution of sample with number of hips that had open reduction

Table 1: Frequency of open reduction according to acetabular index

Acetabular angle AI	Number of hips in closed reduction group	Number of hips in open reduction group, n (%)
30°-40°	15	1 (6.7)
41°-50°	12	2 (16.7)

AI: Acetabular index

The patients in this series were unfortunately all diagnosed at a walking age and their hips were showing signs of dysplasia with a minimum AI of 31°. Non-operative initial treatment was necessary in terms of maintained reduction. We did not notice a clear correlation between the success of reduction and the child age. Our findings, also showed a statistically non-significant relationship between success of CR and AI, which lead us to conclude that careful CR with preliminary traction for few weeks may be successful in children above 18 months of age if their AI is <40°. However, a longer period of follow up is required to assess the long term acetabular development in these patients. The need for operative reduction with reconstruction procedure of some type in this study was 10%, despite late diagnosis, but we feel that this low frequency is also due to the relatively short-term follow-up.

Several authors demonstrated that the younger the age at reduction the better the outcome and the less is the need for a secondary operation. Powell *et al.*^[13] in a study of 49 hips reported that the frequency of secondary procedures was 29% for patients who were <12 months old, 49% for those who were 12–24 months old, and 79% for those who were more than 2 years old, similar results were shown by Luhmann *et al.*^[5]

It has been shown that success of CR requires a long period of immobilization in hip spica followed by a longer period in bracing to achieve any improvement in acetabular development and lower AI, this may not be achievable if population is noncompliant and secondary procedure may not be then acceptable to patients after such long treatment. Huang and Wang^[7] reported that 15 out of 16 hips reduced by closed methods had residual dysplasia or subluxation, while there was only one residual dysplasia in the operative group (32 hips), they also showed that the AI of the operated group improved from 38° to 19° after a much shorter period of time. Barakat *et al.*^[14]

reported similar results to our study in matching circumstances in the facilities and resources of a developing country.

CONCLUSION

Staged CR of DHD in older children in the hands of experienced specialists is still a valid means of their treatment, especially in developing countries with limited resources. There is a relatively higher failure rate of CR, the older the child is and the higher the AI.

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