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**Research Article**

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# *The Outcome of Closed Reduction of Developmental Dysplasia of Hip Before the First Year of Age*

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**ABSTRACT**

*This lack of consensus has established no specific recommendations or radiographic criteria for identifying and treating hip dysplasia. Closed reduction, open reduction and skin traction, and hip spika are just a few of the therapeutic options available. The study focuses on infants under the age of 12 months. It will look at the effects of reducing the amount of closure on them. A retrospective study looked back at patients treated with closed reduction at a great referral medical center before one year. Over 100 participants and 168 hips were involved. Following a median follow-up of 5.97 years (plus or minus 3.01 years), the effectiveness of the closure replacement surgery was assessed using a pelvic A.P. x-ray. People thought that most hip joints were healthy because the European Hip Dysplasia Institute gave them 1 or 2. This study found that most patients with class 1 and 2 hip severeness had a positive outcome. Following the conclusion of the decrease, the acetabular index dramatically improved. As part of this standardization, the values of C.E. angels are being determined. If a patient is under one year old and has DDH, the American Diabetes Association recommends a safely closed reduction rather than an open reduction.*

**Key words:** *DDH, Closed reduction, AVN, Structural abnormalities*

## INTRODUCTION

Children with developmental dysplasia of the hip (DDH) have a multitude of structural abnormalities in the hip joint [1, 2]. There are two ways in which DDH-related dysplasia can cause the femur to dislocate: [3]. When the term "congenital hip dysplasia" first came into use, it only referred to a condition in which a baby was born with a CDH. The new DDH abbreviation now includes hip dysplasia and displacement [4].

In some cases, surgical intervention and manipulations under anaesthesia can be used as treatment options for patients of all ages and degrees of dislocation. Because of its high success rate in treating DDH in children who cannot walk, surgical treatment is a standard therapy option for these children [5]. It might have long-term implications when misused [6].

Much progress has been made in DDH treatment in the last three decades [7]. It is more challenging to reduce a hip if you wait longer between getting diagnosed and starting treatment [6].

It is critical to address any difficulties during a patient's therapy with closed reduction. Avascular necrosis was found in 35% of patients who underwent closed reduction surgery. Femoral head anomalies, leg length discrepancies, and other joint-related disorders can have a severe influence on his ability to carry out his day-to-day duties [8, 9]. Closed reduction can result in redislocation, prolonged subluxation, or chronic acetabular dysplasia [5, 10]. Probable the surgeon did not reduce the circumference properly, which led to these bad results [9].

Early diagnosis of anomalies or unimproved hips is critical following the procedure to minimize the long-term negative effects of a closed reduction and surgical surgery [11]. The patient's age, sexual preference, side, degree of displacement, acetabular index (A.I.), Wiberg center-edge angle (C.E.), Reimer's index (R.I.), center-head massive disparity distance (CHDD), social orientation, and the use of adductor tenotomy can all influence the outcome of a closed reduction. Other factors to consider include: [9, 11-14]. The X-rays show that the reduction has been completed [6]. We conducted this study better to understand the long-term effects of early femur reduction surgery. The College approved the research of Medicine's Intuitional Review Board.

## MATERIALS AND METHODS

Individuals diagnosed with DDH and who had undergone closed closure under general anesthetic were examined in this study. All patients got hip adductor tenotomies during the hip spasm/cast. The effectiveness of the hip closure reduction was assessed with the use of an arthrogram and fluoroscopy. To keep my hip immobilized, I was forced to wear three different types of hip immobilization devices for an average of 12 weeks each at a time. Open-reduction hips were also excluded from the study, as were those with neuromuscular issues, teratological dislocations, or inadequate follow-up radiographs because of their inability to be reduced. The King Saud University medical college's institutional ethics committee approved the project's ethics.

The individuals ranged in age from 0 to 11 months, with a median of 4.92 months (with a standard deviation of 2.49 months). After an average of 5.97 years of follow-up (plus or minus 3.01 years). There were two categories of patients based on their age at their reduction: the young and the old. Infants between the ages of 1 and 6 months were included in the first group, while children between the ages of 7 and 12 months were part of the second group. IHDI displacement was chosen over Tönnis displacement because it is more widely applicable and can be used even when an ossification center is not present. The IHDI displacement classification technique is more general in application than the Tönnis approach [15] because it lacks an ossification center. Dislocations of the hip are graded from 1 to 4 on the International Hip Dislocation Index Scale (IHDI Scale). Grades range from the least severe (Grade 1) to the most serious (Grade 4). Researchers categorize source reduction as either horizontally or vertically based on their observations. Measurements and records were made for each hip in parameters of Wiberg's middle angle, Reimer's index (R.I.), and concentration mismatch distance (CHDD). Smith multiplied Perkin's line by Smith's c/b ratio to arrive at the given equations: [13].

This study documented and classified post-reduction avascular necrosis (AVN). The hip groups were also grouped according to their A.I. (acetabular index) [11].

SPSS Inc. of Chicago, Illinois, developed the data entry and analysis software. First, we used the chi-square test to examine categorical data. Then we looked at the rectified residual t-tests and one-way variance analysis (ANOVA) before moving on to continuous data analysis. The significance level was set at 0.05 in all of the comments.

## RESULTS AND DISCUSSION

On average, when patients were 6.31 months old, they were reduced in size (range 0:12 to 2.74). The study, which examined the hips of 144 women and 24 men, included both sexes equally. A total of 168 hips were given IHDI displacement grades I, II, and III; a total of 12 of the 168 hips were given Grade IV IHDI displacement grades **(Table 1)** [15]. The acetabular index value was used to assess the health of the acetabulum. Before reduction, this was the highest possible acetabular index value, ranging from 38.56 degrees to 9.59 degrees (the standard deviation). Patient age determined pre-reduction acetabular index values for both groups: Group 1 had an average acetabular performance index of 38.58° (6.45°), while Group 2 had a value of 38.54° (8.75°). A statistically insignificant difference (p-value = 0.67) between the two groups may mean the results may be thrown out. A.I. scores did not differ statistically significantly between Group 1 and Group 2 (p = 0.74). It is vital to remember that there was no change in A.I. levels between men and women (p-value = 0.19).

**Table 1.** International Hip Dysplasia Institute displacement classification

| Grade | Description |
|---|---|
| **I** | the H-point is at or medial to the P-line. |
| **II** | the H-point is lateral to the P-line and at or medial to the D-line. |
| **III** | the H-point is lateral to the D-line and at or inferior to the H-line |
| **IV** | the H-point is superior to the H-line |

Based on the Smith's research, hip c/b ratios between 0.60 and 0.85 are associated with many health benefits [13]. Group 2's c/b ratios were 0.98 (-0.670) and 0.98 (-0.179) before the drop in Group 1. As a result, no considerable differences between the outcomes of the two groups existed. In this case, the p-value is 0.14. Following reductions, the c/b ratios in Group 1 and Group 2 were, on average, 0.76 (0.05) and 0.74 (0.05), respectively. (10%) (0.22). Comparing the c/b ratios (p-value = 0.274) revealed a statistically significant difference. Group 1 had a mean of 37.97 degrees (8.71 degrees) in the CE-angle, while Group 2 had 38.90 degrees (7.71 degrees) in the CE-angle. When comparing the two groups after the C.E. angle was reduced, there was no significant difference (p-value = 0.65) between the two groups. Gender did not seem to affect the c/b ratio (p-value: 0.175) or the angle of the C.E., which were both found not to be affected by gender.

The radiographs were assessed using the adapted Severin categories **(Table 2)**, initially developed by the renowned surgeon Dr. Severin and are now used in the modern surgical community [11]. This study looked at the Ia (143), II (14), III, IVa (eight), and VIa (ten) hip groups (0.6 percent). The chi-square test revealed no considerbale significant difference between Severin's groups 1 and 2 (p-value = 0.540). Group 1 had 81 hips, Group II had 9, whereas Group 2 had 61 hips and Group II had only one. The direction of the source's decline was demonstrated to be significantly associated with Severin categories in the chi-square test (p-value = 0.0001). Possibly their horizontal orientation influenced Severin's classification of some sources as belonging to Group Ia. Reimer's index percentages of 0.121 and 0.124 were statistically significant for hips in groups Ia and II.

**Table 2.** Relationship between station of the hip at reduction and anatomical results

| | **No. of Hips** | **Anatomical Results** | | | | |
|---|---|---|---|---|---|---|
| **Station** | | I | II | III | IV | VI |
| **(-1)** | 16 | 13 | 2 | 0 | 1 | 0 |
| **(0)** | 107 | 87 | 11 | 2 | 6 | 1 |
| **(+1)** | 42 | 40 | 1 | 0 | 1 | 0 |
| **(2)** | 2 | 2 | 0 | 0 | 0 | 0 |
| **AVN** | | | | | | |
| **No** | 157 | 87 | 3 | 2 | 1 | 0 |
| **Yes** | 11 | 2 | 4 | 0 | 4 | 1 |

AVN Avascular necrosis

The acetabular index was at 38.43°, or 11.27° on average, before it was reduced in cases where the results were good. According to Severin's classification, patients who did not perform as well as those who did had an acetabular index of 42.29° (6.27°). One-way ANOVA allowed us to establish the statistical significance of the differences between the two groups. More than 99.9% of hips were free of necrosis symptoms, whereas only eleven were impacted. At any age or gender, there were no significant differences in AVN between the sexes (p-values: 0.295 and 0.171, respectively). This means that the A.I. score for avascular necrosis did not affect the p-value.

We found an association between AVN and the IHDI displacement category (p-value = 0.038). One could conclude a statistically significant difference between AVN and Severin's anatomical classification (p-value = 0.0001). In most cases, AVN should be avoided rather than developed.

This study included infants with DDH under the age of one year. Several hips (83.3 percent) in this study had a favorable outcome with no signs of AVN, and because the results were tracked over time, most patients did not require additional surgeries. After Severin's **(Table 3)** examination, only 6.6% of the hips were deemed "unsatisfactory" [13].

**Table 3.** Modified Severin's Classification of hips [11]

| | **Radiographic appearance** | **Center edge angle** |
|---|---|---|
| **1a** | Within normal limits | C.E. angle >19°, age 6-13 years<br>C.E. angle >25°, ≥ 14 years |
| **1b** | Within normal limits | C.E. angle 15° - 19°, age 6-13 years<br>C.E. angle 20° - 25°, ≥ 14 years |
| **2** | Moderate distortion of the femoral head, however as group 1a or 1b | |

| | | |
|---|---|---|
| **3** | Dysplastic but without subluxation | C.E. angle <15°, age 6-13 years<br>C.E. angle <20°, ≥ 14 years |
| **4a** | Subluxation | Moderate, C.E. angle ≥ 0° |
| **4b** | | Sever, CE angle < 0° |
| **5** | Femoral head joints with a secondary acetabulum in the upper part of the original acetabulum | |
| **6** | Redislocation | |

Center-edge angle of Wiberg (C.E. angle)

A Smith c/b ratio was measured to confirm the anatomical relationship between the two procedures before and after each femur reduction. A considerable increase in the ratio's value was discovered (below 0.8) [13]. With the C.E. angel, one can see the femoral head about the acetabulum and the remarkable expansion of the acetabulum's roof after surgery.

Only 6% of patients had a poor outcome, including AVN, because all patients had an acetabular index value of 18.24 to 18.27 following the closure reduction **(Table 3)**. Class, I and Class II hips were considered good outcomes, whereas Class III and Class IV hips were deemed poor outcomes [8]. Risk variables for AVN, such as Tonnis classification and treatment-initiation age, have previously been established. In contrast, additional risk factors such as gender, laterality, treatment-initiation age, and adductor tenotomy have not previously been identified [8]. Patients with a positive diagnosis in Zhe Fu's study were found to have less than 33% of their spines bent in either a horizontal or oblique direction.

Reimer's more than 33% index indicates excessive hip subluxation [14] According to the study findings [14], there was a connection between low grades from Severin and hips measuring 26/30 with a high R.I. This study demonstrated a strong correlation between a high Severin's score and a low R.I. (I & II). According to the data, 8.3% to 47% of babies whose hips were lowered before twelve months had AVN [5-8, 11, 16]. In a recent study, 12 of the hips tested were found to have AVN (7.1 percent). However, AVN was not linked with age, gender, or AVN incidence in Brougham *et al.*'s, despite Mathew *et al.*'s [8, 16]. The incidence of AVN was also found to have no statistically significant correlation with either gender or age. Students who earned poor Severin grades were more likely to acquire AVN, according to Chango *et al*. [17]. This study demonstrated a substantial connection between AVN and Severin classification. 13.1 percent of hips in this study required a second procedure. The issue was present in 82% of the hips that were surgically repaired.

## CONCLUSION

in conclusion we noted that an AVN was a strong predictor of having more minor hip IHDI displacement classification. In 83.3 percent of the hips, there was no AVN and no need for additional DDH surgery, resulting in an excellent outcome. Children with DDH who did receive a protected closed reduction had fewer AVMs, growth problems, and needed open decreases in the future. Practical effects were observed to be substantially linked with the horizontal of the soil. The results are better when Reimer's index falls below a specific level. Hips with a positive outcome had a significantly lower mean A.I. than hips with a poor product.

*Guidelines*

An abductor pollicis tenotomy and a fluoroscopic hip arthrogram were used to guarantee that the closed reduction technique was completed correctly and accurately in patients under general anesthesia. This treatment takes 12 weeks to complete (12 weeks of abduction brace, six weeks of the hip brace, and 12 months of hip spica). Patients who have been on hip splints for an average of 7.5 months are listed below.

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**CONFLICT OF INTEREST :** None

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**ETHICS STATEMENT :** The King Saud University Medical College Ethical Approval was obtained for the study on February 14, 2018. Each patient's legal guardian signed off on the procedure after already being fully briefed.

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