

Study of acetabular index before and after salter innominate osteotomy

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ABSTRACT

Objective: To evaluate pre and post acetabular index in patients with Developmental Dysplasia of Hip whom underwent Salter innominate osteotomy.

Methodology: This cross sectional study was carried out on patients with CDH that underwent Salter innominate osteotomy. All cases with CDH admitted in Imam Khomeini and Razi Hospitals from November 2007 to August 2009 were included. Age, sex, number of involved limb, and affected side were recorded. Antero-posterior (AP) roentgenogram were done and acetabular index were calculated before and after surgery. Five months later after surgery, AP Roentgenogram were obtained from cases and acetabular index were calculated again. Before and after surgery acetabular index were compared for each cases. Dislocation of hip and avascular necrosis occurrence and grading were assessed for each case. Dislocation rate were assessed based on proposed criteria by author from 0 to 4. This criteria was based on percentage of head of femur, which was not covered by acetabulum. Our classification is as follows: Grade 0: No dislocation; grade I: 30% subluxation; grade II: 30-60% subluxation grade III: 60-90% subluxation; grade IV: Complete dislocation.

Results: During two year period of the study, fourteen CDH patients were operated. From these cases, four hips were excluded because the patients did not come for follow up. Pre operative acetabular index was 34.40 ± 1.22 and post operative acetabular index was 19.20 ± 1.22 . There was significant difference among pre- and post- acetabular index.

Conclusion: This study showed that there was significant difference among pre and post operative acetabular index. Our limitations in this study were low sample size and short duration of follow-up. Another prospective study with more sample and long duration is recommended.

KEY WORDS: Acetabulum, Hip joint, Salter innominate osteotomy, Developmental Dysplasia of Hip (DDH).

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INTRODUCTION

The term congenital dislocation of the hip dates back to the time of Hippocrates. This condition, also known as hip dysplasia or developmental dysplasia of the hip (DDH), has been diagnosed and treated for several hundred years. Developmental dysplasia of the hip is one of the most common orthopedic problems seen during childhood with reported incidences of 1 per 1000 to 3.4 per 100.^{1,2} Numerous surgical procedures for DDH have been described.³⁻⁵ Most surgeons are familiar with procedures described by Salter in 1961⁶ and by Pemberton in 1965. Most notably, Ortolani, an Italian

Table-I: Mean of Acetabular index among pre and post operative cases.

<i>Acetabular index</i>	<i>Mean</i>	<i>N</i>	<i>Std.Deviation</i>	<i>Std. Error Mean</i>
Pre operation	34.40	10	3.438	1.087
Post operation	19.20	10	3.882	1.227

pediatrician in the early 1900s, evaluated, diagnosed, and began treating hip dysplasia.

Galeazzi later reviewed more than 12,000 cases of DDH and reported the association between apparent shortening of the flexed femur and hip dislocation. In the neonatal period mean of acetabular index was 27.5, in the 6 months of life was 23.5 and at two year was 20 degree. Upper limit of acetabular index was 30 degree. Improvement of acetabular index following treatment of DDH is an indicator of treatment success.⁷ Since then, significant progress has been made in the evaluation and treatment of DDH.⁸⁻¹¹ The etiology of hip dysplasia is not clear, but this condition does appear to be related to a number of different factors.¹²

One such factor is racial background; among Native Americans and Laplanders, the prevalence of hip dysplasia is much higher (nearly 25-50 cases per 1000 persons) than other races, and the prevalence is very low among southern Chinese and black populations.¹³⁻¹⁵ An underlying genetic disposition also appears to exist in that a 10-fold increase in the frequency of hip dysplasia occurs in children whose parents had developmental dysplasia of the hip (DDH) compared with those whose parents did not.¹⁶ The aim of this study was to evaluate pre and post acetabular index in Developmental Dysplasia of Hip in patients who underwent Salter innominate osteotomy.

METHODOLOGY

This prospective study was carried out on patients with CDH that underwent Salter innominate osteotomy. All cases with CDH admitted in Imam Khomeini and Razi Hospitals from November 2007 to August 2009 were included. Imam Khomeini and

Razi Hospitals are two referral centers for orthopedic surgery. Age, sex, number of involved limb, and affected side were recorded. Antero-posterior (AP) roentgenogram were done and acetabular index were calculated before and after surgery. Five months later after surgery, AP Roentgenogram were obtained from cases and acetabular index were calculated again.

Before and after surgery acetabular index were compared for each cases. Dislocation of hip and avascular necrosis occurrence and grading were assessed for each cases. Dislocation rate were assessed based on proposed criteria by author from 0 to 4. This criteria was based on percentage of head of femur, which was not covered by acetabulum. This criteria was suggested because it is simple and easy to use. Our suggested criteria are as follows: grade 0: No dislocation; grade I: 30% subluxation; grade II: 30-60% subluxation; grade III: 60-90% subluxation; grade IV: complete dislocation.

RESULTS

In this study, eventually 10 hips were included. Minimum and maximum of age were 21 and 60 months respectively with Mean \pm SE equal to 37.70 \pm 11.29. Trendelenberg sign were positive in 3(30%) and negative in 7(70%) of cases. Avascular necrosis (grade II) were seen in 4(40%) of cases according to Bucholz and ogden classification. Four cases underwent femoral derotational osteotomy in addition to Salter innominate osteotomy. Three of these four cases developed avascular necrosis . One case of avascular necrosis developed in cases who underwent Salter innominate osteotomy alone (Fisher's exact test, X²=0.4, df=1, P=0.754). Hip movement was assessed post operatively. Hip movement was normal in 6(60%) of cases and in the four cases

Table-II: Paired Samples Test among pre and post operative acetabular index (P=0.000).

	<i>Mean</i>	<i>Std. Deviation</i>	<i>Std. Error</i>	<i>95% Confidence Interval of the Difference</i>		<i>T</i>	<i>dF</i>	<i>Sig. (2-tailed)</i>
				<i>Lower</i>	<i>Upper</i>			
Pre vs Post Operative AI	15.200	2.486	0.786	13.422	16.397	19.399	9	0.000

limited range of motion was seen. Dislocation after surgery was evaluated based on simplified criteria proposed by authors. Six patients had no dislocation. One patient had grade 2 dislocation and three cases had grade 4 (complete) dislocation.

All of dislocations were posterior type and two of them were associated with limited range of motion. In our cases, there are 2(20%) cases with 1cm difference between limb length postoperatively. There was 2cm difference among two limb in one (10%) cases. Four (40%) cases had no difference among two limb length. In 3(30%) cases with complete dislocation, difference in limbs length had no means. From 10 hips who underwent Salter innominate osteotomy, only 4 of them underwent associate femoral osteotomy. Two of cases underwent femoral osteotomy showed posterior dislocation. There is no significant difference between cases who underwent Salter+femoral osteotomy and Salter alone for posterior dislocation (Fisher's exact test, $\chi^2=1.6, df=1, P=0.344$). From our cases, two cases had internal rotation after surgery and the reminder had normal position. Pre- and post-operative acetabular index (Mean \pm SE) were shown in Table-I. As seen in Table-II, there is significance difference among pre- and post-operative acetabular index ($p=0.000$).

DISCUSSION

This study showed that there was significant difference among pre and post operative acetabular index. In our study pre and post operative acetabular index were 34.4 (Min=30, Max=40) and 19.2 (Min=13, Max=25) respectively. Difference between pre and post acetabular index was 15.2 (Min=10, Max=18). The results of this study were similar to other study.^{1,17} In the Eren A et al study, pre and post operative acetabular index were 37.5 and 19.9 respectively with 14.6 degree improvement.¹⁸

In the study done by Fritch EW et al on the 108 hips who underwent Salter innominate osteotomy, pre and post operative acetabular index was 34 and 18 respectively with 16 degree improvement.¹⁹ Avascular necrosis were seen in 40% of cases. Rate of avascular necrosis is higher than reported by Rajendra et al.²⁰ In our study, minimum and maximum time of follow up was 5.5 and 27 months respectively. In other study, this time was greater than our study. For example, Banskota et al, 9 years and 3 month.⁷ Short duration of follow up is one of our limitation compared to other studies.

However our study is the prospective. Another limitation in our study, is small sample size compared to other study, ex. Fritsch (n=108)¹⁹, Eren (n=114).¹⁸ In contrast to these studies, there is study with small sample size, ex. Banskota (n=22)⁷, Ito (n=35)¹⁷, Dutoit (n=19).²¹ Small sample size in our study may be due to good physical examination and frequent neonatal and child visit by pediatrician. These regular visits may increase the rate of successful conservative treatment and decrease the rate of surgery for CDH. In our study, there was 4 cases with posterior dislocation (Grade II=1, Grade IV=3). These cases who underwent Salter innominate osteotomy and femoral derotational shortening. To avoid this problem, pre operative inspection for posterior acetabular defect and intra-operative reassessment is mandatory. Another prospective study with greater sample size is recommended.

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