Short term results of Anterolateral approach for open reduction of neglected Developmental Dysplasia of Hip (DDH)

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ABSTRACT

Objective: To determine the short term functional and radiological results of open reduction of Developmental Dysplasia of Hip (DDH) through anterolateral approach.

Methods: This was a descriptive study conducted in Paediatric unit of Orthopaedic department, Khyber teaching hospital, Peshawar from January 2018 to December 2018.Children with DDH fulfilling the inclusion criteria were treated with open reduction via anterolateral approach. Post-operative clinical outcome was assessed with Mckay's criteria while radiographic outcome was assessed by measuring Acetabular index, neck shaft angle and restoration of Shenton line and concentric reduction.

Results: Total patients were 35(age more than 18 months).Male were 9(25.7%) while female were 26(74.3%). Mean age was 3.1 ± 1.71 years. Family history of DDH was positive in 06 cases (17.1%). According to Mckay's criteria 20(57.1%) patients had excellent functional outcome, 8(22.8%) had good, 2(5.7%) fair and 5(14.2%) patients had poor results. Mean Pre-operative Acetabular index (AI) was improved from 35.7^0 ± 5.83^0 to post-operative 22.5^0 ± 5.6^0. Concentric reduction were found in 34(97.1%) patients and subluxation in one (2.8%) patient. About 6(17.1%) patients had femoral head avascular necrosis (AVN). Mean follow up period was 18 months.

Conclusion: Anterolateral approach of hip for open reduction is an excellent approach as it gives better functional and radiological outcome in neglected Developmental Dysplasia of Hip (DDH).

Key words: Anterolateral Approach for DDH, Developmental Dysplasia of Hip (DDH), Neglected DDH**,** Open Reduction of DDH.

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INTRODUCTION

The term Developmental Dysplasia of Hip(DDH) consists of variable set of paediatric hip abnormalities affecting the growth and congruity of hip joint during the period of its critical growth.[1] The DDH is a very common condition with a frequency of 0.5% to 30% in all new born babies.[2,3] The early diagnosis of DDH make its treatment very easy and with less complications.[4,5] Treating an older DDH child is not only complex but extremely difficult.[6-8] Relocation of the femoral head into the acetabulum is achieved surgically when closed reduction fails but the aim should be to achieve a stable mobile hip without ischemic necrosis of the femoral head.[9-11]

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The medial approach requires minimal dissection and the obstructions to reductions are encountered directly but the disadvantages of medial approach are a limited view of the hip, the possible interruption of vessels and the inability to perform a capsulorrhaphy.[12-14]

The Anterolateral surgical approach(Smith-Petersen-modified) is the approach of choice to treat DDH in children older than 18 months because through this approach both capsulorrhaphy and pelvic osteotomy is done and post op spica is applied for a short period.[15] The medial approach leads to a higher rate of osteonecrosis after the walking age. Therefore, it is not recommended in children older than 12-18 months.[16-18]

There are many cases of neglected dysplastic hip joint presenting late due to a variety of reasons the important being lack of screening program, non-availability of the expertise, ignorance, illiteracy and financial constraints. The indications, time of surgery, surgical approach, single stage versus multiple stage and

secondary surgeries in neglected DDH is still a subject of debate.[19-24]

The objective of our study was to assess the outcome of anterolateral approach of neglected DDH clinically & radiologically.

METHODS

The design of our study was descriptive and was conducted in the paediatric Orthopaedic unit of Khyber Teaching Hospital, Peshawar from January to December 2018.The study was approved by the institutional review of the hospital. The informed consent for surgery and research publication was obtained from parents or guardian. A total of 35 cases of neglected DDH presented after the age of 18 months were included. Previously treated patients with close reduction or surgically with medial approach were not included in our study. All the patients were admitted from OPD and had thorough history, clinical examination, plain radiograph and hematological investigations. Pre operative acetabular index was noted in all the patients and the severity of DDH was graded through Tonnis grading system.

SURGICAL TECHNIQUE

All the patients had anterolateral "Smith-Petersen approach" through Bikini skin incision. The lateral femoral cutaneous nerve was identified for protection as a first step in dissection near anterior superior iliac spine. The iliac crest was exposed subperiosteally with a periosteum elevator after splitting the apophysis with scalpel. After this, the rectus femoris (straight head) identified which is attached to anterior Inferior Iliac spine and tagged with a stay suture and lifted from its origin and underlying capsule. Next the tendinous part of the iliopsoas tendon was identified by searching it in the deeper part of the muscle and sectioned. The hip capsule was exposed laterally from the abductors and medially from iliopsoas muscle by blunt dissection with the help of periosteum elevator and sterile gauze. The hip joint capsule was opened by giving T shaped incision. The ligamentum teres was then identified and cut next to the femoral head. Medially it was traced to the real acetabular cavity and cut. Any pulvinar inside was then removed. The transverse acetabular ligamentum was incised to open up the acetabulum to accommodate femoral head. After reduction of femoral head, the labrum was checked that it was not folded into acetabulum preventing concentric reduction. Capsulorraphy was performed. The rectus femoris (straight head) was sutured back near its origin. If needed, pelvic osteotomy was performed through same incision while using a separate longitudinal incision for femoral osteotomy. Pelvic osteotomy was performed if acetabular index was more than 35 degrees while Femoral osteotomy was performed if the dislocation is too high and de rotation of the distal femoral fragment was done. The osteotomy was fixed with 4-5 holes dynamic compression plate. The wounds were closed subsequently and covered with sterile gauzes.

Immediately after the surgery, hip spica was applied for 6 weeks. Radiographs were used on next day and subsequently in follow ups. After 6-8 weeks, the hip spica cast, suture materials and k-wires were removed and wounds assessed. A petrie type cast consisting of long cylinder casts connected by a bar maintaining abduction of hips in 45^{o} and internal rotation of 15^{o} applied for a 6 weeks. On the removal of cylinder casts, home based physiotherapy was started after educating the parents and abduction orthosis had to be used at night time for a period of 2 months. The reduction of hip was checked at 1 month by CT scan, looking for the intact anterior Shenton line and subsequently the reduction and development of joints was monitored with monthly radiographs for initial three months after the removal of hip spica and every third months for one year thereafter. After one year, twice a year follow up radiographs were obtained. Growth assessment of the femoral head was done by measuring the diameter of epiphysis on anterioposterior x ray was expressed in percentage and compared with the normal opposite side. Post operatively Shenton line and neck shaft angle were evaluated with radiographs and avascular necrosis of the femoral head was graded radiographically with the Kalamchi and MacEwen's classification.

Data was stored on a digital MS Excel chart. All analyses were made using SPSS for windows version 17. Descriptive statistics and frequency distributions were calculated. The success rate of open reduction through anterolateral approach was presented as percentage. Data presented in tabulated form where necessary.

RESULTS

Our study included a total of 35 children with mean age of 3.1 ± 1.71 years. The ratio of male female in our study was 1:2.9. Family history of DDH was present in 6(17.1%) patients. About 15(42.8%) patients had right DDH while left side was involved in 20(57.2%). Mean follow up was 25.7 ± 6.76 months with minimum of 18 months and maximum 42 months. Open reduction and femoral

varus osteotomy were performed in majority (60%,n=21) of our patients.(table I) Among the 10 patients of pelvic osteotomies, Pemberton osteotomy were performed in 5(50%) hips and salter innominate osteotomy in 5(50%) hips. Follow up CT scan at one month showed concentric reduction in 34(97.1%) hips with subluxation in only 1(2.8%) case on follow up anterioposterior (AP) radiographs. Pre-operative Tonnis grade was grade III in most (60%,n=21) of patients as shown in table II . According to the Kalamchi and MacEwen's classification (table III) 6(17.1%) of our patients had avascular necrosis. About 2(5.7%) patients had shortening and Trendelenburg gait in 6(17.1%) patients. Follow up Shenton line was broken in 2(5.7%) out of 35 hips. Mean Pre-operative Acetabular index (AI) was $35.7^0 \pm 5.83^0$ and mean post-operative AI was $22.5^0 \pm 5.6^0$. Mean post-operative neck shaft angle was $123.1^0 \pm 7.85^0$. Functional outcome was graded according to Mckay's criteria (table IV) as excellent in 20(57.1%) patients, good outcome in 8(22.9%), fair outcome in 2(5.7%) and poor outcome in 5(14.3%) patients.

Table I: Type of Procedure

	Frequency	Percent (%)
Open Reduction(OR)	4	11.4
Open Reduction (OR) plus Femoral Varus Osteotomy.	21	60.0
Open Reduction(OR) plus Pelvic Osteotomy	1	2.9
Open Reduction(OR) plus Femoral Varus Osteotomyh plus Pelvic Osteotomy	9	25.7
Total	35	100.0

Table II: Pre Op Tonnis Grading

Grade	Frequency	Percent
I	0	0
II	5	14.3
III	21	60.0
IV	9	25.7
Total	35	100.0

Table III: Kalamchi and MacEwen's Classification of AVN In DDH

Grade	**Description**
I	Ossific Nucleus has detectible changes
II	Damage to the lateral portion of Physis
III	Damage to the central portion of physis
IV	Both the head as well as the physis is damaged

Table IV: The clinical evaluation of DDH through Mckay 's Criteria

Grade	**Description**
Excellent outcome	The hip is stable with normal range of motion and without any pain: Trendelenburg sign is negative.
Good	The hip is stable and no pain but limping is there and decrease mobility:
Fair	The hip is stable having no pain but limping and : limp, positive Trendelengburg's sign is positive and decrease range of hip motion
Poor	The hip is unstable, painful or both and with a positive Trendelenburg's sign

DISCUSSION

There are many surgical options to treat neglected DDH but consensus has not yet been achieved regarding the ideal treatment so far.[1,25,26] Based upon the results of our study we would suggest this one stage antero lateral approach for neglected DDH is a reasonable treatment option to treat all such cases.

Castillo and Sherman[27] in 13 unilateral hip dysplasia, with follow up of 7 years reported improvement of acetabular indices continually over the

course of time. These indices approached those of controls in a graded manner. In our study, we also noted the same findings as acetabular index (AI) was improved from a mean pre-operative value of $35.7^0 \pm 8.53^0$ to a mean post operative value of $22.5^0 \pm 5.6^0$.

Subluxation, redislocation and AVN are commonly observed complications. Roose[28] in 26 hips of 23 patients reported no cases of AVN while redislocation were observed in 6 cases. Kalamchi & associates[10] in a long-term follow-up study (4.5 years) reported AVN in 67%. Kalamchi and MacEwen[29] have concluded that AVN eventually need to secondary surgeries in a large number of patients. Bulut[30] has reported AVN in 11.7% which was significantly associated with the anterior approach as compared to those operated by medial approach ($P = 0.034$)

In another prospective study by Koizumi *& co-workers*[9], 35 hips were operated in a total of 33 children having an average age of 14 months and with a 19.4 years follow up period. A very high (43%) rate of avascular necrosis was reported by them primarily related to transect the iliopsoas tendon as well as to the maintenance of spica cast at 90°-90° for 1 month. Other authors believe that aggressive manipulation of the hip while reducing it & wrong positions of the casts promote AVN which can be easily avoided.

In our study, we found excellent outcome in 20(57.1%) patients, good outcome in 8(22.9%), fair outcome in 2(5.7%) and poor outcome in only 5(14.3%) hips according to Mckay's criteria. Our results are comparable with results of studies by Bulut [30] and Bhatti.[31]

We had post op subluxation in one case (2.9%) and AVN in 6(17.1%) hips. Although we did perform adductor and iliopsoas tenotomies and effective capsular plication in all patients but we attributed this to holding the hip in extreme position of abduction in our earlier cases during casting which we avoided later on.

The limitations of our study is a small sample size and short follow up period. It would be more appropriate if larger sample size studies with longer follow up are conducted so that our results are confirmed.

CONCLUSION

Anterolateral approach of hip for open reduction is an excellent approach as it gives better functional and radiological outcome in neglected Developmental Dysplasia of Hip(DDH).

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Conflict of interests: None

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Authorship and Contribution Declaration

Muhammad Salman, conception and design of the study, acquisition of data,
Sikandar Hayat, interpreted the data, final approval of the version for publication
Muhammad Saqib, Revised the manuscript for important intellectual content
Gulzada, Drafted the manuscript