Original Article

Developmental Dysplasia of Hip

Management of Developmental Dysplasia of Hip in Older Children by Triple Procedure

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ABSTRACT

Objective: To review the presentation and evaluate the radiographic and functional outcome of developmental dysplasia of hip (DDH) in older children treated by triple procedure surgery, consisted of open reduction, Salter Innominate Osteotomy (SIO), femoral shortening and derotation Osteotomy.

Study Design: Observational / descriptive study.

Place and Duration of Study: This study was conducted at the BMC Hospital Quetta from January 2013 to December 2015.

Materials and Methods: We assess the efficacy and safety of underwent triple procedure treatment of DDH in older children. The study series comprising 22 patients (25 hips).Patients were classified pre-operatively according to the Tonnis Classification, and post-operative functional evaluation was performed using modified Mackay's scoring system, while radiographic assessment considered Severin scoring method.

Results: The average age at presentation was 5.60 years and the male to female ratio was 2:46 months. While the average follow-up were 16.4 months. The final outcome was successful in 19 hips (76%) in 16 patients. Patients younger than 5-6 years of age had a better radiological and clinical outcome as compared to older children. Although in the outcome of clinical and radiological assessment there were no significant different between group-I and group-II.

Conclusions: Late presentation of DDH is still common in Quetta, Balochistan, which necessitates Triple procedure operative management given frequent occurrences of best result in younger children. Early diagnosis and surgical interventions is therefore imperative in the successful treatment of patients suffering from DDH.

Key Words: Developmental Dysplasia of Hip, (DDH), open reduction, pelvic osteotomy, older children

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INTRODUCTION

The developmental Dysplasia of hip is relatively unusual in the developed world due to their well-functioning neonatal screening procedures[3]. However it is not uncommon to see an older child who has neglected and untreated DDH in our society as well as clinical practice. The Tertiary level Care and proper screening programmes are lacking in many parts of province and along the adjoining war-torn country of Afghanistan. Most of the patients from these areas are older children whose parents spend a lot of time and effort in gathering necessary resources to travel to any big hospital.

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The management of DDH varies with the age of patients. But principles of management of dislocated hip joint for an older child are quite different from that of a neonate. Whenever the patient enters walking age and beyond, treatment becomes problematic and controversial. This is because contractures of the capsule and musculotendinous structure surrounding the hip joint prevent reduction of the femoral head into the acetabulam, and may produce pressure on the femoral and head during or after reduction leading to Ischaemia. Those left untreated dysplastic changes lead to osteoarthritis in early adulthood. Many authors have reported success with a single surgical procedure consisting of open reduction, capsulorraphy, femoral shortening and pelvic osteotomy. The aim of study to evaluate the radiographic and functional achievement of triple procedure of open reduction, femoral shortening and Salter Innominate Osteotomy in 22 patient (25 hips) with delayed diagnosis of DDH who were managed at BMC Hospital Quetta.

MATERIALS AND METHODS

The study was carried out on Series of 25 Cases who underwent triple surgical procedure management for

DDH in older children between January 2013 and December 2015. The patient who were initially improper treated in another hospital also included. The study designed was retrospectively reviewed a total of 22 patient (25 hips) patients 13 (59%) were male 9 patients (40%) were female. 3 (13%) patients were bilateral dislocation.

The patients were distributed in to two groups according to the age at which they were operated: Group-I included 11 (44%) patients with aged between 4 years and 5 years, and group II, 14(56%) patients with aged between 5 years and 6 years.

The triple operative procedure consisted of open reduction Salter Innominate Osteotomy (SIO), femoral shortening and derotation osteotomy.

Clinical data assessment regarding pain symptoms, gait pattern (limping), range of hip joint motion, Limb Length Discrepancy (LLD) and status of Trendelenburg sign were recorded for each patient pre-operatively and on the latest follow-up using the modified McKay's Criteria. While the Tonnis classification system was used to assess the degree of dislocation of the femoral head. Radiographic evaluation included examination of pre-operative and follow-up plain radiographs to classify patients according to the Severin's grading system.

Avascular necrosis was assessed using the criteria of Kalamchi and Mac Even[9] and ace tabular index (AI13) and center-edge angle (CEA 17) based on most recent radiological system.

Surgical Technique: Patients were placed in supine position. The whole limb was included in the surgical field. The one stage triple procedure consisted of open reduction, Salter innominate osteotomy, femoral derotation, and shortening osteotomy. One of them was Smith-Peterson incision and the other was a lateral proximal femoral incision. We performed the soft tissue procedure according to the technique described by Salter in his first report[13]. Extending from the inferior to the posterosuperior aspect of the acetabulum, the capsule was incised in a T-shape, and a transverse incision along the femoral neck. He transverse acetabular ligament was divided. The anterior part of the capsule down to the femoral neck was excised togher with the hypertrophied ligamentum teres. The psoas tendon was detached near its incsertion. Pelvic osteotomy, psoas tendon was detached near its insertion. Pelvic osteotomy, psoas tendon release, femoral derotation, and shortening osteotomy were performed. In order to achieve a force-free reduction, femoral osteotomy was performed at the level of the subtrochanteric femur and the femur was shortened by 1 cm to 2 cm. in association with the shortening, the derotation of the femur was performed. The amount of correction of derotation or femoral shortening was decided intraoperatively under direct visualization. Varus position was not added to decrease the neck shaft angle. None of the femoral heads were fixed to the acetabulum by a Kirschner wire for maintenance of reduction.

Post-operatively, the hips were immobilized in a 1 ½ his spica for 6-8 weeks. This was changed to an abduction splint for a further 4 weeks during which time the hips were mobilized progressively under the guidance of a physiotherapist. Progressive walking and gradual range of motion exercises were advised. Krichner wires were removed after consolidation of the osteotomy site. Patients with bilateral dysplasia had the procedures on both hips at a mean interval of 5.3 months (range 5 to 8 months).

RESULTS

There were a total of 22 patients and a total of 25 hips reconstruct, 13 (52%) patients were female. The mean age of the patients at the time of operation was 6.84$\pm$ 4.5 years, the mean follow up was 29.6$\pm$10 months. According to the modified Mckay Criteria, functional results were excellent at last follow up in 15 hips 60% good in 6 hips (24%) fair in 2 hips (8.0%) and poor in ships (8.0%).

In Group-I clinical results were excellent in 11 hips (44%) and good in 4 hips (16%) in Group-II clinical results were excellent in 6 (24%) good in 4 hips (16%). However in group I and II yielded satisfactory results clinically, there was no significant difference between Group-I and Group-II according to Mckay's clinical criteria at final follow-up (P>0.06).

Radiological results were excellent in 14 hips (56%), good in 7 hips (28%) fair in 3 (12%) poor in 1 (4%).

AVN was detected in 2 cases (8%) during follow-up in Group-I, no AVN was detected, in Group-II AVN detected in two hips (8%), one of them had grade-I and one Grade-II. No patient with AVN had subsequent surgery. Limb length discrepancy of less than 1.5cm was found in 3 cases, without need for further surgical intervention till the last follow up.

There was no significant difference between group-I and group-II according to the evaluation Scheme of Trevor et al[16] at final follow up (P>0.05).

There were no other complications such as infection or graft displacement.

At the end of the study there were 17 hips (68%) in excellent condition, 5 hips (20%) in good conditions, and 3 hips (12%) in poor condition.

Table No.1: Clinical assessment results

Grade	Group-1 11 hips	Group-II 14 Hips	Total 25 hips	%
Excellent	7	9	16	64%
Good	2	3	5	20%
Fair	1	2	3	12%
Poor	1	0	1	4%

Table No.2: Radiological assessment results

Grade	Group-1 16 hips	Group-II 9 Hips	Total 25 hips	%
Excellent	9	5	14	56%
Good	5	2	7	28%
Fair	2	1	3	12%
Poor	0	1	1	4%

Table No.3: AVN Results

Grade	AVN Cases		Incidence of AVN (%)
	Grade – I	Grade – II	
Group-I(16 hips)	0	0	0%
Group-II (9 hips)	1	1	22.3%

DISCUSSION

The aim of treatment of DDH in older children is to obtain concentric and stable reduction without complications such as AVN[5]. Reduction must be obtained, redislocation must be prevented, and optimum relationship between acetabulam and femoral head must be protected[1]. If concentric reduction is obtained, acetabular dysplasia can improve in time[5].

The triple procedure surgery has advantages that include reducing the risk of AVN of the femoral head while correcting associated femoral and acetabular deformities. The Saltar Osteotomy provides anterolateral coverage of femoral head that allows the acetabulam to develop and the hip joint to stabilize. The best-time to perform an osteotomy of the acetabulam for DDH is older children is however still a concern[11,12]. Several authors suggested a triple procedure consisting of open reduction, pelvic osteotomy and femoral osteotomy[1,2,7,10,11], particularly in children older than three years of age[4]. Ganger R, Radler et al[5] reported a series of 33 DDH in patients older than two years of age who were treated with a one-stage open reduction, femoral shortening, and pelvic ostestomy. The found satisfactory results clinically in 85% of hips and radiographically in 75%. Salter and Dubos[13] showed 93.6% good to excellent results in children younger age group. Karakas et al[7] operated on 47 patients (55 hips) who were 4 years and more with 67% good or excellent clinical results and 65% good or excellent radiological results.

Saleh et al demonstrated that the acetabulum remodels quickly after the Salter innominate osteotomy in a range of age groups. The lower limit of surgical timing is still under debate.

The advantages of immediate acetabular alignment include the probability that stability will be enhanced if a careful capsulorrhaphy is carried out after the open reduction, and that later surgery will be avoided.

Ehan Ahmed et al[3] reported that open reduction combined with Salter osteotomy does no impede the acetabular remodeling of the hip in older children.

AVN is the most important complication seen during treatment of DDH, Particularly in a higher grade of dislocation combined with an inverted limbus, hypertrophic soft tissue in the acetabulum and older age of the patient at treatment onset, AVN of the femoral head is more often occur[6] Kalamachietal reported a rate of AVN of 9.0%, El-Sayed[6] reported 4.2%.

Some studies show that femoral shortening can facilitate reduction and reduce the risk of AVN[8,9].

Demirhan et al[2] operated 33 hips in 24 patients. AVN was observed in 10 patients (30%) and 4 (12%) cases underwent secondary interventions. They found a significantly lower incidence of AVN in patients whose treatment was started by Triple procedure treated at a relatively older age. Ehan et al[3] reported that in patients with DDH who underwent an operation in older children, the risk of developing AVN was relatively low. In our study, AVN was detected in 2 cases.

Our study support that complications are limited and could be avoided if care is given to the technical details. This entails a generous clear exposure of the hip and upper femur. Performing adequate femoral shortening, with correctly estimated derotation allowing the femoral head to be easily reduced into the wel-reconstructed acetabulum, preventing undue pressure exerted over the head.

The authors found no method to determine the specific reason for the fact that clinical results were statistically different between the age groups, but that the radiological findings showed no significant difference.

The mean period of follow up in this study ranged from 3-6.8 years, which is not a long enough period for evolving osteoarthritic changes to show up in young patients. Prospective randomized controlled trials with larger sample sizes are needed to support our findings.

Our clinical results were not as good as those noted by other authors, especially the variation in the clinical outcome in older children.

There was a significant difference between the group less than 4 years and the group older than 4 years of age according to the evaluation scheme of Trevor at final follow-up.

Therefore, we believe that a one stage Triple procedure reduction, femoral shortening, capsulorrhaphy, and pelvic osteotomy corrects associated femoral and acetabular deformities is convenient and effective in children older. This operation improves the cover of the femoral head and provide stability in the weight-bearing position. This procedure can be done safety, with reliable results and without an increase in the risk of avascular necrosis.

CONCLUSION

Late presentation of DDH is still common in developing countries. This problem necessitates more complicated management and a larger economic burden on the community. So in our experience in BMCH Quetta we recommend the triple procedure surgery, a combination of open reduction with femoral pelvic

osteotomy for treatment of DDH in older children gives good results and the qualitative merits of this methods with become evident with its more application in future. The triple procedure methods for DDH in older children have undergone historical evolution remaining the treatment of choice worldwide.

Conflict of Interest: The study has no conflict of interest to declare by any author.

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