Comparative Study between One or Two Stage Bilateral Open Reduction and Bony Procedures for Neglected Developmental Dysplasia of the Hips

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Abstract:

Objectives: This study aimed at evaluating the surgical management of bilateral developmental dysplasia of the hip (DDH), reducing both sides of the hips in one or two different stages.

Patients and Methods: A retrospective sequential comparative study on children with bilateral DDH was carried out in the Azadi Teaching hospital of Kirkuk, in between October 2009 and June 2013. There were two groups of patients. The first group consisted of 10 children (20 hips), with a mean age of 26 months (12-36 months), treated by open reduction of the DDH performing the procedure on each hip at two different occasions. The second group of 13 children with bilateral DDH had a mean age of 26 months (12-48) months, were treated in a single-stage; openely reducing both hips in the same operative session. In the first group in addition to the open reduction of the hips, 8 patients required Salter osteotomy, and 3 patients required femoral shortening in order to achieve concentric stable reduction. In the second group, shortening of four femori, Salter osteotomy of 12 acetabulae was performed for the same purposes.

At a mean follow-up of 28 months, clinical and radiological assessment was carried out. Modified McKee and Severin criteria was used, the assessment also included analysis of the operative time, the amount of blood loss and transfusion, duration of analgesia, and record of the complications.

Results: There were no significant differences between those who underwent open reduction of the hips with respect to mean age, gender, pre- and postoperative acetabular indices. Mean duration of anaesthesia, analgesia, and the amount of blood transfusion was more in patients of group two compared to group one. Rehabilitation and physiotherapy was needed more in group one. Mean improvement of the acetabular index was 10 degrees in both groups.

Conclusion: Single-stage bilateral open reduction of DDH with or without bony surgery in patients with bilateral DDH is safe.

Key words: DDH, Osteotomy, Shortening, Bilateral, One stage, Outcome

Introduction:

Developmental dysplasia of the hip can be bilateral in a third of cases. The surgical treatment of this condition often involves open reduction of the joint after the first 12-18 months of life. Containing the hip in neglected DDH, involves soft tissue and bony surgery. Additional operative bony containment procedures may become necessary. The operative intervention requires skills and expertise, it is also time consuming especially if bony containement deem to be necessary. Anecdotally, open reduction of bilateral hip replacement is performed in one stage [(1)]. Recent literature however has challenged this approach [(2, 3, 4, 5, 6, 7, 8, 9, 10)]. In the current study, the outcome using bilateral one stage to two stage surgery for DDH has been compaired.

Material and Methods:

Between October 2009 and June 2013, 23 children (46 hips) suffering from bilateral DDH, were surgically reduced in the Azadi Teaching Hospital of Kirkuk, in Iraq. Patients with cerebral palsy, arthrogryposis and other neuromuscular disorders were excluded from the study. All these children were walking on presentation, the reasons for specialist referral was done because of having waddling gait, limp, increased skin folds of the thighs, and limited hip abduction of the hips. The radiographs of the pelvis confirmed dislocation of the hips. Pelvic radiographs were analyzed using Tonnis classification [(1)]. The operations in both groups were performed by the same surgeon. No routine preoperative traction of the hips was used in these patients.

All these patients underwent open reduction of the hip through Bikini anterior ilioingunal incision, obstructing elements were excised or released and capsullorraphy was carried out. Adductor tenotomy was carried out in all these patients, through a medial small transverse incision. When necessary, additional bony procedures were used to contain the hip and stabilize it. The femoral osteotomy performed through a separate incision, using transverse femoral cuts. Plate and screws were used for fixation. Salter osteotomy was used when the hip felt unstable after reduction; dislocates with hip in 30 degrees of abduction. There were two groups of children with bilateral DDH, in the first group; sequential surgery was performed for each side with a mean interval of 6 months between each stage. In the second group, one stage bilateral open reduction of DDH was performed. The first group included ten children (eight females and two males), with a mean age, was 26 months (12-36). There was 10 Tonnis grade IV, 7 Tonnis grade III, and 3 Tonnis grade II. In addition to open reduction of the hips, three cases required femoral shortening and internal fixation, and eight hips required Salter osteotomy.

The second group included thirteen patients (12 females and one male) with bilateral dysplasia of the hips (26 hips); these children were treated by open reduction of DDH on both sides in one session. Mean age was 26 months (range 12-48). Eight children had Tonnis class IV, one had class II, and the remaining had class III.

Shortening of the femur was used in two children (4 femori); Salter osteotomy was used for 7 patients (12 hips), in the bilateral group. Eight patients within the unilateral group required Salter osteotomy, shortening of the femur was necessary in 3 cases.

Operative time and intraoperative blood loss was recorded. All these patients routinely received a unit (20 ml/Kg) of cross matched blood to compensate for the lost and anticipated loss of blood. Duration of anesthesia, blood loss was estimated counting blood loss in suckers and the gauze swabs. Following surgery, all the patients were put in hip spica for a total period of 3 months. It is our practice to use hip abduction splint for two months after removal of hip splica (a month continously, and a months during the night only).

Results:

The medical notes and radiographs were analyzed in all these patients. Mean period of follow-up was 28 months (14-50 months). The medical notes and radiographs of these patients were

reviewed (figure 1). The patients were followed up in the clinic, one week, three months, six months, and on yearly basis afterwards.

The results were assessed using modified McKee criteria for analysis of outcome [5], (table 1); where the hip reduction is assessed on the radiographs together with clinical outcome. Modifed McKee criteria are as follows:

I. (Excellent) Painless, stable hip, no limp, >= 15˚ of internal rotation, negative Trendelenburg sign

II. (Good) Painless, stable hip, slight limp; slight decrease in hip motion, negative Trendelenburg sign

III. (Fair) Minimum pain, moderate stiffness, positive Trendelenburg sign

IV. (Poor) Significant pain, stiff, positive Trendelenburg sign

The assessment also included operative time, amount of blood loss and transfusion, analgesia, and complications.

Mean postoperative Hemoglobin count was 10.1g/dl (9.6-12g/dl) for group 2, and 11g/dl (8.5-12.5 g/dl) for group 1. Mean intraoperative blood loss was 200 cc (100-500 cc) for bilateral and 110cc (50-150cc) for unilateral group. Mean duration of surgery was 2 hours (1.5-3 hrs) in group 2, and 55 minutes (45-90min) for group 1.

Parents of children were asked about duration of painkillers they had to use for their children. In the 2nd group the need for postoperative analgesia was longer than the first group; the requirement was for a mean period of 4 weeks following surgery (3-5 weeks), while analgesia was required mainly in the first week (1-2 weeks), for the first group. The requirement of analgesia was longer for the 2nd group. Stiffness of the hips was more frequent in the first group; mean period for the rehabilitation was longer for the one stage group (3-9 months) compared to rehabilitation of the hip in staged operation (3-12 months).

Using Severin criteria, after a mean follow up, the results for group one patients (the two stage operation) was excellent in one, poor in one with re-dislocation, fair for a child who developed avascular necrosis of the head (AVN), and good in the remaining (table 1). In group two (one staged operation), the outcome was fair in one case who developed AVN, excellent in one and good in the remaining (table 2).

Modified Severin classification is as follows:

IA Excellent; CE angle > 19˚, age 6 to 13 years; CE angle > 25˚, age > 14 years

IB Good: CE angle 15˚ to 19˚, age 6 to 13 years; CE angle 20˚ to 25˚, age > 14 years.

II Moderate deformity of femoral head, femoral neck or acetabulum but otherwise same as grade I

III Fair, Dysplastic hip, no subluxation; CE angle < 20˚, age > 14 years

IV Poor, Subluxation

V dislocation

Radiological assessment included, plain radiograph of the pelvis, checking the reduction of the hip, any complications and the net improvement of the acetabular index. Mean improvement in the acetabular index for patients undergoing Salter osteotomy, was 10 degrees (8-20 degrees). Preoperative range was 30-45 degrees. There was inadequate improvement of the acteabular index in two of the unilateral group. This may have been because of the learning curve.

Complications:

Group 1 (staged group):

1. One hip was stiff (after six months of surgery), this improved with time.
2. One Salter and femoral shortening failed to contain the head. The Salter osteotomy was redone. The acetabular coverage improved, however, the result remained fair.
3. The Salter osteotomy in one patient extended to the iliac blade, this however eventually healed well without sequel.
4. One failure of reduction, was planned to revise, patient failed to attend and lost follow up.

Group 2 (Bilateral one stage group):

1. Inadequate fixation of the plate in one case required further surgery for augmentation of the plate fixation with more screws. The hip remained secure and the outcome was good.
2. One patient required delayed Salter osteotomy as the hip slipped out on the radiograph taken 6 weeks after surgery.
3. One patient developed avascular necrosis of the left hip, following open reduction and Salter osteotomy, this patient was 42 months old on presentation. The patient maintains good range of hip movement and is under surveillance.

Table (1): Demographics, procedures and outcome of patients with DDH performed in two stages on 10 patients (20 hips).

Sex	Age Months	Tonnis	Additional procedures	Mckee criteria	Complications
F	36	IV	Rt femoral Shortening	Good	AVN
F	36	III	Left Salter osteotomy	Good	
F	25	IV		Good	
F	25	IV	Rt Salter osteotomy	Excellent	
F	24	IV	Rt Salter osteotomy	Good	Osteotomy migrated to the iliac blade, healed up.
F	24	IV		Good	
F	26	III	Left Salter osteotomy	Good	
F	26	III	Right Salter osteotomy	poor	Dislocated, failed to attend, AVN
M	36	IV	Rt. Femoral shortening	Good	
M	36	III		Good	
F	12	IV		Good	Stiffness, got better
F	12	III		Good	
F	27	IV	LT Salter osteotomy	Good	
F	27	II		Good	
M	32	III	Rt.Salter osteotomy	Good	
M	32	III	Left Salter osteotomy	Fair	Inadequate coverage of the acetabulum, redo Salter, AVN
F	26	IV	Femoral shortening derotation osteotomy	Good	
F	26	IV		Good	
F	23	II		Good	Stiffness, got better
F	23	II		Good	

Table (2): Demographics, procedures and outcome of patients with DDH performed in one stage.

Sex	Age Month	Tonnis	Additional procedures	Mckee criteria	Complications
F	24	IV		Good	slipped plate, refixed
F	42	IV	Salter osteotomy (left) Femoral shortening	Fair	AVN
F	17	IV	-	Good	Stiffness, improved with time
F	25	IV	Salter osteotomy /2	Excellent	
F	42	IV	Rt Salter osteotomy	Good	
F	24	III		Good	
F	26	III	Salter osteotomy /2	Good	
F	24	II	Salter osteotomy /2	Good	
M	26	IV		Good	
F	48	IV	Salter osteotomy /2 Femoral shortening/2	Good	
F	12	III		Good	
F	12	III		Good	
F	27	IV	Salter osteotomy /2	Good	

Figure (1): Preoperative radiographs of the pelvis showing bilateral DDH

Figure (2): Postoperative radiographs of the pelvis showing bilateral DDH

Discussion:

The main complications following surgery for bilateral neglected developmental dysplasia of the hip in children is re-dislocation and avascular necrosis of the head of femur [2, 3]. Undoubtedly, age has a negative influence on the outcome [4]. Additional bony procedures, to ensure containment of the hip is sometimes indicated; the bony procedure(s) is time consuming and demanding; hence the staged procedure. There are reports of one staged bilateral surgery for DDH [2, 3, 4, 5, 6, 7, 8, 9, 10, 11]. The benefits of single stage bilateral hip reduction over 2 consecutive operations, is thought to be the reduction of overall costs and the period in plaster, also a better recovery period [10]. Undoubtedly, the long period of immobilization in plaster will be stressful for the working parents as well (especially if preoperative skin traction is performed).

There is no strong evidence supporting the routine use of preoperative skin traction for DDH; we have not used in the current study preoperative traction of the limbs [6]. The argument against one stage bilateral open reduction of DDH has been that the surgical procedure is a lengthy one, the child will not tolerate it, and that one stage operation may increase complications. Additional bony procedure following open reduction of unilateral developmental dysplasia of the hip however is reported to be safe [7]. There are so far few comparative studies of one or two staged operations. In a comparative study of single stage bilateral Pemberton osteotomy, compared with unilateral Pemberton osteotomy for DDH; it was concluded that bilateral procedures have significant advantages over two separate consecutive interventions [8]. In another

comparative study on 45 children (3 years 9 months old in average), suffering from congenital dislocation of the hip or acetabular dysplasia who have sustained a bilateral innominate osteotomy in a single stage; the authors conclude that one-step bilateral innominate osteotomy is viable and simple. It makes a second operation unnecessary and results are better compared to that obtained after unilateral osteotomy [(9)].

The current study lacks proper randomised comparison, further studies with proper randomization and longer duration of follow-up in the future is recommended. The conclusion drawn in the current paper however, is justified, because of the relatively good number of the cases included.

Conclusion:

There is minimal difference between operating on both hips in one session compared with two stage operations for bilateral DDH inregards to the anaesthetic time, blood loss and overall complication. The requirement of analgesia however is longer for one stage bilateral surgery. Bilateral one stage surgery offers a better rehabilitation benefit to the patient and family.

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