Midterm Results Of Total Hip Arthroplasty (THA) In Developmental Dysplasia Of The Hip (DDH)

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Abstract

Objectives

Total hip arthroplasty (THA) in developmental dysplasia of the hip (DDH) is a challenging procedure. We analysed 51 patients with this condition. The focus of this article is to provide our experience; the results and complications of THA in DDH.

Patients and Methods

In a retrospective approach, 51 patients with 59 hip arthrosis secondary to developmental dysplasia of the hip were included. Eight patients with 8 hips were lost to follow-up. Forty three patients with 51 hip arthrosis secondary to developmental dysplasia of hip were available for clinical and radiological evaluation at a mean follow-up time of 57 months (20 to 81 months).

Results

According to Crowe, 27 hip were Type 1, 12 hips were Type 2, 5 hips were Type 3, and 7 hips were Type 4. Mean Harris hip score was improved from 31 to 93,23. Complications were 2 acetabular cup migration and 1 femoral stem migration in the early period as well as dislocation in 5 hips during the early postoperative period. During introducing the femoral stem or intraoperative reduction of 9 hips (17.65%) a fissure in the femur occurred. Also there were 2 hips with trochanteric bursitis and one with femoral stem failure. There was no nervous injury.

Conclusions

THA is more complicated in secondary osteoarthritis due to DDH than primary osteoarthritis. The degree of deformation in DDH is proportionate to the degree of dislocation. Thus a higher rate of dislocation indicates a technically more demanding procedure which is also prone to more complications. Nevertheless, when preoperative planning is done carefully, THA is the best surgery choice in a painful, disabling osteoarthritis of the hip secondary to DDH.

INTRODUCTION

Arthrosis secondary to developmental dysplasia of the hip (DDH) is a disabling condition. Parents and patients with DDH usually fail to recognize that the different gait and walking pattern may be due to an abnormality. Therefore, DDH is not diagnosed until adulthood in many patients in Turkey. Undiagnosed or inefficient treatment of DDH can lead to a severe prognosis and disability due to arthrosis of the hip.

In 1973, Charnley and Feagin reported the results of total hip arthroplasty (THA) in DDH patients (1). They stated that arthrosis secondary to DDH is a contraindication for arthroplasty due to insufficient bone stock in acetabulum. Since then, there has been progress in THA surgery in DDH due to new surgical techniques and a wide variety of implants in the market.

The focus of this article is to provide our experience; the results and complications of THA in DDH.

MATERIALS AND METHODS

In a retrospective approach, all patients eligible for total hip arthroplasty due to osteoarthritis secondary to DDH between February 2006 and November 2009 were identified from medical records. Ethical approval was granted for the study by the local ethics committee. Informed consent was obtained in all cases prior to the inclusion into this study.

The diagnosis of DDH was based on historical, clinical, and radiographic findings. Patients who had a minimum of 2 years of clinical and radiographic follow-up were included in the study. Patients were excluded if they had primary hip arthrosis or secondary hip arthrosis due to any other pathology except DDH.

All patients were classified using Crowe classification (2). Last follow-up physical examination of all patients was done by one of the authors.

All operations were performed by 3 surgeons who had previous experience in hip arthroplasty in DDH. General anesthesia was applied for 38 hips and regional anesthesia was used for 13 hips. Mean operation time was 145 ± 58 minutes. Mean intraoperative blood transfusion (erythrocyte suspension) rate was 2.12 ± 0.89 packs and mean total (intraoperative and postoperative) blood transfusion rate was 2.37 ±0.98 packs, also fresh frozen plasma transfusion was given in 3 patients.

Posterolateral approach with lateral decubitus position was used in all patients. Transvers osteotomy for femoral shortening of 2 cms in 2 patients, 3 cms in 1 patient, and 5 cms in 1 patient was done. Reconstruction plate and 4 screws were used for osteotomy site fixation in one femoral shortening and femoral stem fixation was sufficient in 3 patients.

Cement-less acetabular cup and cement-less femoral stem were used in all patients. Metal on metal, metal on UHMWPE and ceramic on ceramic surface were used in the patients (Table 1). Porous coated, tapered femoral stem was used in 43 hips, fully porous coated, cylindrical femoral stem was used in 7 hips, and resurfacing arthroplasty was used in 1 hip. Simple trochanteric osteotomy was done in 2 hips. Trochanteric plate and cable fixation was used for both hips.

Due to acetabular deficiency, autograft was used in 7 acetabuli which were positioned superiorly in 5 hips, medially in 1 hip and intra-cystic cavity in 1 hip. Superiorly placed autografts were fixed with screws in 2 hips and K-wires in 2 hips and no fixation in 1 hip.

Mean hospitalization rate was 5.75 ± 3.26 days (3 to 18 days). For deep venous thrombosis (DVT) prophylaxis, lower extremity exercises were started immediately postoperatively. Also subcutaneous low molecular heparin injection was used for 2 weeks.

For evaluation of the x-rays, Nikon P100 digital camera was used to digitalise, then AutoCAD 2009 (Autodesk, Spatial Corp.) software was used for evaluation of Crowe classification, acetabular inclination, femoral head position in acetabular insert, insert wear rate, femoral stem migration, acetabular cup loosening according to De Lee & Charnley (3), femoral stem loosening according to Gruen (4), heterotrophic ossification according to Brooker (5), and radiologic follow up according to Callaghan (6).

For all patients, preoperative and postoperative Harris Hip Scores were evaluated.

IBM SPSS Statistics, New York, USA software was used for statistical analysis. Data distribution was not normal, therefore Wilcoxon signed ranks test was used. The significance level was set at $p < 0.01$.

RESULTS

A total of 51 patients with 59 hip arthrosis secondary to DDH were included. Eight patients with 8 hips were lost to follow–up. Therefore, 43 patients with 51 hip arthrosis secondary to DDH were available for clinical and radiological evaluation. Mean patient age was 50.3 ± 9.6 years (33 years to 73 years) and median age was 50 years. Nine patients were male and 34 were female. In 22 patients, only right hip surgery was performed, in 13 patients, only left hip surgery was performed, and in 8 patients, bilateral hip surgery was performed. Mean surgery time between hips in bilateral cases was 12.3 months (6.1 to 26.4 months), mean follow-up time was 57 ± 14 months, median 59 months, (25 to 81 months). According to Crowe, 27 hips were Type 1, 12 hips were Type 2, 5 hips were Type 3, and 7 hips were Type 4.

Mean acetabular inclination of all cases except acetabular revisions (two hips) was 49 ± 10 degrees. Acetabular inclination of two cases were as 54 and 67 degrees at immediate postoperative x-rays, which were 78 and 78 degrees at postoperative 6th and 21st months, respectively. Both patients were crutch dependent with painful hips which showed aseptic loosening of acetabular cups. Acetabular revision was done in both cases. Mean acetabular cup coverage was 96% (81% to 100%). Acetabular cup loosening was evaluated according to De Lee & Charnley zones (Table 2). All acetabular cups were stable radiologically except revision cases, which were also stable at last follow-up.

Femoral head position in the cup was analysed for insert wear rate. There was no significant insert wear at the last follow-up. Analysis of x-rays showed only one femoral stem migration which needed no surgical intervention. Delayed weight bearing was sufficient for bone in-growth into the femoral stem which was radiologically stable at the postop 6th week. Femoral stem loosening was classified according to Gruen which showed all stems stable at the last follow-up (Table 3)

Heterotrophic ossification according to Brooker was analysed (5) and radiologic follow-up was done according to Callaghan (6). There was mild ossification in 11 hips and moderate ossification in 2 hips. There was no range of motion limitation in patients with heterotopic ossification, thus those cases were of no clinical significance.

In the series of patients with DDH who underwent total hip arthroplasty, wound infection was found in 2 patients. Wound culture studies showed Klebsiella in one case and methycilline sensitive staphylococcus aureus in another case which were treated with antibiotics for 3 weeks. There was no infection sign at last follow-up.

During follow-up, Deep Vein Thrombosis (DVT) below the knee was diagnosed in 3 patients which caused symptomatic pulmonary emboli in 2 cases, on the 35th postoperative day and 3rd month, respectively. All DVT cases were referred to cardiovascular surgery and were treated successfully.

There was early postoperative dislocation of the hip in 5 hips. Closed reduction under general anesthesia was successful in three cases. Closed reduction was followed by anti-rotation short leg cast for 3 weeks. However, closed reduction failed in 2 cases, therefore neck length was increased in one case and acetabular cup revision was done in another case. During the last follow-up, there was no recurrence of hip dislocation in any case.

During introducing the femoral stem or reduction maneuver of 9 hips (,65), a fissure or fracture in the proximal femur occurred. Fixation was done with only wire or cables in 5 femurs and with plate and cables in 4 femurs.

Limb length discrepancy was –4 mm preoperatively (–78 mm up to +43,7 mm) and it was +7 mm (-35 mm up to +73 mm) postoperatively. The variety of limb length difference is due to bilateral DDH cases which were operated unilaterally. In those cases, shoe raises were given until operation of the other side. Besides bilateral DDH cases, unilateral DDH patients were satisfied with their limb lengths.

Trochanteric bursitis was diagnosed in two cases. Symptoms of trochanteric bursitis in one of the cases was mild and required no treatment. The other case with trochanteric bursitis had moderate symptoms which were treated conservatively.

There was 1 femoral stem migration in the early period. The patient used crutches for 6 weeks and femoral stem position was good and bone in-growth occurred. The patient had no pain and the femoral stem was stable radiologically during the last follow up. There was no nerve injury postoperatively.

Mean preop and postop Harris hip scores were 31 and 92 respectively. There was statistically significant difference between preop and postop Harris hip scores ($p<0.000$) (Figure 1 – 4).

DISCUSSION

The presented data shows that hip osteoarthritis secondary to DDH can be successfully treated by arthroplasty. The cement-less cups in primary THA can achieve promising short to mid-term results in patients with hip dysplasia (8 – 12).

There are some limitations to this study due to its retrospective design and the follow-up range from 25 to 81 months. Serial x-rays were analyzed for socket and stem loosening.

It is well documented that the anatomic hip center should be restored for initial and long-term stability in cases of dysplasia. However, if the acetabular cup is placed superiorly with adequate medialisation, cup position and long-term survival rate is acceptable (13). In our study, 9 of the hips had a high hip center, in which 5 hips were placed with adequate medialisation which showed similar wear rate and bone in-growth on the acetabular cup. However, 2 of 4 hips with inadequate medialisation were revised in the early post-operative period. Those two hips had 67 and 54 degrees of acetabular inclination in the immediate post-operative period and before revision, acetabular inclination of both hips were 78 degrees.

Femoral stem loosening was classified according to Gruen. There was only one femoral stem migration in the early postoperative period. The patient was mobilized with non-weight bearing touch of the operated leg which was stable at the 6 week follow-up. X-ray analysis showed all stems were stable at the last follow-up (Table 3).

Femoral head size is an important factor of incidence of hip dislocation rate. Highest dislocation rate is with 22 mm femoral head size, this decreases with increase of the head size (14, 15). A small size acetabular cup use is required in some DDH cases due to dysplasia of the acetabulum. For adequate insert thickness, a 22 mm femoral head should be used for smaller acetabular cups such as 38 mm which increases dislocation rate compared to arthroplasty in primary hip osteoarthritis. In our study, 22.225 mm head size was used in 9 hips, 28 mm head size in 23 hips, and 32 mm or larger head sizes were used in 19 hips. However, dislocation occurred with 28 mm head sizes in 4 hips and 48 mm head size in 1 hip. In three hips, the hips were dislocated because of patient incompatibility of early extreme hip range of motion. There was no mal-alignment of arthroplasty components in which closed reduction had satisfactory result. But in another two hips closed reduction was not successful and femoral neck lengthening and acetabular cup revision were done respectively.

DVT is a major complication of total hip arthroplasty which may lead to fatal pulmonary emboli. Early mobilization, pneumatic device use, low molecular heparin use, pressurized stocking are suggested for prevention of DVT. In our study, all patients were mobilized at the 1st postoperative day. Low molecular heparin use was continued for 3 weeks and pressurized above-knee stocking was used for 6 weeks in all patients. However, DVT below the knee was diagnosed in 3 cases. In 2 cases, symptomatic pulmonary emboli were diagnosed at the 35th postoperative day and 3rd month, respectively. All DVT cases were referred to cardiovascular surgery and were treated successfully.

Patients with DDH usually have limb length discrepancy which leads to lumbar scoliosis and valgus deformity at the contralateral knee long-term. Presence of Trendelenburg gait, asymptomatic lumbar scoliosis is not an indication for hip arthroplasty in DDH. However, when they become structural deformities, arthroplasty in DDH becomes difficult and the complication rate increases. Therefore, some authors suggested to do hip surgery before structural changes occur at the hip joint and lumbar area (16, 17). Limb length discrepancy was corrected in our series, however due to presence of unilateral surgeries of bilateral high dislocation cases, limb length difference varies in our data. All unilateral DDH cases were satisfied with their limb lengths. Bilateral high dislocation cases whom had unilateral surgeries were informed before surgery that they would have inequality in limb length until contralateral hip surgery is done and they would use shoe inserts for inequality.

In the literature, nerve injury complication rate is about 1%. 0.9% occurs in primary THA, 2.6% in revision THA and 5.2% in DDH patients (18). There was no nerve injury in our study.

The limitation of our study was that it is a retrospective study that evaluates the data of a protectively followed patient group with relatively short follow-up period. A longer follow-up is needed for long term analysis. The subgroups of DDH are not equally distributed to do statistical analysis of graft incorporation, femoral shortening osteotomy healing and nerve injury incidence.

In conclusion, cement-less total hip arthroplasty resulted in satisfactory clinical outcomes in secondary hip osteoarthritis due to DDH.

Table 1

Femoral head and acetabuler liner choices

	Metal (22.225 mm)	Metal (28 mm)	Metal (Mega size)	Ceramic (28 mm)	Ceramic (32 mm)	Ceramic (36 mm)
Ceramic liner				3	1	1
Metal liner		5	17			
UHMWPE liner	9	15				

Table 2

Acetabular cup loosening according to De Lee ve Charnley

Patient	Region 1	Region 2	Region 3
1	None	Regular, less than 1 mm	Regular, less than 1 mm
2	None	Regular, less than 1 mm	None
3	Regular, less than 1 mm	None	Irregular, less than 1 mm
4	Irregular, less than 1 mm	Regular, less than 1 mm	None
5	Regular, less than 1 mm	None	Regular, less than 1 mm
6	None	None	Regular, less than 1 mm
7	Irregular, less than 1 mm	None	None
8	None	None	Irregular, less than 1 mm
9	None	None	Irregular, less than 1 mm
10	None	None	Irregular, less than 1 mm
11	None	Irregular, less than 1 mm	Regular, less than 1 mm
12	None	None	Irregular, less than 1 mm

Table 3

Femoral stem loosening according to Gruen

Patient	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 7
1	None	None	None	Regular radiolucent area, less than 1 mm	None	None	None
2	Irregular radiolucent area, less than 2 mm	Irregular radiolucent area, less than 2 mm	Irregular radiolucent area, less than 2 mm	None	None	None	None
3	Irregular radiolucent area, less than 2 mm	Irregular radiolucent area, less than 2 mm	None	None	None	None	None
4	Irregular radiolucent area, less than 2 mm	Irregular radiolucent area, less than 2 mm	None	None	None	None	None
5	None	Irregular radiolucent area, less than 2 mm	None	None	None	Irregular radiolucent area, less than 2 mm	None
6	Irregular radiolucent area, less than 2 mm	None	None	None	None	None	None

Table 3 Continued

7	Regular radiolucent area, less than 2 mm	Regular radiolucent area, less than 1 mm	None	None	None	None	None
8	Regular radiolucent area, less than 2 mm	Regular radiolucent area, less than 2 mm	None	None	None	None	None
9	None	None	None	None	None	Irregular radiolucent area, less than 1 mm	None
10	Regular radiolucent area, less than 2 mm	Regular radiolucent area, less than 2 mm	None	None	None	Regular radiolucent area, less than 2 mm	Regular radiolucent area, more than 2 mm
11	None	None	None	None	None	None	Regular radiolucent area, more than 2 mm
12	Regular radiolucent area, more than 2 mm	None	None	None	None	None	Regular radiolucent area, more than 2 mm
13	Regular radiolucent area, more than 2 mm	None	None	None	None	None	Regular radiolucent area, more than 2 mm
14	Regular radiolucent area, more than 2 mm	Regular radiolucent area, more than 2 mm	None	None	None	None	None
15	Regular radiolucent area, more than 2 mm	None	None	None	None	None	None

Table 3 Continued

16	Regular radiolucent area, less than 1 mm	None	None	None	None	None	Regular radiolucent area, more than 2 mm

Table 4

Heterotopic ossification according to Brooker

	Heterotopic Ossification			
	1st Degree	2nd Degree	3rd Degree	4th Degree
Total hips	7	4	2	0

Figure 1

Histogram of Preoperative Harris Hip Score

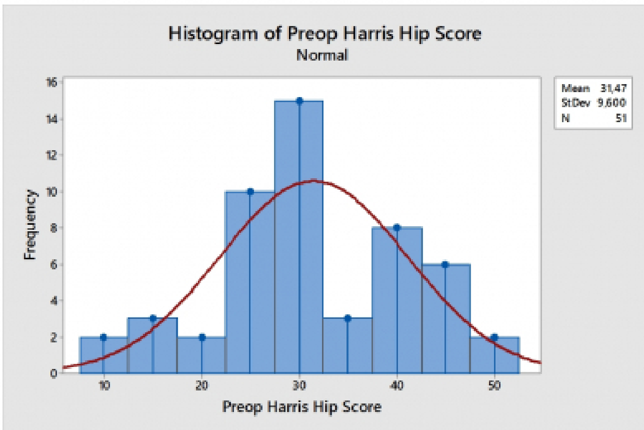

Figure 2

Histogram of Postoperative Harris Hip Score

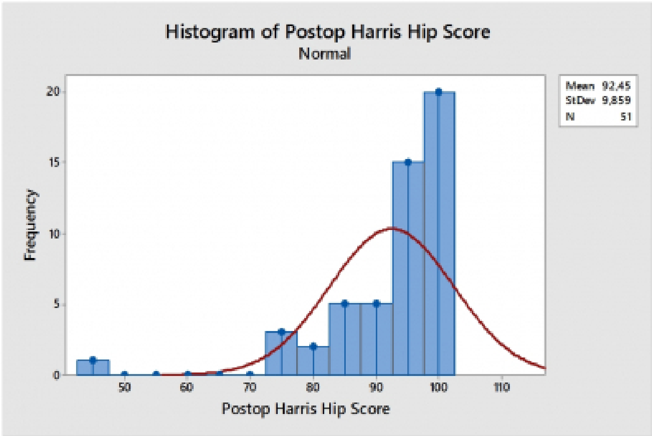

Figure 3

Wilcoxon Signed Rank Test

Ranks

		N	Mean Rank	Sum of Ranks
Postop Harris Hip Score - Preop Harris Hip Score	Negative Ranks	0[a]	,00	,00
	Positive Ranks	51[b]	26,00	1326,00
	Ties	0[c]		
	Total	51		

a. Postop Harris Hip Score < Preop Harris Hip Score

b. Postop Harris Hip Score > Preop Harris Hip Score

c. Postop Harris Hip Score = Preop Harris Hip Score

Figure 4

Test Statistics

Test Statistics[a]

	Postop Harris Hip Score - Preop Harris Hip Score
Z	-6,215[b]
Asymp. Sig. (2-tailed)	,000

a. Wilcoxon Signed Ranks Test

b. Based on negative ranks.

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