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Original Article

Previous hip surgery due to developmental dysplasia of the hip affects major complication rates but not revision rates in total hip arthroplasty

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Abstract

Aim: Total hip arthroplasty in patients with developmental dysplasia of the hip is challenging due to accompanying acetabular and femoral deformities, soft-tissue contractures and shortening of the affected limb. In addition, changed anatomy after pelvic and/or femoral osteotomies can also make the total hip arthroplasty procedure challenging. This study aimed to evaluate the effect of previous hip surgery on clinical and radiological outcomes after total hip arthroplasty in previously operated patients due to developmental dysplasia of the hip.

Material and Methods: A total of 55 developmental dysplasia of the hip patients, twenty-five patients (29 hips) with a previous hip surgery (Group 1) and 30 patients (31 hips) without previous hip surgery (Group 2) were included. The primary outcome measures were major complication and revision rates. The secondary outcome measure was the Harris Hip Score.

Results: Major complications were found significantly higher in group I ($p = 0.009$). However, no significant difference was observed between groups regarding revision rates ($p = 0.514$). No significant difference was observed between groups in the preoperative and the last follow-up Harris Hip scores.

Conclusion: Although similar revision rates, patients with a previous hip surgery due to developmental dysplasia of the hip who underwent total hip arthroplasty are more prone to major complications than patients without previous hip surgery patients. Level of Evidence IV. Case-Control Study.

Keywords: Developmental dysplasia of the hip; major complication; osteotomy; revision; total hip arthroplasty

INTRODUCTION

The primary goal of the treatment in developmental hip dysplasia of the hip (DDH) is to obtain concentric reduction between femoral head and acetabulum (1). A concentric reduction is important in functional recovery, prevention from possible deformities and prevention from secondary osteoarthritis. Secondary osteoarthritis may develop even if the concentric reduction is achieved with hip-preserving surgeries (2). Due to acetabular and femoral deformities, soft-tissue contractures and shortening of the affected limb, total hip arthroplasty (THA) continues to be challenging in DDH (3,4). In addition, performing THA after previous pelvic and/or femoral osteotomy can also be technically challenging due to altered anatomy (5,6). Major devastating complications, such as nerve injury, dislocation, and deep infection can also be expected after THA in patients with previous hip surgery.

In the literature, various studies reported similar outcomes in DDH patients with or without a history of hip surgery who underwent THA (7-12). Most of these studies reported the results of THA after previous acetabular osteotomies. To the best of our knowledge, there is limited data regarding the effect of previous combined pelvic and femoral osteotomies on clinical and radiological outcomes, and major complication and revision rates in THA patients. We hypothesized that major complication and revision rates might be higher in patients who underwent previous surgery than those without previous surgery in patients

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with DDH who underwent primary THA. This study aimed to evaluate the effect of previous hip surgery on clinical and radiological outcomes, and major complication and revision rates after total hip arthroplasty in previously operated patients with DDH.

MATERIAL and METHODS

Patient population

The study protocol was approved by our institution's review board. We retrospectively evaluated patient records, radiographs and operation details of DDH patients who underwent primary THA in a referral tertiary hospital between 2007 and 2015. An informed consent was obtained from all patients. Patients with a minimum 3-year follow-up were included. Patients with insufficient data and/or lost to follow-up (n = 49) and who underwent additional surgery from the ipsilateral lower extremity (n = 19) were excluded from the study. After exclusions, a total of 25 DDH patients (29 hips) with previous hip surgery were included in the study group (Group 1). Thirty DDH patients (31 hips) without a previous history of hip surgery who underwent primary THA were randomly selected as a control group (Group 2). Group I underwent the following hip surgeries previously: pelvic osteotomy in 6 hips, femoral osteotomy in 9 hips and combined pelvic and femoral osteotomies in 14 hips (Table 1).

Table 1. Patients' demographics and clinical data

	Group I	Group II
Number of patients (hips)	25 (29)	30 (31)
Age (years)	35.5 (17-53)	43.2 (28-72)
Gender		
Female	21 (84%)	21 (70%)
Male	4 (16%)	9 (30%)
Side		
Left	15 (52%)	13 (42%)
Right	14 (48%)	18 (58%)
Crowe Classification[14]		
Grade I	12 (41%)	13 (42%)
Grade II	8 (28%)	7 (23%)
Grade III	6 (21%)	6 (19%)
Grade IV	3 (10%)	5 (16%)
Follow-up (months)	77.2 (36-129)	81.3 (37-119)

Surgical method

All surgeries were performed by two experienced hip arthroplasty surgeons. The anterolateral approach was used in 10 (34%) and 9 hips (29%) in groups 1 and 2, respectively. The posterolateral approach was used in 19 (66%) and 22 hips (71%) in groups 1 and 2, respectively. Femoral osteotomy was performed in 6 patients during the THA procedure. Cementless femoral fixation was used in all patients, except for one patient who underwent cemented acetabular fixation with a reconstruction type acetabular cage. Femoral head sizes used during THA were shown in Table 2.

Table 2. Femoral head sizes

Head diameter (mm)	Group I	Group II
22	0 (0%)	6 (19%)
28	10 (35%)	11 (36%)
32	12 (41%)	9 (29%)
36	5 (17%)	5 (16%)
40	2 (7%)	0 (0%)

mm: millimeter

Outcome assessment

The primary outcome measures were major complications (intraoperative femur fracture, deep infection, nerve palsy, dislocation, and aseptic loosening) and revision rates. The secondary outcome measure was the Harris Hip Score at the last follow-up (13).

Radiographic evaluation

Radiographic evaluation was performed on preoperative, immediate postoperative and the last follow-up radiographs (Figure 1). Preoperative radiographs were evaluated to define the type of dysplasia based on the Crowe classification and to identify the details of previous surgeries (14). Acetabular component abduction angle was measured from the postoperative radiographs. Femoral or acetabular loosening and femoral subsidence were assessed on the last follow-up radiographs (Figure 2). The stability of the acetabular component was evaluated according to the radiological regions defined by De Lee and Charnley (21). Femoral component stability was defined as fixation by bony ingrowth, stable fibrous ingrowth and unstable implant based on criteria of Engh et al. (15) The degree of femoral subsidence was assessed using the criteria described by Malchau et al. (16)

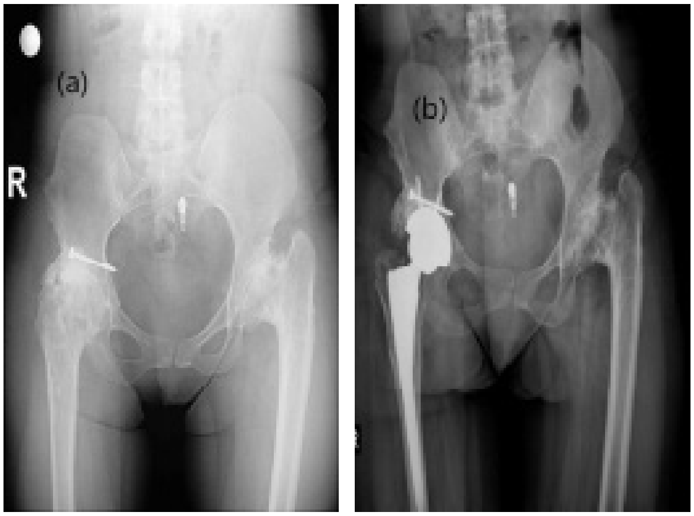

Figure 1. (a) Preoperative radiograph of a patient with previous hip surgery. (b) Postoperative radiograph after cementless THA

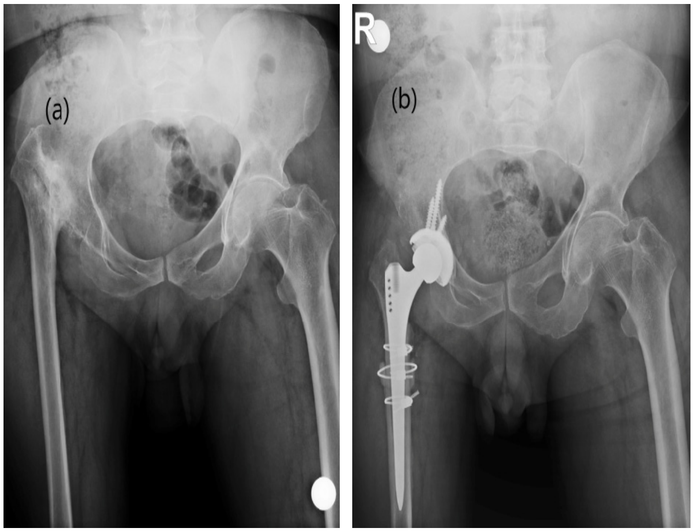

Figure 2. (a) Preoperative radiograph of a patient without previous hip surgery. (b) Postoperative radiograph after cementless THA with femoral shortening

Statistical analysis

Numeric variables were provided as means and ranges (minimum–maximum). Categorical variables were provided as frequencies and percentages. The means were compared using the t-test or Mann–Whitney U test in accordance with the Kolmogorov–Smirnov normality test. The frequencies were compared using the Pearson chi-squared test or Fisher exact test.

A post-hoc power analysis was performed to determine if the number of patients in the groups was adequate to be able to assess that all statistical differences exist between them and to avoid type II error. An 83% power was detected for the comparison of major complication rate selected as the parameter of comparison between the groups.

RESULTS

The major complication rate was significantly higher in group I (p = 0.009). However, no significant difference was observed between groups in revision rates (p = 0.514) (Table 3). There were similar major complication rates

Table 3. Major complications and revisions in two groups

	Group I	Group II	p*
Major Complications	11	3	**0.009**
Intraoperative femur fracture	3	2	0.585
Nerve injury	3	1	0.269
Deep infection	1	0	0.305
Aseptic loosening	2	1	0.514
Dislocation	2	0	0.141
Revision THA	2	1	0.514
Aseptic loosening	1	1	0.962
Instabilitiy	1	0	0.305

* p values according to Pearson Chi-Square test,
THA: Total Hip Arthroplasty

between pelvic, femoral, or pelvic and femoral osteotomies (Table 4). Intraoperative femur fracture (8.33%) was the most common complication in groups I and II. Three nerve injuries (10.34%) occurred postoperatively in group I [two sciatic nerves (One complete and one partial) and one femoral nerve (Partial)]. At the last follow-up, only the complete sciatic nerve lesion was not recovered. Mobilization with an ankle-foot orthosis (AFO) was recommended because the patient did not want additional surgery. The dislocation was also more common in group I. One patient underwent femoral component revision due to recurrent dislocation. Aseptic loosening (1 patient, 3.44%) and instability (1 patient, 3.44%) were the causes for revision in group I, whereas aseptic loosening (1 patient, 3.22%) was the cause for revision THA in group II.

Table 4. Major complications in Group 1

	Pelvic osteotomy (6 hips)	Femoral osteotomy (9 hips)	Pelvic and Femoral osteotomy (14 hips)
Major Complications			
Intraoperative femur fracture	0	1 (11.1%)	2 (14.28%)
Nerve injury	1 (16.6%)	0	2 (14.28%)
Deep infection	0	1 (11.1%)	0
Aseptic loosening	1 (16.6%)	1 (11.1%)	0
Dislocation	0	1 (11.1%)	1 (7.14%)

Preoperative and the last follow-up Harris Hip Scores of the patients were shown in Table 5. No significant difference was observed between groups regarding preoperative and the last follow-up scores. However, the last follow-up Harris Hip Scores were significantly higher than the preoperative scores in both groups (Table 5).

The mean acetabular component abduction angle was 46.3° ± 7.2° and 42.4° ± 5.8° in groups I and II, respectively (p = 0.533). The femoral head sizes used during THA procedure was not significantly different between 2 groups (p = 0.724).

Table 5. Preoperative and postoperative Harris hip scores of the two groups

	Group I	Group II	p*
Harris Hip Score			
Preoperative	47.6 ± 14.3 (23–69)	44.4 ± 12.1 (14-63)	0.198
Last follow-up	72.7 ± 23.2 (39–89)	76.7 ± 25.8 (50-92)	0.301
p (preop vs last follow-up)	0.000	0.000	

DISCUSSION

The most important finding of the current study was that despite similar revision rates, major complications were significantly more common in patients with DDH who underwent hip surgery previously.

The goals of hip osteotomies (pelvic and/or femoral) for the treatment of symptomatic dysplastic hip are to improve function and achieve concentric reduction (5). Despite satisfactory results, many of these patients will eventually require THA due to symptomatic end-stage arthritis (6,17). Previous clinical studies reported that previous periacetabular osteotomies did not affect the outcomes of THA in patients with DDH (7,9-12). Migaud et al. compared patients with previous pelvic, femoral, or pelvic and femoral osteotomies with the control group and found similar functional results and survival of THA (8). In our study, we observed similar functional outcomes and revision rates between groups. However, major complication rates were found to be significantly higher in patients with previous hip surgery.

On the basis of our results, major complications, such as femoral fracture, nerve palsy, deep infection, aseptic loosening, and dislocation were more common in our study group compared with the control group. Also, the major complications encountered during follow-up were similar in patients with previous pelvic, femoral or pelvic and femoral osteotomies. Hasemi-Nejad et al. reported three femoral fractures in patients without previous hip surgery and nerve palsy was observed in a patient with previous hip surgery (10). Tokunaga et al. also reported. three femoral fractures in the control group and nerve palsy in a previous hip surgery group (9). Similar to our results, they reported that the development of dislocation and infection were more common in the previous osteotomy group. However, the authors reported no significant difference between groups in terms of complications and revision rates (9). Ito et al. reported one infection and one reoperation in their control group (12). Amanatullah reported no significant difference in the complication rates between groups (7). However, they observed three complications involving operative intervention in the previous periacetabular osteotomy group, whereas no complications were observed in the control group. Similar to our results, they also reported higher dislocation rate in the previous periacetabular osteotomy group (7).

On the basis of the results from previous studies, dislocation rates and nerve injuries were found to be higher in patients with previous hip surgery. However, Migaud et al. reported similar dislocation and nerve injury rates in their study comparing the previous hip surgery group with the control group (8). Hasija et al. also mentioned that DDH and previous hip surgery carries a higher risk for nerve injury during the THA procedure (18). Eggli et al. also reported that nerve injury seen in THA surgery performed on dysplastic hips was correlated with previous surgery (19). In the current study, we also observed higher nerve injury rates after THA in patients with previous hip surgery. All nerve injuries occurred in patients with previous combined pelvic and femoral osteotomy. Nerve injury may be caused by altered anatomy and fibrotic tissues.

Harris Hip Score was mainly used to assess the functional outcome after THA (20). On the basis of the results acquired from previous studies, any significant difference between the previous hip surgery and control groups in terms of Harris Hip Scores was not reported (7-10).

The main limitation of the current study was the retrospective evaluation of a heterogeneous patient group who underwent previous surgery with different types of osteotomies. However, previous studies have mainly investigated the effect of acetabular osteotomies on THA outcome. Previously, a study involving 159 hips was available (8). However, the number of patients undergoing combined pelvic and femoral osteotomy in this study was the same as in our study.

CONCLUSION

On the basis of our results, development of major complications were significantly more common in patients with DDH with previous hip osteotomy undergoing THA. However, previous acetabular and/or femoral osteotomy performed for DDH did not impair the functional outcomes or revision rates of subsequent THA. Surgeons should be aware of major complications in DDH patients who underwent previous hip surgery.

Competing interests: The authors declare that they have no competing interest.
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