

ORIGINAL
INVESTIGATION

Posterior Rotational Intertrochanteric Osteotomy in Femoral Head Deformities

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ABSTRACT

Objective: In this study, we aimed to evaluate the clinical and radiological results of posterior rotational intertrochanteric osteotomy used in the treatment of residual femoral head deformity.

Materials and Methods: In this study, the clinical and radiological results of posterior rotational intertrochanteric osteotomy performed on 12 patients in our clinic were examined. The mean follow-up period was 35.4 (12-72) months. The patients were evaluated radiologically by considering the center-edge (CE) angle, femoral neck-shaft angle, epiphyseal quotient and Severin classification. The patients were evaluated clinically by considering the McKay classification, leg length difference and Trendelenburg test.

Results: The McKay clinical scores were significantly improved in the postoperative period compared to the preoperative period ($p < 0.05$). The mean extremity shortness was 0.8 cm preoperatively and decreased to 0.2 cm postoperatively ($p = 0.007$). While eight patients had hip pain during daily activity in the preoperative period, only one patient had hip pain during daily activity in the postoperative period. The Severin radiological scores were significantly improved in the postoperative period compared to the preoperative period ($p < 0.05$).

Conclusion: The short- and long-term results of posterior rotational intertrochanteric osteotomy used in the treatment of residual femoral head deformity were found to be successful both clinically and radiologically.

Keywords: Developmental dysplasia of the hip, osteotomy, avascular necrosis

INTRODUCTION

Residual femoral head deformities may be observed after the conservative or surgical treatment of developmental dysplasia of the hip (DDH). These deformities may be directly due to the surgical technique applied or may be due to avascular necrosis (AVN) that developed in the femoral head after conservative and surgical treatment (1-3). These lesions that occur in the femoral head may lead to hip pain and movement restriction. They may cause degenerative osteoarthritis in the hip joint in the later years of life if they are not treated (4).

In femoral head lesions due to different causes, many proximal femoral osteotomies have been described that aimed to redirect the load-bearing surface of the femur head (5-7). In this study, we aimed to evaluate the clinical and radiological results of posterior rotational intertrochanteric osteotomy applied to patients who were treated with a diagnosis of DDH in our clinic and who had a femoral head deformity in the long-term follow-up.

MATERIALS and METHODS

In this study, we examined the clinical and radiological results of posterior rotatory intertrochanteric osteotomy applied to 12 patients who underwent conservative treatment (4 hips, closed reduction and casting) or surgery (8 hips, medial open reduction) and who had a proximal femoral residual deformity (Figure 1) in the following years. This study was approved by the institutional ethics committee and a written informed consent was obtained from patient or patients parents. Among the patients, there were 10 females and two males. The mean age of the patients at the time of surgery was 22.3 (range, 12-30) years. The mean follow-up period of the patients was 35.4 (range, 12-72) months. Patient selection for surgery was based on the presence of hip pain during simple daily activities (it was present in 66.7% of patients before surgery), incompatibility between the femoral head and the acetabulum on performing hip radiography, and improvement of this incompatibility between the femoral head and the acetabulum in the Lauenstein projection. This technique has not been applied to patients with moderate-to-severe osteoarthritis (OA) of the hip.

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Figure 1. A 27-year-old female patient. There is a deformity in the load-bearing area of the right proximal femur and deterioration in the roundness of the femoral head



Figure 2. Anteroposterior hip radiography after posterior rotational intertrochanteric osteotomy



Figure 3. Anteroposterior hip radiography at six years postoperatively

As Sokolovsky et al. (6) described, the exposure reached the proximal femur with the lateral approach, and then, the long axis of the 130° wedge plate was placed at an angle of 90° with the femur shafts, and proximal femoral intertrochanteric osteotomy was applied. Then, the proximal femur was posteriorly rotated around the long axis of the femur, and the plate was placed in the shaft. After the trochanter major was fixed with two wires, a tension band was applied between the wires and the tip of the screw, which was longer at the distal end of the plate, to increase stability (Figure 2). The patients were allowed to walk using the armrest two days after the operation. They were allowed to walk with partial load using the armrest two months after the operation. After radiographic union was confirmed, full load was given to the extremity.

All patients were clinically evaluated by considering the McKay criteria, leg length difference (calculated by measuring the distance between the anterosuperior iliac crest and the medial malleolus when the patient was lying on the back and the hip and knee were in extension), and the Trendelenburg test in the pre- and postoperative controls (8). The patients were radiologically evaluated by considering the center-edge (CE) angle, femoral neck-shaft angle, epiphyseal quotient, and Severin classification on hip radiographs (Figure 3) in the pre- and postoperative controls (9).

In the study, ratio, proportion, and percentiles were used as descriptive statistics. The compliance of the interval data with normal distribution was evaluated using the Kruskal-Wallis test. The non-parametric circumstance bearing interval data was compared with the Wilcoxon test.

Table 1. Preoperative (Pre) and postoperative (Post) radiological measurements of the patients

		Minimum value	Maximum value	Mean value	p
Center-edge angle (CE)	Pre	5	22	16.2	0.002
	Post	12	24	20.2	
Neck-shaft angle	Pre	128	145	133.4	0.006
	Post	132	150	138.3	
Epiphyseal quotient	Pre	54	73	64.6	0.005
	Post	70	92	83.7	

RESULTS

According to the McKay criteria, in the preoperative clinical evaluation of the patients, five were evaluated as good (type II), six as moderate (type III), and one as poor (type IV). In the postoperative clinical evaluation of the patients, six were evaluated as very good (type I), five as good (type II), and one as middle (type III) ($p < 0.05$). While the Trendelenburg test was positive in five patients (41.7%) preoperatively, it was positive in only one patient (8.3%) postoperatively. The mean shortness of the affected lower extremities was 0.8 cm (0-2 cm) preoperatively, and it decreased to 0.2 cm (0-0.5 cm) postoperatively ($p = 0.007$). While eight (66.7%) patients had hip pain when performing daily activities in the preoperative period, only one (8.3%) patient had hip pain when performing daily activities in the postoperative period.

No infection or nonunion was detected in any patient. Progression occurred medially in the wires placed for fixation of the trochanter major in two patients. The medially progressed wires were removed in both patients. In one patient, the tension band could not be removed because the new bone tissue covered it (Figure 3).

When the patients were radiologically evaluated according to Severin classification, four patients were classified as type II and eight were classified as type III in the preoperative period. Four patients were classified as type I and eight were classified as type II in the postoperative period ($p < 0.05$). While the Shenton line was fractured in 50% (six patients) of the patients preoperatively, it was fractured in 16.6% (six patients) of the patients postoperatively. The CE angles, femoral neck-shaft angles, and epiphyseal quotients of the patients in the pre- and postoperative periods are given in Table 1.

DISCUSSION

In the treatment of DDH, the aim is to achieve proper reduction without disturbing circulation in the femoral head (10). Appropriate reduction can be conservatively or surgically achieved. Femoral head deformities may develop in conservative methods and surgical procedures. These deformities may be associated with the applied surgical technique or may be due to the developing AVN (1-3, 11).

Different rotational osteotomies of the proximal femur have been described for deformities in the load-bearing portion of the femur head (6, 7, 12). These osteotomies are difficult to apply as a surgical technique. The applied osteotomy does not remove femoral

head deformities but allows for the maximum use of the undamaged parts of the femur head (6). Sugioka et al. defined anterior rotational intertrochanteric osteotomy and reported a success rate of 78% at the 3-16-year follow-up (5). They clarified that an appropriate age for undergoing osteotomy is over 10 years. In this sense, the age range of our patients is similar with the recommended age range. One of the disadvantages of this osteotomy procedure is the increased risk of disrupting the proximal femoral blood supply (13). On the contrary, posterior rotational intertrochanteric osteotomies alter the proximal femoral prolapse less by affecting the posterior circumflex artery less (6, 14). None of our patients had AVN or nonunion postoperatively.

Some authors have stated that osteotomy of the trochanter major may lead to early physeal closure and may cause growth retardation in the proximal femur (15). However, Gage and Cary have reported that trochanteric epiphysiodesis did not significantly affect the final shape of proximal femur at the six-year follow-up (16). One of the difficulties of posterior rotational intertrochanteric osteotomy is the problem in the complete and rigid fixation of the trochanter major (6). To reinforce the fixation of the trochanter major, we left a slightly long screw at the distal end of the plate and applied a tension band between the wires used in the fixation and the tip of this screw.

The purpose of joint-sparing surgeries applied to the proximal femur due to AVN is to replace damaged cartilage surfaces on load-bearing joints by firm cartilaginous surfaces with redirection. Thus, the need for undergoing total joint arthroplasty at an early age can be delayed or eliminated. Hamanishi et al. applied curved intertrochanteric varus osteotomy to 53 hips with the diagnosis of femoral head osteonecrosis and reported successful clinical results in a mean follow-up of 6.2 years (17). Similarly, Ito et al. (18) reported good or very good clinical outcomes at the 12.5-year follow-up in 73% of patients with osteonecrosis who underwent simple femoral varus osteotomy. Our clinical outcome rates may seem high (91% of patients were evaluated as good or very good) when compared to the rate in the literature, but our median follow-up period was three years.

CONCLUSION

Posterior rotational intertrochanteric osteotomy applied in our patients significantly improved the clinical and radiological results of the patients in the short- to medium-term follow-up. It also significantly reduced extremity shortness in the affected side. According to data in the literature, our study is the second case series to evaluate the results of posterior rotational intertrochanteric osteotomy after the case series of Sokolovsky et al. (6) who defined the technique. The major limitations of our study are the small number of cases, the short- and medium-term follow-up, and the absence of computed tomographic evaluations of patients.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Karadeniz Technical University Faculty of Medicine.

Informed Consent: Written informed consent was obtained from patients who participated in this study.

Peer-review: Externally peer-reviewed.

Conflict of Interest: No conflict of interest was declared by the authors.

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