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Conversion Total Hip Arthroplasty After Previous Transtrochanteric Rotational Osteotomy for Osteonecrosis of the Femoral Head

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ABSTRACT

The results of conversion total hip arthroplasty (THA) after failed transtrochanteric rotational osteotomy (TRO) are still controversial. We retrospectively reviewed 18 patients with ONFHs who had been treated previously by TRO and were later converted to THAs (conversion group). We made a matched control group of 18 primary THAs for ONFH done by same hip surgeon (PTHA group). There was an improvement in the Harris hip score and WOMAC score at the final follow-up but the improvement was not statistically significant between the two groups. Only internal rotation was significantly better in the PTHA group than in the conversion group. THA after TRO provides satisfactory clinical and radiological outcomes with no significant increase in perioperative morbidity in comparison with that in the primary THA.

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Osteonecrosis of the femoral head (ONFH) is a potentially debilitating condition with etiology still undefined. It is one of the most common diseases of the hip in Korea, comprising more than a half of the underlying causes of total hip arthroplasty (THA) [1]. Osteonecrosis of the femoral head in adults can be devastating especially because of its propensity to affect young people [2]. The disease is usually progressive and the natural course is favorable only if the necrotic area is small enough, but a large necrosis of the weight-bearing area usually progresses to collapse and eventually to secondary osteoarthritis [3,4].

Numerous treatment modalities exist for the treatment of ONFH and can be largely categorized into joint-preserving procedures and THA. However, because patients with ONFH are generally young adults, joint-preserving procedures are usually recommended as the first choice. The aim is to slow down or even delay the progress of collapse and degenerative changes, and postpone a THA as long as possible. Despite some reports of good results, not all have reported success with THA [5]. Therefore, many patients with failed transtrochanteric rotational osteotomy (TRO) are converted to THA as a salvage option. THA is the last surgical option recommended when there is progressive collapse with or without secondary arthritis. However, failure rates for THA in young patients remain high despite continuous improvement in the design and technique [6,7]. Meanwhile, the results of conversion THA after failed TRO are still controversial. Even though some studies reported no difference in the results and survival rates [8–10], others have reported higher complication rates and revision rates due to anatomic deformities after TRO [11].

In our study, we assessed the perioperative morbidity, clinical and radiological outcomes of THA after a previous modified TRO and compared these results with those of primary THA for ONFH.

Methods and Materials

We retrospectively reviewed 18 patients (18 hips) with diagnosis of ONFH who had been treated initially by transtrochanteric anterior rotational osteotomy (134 hips) and were later converted to THA between November 2003 and March 2009 (conversion group). All surgeries were performed by single senior hip surgeon. The conversion THA was done for secondary collapse and osteoarthritis in 17 hips and fixation failure in 1 hip. The index osteotomy procedures had been performed by the same surgeon using the technique described by Sugioka [12], modified in that the greater trochanter was not osteotomized. The modification of the technique was done to decrease tissue trauma and thereby provide better hip function. This method of TRO also allows for muscle–pedicle–bone grafting done at the same time. We used two or three 6.5-mm cannulated screws to fix the osteotomies [13].

There were 16 males and 2 females in this study group (Table 1). The mean interval between osteotomy and subsequent conversion THA was 2.6 years (range, 0–6 years). The mean age at the time of conversion THA was 38.1 years (range, 25–51 years). There were 8 hips in stage II and 10 hips in stage III according to the Association Research Circulation Osseous (ARCO) staging system [14]. The etiology of ONFH was idiopathic in six hips, alcoholism in six hips, steroid in four hips and post-trauma in two hips. Alcoholism and

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Table 1
Demographic Data of Patients.

	Conversion Group	PTHA Group
Number of patients	18	18
Male/female	16:2	16:2
Average age at time of THA (years)	38.1 (25–51)	39.8 (27–54)
BMI (kg/m^2)	24.4 (19.9–36.3)	25.1 (19.9–32.6)
THA side (right/left)	8:10	11:7
Etiology of ONFH		
Idiopathic	6	6
Alcoholism	6	10
Steroid	4	1
Post-trauma	2	1

THA indicates total hip arthroplasty; BMI, body mass index; ONFH; osteonecrosis of femoral head; PTHA, primary total hip arthroplasty.

idiopathic ONFH were the most common etiologies at our hospital. The preoperative assessment of the patients included the Harris hip scores (HHS) [15], WOMAC scores [16], range of motion (ROM) and limb length discrepancy (LLD). Two designs of cementless implants were used: DELTA PF cup (Lima-Lto, Udine, Italy) with M/L Taper stem (Zimmer, Warsaw, IN, USA) in 13 hips and Secur-fit cup (Stryker Orthopaedics, Mahwah, NJ, USA) with Wagner Cone Prosthesis stem (Zimmer, Warsaw, IN, USA) in 5 hips. An alumina head and an alumina liner (BIOLOX forte, CeramTec AG, Plochingen, Germany) were used in all 18 hips. The diameter of the femoral head was 28 mm in eight hips, 32 mm in one hip and 36 mm in nine hips.

All conversion THAs were performed through a posterior–lateral approach with the patient in a lateral decubitus position. We removed the previously inserted screws. The hip joint was dislocated and osteotomy of femoral neck was done with an oscillating saw. After removal of the femoral head, the acetabulum was reamed. We tried to place the acetabular cup in 15° anteversion and 40° abduction. The normal anteversion angle of the femoral neck was distorted because the neck had been rotated anteriorly by 70° to 90° during the previous osteotomy. Endosteal sclerotic bone present in the proximal femur along the path of the lag screws was removed with a burr. Thus, we used burr to remove sclerotic bone in the proximal femur and to prepare the femoral canal for reaming. The sclerotic bone on medial side of the neck and lateral subtrochanteric area was delicately burred off to avoid varus/valgus malposition of the stem and maintain correct anteversion. We tried to position the stem in 15°anteversion using transepicondylar axis of the femur as a reference line instead of the axis of the femoral neck at the cut surface. Press fit fixation for all cups and stems was ensured. Patients were instructed to walk with partial weight bearing with the aid of two crutches for 4 weeks after surgery (Fig. 1).

The control group consisted of 18 primary THAs for ONFH done by the same surgeon (PTHA group). This control group included 16 males and 2 females (Table 1) with a mean age of 39.8 years (range, 27–54 years). According to the ARCO staging, there were 2 hips in stage III and 16 hips in stage IV. The control group was matched for sex, age, THA side, the etiology of osteonecrosis and follow-up duration. The factors assessed were operative time, perioperative blood loss, length of hospitalization, clinical and radiological outcome. Follow-up evaluations were performed at 6 weeks, 3, 6, 9, and 12 months; and yearly thereafter using the HHS, WOMAC score, ROM. The mean follow-up duration was 54 months (range, 27–110 months) in the conversion group, and 55 months (range, 26–84 months) in the PTHA group. Radiographs were assessed by one knee specialist who has not involved in this study. Antero-posterior and frog leg view (Lauenstein's views) radiographs of the hips were taken at each follow-up. The radiological evaluations included the lateral opening angle (abduction) [17] and anteversion angle of the acetabular components [18], alignments of the femoral stems [19], and limb length discrepancy which was measured on the 6-week antero-posterior radiographs. The final follow-up radiographs were used to estimate acetabular fixation [20], femoral fixation [21,22], liner wear [23], osteolysis [24] and heterotopic ossification [25].

HHS, WOMAC score, and ROM before and after surgery were used as clinical parameter for comparison between the two groups at the final follow-up. We used the Fisher's exact test for categorical variables and the Mann–Whitney *U* test for numerical variables. All reported *P* values were two sided, and $P < 0.05$ was used to determine statistical significance. All hips were assumed to be independent in the statistical analysis. For all statistical analyses, we used SPSS software version 19.0 (SPSS Inc., Chicago, IL, USA).

Results

None of the patients were lost to follow-up and all 18 patients were available for review. There was an improvement in both the HHS and WOMAC scores between the preoperative and the last follow-up in both the groups (Table 2). However, there was no significant difference between the two groups. In the conversion group, the mean HHS before THA was 52 (range, 32–89) and at the last follow-up, it was 95 (range, 68–100). In the PTHA group, the mean HHS before THA was 51 (range, 35–66) and 95 (range, 87–100) at the last follow-up. On reviewing the details of the HHS, a significantly greater number of patients in the PTHA group were able to sit with a better ROM of the treated hip. The mean WOMAC score before THA was 61 (range, 24–89) and 68 (range, 56–82), which improved significantly at the last follow-up to 28 (range, 24–35) and 26 (range, 24–30) in the

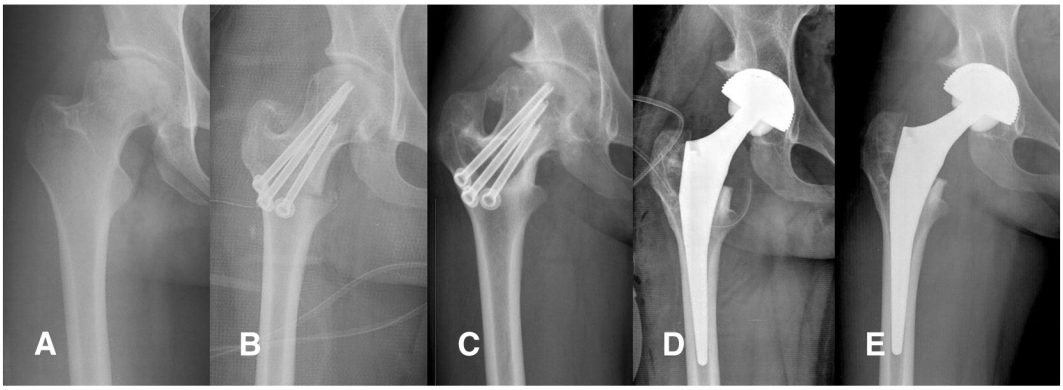

Fig. 1. (A) Preoperative radiograph of 20-year-old woman with osteonecrosis of femoral head. (B) Immediate postoperative radiograph after modified transtrochanteric osteotomy and bone graft. (C) Radiograph of 5-year and 6-month follow-up shows osteoarthritic change of her right hip joint. (D) Immediate postoperative radiograph after total hip arthroplasty. (E) Radiograph of 2-year follow-up shows good bone ingrowth without implant position change.

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