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The Results of Total Hip Arthroplasty After Sugioka Transtrochanteric Anterior Rotational Osteotomy for Osteonecrosis

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ABSTRACT

Background: Since Sugioka transtrochanteric anterior rotational osteotomy (ARO) for osteonecrosis of the femoral head (ONFH) changes the morphology of the proximal femur, total hip arthroplasty (THA) after previous ARO is considered a technically demanding procedure. The purpose of this study was to compare the clinicoradiologic outcomes of THA after ARO with those of THA without any antecedent surgery for ONFH.

Methods: Twenty-four hips in 20 patients who underwent cementless THA after ARO (postosteotomy group) were retrospectively reviewed and compared with patients who underwent cementless THA without any antecedent surgery for ONFH during the same period (primary group). In the postosteotomy group, the mean duration from ARO to THA was 19.7 years. All patients were followed for at least 5 years (mean, 8.3 years; follow-up rate, 78.5%). A clinical assessment was performed preoperatively and at the latest follow-up using the Harris Hip Score. A radiographic examination was performed at 3 months after THA and at the latest follow-up.

Results: The Harris Hip Score at the latest follow-up in the postosteotomy group was equivalent to that in the primary group, but longer operation time and greater intraoperative blood loss were observed in the postosteotomy group. There were no significant differences in postoperative complications, including dislocation (2 hips in each group). The leg lengthening in the postosteotomy group tended to be longer. No hips showed implant malpositioning, loosening, or required any revision surgery.

Conclusion: The clinicoradiologic outcomes of THA after ARO are considered to be comparable with those of THA without any antecedent surgery for ONFH.

Osteonecrosis of the femoral head (ONFH) has been reported to occur in young adults [1–3]. Once a necrotic lesion within the weight-bearing area of the femoral head progresses to the point of collapse, patients suffer from hip pain and a loss of the hip function, resulting in secondary osteoarthritis. Therefore, cases with a collapsed femoral head generally require surgical treatments, including total hip arthroplasty (THA) [4–11] and joint-preserving procedures [12–17].

THA has been used to treat ONFH, especially in the advanced stages [7,18], since this procedure can achieve pain relief and provide prompt functional improvement [5–11]. However, the durability of THA for ONFH has been questioned because of the relatively young age and high activity level of ONFH patients [18–20]. In addition, the revision rates in patients with ONFH have been reported to be significantly higher than those in patients with osteoarthritis, even in the same age groups (<50 years old) [4,5]. Therefore, joint-preserving procedures are usually considered in young patients with ONFH.

Sugioka transtrochanteric anterior rotational osteotomy (ARO) was developed as a joint-preserving procedure for ONFH [12]. Briefly, ARO includes transtrochanteric osteotomies as well as

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detachment of the major trochanter and anterior rotation of the femoral head with varus realignment to transpose the intact healthy area to a weight-bearing area, resulting in transfer of the necrotic area to a non–weight-bearing area [12] (Fig. 1A and B). The findings for ARO remain controversial. Some previous studies have reported good clinicoradiologic outcomes with ARO [12–17]. Hosokawa et al [16] showed that 85% of hips with ONFH and <2 mm of collapse achieved satisfactory results at >10 years follow-up after ARO. Motomura et al [17] also reported that the hip survival rate at 25 years after ARO was 73.7% (95% confidence interval, ±19.8%) in patients with systemic lupus erythematosus. On the other hand, other patients who underwent ARO suffered secondary osteoarthritis or failure of osteotomy. These cases required conversion to THA as a salvage operation, which is considered a technically demanding procedure because of the anatomic changes of the proximal femur after the osteotomy [21–24] (Fig. 1B). To our knowledge, there have been few reports describing the outcomes of THA after ARO in detail [21–24].

The authors hypothesized that the proper treatments for the anatomic changes of the proximal femur after ARO could provide the equivalent outcomes of conversion THA after ARO. The purpose of this study was to assess whether previous ARO affects the clinicoradiologic outcomes of conversion THA.

Materials and Methods

Patients

This retrospective review was approved by the local institutional review board. Between January 1998 and December 2010, 67 hips in 56 patients with ONFH underwent cementless THA at our institution. The diagnosis of ONFH was based on the findings of radiographs and magnetic resonance imaging. All the patients were classified as Stage IV with the modified Ficat system [25,26]. Of these patients, 53 hips in 44 patients who could be followed for at least 5 years were the subjects of this study (mean follow-up duration: 8.3 years; follow-up rate: 78.5%). These patients were divided into 2 groups depending on the presence/absence of previous ARO for ONFH. Since 24 hips in 20 patients (12 males and 8 females) who had been treated with ARO for ONFH subsequently underwent cementless THA after ARO, we defined these patients as the postosteotomy group. The remaining 29 hips in 24 patients (10 males and 14 females) did not have any antecedent surgery for ONFH and were therefore defined as the primary group. The details of the patients are listed in Table 1. The mean patient age at the time of THA was 58.4 and 57.3 years in the postosteotomy group and the primary group, respectively. In the postosteotomy group, the mean duration from ARO to THA was 19.7 years (range, 6.3-29.8 years) after ARO. The mean body mass index was 23.5 and 23.7 kg/m^2 in the postosteotomy and the primary groups, respectively. The etiology of ONFH in the postosteotomy group was steroid associated in 8 patients, alcohol associated in 8 patients, and idiopathic in 4 patients. The etiology of ONFH in the primary group was steroid associated in 16 patients, alcohol associated in 6 patients, and idiopathic in 2 patients.

Both the Harris Hip Score (HHS) [27] and the range of motion were compared between the postosteotomy and primary groups preoperatively and at the latest follow-up, respectively. Regarding the short-term disability (within 12 months after THA), the length of stay as well as the duration using assistive devices and the narcotic usage were compared between the 2 groups. In addition, both the operation time and the intraoperative blood loss were assessed from the medical records. Complications were also assessed in terms of dislocation, intraoperative fracture, infection, deep vein thrombosis, sciatic nerve palsy, and heterotopic ossification [28].

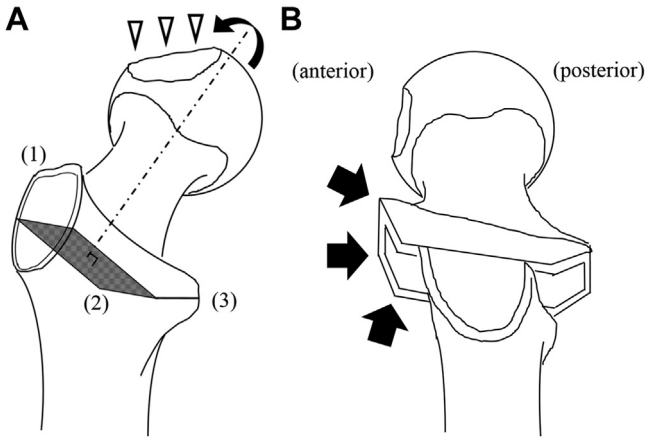

Fig. 1. Schematic illustration of Sugioka transtrochanteric anterior rotational osteotomy (ARO) in the left femur. (A) Posterior view of the left femur during ARO. ARO includes 3 osteotomies: (1) osteotomy of the greater trochanter, (2) intertrochanteric osteotomy (parallelogram), which is perpendicular to the neck axis (black dotted line) and passes through superolateral to inferomedial, and (3) an osteotomy which passes from the proximal flare of the lesser trochanter inferolaterally toward the inferomedial extent of the intertrochanteric osteotomy. After these osteotomies, the proximal fragment of the femur is rotated anteriorly (arrow) around the neck axis (black dotted line) to transpose the intact healthy area to a weight-bearing area, resulting in transfer of the necrotic area (arrow heads) to a non–weight-bearing area. (B) Lateral view of the left femur after ARO. Anterior overhang of the trochanteric region is seen (black allows).

Radiologic Assessments

Anteroposterior radiographs of the hips were assessed preoperatively, at 3 months after THA, and at the latest follow-up. The cup abduction angle was measured using the methods described by Nomura et al [29]. The cup anteversion angle was calculated using the method by Widmer [30]. The cup migration was defined as a change in position of ≧2 mm or more at the latest follow-up compared with that at 3 months after THA [21]. The femoral stem alignment was determined by measuring the angle between the longitudinal axis of femoral stem and that of the femoral canal. The stem alignment was defined as valgus with >5° of lateral deviation, and as varus with >5° of medial deviation [21]. Subsidence of the femoral stem was defined when the femoral stem progressively sank >3 mm between 3 months after THA and the latest follow-up

Table 1
Demographic Data of Patients and Implants.

	Postosteotomy Group: 24 Hips (20 Patients)	Primary Group: 29 Hips (24 Patients)	*P* Value
Age at THA (y)[a]	58.4 ± 9.2	57.3 ± 9.9	.92
Gender (n)			
Male/female	12/8	10/14	.36
Body mass index[a] (kg/m^2)	23.5 ± 2.5	23.7 ± 3.6	.78
Etiology of ONFH (n)			
Steroid/alcoholism/idiopathic	8/8/4	16/6/2	.21
Follow-up duration after THA (y)[a]	9.5 ± 3.3	7.3 ± 2.1	.022[b]
Implants of cementless THA (number of hips)			
AMS cup with PerFix910 stem	23	25	.306
Trabecular metal cup with VerSys cementless stem	1	1	
Trilogy with APS Natural-Hip system	0	3	
Ball size 22 mm/26 mm/32 mm	7/15/2	0/25/4	.0042[b]

ONFH, osteonecrosis of the femoral head; THA, total hip arthroplasty.
[a] Data were expressed as the mean ± standard deviation.
[b] Statistical significance was established at $P < .05$ for all tests.