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Original article

Significantly Poor Outcomes of Total Hip Arthroplasty After Failed Periacetabular Osteotomy

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ABSTRACT

Background: Periacetabular osteotomy (PAO) is an effective treatment for preosteoarthritis and early osteoarthritis in young and active patients with hip dysplasia. However, conversion to total hip arthroplasty (THA) for failed PAO is difficult owing to morphologic changes. The objective of the present study was to investigate outcomes of patients who underwent THA for failed PAO.
Methods: We performed a case–control study. The participants were 48 patients (52 hips) who underwent THA after PAO (the osteotomy group); type of PAO was eccentric rotational acetabular osteotomy in 36 hips and rotational acetabular osteotomy in 16 hips. These patients had a mean age at surgery of 56.5 years and underwent postoperative follow-up for a mean period of 5.4 years. For the control group, after matching age, gender, and time of surgery, we included 96 patients (104 joints) who underwent primary THA for hip dysplasia.
Results: The 2 groups demonstrated no significant difference in the preoperative Harris Hip Score. However, the osteotomy group demonstrated a significantly poor Harris Hip Score at the last follow-up, with particularly low scores for gait and activity. The osteotomy group demonstrated significantly poor range of motion at the last follow-up. Although neither group had any cases of revision surgery, both groups had 1 case of postoperative dislocation. Considering socket placement in Lewinnek's safe zone, the osteotomy group had significantly poorer results compared to that obtained after primary THA.
Conclusion: The therapeutic outcomes and socket positioning for THA after PAO were poorer compared to those of primary THA.

Various types of periacetabular osteotomy (PAO) are considered for acetabular dysplasia in young adults to prevent progression of osteoarthritis [1-4]. We have previously developed a type of PAO, named the eccentric rotational acetabular osteotomy (ERAO) [4], an improved version of rotational acetabular osteotomy (RAO) [1], and we have reported the favorable long-term outcomes [5]. ERAO is a spherical osteotomy and provides early bone union because of no bone defect between acetabular fragment and host bone. It will be beneficial for early ambulation and bone union. However, some patients who undergo PAO demonstrate long-term progression of osteoarthritis, thereby needing conversion to total hip arthroplasty (THA) [6-10]. In THA after failed PAO, rotation of the acetabular fragment results in morphologic changes, which are reported to make surgical techniques difficult [6,7,9]. In addition, as THA is a reoperation on the hip, therapeutic outcomes are reported to be poorer than that obtained after primary THA [11].

The objective of the present study was to clarify the difference of the clinical outcomes and imaging findings between primary THA and THA after failed PAO.

Patients and Methods

We obtained institutional review board approval for the study. All patients provided informed consent to participate in the study. The participants were 67 patients (71 hips) who consecutively underwent THA between April 2000 and April 2014 owing to progression of osteoarthritis after PAO. We excluded 18 hips that

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also underwent concomitant intertrochanteric valgus osteotomy to improve joint conformity, and 1 patient (1 hip) who could not be followed up. The osteotomy group finally consisted of 48 patients (52 hips). The type of PAO was ERAO [4] in 36 hips at our institution and RAO [1] in 16 hips at other hospitals. The participants comprised 2 men (2 hips) and 46 women (50 hips), with a mean age of 56.5 years (range, 44-74 years) at the time of THA; the patients were followed up for a mean period of 5.4 years (range, 1-14 years; Table 1). The mean age at the time of PAO was 45.2 years. Tonnis classification for osteotomy group was stage1 for 2 cases and stage2 for 34 cases at time of preoperative ERAO. We could not investigate the detail of Tonnis classification for 16 cases of preoperative RAO performed in other hospitals. We performed PAO through a trans-trochanteric lateral approach. Almost the cases of screws and wire were removed after 1 year of PAO. The mean interval from PAO to THA was 11.4 years (range, 1-23 years). All patients were stage 3 osteoarthritis of Tonnis classification at the time of conversion to THA. The control group was abstracted via hospital records from among approximately 1500 cases of THA performed between 2000 and 2014. Patients were matched by age (±2 years), gender, and time of surgery (±1 year). We abstracted 96 patients (104 hips) with no history of osteotomy who had undergone primary THA for Crowe type I/II hip dysplasia to perform a case–control study. All cases of THA after PAO and primary THA were performed by a single senior surgeon or under the guidance of a senior surgeon.

In all cases, THA was performed via a standard posterior approach, with the patient in the lateral decubitus position. To install the socket at a precise angle, we placed a guidewire on the pelvis [12]. The guidewire was placed to perform surgery with 45° inclination and 20° anteversion.

Generally cementless sockets were chosen; however, in the case of poor bone quality on preoperative radiography findings and problems with fixation, cement sockets were chosen instead. For preoperative planning, the socket was positioned in the anatomic center of the hip to the maximum extent possible. Autologous bone grafting was performed from the femoral head for the patients with a high hip center after PAO. Bone grafting was performed in 11 of 52 (21%) cases in the osteotomy group and 12 of 104 (12%) cases in the control group. Cementless sockets were used for 44 hips, and cement sockets were used for 8 hips. These 52 sockets comprised Trident HA (Stryker Orthopedics, Mahwah, NJ) for 25 hips, TriAD HA (Stryker Orthopedics) for 13 hips, Secur-Fit AD (Stryker Orthopedics) for 6 hips, and an all-polyethylene acetabular cup (Stryker Orthopedics) for 8 hips.

As a rule, cementless stems were chosen, except for patients with Dorr Type C femoral bone with an expanded medullary cavity, for whom, cement stems were chosen. Cementless stems were used for 43 hips, and cement stems were used for 9 hips. These stems consisted of Super Secur-Fit (Stryker Orthopedics) stems for 43 hips, Exeter (Stryker Orthopedics) stems for 7 hips, and Omnifit Super EON (Stryker Orthopedics) stems for 2 hips (Table 2).

The groups demonstrated no significant difference in age, gender, body mass index, or follow-up period. For the implants used, cement sockets and cement stems were significantly more common in the osteotomy group.

Table 1
Patient Demographics.

	Osteotomy Group (n = 52)	Control Group (n = 104)	*P*
Number of hips	52	104	
Number of patients	48	96	
Gender (male/female)	2/46	2/94	.456
Height (cm)	153.6 ± 4.4	152.6 ± 6.3	.367
Weight (kg)	56.7 ± 9.4	54.9 ± 12.6	.257
BMI	23.9 ± 4.0	23.3 ± 3.6	.388
Age at THA (y)	56.5 ± 6.4	57.0 ± 6.3	.632
Duration PAO to THA (y)	11.4 ± 6.8		
Follow-up (y)	5.4 ± 3.2	5.3 ± 3.1	.956
Acetabuler socket (cementless/cement)	45/7	103/1	<.01
Femoral stem (cementless/cement)	44/8	101/3	<.01
Socket size (mm)	48.8 ± 3.7	47.4 ± 4.3	.018
Bone grafting	11 (21%)	12 (12%)	.122

BMI, body mass index; PAO, periacetabular osteotomy; THA, total hip arthroplasty.

Table 2
Types of Hip Prosthesis.

	Osteotomy Group (n = 52)	Control Group (n = 104)
Joint articulation (hips)		
Metal on polyethylene	13	11
Ceramic on polyethylene	11	23
Ceramic on ceramic	28	70
Acetabular cup (hips)		
Cementless cup		
Trident HA	25	66
TriAD HA	13	27
Secur-Fit AD	6	10
Cement cup		
All-polyethylene acetabular cup	8	1
Femoral stem (hips)		
Cementless stem		
Super Secur-Fit	43	101
Cement stem		
Exeter	7	2
Omnifit Super EON	2	1

Clinical Evaluation

We examined the medical records to determine the operative time, intraoperative blood loss, and postoperative complications such as infection, deep venous thrombosis, dislocation, and nerve palsy. Hip function was evaluated by using the Harris Hip Score (HHS) and range of motion (ROM) before surgery and at the last follow-up. Both HHS and ROM were assessed annually by a single senior surgeon for the osteotomy group, and they were abstracted from the medical records for the control group.

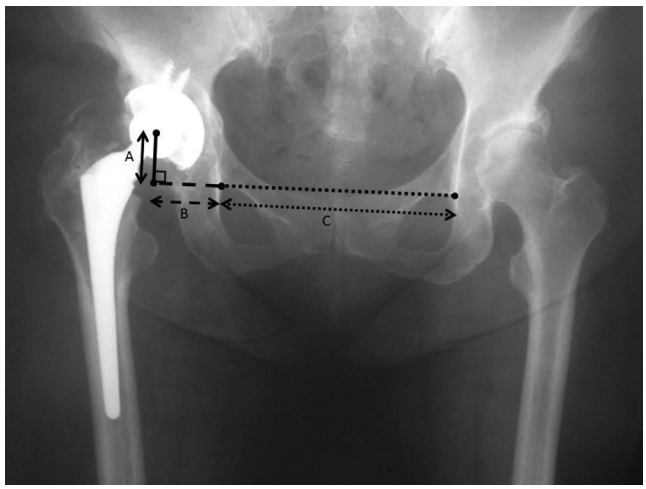

Fig. 1. Measurements of the hip joint center on an anteroposterior radiograph of the pelvis. A, vertical distance; B, horizontal distance; C, interteardrop line that connects both inferior edges of the teardrop.