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Conversion Hip Arthroplasty in Failed Fixation of Intertrochanteric Fracture: A Propensity Score Matching Study

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ABSTRACT

Background: Conversion hip arthroplasty is a salvage procedure for failed internal fixation of intertrochanteric fractures. However, the technical difficulties and perioperative morbidity of conversion arthroplasty are uncertain.
Methods: We compared the type of arthroplasty (total hip arthroplasty or hemiarthroplasty), operative parameters, perioperative morbidity, 1-year mortality, implant stability, and clinical results of 33 conversion hip arthroplasties due to a failed internal fixation of intertrochanteric fracture with those of a matched control group of 33 primary hip arthroplasties due to the same fracture. Propensity score was used for the control matching of gender, age, and body mass index.
Results: Total hip arthroplasty was more frequently performed in the conversion group (10/33) compared to the primary group (3/33) ($P = .016$). The operation time, perioperative blood loss, amount of transfusion, and risk of femoral fracture during the operation were increased in the conversion group. The overall 1-year mortality was 3% (1 patient) in the conversion group and 9% (3 patients) in the primary group ($P = .307$). At a mean of 3-year follow-up, there was no significant difference in clinical results and none of the implants were loose in both groups.
Conclusion: In patients with failed internal fixation of intertrochanteric fracture, conversion hip arthroplasty should be planned and executed, bearing in mind the increased operative morbidities corresponding to operation time, perioperative blood loss, requirement of transfusion, and intraoperative femoral fracture.

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Internal fixation is the treatment of choice for most of intertrochanteric fractures. However, fixation is frequently associated with a failure especially in osteoporotic elderly patients. Reportedly, rates of fixation failure ranged from 1.2% to 9.6% [1,2]. Conversion hip arthroplasty is a salvage procedure in patients with this failure [3]. Several studies have reported favorable results of conversion arthroplasty [4,5].

During conversion, previous hardware should be removed and adhesions should be released. Altered anatomical structure owing to previous surgery and compromised bone quality due to preexisting osteoporosis and prolonged immobilization often convolute arthroplasty. Due to these technical challenges, conversion arthroplasty might be associated with increased risk of perioperative morbidity [5-9].

Previous studies of conversion hip arthroplasty were case series lacking proper comparative group [10-15] or compared the results with those of conversion arthroplasties due to other reasons than fixation failure of intertrochanteric fracture [8,16,17].

We postulated that there are differences in the type of arthroplasty (total hip arthroplasty [THA] vs hemiarthroplasty [HA]), operative parameters, morbidity, mortality, and outcome of arthroplasty between conversion hip arthroplasty after fixation failure of intertrochanteric fracture and primary arthroplasty for the same fracture. The purpose of our study was to determine whether there were differences in the type of arthroplasty,

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operative parameters, perioperative morbidity, 1-year mortality, and postoperative outcome between conversion hip arthroplasty due to fixation failure and primary hip arthroplasty in intertrochanteric fracture.

Materials and Methods

Patients

The study design and protocol of this retrospective study were approved by the Institutional Review Board in our hospital.

Between October 2003 and March 2015, 33 hips in 33 patients, who had been treated previously by internal fixation for intertrochanteric fractures, were converted into hip arthroplasty (HAs or THAs) because of failure of fixation. Among the 33 patients, 26 patients had undergone internal fixation elsewhere and transferred to our institution for the treatment of fixation failure. Fourteen hips were treated with compression hip screw and 19 hips with intramedullary nail. The causes of failure were cutting out in 22 hips, nonunion in 7, cutting through in 2, and metallic failure in 2.

There were 10 men (10 hips) and 23 women (23 hips) and the mean age at the time of internal fixation was 74.1 years (range 45-92). The mean interval between internal fixation and conversion hip arthroplasty was 11 months (range 0.5-48). The mean age at the time of conversion was 75.1 years (range 47-96). The type of conversion was THA in 10 hips and bipolar HA in 23. The initial fracture pattern was stable in 8 hips and unstable in 25 [18].

Control subjects were matched with each of the 33 hips for gender, age, and body mass index by using propensity score [19] (Table 1). The indication for primary hip arthroplasty was ≥3-part fractures, loss of posteromedial cortical buttress, and severe osteoporosis (Singer index ≥ 4). All 33 fractures were unstable fracture patterns in the control group [18].

Surgical Techniques

To rule out infection, we routinely performed hematologic tests including complete blood cell count, erythrocyte sedimentation rate, and C-reactive protein (CRP) before arthroplasty. When there was an unexplained elevation of erythrocyte sedimentation rate, C-reactive protein, and/or white blood cell count in preoperative laboratory workup, we analyzed joint aspirate using sonography before arthroplasty.

All 33 conversion hip arthroplasties were carried out through the posterolateral approach. Femoral head was dislocated before removal of previously inserted implant for fixation, in order to prevent femoral fracture. After the removal of fixation devices, the femoral head was removed and femoral canal was prepared.

We used a gauge osteotome and/or a burr to remove endosteal sclerotic bone, which was formed in the proximal femur along the lag screw. Special attention was paid to remove sclerotic bone in the medial portion of the femoral neck and the lateral portion of subtrochanteric area to avoid varus or valgus positioning of the stem. We tried to place the femoral component at 15° of anteversion according to the horizontal axis of the knee joint, instead of referencing axis of the femoral neck, because of postoperative deformity in the proximal femur. In case of THA, we tried to place the acetabular component at 15° of anteversion and 40°-45° of abduction angle. Cups and stems were inserted in a press-fit manner.

We also used posterolateral approach in all primary hip arthroplasties. After the insertion of cementless stem, the greater trochanteric and the medial fracture fragments were reduced and fixed with 2-4, 16-gauge wires. In case of THA, target position of the acetabular cup was the same as that of the conversion group.

Table 1
Patient Demographic Data.

	Conversion Group ($n = 33$)	Control Group ($n = 33$)	*P* Value
Male/Female	10/23	11/22	1.000
Age at hip arthroplasty (y)	75.1 ± 11.0	75.1 ± 10.4	.991
BMI (kg/m^2)	23.4 ± 4.0	23.5 ± 3.5	.896
Preinjury Koval score	2.8 ± 1.9	2.6 ± 1.9	.746
ASA score	1.6 ± 0.07	1.6 ± 0.5	.926

BMI, body mass index, ASA, American Society of Anesthesiologists physical status classification.

Implants

Cementless implants were used in all patients in both groups. We exclusively used cementless stems even in elderly patients, because of concerns of cement-related cardiopulmonary complications [20].

For the conversion group, Bencox II stem (Corentec, Cheonan, South Korea) was used in 9 hips, BiCONTACT® stem (Aesculap, Tuttlingen, Germany) in 7, KAR stem (DePuy, Warsaw, IN) in 6, COREN POROFIX (Corentec) in 4, Bencox ID stem (Corentec) in 2, and Bencox stem (Corentec) in 2. Bencox M stem (Corentec), CORAIL (DePuy), and ML taper stem (Zimmer, Warsaw, IN) were used in one hip each. In 10 patients, who were treated with THA, COREN cup (Corentec) was used in 6 hips, PLASMACUP® SC (Aesculap) in 2 hips, Trilogy cup (Zimmer) in 1 hip, and Pinnacle cup (DePuy) in 1 hip. Alumina ceramic head (BIOLOX® forte; CeramTec AG, Plochingen, Germany) was used in 21 hips, Delta ceramic head (BIOLOX delta, CeramTec) in 7 hips, and CoCr head in 5 hips. In 23 HAs, ultra-high-molecular-weight polyethylene (UHMWPE) liner was coupled with all 5 metal heads and 18 alumina ceramic heads. In 10 THAs, all 7 Delta ceramic heads were coupled with Delta ceramic liners, 2 alumina ceramic heads with alumina ceramic liners, and 1 alumina ceramic head with UHMWPE liner. The diameter of the femoral head was 28 mm in 23 hips, 32 mm in 8 hips, 22 mm in 1 hip, and 36 mm in 1 hip.

For the control group, KAR stem (DePuy) was used in 10 hips, Bencox stem (Corentec) in 8, COREN POROFIX (Corentec) in 5, BiCONTACT stem (Aesculap) in 5, CORAIL (DePuy) in 3, and Bencox II stem (Corentec) in 2. In 3 patients, who were treated with THA, Pinnacle cup (DePuy) was used and all 3 Delta ceramic liners were coupled with Delta ceramic heads. In 30 HAs, UHMWPE liner was coupled with 11 metal heads and 19 alumina ceramic heads. Alumina ceramic head was used in 19 hips, Delta ceramic head in 3 hips, and CoCr head in 11 hips. The diameter of the femoral head was 28 mm in 27 hips, 22 mm in 3 hips, 36 mm in 2 hips, and 32 mm in 1 hip.

Postoperative Care With Assessment

Patients were instructed to walk with partial weight bearing with the aid of 2 crutches for 4 weeks after surgery. All patients had mechanical prophylaxis of venous thromboembolism by an intermittent pneumatic compression device. Follow-up evaluations were performed at 6 weeks; at 3, 6, 9, and 12 months, and every year thereafter. Patients who had not returned for regular scheduled visits were contacted by telephone. These 33 patients (33 hips) were followed up for an average of 3.0 years (range 0.5-11.3) after conversion hip arthroplasty.

We compared the type of arthroplasty (THA or HA), operation time, broken screw which was left, perioperative blood loss, requirement of transfusion, cup position and stem alignment, intraoperative complications, and hospital stay between the

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