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Influence of Prior Hip Salvage Surgery on Outcomes After Total Hip Arthroplasty in Young Patients

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ABSTRACT

Background: As the indications for total hip arthroplasty (THA) have expanded, this procedure is being increasingly performed in young patients. Oftentimes, this population has undergone one or more salvage procedures in an attempt to delay or forestall a THA. However, it is unclear whether patients with prior salvage procedure have higher risk of adverse events.

Methods: From 2004 to 2014, 215 THAs performed in patients less than 30 years at a single institution were identified. These patients were screened to identify 37 THAs in which one or more salvage procedures were performed prior to the THA (salvage group). The prior salvage procedures were open in 30 (pelvic osteotomy = 5, femoral osteotomy = 15, combined osteotomy = 2, core decompression = 7, bone graft = 1) and arthroscopic in 7. Medical and surgical complications within 90 days and overall survivorship at a minimum follow-up of 2 years were recorded. Nonparametric tests and Kaplan-Meier survival curves were used to compare the groups.

Results: Salvage group had a higher rate of wound complications ($P = .037$), superficial infections ($P = .005$), and reoperations ($P = .015$). The 5-year survivorships in the salvage and nonsalvage groups were 97.1% and 96.7%, respectively ($P = .787$).

Conclusion: Patients less than 30 years who undergo THA after a previous salvage procedure have a higher risk of wound complications, superficial infections, and reoperations, but similar survivorship, compared to those who did not have any prior salvage procedures. This information is helpful in counseling young patients while offering various surgical options for the management of various hip pathologies.

Total hip arthroplasty (THA) is increasingly performed in young patients [1,2]. A number of hip pathologies such as hip dysplasia, osteonecrosis, Perthes disease, and post-traumatic arthritis can result in debilitating hip symptoms in young patients and may need to be treated with THA [3,4]. Despite the improvements in surgical techniques and implant designs, THA is often delayed in these patients due to the concerns about the prosthetic longevity [5,6]. Various joint preserving surgeries are sometimes attempted before a THA is considered, especially when there are lesser degrees of damage to the articular cartilage [7,8]. Although some surgeries such as labral repair and chondroplasty can be performed arthroscopically with little morbidity, surgeries like periacetabular and femoral osteotomies are associated with marked morbidity [9–12]. The success rates of these procedures are variable with many patients eventually requiring a THA [9,12–14].

Although many patients undergoing salvage procedures experience improvements in symptoms and have delayed the need for a THA, there are concerns that these procedures might make subsequent conversion difficult [15–17]. In addition to understanding the outcomes of various salvage procedures, it is important to study the outcomes of conversion in order to make a comprehensive assessment of the long-term benefits of an initial preservation approach [18,19]. Previous studies evaluating the outcomes of conversion THAs after failed salvage procedures have yielded mixed results [15,17,20–23]. Although some have demonstrated that THAs performed after a failed salvage procedure have worse outcomes,

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other did not show any differences [15,17,20,21]. One possible reason for the discrepancy in the results between the studies is the low sample size in some (range 26-411 THAs) [15,17,20,21]. Furthermore, the majority of previous studies reporting the outcomes of conversion THAs included patients from all age groups [15,17,20–23]. As salvage procedures are usually indicated in young patients, it is important to specifically study their effect in this specific subset [7,8].

Therefore, the objectives of this study were to compare (1) lengths-of stay (LOS) and discharge destination, (2) medical and surgical complications within 90 days, (3) survivorship, and (4) radiographic outcomes between THAs with and without prior salvage procedure in patients less than 30 years.

Methods

After obtaining approval from the institutional review board, a consecutive series of all THAs performed at a large single institution from January 1, 2004 to December 31, 2014 were identified using an electronic medical query. Patients were included if they were less than 30 years at the time of THA and were excluded if they received a hip resurfacing or had a simultaneous bilateral procedure. A total of 215 THAs (174 patients) meeting the inclusion/exclusion criteria were included. Demographics, surgical and medical history, and outcomes were recorded by manual chart review.

A hip salvage procedure or joint preserving procedure was defined as any surgery aimed at improving the symptoms while preserving the joint surface. For the purposes of the study, we included both arthroscopic and open surgeries aimed at treating the arthritis and joint deformity. Surgeries which were performed for the inciting event and not for the secondary arthritis/deformity such as open reduction and internal fixation for fractures, irrigation, and debridement for septic arthritis and pin fixation of slipped capital femoral epiphysis (SCFE) were not considered as salvage procedures. Thirty-seven (34 patients) THAs had a prior salvage procedure (salvage group). The mean number of surgeries in these patients was 1.9 ± 1.5, and the mean duration between the last salvage procedure and THA was 4.9 ± 5.4 years. The indications of these THAs were osteonecrosis (n = 17; Perthes disease = 5, steroid use = 4, sickle cell disease = 3, others = 5), developmental dysplasia of the hip (n = 10), chondrolysis (n = 3), secondary arthritis from SCFE (n = 2), multiple epiphyseal dysplasia (n = 2), post-traumatic (n = 1), post-septic arthritis (n = 1), and inflammatory arthritis (n = 1). The prior salvage procedures were open in 30 and arthroscopic in 7. The open procedures include acetabular/pelvic osteotomies (n = 5), proximal femoral osteotomy (n = 15), combined pelvic and femoral procedures (n = 2), core decompression (n = 7), and vascularized fibular bone graft (n = 1), while arthroscopic procedures were osteochondroplasty with or without labral repair (n = 4) and labral repair (n = 3). The reasons for failure of the salvage procedures were progression to arthritis (n = 30), advanced collapse of femoral head with minimal arthritis (n = 4), persistent pain with limited range of motion (n = 2), and nonhealing of osteotomy (n = 1).

All patients had a cementless THA. The following bearing surfaces were used: ceramic-on-polyethylene (n = 102 [47%]), ceramic-on-ceramic (n = 101 [47%]), metal-on-polyethylene (n = 8 [4%]), and metal-on-metal (n = 4 [2%]). The acetabular and femoral components used in the study cohort are given in Table 1. Baseline characteristics of all the patients are given in Table 2. The mean age of the salvage group was 23.1 ± 4.9 years and majority of the patients were women (22/37 [59.5%]). There were no significant differences between the 2 groups (P > .05 for all comparisons). Furthermore, no differences were found between those with an open salvage procedure and those who did not have any salvage procedure (P > .05 for all comparisons).

Table 1
The Implants Used in the Study Population (n = 215).

Implants	Number of Hips (%)
Acetabular components	
Trident (Stryker)	131 (60.9)
R3 (Smith & Nephew)	25 (11.6)
Pinnacle (DePuy)	19 (8.8)
Tritanium (Stryker)	13 (6.0)
Continuum (Zimmer Biomet)	10 (4.7)
Novation (Exactech)	8 (3.7)
Reflection (Smith & Nephew)	5 (2.3)
Regenerex (Zimmer Biomet)	2 (0.9)
DuraLoc (DePuy)	2 (0.9)
Femoral components	
Accolade TMZF (Stryker)	130 (60.5)
Synergy (Smith & Nephew)	30 (14.0)
S-ROM (DePuy)	19 (8.8)
Accolade II (Stryker)	14 (6.5)
M/L Taper (Zimmer Biomet)	10 (4.7)
Novation (Exactech)	8 (3.7)
Corail (DePuy)	4 (1.9)

LOS and discharge disposition (home vs others) were recorded for all patients. We also assessed the following complications within 90 days of the procedure: unplanned readmission for any cause, any reoperation of the same joint, dislocation, wound complications, superficial infection, periprosthetic joint infection, pulmonary embolism (PE), and deep vein thrombosis (DVT). A wound complication was defined as the presence of any drainage or dehiscence of the wound. Superficial infection was defined using Centers for Disease Control and Prevention guidelines, while periprosthetic joint infection was defined based on the Musculoskeletal Infection Society criteria [24,25]. The presence of PE and DVT was assessed based on clinical, radiographic, and laboratory features. Implant survivorship, which was defined as the probability of survival without the need for revision of any components, was recorded for all patients who had a minimum follow-up of 2 years. Radiographs were obtained for all patients during their follow-up visits and the radiographs at the last visit were reviewed by 2 of the authors (J.G., E.M.M.) for component malalignment, progressive radiolucencies, and implant subsidence.

All patients had complete data with respect to LOS, discharge destination, 90-day complications, and radiographic outcomes, and were included for the analyses of the respective outcomes. For the analysis of survivorship, only 189 (88%) THAs with at least 2 years of follow-up were included for the analysis. The mean follow-up was 5.9 ± 3.2 years for the patients included for survivorship analysis. There were 3 (8%) THAs in the salvage group and 23 (13%) THAs in the nonsalvage group which were lost to follow-up. There was no difference in the number of THAs lost to follow-up among the salvage and nonsalvage groups (P = .582).

Differences in continuous variables were tested using Wilcoxon rank-sum test. Differences in categorical variables were tested using Fisher's exact test or chi-squared test as appropriate. Although the effect of each type of salvage procedure on subsequent THA is expected to be different, separate analysis for each salvage procedure was not attempted due to inadequate numbers. However, a separate subgroup analysis was performed comparing those who received an open salvage procedure with those who did not have any prior salvage procedure. Kaplan-Meier survival curves were used to calculate the survivorship free of any revision for both the salvage and nonsalvage groups. Cox proportional hazards model was used to identify whether prior salvage procedures were associated with worse survival. As baseline characteristics did not show any difference between the salvage and nonsalvage groups, adjusting for these characteristics was not performed (see Table 1). The level of significance was set at $P < .05$. Data analyses were