Revision Hip Arthroplasty in Patients With a Previous Total Hip Replacement for Osteonecrosis of the Femoral Head

YOUN-SOO PARK, MD; YOUNG-WAN MOON, MD; KEUN-HO LEE, MD; SEUNG-JAЕ LIM, MD

Abstract

Patients with osteonecrosis of the femoral head are typically relatively young and active and often require high rates of revision after primary total hip arthroplasty. However, outcomes of revision hip arthroplasty in this patient population have rarely been reported in the literature. The authors conducted a retrospective review of 72 patients (75 hips) who underwent revision hip arthroplasty with a primary diagnosis of osteonecrosis of the femoral head. Mean age at index revision was 53.3 years (range, 34-76). Components of acetabular revision included a cementless porous-coated cup in 58 hips and an acetabular cage in 3 hips. Components of femoral revision included a fully grit-blasted tapered stem in 30 hips and a proximally porous-coated modular stem in 9 hips. Mean duration of follow-up was 7 years (range, 3-17). Mean Harris Hip Score improved from 49 points preoperatively to 90 points postoperatively. At final follow-up, 11 hips (14.7%) required reoperation because of aseptic loosening (6 hips), infection (2 hips), recurrent dislocation (1 hip), periprosthetic fracture (1 hip), and ceramic fracture (1 hip). Kaplan-Meier survivorship with an endpoint of re-revision for any reason was 81% and for mechanical failure was 87.5% for the cup and 100% for the stem at 10 years. Unlike the previous report, the authors’ study showed a lower failure rate of the femoral stem after revision hip arthroplasty using modern cementless femoral components in patients with osteonecrosis of the femoral head. Aseptic cup loosening or osteolysis is the most common mechanism of failure at medium-term follow-up. [Orthopedics. 2014;37(12):e1058-e1062.]

The authors are from the Department of Orthopaedic Surgery, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, South Korea.

The authors have no relevant financial relationships to disclose.

Correspondence should be addressed to: Seung-Jae Lim, MD, Department of Orthopaedic Surgery, Samsung Medical Center, 50 Iwon-Dong, Gangnam-Ku, Seoul 135-170, South Korea (limsj@skku.edu).

Received: December 29, 2013; Accepted: March 4, 2014; Posted: December 10, 2014.

doi: 10.3928/01477447-20141124-51
Traditionally, results of primary total hip arthroplasty (THA) have been inferior in patients with osteonecrosis of the femoral head compared with patients with osteoarthritis.\(^1\) With the use of modern prosthetic designs and techniques, several reports have shown improved outcomes of THA in this patient population.\(^2\) However, revision rates after primary THA remain high for patients with osteonecrosis of the femoral head because these patients are usually younger and more active than patients with osteoarthritis.\(^3\) In addition, etiologic factors associated with osteonecrosis, such as corticosteroid use and alcohol dependence, are associated with poor quality of bone stock and potentially poor implant fixation. Revision hip arthroplasty in patients with osteonecrosis of the femoral head is a considerable issue, but the outcomes are not fully understood.\(^4,5\) Wei et al\(^6\) reported comparable success rates with revision THA using cemented stems in patients with either osteonecrosis or osteoarthritis. In contrast, Hungerford et al\(^7\) reported a high failure rate for revised, uncemented, proximally coated femoral components in osteonecrotic hips.

The goal of this study was to evaluate intermediate-term clinical and radiographic outcomes of revision hip arthroplasty with modern cementless components in patients with osteonecrosis of the femoral head.

**Materials and Methods**

After approval was obtained from the institutional review board, the authors conducted a retrospective review of 137 patients who had undergone revision hip arthroplasty with a primary diagnosis of osteonecrosis of the femoral head at their institution between November 1994 and December 2009. Of these, 38 patients who had undergone polyethylene cementing or exchange with retention of the cup and stem and 19 patients who had undergone revision surgery because of infection or recurrent instability were excluded. In addition, 3 patients died before the 3-year evaluation and 5 patients were lost to follow-up. The final study cohort consisted of 72 patients (75 hips), with mean age at revision surgery of 53.3 years (range, 34-76). The study group included 41 men and 31 women. Risk factors for osteonecrosis included excessive alcohol intake in 19 patients, corticosteroid use in 15 patients, and trauma in 5 patients. No risk factors were identified in 34 patients. The average time from primary THA to index revision surgery was 11.4 years. Preoperative acetabular and femoral bone defects were classified according to the Paprosky system.\(^8\) Mean follow-up after the index revision was 7.1 years (range, 3-17).

All procedures had been performed by a single surgeon (K.-H.L.). Among total 75 hips, isolated cup revision was performed in 36, simultaneous cup and stem revision in 25, and isolated stem revision in 14. Components used in acetabular revision included cementless hemispheric porous-coated sockets in 58 hips and acetabular cages in 3 hips. Components used in femoral revision included fully grit-blasted tapered stems in 30 hips and proximally porous-coated modular stems in 9 hips. Average outer diameter of the acetabular socket was 58.8 mm (range, 50-70), and average diameter of the femoral head was 29.3 mm (range, 28-36). Bearing surfaces included conventional polyethylene in 28 hips, highly cross-linked polyethylene in 24, and ceramic-on-ceramic in 23.

Clinical and radiographic evaluations were performed preoperatively, at 6 weeks, 3 months, 6 months, and 1 year postoperatively, and then annually. Clinical evaluations were performed using the Harris Hip Score.\(^9\) “Excellent” was defined as a score of greater than 90 points, “good” as 80 to 89 points, “fair” as 70 to 79 points, and “poor” as less than 70 points. Radiographic analyses were performed using standardized anteroposterior and lateral radiographs of the affected hips taken postoperatively, during hospitalization, and at each follow-up visit. All radiographs were digitized with PathSpeed software (General Electric Inc, Milwaukee, Wisconsin) and reviewed by a single independent observer who did not participate in the clinical care of patients (Y.-S.P.). Radiolucent lines of greater than 2 mm around the acetabular component were identified and assigned to 1 of the 3 zones described by DeLee and Chanley.\(^10\) Acetabular cup loosening was defined as 1 of the following: progression of radiolucent lines, acetabular screw breakage, or greater than 2 mm of acetabular cup migration and change in the cup inclination angle of greater than 4°. Stability of the femoral components was assessed using the criteria described by Engh et al.\(^11\) Subsidence of the femoral component was evaluated by measuring the change in distance between the most proximal point of the lesser trochanter and the most superomedial point of the femoral component on sequential radiographs.\(^12\) Periprosthetic osteolysis was defined as radiographic appearance of a focal area of bone resorption as a cystic or scalloped lesion that was not linear and was at least 5 mm wide.\(^13\) Postoperative complications, such as infection, nerve palsy, dislocation, and periprosthetic fracture, were also documented.

Statistical analysis was performed with SPSS version 15.0 software (SPSS, Chicago, Illinois). Paired Student’s t test was used to compare preoperative and postoperative Harris Hip Scores. Kaplan-Meier survivalship curves were generated, with failure defined as the need for re-revision for mechanical failure of the cup or stem and with failure defined as the need for re-revision for any reason. Chi-square test or, when necessary, Fisher’s exact test, was used to compare the surviving and failed hips. Statistical significance was set at P<.05.

**Results**

Mean Harris Hip Score improved from 49 points (range, 24-89) preoperatively to 90 points (range, 52-100) at final fol-
Kaplan-Meier survival analysis of the cup (Fig. 2). The survival rate at 10 years was 98.4% (95% CI, 88.9%-99.8%) and 90.7% at 10 years (95% CI, 81.9%-96.4%). Survival rates with an endpoint of mechanical failure of the femoral stem were 100% at both 5 years (95% CI, 100%-100%) and 10 years (95% CI, 100%-100%) (Fig. 2). When surviving and failed hips were compared, no significant differences were found regarding age, sex, body mass index, preoperative bone defects, or bearing surfaces used. Two of 58 cementless hemispheric porous-coated sockets and 1 of 3 acetabular cages failed because of aseptic loosening. None of the 30 fully grit-blasted tapered stems failed because of aseptic loosening, but 1 of 9 proximally porous-coated modular stems failed because of aseptic loosening. Re-revision surgery for extensive wear and osteolysis was performed in 2 of 28 conventional polyethylene bearings. No cases of re-revision occurred in either 24 highly cross-linked polyethylene bearings or 23 ceramic-on-ceramic bearings (Fig. 3).

**DISCUSSION**

Recent advances in surgical techniques and prosthesis designs have resulted in improved outcomes of primary THA in patients with osteonecrosis of the femoral head. However, revision hip arthroplasty in this patient population can be a challenging procedure because of the relatively young age of the patients and poor quality of the bone stock. Few reports have described revision hip arthroplasty in this patient population, and only 1 study reported the survival rate of femoral re-revision using modern cementless femoral components. Wei et al. directly compared the results after cementless cup and cemented femoral stem revision in patients with either osteonecrosis or osteoarthritis. The failure rates were 18% in the osteonecrosis group and 16% in the osteoarthritis group at an average follow-up of 7 years. Hungerford et al. reported intermediate-term results in 34 hips that underwent revision arthroplasty using cementless femoral components in 30 patients with osteonecrosis of the femoral head. The study reported an unacceptably high failure rate for revised, uncemented, proximally coated femoral components. The femoral component survival rate was 54.8% at 10 years. The reasons for failure did not correlate with age, sex, type of fixation, or degree of femoral bone defect. In the current study, 14.7% of hips required reoperation at a mean follow-up of 7.1 years. The survival rate with an endpoint of re-revision for any reason was 81% at 10 years. Survival rates with an endpoint of re-revision for mechanical failure were 87.5% for the cup and 100% for the stem at 10 years. To the authors’ knowledge, no study has reported the survival rates for both acetabular and femoral revisions using modern cementless components in patients with osteonecrosis of the femoral head. The comparatively low failure rate after revision hip arthroplasty in the authors’ patients with osteonecrosis is encouraging. Compared with previous reports, in which hips were revised with cemented stems or proximally coated stems, all of the hips in the current study were revised with either a fully grit-blasted tapered stem or a proximally porous-coated modular stem. The authors believe that the high success rates of revision hip arthroplasty in this series may reflect the extensive use of a fully grit-blasted stem or a proximally coated modular stem with distal flutes.

The current study found no significant difference with regard to age, sex, body mass index, preoperative bone defects, or bearing surfaces between surviving and failed hips. Several authors have reported favorable outcomes of primary THA in young patients using highly cross-linked polyethylene or ceramic bearings. However, few reports have focused on the choice of bearing surfaces and the results of revision hip arthroplasty in young and active patients. In a study of revision...
hip arthroplasty in young patients with osteolysis, Yoo et al. reported that an alumina-on-alumina bearing surface resulted in improved implant survival rates, with a mean follow-up of 9.8 years. Given the small sample size of the current study, re-revision surgery for extensive wear and osteolysis was performed only in hips with conventional polyethylene bearings, but not in hips with highly cross-linked polyethylene and ceramic-on-ceramic bearings. The study had several limitations, including its retrospective nature. In addition, it was not a comparative study; Therefore, conclusions cannot be drawn about the outcomes of osteonecrosis compared with osteoarthritis. Heterogeneity of causes for surgery and the variety of implants used are possible confounding factors. Despite these limitations, given the rarity of outcome data for revision hip arthroplasty in patients with osteonecrosis of the femoral head, the authors believe that the findings of this study are of value because the study included a relatively large number of consecutive patients with osteonecrosis who were treated by a single surgeon at a single institution.

**Conclusion**

The current study showed a high success rate for the femoral stem after revision THA using a fully grit-blasted stem or a proximally coated modular stem in patients with osteonecrosis of the femoral head. Aseptic cup loosening or polyethylene wear and osteolysis were more common mechanisms of failure at medium-term follow-up in this patient population.

**References**


**Figure 3:** Anteroposterior radiograph obtained 6 years after primary total hip arthroplasty for osteonecrosis of the femoral head in a 34-year-old woman showing extensive osteolysis around the acetabular component and the proximal femur (A). Revision total hip arthroplasty was performed with a cementless hemispheric cup and a fully grit-blasted modular distal fixation stem combined with an alumina-on-alumina ceramic bearing (B). Radiograph obtained 10 years after index revision arthroplasty showing well-fixed prostheses with no osteolysis (C).


