



Contemporary Surgical Indications and Referral Trends in Revision Total Hip Arthroplasty: A 10-Year Review



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ABSTRACT

Background: Revision total hip arthroplasty (THA) represents nearly 15% of all hip arthroplasty procedures in the United States and is projected to increase. The purpose of our study was to summarize the contemporary indications for revision THA surgery at a tertiary referral medical center. We also sought to identify the indications for early and late revision surgery and define the prevalence of outside institution referral for revision THA.

Methods: Using our institution's arthroplasty registry, we identified a retrospective cohort of 870 consecutive patients who underwent revision THA at our hospital from 2004 to 2014. Records were reviewed to collect data on patient's primary and revision THA procedures, and the interval between primary THA and revision surgery was determined.

Results: Aseptic loosening (31.3%), osteolysis (21.8%), and instability (21.4%) were the overall most common indications for revision THA and the most common indications for revision surgery within 5 years of primary THA. Aseptic loosening and osteolysis were the most common indications for revision greater than 5 years from primary THA. Only 16.4% of revised hips had their index arthroplasty performed at our hospital, whereas 83.6% were referred to our institution.

Conclusions: Aseptic loosening, osteolysis, and instability remain the most common contemporary indications for revision THA in an era of alternative bearings and modular components. Most of our revisions were referred from outside institutions, which highlights the transfer of a large portion of the revision THA burden to tertiary referral centers, a pattern that could be exacerbated under future bundled payment models.

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Total hip arthroplasty (THA) is a cost-effective and successful treatment of end-stage hip osteoarthritis. The clinical success rate of THA exceeds 90% at 10-year follow-up [1–4]. However, the incidence of revision THA is increasing, with recent studies showing that revision THA represents nearly 15% of all hip arthroplasty procedures performed in the United States [5]. Although revision surgery is effective, it is also associated with increased cost and patient morbidity [6–8]. An upswing in the absolute number of primary THA being performed; the trends toward younger, more active patient population seeking THA; and growing trends of increased body mass index in patients undergoing THA are all factors that contribute to the increased demand for revision surgery [9–13].

A paucity of THA revision literature focuses on indications for revision. In 2004, Clohisy et al [14] reviewed 439 patients who underwent

revision THA surgery over an 8-year period. This study reported that 55% of revisions were for aseptic loosening; 14% were for instability; 13% were for osteolysis around a well-fixed implant; 7% were for infection; 5% were for periprosthetic fracture; 3% were for conversion from a hemiarthroplasty; and 1% each were for implant fracture, recalled implants, and psoas impingement [14]. More recently in 2007, Ulrich et al [15] reported on 225 patients who underwent revision THA over a 6-year period. Their study found that 51.9% of revisions were for aseptic loosening; 16.9%, for instability; and 5.5%, for infection. They also found that 50% of revisions occurred within 5 years of index THA and that instability and deep infection were the primary indications for revision surgery within 5 years of primary THA [15].

A contemporary characterization of the indications for revision THA is imperative given the increasing demand for primary THA in the younger, more active patient population; the introduction and acceptance of new implant designs using greater degrees of modularity; and the utilization of various combinations of bearing surfaces including metal on metal surfaces. This information, when compared with prior studies, will aid in understanding which causes of THA failure and revision are being successfully mitigated and will serve to identify those causes that remain problematic. In addition, with the shift in the physician reimbursement

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model to a bundled payment system, an understanding of the most recent indications and referral trends in revision THA is important in predicting future volume and possible impact on the arthroplasty surgeon's practice. The primary purpose of our study is to review and summarize the contemporary indications for THA revision surgery at a large, tertiary referral academic medical center. Secondly, we aim to characterize the indications for early and late revision surgery and identify the prevalence of outside institution referral for revision THA.

Methods

Using our institution's joint arthroplasty registry, we retrospectively identified all revision THA surgeries performed at our institution between May 2004 and September 2014. All revision surgeries were performed by 1 of 7 fellowship-trained arthroplasty surgeons who were credentialed as attending physicians at the hospital during the study period. Patient clinical charts and operative records were reviewed by 2 of the authors not involved in surgical care to collect patient age, sex, date of index THA surgery, and date(s) of revision surgery. Records were also examined to identify the location (outside hospital vs our institution) of the index THA surgery as well the incidence and reason for revision surgery.

The primary indication for THA revision for each patient was determined by reviewing the available electronic clinical records and operative reports. Revision indications were grouped to include the following general diagnoses: osteolysis (cup, stem, or both), aseptic loosening (cup, stem, or both), infection, metallosis (bearing or trunnion, with or without pseudotumor), periprosthetic fracture, instability, asymmetric/excessive polyethylene bearing wear, mechanical failure of implants (fracture of components, dissociation of head/neck junction, breakage of liner locking ring, etc), progressive coxalgia associated with hemiarthroplasty, failed hip resurfacing, component malposition, and pain not otherwise specified (NOS). Component malposition was defined using the accepted "safe zone" for the acetabular implant, based on initial work of Lewinnek et al, with modifications for contemporary implants [16–19]. Components were classified as malpositioned if the abduction angle of the acetabular component was less than 30° or greater than 45° in relation to a transischial line drawn on an anteroposterior pelvic radiograph or if cup anteversion was less than 5° or greater than 25°, as measured on the cross table lateral radiograph. Based on the findings in the clinical and operative records, patients were assigned a primary indication for revision THA and up to 2 secondary indications. The duration between primary THA and revision surgery was determined, with subjects assigned to 1 of 4 groups based on the interval between index THA and revision surgery (<2, 2–5, 5–10, and >10 years).

Results

Eight hundred seventy consecutive revision hip arthroplasties were performed at our institution between May 2004 and September 2014. Six hundred thirty-eight of the revision surgeries were initial revisions of a primary THA, and 232 (191 patients) were repeat revision surgeries. Twelve patients underwent bilateral THA revisions. Of the 870 subjects (hips) included, 58% (n = 504) were male, and 42% (n = 366) were females. The mean age of the cohort at time of all revision THA was 62.2 years (SD, 13.1; range, 23–95 years). All revision surgeries were performed via a posterior approach, incorporating the prior surgical incision when technically feasible. The mean age at time of initial revision of a primary THA was 62.2 years and was 62.1 years for re-revision THA surgery. Only 16.4% (n = 143) of revised hips had their index arthroplasty performed at our urban teaching hospital, whereas most hips, 83.6% (n = 727), were referred to or transferred to our institution. One hundred sixty-four revisions (18.9%) were performed in patients 50 years or younger. Two hundred twenty-three revisions (25.6%) were in patients aged 51 to 60 years, 236 revisions (27.1%)

Table 1
Patient Demographics.

| | Percentage of Total (870 Hips) |
|-----------------------------|--------------------------------|
| Male | 504 (57.9%) |
| Female | 366 (42.1%) |
| Initial revision surgery | 642 (73.8%) |
| Repeat revision surgery | 238 (27.2%) |
| Age at time of revision (y) | 62.2 y (mean avg.) |
| ≤50 | 164 (18.9%) |
| 51–60 | 223 (25.6%) |
| 61–70 | 236 (27.1%) |
| ≥71 | 247 (28.4%) |

were in patients 61 to 70 years old, and 247 (28.4%) were in patients 71 years or older (Table 1).

There were a total of 1079 conditions identified as contributing to the failure of THA, resulting in 21.8% of participants (190 hips) having more than 1 reason for revision surgery identified. Aseptic loosening was the most common indication for revision hip arthroplasty in our cohort, representing 31.3% of all revision indications. For this study, the diagnosis of aseptic loosening was determined based on clinical records, including preoperative radiographs, with a confirmation of the loose implants noted at the time of surgery in the operative note. Of the 272 revision cases with aseptic loosening as an indication, 126 (46.3%) were for loosening of the acetabular component only, 112 (41.5%) were for loosening of the femoral component only, and 34 (12.5%) were for loosening of both the acetabular and femoral implants. Progressive osteolysis was the second most common indication for revision surgery representing 21.8% (190 hips) of the listed revision indications. Within the 190 patients undergoing revision for osteolysis, 54.7% were for acetabular component only; 20%, for femoral component only; and 25.3%, for osteolysis of both the femoral and acetabular components. Information on the initial articular bearing surface was available for 48.9% (93 hips), and all of the patients had a metal-on-polyethylene articulation. The incidence of revision for osteolysis decreased over the study period, with 67.3% (n = 128) of the revisions for osteolysis occurring between 2004 and 2009, whereas only 33.7% (n = 62) were done from 2010 to 2014.

Instability was the third most common indication for revision, representing 21.4% (186 hips) of reported indications. Within the group of patients undergoing revision surgery for instability, component malpositioning was acetabular sided only in 166 hips (89.2%), femoral sided only in 9 hips (4.8%), and both femoral and acetabular sided in 11 (5.9%). The remainder of the indications included infection (13.7%), conversion of hemiarthroplasty (6.7%), excessive/asymmetric polyethylene liner wear (6.4%), periprosthetic fracture (5.1%), metallosis (4.1%),

Table 2
Revision Indications.

| Indication for Revision | Percentage of Revisions |
|--|-------------------------|
| Aseptic loosening | 31.3% |
| Acetabular component | 14.5% |
| Femoral component | 12.9% |
| Both components | 3.9% |
| Osteolysis | 21.8% |
| Acetabular component | 12% |
| Femoral component | 4.4% |
| Both components | 5.5% |
| Instability | 21.4% |
| Infection | 13.7% |
| Conversion of hemiarthroplasty | 6.7% |
| Excessive/asymmetric polyethylene liner wear | 6.4% |
| Periprosthetic fracture | 5.1% |
| Metallosis | 4.1% |
| Component malposition | 4.0% |
| Hip pain (NOS) | 4.0% |
| Mechanical failure of implants | 3.6% |
| Failed hip resurfacing | 2.0% |

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