Efficacy of Revision Surgery for the Dislocating Total Hip Arthroplasty: Report From a Large Community Registry

Tiare Salassa MD, Daniel Hoeffel MD,
Susan Mehle BS, Penny Tatman MPH,
Terence J. Gioe MD

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Abstract

Background Historically, achieving stability for the unstable total hip arthroplasty (THA) with revision surgery has been achieved inconsistently. Most of what we know about this topic comes from reports of high-volume surgeons' results; the degree to which these results are achieved in the community is largely unknown, but insofar as most joint replacements are done by community surgeons, the issue is important.

Each author certifies that he or she, or a member of his or her immediate family, has no funding or commercial associations (eg, consultancies, stock ownership, equity interest, patent/licensing arrangements, etc) that might pose a conflict of interest in connection with the submitted article.

All ICMJE Conflict of Interest Forms for authors and *Clinical Orthopaedics and Related Research* editors and board members are on file with the publication and can be viewed on request. Each author certifies that his or her institution approved the human protocol for this investigation, that all investigations were conducted in conformity with ethical principles of research, and that informed consent for participation in the study was obtained. This work was performed at HealthEast Care System, St Paul, MN, USA.

T. Salassa, T. J. Gioe
Department of Orthopaedic Surgery, University of Minnesota
Medical School, Minneapolis, MN, USA

D. Hoeffel
Summit Orthopaedics, St Paul, MN, USA

T. J. Gioe (✉)
Minneapolis Veterans Affairs Health Care Center, Section 112E,
1 Veterans Drive, Minneapolis, MN 55417, USA
e-mail: terence.gioe@va.gov; tjgioe@gmail.com

S. Mehle, P. Tatman
HealthEast Care System, St Paul, MN, USA

Questions/purposes We used a community joint registry to determine: (1) the frequency of repeat revision after surgery to treat the unstable THA; (2) what surgical approaches to this problem are in common use in the community now; (3) are there differences in repeat revision frequency that vary by approach used; and (4) has the frequency of repeat revision decreased over time as surgical technique and implant options have evolved?

Methods We reviewed 6801 primary THAs performed in our community joint registry over the last 20 years. One hundred eighteen patients (1.7%) with a mean age of 67 years were revised within the registry for instability/dislocation. Failure was defined as a return to the operating room for rerevision surgery for instability. Minimum followup was 2 years (average, 9.4 years; range, 2–20 years) with six patients having incomplete followup. The frequency of rerevisions was calculated and compared using Pearson's chi-square test. Cumulative rerevision rates were calculated using the Kaplan-Meier method and types of revision procedures were compared using the log-rank test.

Results The initial revision procedure was successful in 108 patients (92%); 10 patients underwent repeat surgery for recurrent dislocation after their initial revision surgery. The most frequently performed procedure was revision of the head and liner only (35 of 118 [30%]); constrained devices were used in 19% (22 of 118) of the procedures. There was no difference in the cumulative rerevision rates for instability or dislocation by type of revision procedure performed. Six of 22 constrained liners were rerevised for varying indications. There was no difference in frequency of repeat revision for instability between those patients revised for THAs performed before 2003 and those managed more recently.

Conclusions Revision surgery for unstable THA is successfully managed in the community with a variety of

surgical interventions. Identifying the reason for dislocation and addressing the source remain paramount. Constrained liners should be used with caution; although typically used in the most problematic settings, rerevision for a variety of failure modes remains troublesome.

Level of Evidence Level III, therapeutic study. See Guidelines for Authors for a complete description of levels of evidence.

Introduction

Instability continues to be one of the most common reasons for revision surgery after THA [5, 9, 15, 21]. Dislocation and subluxation are significant causes of patient concern and morbidity with the prevalence of dislocation after primary THA reported to range from less than 1% to greater than 15% and most studies reporting a prevalence of 2% to 5% [23]. Although many early first-time dislocations can be treated successfully with bracing and restricted activity, approximately one-third of patients have recurrent dislocation events necessitating operative treatment [6, 20, 29, 30].

Many authors have reported revision outcomes using specific techniques or implants such as head and liner exchange, constrained devices, or conversion to a bipolar prosthesis [4, 8, 10, 22, 24] or combinations of these approaches based on clinical circumstances [6, 16, 19]. However, nearly all of these studies are reports of high-volume surgeons' results; the degree to which the results of one surgeon or small groups of surgeons can be achieved more broadly in the community is largely unknown. This may be of some concern because the large majority of THAs are performed in lower-volume community settings [17]. Additionally, although larger diameter femoral head implants have increasingly been shown to decrease the dislocation rate after primary THA [3, 16, 28], little information is available regarding the use of a larger head during revision hip surgery for dislocation [25, 26].

We therefore sought to determine, in the context of a community arthroplasty registry over a 20-year period, (1) the frequency of repeat revision after surgery to treat the unstable THA; (2) what surgical approaches to this problem are in common use in the community now; (3) are there differences in repeat revision frequency that vary by approach used; and (4) has the frequency of repeat revision decreased over time as surgical technique and implant options have evolved?

Materials and Methods

A community joint registry (HealthEast, St Paul, MN, USA) of 6801 primary THAs implanted between

September 1, 1991, and September 30, 2011, was analyzed to determine the incidence of revision for THA dislocation. Details of the registry data entry and collection methods and application of statistical analyses have been reported previously [11]. A prior validation study of the registry demonstrated a 94% capture (revisions done within the registry as opposed to elsewhere), similar to the Scandinavian registries [12, 21]. Data maintained in the registry allowed for identification and analysis of several variables, including patient factors (sex, age, diagnosis at the time of the index procedure), indication for revision surgery (dislocation), type of revision procedure performed (head exchange, liner exchange, cup and/or stem revision) as well as rerevision rates.

Head exchange was defined as removal of the original head and replacement with a head of a different neck length and/or head diameter. Patients in whom the original head was removed and a new head of identical dimensions was placed were not counted as having a "head exchange." Liner exchange was defined as removal of the original polyethylene liner and replacement with an elevated or face-changing liner in a different position within the acetabulum. Shell exchange was defined as removal of the original acetabular shell and replacement with a new shell in a different position (acetabular version and/or inclination altered). Stem exchange was defined as removal of the original femoral stem and replacement with a new stem in a different position (femoral version altered).

A total of 118 hips in 118 patients (1.7%; 45 male, 73 female) with a mean age of 67.4 years were revised for instability/dislocation during the study period (Table 1). Failure was defined as a return to the operating room for rerevision surgery for instability including adjustment, exchange, or addition of any prosthetic components. Minimum followup was 2.0 years (average, 9.4 years; range, 2–20 years).

Further record review was performed in the surgeon offices to determine whether any patient revised for

Table 1. Variables of interest by dislocation rerevision (n = 118)

Patient characteristic	Rerevised for dislocation (n = 9)	Not rerevised for dislocation (n = 109)	p value
Age (years)*	62.4 (17.1)	67.9 (11.9)	0.36
Sex			
Male	2 (22%)	43 (39%)	0.31
Female	7 (78%)	66 (61%)	
Age category (years)			
< 75	6 (67%)	70 (64%)	0.88
≥ 75	3 (33%)	39 (36%)	

* SD in parentheses.

dislocation had undergone a rerevision outside of the registry capture; six patients had been lost to followup in that time period and one additional patient was identified who had undergone rerevision elsewhere. Because no details were available regarding the nature of that rerevision surgery, the patient was not included in the analysis.

The frequency of rerevisions was calculated and compared using Pearson's chi-square test. Cumulative rerevision rates were calculated using the Kaplan-Meier method and types of revision procedures were compared using the log-rank test. Rerevision rates for instability were compared between the years 1991–2003 and 2003–2011 as larger head sizes (≥ 36 mm) became more widely available from most manufacturers in 2003.

Results

Revision surgery for the dislocating hip arthroplasty was successful in 108 patients (92%). Nine patients required a second return to the operating room within the HealthEast Joint Registry capture database for recurrent instability after their initial revision surgery. Of these nine patients, seven were rerevised within the first year after their initial revision procedure. During the study period, none of the 112 patients who had not been lost to followup required a third revision surgery for instability or recurrent dislocation.

The most frequently performed procedure was revision of the head and liner only (35 of 118 [30%]) followed by head, liner, and shell exchange (24 of 118 [20%]; Table 2). Constrained devices were used in 19% (22 of 118) of the cases (Fig. 1).

Cumulative rerevision rates for instability did not differ by type of initial revision procedure performed ($p = 0.764$; Table 2). However, of the 22 constrained devices implanted, six (27%) were rerevised for varying indications during

the study period including dislocation, aseptic loosening, and fracture. The cumulative revision rate (CRR) for all reasons of nonconstrained constructs was 11.0% (95% confidence interval [CI], 3.8%–18.1%) and the CRR of constrained devices was 42.0% (95% CI, 14.7%–69.2%, $p = 0.012$; Fig. 2). There was no difference between those that were rerevised for instability and those that were not for sex or age ($p = 0.480$, $p = 1.0$).

There was no difference in frequency of repeat revision for instability between those patients whose revisions were performed before 2003 versus those managed more recently. Of the 92 revised patients whose primary THA was performed before 2003, eight underwent repeat revision surgery for instability (9%). Of the 26 revised patients whose primary THA occurred during or after 2003, only one was rerevised for instability (4%; $p = 0.683$).

Fig. 1 Nature of first revisions ($n = 118$). The most common revision was of the head and liner with constrained devices being used in 19% of the cases.

Table 2. Nature of revision surgery

First revision procedure	Total count	Rerevised	
		Dislocation/instability	Other reasons
Constrained	22 (19%)	2 (9%)	4*
Head, stem, liner, and shell	1 (1%)		1 [†]
Head, stem, liner	2 (2%)		0
Head and stem	1 (1%)		0
Head, liner, and shell	24 (20%)	2 (8%)	0
Head and liner	35 (30%)	3 (9%)	0
Head	9 (8%)	1 (11%)	1 [‡]
Stem, liner, and shell	1 (1%)		0
Liner and shell	11 (9%)		0
Liner	12 (10%)	1 (8%)	0

* Aseptic loosening, mechanical failure/breakage, other, reason missing; [†] periprosthetic fracture; [‡] aseptic loosening.

Fig. 2 Constrained versus not constrained: all revisions. The overall failure rate of constrained devices was significantly higher than for nonconstrained devices.

Discussion

Dislocation remains one of the most common and problematic postoperative complications after THA. Previous studies have reported a wide range of efficacy of revision procedures to achieve stability, often focused on the type of implant used in the revision surgery. Most of what we know in this area is the result of studies performed in single institutions or by high-volume surgeons; it is unclear whether such results are mirrored in the community. Given the multitude of implant options and procedures available in such cases, we looked to explore the overall efficacy of revision surgery for the dislocating THA in the community in addition to determining if differences exist among various implant options and how management of this complex problem has evolved over time.

Inherent to our study are the obvious limitations of any joint registry that primarily captures implant/explant and demographic data. Dislocation issues presumably occur on a spectrum from the easily correctable to the complex based on numerous factors, and we have been unable to risk-adjust for these factors or examine specific surgeons' surgical indications. Second, revision is not an ideal end point because it does not capture all patients who may have had poor clinical or functional results after surgery but either declined revision or were too ill to undergo additional surgical procedures. Third, there is a subset of patients who may experience postrevision dislocation

events, which are successfully managed nonoperatively and thus not captured by our registry. Finally, there may be patients who had repeat revision surgery performed outside our registry who were not captured in our database, a common registry concern. Of note, prior validation analysis of our registry suggests a capture rate of 94% [12], similar to that reported in the Scandinavian registries. In a separate quality review study, surgeon offices were contacted and asked to determine whether any patient had undergone a rerevision outside of the registry capture. Six of the study patients had been lost to followup and only one had a revision at a hospital not included in the registry, a finding very consistent with our earlier validation work [12]. Despite these limitations, registries continue to have the unique advantage of offering a broad representation of contemporary community-based total joint practice.

To our knowledge, this series represents one of the largest cohorts in the literature to date evaluating the efficacy of revision surgery for instability in THA in the hands of community-based surgeons. The 92% success rate of initial revision surgery in our study population indicates that revision procedures for recurrent THA dislocation may be more successful in some circumstances than previously reported. Daly and Morrey [7] reported surgical intervention for the subluxing or dislocating THA to be successful in 61% of their cohort of 95 patients and Lachiewicz et al. in 2004 [19] reported a success rate of 82% in their 23 revision surgeries.

Our report documents that revision surgery for the unstable THA may be successfully managed in the community with head and liner exchange, femoral revision, acetabular revision, or some combination of these approaches. With the numbers available, there was no clear superiority of any one method. This undoubtedly reflects the commonly held tenet that the reason for dislocation must be clearly ascertained and addressed; a single approach to solve the problem will often fail. The option of using larger femoral heads with highly crosslinked polyethylene acetabular liners appears to be an increasingly successful strategy to reduce dislocation in both primary THA and in the revision setting [1, 13, 14, 18, 25, 27, 29].

Our results also suggest that although constrained devices can be an effective method to regain stability in the unstable/dislocating THA, caution should be used when using these devices, because their cumulative rerevision rate for all reasons was higher than other more traditional implant designs. This has also been supported elsewhere in the literature with Della Valle et al. [8] reporting a 16% rate of redislocation in constrained devices when used in the setting of the dislocating THA or inadequate intraoperative stability at the time of revision surgery. Anderson et al. [2] reported an even higher rate of redislocation after the use of constrained devices at 29%. These findings may represent a selection bias toward using this device in the most difficult circumstances with poor soft tissue constraints.

Over the 20-year study period, the incidence of dislocation requiring surgical intervention significantly decreased after 2003 as compared with before 2003. However, we were unable to show that the incidence of rerevision for instability after initial surgical management for this complication had decreased significantly in the same timeframe. This is likely secondary to the relatively small number of events observed.

Revision surgery for the unstable THA is successfully managed in the community with a variety of surgical interventions. Identifying the reason for dislocation and addressing it remains an important treatment principle. Constrained liners should be used with caution; although typically used in the most problematic settings, rerevision for a variety of failure modes with implants of this design remains a concern.

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