Is Routine Mid-term Total Hip Arthroplasty Surveillance Beneficial?

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Abstract

Background Routine followup of patients after primary or revision THA is commonly practiced and driven by concerns that delays in identifying early failure will result in more complicated or more costly surgical interventions. Although mid-term followup (4–10 years) has been performed to follow cohorts of patients, the benefit of observing individual patients regardless of symptoms has not been established.

Questions/purposes We determined (1) the reasons patients with THA return for mid-term followup, (2) the treatment recommendations and interventions occurring as

a result of mid-term followup, and (3) how frequently revision surgery is recommended for asymptomatic and symptomatic patients at mid-term followup.

Methods We retrospectively identified 501 patients (503 hips) who returned for followup at least 4 years (mean, 5 years; range, 4–10.9 years) after their primary or revision THA. We recorded their reasons for followup and treatment recommendations, including those for revision surgery, at mid-term followup.

Results Fifty-three percent of patients returning for routine followup had no symptoms, 31% reported an unrelated musculoskeletal concern, and 19% had symptoms from their primary THA (15%) or revision THA (32%). Sixty-nine percent of symptomatic patients and 10% of asymptomatic patients received treatment recommendations, with physical therapy as the most frequent intervention (74%). Revision surgery was recommended for 6% of symptomatic and 0.6% of asymptomatic patients.

Conclusions Although routine surveillance may identify rare, asymptomatic patients with arthroplasty failure, it is much more likely to result in recommendations for non-operative management during early followup.

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

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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.
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Introduction

Osteolysis and aseptic loosening have been identified as major causes of mid-term and long-term THA revisions [14, 22, 23]. Concerns that treatment delays will result in more complicated and costly interventions with compromised surgical outcomes have directed a common practice of routine patient followup for implant surveillance [26].

Despite the common practice, the cost and benefits of this treatment approach have not been established and detailed, evidence-based patient followup protocols to minimize cost yet optimize early diagnosis of implant failure have not been identified or adopted. With estimates that total joint arthroplasties in the United States will increase substantially during the next 20 years [18], the ability to establish protocols that identify patients at increased risk of implant failure and to create a targeted surveillance strategy will be beneficial for surgeons and patients and for more cost-effective healthcare delivery.

We have recommended annual followups for all patients with hip and knee arthroplasties for the initial 3 years after surgery and then at 5 years. Our recommended followup beyond 5 years after surgery is influenced by patient age and activity level, with younger and more active patients considered for more frequent followup to assess for wear-related concerns. Although patients are reminded about followup recommendations during appointments, they are not routinely contacted by telephone, email, or letter to encourage compliance. Our clinical impression is that musculoskeletal interventions are not recommended for the majority of patients during the first decade after primary or revision THA.

To confirm the impression we determined (1) the reasons the patients returned for followup, (2) the treatment recommendations and interventions that occurred as a result of mid-term followup, and (3) how frequently revision surgery after primary THA or revision THA was recommended for asymptomatic and symptomatic patients during mid-term followups. For each of these study purposes, we also assessed whether any of the recommendations differed for patients returning after a primary or revision THA.

Patients and Methods

After obtaining IRB approval, we retrospectively reviewed the records of 1677 patients who underwent primary and revision THAs performed by two surgeons (JCC, WJM) between June 1996 and May 2004. From these 1677 patients, 501 (29.9%) had returned for followup of 503 primary or revision THAs at a minimum of 4 years (mean, 5 years; range, 4–10.9 years) after surgery. Among the patients who had returned for at least one mid-term followup, primary THA was performed as the initial procedure for 410 hips (81.5%) and revision THA was performed as the initial procedure for 93 hips (18.5%). These patients returned for a total of 976 physician appointments during the study period, with an average of 1.94 appointments per patient. Patients with primary THAs returned for 763 appointments (78.2%) with an average of 1.86 appointments per patient and patients with revision

THAs returned for 213 appointments (21.8%) with an average of 2.29 appointments per patient.

Three reviewers (AF, EM, KM) not involved in the patients' surgery or postoperative care retrospectively reviewed clinic notes for all patient followups at a minimum of 4 years after surgery. Patient demographic information was documented (Table 1). Medical records were evaluated to determine reasons for the appointment, with attention to the presence or absence of physical complaints (Table 2), treatment recommendations for either the surgical hip or other musculoskeletal concerns

Table 1. Demographics for patients returning at minimum 4-year followup

Variable	Value
Total patients (surgeries)	501/503
Index procedure	
Primary THA	410 (81.5%)
Revision THA	93 (18.5%)
Mean age at surgery (range)*	56.7 ± 14 years (14.0–88.0)
Race	
White	419 (83.6%)
Nonwhite	82 (16.4%)
Gender	
Female	264 (52.7%)
Male	237 (47.3%)
Followup at first visit in dataset (years)*	5.07 ± 1.1 (4.0–10.9)
Number of visits included per surgery*	1.9 ± 1.3 (1–8) (median = 1)

* Values are expressed as mean ± SD, with range in parentheses.

Table 2. Summary of reasons for mid-term followups

Reason for followup	Number = 976
Scheduled appointments	699 (71.6%)
Routine appointments	519 (53.2%)
Routine appointments with complaints reported	180 (18.4%)
Total with symptomatic presentation at followup	457 (46.8%)
Presentation for specific evaluation of complaint	277 (28.4%)
Routine appointments with complaints reported	180 (18.4%)
Appointments with localized pain complaint	
Surgical hip	183 (18.8%)
Pain not associated with injury or illness	138 (14.1%)
Pain reported as result of injury or illness	46 (4.7%)
Contralateral hip or knee pain	145 (14.9%)
Other musculoskeletal pain	156 (16.0%)
Concerns other than musculoskeletal or joint condition	67 (6.8%)

(Table 3), and followup instructions. Recommended interventions were associated with the nature of the patient followup (Table 4). Thirty-eight patients (7.6%) received more than one treatment recommendation.

We determined whether there were differences between patients who had primary and revision THAs with respect to their reasons for followup and treatment recommendations. Chi-square analysis was used when incidence was greater than 10% of the subpopulation and Fisher's exact

test when it was less than 10% of the total population. A Bonferroni adjustment was done when there were interrelationships between responses (Tables 5 and 6). Differences in surgical treatment recommendations for patients who had primary and revision THAs also were determined using chi-square analysis or Fisher's exact test and referenced against the total population of 1677 patients who had undergone either primary or revision THA during the period of study (Table 7).

Table 3. Interventions recommended or performed after followups

Intervention recommended	Number of appointments (n = 976)
No intervention	609 (62.4%)
Physical therapy (contralateral hip or knee)	161 (16.5%)
Physical therapy (surgical hip)	138 (14.1%)
Contralateral hip or knee arthroplasty	56 (5.7%)
Revision surgery on index hip arthroplasty	31 (3.1%)
Other musculoskeletal operation	21 (2.2%)

Results

Of the total 976 appointments, 699 (72%) occurred at a scheduled interval, with patients reporting at least one musculoskeletal concern during 180 of these visits (18%), whereas 277 visits (28%) occurred specifically for assessment of a patient-reported concern. Patients presented without symptoms during 519 visits (53%), with pain from their surgical hip accounting for 183 appointments (19%), and with symptoms from the contralateral hip or other

Table 4. Summary of interventions for patients by visit type

Intervention resulting from appointment	Number of interventions		
	Routine appointment (n = 519)	Routine appointment with symptoms (n = 180)	Appointment for evaluation of symptoms (n = 277)
No intervention	468 (90.2%)	55 (30.6%)	86 (31.0%)
Physical therapy (surgical extremity)	27 (5.2%)*	39 (21.7%)	72 (26%)
Physical therapy (contralateral extremity)	23 (4.4%)*	61 (33.9%)	77 (27.7%)
Revision surgery (index hip)	3 (0.6%)	6 (3.3%)	22 (7.9%)
Primary surgery (contralateral hip or other joint)	1 (0.2%)	24 (13.3%)	31 (11.2%)
Other orthopaedic surgery	0 (0.0%)	5 (2.7%)	16 (5.8%)

* Six patients (1.2%) received recommendations for ipsilateral and contralateral physical therapy.

Table 5. Summary of reasons for followups based on index procedure

Reason for appointment	Number of appointments		p value*
	Primary THA (n = 763)	Revision THA (n = 213)	
Routine only	433 (57%)	86 (40%)	0.001
At least one of the reasons was routine	575 (75%)	124 (58%)	< 0.001 [‡]
At least one of the reasons was ipsilateral pain (not from injury or illness)	88 (12%)	50 (23%)	0.006 [§]
At least one of the reasons was ipsilateral pain from injury or illness	27 (4%)	19 (9%)	0.003 [§]
At least one of the reasons was ipsilateral pain, regardless of source of pain	114 (15%)	69 (32%)	< 0.001 [§]
At least one of the reasons was contralateral pain	126 (17%)	19 (9%)	0.05
At least one of the reasons was other pain	116 (15%)	40 (19%)	0.20
At least one of the reasons was some other reason	43 (6%)	24 (11%)	0.10

* p values were obtained using Chi-Square or Fisher's exact test and Bonferroni-adjusted pairwise comparison; [‡]p < 0.05 compared with the routine-only visits; [§]p < 0.05 compared with the complaint-only visits.

Table 6. Summary of interventions by type of procedure (primary THA versus revision THA)

Interventions recommended at appointment	Number of interventions		p value*
	Primary THA (n = 763)	Revision THA (n = 213)	
No intervention	494 (65%)	115 (54%)	0.02
At least one intervention is ipsilateral operation	18 (2%)	13 (6%)	0.01
At least one intervention is ipsilateral therapy	88 (12%)	50 (23%)	0.007 [§]
At least one intervention is contralateral operation	49 (6%)	7 (3%)	0.08 [‡]
At least one intervention is contralateral therapy	128 (17%)	33 (15%)	0.92

* p values were obtained using Chi-Square or Fisher's exact test and Bonferroni-adjusted pairwise comparison; [‡]p < 0.05 compared with other operative intervention; [§]p < 0.05 compared with other nonoperative intervention.

Table 7. Revision procedures by index procedure

Reason for revision surgery	Number of procedures					
	Index procedures in this study			Index procedures 1996–2004*		
	Primary (n = 410)	Revision (n = 93)	p value	Primary (n = 1267)	Revision (n = 410)	p value
Polyethylene wear and osteolysis [#]	9 (2.2%)	6 (6.4%)	0.02 [#]	9 (0.7%)	6 (1.5%)	0.159
Infection [#]	7 (1.7%)	13 (14.0%)	< 0.001 [#]	7 (0.6%)	13 (3.2%)	< 0.001 [#]
Acetabular loosening	7 (1.7%)	4 (4.3%)	0.12	4 (0.3%)	4 (1.0%)	0.092
Recurrent dislocation [#]	3 (0.7%)	4 (4.3%)	0.008 [#]	3 (0.2%)	4 (1.0%)	0.044 [#]
Femoral fracture	3 (0.7%)	0 (0%)	0.408	3 (0.2%)	0 (0%)	0.324
Femoral loosening	1 (0.2%)	0 (0%)	0.634	1 (0.07%)	0 (0%)	0.569
Painful accessory hardware	1 (0.2%)	1 (1.1%)	0.250	1 (0.07%)	1 (0.2%)	0.400
Heterotopic ossification	1 (0.2%)	0 (0%)	0.634	1 (0.07%)	0 (0%)	0.569

* Comparison indicates revision rates for procedures if all revision surgery were accomplished in same institution; [#]statistically significant (p < 0.05).

musculoskeletal concerns in 301 appointments (30.8%). When compared with patients who had revision THA, individuals returning for followup of a primary THA were more likely to return for routine scheduled appointments without symptoms (57% versus 40 %; p < 0.001) or with contralateral hip or knee concerns (17% versus 9%; p = 0.05). Patients with a revision THA as their index procedure were more likely (p < 0.001) to present with pain from their surgical hip (32 % versus 15%) (Table 5).

Treatment recommendations were uncommonly associated with the followup of asymptomatic patients (Table 4). No treatment interventions were recommended during 468 of the scheduled appointments for asymptomatic patients (90.2%), with physical therapy infrequently directed toward the surgical (5.2%) or contralateral (4.4%) hip. Three appointments (0.6%) were associated with a recommendation for revision of the surgical hip. This included two young and active patients who had primary THAs with conventional polyethylene bearings who underwent revision for wear and osteolysis at 8 and 10 years after their surgery. One revision THA was revised for asymptomatic

acetabular component loosening. One appointment (0.2%) in an asymptomatic patient was associated with a recommendation for an unrelated surgical procedure. In contrast, 69% of symptomatic appointments were associated with at least one recommendation for treatment. Physical therapy was recommended during 55.6% of visits, surgery for a symptomatic contralateral joint was recommended during 13.3% of visits, and revision of the index surgical procedure was recommended during 28 visits (6.1%). Patients with a primary THA as their index surgery were slightly more likely (65% versus 54%; p = 0.02) to have no recommendations for treatment than patients who had a revision THA performed at the index operation. Either no intervention (54%) or a referral to physical therapy (38%) was most commonly associated with appointments for patients with primary and revision THAs (Table 6).

There were a total of 60 revision THAs performed during this mid-term followup (Table 7). Thirty-two revision surgeries (53%) were performed for patients treated with primary THAs and 28 revisions (47%) were performed for patients with revision THAs. Revision surgery

was recommended more often ($p < 0.01$) during revision THA appointments (13.1%) than during primary THA appointments (4.2%). Polyethylene wear with associated osteolysis (2.2%) was the most common indication for revision of a primary THA. Infection (14.0%) was the most common indication for secondary revision of a previously revised THA.

Discussion

Clinical and radiographic surveillance of patients with total joint arthroplasties has been proposed to provide early identification of implant failures and to minimize the extent, cost, and complexity of revision surgery. Although no clear consensus exists, many surgeons have recommended annual followups for their patients to assess for clinically silent periprosthetic osteolysis associated with either component loosening or with a size and location concerning for impending failure [8, 26, 27]. It is our impression that treatment recommendations are not made for the majority of patients during the first decade after primary or revision THA. To confirm that impression we determined (1) the reasons the patients returned for followup, (2) the treatment recommendations and interventions that occurred as a result of mid-term followup, and (3) how frequently revision surgery was recommended for asymptomatic and symptomatic patients during mid-term followups.

This study has noteworthy limitations. First, the study population comprises a sample group (29.9%) from a substantially larger primary and revision total joint arthroplasty population. The percentage of patients returning for postoperative followup mirrors data from previously published data from our institution [5]. Although we anticipate the majority of patients who are symptomatic would return for postoperative assessment, extrapolation of the data from this subgroup to the patients who did not return for followup may not be accurate. The revision rates presented relative to patients returning for followup and the total patients undergoing primary and revision THAs in our institution (Table 7) may understate overall revision rates for the total patient population. However, infection was the only surgical indication for which there was a statistical difference noted; and we would anticipate that the majority of patients with periprosthetic infection would return or be referred for treatment. Second, surgeon-directed referral and selection bias also might have impacted our observations. The number of followups, particularly for patients receiving interventions for symptomatic conditions, may have been influenced by independently directed surgeon recommendations. This may have influenced some variability in

appointment numbers when comparing primary and revision THA groups. Finally, mid-term followup may not accurately reflect long-term outcomes. Although our data suggest interventions are uncommon for asymptomatic patients at mid-term followup, further evaluation is necessary to determine whether prosthetic durability will be maintained during the second postoperative decade. Several published studies have shown, despite excellent clinical results, function and implant longevity normally decline with long-term followup [10, 11, 13, 16]. We recognize future protocols must identify early failures to prevent catastrophic failures and costly revision surgeries.

Although THA provides improvement in pain and function for most patients, surgical revision may be necessary to manage short-term and long-term complications. Aseptic loosening, hip instability, and infection are the most frequently reported causes of prosthetic failure and have been reported after primary and revision THAs [4, 7, 27, 29]. Primary total hip replacement failure appears to occur with a bimodal pattern, with early failures predominantly secondary to hip instability and infection which are likely to be associated with a symptomatic THA [4, 7, 29]. Late primary THA failure is most commonly caused by bearing surface wear and associated consequences of periprosthetic osteolysis and aseptic loosening [4, 7, 29]. Late presentations from wear-related complications may progress without symptoms until clinical and radiographic failure have occurred [8]. Springer et al. reported a THA rerevision rate of 13% at a mean 6-year followup [27]. Instability (35 %), component loosening (30 %), and infection (12 %) were the most common reasons for revision of a previously revised THA [27]. Although hip instability is more commonly associated with early THA revision, a cumulative risk for dislocation may persist for female patients and others with indications from osteonecrosis, femoral neck fracture, or inflammatory arthropathy [2]. Although prosthetic hip instability may be decreased with the use of larger diameter femoral heads, this benefit may be offset by elevated volumetric wear [20].

Although THA failures related to component loosening and osteolysis have been reported infrequently at mid-term followup of second-generation cementless components, wear of conventional polyethylene may limit long-term durability during the second postoperative decade [6, 17, 29]. Second-decade failure of THA components has implicated specific acetabular component designs [1, 12, 15] and undersizing cementless femoral components [1]. Mechanical weakness of conventional polyethylene resulting from sterilization processes also can contribute to an increased risk of prosthetic failure [19, 25, 28]. Higher failure rates also have been associated with acetabular component malposition, younger age, and male gender [6, 21, 29]. Although mid-term followup of cross-linked

polyethylene bearings suggests that clinically important periprosthetic osteolysis will be rare during the first decade after THA [3, 9, 17], longer followup is needed to determine that early results will be sustained into the second decade. Surgeons recognizing that components with a track record of concern may consider closer clinical and radiographic followup.

Our data suggest treatment interventions are rarely recommended for asymptomatic patients during mid-term followups after primary and revision THAs. Revision surgery was recommended only for two asymptomatic patients with primary THAs, asymmetric acetabular liner wear, and osteolysis and one asymptomatic patient with revision THA with a loose acetabular component (0.6%). Improved implant fixation methods and bearing surfaces with established track records may reduce the importance of routine surveillance for asymptomatic patients during the first 5 to 7 years after primary THA [3, 24]. Asymptomatic low-risk patients (older and less active) may require less frequent surveillance while higher risk (young and active) patients may require more rigorous followup protocols. Although symptomatic patients with revision THAs are at a low risk for mid-term intervention (7.9%, variability in surgical complexity—including surgical exposure, bone deficiencies, reconstructive techniques, implant alignment, and implant material consideration—may direct closer postoperative surveillance.

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