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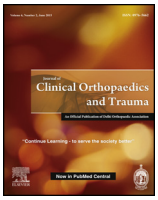

Full length article

Total hip arthroplasty in patients 55 years or younger: Risk factors for poor midterm outcomes

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ABSTRACT

Background: Total hip arthroplasty (THA) is increasingly performed in younger patients. The purpose of this study is to report on the midterm outcomes of primary cementless THA in patients 55 years and younger; and specifically to examine the risk factors for aseptic failure, all-cause revision, and mortality in this patient population.
Methods: Four hundred and twenty-six consecutive patients with minimum 5-year follow-up were retrospectively reviewed. Multivariate analyses were conducted to control for potential confounding factors identified by univariate analyses.
Results: Mean follow-up was 92.12 ± 30.9 months. The overall 5-year implant survival rate was 90.8% and the aseptic survival rate was 92.6%. Among the potential risk factors, only bearing surface had a significant relationship with aseptic revision ($P = 0.041$). Aseptic revisions occurred more frequently with metal-on-polyethylene articulation ($P = 0.012$). Higher Charlson comorbidity index (CCI) was a significant risk factor for all-cause complications ($P = 0.04$) while higher CCI and lower body mass index were significant risk factors for mortality ($P = 0.001$ and 0.006 respectively).
Conclusion: Bearing type was the only risk factor for revision surgery, particularly metal-on-polyethylene bearing. Patients with higher comorbidities were at increased risk for postoperative complications and mortality, while higher body weight appeared to have a protective effect against mortality. These findings should be considered before surgery for risk modification and management of patient expectations. While it appears that bearing couples other than metal-on-polyethylene are especially suitable for young patients, more studies are needed to determine the best bearing couple and to reduce the rates of postoperative complications in this patient population.

1. Introduction

Total hip arthroplasty (THA) is a highly effective treatment for end-stage degenerative hip disease when nonsurgical management has failed. While this operation was initially intended for elderly, low demand patients, those undergoing THA today are increasingly younger, live longer, and have higher expectations.[1] As a result, arthroplasty surgeons are now faced with higher demands to provide longer lasting implant designs. There have been tremendous improvements in this regard including the advent of higher wear-resistant bearing surfaces, safer anesthetic and analgesic modalities, effective postoperative rehabilitation pathways, and improved preoperative risk stratification.[2–4] The latter is very important. Understanding risk factors associated with poor THA survival is not only important for risk reduction, but also for optimizing outcomes and modulating unrealistic expectations.

The burden of revision THA in young North American patients is unclear, but it is reported to be higher than older patients.[5–7] Using data from the Finnish Arthroplasty Register, the 10-year revision rate in patients younger than 55 years who underwent THA for primary osteoarthritis (OA) is 94%.[8] Numerous studies had examined the factors influencing THA survival. However, many of those studies were not specific to young patients, were based on Medicare and European Joint Registries data, excluded patients with diagnoses other than primary OA, included a mix of cemented and hybrid fixation, had small sample sizes, or predated modern THA bearings. As such, there is limited available data on the risk factors for revision THA in young patients.

The purpose of this study is to estimate the 5-year survival rate of modern cementless THA in patients 55 years or younger. In addition, the risk factors for aseptic revision, all-cause complications, and mortality are examined. Understanding the risk factors

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associated with poor midterm outcomes in young adults is important as orthopaedic surgeons are challenged with higher functional demands in an increasingly younger patient population.

2. Materials and methods

Institutional Review Board approval was obtained. Four hundred and twenty-six consecutive patients aged 55 years or younger who underwent primary cementless THA in our health care system and had a minimum 60 months follow-up were included. Exceptions to the minimum follow-up period were patients who experienced any of the three main study outcomes (aseptic revision, postoperative complications, and mortality) within the first 60 months. All procedures were performed by high-volume arthroplasty surgeons (defined as performing at least 50 THAs per year) to eliminate the potential confounding effect of surgeon experience. Exclusion criteria were non-elective procedures and procedures performed for tumors or fractures. Spinal anesthesia was used unless contraindicated. Following THA, patients underwent a standardized clinical pathway. Preoperative and postoperative X-rays were reviewed to confirm the correct procedure (THA) and no prior ipsilateral reconstructive surgery had been performed. The most common femoral implants used for THA were Citation (50.7%, Stryker, Kalamazoo, MI), Accolade TMZF (17.1%, Stryker, Kalamazoo, MI), Synergy (8.8%, Smith and Nephew, Memphis, TN), Corail (DePuy Synthes, Warsaw, IN), and S-ROM (4.9%, DePuy Synthes, Warsaw, IN). The most common acetabular implants were Trident (74%, Stryker, Kalamazoo, MI), Pinnacle (9.1%, DePuy Synthes, Warsaw, IN), and Reflection (8.8%, Smith and Nephew, Memphis, TN).

An electronic medical record chart review was performed to collect the following patient variables: age, gender, body mass index (BMI), Charlson Comorbidity Index (CCI), preoperative diagnosis, prior non-arthroplasty hip surgery, surgical approach, femoral head size, and bearing surface. Preoperative diagnoses were divided into six major categories: primary osteoarthritis (OA), inflammatory arthritis, avascular necrosis, developmental dysplasia of the hip (DDH), posttraumatic arthritis, and slipped capital femoral epiphysis (SCFE). Bearing surfaces included ceramic-on-ceramic, metal-on-metal, metal-on-polyethylene, and ceramic-on-polyethylene. The primary study outcomes were aseptic revision, all-cause revision, and mortality. Patients with missing five-year follow-up were contacted via telephone or email. Participation was voluntary and no financial compensation was provided. Complete follow-up was available on 84.3% of patients.

Results for continuous variables were described using means, standard deviations, medians, and/or interquartile ranges. Categorical variables were described using counts and percentages. Numerical variables were compared between groups using Wilcoxon's rank-sum test or Welch's two sample t-test. Categorical variables were compared between groups using Pearson's chi-squared test or Fisher's exact test. All multivariate modeling was performed using logistic regression. Variables were selected in a stepwise manner according to P values. Linear multiplicative interactions were tested for among the selected main effects and included where significant. All analyses were done using R software (R version 3.2.3 (2015-12-10), Vienna, Austria). All testing assumed a 5% level of significance.

3. Results

There were 426 consecutive patients in the study group. Mean age was 46.9 ± 7.1 years (range 19–55) and follow-up 92.1 ± 30.9 months (range 0–123.5). There were 42 patients (9.8%) who experienced one of the three primary outcomes before the minimum 60 months required follow-up and were included in the analyses.

3.1. Aseptic revision

The 5-year rate of revision for any reason was 9.2% and for aseptic revisions was 7.4%. Among the potential risk factors, only bearing surface had a significant univariate relationship with aseptic revision ($P = 0.04$). Table 1 describes the patient variables in the aseptic revision group compared to the control group. A logistic regression model was built according to the criteria described in the Methods section with bearing surface remaining as the only significant variable. The model (Table 2) showed that septic revisions occurred at different frequencies depending on the bearing surface. Specifically, in comparison to the ceramic-on-ceramic bearings (reference group), aseptic revisions were more frequently associated with metal-on-polyethylene bearings ($P = 0.01$). Excluding THAs with metal-on-metal bearings, the most common cause of aseptic revision was loosening of the acetabular component (4.6%) followed by periprosthetic fractures (1.5%) followed by loosening of the femoral component (0.9%). Periprosthetic infection was the most common cause of revision in metal-on-metal bearings (4.9%).

3.2. All-Cause Complications

The 5-year rate of all-cause complications was 9.6%. Among the potential risk factors, only younger age had a significant relationship with the complications ($P = 0.03$). Table 3 describes the patient variables in the complications group compared to the

Table 1
Potential risk factors for aseptic failure in the study group.

	Control Group	Aseptic Revision Group	P-Value
N	350 (92.59%)	28 (7.41)%)	
Age (years)	49 (43.25, 52)*	45.5 (39.5, 49.75)*	0.052[W]
Sex			
Male	187 (53.43%)	16 (57.14%)	0.86[C]
Female	163 (46.57%)	12 (42.86%)	
Body mass index	30.41 ± 7.54	29.04 ± 6.54	0.33[T]
Charlson Comorbidity Index	2 (1, 2)*	2 (1, 2)*	0.15[W]
Preoperative diagnosis			
Primary osteoarthritis	178 (50.86%)	10 (35.71%)	0.26[F]
Avascular necrosis	83 (23.71%)	6 (21.43%)	
Dysplasia	47 (13.43%)	7 (25.0%) 3	
SCFE	18 (5.14%)	(10.71%)	
Posttraumatic arthritis	13 (3.71%)	1 (3.57%)	
Inflammatory arthritis	11 (3.14%)	1 (3.57%)	
Approach			
Posterolateral	170 (48.57%)	12 (42.86%)	0.84[C]
Anterolateral	114 (32.57%)	10 (35.71%)	
Direct lateral	66 (18.86%)	6 (21.43%)	
Prior ipsilateral non-arthroplasty hip surgery			
No	313 (89.43%)	22 (78.57%)	0.15[C]
Yes	37 (10.57%)	6 (21.43%)	
Head size	32 (32, 36)*	32 (32, 36)*	0.84[W]
Articulation			
Ceramic on ceramic	169 (49.71%)	9 (33.33%)	0.041[F]
Ceramic on polyethylene	44 (12.94%)	5 (18.52%)	
Metal on metal	79 (23.24%)	4 (14.81%)	
Metal on polyethylene	48 (14.12%)	9 (33.33%)	

*: Median [25th percentile, 75th percentile); C: Pearson's Chi-squared test; F: Fisher's exact test for count data; T: Welch two sample t-test; W: Wilcoxon rank sum test with continuity correction.

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