Trends in Complications and Outcomes in Patients Aged 65 Years and Younger Undergoing Total Hip Arthroplasty: Data From the American Joint Replacement Registry

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ABSTRACT

This study sought to determine common complications and the rates of readmission and revision in total hip arthroplasty patients younger than 65 years. Using the American Joint Replacement Registry, we conducted a retrospective review of all THAs in patients aged 18 to 65 years from 2012 to 2020. We excluded patients aged older than 65 years, revisions, oncologic etiology, conversion from prior surgery, and nonelective cases. Primary outcomes included cumulative revision rate, 90-day readmission rate, and reason for revision. The Kaplan-Meier method and univariate analysis were used. Five thousand one hundred fifty-three patients were included. The average age was 56.7 years (SD 7.8 years), 51% were female, 85% were White, and 89% had a Charlson Comorbidity Index of 0 (1 = 7%, >2 = 4%). The mean follow-up was 39.57 months. Fifty-three patients (1.0%) underwent revision. Seventy-four patients (1.4%) were readmitted within 90 days. Revision was more common in Black patients (P = 0.023). Survivorship was 99% (95% confidence interval, 98.7 to 99.3) and 99% (95% confidence interval, 98.5 to 99.3) at 5 and 8 years, respectively. Infection (21%), instability (15%), periprosthetic fracture (15%), and aseptic loosening (9%) were the most common indications for revision. Total hip arthroplasty performed in young and presumed active patients had a 99% survivorship at 8 years. A long-term follow-up is needed to evaluate survival trends in this growing population.

The demand for total hip arthroplasty (THA) in the United States is expected to increase 174% from 2005 to 2030.1 It is estimated that 572,000 THAs will be done annually with 28% of these in patients younger than 55 years.1 As the general population ages and indications for
THA expand, increasing demands have been placed on arthroplasty surgeons to operate on younger, more active patients. Historically, poor long-term outcomes have been reported in this subgroup population, with implant failure most commonly due to component loosening, polyethylene wear, instability, and infection. However, improvements in surgical technique and implant design over the past 15 years may not be accurately represented in past reports.

Several authors have reported excellent survivorship of THA in young, active patients at 10 years. However, these studies were retrospective case series and limited to few institutions and surgeons. As a result, the generalizability of these data can be limited. To date, there is no study that analyzes outcomes of young and presumed active patients who underwent primary THA as reported in the American Joint Replacement Registry (AJRR) database. This registry provides robust data on hip and knee replacements and offers a standardized metric to analyze surgical trends and patient outcomes across the United States. The AJRR collects knee and hip arthroplasty data, including procedural, postoperative, and patient-reported outcome measures and currently contains more than 1.5 million procedures from hospitals, ambulatory surgery centers, and private practice groups.

In this study, we analyzed the AJRR database for young and active patients younger than 65 years who underwent THA. The objective was to determine the mid-term survivorship of these patients with revision for any reason as the end point.

**Methods**

Using the AJRR database, we identified all THAs performed in patients aged 18 to 65 years from 2012 to 2020. Patient demographic factors including age, sex, Charlson Comorbidity Index (CCI), and preoperative VR-12 Physical Component Scores (PCS) were collected from the registry. The VR-12 PCS is derived from a patient-reported questionnaire that measures physical function, mental health, pain, energy, social interaction, and overall health. The CCI is a method for evaluating comorbid conditions that might affect mortality and assigns an objective score to a patient. Only patients who had documentation of all the above variables were included in the analysis.

Age was stratified into four groups: 18 to 34 years, 35 to 44 years, 45 to 54 years, and 55 to 65 years. Sex was either male or female, and race was categorized into Black, White, or Others. CCI was stratified into three groups: 0, 1, or >2, with each integer representing the number of medical conditions associated with morbidity.

Exclusion criteria included patients older than 65 years, revisions, oncologic THA cases, conversion from prior surgery, and nonelective cases. Primary outcome measures included cumulative revision rate, 90-day readmission rate, and reason for revision.

Logistic regression analysis was used to evaluate the association between preoperative VR-12 PCS and a subsequent revision or 90-day readmission without a revision adjusting for potential confounders. Statistical significance was set at $P < 0.05$. The Kaplan-Meier method was used to measure survivorship with revision for any reason as the end point.

**Results**

In total, 5153 patients were included in the analysis, comprising 51% women and 49% men with an average age of $56.7 \pm 7.8$ years (Table 1). The mean follow-up was 39.57 months (range: 0 to 72.03 months). Fifty-three patients (1.0%) underwent revision during the study period. Seventy-four patients (1.4%) were readmitted within 90 days (Table 2). Most common causes for revision were infection (20.8%), instability (15.1%), periprosthetic fracture (13.2%), and aseptic loosening (9.4%). Most common reasons for 90-day readmission without revision were infection (22.9%), pain (9.5%), and periprosthetic fracture (5.4%) (Table 2).

Readmission within 90 days requiring revision was more common in Black patients compared with White patients ($P = 0.023$) (Table 3). Age, sex, CCI, and preop VR-12 scores were not associated with increased early
Readmission requiring revision. Using the Kaplan-Meier method, patient survivorship free of revision was 99% (95% confidence interval [CI], 98.97 to 99.46) at 2 years, 99% (95% CI, 98.7 to 99.3) at 5 years, and 99% (95% CI, 98.5 to 99.3) at 8 years (Figure 1).

Table 1. Demographic Summary

| Factors       | THA (N = 5153) |   |
|---------------|----------------|---|
| Mean age (SD) | 56.7 (7.8)     |   |
| Age category  |                |   |
| 18-34         | 126            | 2.5|
| 35-44         | 265            | 5.1|
| 45-54         | 1093           | 21.2|
| 55-65         | 3669           | 71.2|
| Sex           |                |   |
| Male          | 2531           | 49.2|
| Female        | 2617           | 50.8|
| Race          |                |   |
| White         | 4357           | 84.5|
| Black         | 233            | 4.5|
| Others        | 563            | 11 |
| CCI           |                |   |
| 0             | 4599           | 89.2|
| 1             | 350            | 6.8|
| >2            | 204            | 4  |

CCI = Charlson Comorbidity Index, THA = total hip arthroplasty

Readmission within 90 days not requiring revision was not associated with any variables analyzed in the database (Table 4). We did not find any correlation between age and VR-12 scores with readmissions.

**Discussion**

Due to its increased popularity, THA is likely being done in younger and active patients more than ever before. Several studies have shown that younger patients have poor survivorship and increased revision rates after THA; however, they do not account for current state-of-the-art implant design, improvements in surgical technique, and perioperative protocols.\(^7\)\(^-\)\(^9\) In our analysis of the AJRR database, we observed revision survivorship of 99% at 8 years with a 1% cumulative revision rate. These results represent trends in data and cannot yet be used to make definitive conclusions on outcomes because of inherent limitations of the database.

In a meta-analysis by Mei et al,\(^10\) 32 studies were analyzed with 3219 THAs performed on patients younger than 55 years with a minimum 10-year follow-up. Most common preoperative diagnoses were osteonecrosis (32%), osteoarthritis (27%), and developmental dysplasia of the hip (20%). The most common implant configuration was modular head, noncemented fixation, and metal-on-polyethylene bearing. Survivorship was 98.7% and 94.6% at 5 and 10 years, respectively, and the mean Harris Hip Score improved from 43 to 91.\(^10\) Their analysis provides encouraging data that performing THA in young patients can improve patient satisfaction and function while maintaining high mid-term implant survivorship.

Rahm et al\(^9\) found that THA in patients younger than 40 years had a 13% revision rate and 87% implant survival at 10 years; however, only 144 patients were included in the analysis. In a 2010 study, Girard et al\(^8\) found that THA in patients younger than 30 years had a 21% revision rate and 36% implant survival at 10 years with 941 patients included in the analysis. Our results differ from these studies for several reasons. The average age of our database study was 57 years and captured fewer patients with congenital hip pathology. It has been shown that altered hip biomechanics stemming from congenital hip disease can contribute to increased failure rates.\(^11\)\(^,\)\(^12\) As a result, our study seems more generalizable to the US population.

In a study by Meftah et al,\(^13\) 112 THAs performed between 1999 and 2003 which used highly cross-linked polyethylene acetabular liners showed 97% survivorship for any reason at 10 years. The authors concluded the superior benefit of the newer generation of polyethylene
and its contribution to decreasing osteolysis from acetabular liner polyethylene wear. Bryan et al showed 93% survivorship at 16 years in patients younger than 50 years with highly cross-linked polyethylene acetabular liners. In the Swedish Hip Arthroplasty Registry from 1992 to 2007, 10-year implant survivorship in patients younger than 65 years was 85%. Limited data were found on a longer term patient follow-up, which is a limitation of newer implant designs. In this study, all patients were given current bearing designs and we believe this was one factor that contributed to the low aseptic loosening rate.

In the current AJRR database analysis, Black patients had higher revision rates when compared with White patients \( (P = 0.023) \). Goodman et al compared pain and function outcomes 2 years postoperatively in Black and White patients who underwent THA. The authors concluded that patients from lower socioeconomic backgrounds have worse pain and function at baseline and that early intervention might mitigate progression of their disease and lead to better outcomes. Moreover, Black individuals are at least as likely as White individuals to suffer from advanced arthritis but are more than 30% less likely to undergo THA. Adelani et al also reported that Black patients have an increased number of emergency department visits after THA but that hospital volume does not alter risk for readmission. Additional studies are needed to

### Table 3. Association Between Independent Factors and Linked Revisions Among Younger Patients (18 to 65 Years)

| Factors      | THA (N = 5124) | Odds Ratio | Lower Limit | Upper Limit | \( P \) Value |
|--------------|----------------|------------|-------------|-------------|--------------|
| Preop VR-12 PCS |                | 0.999      | 0.969       | 1.031       | 0.966        |
| Age          |                | 1.004      | 0.968       | 1.041       | 0.838        |
| Sex: female versus male | | 1.078      | 0.624       | 1.862       | 0.788        |
| Race: Black versus White | | 2.76       | 1.148       | 6.633       | 0.023        |
| Race: Other versus White | | 0.55       | 0.169       | 1.786       | 0.32         |
| CCI          |                | 0.854      | 0.508       | 1.436       | 0.552        |

Boldface indicates \( p < 0.05 \). CCI = Charlson Comorbidity Index, PCS = Physical Component Scores, THA = total hip arthroplasty

Figure 1

Graph showing Kaplan-Meier survivorship for THA in young, active patients younger than 65 years old. THA = total hip arthroplasty

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Table 4. Association Between Independent Factors and Linked 90-Day Readmissions w/o Revision Among Younger Patients (18 to 65 Years)

| Factors     | Odds Ratio | Lower Limit | Upper Limit | P Value |
|-------------|------------|-------------|-------------|---------|
| Preop VR-12 PCS | 1.017      | 0.789       | 1.31        | 0.896   |
| Age (yr)    | 0.874      | 0.543       | 1.408       | 0.581   |

PCS = Physical Component Scores, THA = total hip arthroplasty

investigate the relationship between race and long-term outcomes in THA in young patients.

Our study had several limitations. First, most of the patients in our study had a CCI of 0. As a result, the study was not designed to determine statistical significance based on comorbidities. However, because little data exist on THA in young and presumed active patients, we believe our study presents the largest sample size in a cohort that is generally healthier than the elderly THA population. Second, there was no standardization of the International Classification of Diseases 10th Revision diagnosis codes for revision cases or readmissions entered into the AJRR database. As a result, cause for revision or readmission for a small percentage of cases could not be determined because of the ambiguity of the International Classification of Disease codes. Third, the AJRR database cannot account for loss to follow-up in the population younger than 65 years. Because of this, we limited to the evaluation of all-time revision to maximize outcome capture. Finally, irregular collection and inconsistent entry of data could have affected the Kaplan-Meier analyses. Nevertheless, we believe most of the revisions and readmissions were captured correctly and offer the largest overview of this population to date.

Conclusion

THA performed in young and presumed active patients, younger than 65 years, has excellent survivorship at the mid-term follow-up. Racial disparities do exist in revision rates, with Black patients being disproportionately affected. Long-term outcome studies are needed to evaluate the validity of the AJRR database and survivorship of these implants in this growing surgical population.

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