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Revision Total Knee Arthroplasty in Octogenarians: An Analysis of 957 Cases

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ABSTRACT

Background: The number of octogenarians undergoing revision total knee arthroplasty (TKA) is increasing. However, there has been a lack of studies investigating the perioperative course and safety of revision TKA performed in this potentially vulnerable population in a large patient population. The purpose of this study is to compare complications following revision TKA between octogenarians and 2 younger patient populations (<70 and 70-79 year olds).
Methods: Patients who underwent revision TKA were identified in the 2005-2015 National Surgical Quality Improvement Program database and stratified into 3 age groups: <70, 70-79, and ≥80 years. Baseline preoperative and intraoperative characteristics were compared between the 3 groups. Propensity score matched comparisons were then performed for 30-day perioperative complications, length of hospital stay, and readmissions.
Results: This study included 6523 (<70 years), 2509 (70-79 years), and 957 octogenarian patients who underwent revision TKA. After propensity matching, statistical analysis revealed only higher rates of blood transfusion and slightly longer length of stay in octogenarians compared to <70 year olds. Similarly, octogenarians had only higher rates of blood transfusion and slightly longer length of stay compared to 70-79 year olds. Notably, there were no differences in mortality or readmission between octogenarians compared to younger populations.
Conclusion: These data suggest that revision TKA can safely be considered for octogenarians with the observation of higher rates of blood transfusion and slightly longer length of stay compared to younger populations. Octogenarian patients need not be discouraged from revision TKA solely based on their advanced age.

As the life expectancy in the United States continues to rise, an increasing number of patients are outliving their implanted medical prostheses, thus necessitating revision surgeries. Recently, in a span of 5 years, the United States has seen an increase of 23% in the number of revision total hip arthroplasties (THAs) and more notably a 39% increase in revision total knee arthroplasties (TKAs) [1]. Models have projected the number of revision TKAs to increase by 601% between 2005 and 2030 [2]. These large increases in demand are partly due to the increase in the elderly population, particularly the octogenarians. Population reports by the Department of Commerce have projected a quadrupling of patients over the age of 85 by 2050 [3]. However, despite this increase in the number of octogenarians undergoing revision TKAs, there has been a paucity of research investigating the perioperative course and safety of this procedure when performed in this potentially vulnerable population.

Previous studies have found octogenarians undergoing primary TKA to have higher perioperative complication rates compared to younger populations [4]. These include higher rates of mortality, blood transfusion, pneumonia, and extended length of stay [4–6].

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Overall, complication rates following primary TKA in octogenarians are reported to be approximately 19% compared to approximately 15% in younger patients [7]. Although slightly elevated over younger counterparts, the current increased risk for octogenarians is generally considered acceptable [8–10]. Furthermore, significant benefits such as pain relief, functional improvement, and high patient satisfaction are reported among these older patients [11–13], making primary TKA a desirable and common procedure among octogenarians.

With regards to the perioperative course of revision total joint arthroplasty performed in octogenarians, most of the research has solely focused on revision THA [13–20]. These studies showed higher complication rates but also substantial clinical benefits in octogenarians [14,16]. Although revision THAs were more frequently performed than revision TKAs in the past, the demand for knee revisions has now surpassed the demand for hip revisions [1,2]. To the authors' knowledge, only one study has specifically investigated revision TKA performed in patients over 80 year old [21]. That study showed a 100% satisfaction rate, but a 29% overall complication rate, among these elderly patients. Notably, this single-institution study included only 7 total patients over age 90 and had no comparison group, leaving a robust opportunity to study this population in greater detail to gain additional insight.

Due to the lack of objective research on the safety of revision TKA performed in octogenarians as noted in a recent review article by Rubin et al [11], the 3 purposes of this study were to utilize a national database with postdischarge follow-up data and a large patient population, National Surgical Quality Improvement Program (NSQIP) to (1) determine the preoperative and intraoperative characteristics of different age groups (<70, 70-79, and ≥80 years), (2) compare complications following revision TKA between octogenarians and a younger patient population (<70 years), and (3) compare complications following revision TKA between octogenarians and a younger geriatric patient population (70-79 years).

Materials and Methods

Patient Population

The NSQIP database collects over 150 preoperative, intraoperative, and postoperative variables through the 30th postoperative day, regardless of discharge status [22]. Data are collected from over 500 participating institutions in the United States [23]. Trained surgical reviewers abstract patient information through a variety of sources, which include medical records and patient interviews [24]. Routine auditing has revealed inter-rater disagreement rates below 2% [23]. Over the years, use of the NSQIP in orthopedics has become increasingly common and accepted [25]. Our institutional review board granted an exemption for studies using this dataset.

Patients who underwent revision TKA procedures between 2005 and 2015 were identified using the Current Procedural Terminology codes 27486 (single-component revision) and 27487 (2-component revision). Patients were then stratified into 3 age groups: <70, 70-79, and ≥80 years [14]. Patients who underwent emergency surgery or having primary International Classification of Diseases diagnosis codes indicating fracture, trauma, neoplasm, infection, septic indications, or inflammatory diagnoses were excluded. Based on these inclusion/exclusion criteria, 9989 revision TKA patients remained for further analysis.

Patient baseline characteristics such as age, gender, height, weight, functional status prior to surgery, American Society of Anesthesiologists (ASA) classification, diabetes mellitus, and smoking status were directly extracted from NSQIP. Body mass index (BMI), defined as weight (kg)/height (m)^2, was calculated from height and weight. The ASA score has been found to correlate well with patient comorbidities and used as a maker of comorbidity in the current investigation [26,27]. Diabetes mellitus was stratified as no diabetes, non-insulin-dependent diabetes mellitus, and insulin-dependent diabetes mellitus [28].

Operative duration, anesthesia type, and hospital length of stay were also directly extracted from the NSQIP database. Operative duration is defined as the total operation time in minutes [23]. Anesthesia type was categorized as other and general. Others included epidural, monitored anesthesia care/intravenous sedation, regional, local, and spinal. Length of stay is defined as the length of hospital stay from operation to discharge. The maximum length of stay in the current study is limited to 30 days.

Perioperative Adverse Events and Readmission

The NSQIP database tracks patients for the occurrence of individual complications through the 30th postoperative day, regardless of hospital discharge status. Individual complications were assessed and used to generate 3 groups of adverse events.

The occurrence of a minor adverse event (MAE) was defined as the occurrence of any of the following: urinary tract infection, pneumonia, blood transfusion, wound dehiscence, and renal insufficiency. The occurrence of a serious adverse event (SAE) was defined as the occurrence of any of the following: return to the operating room, wound-related infection, thromboembolic event, cardiac arrest, renal failure, myocardial infarction, stroke/cerebrovascular accident, on ventilator >48 hours, unplanned intubation, sepsis/septic shock, and death. The occurrence of any adverse event (AAE) was defined as the occurrence of an MAE or SAE.

In comparisons prior to propensity score matching, any individual complication that was significantly different between the 2 age groups was not counted as an MAE, SAE, or AAE. Likewise, in comparisons after propensity score matching, any individual complication that was significantly different between the 2 age groups was not counted as an MAE, SAE, or AAE. For example, blood transfusion was not counted as an MAE, SAE, or AAE in the comparison of grouped adverse events between the matched <70 vs ≥80-year-old groups. This was done because it was desired to see if aggregated other adverse events would be different between the 2 age groups when not being driven by the difference in individual complications already identified.

Occurrence of readmission within 30 days of operation is reported in the NSQIP database for cases that occurred in 2011-2015 but not for earlier cases. Hence, the analysis of readmission includes 8769 of 9989 cases, and this represents 87.8% of all cases included in the current study.

Data Analysis

Unadjusted Analysis

The first set of statistical analyses involved unadjusted comparisons of patient baseline characteristics, operative time, individual adverse events, aggregated adverse events, postoperative length of stay, and 30-day readmissions between the <70 vs ≥80-year-old groups and the 70-79 vs ≥80-year-old groups. Chi-squared tests or Fisher's exact tests were used for categorical variables and 2-tailed Student's *t*-tests for continuous variables.

Propensity Score Matched Analysis

For the second set of statistical analyses, propensity score matching was used in order to account for potential selection bias and different preoperative or intraoperative factors between the different age groups studied [29]. Propensity score matching uses a propensity score, which is a single score that is calculated based on