The Epidemiology of Revision Total Knee Arthroplasty in the United States

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Introduction:

Total knee arthroplasty is one of the most clinically successful and cost-effective interventions in health care, with numerous investigators reporting excellent long-term results in terms of reducing pain and improving function and quality of life in patients with knee arthritis. However, despite continual changes in surgical technique and implant design, the revision TKA burden (defined as the percentage of revision TKA cases as a function of all TKA cases) in the United States (U.S.) continues to rise. Factors related to patient selection, including an increase in the number of TKA procedures performed in younger, more active patients, and implant longevity have led to a steady rise in the volume of revision TKA procedures performed in the U.S. in recent years. Furthermore, recent population-based estimates suggest that the number of revision TKA procedures is expected to grow substantially over the next several decades.

The purpose of this study was to investigate the current causes of TKA failure and types of revision TKA procedures performed in the U.S., and to evaluate utilization of the newly adopted ICD-9-CM diagnosis and procedure codes related to revision TKA in administrative claims submissions.

Methods:

The Nationwide Inpatient Sample was used to identify revision TKA procedures performed in the U.S. between October 1, 2005 and December 31, 2006 using the ICD-9-CM procedure codes 00.80 (all component revision), 00.81 (tibial component), 00.82 (femoral component revision), 00.83 (patellar component), 00.84 (isolated tibial insert) 80.06 (arthrotomy/removal of prosthesis), and 81.55 (revision TKA, not otherwise specified). The Nationwide Inpatient Sample is a stratified, statistically valid survey of hospitals conducted by the Federal Healthcare Cost and Utilization Project. Hospitals within the sampling frame are stratified according to census regions, ownership (e.g., public, private), location (rural, urban), teaching status, and bed-size. Hospitals are randomly selected to achieve an approximate 20% sample of the universe of hospitals in each stratum. All discharge records from each of the selected hospitals are collected and form part of the Nationwide Inpatient Sample file for a given year. In 2006, the Nationwide Inpatient Sample had a sample size of approximately 8 million records from 1,054 hospitals in 37 states, which represent approximately 20% of all discharges from community hospitals in the United States, regardless of payment source. Because of the large size of the database, the Nationwide Inpatient Sample is particularly well suited for epidemiological studies related to specific procedures or diseases in the national population.

The prevalence of revision TKA procedures was calculated using the Nationwide Inpatient Sample for population subgroups in the United States stratified by age, gender, race, diagnosis, census region, primary payer class, and hospital characteristics (including size, location (e.g., urban or rural), and teaching status). Cause of failure, average length of hospital stay and total charges were also computed for each type of revision TKA procedure.

Results:

The total sample size included in the analysis was 60,355 revision TKA procedures with a mean patient age of 65.8 years. Men comprised 42.6% of the sample, while 83.3% of the patients were white.

The most common causes of revision TKA were infection (25.2%), mechanical loosening (16.1%), and implant failure (9.7%). Mechanical loosening was the most common indication for all component revision (19.1%), tibial component revision (24.6%), femoral component revision (23.1%), and patellar component revision (13.8%). Infection was by far the most common reason for arthrotomy and removal of prosthesis (79.1%) and isolated tibial insert revision (31.2%). Overall, 79% of procedures were reported using one of the 996 ICD-9 diagnosis codes, and 91% were reported using one of the new ICD-9 procedure codes.

The most common type of revision TKA procedure reported during the time period under study was all component revision (35.2%), followed by arthrotomy/revision (15.2%), tibial component revision (9.6%), and revision TKA, not otherwise specified (9.4%).

Overall, revision TKA procedures were most commonly reported in the 65-74 year old age group (30.1%), while isolated tibial component revisions and femoral component revisions were more commonly reported in patients age 55-64 (29.3% and 28.8%, respectively). Revision TKA procedures were most commonly reported in urban non-teaching hospitals (48.8%), compared with 41.2% in urban teaching hospitals, and only 9.9% in rural hospitals. Large hospitals accounted for the largest percentage of revision TKA procedures (61.3%), while only 13.7% of revision TKA’s were reported in small hospitals.

Medicare was the primary payer for 59.5% of revision TKA procedures, while Medicaid patients accounted for only 3.5% of cases.

The average hospital length of stay for all types of revision TKA procedures was 5.1 days; arthrotomy/removal of prosthesis procedures were associated with the longest length of stay (8.1 days). Component revision procedures were associated with the shortest length of stay (3.4 days). All component revisions were associated with the highest average billed charges ($56,087), while patellar component revision procedures were associated with the lowest average billed charges ($26,047). The average billed charges for all types of revision TKA procedures were $49,360.

The highest volume of revision TKA procedures were reported in the South (37.5%), and the lowest volume of revision procedures were reported in the Northeast (16.3%). Length of stay and total charges also differed by Census region. The shortest average length of stay (4.8 days) was reported in the Midwest and the West, compared with the longest average length of stay (5.8 days) in the Northeast. Average total charges for revision TKA procedures were highest in the West ($61,465), and were 1.4 times the average total charges for revision TKA procedures in the Midwest ($43,527).

Discussion:

Despite the excellent long-term results that have been reported with primary TKA, TKA failure and revision TKA remain significant clinical challenges for orthopaedic surgeons and their patients. However, despite continual changes in surgical technique and implant design, the revision TKA burden in the United States (U.S.) has not decreased over time. Understanding the causes of TKA failure and types of TKA procedures performed are essential to improving implant performance and long-term patient outcomes.

Our data indicate that infection is currently the most common indication for revision TKA in the U.S. This is particular concerning, especially given the substantial resources required to treat infected total joint replacements.

Our analysis suggests that adoption of the new revision TKA-related ICD-9-CM diagnosis and procedure codes by hospital administrative coding personnel is relatively high, but could be improved with additional education and training regarding the appropriate use of these new codes. The value of these new administrative codes in further elucidating the mechanisms of TKA failure and monitoring trends in failure rates and specific types of revision procedures is dependent on a clear understanding of the description and the intended meaning of each code, accurate and unambiguous clinical documentation in the medical record, and appropriate use of the new codes when submitting administrative claims related to revision TKA procedures.

Further study will be necessary to verify the accuracy of the new administrative codes (vis-à-vis their correlation with clinical documentation) and to determine if our findings persist in larger data sets encompassing longer time periods. As additional experience is gained with the new ICD-9-CM diagnosis and procedure codes related to revision TKA, valuable insights will be gained into TKA failure mechanisms, which may help guide future research, implant design, clinical decision making, and healthcare policy related to total knee arthroplasty.

References: