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Original Article

A Current Procedural Terminology Code for "Knee Conversion" Is Needed to Account for the Additional Surgical Time Required Compared to Total Knee Arthroplasty

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ABSTRACT

Background: Previous knee injury requiring surgical intervention increases the rate of future arthroplasty. Coding modifiers for removal of previous hardware or increased complexity offer inconsistent results. A Current Procedural Terminology code for knee conversion does not currently exist as it does for conversion hip arthroplasty. We investigate the extra time associated with conversion knee arthroplasty.
Methods: Sixty-three total knee arthroplasty (TKA) cases in the setting of previous knee hardware were identified from our institution between 2008 and 2015. Knee conversions were matched to primary TKA by age, gender, body mass index, Charlson Comorbidity Index, and surgeon, in a 3:1 ratio. Patients who underwent knee conversions were compared to matched TKA with regard to operative time, length of stay, discharge destination, readmission, and repeat procedures within 90 days from index procedure.
Results: The mean operating room time for primary TKA was 71.7 minutes (range 36-138). The mean operating room time for knee conversion was significantly greater by an additional 31 minutes; mean 102.1 minutes (range 56-256 minutes, $P < .0001$). Rates of readmission, 0.5% vs 3.2%, and repeat procedures, 5.3% vs 12.7%, within 90 days were greater for knee conversions. There was no difference in length of stay or discharge destination.
Conclusion: Total knee conversion results in a 43% increase in operative time and more than twice the rate of readmission and repeat procedures within 90 days compared to TKA. This suggests the need for an additional Current Procedural Terminology code for knee conversion arthroplasty to compensate surgeons for the extra time required for conversions.

Total knee arthroplasty (TKA) is one of the most successful surgical interventions for patients with severe knee osteoarthritis. The demand for TKA is expected to increase dramatically in the coming decade, up 673% by the year 2030 [1]. During the same period, the numbers of fellowship-trained arthroplasty surgeons are not expected to keep pace with demand for total joint arthroplasty [2,3]. This supply and demand mismatch may force busy arthroplasty surgeons to be more selective in the cases they undertake.

It is well documented in the literature that previous injury to the knee requiring operative intervention increases the likelihood of TKA in the future [4-6]. TKA in these cases may involve a more difficult surgical exposure, difficult removal of hardware, the use of more advanced implants, a more difficult patient recovery, and an increased risk of complications. Yet, the surgeon compensation for TKA is not currently increased when the technical complexity of the case is elevated. Unlike hip conversion arthroplasty (CPT 27132), a separate CPT for knee conversion arthroplasty does not currently exist. The use of coding modifiers, 22, 51, and 59 modifiers, may instead be used with inconsistent results [7,8]. One retrospective analysis demonstrated increased reimbursement in 42% cases using the

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22 modifier in elective arthroplasty and spine procedures. In these cases, reimbursement was increased by a mean 5% but resulted in a significant delay in payment [7]. In addition, the Centers for Medicare and Medicaid Services classifies TKA under Medicare Severity–Diagnosis-Related Groups 469 (primary TKA with major complication/comorbidity) and 470 (primary TKA without major complication/comorbidity) to capture differences in illness severity [9,10]. As a result, conversion and primary TKA with similar comorbidities remain bundled under the same Diagnosis-Related Group (DRG).

Considering the developing mismatch in the supply and demand for fellowship-trained joint arthroplasty surgeons, there may be disincentives to surgeons performing knee conversion cases, thereby reducing patient access to care. In this study, we seek to investigate the additional time required by the surgeon in knee conversion arthroplasty.

Materials and Methods

Institutional review board approval was obtained for this retrospective study. A total of 3623 TKA procedures conducted at a single institution by all surgeons between 2008 and 2015 were identified by CPT (27447) and International Classification of Diseases, Ninth Revision (81.54) codes. Preoperative and postoperative radiographs were used to identify a total of 63 knee conversions. Knee conversions were defined by the presence of periarticular hardware requiring removal prior to insertion of knee arthroplasty components. In some instances, conversions required use of revision arthroplasty components after removal of hardware due to bone loss, deformity, and/or question of component stability. All hardware was confirmed present and/or removed based on preoperative and postoperative knee radiographs, respectively. Exclusion criteria included procedures performed for infection, antibiotic spacer placement, revision antibiotic spacer, conversion from antibiotic spacer to TKA, revision of unicompartmental arthroplasty to TKA, revision TKA, and bilateral TKA. Patients with incomplete clinical and radiographic data were not included in the analysis.

All identified knee conversion patients were matched to primary TKA patients by age, sex, body mass index (BMI), age-adjusted Charlson Comorbidity Index [11,12], and surgeon in 1-3 fashion using propensity score matching [13]. Operating room (OR) time was determined for all identified conversions and matched TKAs based on the intraoperative incision and close times recorded in the institution's electronic medical record (EMR). Similarly, hospital length of stay (LOS) and discharge destination (home vs inpatient rehabilitation facility) were determined for all patients from the EMR. Readmission rates and reoperation rates within 90 days of index procedure with associated diagnosis were determined for all patients from the hospital and practice EMRs. Readmission was defined as any unplanned inpatient hospital admission within 90 days of index procedure. Reoperation was defined as any return to the OR within 90 days of index procedure.

Statistical Analysis

Mann-Whitney test was performed to compare OR times and LOS between the 2 groups. Fisher's exact test was used to compare binary outcomes, discharge to a rehab facility, readmission, and reoperation rates between knee conversions and matched TKAs. Significance was set at $P = .05$. Statistical analysis was performed by a single statistician, using R 3.2.3 software (R Foundation for Statistical Computing, Vienna, Austria).

Results

Sixty-three knee conversions were identified based on preoperative and postoperative radiographs. The majority of conversions had previous ligament reconstruction requiring internal fixation (27%), followed by tibial hardware from previous plateau fracture (25.4%) and high tibial osteotomy (25.4%) (Table 1). Identified conversions were 57% male, 43% female, had a mean age of 58.7 years, BMI 31.2, and age-adjusted Charlson Comorbidity Index of 2.47 (Table 2). A total of 189 primary TKAs were matched to the identified conversions by age, gender, BMI, age-adjusted Charlson Comorbidity Index, and surgeon by propensity score matching in a 3:1 ratio. Those matched primary TKAs were 57% male, 43% female, had a mean age of 59.5 years, BMI 31.1, and age-adjusted Charlson Comorbidity Index of 2.55 (Table 2).

The mean OR time for identified knee conversions was 102.1 ± 38.6 minutes (range 56-256 minutes). This average was 31 minutes longer than mean OR time for matched primary TKA, 71.7 ± 17.1 minutes (range 36-138 minutes) ($P < .0001$). There was no difference in mean LOS for knee conversions, 2.48 days (range 1-5 days) and matched TKA, 2.43 days (range 0-10 days) ($P = .65$). There was also no difference in the proportion of patients discharged to a rehabilitation facility from the hospital for knee conversions (14.3%) compared to TKAs, (13.2%) of patients ($P = .8329$). More patients undergoing knee conversion (3.2%) required 90-day readmission compared to TKAs (0.5%) ($P = .1551$). More patients who had undergone knee conversion required an additional procedure within 90 days (12.7%), compared to matched TKAs (5.3%; $P = .08483$; Table 3). A single matched TKA patient required popliteal artery stent on postoperative day (POD) 1 for acute arterial injury. The majority of patients requiring return to the OR underwent manipulation under anesthesia for arthrofibrosis (Table 4). Two knee conversion patients underwent component explant and antibiotic spacer placement for prosthetic joint infection as defined by the Musculoskeletal Infection Society criteria [14], both on POD 20. These 2 patients underwent knee conversion and removal of hardware from previous tibial plateau fracture and high tibial osteotomy. One patient presented with acute sepsis and gross purulence from the knee. The other conversion demonstrated gross purulence intraoperatively. In both cases, it was noted by the surgeon that they felt 2-stage revision gave the patient the best chance for clearing their infection. One matched TKA patient underwent irrigation and debridement with polyethylene exchange for wound drainage on POD 19 (Table 4). This patient presented with persistent serous drainage with insignificant preoperative knee aspiration results. Polyethylene exchange was performed as precaution in the acute postoperative period.

Discussion

Recent studies have demonstrated greater time, cost, and increased complications associated with conversion total hip

Table 1
The Number and Percentage of Identified Conversions by Previous Knee Surgery.

Hardware	Number of Patients	Percentage
Ligament reconstruction	17	27.00
Tibial plateau hardware	16	25.40
High tibial osteotomy	16	25.40
Femoral plate	6	9.50
Femoral staples	5	7.90
Tibial nail	2	3.20
Femoral nail	1	1.60

All identified knee conversions required removal of previous hardware during preparation and insertion of arthroplasty components.