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Total Knee Arthroplasty Within Six Months After Knee Arthroscopy Is Associated With Increased Postoperative Complications

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ABSTRACT

A national database was queried for patients who underwent TKA following ipsilateral knee arthroscopy. Three cohorts were created: TKA within 6 months of knee arthroscopy (n = 681), TKA between 6 months and 1 year after knee arthroscopy (n = 1301) and TKA between 1 and 2 years after knee arthroscopy (n = 1069). An age-matched control group of TKA without prior knee arthroscopy was also created (n = 37,235). The incidences of infection (OR 2.0, $P = 0.004$), stiffness (OR 2.0, $P = 0.001$) and VTE (OR 1.6, $P = 0.047$) were higher in patients who underwent TKA within 6 months after knee arthroscopy compared to controls. There was no increase in complications when TKA was performed more than six months after knee arthroscopy.

In younger patients with symptomatic knee osteoarthritis, many surgeons attempt to delay total knee arthroplasty (TKA) by performing an arthroscopic procedure which may include a shaving chondroplasty, partial meniscectomy, and/or loose body removal. This seemingly low-risk and outpatient procedure may provide a short duration of reduced knee symptoms and postpone the need for arthroplasty [1,2]. Additionally, arthroscopy has been proposed as a method to preoperatively evaluate a patient's suitability for unicompartmental arthroplasty [3]. Recently, however, the utility of knee arthroscopy for osteoarthritis has been questioned, as arthroscopic debridement was found to have no benefit over sham procedures or physical therapy for select patients with this diagnosis [4,5]. Despite conflicting evidence, many patients desire knee arthroscopy, as they are not yet an appropriate candidate for TKA, not mentally prepared for a large arthroplasty procedure, or are not yet willing to follow the postoperative restrictions or rehabilitation after TKA. However, although less of a commitment than TKA, arthroscopy still comes with risk and cost and cannot be considered a benign procedure.

For patients with arthritis who remain symptomatic following arthroscopic debridement, TKA remains a viable option. Between 2.2% and 10.2% of patients with osteoarthritis who have knee arthroscopy will undergo TKA within 1 year of arthroscopy [6–8]. Risks for early TKA after arthroscopy include advanced arthritis, older age and female sex [1,6–8]. The risks that prior arthroscopy confer on subsequent TKA are not as well characterized. Previous studies have reported conflicting results of TKA after knee arthroscopy; increased rates of postoperative complications and revision TKA were seen in one study, whereas another demonstrated no difference in subjective outcomes or implant survivorship [9,10]. No previous studies have determined a correlation between the interval of time between arthroscopy and arthroplasty and the risk of complications or need for revision TKA.

The purpose of the present study was to examine the association of knee arthroscopy prior to TKA with selected postoperative complications after TKA. A large, established national administrative database was utilized to achieve a comprehensive comparative analysis, including a control cohort of TKA without prior arthroscopy and three study groups of patients who underwent TKA within six months, six months to one year, and one to two years after ipsilateral knee arthroscopy. Our hypothesis was that recent ipsilateral knee arthroscopy will have a significant association with increased rates of postoperative complications after TKA, including prosthetic joint infection, arthrofibrosis and venous thromboembolism.

Materials and Methods

The PearlDiver Patient Records Database (www.pearldiverinc.com, Fort Wayne, IN), a for-fee insurance-based database of patient records, was utilized for this study. The database contains procedural volumes, patient demographics and average charge information for patients with International Classification of Diseases, 9th Revision (ICD-9) diagnoses and procedures or Current Procedural Terminology (CPT) codes. All data are de-identified and anonymous, and were thus exempt from institutional review board approval. The PearlDiver Data for the present study was derived from two databases within the PearlDiver database: a

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private-payer database and a Medicare-based database. The private-payer database has its largest contribution from UnitedHealth Group (Decatur, IL), with over 30 million individual patient records. The Medicare database has over 100 million individual patient records from 2008 to 2011.

The database was queried for TKA using CPT 27447 and two common knee arthroscopy procedures for osteoarthritis: partial meniscectomy (CPTs 29880 or 29881) and shaving chondroplasty (CPT 29877). CPT codes were used in favor of ICD-9 procedure codes as CPT modifiers were necessary to ascertain laterality. The resulting TKA and knee arthroscopy cohorts were then divided into "left" and "right" cohorts using CPT modifiers for left (LT) and right (RT). Records without laterality designation were excluded.

Patients who underwent TKA after ipsilateral knee arthroscopy were then identified using Boolean coding within the database; this included patients who underwent left TKA after left knee arthroscopy and those who underwent right TKA after right knee arthroscopy. These study patients were then divided into three separate cohorts: TKA within 6 months of ipsilateral knee arthroscopy (Arthroscopy/TKA #1), TKA between 6 months and 1 year after ipsilateral knee arthroscopy (Arthroscopy/TKA #2) and TKA between 1 and 2 years after ipsilateral knee arthroscopy (Arthroscopy/TKA #3). Patients who underwent TKA exactly 6 months following knee arthroscopy were included in Arthroscopy/TKA #2; patients who underwent TKA exactly 1 year following knee arthroscopy were included in Arthroscopy/TKA #3. Patients who underwent TKA exactly 2 years following knee arthroscopy were not included in the study.

A control group of TKA without previous knee arthroscopy was created for comparison purposes. The PearlDiver database coding as it presently exists does not allow for line-by-line output of patient data due to patient confidentiality concerns and thus matching of the control cohort to all demographics of arthroscopy prior to TKA cohorts was not feasible. Selecting a control cohort based on a single demographic variable was possible; thus the control cohort of TKA was selected to match the average age distribution of the three study cohorts.

The demographics of the control cohort and three study cohorts were recorded as provided by the database and compared. The average Charlson Comorbidity Index (CCI) and standard deviation for each cohort was calculated by the database and compared between cohorts. Three major categories of postoperative complication after TKA were assessed: infection, stiffness, and venous thromboembolism (VTE). Postoperative infection was characterized by either a diagnosis of or procedure for either wound or deep infection within 90 days after TKA using the following codes: ICD-9s 996.66, 996.67, 996.69, 998.51, 998.59 and CPTs 20005, 27310, 29871. Postoperative stiffness was characterized by either a diagnosis of or a procedure for arthrofibrosis within 90 days after TKA using the following codes: ICD-9s 718.46, 718.56 and CPT 27570. Postoperative VTE was characterized by a diagnosis of pulmonary embolism (PE) and/or lower extremity deep venous thrombosis (DVT) within 90 days after TKA using the following codes: ICD-9s 453.40, 453.41 and 453.42.

Statistical comparisons of cohort demographics and postoperative complications were completed with Pearson χ^2 analysis. An independent sample t-test was used to compare the average CCI between cohorts. Odds ratios (ORs) were calculated with respective 95% confidence intervals (CIs). For all statistical comparisons, $P < 0.05$ was considered significant. SPSS version 21 for Macintosh (IBM, Armonk, New York) was used for all statistical calculations.

Results

In total, 40,286 unique patients who underwent TKA were included in the study. This included 37,235 patients in the control cohort, 681 who underwent TKA within 6 months after knee arthroscopy (Arthroscopy/TKA #1), 1301 who underwent TKA within 6 months to 1 year after knee arthroscopy (Arthroscopy/TKA #2) and 1069 who underwent TKA within 1–2 years after knee arthroscopy (Arthroscopy/TKA #3). Demographics of each cohort, including sex, age group and CCI, are presented and compared in Table 1. There were no significant differences in age group distribution between the cohorts. The sex distribution was similar between cohorts; however, there was a slight but statistically significant higher percentage of female patients in Arthroscopy/TKA cohorts #2 and #3. The average CCI was similar between the control cohort and the Arthroscopy/TKA #1. The CCI was significantly lower (less severe) in Arthroscopy/TKA #2 and #3 compared to the control TKA cohort (Table 1).

The incidences of postoperative complications within 90 days after TKA for each cohort are presented in Table 2A and associated statistical comparisons in Table 2B. The incidences of infection (OR 2.0, $P = 0.004$), stiffness (OR 2.0, $P = 0.001$) and VTE (OR 1.6, $P = 0.047$) within 90 days following TKA were higher in the Arthroscopy/TKA #1 cohort compared to the control TKA cohort. There were no significant differences in the incidences of the assessed postoperative complications between the Arthroscopy/TKA #2 and #3 cohorts compared to the control TKA cohort (Fig. 1).

Discussion

The role and effectiveness of arthroscopy in the management of knee osteoarthritis is unclear [11–18]. Despite recent studies reporting little utility for arthroscopic debridement for arthritis and high rates of conversion to TKA within a year following arthroscopy, it is still frequently performed in individuals who are not yet appropriate or prepared for arthroplasty [4,6–8,19]. Previous studies have reported conflicting outcomes of TKA after knee arthroscopy [9,10]. Our study of 40,286 TKA patients including 3051 who underwent arthroscopy prior to TKA demonstrated that TKA within 6 months of prior ipsilateral knee arthroscopy is associated with significantly higher rates of infection, stiffness, and VTE compared with age-matched controls. This effect appears to normalize with time, as TKA more than 6 months after ipsilateral knee arthroscopy had no difference in complication rates compared to age-matched controls.

Two previous studies have attempted to characterize outcomes of TKA after knee arthroscopy. Piedade et al retrospectively evaluated 60 primary TKAs with prior arthroscopic debridement and compared them to 1119 primary TKAs without previous surgery [9]. The average interval between arthroscopy and TKA in their series was 53 months (4.4 years). The authors found higher postoperative complication ($P < 0.01$) and revision rates ($P < 0.01$) in patients who underwent prior arthroscopy. The authors did not find a correlation between the arthroscopy to TKA time interval and postoperative complication or failure rate ($P < 0.55$) [9]. In contrast, Issa et al retrospectively compared 62 TKAs in 60 patients who underwent at least two prior arthroscopic procedures with 438 patients who underwent primary TKA without any previous knee surgery [10]. The authors found no significant difference in implant survivorship, Knee Society objective and function scores, or radiographic outcomes. Both studies were likely underpowered to detect the effect of time interval between arthroscopy and TKA on postoperative outcomes, or to detect differences in important postoperative complications such as infection, stiffness, and VTE.

Periprosthetic joint infection is a devastating and expensive postoperative complication. For primary TKA, large prospective and database studies have estimated the risk to be between 0.4% and 2% [20,21]. The infection rate in our control cohort was 1.4%, well within published range. Obesity, diabetes, hypertension, knee steroid injections, rheumatoid arthritis, malnutrition, tobacco smoking, alcoholism, depression, and urinary tract infection have all been identified as risk factors for periprosthetic joint infection [20–26]. Our data found knee arthroscopy within 6 months prior to TKA was associated with a 2-fold increase in 90-day postoperative infection risk. The etiology for this increased infection risk cannot be determined from this study but may be a result of the capsular violation from recent arthroscopy or persistent synovitis