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Early Postoperative Outcomes of Primary Total Knee Arthroplasty After Solid Organ Transplantation in the United States, 1998–2011

Alison K. Klika, MS [a], Thomas Myers, MD [a], Caleb R. Szubski, BA [a], Nicholas K. Schiltz, PhD [b], Suparna Navale, MS, MPH [b], Wael K. Barsoum, MD [a]

[a] Department of Orthopaedic Surgery, Cleveland Clinic, Cleveland, Ohio
[b] Department of Epidemiology and Biostatistics, Case Western Reserve University, Cleveland, Ohio

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ABSTRACT

This review of the Nationwide Inpatient Sample (1998–2011) examined trends in solid organ transplant patients who received a total knee arthroplasty (TKA) to determine whether length of stay (LOS), cost, and perioperative complications differed from non-transplant peers. Primary TKA patients (n = 5,870,421) were categorized as: (1) those with a history of solid organ transplant (n = 6104) and (2) those without (n = 5,864,317). Propensity matching was used to estimate adjusted effects of solid organ transplant history on perioperative outcomes. The percentage of TKA patients with a transplant history grew during the study period from 0.069% to 0.103%. Adjusted outcomes showed patients with a transplant had a 0.44 day longer LOS, $962 higher cost of admission, and were 1.43 times more likely to suffer any complication ($P = 0.0002$).

Over 500,000 solid organ transplants have been performed in the United States since 1988. [1] In order of most common to least common these include kidney, liver, heart, lung, and pancreas. Increased survival of solid organ transplant patients over the past 30 years has allowed more of these patients to develop osteoarthritis requiring total knee arthroplasty (TKA) [2–5]. The increased survival of transplant patients is due to a combination of improvements in surgical technique, immunosuppressive regiments, patient selection, and postoperative care [2,3]. In addition, these patients are subjected to long-term steroid use to prevent organ rejection, placing them at risk for osteonecrosis of the femoral condyle which may require TKA. Increased complication rates status post TKA from immunosuppression and metabolic derangements secondary to organ dysfunction are of high concern for the orthopedic surgeon.

The current medical literature is limited in regards to outcomes of solid organ transplant patients following TKA. A systematic review of published studies regarding TKA status post solid organ transplant encompassed 51 TKAs in 9 studies [6]. Klatt et al [7] recently reported a high complication rate (9/23; 39.1%) and infections (4/23; 17.3%) in a retrospective review of 23 TKA patients with a history of solid organ transplant. In contrast, Boquet et al reviewed 16 TKA patients with a history of renal transplant and found no complications. The common limitation in these studies and other studies in the literature is that they rely on relatively small case series. With such low numbers of TKAs, firm conclusions regarding the outcomes of TKA following solid organ transplantation are difficult to determine.

To overcome the low incidence of patients with a history of solid organ transplant who go on to receive a TKA, the present study utilized a large, nationally representative database to retrospectively compare outcomes in these patients with non-transplant peers. The purpose of the present study was to examine annual trends in solid organ transplant patients who receive a TKA and to determine whether length of stay (LOS), cost, and perioperative complications differed between the two groups of patients. We hypothesized that patients with a history of solid organ transplantation would have a significantly greater LOS, cost, and experience more perioperative complications when compared with patients without a history of transplantation following TKA.

Methods

Data Description

Data were obtained from the Nationwide Inpatient Sample (NIS) for the years 1998–2011 [8]. This study was deemed exempt from review by the institutional review board because the data used in this study were deidentified. The NIS is part of the Healthcare Cost and Utilization Project (HCUP), sponsored by the Agency for Healthcare Research and Quality. It is the largest all-payer inpatient care database that is publicly available in the US containing nearly 8 million records of inpatient stays per year from over 1000 hospitals, approximating a 20% stratified sample of hospitals in the US (see www.hcup-us.ahrq.gov/nisoverview.jsp for further information). The NIS provides weights that allow for

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Reprint requests: Alison Klika, MS, Department of Orthopaedic Surgery, Cleveland Clinic — A41, 9500 Euclid Ave., Cleveland, OH 44195.

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nationally representative estimates. There are over 100 clinical and non-clinical data elements available through the NIS, such as International Classification of Disease, 9th edition (ICD-9-CM) primary and secondary diagnoses and procedures, admission and discharge status, and patient demographics (*e.g.*, sex, age, race, payment source, duration of stay).

Sample Selection

Patients who received a primary TKA (ICD-9-CCCM 81.54) from 1998 through 2011 were included in the study (weighted n = 6,350,918) (Fig. 1). The following were sequentially excluded from the study: patients with admission type of emergency, urgent, newborn, trauma center, or other or admission source of emergency room, patients with a primary diagnosis suggestive of prior arthroplasty, patients with malignant neoplasm and/or metastatic cancer, patients with pathologic fractures of the lower extremity, and patients under 18 years old. Appropriate codes were used to identify patients with a transplant of any kind (n = 15,529) and were removed entirely to create the "non-transplant group (n = 5,864,317). Of those 15,529 patients, there were 6104 primary TKA patients with a history of solid organ transplant [DX: V42.0 (kidney), V42.1 (heart), V42.6 (lung), V42.7 (liver), V42.83 (pancreas)].

Demographic and Outcome Measures

The annual frequency of primary TKA status post solid organ transplant was estimated using weighted frequencies. Demographics including age, sex, race, primary source of payment, distribution of procedures by hospital size, teaching status, and regional location were estimated. For a large number of cases (approximately 23%), the race category was not available. Comorbidity profiles were analyzed by determining the prevalence of a number of disease states as defined in the Comorbidity Software provided by the Agency for Healthcare Research and Quality [9]. We also examined the trends and comparison between groups in terms of hospital length of stay (LOS), costs per admission, and perioperative complications and adverse events. Costs were

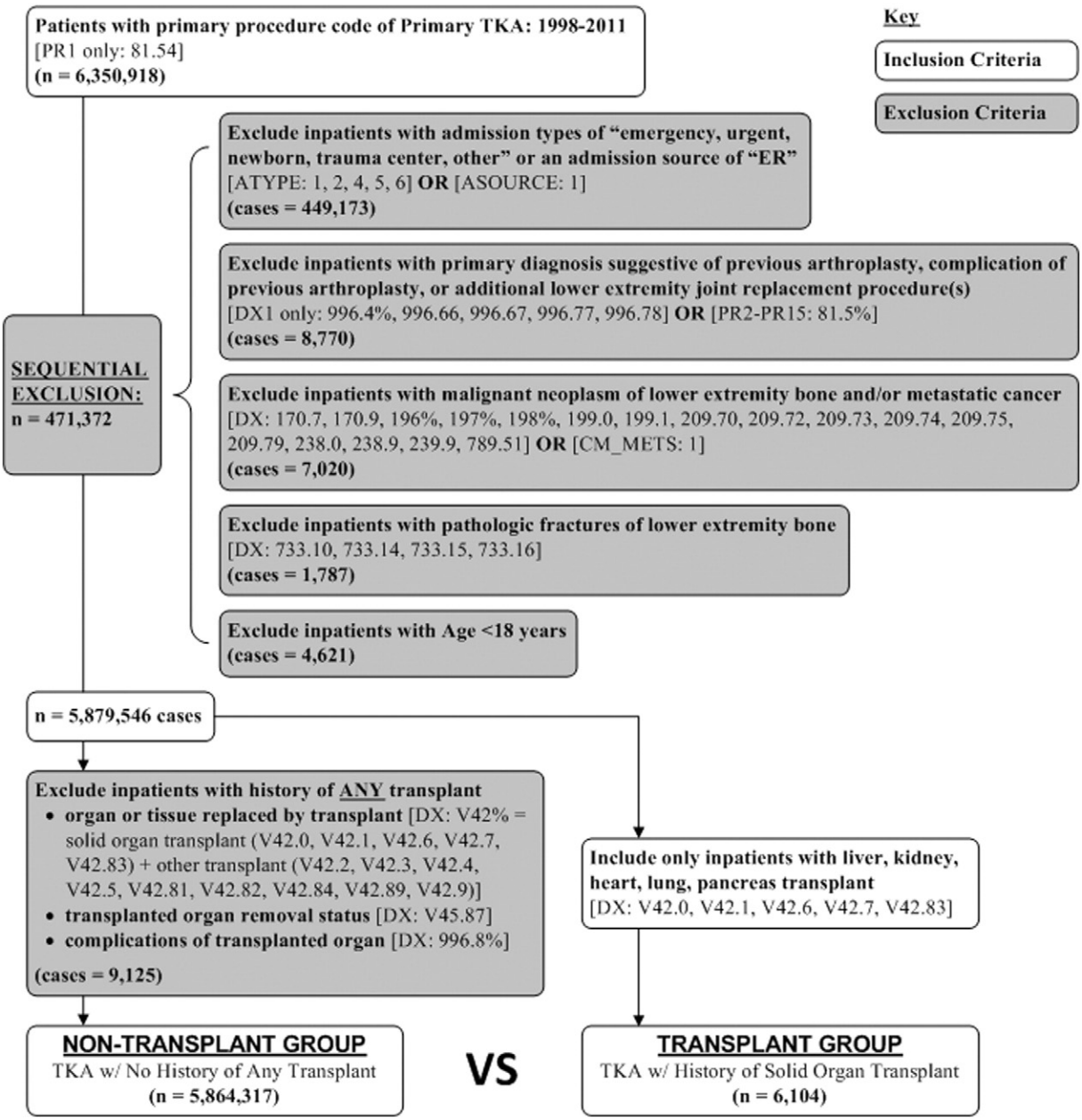

Fig. 1. Flow diagram describing the methodology for cohort identification.