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Original Article

Primary Total Knee Arthroplasty After Solid Organ Transplant: Survivorship and Complications

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ABSTRACT

Background: Clinical outcomes remain largely unknown beyond perioperative and short-term follow-up of solid organ transplant (SOT) patients undergoing total knee arthroplasty (TKA).
Methods: Patient mortality, implant survivorship, and complications of 96 TKAs (76 patients) after SOT were retrospectively reviewed through an internal joint registry. Mean age at index arthroplasty was 66 years, and mean follow-up was 4 years.
Results: Overall mortality rates at 1 year, 2 years, and 5 years from TKA were 2.6%, 7.9%, and 13.2%, respectively, and combined SOT patient survivorship was 92% at 2 years and 82% at 5 years. Implant survivorship free of any component revision or implant removal was 98% at 2 years and 93% at 5 years. There was a high rate of perioperative complications (12.5%), including periprosthetic fractures (5.2%) and deep periprosthetic infection (3.2%).
Conclusion: TKA does not appear to have any effect on SOT patient survivorship following the procedure. However, SOT patients may have a higher risk of perioperative complications and a lower implant survivorship than the general population of TKA patients at midterm follow-up.

Solid organ transplantation (SOT) continues to be an increasingly effective life-saving treatment for patients with end-stage kidney, liver, heart, lung, and pancreas disease. In 2014, approximately 30,000 patients underwent various SOTs, which sustained an upward trend of most types of transplants over the previous year [1]. The increasing success of SOT operations and patient survival can be attributed to improved patient/donor selection, surgical techniques of the transplant, novel immunosuppressive regimens, and long-term coordinated medical care. With improved patient survival and natural development of knee osteoarthritis, transplant patients can be expected to pursue total knee arthroplasty (TKA). According to a recent nationwide inpatient sample, the percentage of TKA patients with a transplant history substantially increased in the past decade from 0.069% to 0.103% [2].

A number of studies have demonstrated higher surgical risks but good clinical outcomes related to total joint arthroplasty after specific SOT [3-8]. However, the majority of current literature primarily focuses on total hip arthroplasty, with relatively smaller cohort numbers and data regarding TKA results after SOT. Sayed-Noor [9] provided an initial review of arthroplasties other than hip (including 8 studies, 51 knees) after SOT and demonstrated a low complication rate and only 1 periprosthetic infection. Conversely, Klatt et al [10] demonstrated a very high complication rate (39%) and incidence of infection (17%) in 23 TKAs after SOT. To overcome the low incidence of TKA after SOT patients, Klika et al [2] used a national database to compare early postoperative outcomes of these patients to those without transplant and found longer lengths of stay, higher admission costs, and increased likelihood of any complication for the transplant cohort.

Still, clinical outcomes remain largely unknown beyond perioperative and short-term follow-up of patients undergoing TKA after transplant. Furthermore, to the authors' knowledge, there have been no such reports estimating patient mortality and survivorship in a contemporary transplant cohort undergoing TKA. The

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aim of the present study was to evaluate the midterm results of TKA after various SOT, with specific focus on patient mortality, implant survivorship, and clinical outcomes including complications.

Patients and Methods

This study used an institutional total joint registry that has followed all primary and revision TKAs at our institution since 1969. We retrospectively identified all SOT patients who underwent primary cemented TKA between January 1, 2000, and December 31, 2013. All patients had a concomitant diagnosis of a SOT before the index primary TKA, and a minimum potential clinical follow-up of 2 years. The mean follow-up was 4.3 years (range, 0.3-13.4 years). Exclusion criteria included age <18 years or TKA performed before SOT. Institutional review board approval was obtained before initiation of the study.

Elective TKA was performed for end-stage degenerative joint disease that failed to improve with conservative treatment, and only after surgical clearance from the organ-specific transplant physicians. All procedures were performed by reconstructive knee subspecialists with contemporary techniques and implants. SOT patients were maintained on their recommended immunosuppressive medication regimen throughout the perioperative period.

The cohort included 96 primary TKAs (76 patients) with a mean age of 66 years (range, 35-81 years) at the time of index arthroplasty, and mean age of 54 years (range, 16-74 years) at the time of SOT. There were 38 women and 38 men. The mean body mass index was 30.9 kg/m^2 (range, 21.4-51.4 kg/m^2). Fifty-nine TKAs (62%) were performed in patients after renal transplantation, 26 (27%) after liver transplantation, 9 (10%) after cardiac transplantation, and 2 (2%) after simultaneous renal-pancreas transplantation (Table 1). Specific clinical outcomes assessed include complications, reoperations/revisions, and Knee Society Scores (KSS) [11].

Statistical Analysis

Dichotomous variables were analyzed with 2-tailed Fischer exact square tests. Kaplan-Meier survivorship curves were constructed to analyze both patient and implant survivorship. Cox regression analysis was used to compare survivorship in subgroups of patients. A significance value was set at alpha <0.05. Statistics were performed using JMP version 10.0 (SAS, Cary, NC).

Table 1
Patient and Organ Transplant Demographics.

Variable	Results
Knee arthroplasties	96
Patients	76
Average age at knee arthroplasty (y)	66 (35-81)
Solid organ transplant type	
Renal (%)	59 (61)
Liver (%)	26 (27)
Cardiac (%)	9 (10)
Simultaneous renal-pancreas (%)	2 (2)
Patient mortality rate	
1 y (%)	2 (2.6)
2 y (%)	6 (7.9)
5 y (%)	10 (13.2)
Patient survivorship (95% CI)	
2 y (%)	92 ± 3
5 y (%)	82 ± 5
Procedure-related complications (%)	12 (12.5)
Reoperations (%)	4 (4.2)
Component revision (%)	4 (4.2)
Infection—operatively treated (%)	3 (3.2)
Implant survivorship (5-y rate, CI)	
Free from any reoperation (%)	93 ± 5
Free from component revision (%)	87 ± 5

CI, confidence interval.

Results

Patient Mortality

The overall mortality rates at 1 year, 2 years, and 5 years from date of TKA were 2.6%, 7.9%, and 13.2%, respectively (Table 1). Mortality rates were not significantly ($P > .05$) different with respect to the type of SOT (Fig. 1). One renal transplant patient (1.3%) had a fatal myocardial infarction on postoperative day 2. All other deaths were secondary to medical comorbidities or transplant-related complications.

The combined estimated SOT patient survivorship was 92% (95% confidence interval [CI] = 89%-95%) at 2 years and 82% (95% CI = 77%-82%) at 5 years. Survivorship did vary among transplant cohorts with 94% (95% CI = 89%-99%) survivorship in the liver and 100% in cardiac transplant patients. The lowest 5-year patient survivorship was found in the renal transplant group (73%; 95% CI = 65%-81%; Table 2). Although a clinical difference was present in patient survivorship based upon type of SOT, this did not reach statistical significance ($P > .05$).

Implant Survivorship

Four TKAs (4.2%) underwent revision procedures. Two knees (2.1%) underwent tibial component revision for aseptic tibial loosening. Two knees (2.1%) required revision procedures and chronic antibiotic suppression for deep periprosthetic joint infection (PJI); 1 patient underwent a successful 1-stage exchange whereas the other patient underwent a successful 2-stage exchange. Combined with the TKAs requiring acute irrigation and debridement, the overall superficial and deep PJI rate was 3.2%, but there was no significant ($P > .05$) difference in the rates between each specific organ group (Table 2). The overall implant survivorship free of component revision or implant removal was 98% (95% CI, 96%-100%) at 2 years and 93% (95% CI, 90%-96%) at 5 years. Type of SOT was not a significant risk factor for component revision ($P > .05$).

Four TKAs (4.2%) required reoperations for various causes without component revision. One knee (1.0%) underwent irrigation and debridement with component retention for PJI. The 3 other reoperations included the following: 1 (1.0%) to remove a retained drain, 1 (1.0%) open reduction and internal fixation of a periprosthetic distal femur fracture with component retention, and 1 (1.0%) open lysis of adhesions for patellar clunk. The overall implant survivorship free of any reoperation or revision was 98% (95% CI, 96%-100%) at 2 years and 87% (95% CI, 82%-92%) at 5 years (Fig. 2).

Complications and Clinical Outcomes

Twelve TKAs (12.5%) experienced procedure-related postoperative orthopedic complications. There were a total of 5 knees (5.2%) with periprosthetic fractures including 4 postoperative fractures (patella, 2; medial femoral condyle, 1; supracondylar femur, 1) and 1 intraoperative patella fracture. Aside from the aforementioned postoperative distal femur fracture open reduction and internal fixation, 4 of the fractures were treated nonoperatively including the medial femoral condyle and 3 patellar fractures with partially intact extensor mechanisms. Two patients (2.1%) with preoperative valgus deformities, including 1 with a 10° flexion contracture, experienced peroneal nerve palsies; 1 fully recovered and 1 only partially recovered function. One patient (1.0%) had a pulmonary embolism postoperatively and was subsequently