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Perioperative Complications of Total Knee Arthroplasty in Dialysis Patients

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ABSTRACT

Background: Total hip arthroplasty in patients with end-stage renal disease (ESRD) may be associated with a high complication rate. However, the perioperative complication and mortality rates in these patients after total knee arthroplasty (TKA) have rarely been investigated. The purposes of this study were to measure the mortality and complication rates and to evaluate the 2- to 10-year clinical outcome of TKA in dialysis patients at our hospital during the past decade.

Methods: We retrospectively assessed 21 patients (26 knees) with ESRD who underwent primary TKA between 2007 and 2015. A preoperative medical evaluation was performed in all patients to assess the risk of surgery. All patients had complete clinical and radiographic evaluations, and the outcome was scored using American Knee Society Scores and the Western Ontario and McMaster Universities Arthritis Index. Perioperative complications and mortality were recorded.

Results: One patient died of stroke 1 year after surgery (4.8% mortality). The mean follow-up period of other 20 patients was 5.8 years (69.7 months, 24 to 119 months). Six patients (28.5%) had medical complications, including pneumonia (n = 3), stroke (n = 2), and cardiovascular events (n = 3), after discharge from hospital. At the latest follow-up, 19 patients (90.5%) had improved clinical outcomes of the knee after TKA according to the American Knee Society Scores ($P < .01$) and Western Ontario and McMaster Universities Arthritis Index scores ($P < .01$).

Conclusion: Our study showed that TKA was a valid option for dialysis patients after careful preoperative evaluation. Most patients had an improved clinical outcome. There were no instances of prosthetic loosening or deep infection. However, dialysis patients under consideration for TKA need to be informed of the risk of possible medical complications due to the nature of ESRD.

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Total knee arthroplasty (TKA) is a successful and widely used procedure for patients with advanced osteoarthritis [1,2]. Patients under dialysis often need a TKA to improve their knee pain caused by advanced arthropathy and to restore knee function. Dialysis patients have a higher risk of comorbidities, including coronary artery disease [3], impaired myocardial function [4], and carotid

stenosis [5], which are related to postoperative complications. Some studies have demonstrated that hip arthroplasty in this patient population has a poor outcome and is associated with high mortality and morbidity [6–13]. For example, one study reported a 58% mortality rate, a 58% early complication rate, and a 13% deep infection rate after 15 total hip arthroplasty (THA) procedures in 12 dialysis patients [9]. However, few studies have specifically focused on the outcome of TKA among patients currently undergoing dialysis. A large cohort study examining the infection rate in TKA patients showed that dialysis patients were at significant risk of late infection (8.03%; $P < .001$) and early revision (3.7%; $P < .001$). However, other complications or deaths have not been reported [14]. Recently, Ling et al [15] reported a low infection rate after TKA in patients with end-stage renal disease (ESRD). However, the authors excluded patients with a history of stroke or with peripheral vascular disease. Lizaur-Utrilla et al [16] also reported an inferior functional outcome of TKA in an ESRD patient group.

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As evidence of the outcome of TKA in patients with ESRD is still limited, we conducted a retrospective study of dialysis patients who had undergone TKA at our hospital during the past 10 years. The aims of this study were to investigate (1) the mortality and perioperative complication rates, including infection, after TKA in dialysis patients and (2) the clinical outcome of TKA in dialysis patients with 2–10 years of follow-up.

Materials and Methods

Patients

As this patient population may have numerous medical comorbidities, all patients have received a consultation with a cardiologist and neurologist at our clinic, which enabled us to evaluate their risk of a postoperative cardiovascular (CV) event or stroke.

Patients were excluded from this study if they were found to be at high risk of (1) a CV event, which requires further evaluation and treatment according to the guidelines of the American Heart Association [17], or (2) stroke, after evaluation of carotid artery stenosis [18]. Between September 2007 and August 2015, 36 dialysis patients with severe knee osteoarthritis requested TKA surgery in our clinics. After consultation with cardiologists and neurologists, 11 patients were considered unsuitable for TKA owing to a high risk of a CV event or stroke and were excluded because they did not undergo a TKA procedure. Twenty-five patients who were on hemodialysis or peritoneal dialysis underwent primary TKA. Four patients (5 knees) with follow-up less than 2 years were excluded. Twenty-one patients (25 knees) were reviewed in this study. Excluding 1 patient who expired at 12-month after surgery, the other 20 patients completed 2-year follow-up (Table 1). The main indication for TKA was end-stage osteoarthritis of the knee in all patients. The average age of the patients at the time of surgery was 65.6 years (range, 48–77 years). These patients had received dialysis for an average of 4.8 years (range, 1–17 years) before the index operation (Table 1).

All patients were informed before surgery of the potential risks of medical complications and thromboembolic disease after TKA. Preoperative comorbidities, the preoperative American Society of Anesthesiologists classification, hemoglobin (Hb) level, prothrombin time (PT), and activated partial thromboplastin time of each patient were recorded. We also recorded preoperative American Knee Society Scores (AKSS), other knee scores, function scores [19], and Western Ontario and McMaster Universities Arthritis Index (WOMAC) scores [20].

Each patient received dialysis in the 24 hours preceding surgery. All patients underwent primary TKA using the same prosthesis (NexGen, Legacy Posterior Stabilized Prosthesis; Zimmer, Warsaw, IN). Prophylactic parenteral antibiotics with cefazolin were given routinely for 1 day after the operation. Antibiotic-loaded bone cement was used during the operation to prevent postoperative infection. Vancomycin (1 g in 40 g of bone cement) (Simplex P Bone Cement; Stryker Orthopaedics, Mahwah, NJ) was used in 5 knees; tobramycin-loaded bone cement (1 g in 40 g of bone cement) (Stryker Orthopaedics, Mahwah, NJ) was used in 17 knees; and gentamycin-loaded bone cement (Palacos MV+G, Heraeus Medical GmbH, Hanau, Germany) was used in 8 knees. Bone cement with gentamicin and vancomycin (Vancogenx, Merete GmbH, Berlin, Germany) was used in 1 knee.

Postoperatively, all patients were scheduled for continuing dialysis, starting on postoperative day 1 and administered every other day thereafter as usual until discharge. Any perioperative blood transfusions were also recorded, the trigger for allogenic blood transfusion having been set at an Hb level of 8 g/dL or the

appearance of symptoms of acute anemia (these criteria could be adjusted up to Hb level of 10 g/dL according to the patient's CV status or history of stroke). Once allogenic transfusion is required, it was performed at the time of dialysis before or after operation.

All patients returned to the clinic 2 weeks after surgery for suture removal and clinical examination. Clinical and radiographic evaluations of all patients were performed before surgery and 6 weeks, 12 weeks, 6 months, and then annually after surgery for the purpose of follow-up using the clinical and radiographic evaluation systems of the AKSS and WOMAC. The WOMAC contains 24 items covering 3 dimensions: pain (5 items), stiffness (2 items), and function (17 items). We recorded WOMAC pain scores and WOMAC function scores and linearly transformed these onto a 0–100 scale, with higher scores indicating more severe impairment.

All complications, including medical complications, superficial skin necrosis, wound infection, deep infection, prosthetic instability or loosening, and all-cause mortality, were recorded. We defined early complications as all complications that occurred within 3 months of the TKA procedure, because they may have been caused by the surgery directly. Late complications were classed as those that occurred over 3 months after the TKA procedure, which may have been attributed to the natural course of ESRD.

This clinical study was approved by the institutional review board of our hospital (IRB No.: 201600338B0).

Statistical Analysis

Preoperative and postoperative AKSS knee scores and WOMAC scores for all patients were compared statistically using the Wilcoxon signed-rank test, with statistical significance set at $P < .05$. Statistical comparisons were made using the Statistical Package for Social Sciences version 18 (SPSS software, Chicago, IL).

Results

The preoperative American Society of Anesthesiologists classification was 2 in 3 patients and 3 in 18 patients, and the mean Hb value was 11.4 g/dL (range, 9.5–13.4 g/dL). The mean PT value was 10.4 seconds (range, 9.3–18 seconds), and activated partial thromboplastin time was 30.2 seconds (range, 23.9–60.2 seconds). The blood transfusion rate was 52.8%. The mean hospital stay for these patients was 7.03 days (range, 5–14 days).

Clinical Outcomes

Excluding 1 patient who died from stroke at 12 month after surgery, the other 20 patients (25 knees) were available for minimum 2-year follow-up at an average of 5.8 years (range, 24 to 119 months; Table 1). The mean AKSS knee and function scores of the patients improved from preoperative scores of 36.6 (range, 27–46) and 20.2 points (range, 10–35) to 80.9 (range, 68–90) and 72.2 points (range, 0–90), respectively, at the latest follow-up (both $P < .01$). The mean WOMAC pain and function scores improved from preoperative mean scores of 49.8 (range, 40–65) and 64.7 points (range, 46–72) to 9.4 (range, 0–30) and 37.9 points (range, 16–97), respectively, at the latest follow-up (both $P < .01$; Table 2).

With the exception of 2 patients, the remaining 19 patients (90.5%) had an improved clinical outcome after TKA. One patient sustained a left femoral intertrochanteric fracture and a humeral fracture in a traffic accident 1 year after left TKA and underwent surgery for the fractures. The patient subsequently had a poor clinical outcome owing to multiple operations. Another patient had a poor functional outcome because of development of dementia and Parkinson's disease after TKA.

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