Simultaneous bilateral total knee replacement: a prospective study of 150 patients

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ABSTRACT

Purpose. To evaluate the safety of simultaneous bilateral total knee replacement (TKR).

Methods. 124 women and 26 men (mean age, 66 years) underwent simultaneous bilateral TKR for tricompartmental osteoarthritis using a posterior-stabilised, high-flexion implant. All patients underwent dobutamine stress echocardiography for detection of any silent cardiac comorbidity by a cardiologist. None had any adverse effect after testing. Five patients had positive outcome and underwent coronary angiography to detect any significant coronary blockage. Functional outcome was evaluated using the Knee Society Score (KSS) and Western Ontario and McMaster Universities Arthritis Index (WOMAC). Tranexamic acid was given intravenously to reduce peri-operative blood loss. Femoral blocks and patient-controlled analgesia were used to facilitate early recovery. Aggressive physiotherapy was allowed. Patients were followed up at months 3, 6, and 12, and yearly thereafter.

Results. At the 2-year follow-up, the mean range of motion improved from 95º to 129º (p=0.032), the mean KSS from 120 to 158 (p<0.001), and the WOMAC from 51 to 88 (p=0.002). One patient developed patellar crepitus at week 6, which resolved with conservative treatment. Another patient developed infection in both knees at month 6. Despite salvage procedures, infection recurred after 3 months and the patient underwent bilateral arthrodesis. No patient developed deep vein thrombosis or pulmonary embolism, myocardial infarction, atrial fibrillation, or other cardiac event.

Conclusion. Simultaneous bilateral TKR is safe for properly selected patients.

Key words: arthroplasty, replacement, knee; echocardiography, stress; dobutamine

INTRODUCTION

Implant survival after total knee replacement (TKR) approaches 95% at 15 years.1,2 The safety of simultaneous bilateral TKR has been controversial...
owing to concerns over peri-operative morbidity and mortality, although it requires only one anaesthetic session and one hospital admission. In severely deformed bilateral knees, unilateral TKR can significantly affect rehabilitation and result in poorer outcome. The current study evaluated the safety of simultaneous bilateral TKR.

MATERIALS AND METHODS

Between January 2007 and December 2010, 124 women and 26 men (mean age, 66 years) underwent simultaneous bilateral TKR for tricompartmental osteoarthritis using a posterior-stabilised, high-flexion, rotating-platform flex total knee system (DePuy, Johnson and Johnson, Warsaw [IN], USA). Patients with cardiac comorbidities (positive for ischaemia on dobutamine stress echocardiography), previous thromboembolism, uncontrolled diabetes, severe hypertension, asthma, and previous knee infection were excluded, as were those unwilling to undergo simultaneous bilateral TKR.

All patients underwent dobutamine stress echocardiography for detection of any silent cardiac comorbidity by a cardiologist. Dobutamine was administered intravenously in escalating doses every 3 minutes according to our hospital’s protocol. The infusion was started at the rate of 10 µg/kg per minute and increased every 3 minutes to 20, 30, and 40 µg/kg per minute and sometimes to 50 µg/kg per minute until the desired endpoint (85% of age-predicted maximum heart rate) was reached. The test result was considered negative if the desired endpoint was reached without any chest pain (angina), abnormal systolic blood pressure (>220 or <90 mm Hg), >30 mm Hg decrease in systolic blood pressure from baseline, sustained ventricular tachycardia, or development of new wall-motion abnormality. None had any adverse effect after testing. Five patients had positive test results and underwent coronary angiography to detect any significant coronary blockage: 2 underwent angioplasty and TKR was deferred, and 3 had negative angiographic results.

All TKRs were performed by a single surgeon using computer navigation (Ci System, Brain Lab, Feldkirchen, Germany) under combined spinal and epidural anaesthesia. All patients were catheterised for urine output calculation. Both knees were prepared at the same time. Peri-operative intravenous antibiotics were given 30 minutes prior to incision and continued until postoperative day 2. Patella was resurfaced.

To reduce peri-operative blood loss, tranexamic acid was given intravenously after the incision (15 mg/kg) and then 6 hourly (10 mg/kg) for next 12 hours. All patients were nursed in a high dependency unit for observation. Vital signs and fluid intake/output were monitored up to 24 hours. Haemoglobin levels were kept at >10 mg/dl of blood. Care was taken to avoid electrolyte imbalance and hyponatraemia. Deep vein thrombosis prophylaxis entailing fondaparinux for 12 hours after surgery and then oral aspirin for 3 weeks after discharge. The urinary catheter was removed 24 hours after surgery. To facilitate early recovery, multimodal pain management was given and included femoral nerve blocks and patient-controlled analgesia. Aggressive physiotherapy was allowed on the day of surgery. Patients were discharged after 3 to 5 days. They were followed up at months 3, 6, and 12, and yearly thereafter.

Functional outcome (ability to walk, sit cross-legged, and climb staircase) was evaluated pre- and post-operatively, using the Knee Society Score (KSS) and the Western Ontario and McMaster Universities Arthritis Index (WOMAC). One-leg standing, supine anteroposterior, lateral, and skyline view radiographs of both knees were taken to assess limb alignment and component position. Pre- and post-operative values were compared using the paired t test.

RESULTS

At the 2-year follow-up, the mean range of motion improved from 95°±7 to 129°±6 (p=0.032), the mean KSS from 120±8 to 158±6 (p < 0.001), and the WOMAC from 51±4 to 88±7 (p=0.002) [Table]. The pain component of the KSS also improved significantly (p<0.001). One patient developed patellar crepitus at week 6, which resolved with conservative treatment. Another patient developed infection in both knees at month 6. Despite salvage procedures, infection recurred after 3 months and the patient underwent bilateral arthrodesis. No patient developed deep vein thrombosis or pulmonary embolism, myocardial infarction, atrial fibrillation, or other cardiac event. There was no implant loosening.

DISCUSSION

Only 24% of knee surgeons in 3 regions of the United Kingdom would regularly perform bilateral TKR under one anaesthetic session. The rates of perioperative complications and morbidity were higher after simultaneous bilateral TKR than unilateral TKR.
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age-related comorbidities, blood loss, and delayed rehabilitation. In the current study, no patient developed safety-related complication, owing to proper patient selection using dobutamine stress echocardiography, which is an effective method to evaluate myocardial ischaemia by detecting stress-induced systolic regional wall motion abnormalities. This is important as silent cardiac comorbidities can exist in healthy patients undergoing TKR. Simultaneous bilateral TKR is more economical, enables higher patient satisfaction and quicker return to function, compared with staged bilateral TKR, which doubles the length of hospital stay and is 18%, or even 50%, more expensive. Simultaneous bilateral TKR is 36% less costly than 2 unilateral TKR and can save >$10 000 per patient. The mean reduction in the length of hospitalisation is 7 days, although there is a minimal increase in the risk of death or other complications. The length of hospital stay is 4 days longer for staged TKR than for sequential TKR. Expenditure on rehabilitation is about 2 fold greater in staged TKR. The peri-operative mortality rate is similar in those having sequential bilateral TKR and unilateral TKR. Simultaneous bilateral TKR is suitable for properly selected patients aged <70 years, with an American Society of Anesthesiologists score of 1 or 2.

In the current study, tranexamic acid was used to reduce intra-operative blood loss and thus the need for blood transfusion was minimal. Routine blood counts and electrolyte examination was performed, and any imbalance was promptly dealt with. Prophylactic use of tranexamic acid is effective, safe, and cheap for reducing blood loss during and after orthopaedic operations. Administration of 20 mg/kg of tranexamic acid at induction of surgery is effective in reducing the haemoglobin decrease following TKR. Oxygen helps rehabilitation in the immediate postoperative days, and hence oxygen was given to all our patients for the first 2 days after surgery.

A major limitation of the current study was that it was not comparative. Thus, no conclusions could be made regarding the outcome. Nonetheless, simultaneous bilateral TKR is safe as long as a proper protocol is followed for patient selection. Aggressive pain management and rehabilitation enables early recovery and thus decreases health care expenses.

**DISCLOSURE**

No conflicts of interest were declared by the authors.

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**Table**

Clinical outcome of patients

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<th>Preoperative</th>
<th>Month 3</th>
<th>Month 6</th>
<th>Year 1</th>
<th>Year 2</th>
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<tr>
<td>Right knee</td>
<td>120±7.6</td>
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<td>158±5.8</td>
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<tr>
<td>Left knee</td>
<td>120±7.9</td>
<td>136±4.6</td>
<td>142±5.2</td>
<td>154±4.6</td>
<td>158±5.7</td>
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<td>Mean±SD Western Ontario and McMaster Universities Arthritis Index</td>
<td>51±4.2</td>
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<td>75±5.2</td>
<td>84±4.6</td>
<td>88±7.2</td>
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**REFERENCES**