International Journal of Orthopaedics Research
www.orthopaedicsjournal.in
E-ISSN: 2663-0923, P-ISSN: 2663-0915
Received: 10-09-2024, Accepted: 11-10-2024, Published: 26-10-2024
Volume 6, Issue 2, 2024, Page No. 30-32

Comparison of peri-operative blood loss between simultaneous bilateral and unilateral total knee replacement for knee osteoarthritis

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Abstract
Objective: The aim of this study is to compare the blood loss and complications between simultaneous bilateral total knee replacement (SBTKR) and unilateral total knee replacement (UTKR).
Methods: 30 SBTKRs and 55 UTKRs performed between March 2023 and March 2024 were included in this study. Haematocrit, D-dimer, haemoglobin, blood loss, blood transfusion, and complications were compared between the groups.
Results: Haemoglobin between the groups was not significantly different ($P > 0.05$). In the SBTKR group, the haematocrit on the 3rd postoperative day was lower ($P < 0.05$). The total drain output of the UTKR group was not significantly different from any unilateral side of the SBTKR group ($P < 0.05$). The mean RBC transfusion requirement was higher in the SBTKR group than in the UTKR group ($P <0.001$). The total drainage of the SBTKR group was significantly more than the UTKR group, but the total drain output of the UTKR group was not significantly different from any unilateral side of the SBTKR group ($P> 0.05$).
Conclusion: This study demonstrates the total drainage and transfusion of SBTKR are not twice that of UTKR, and after treatment, haemoglobin could be increased to a similar level. Thus, SBTKR is an effective and safe option.

Keywords: Haemoglobin, haematocrit, UTKR, SBTKR, transfusion

Introduction

The most popular orthopaedic procedure for treating severe osteoarthritis (OA) is total knee arthroplasty (TKR), which can significantly reduce pain, enhance knee function, and improve patients' quality of life [1]. However, in many patients, bilateral TKR is required due to involvement of Bilateral OA. The current consensus of the surgical protocol in this case is divided between staged unilateral total knee replacement (UTKR) in succession or simultaneous bilateral total knee replacement (SBTKR) under the same anaesthesia. There has been dispute about the different protocols for a long time, and no agreement has been reached regarding which protocol is more reasonable. On the one hand, proponents of SBTKR think that by cutting down on combined operating and tourniquet time, SBTKR could lower operating costs and complications associated with tourniquets [2]. Some researchers demonstrated that SBTKR does not have higher rates of death, deep venous thrombosis (DVT), pulmonary embolism (PE), revision, or infection than UTKR [3]. Those who oppose SBTKR, however, maintain that the associated mortality rate is greater than that of UTKR [4, 5], that SBTKR patients experience more severe postoperative pain, and that these patients require more analgesic remedies [6]. In clinical practice, whether SBTKR is as safe as UTKR is a basic question that concerns joint surgeons. So far, the safety of SBTKR has not been amply demonstrated. The purpose of this study was to compare the perioperative parameters related to blood loss between SBTKR and UTKR. The authors hope that the outcome may help surgeons to decide between SBTKR and staged UTKR for cases with bilateral knee OA.

Patients and methods

The total study population consisted of 30 patients who underwent simultaneous bilateral TKR and 55 patients who underwent unilateral TKR in our hospital, SSIMS and RC between 2013 and 2014. All of the patients were aged more than 60 years, diagnosed with severe knee osteoarthritis – Kellegren and Lawrence Grade 3 and 4 [7], and the exclusion criteria included severe obesity, the requirement for combined special procedures, such as correction of severe knee deformity and valgus deformity of knee. TKR was considered necessary due to persisting pain even after a year of conservative management. Patients were split into two groups: those who underwent UTKR (n = 55) and those who underwent SBTKR (n = 30). The SBTKR group comprised 23 women and 7 men, while UTKR group comprised 40 women and 15 men. There were no notable inter-group differences in patient demographics, such as height, mean age, and body mass index ($P > 0.05$) (Table 1).

Table 1: Demographic data

Preoperative parameter	UTKR Mean ± SD	SBTKR Mean ± SD	Total Mean ± SD	*P*
Gender (M/F)	15/40	7/23	85	
Height (cm)	165.10 ± 4.48	162.27 ± 2.61	164.85 ± 4.41	0.071
Mean Age (yrs)	71.39 ± 10.15	69.47 ± 10.32	70.8 ± 10.14	0.521
BMI	25.7 ± 4.17	24.06 ± 3.01	25.23 ± 3.91	0.224

A fixed-bearing, posterior stabilized prosthesis of knee joints was used in all patients. All the respective procedures were carried under combined spinal epidural anaesthesia. The same surgeon performed all surgeries using a medial parapatellar approach without patellar replacement but denervation of patella was performed for all patients.
Cement was used for prosthesis fixation. Simultaneous bilateral TKRs were performed sequentially under the same anesthetization. Both knees were prepared and draped together. In the SBTKRs, the procedure for the second knee proceeded after the first knee was closed. Low-molecular-

weight heparin calcium injection was performed for postoperative thromboembolic prophylaxis for one week followed by Aspirin therapy for 1 month. Blood transfusion was performed if the haemoglobin level was ≤8.0 mg/dl or for patients with a haemoglobin level of eight to nine milligrams per decilitre if the blood pressure was ≤100 mm Hg, ≤30 ml/h urine output, or symptoms of anaemia were observed [8]. Patients were started on a supervised physiotherapy program from the 1st postoperative day. The same standardized postoperative clinical routine was followed for all patients. Retrospective review of the patient demographics, including sex, age, and body mass index (BMI), was conducted using data retrieved from the electronic medical record. Haemoglobin and haematocrit of postoperative days 1, 3, 7 and 14 were recorded. The haemoglobin, haematocrit, intraarticular drainage volume, and postoperative blood transfusion volume were compared between the groups.

1. Statistical analysis

Statistical analysis was performed using SPSS version 20.0 The Student t-test was used for intergroup comparison of continuous demographic variables, and Fisher's exact test was used for comparison of categorical demographic variables.

Results

1. Perioperative blood parameters

There was no significant difference in haemoglobin levels between the groups at any record points (Table 2). In the SBTKR group, the haematocrit level on the 3rd postoperative day decreased more than that of the UTKR group (P = 0.024). But at the other record points it showed no significant difference between the groups (Tables 3). Furthermore, it was found that haemoglobin (HGB) and haematocrit (HCT) level at the 3rd postoperative day was the lowest, and after that they increased gradually.

Table 2: Perioperative haemoglobin

Variable	UTKR (g/L)	SBTKR (g/L)	*P*
At admission	123.77 ± 16.25	122.15 ± 12.16	0.721
Post op day 1	91.4 ± 13.02	86.77 ± 16.25	0.311
Post op day 3	81.54 ± 18.23	74.61 ± 14.08	0.182
Post op day 7	89.35 ± 11.07	85.35 ± 12.78	0.277
Post op day 14	95.96 ± 10.57	93.72 ± 10.95	0.556

Table 3: Perioperative haematocrit

Variable	UTKR (%)	SBTKR (%)	*P*
At admission	37.53 ± 5.41	37.62 ± 3.40	0.949
Post op day 1	27.50 ± 3.73	26.05 ± 5.32	0.255
Post op day 3	25.37 ± 3.70	22.62 ± 4.52	0.024
Post op day 7	27.07 ± 3.22	26.98 ± 5.20	0.943
Post op day 14	29.48 ± 2.97	29.20 ± 3.38	0.797

2. Blood loss and transfusion requirement

The total drain output of the SBTKR group was significantly more than the UTKR group, but the total drain output of the UTKR group was not significantly different from any unilateral side of the SBTKR group (P = 0.415, 0.093). The mean RBC transfusion requirement was higher in the SBTKR group than in the UTKR group (P b 0.001) (Table 4).

Table 4: Blood loss and transfusion requirement

Variable	UTKR (ml)	SBTKR (ml)	*P*
Amount of drainage	553.75 ± 351.17	Left: 667.50 ± 606.54 Right: 797.50 ± 646.50	0.415 0.093
RBC transfusion	410.00 ± 275.61	815.63 ± 447.85	*P < 0.001*

Discussion

One significant concern for joint surgeons is the safety of SBTKR. If bilateral TKR could be carried out without raising the operational risk in comparison to UTKR, it would be ideal. But previous published reports exhibited opposite outcomes, some being pros and the others cons [9, 10, 11]. To make the argument clear, more clinical data and experience must be gathered.

The current study showed that at one, three, seven, and fourteen postoperative days, the overall haemoglobin and haematocrit levels were comparative between SBTKR and UTKR. Only on the 3rd postoperative day was the haematocrit level in the SBTKR group statistically lower than that in the UTKR group, though the difference may not be very clinically significant since the haematocrit levels were 22.62 ± 4.52% and 25.37 ± 3.70%, respectively.

For blood transfusion, the volume in the SBTKR group was 1.7-times that in UTKR group. All this indicated that, on the basis of adequate and timely transfusion, blood haemoglobin and haematocrit levels in SBTKR could be maintained at almost the same levels as those in UTKR. SBTKR does not increase the risk of bleeding and the amount of transfusion was compared in unilateral TA in SBTKR and UTKR. Literature reported that the amount of transfusion in the SBTKR group is 1.7- to 2.1-times that in the UTKR group [12, 13]. Nevertheless, this requirement for transfusion is less than the total amount used in staged UTKR [14]. The results in current research are in accordance with these outcomes.

Closed suction drainage (CSD) was recommended in orthopaedic wounds by Waugh and Stinchfield in 1961 [20]. It is a controversial problem. A good CSD could prevent hematoma which may impair wound healing, restrict mobilization, and could reduce deep infection and pain [20]. Many studies showed that CSD may decrease the risk of wound complications and deep infection [21, 22, 23]. However, it was also reported that the routine use of CSD is unnecessary after total joint arthroplasty [24], and lack of drainage did not increase the incidence of complications [25]. Although there is insufficient evidence from randomized trials to support the routine use of CSD in TKR [26], from our previous experience, CSD is safe for patients who undergo TKR, so the routine use of CSD is worth considering. The unilateral postoperative drainage in the SBTKR group was not more than that of UTKR.

Our study has some limitations. Firstly, the number of patients is small to explain the differences in certain complications, and the follow-up is short to evaluate patients' joint functions, so we will accumulate more cases in our future work. Secondly, our study is a retrospective study; some data on potential confounding factors is absent, because the data was recorded in the past, which resulted in the small number of patients. Thirdly, as a retrospective study, it is prone to recall bias or misclassification bias, although we have tried our best to avoid this. Lastly, the data were collected from one institution's experience and may not be applicable to all joint surgeons.

Conclusion

This study demonstrates that the rate of complication in SBTKR and in UTKR is similar. The total drainage and transfusion of SBTKR are not twice that of UTKR, and after treatment, Haemoglobin could be increased to a similar level in a short time. Thus, SBTKR is an effective and safe option.

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