

Clinical outcomes of simultaneous bilateral total knee arthroplasty. A tertiary-center experience

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ABSTRACT

Objectives: To characterize patients who underwent simultaneous bilateral total knee arthroplasty (simBTKA) and study the outcomes of surgery along with complication rates.

Methods: This is a retrospective study carried out at King Faisal Specialist Hospital and Research Center, Jeddah, Saudi Arabia. The study included patients who had undergone simultaneous bilateral total knee replacement from January 2010 until June 2021.

Results: The median age of our patients was 64 (Q1-Q3: 59-70) years, 76 (13.2%) males and 393 (83.8%) were females. Hypertension was the most common associated comorbidity (56.29%) and primary osteoarthritis was the most common indication of surgery (96.8%). The median duration of surgery was 155 (140-175) minutes and the median duration of hospital stay was 9 (8-11) days. A total of 17 (3.62%) patients needed revision of surgery in a median duration of 265 (112-529) days. The composite endpoint of complications, intensive care unit admission, and blood transfusion occurred in 132 (28.14%) patients. Hospital stay was longer in males (coefficient: 0.11 [0.02-0.19]; $p=0.01$) and in patients with cardiac (coefficient: 0.12 [0.02-0.21]; $p=0.02$), and renal diseases (coefficient: 0.23 [0.06-0.39]; $p=0.01$). Cardiac disease was the only factor associated with the composite outcome (odds ratio: 2.25 [1.19-4.24]; $p=0.01$).

Conclusion: Our results suggest simBTKA is a safe procedure with a low complication rate. However, male patients and those with cardiac and renal diseases are at increased risk of post-operative complications and prolonged hospital stay.

Keywords: simultaneous bilateral knee arthroplasty, operative complications, hospital stay

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The prevalence of knee osteoarthritis increases with age, and it usually affects the knees bilaterally.¹ Surgical total knee arthroplasty is the optimal treatment for advanced knee osteoarthritis. Surgery can be carried out in 2 stages or one stage as bilateral knee arthroplasty.¹ Almost one-third of patients with knee osteoarthritis have severe bilateral disease at the time of the first presentation, and 20% of the patients who had unilateral knee replacement require surgery for the other knee within 2 years of the primary operation.²

Simultaneous bilateral total knee arthroplasty (simBTKA) has the benefits of reduced hospital stay, cost, and rehabilitation time. On the other hand, simBTKA could be associated with a higher complication rate.³ Few studies from Saudi Arabia have reported the outcomes and quality of life after total knee replacement.⁴ However, there is a paucity of data regarding the outcomes of simBTKA in Saudi Arabia in the literature. Therefore, this study aimed to delineate the characteristics of patients who underwent simBTKA and the outcomes of surgery.

Methods. This retrospective study was carried out at King Faisal Specialist Hospital and Research Center, Jeddah, Saudi Arabia. This study included adult patients (n=469) who had undergone simultaneous bilateral total knee replacement from January 2010 until June 2021. Simultaneous knee replacement means that the patients had replacement of both knees at the same session under the same anesthesia. Patients who had unilateral or staged arthroplasty were excluded. The Institutional Review Board approval was granted for this study.

Patients' data were extracted from the hospital electronic records system. The variables collected for this study were the demographic data, associated comorbidities, surgery indication, surgery time, tourniquet time, blood loss, hospitalization period, surgery revision, intensive care unit (ICU) admission, intraoperative and postoperative complications, and blood transfusion rate.

The following complications were reported; bleeding, fracture, wound healing problems, infection, persistent pain, joint stiffness, joint instability, hemarthrosis, stroke, knee laxity, patellar clunk syndrome, patellar dislocation, synovitis, and pulmonary embolism. The study outcomes were the duration of hospital stay and the composite endpoint of intraoperative, post-operative complications, ICU admission, and blood transfusion.

Statistical analysis. We described continuous data and median (Q1-Q3) and binary or ordinal data as frequencies and percentages. Negative binomial regression was used to assess factors affecting the

hospital stay and logistic regression analysis was used to evaluate factors affecting post-operative complications. Pre-operative data was included in the multivariable analysis. Model goodness of fit was tested with Hosmer-Lemeshow test and model discrimination with the area under the curve. Statistical analysis was carried out using Stata 16 (Stata Corp-College Station, TX, USA), and a *p*-value of <0.05 was considered significant.

Results. The median age of our patients was 64 years (Q1-Q3: 59-70), 76 (13.2%) males and 393 (83.8%) were females. Hypertension was the most common associated comorbidity (56.3%) and primary osteoarthritis was the most common indication of surgery (96.8%; [Table 1](#)).

The median duration of surgery was 155 (140-175) minutes (min), and the median duration of hospital stay was 9 (8-11) days. All patients were followed for 2 years. A total of 17 (3.6%) patients needed revision of surgery in a median duration of 265 (112-529) days. Blood transfusion was required in 104 (22.1%) patients, and the composite endpoint of all the recorded complications, ICU admission in 6 (1.3%) and blood transfusion occurred in 132 (28.1%) patients ([Table 2](#)).

Hospital stay increased significantly in males (coefficient: 0.11; *p*=0.01) and patients with cardiac (coefficient: 0.12; *p*=0.02) and renal diseases (coefficient: 0.23; *p*=0.01; [Table 3](#)). Cardiac disease was the only factor associated with the composite outcome (odds ratio: 2.25 (1.19-4.24); *p*=0.01; [Table 4](#)).

Discussion. The prevalence of osteoarthritis has increased because of the increased life expectancy and prevalence of obesity.⁵ Total knee arthroplasty effectively restores function and relieves pain in patients with a severe degree of osteoarthritis.⁶ Previous studies demonstrated that simBTKA was associated with shorter hospitalization and lower cost when compared to the staged repair.³ However, simBTKA could be associated with higher blood transfusion rates, mortality, and pulmonary embolism, but lower frequency of infection and revision of the procedure compared to staged bilateral total knee arthroplasty.⁷

Studies on simBTKA in Saudi Arabia are scarce. We evaluated the outcomes in 469 patients who had simBTKA in a single tertiary referral center. Females

Table 1 - Preoperative data (N=469).

| Demographics | n (%) |
|--|----------------|
| Age (years) | 64 (58-70) |
| Female | 393 (83.8) |
| Males | 76 (16.2) |
| BMI (kg/m ²) | 34.6 (31-39.1) |
| Smokers | 12 (2.6) |
| Comorbidities | |
| Diabetes mellitus | 183 (39.0) |
| Hypertension | 264 (56.3) |
| Cardiac disease | 50 (10.7) |
| Renal disease | 13 (2.8) |
| Rheumatoid arthritis | 26 (5.5) |
| Osteoporosis | 13 (2.8) |
| Indications for surgery | |
| Primary osteoarthritis | 454 (96.8) |
| Post-traumatic osteoarthritis | 3 (0.6) |
| Preoperative diagnosis of rheumatoid arthritis | 26 (5.5) |
| Arthritis secondary to still disease | 1 (0.2) |

Continuous data are presented as median (Q1-Q3) and categorical data as number and percentages (%).

Table 2 - Operative and postoperative data (N=469).

| Operative data | n (%) |
|--|---------------|
| Duration of surgery (minutes) | 155 (140-175) |
| Duration of right tourniquet (minutes) | 49 (42-57) |
| Duration of left tourniquet (minutes) | 45 (41-50) |
| Postoperative data | |
| Hospital stay (days) | 9 (8-11) |
| Blood loss (ml) | 140 (100-250) |
| Revision of surgery | 17 (3.6) |
| Revision of surgery time (days) | 265 (112-529) |
| Complications | |
| Need blood transfusion | 104 (22.1) |
| ICU admission | 6 (1.3) |
| Intraoperative bleeding | 2 (0.4) |
| Intraoperative fracture | 2 (0.4) |
| Postoperative wound healing problem | 3 (0.6) |
| Postoperative infection | 3 (0.6) |
| Postoperative stiff joint | 1 (0.2) |
| Postoperative persistent pain | 9 (1.9) |
| Postoperative joint instability | 1 (0.2) |
| Postoperative hematoma | 2 (0.4) |
| Postoperative stroke | 1 (0.2) |
| Postoperative bilateral knee laxity | 1 (0.2) |
| Post operation right patellar Clunk syndrome | 1 (0.2) |
| Post operation left patellar Clunk syndrome | 4 (0.9) |
| Postoperative patellar dislocation | 2 (0.4) |
| Postoperative periprosthetic fracture | 2 (0.4) |
| Postoperative synovitis | 2 (0.4) |
| Postoperative pulmonary embolism | 3 (0.6) |
| Postoperative hemarthrosis | 1 (0.2) |
| Complications | 132 (28.1) |

Continuous data are presented as median (Q1-Q3) and categorical data as number and percentages (%).

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Table 3 - Factors affecting hospital stay

| Factors | Coefficient (95% CI) | P-value |
|----------------------|------------------------|---------|
| Age | 0.001 (-0.03 - 0.004) | 0.69 |
| Male | 0.11 (0.02 - -0.19) | 0.01 |
| Body mass index | 0.004 (-0.001 - 0.008) | 0.10 |
| Diabetes mellitus | 0.06 (-0.004 - 0.13) | 0.07 |
| Hypertension | -0.06 (-0.13 - 0.01) | 0.08 |
| Cardiac disease | 0.12 (0.02 - 0.21) | 0.02 |
| Renal disease | 0.23 (0.06 - 0.39) | 0.01 |
| Rheumatoid arthritis | 0.02 (-0.12 - 0.16) | 0.77 |
| Osteoporosis | 0.08 (-0.1 - 0.23) | 0.39 |

CI: confidence interval

Table 4 - Factors affecting complications

| Factors | OR (95% CI) | P-value |
|----------------------|--------------------|---------|
| Age | 1.01 (0.98 - 1.04) | 0.49 |
| Gender | 0.89 (0.49 - 1.61) | 0.69 |
| Body mass index | 1.02 (0.99 - 1.05) | 0.32 |
| Diabetes mellitus | 1.29 (0.81 - 2.05) | 0.28 |
| Hypertension | 1.35 (0.84 - 2.17) | 0.22 |
| Cardiac disease | 2.25 (1.19 - 4.24) | 0.01 |
| Renal disease | 0.74 (0.2 - 2.8) | 0.66 |
| Rheumatoid arthritis | 1.14 (0.42 - 3.11) | 0.79 |
| Osteoporosis | 2.48 (0.79 - 7.72) | 0.12 |

OR: odd ratio CI: confidence interval

represented the majority of our cases and most patients had obesity. Hypertension was the most common associated comorbidity and primary osteoarthritis was the most common indication of surgery. The median hospital stay was 9 days, and hospital stay increased significantly in males, patients with cardiac and renal diseases.

Gromov et al⁸ reported zero percent mortality after simBTKA, which is consistent with our findings. They reported the need for postoperative transfusion in 54% of their patients, while our study had a 22% transfusion rate. Poultides et al⁹ studied the trends of simBTKA in 2 time periods. They found that the age of patients was decreasing, and the patients had a shorter hospital stay in the recent time era. However, the rate of complications remained relatively stationary.

The hospital stay in our series was higher than in other studies. The mean hospital stay reported in the literature was 4-6 days.^{9,10} The differences in hospital stay reported in different series could be related to the different risk profiles of the included patients. The risk of complications and mortality increased in elder and male patients, while we found that males had prolonged hospital stay in our series. Al-Turki et al¹¹ found that age,

body mass index (BMI), and other patient characteristics did not affect the duration of hospital stay nor the postoperative complications.¹⁰ Thomas et al¹² found that older age, high BMI, females, and cardiopulmonary diseases predicted prolonged hospital stay. Our study indicated that male patients and those with cardiac or renal diseases are at higher risk of prolonged hospital stay and postoperative complications. Those patients may benefit from comprehensive preoperative preparation and optimization.

Warren et al¹³ compared simBTKR to unilateral replacement and found that the risk of complications increased in all risk-profile categories and healthier patients in the simBTKR approach. In a meta-analysis comparing simBTKR to the staged approach, simBTKA had a lower risk of infection and respiratory complications.⁵ Another study found an increased risk of recurrent complications in patients undergoing staged approaches.¹⁴ The implant survival was significantly longer in patients who had simBTKR.¹⁵ The contradictory results of these studies indicated the need for a randomized trial comparing both approaches.

Study limitations. The study is a single-center experience. Additionally, the study is a retrospective in design with all of its inherent selection and referral biases. Another limitation, is the lack of a control group for patients who had unilateral total knee arthroplasty. A further randomized study comparing bilateral and unilateral knee arthroplasty is recommended.

In conclusion, our study suggests simBTKA is a relatively safe procedure with an acceptable rate of complications. Male patients and those with cardiac and renal diseases are at increased risk of postoperative complications and prolonged hospital stay.

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