

# A comparative analysis of simultaneous and staging total knee arthroplasty in one hospitalization cycle

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**Abstract:** To evaluate the efficacy and safety of bilateral TKA in patients with knee osteoarthritis (KOA) during one hospitalization cycle. Bilateral knee osteoarthritis in 56 patients studied retrospectively. 30 patients underwent bilateral TKA operation as control group, 26 patients underwent bilateral TKA operation as observation group by stages. The preoperative general condition, intraoperative condition, postoperative recovery and incidence of complications were compared and analyzed among the two groups. No significant differences have been observed in age, sex composition, BMI and NNIS scores in the two groups before operation ( $P>0.05$ ); No significant differences have been observed in joint activity, HSS score, VAS score and complications in the two groups after operation ( $P>0.05$ ); The observation group showed a shorter operative time and postoperative hospital stay, and the medical cost was lower in the observation group when compared with the control group ( $P<0.05$ ). The blood loss and transfusion, however, were significantly higher in the observation group when compared with the control group ( $P<0.05$ ). For first-time patients underwent bilateral total knee arthroplasty, there was no statistically significant in safety and effectiveness between the observation group and control group under strict perioperative management and careful evaluation. However, the observation group has the advantages of short total operation time and postoperative hospital stay, economical applicability and quick postoperative recovery, and thus deserving popularization.

**Keywords:** Osteoarthritis; Total knee arthroplasty; Bilateral

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## 1. Introduction

At present, total knee arthroplasty (TKA) is the main treatment for end-stage knee osteoarthritis (Knee Osteoarthritis, KOA), which can reduce pain and improve the function, and increase the patients' quality of life[1]. Besides, TKA has a good long-term effect[2,3]. However, there is still considerable controversy in the simultaneous or staged replacement surgery during TKA treatment in a hospitalization period for patients with bilateral KOA. This study retrospectively analyzed 56 patients with KOA who underwent bilateral TKA in our hospital. The comparative analysis of the efficacy of a hospitalization cycle with simultaneous TKA surgery is reported below.

## 2. Materials and Methods

### 2.1. Research object

KOA patients who underwent bilateral TKA surgery from December 2017 to July 2018 in our hospital were selected. Inclusion criteria: Meet the diagnostic criteria of the American College of Rheumatology; TKA is performed for the first time in both knees; the patient with stage replacement is a hospitalization period, one side of the operation is performed first, and the other side is operated on the same day of surgery next week, with an average interval of  $7.38 \pm 0.52$  days; The same brand of prosthesis was used on both knees. The surgeon used the prosthetic brand as: Stryker and Wright; the

operation was performed by the same surgeon and team; the clinical and follow-up data were complete. Exclusion criteria: rheumatoid arthritis, traumatic osteoarthritis, ankylosing spondylitis and knee joint tumors; joint infection and revision patients; lower extremity motor dysfunction affecting knee function evaluation patients; clinical and follow-up data incomplete patients. A total of 56 patients were enrolled and divided into control group and observation group. 30 patients in the control group underwent TKA on both sides. 26 patients in observation group were divided into stages TKA was performed.

### 2.2. Method

#### 2.2.1. Surgical methods

All operations were performed by the same senior doctor. The two groups took substantially the same surgical procedure and postoperative rehabilitation program. An electric pneumatic hemostasis instrument was used during the operation. The median incision was made in the front of the knee, and the medial approach was used to cut the switch capsule. Preoperative osteotomy and careful treatment of soft tissue balance around the joint. The posterior cruciate ligament is cut off. The femur was intramedullary, with an external rotation of  $3^\circ$  and an eversion of  $5^\circ$  osteotomy. The iliac bone is externally positioned, and the osteotomy is performed perpendicular to the plane of the tibial line of the coronal plane, with a thickness of about 7 to 8 mm,

and the tibial plateau osteotomy surface is inclined by 5°. Selective release of the inner and outer soft tissues. All tibias were depolarized and treated for articular surfaces. The cement is fixed to the prosthesis. After being sufficiently dried, the drainage is placed and sutured layer by layer and pressure bandage.

### 2.2.2. Postoperative treatment

All patients were given ECG monitoring after surgery, and antibiotics were routinely used to prevent infection for 48 hours. After the anesthesia was recovered, the paralyzed patients were trained in pumping. Anticoagulation was given to low molecular weight heparin 12 hours after surgery; the drainage tube was removed 24 hours after surgery and the wound was changed. At 24 hours after surgery, the undergraduate doctors guided the active and passive functional exercise of the knee and went to the ground.

### 2.3. Observation indicators

Preoperative general data such as gender, age, BMI and comorbidities; treatment time, blood loss, blood transfusion and blood transfusion rate, postoperative complications, length of hospital stay, hospitalization expenses, etc.; post-treatment joint mobility, HSS score And VAS score.

### 2.4. Statistical methods

Data processing analysis was performed using SPSS 20.0 statistical software. All data were resented as mean±SD. The data were analyzed by t-test and chi-square test. P < 0.05 indicates that the difference is statistically significant.

## 3. Results

### 3.1. Comparison of preoperative general conditions between the two groups of patients

There were no significant differences in the preoperative general conditions between the two groups in terms of age, gender composition, BMI, and medical complications (P<0.05) (Table 1). There was no significant difference in the use of prosthesis between the two groups (P <0.05).

### 3.2. Comparison of surgical conditions between the two groups

Results showed that the operation and hospitalization time was relatively short in the first-stage simultaneous replacement and the hospitalization cost was low compared with the graded replacement surgery (P>0.05), but the bleeding volume, blood transfusion volume and postoperative complications were higher than the fractional replacement surgery (P>0.05) (Table 2); 6 cases of postoperative complications occurred in the control group and 4 cases in the observation group respectively, and the difference was not statistically significant (Table 3).

### 3.3. Two groups of patients with post-treatment joint mobility

HSS score and VAS score two clinical efficacy data. There was no significant difference in preoperative joint mobility and NNIS score between the two groups (P<0.05). There was no significant difference in joint activity, HSS score and VAS score at 3 months after operation (P<0.05), (Table 4).

**Table 1. Comparison of preoperative general conditions between the two groups of patients**

Group	age (x±s)	Gender (man: women)	BMI ( $\bar{x}$ ±s)	Medical complications
Control group	64.37±5.21	6:24	27.41±3.73	10
Observation group	64.81±6.46	5:21	27.55±3.86	8
T or $\chi^2$ value	-0.28	0.01	-0.14	0.04
P value	0.78	0.94	0.89	0.84

**Table 2. Comparison of treatment status between the two groups of patients**

Group	operation time(min)	Amount of bleeding(ml)	Blood transfusion(ml)	Hospital stay(d)	Hospital Costs (RMB)
Control group	102.59±21.99	875.38±35.21	178.27±15.48	8.96±2.93	71674.66±5558.50
Observation group	139.86±28.41	776.49±39.46	60.36±9.45	14.36±1.40	82706.74±5864.27
T value	-5.18	-6.56	-5.63	-8.47	-6.74
P value	<0.01	<0.01	<0.01	<0.01	<0.01

**Table 3. Comparison of complications between the two groups**

	Control group	Observation group
death	0	0
DVT	1	1
PE	0	0
Myocardial infarction	1	0
Incision event	1	1
Freckle	2	1
heat	1	1

**Table 4. Comparison of the two groups of patients after 3 months**

Group	Postoperative joint mobility	HSS score	VAS score
Control group	119.26±5.38	85.32±8.71	1.54±0.42
Observation group	120.38±5.09	84.86±7.35	1.68±0.35
t value	0.62	1.89	-0.40
P value	0.22	0.36	0.14

**3.4. Postoperative knee joint DR positive side.**

The two groups of patients were in place with prosthesis, and no loosening or sinking of the prosthesis.

**4. Discussion**

With the development of society and the improvement of living standards, TKA surgery is becoming more and more popular as it can restore the joint function of patients with end-stage osteoarthritis to the greatest extent, eliminate joint pain and improve the quality of life of patients. Speed is estimated that by 2030 knee replacement will increase by 673% to 3.48 million cases per year[4]. At the same time, after joint replacement, bilateral TKA surgery in bilateral KOA patients is a choice of simultaneous or staging, and there is no “gold standard”. In this study, randomized controlled trials were not used because of ethical issues. The study group was determined by the doctor and the patient based on the condition and the condition of the patient.

The results of the study showed no statistically significant differences in joint mobility, HSS scores, and VAS scores between the two groups at the last follow-up. On this basis, for the patients who replaced the patients during the same period, the reduction in hospitalization time, hospitalization expenses, etc., satisfied the patients. However, the replacement bleeding was significantly higher than that of stage replacement patients. Studies have shown that bilateral TKA can lead to increased perioperative blood loss[5,6], in line with the results of our study. Because the amount of bleeding

increases, the corresponding blood transfusion rate was also increased, and blood transfusion induced complications, such as allergic reactions and infections of blood-borne infectious diseases[7]. At the same time, blood transfusion and infusion process induced ischemia and reperfusion of cardiac cells, increased cardiac load, and produced complications, such as heart failure. Therefore, the surgeon should strictly control the application of the tourniquet, the operation time, the amount of surgical bleeding, and minimize blood transfusion. For both knee joint replacement, the time interval varies[8]. However, Hassan and other studies have shown that it is safe to have a two-week TKA surgery staging interval[9], and a one-week interval is beneficial to postoperative recovery and cost reduction compared to longer intervals. In this study, both postoperative and staging patients achieved good postoperative outcomes and patient satisfaction.

Lonner JH and other studies have shown that there is no difference in mortality and complication rates between the same period and staged surgery[10]. Dimitris CN and other studies have reached the same conclusion[11]. However, some studies have shown that patients with bilateral TKA surgery have lower costs and better results[12]. Conversely, studies have shown that the rate of severe complication and mortality is higher during the same period[13,14]. Possible risk factors including trauma, large amount of bleeding, and long tourniquet. However, studies by Lombardi et al. showed that age is a major factor in postoperative complications[15]. Some studies suggested that elderly patients with significant complications should avoid simultaneous knee surgery[16,17]. Older patients have higher

complications and rehospitalization rates[18,19]. In this study, there was no significant difference in postoperative complications between the two groups, and there were no serious complications such as death, pulmonary embolism, and myocardial infarction. Therefore, we believe that preoperative evaluation of patients, good operating room basic conditions, superb anesthesia and surgical techniques, and standardized management of postoperative wards are key factors in the success of TKA surgery. For patients with knee osteoarthritis who underwent bilateral total knee arthroplasty, there was no significant difference in the safety and efficacy of bilateral bilateral replacement and stage replacement during strict perioperative management and careful assessment. However, in the total operation time, total hospitalization time and economy, the former is significantly better than the latter, which is helpful for the rapid recovery of patients, and it is worth further promotion and research.

In the study, the surgeons were more likely to use fractional surgery for patients with relatively advanced age and medical complications, and some patients expected surgery on both knees. On the contrary, some patients tend to be replaced at the same time due to the cost of surgery, hospital stay, fear of secondary surgery and the like. These biases may affect the accuracy of the results of this study. At the same time, the follow-up time is short, and complications such as loosening of the prosthesis and infection around the prosthesis require long-term follow-up to obtain results. Therefore, the above issues will continue to be explored in the next study.

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