RESEARCH

TOTAL KNEE ARTHROPLASTY: UNILATERAL, SIMULTANEOUS BILATERAL OR STAGED BILATERAL IN ADVANCED AGE?

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Abstract

Introduction: Most people with arthritic knees often present with symmetrical joint involvement, a condition often requiring surgery for both knees. There are, however, some disagreements concerning whether or not total knee arthroplasty should be performed simultaneously or in stages. This study aimed to evaluate the length of hospital stay, the need for erythrocyte suspension transfusion, the need for intensive care, and the mortality rates of the patients who underwent unilateral, simultaneous bilateral, and staged bilateral total knee arthroplasty.

Materials and Methods: This retrospective study included 1,129 patients, who were divided into three groups based on whether they underwent unilateral, simultaneous bilateral, or staged bilateral total knee arthroplasty, and they were evaluated in terms of hospital stay, erythrocyte suspension transfusion needs, intensive care needs, and mortality rates.

Results: Of all the patients, 85.5% were women, with the mean age of 67.58±7.23 years; and 75.6% of them underwent unilateral, 19.9% underwent simultaneous bilateral, 4.5% had staged bilateral total knee arthroplasty, 8.8% required ICU care, and 5 patients died.

The need for erythrocyte suspension transfusion and length of hospital stay were highest in those who underwent staged bilateral knee arthroplasty surgery, while it was lowest in those who underwent simultaneous bilateral total knee arthroplasty surgery (all $p<0.001$). There was no statistically significant difference in terms of the need for intensive care need, length of stay in intensive care unit and mortality rates between patients who underwent unilateral, simultaneous bilateral, and staged bilateral total knee arthroplasty.

Conclusion: Simultaneous bilateral total knee arthroplasty may be preferred in younger patients with bilateral knee osteoarthritis but without risky comorbidities, just as we practiced in our clinic.

Keywords: Osteoarthritis, Knee; Arthroplasty, Replacement, Knee; Mortality.

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INTRODUCTION

Osteoarthritis is defined as a number of changes including damage, abnormal bone formation, reactive changes in the synovial membrane, and pathological synovial fluid produced in the knee joint cartilage (1). Knee osteoarthritis (gonarthrosis) is an important public health concern, the frequency of which is increasing day by day with the aging population as well as the rising prevalence of obesity worldwide and in Turkey.

The prevalence of patients who underwent total knee arthroplasty (TKA) with a diagnosis of gonarthrosis in 2010 among the entire population of the USA was 1.52%, and the prevalence was found to be higher in women than in men. The same study reported that the ratio of those who underwent TKA at the age of 80 to the entire population reached 10.38% (2). Ceyhan et al. reported that a total of 283,400 and 9,900 primary and revision knee arthroplasty, respectively, were performed due to the diagnosis of gonarthrosis between 2010 and 2014 in Turkey, that 67% of those who underwent primary knee arthroplasty were women, and that TKA was mostly performed in patients between the ages of 60 and 69 (3).

In this context, advanced age, female sex, ethnicity, genetic characteristics, congenital/developmental conditions, and diet are considered as systemic risk factors for knee osteoarthritis, whereas obesity, injury/surgery history, occupation, physical activity, mechanical factors, and knee laxity are known as local risk factors (4).

Choosing cartilage treatment methods in patients with gonarthrosis depends on the degree of the disease, patient's reactions to pain, and deterioration in daily activities due to the disease, age, and general condition of patients (5). TKA should be performed in those with end-stage degenerative and inflammatory arthritis who do not respond to conservative treatment (6). Being the most frequently preferred surgical method in patients with advanced knee osteoarthritis, TKA is a cost-effective option that increases the quality of life of patients by reducing pain and improving knee joint functions (7-9).

Most patients with arthritic knees present with symmetrical joint involvement. Therefore, surgery is often required for both knees (10). Nevertheless, there are some disagreements regarding whether TKA should be performed simultaneously or in stages. According to some researchers, simultaneous bilateral TKA has proven to be relatively safer than the staged bilateral TKA (9), and that single-session bilateral TKA may be appropriate for compatible patients aged <70 years, who have no comorbidities (10); moreover, bilateral TKA may be more beneficial than two-stage surgery due to its advantages such as shorter hospital stay, shorter duration of anaesthesia in total, total duration of physical therapy, fewer days with pain after surgery, and lower medical costs (11,12).

Based on the hypothesis that the advantages of simultaneous bilateral TKA will outweigh its disadvantages as long as it is performed on the right patient, this study aimed to evaluate the length of hospital stay, need for erythrocyte suspension (ES) transfusion, need for intensive care, and mortality rates in patients who underwent unilateral, simultaneous bilateral and staged bilateral knee replacement surgeries. In addition, the impacts of concomitant anaemia and advanced age on hospitalization in the intensive care unit (ICU) and mortality were also investigated separately in patients who underwent unilateral, simultaneous bilateral and staged bilateral TKA.

MATERIALS AND METHODS

Study design, participants and technique

The population of this retrospective study consisted of 1,218 patients who underwent TKA for gonar-

throsis at the Orthopedics Clinic at Antalya Ataturk Public Hospital, between 1 January, 2018 and 31 December, 2019. This study included 1,129 patients after excluding those who underwent revision knee arthroplasty, and those whose medical records could not be reached. The patients who underwent a TKA surgery on the contralateral knee within 1 year were also excluded from the scope of the study, as they could be considered as having undergone a staged bilateral TKA. Only TKA operations performed on different days, usually 1 week apart, during the same hospital stay were considered as a staged bilateral TKA.

The patients were divided into three groups based on whether they underwent unilateral, simultaneous bilateral, or staged bilateral TKA, and were evaluated in terms of hospital stay, ES transfusion needs, intensive care needs, and mortality rates. They were further divided into groups based on whether they were anaemic or non-anaemic, and according to age (≤70 years or >70) in order to determine the effect of anaemia and age on the process.

All patients within the scope of the study had grade 3 and 4 osteoarthritis according to the Kellgren and Lawrence system, and did not respond to conservative treatment. They were evaluated by an orthopaedic surgeon and an anaesthesia team preoperatively, and relevant preoperative workup and optimization was performed. The patients were also examined by cardiology, endocrinology, pulmonology or other relevant specialists according to their comorbidity status. All patients were provided with standard preoperative, intra-operative and post-operative care, including antibiotics, deep vein thrombosis (DVT) prophylaxis, rehabilitative physiotherapy and routine monitoring of their vitals and respective comorbidities. They were discharged following the restoration of a stable hemodynamic status with independent, pain free mobilization, after which a follow-up was planned by the relevant orthopaedic surgeon who performed the surgery.

Regardless of whether it is unilateral, simultaneous bilateral or staged bilateral TKA surgery, the surgical technique does not differ in our clinic. In this connection, the points to be considered by an anaesthesiologist in the selection of anaesthesia include cardiac comorbidities such as hypertension, psychiatric problems such as panic attacks that may increase the sympathetic activity of the patient during the operation, anatomical disorders in the region if spinal anaesthesia is to be applied, or previous medical history in that region, rather than the type of operation to be performed being unilateral, simultaneous bilateral or staged bilateral.

Currently, tranexamic acid is used as a standard in our clinic to reduce bleeding during unilateral, simultaneous bilateral or staged bilateral TKA surgery. It was, however, not used in all cases as a standard during the study period. Since the amount of bleeding could be higher, the use of tranexamic acid was relatively more common in cases that underwent simultaneous bilateral TKA than in those with unilateral TKA or staged bilateral TKA during the given study period.

Ethical approval

Prior to the study, ethical approval was obtained from the Clinical Research Ethics Committee of University of Health Sciences, Antalya Training and Research Hospital. The study was conducted in accordance with the principles of Declaration of Helsinki.

Data collection and laboratory measurements

Demographic and clinical data of the patients and their surgical results were obtained from electronic patient files, medical records, and operation notes, including sex, age, follow-up duration, and number of blood transfusion units, complications and mortality status.

Statistical analysis

G*Power 3.1.9 program was used to calculate the sample size in the study. The findings of another study conducted by Memtsoudis et al. were used to determine the sample size. In the study, the rate of procedure-related complications was reported as 12.2% in bilaterally operated patients and 8.5% in unilaterally operated ones (13). For an 80% statistical power and 0.05 margin of error, the minimum number of samples to be included in the study was determined as 1,061 patients.

In the present study, continuous data are presented as mean ± standard deviation (SD) or median (IQR: 25-75. percentile). Categorical variables are presented as frequencies (n) and percentages (%), and analysed using Pearson's chi-square and Fisher's exact tests. Normality assumptions were controlled using the Shapiro-Wilk test. The Student's t-test and Mann-Whitney U test were used for the comparison of numerical data between the two groups, as appropriate. One-way ANOVA was used for the comparison of parametric variables among groups, and Tukey's HSD test was performed as a post-hoc test for significant results. The Kruskal-Wallis test was carried out to compare non-parametric variables among the groups, and the Bonferroni-Dunn test was performed as a post-hoc test for significant results. Univariate and multivariate logistic regression analyses were used to establish the predictor variables that were significantly related to the length of ICU stay. Odds ratios (OR) with corresponding 95% confidence intervals (95% CIs) were reported. Statistical analysis was performed using IBM SPSS Statistics for Windows, version 23.0 (IBM Corp., Armonk, NY, USA). A two-sided p-value of < 0.05 was considered statistically significant.

RESULTS

This study included a total of 1,129 patients, 85.5% of whom were women, with a mean age of 67.58±7.23 years. Three most common comorbidities were hypertension (38.5%), diabetes mellitus (13%), and cardiovascular disease (9.3%), whereas anaemia was detected in 50.8%. Of all the patients, 75.6% underwent unilateral, 19.9% simultaneous bilateral and 4.5% staged bilateral TKA. In the study, 99 patients (8.8%) required ICU care, while 5 patients died (4 patients died in the hospital and 1 patient died within 1 month after discharge).

When the patients were divided into three groups, according to whether they underwent unilateral, simultaneous bilateral, or staged bilateral TKA, it was determined that the need for ES transfusion and the length of hospital stay were highest in those who underwent staged bilateral, but the lowest in those who underwent simultaneous bilateral TKA (all p<0,001). However, no statistically significant difference was found between the groups in terms of type of anaesthesia (general anaesthesia or spinal anaesthesia), intensive care need, ICU length of stay, and mortality rates (Table 1).

There was no statistically significant difference between patients with and without anaemia in terms of the type of anaesthesia, length of hospital stay, need for intensive care, ICU length of stay, and mortality rates, except for the need of ES transfusion, which increased significantly in anaemic patients, set as p=0.011 (Table 2).

In addition to comorbidities (p<0.001), the incidence of anaemia (p<0.001), need for intensive care (p=0.006), and mortality rate (p=0.014) were significantly higher in patients aged ≥70 years (Table 3).

No statistically significant difference was found in terms of the need for intensive care admission and mortality rates between patients with and without anaemia who underwent unilateral TKA, simultaneous bilateral TKA and staged bilateral TKA (Table 4).

Similarly, no statistical significance was observed in terms of need for ICU hospitalisation and mortality rates between patients younger than 70 and those aged ≥70, who underwent unilateral TKA, simultaneous bilateral TKA and staged bilateral TKA (Table 5).

Table 1. Comparison of demographic and clinical characteristics of patients who underwent unilateral, simultaneous bilateral and staged bilateral TKA

Variables	Unilateral (n=853)	Simultaneous bilateral (n=225)	Staged bilateral (n=51)	p values
Age (years)	67.65±7.58	66.88±5.79	69.52±6.7	0.056
Female	67.52±7.4[a,b]	66.50±5.83[a]	69.74±6.93[b]	**0.025**
Male	68.47±8.61	69.06±5.1	68.83±6.1	0.923
Gender				
Female	735(86.2)	191(84.9)	38(76)	0.135
Male	118(13.8)	34(15.1)	12(24)	
Comorbidity	397(46.5)[a]	118(52.4)[a,b]	32(64)[b]	**0.023**
HT	304(35.6)[a]	105(46.7)[b]	26(52)[b]	**0.001**
DM	122(14.3)[a]	15(6.7)[b]	10(20)[a]	**0.003**
CVD	72(8.4)	27(12)	6(12)	0.210
CKD	48(5.6)	11(4.9)	2(4)	0.822
CPD	51(6)	8(3.6)	0(0)	0.082
Anaemia	447(52.4)	103(45.8)	24(48)	0.192
ES transfusion unit	3(3-3)[a] Mean Rank=561.41	3(2-3)[b] Mean Rank=500.37	6(3-8)[c] Mean Rank=905.80	**<0.001**
Type of anaesthesia				
General anaesthesia	228(26.7)	75(33.3)	10(20)	0.066
Spinal anaesthesia	625(73.3)	150(66.7)	40(80)	
Length of hospital stay	6(5-7)[a] Mean Rank=565.51	6(5-7)[b] Mean Rank=476.93	13(8-15)[c] Mean Rank=941.34	**<0.001**
ICU hospitalization	69(8.1)	24(10.7)	6(12)	0.340
ICU length of stay	1(1-1)	1(1-1)	1(1-1)	0.253
Mortality	4(0.5)	1(0.4)	0(0)	0.999

Results are presented as mean ± SD, median (IQR) or n (%). One-way ANOVA, Kruskal-Wallis test, Pearson chi-square test, Fisher's Exact test.

TKA: Total knee arthroplasty, HT: Hypertension, DM: Diabetes mellitus, CVD: Cardiovascular disease, CKD: Chronic kidney disease, CPD: Chronic pulmonary disease, ICU: Intensive care unit.

Table 2. Comparison of demographic and clinical characteristics of patients with and without anaemia

Variables	Patients without anaemia (n=555)	Patients with anaemia (n=574)	p values
Age (years)	66.73±7.08	68.4±7.28	**<0.001**
Female	66.6±6.77	68.16±7.35	**0.001**
Male	67.46±8.55	69.92±6.71	**0.041**
Gender			
Female	468(84.3)	497(86.6)	0.281
Male	87(15.7)	77(13.4)	
Comorbidity	253(45.6)	295(51.4)	0.051
HT	201(36.2)	234(40.8)	0.116
DM	63(11.4)	84(14.6)	0.101
CVD	47(8.5)	58(10.1)	0.344
CKD	27(4.9)	35(6.1)	0.363
CPD	23(4.1)	36(6.3)	0.108
HGB level	13.37±1.05	10.8±0.8	**<0.001**
ES transfusion unit	3(3-3) Mean rank: 544.69	3(3-3) Mean rank: 584.64	**0.011**
Type of anaesthesia			
General anaesthesia	146(26.3)	168(29.3)	0.267
Spinal anaesthesia	409(73.7)	406(70.7)	
Length of hospital stay	6(5-7)	7(5-7)	0.121
ICU hospitalization	44(7.9)	55(9.6)	0.326
ICU length of stay	1(1-1)	1(1-1)	0.838
Mortality	2(0.4)	3(0.5)	0.999

Results are presented as mean ± SD, median (IQR) or n (%). Student's t-test, Mann-Whitney U test, Pearson chi-square test, Fisher's Exact test.

TKA: Total knee arthroplasty, HT: Hypertension, DM: Diabetes mellitus, CVD: Cardiovascular disease, CKD: Chronic kidney disease, CPD: Chronic pulmonary disease, ICU: Intensive care unit.

Table 3. Comparison of demographic and clinical characteristics of patients by age groups

Variables	<70 years (n=649)	≥70 years (n=480)	p values
Gender			
Female	575(88.6)	390(81.3)	**0.001**
Male	74(11.4)	90(18.8)	
Comorbidity	218(33.6)	330(68.8)	**<0.001**
HT	154(23.7)	281(58.5)	**<0.001**
DM	78(12)	69(14.4)	**0.245**
CVD	17(2.6)	88(18.3)	**<0.001**
CKD	7(1.1)	55(11.5)	**<0.001**
CPD	17(2.6)	42(8.8)	**<0.001**
Anaemia	300(46.2)	274(57.1)	**<0.001**
ES transfusion unit	3(3-3)	3(3-3)	0.716
Type of anaesthesia			
General anaesthesia	180(27.7)	134(27.9)	0.946
Spinal anaesthesia	469(72.3)	346(72.1)	
Length of hospital stay	6(5-7)	6(5-7)	0.375
ICU hospitalization	44(6.8)	55(11.5)	**0.006**
ICU length of stay	1(1-1) Mean rank: 52.61	1(1-1) Mean rank: 47.91	**0.049**
Mortality	0(0)	5(1)	**0.014**

Results are presented as mean ± SD, median (IQR) or n (%).Student's t-test, Mann-Whitney U test, Pearson chi-square test, Fisher's Exact test.

TKA: Total knee arthroplasty, HT: Hypertension, DM: Diabetes mellitus, CVD: Cardiovascular disease, CKD: Chronic kidney disease, CPD: Chronic pulmonary disease, ICU: Intensive care unit.

DISCUSSION

This study revealed that the need for ES transfusion and the length of hospital stay were highest in patients who underwent staged bilateral TKA and lowest in those who underwent simultaneous bilateral TKA. However, no significant differences were found between the groups in terms of intensive care needs, ICU length of stay, and mortality rates. Although the need for intensive care and mortality rates increased significantly in patients aged ≥70 years, performing unilateral, bilateral or staged TKA did not appear to have caused an additional increased risk when compared in terms of age groups.

Table 4. ICU hospitalization and mortality rates according to the presence of preoperative anaemia

Variables	Patients without anaemia (n=555)	Patients with anaemia (n=574)
ICU hospitalization		
Unilateral	29(7.1)	40(8.9)
Simultaneous bilateral	11(9)	13(12.6)
Staged bilateral	4(15.4)	2(8.3)
p values	0.284	0.510
Mortality		
Unilateral	1(0.2)	3(0.7)
Simultaneous bilateral	1(0.8)	0(0)
Staged bilateral	0(0)	0(0)
p values	0.463	0.999

Results are presented as n (%).Pearson chi-square test, Fisher's Exact test.

Table 5. ICU hospitalization and mortality rates according to the age

Variables	<70 years (n=649)	≥70 years (n=480)
ICU hospitalization		
Unilateral	30(6.2)	39(10.7)
Simultaneous bilateral	10(7.4)	14(15.6)
Staged bilateral	4(15.4)	2(8.3)
p values	0.181	0.377
Mortality		
Unilateral	-	4(1.1)
Simultaneous bilateral	-	1(1.1)
Staged bilateral	-	0(0)
p values	-	0.999

Results are presented as n (%).Pearson chi-square test, Fisher's Exact test.

A review of the relevant literature on bilateral TKA revealed that administering anaesthesia as a single session, shorter duration of surgery, and reduced use of painkillers, lower costs, excellent clinical results, as well as patient satisfaction could be considered as the advantages of this procedure (14). Considering the similar advantages, simultaneous bilateral TKA was performed in selected cases in our clinic. However, in accordance with the opinions of anaesthesiology and reanimation specialists, unilateral or staged bilateral TKA is mostly preferred for patients of advanced age and those having serious comorbidities or doubts about their haemodynamic stability.

Despite the availability of various studies in the literature evaluating the results of unilateral - bilateral (simultaneous + staged) or simultaneous bilateral - staged bilateral TKA, the number of studies evaluating the results of unilateral - staged bilateral - simultaneous bilateral TKA are limited. For example, a study conducted in Pakistan that included 658 patients reported no statistically significant differences regarding mortality and major complications between patients who underwent unilateral and those that underwent bilateral TKA. The same study further reported that 3 patients who had undergone bilateral TKA developed DVT complications. The study also suggested that bilateral TKA may be preferred in selected patients with bilateral knee osteoarthritis in terms of its additional benefits such as lower surgery costs, faster recovery, less absenteeism, single anaesthesia exposure, single hospital admission, and lesser follow-up necessity (15). In our study, no statistically significant difference was found in terms of major complications, such as severe haemodynamic disorders, DVT, and pulmonary embolism, which may cause mortality and ICU hospitalisations between patients who underwent unilateral, simultaneous bilateral, and staged bilateral TKA. Undoubtedly, the most important factor in obtaining this result in our clinic was based on the fact that simultaneous bilateral TKA was performed

in younger patients, in those without serious comorbidities, and in those who were more haemodynamically stable. Since the amount of bleeding could have been higher, the use of tranexamic acid was relatively more common in cases that underwent simultaneous bilateral TKA than in cases with unilateral TKA or staged bilateral TKA. This situation may have prevented increased mortality and ICU hospitalizations associated with postoperative hemodynamic disorders that patients who underwent simultaneous bilateral TKA could have developed.

However, in another study evaluating the results of simultaneous bilateral and staged bilateral TKA, Liu et al. analysed the data obtained from ten studies involving 92,782 patients and reported that the prevalence of mortality in patients who underwent simultaneous bilateral TKA increased significantly when compared with those who underwent staged bilateral TKA. The meta-analysis also indicated that the risk of deep infection and respiratory complications was lower in patients who underwent simultaneous bilateral TKA than in those who underwent staged bilateral TKA, though pulmonary embolism and DVT were observed more frequently. No statistical significance was observed in terms of revision, superficial infection, arthrofibrosis, cardiac complications, neurological complications, or urinary complications (16). In another similar study, Yoon et al. compared TKA performed bilaterally in a single session and in two separate sessions, emphasising the probability of a significant increase in systemic complications in patients aged ≥70 who underwent bilateral TKA in a single session compared to that performed in stages. The same study noted that simultaneous bilateral TKA in elderly or high-risk patients may increase the rate of systemic complications, and it should, therefore, be performed with caution, particularly in this group (17). In our study, we investigated the effect of advanced age on the need for ICU admission and mortality, especially in patients who underwent unilateral, staged bilateral, and simultaneous bilateral TKA. Regardless of how significantly the need for intensive care and mortality rates increased in patients aged ≥70, we found that performing unilateral, bilateral or staged bilateral TKA did not result in an additional risk in terms of an increased need for ICU hospitalisation or mortality.

Similar to our study, Bohm et al. examined the results of unilateral, staged bilateral, and simultaneous bilateral TKA cases in a study conducted with approximately 240,000 patients, and reported that those who underwent simultaneous bilateral TKA were younger and had with fewer comorbidities than those who underwent unilateral TKA and staged bilateral TKA. The same study further indicated that patients undergoing simultaneous bilateral TKA had a shorter hospital stay, but generally more blood transfusion was needed than the case in other groups. It was also reported that there was no statistically significant difference regarding in-hospital mortality between patients who underwent simultaneous bilateral and unilateral TKA, while those who underwent staged bilateral TKA had the lowest in-hospital mortality rate (18). Similarly, the present study found that the mean age of those who underwent simultaneous bilateral TKA was lower, although not statistically significant, and that comorbidities, especially DM, were also significantly less common in general than those who underwent staged bilateral TKA. In our study, the need for ES transfusion and the length of hospital stay were highest in those who underwent staged bilateral TKA and lowest in those who underwent simultaneous bilateral TKA. No statistically significant differences were found between the groups in terms of intensive care need, length of ICU stay, and mortality.

In the literature, there are studies conducted with fewer patient groups comparing unilateral and bilateral TKA in terms of pain levels and functional improvement. In one of those studies, Alghadir et al. reported a significant decrease in pain intensity and considerable improvement in functional capac-

ity observed on postoperative day 30, after total knee replacement (TKR) surgery in both groups. Nonetheless, no significant difference was noted between simultaneous bilateral and unilateral TKR in terms of alleviating the intensity of pain and of improving functional capacity on postoperative day 30 (19). In a similar study, Yıldız et al. compared the results of unilateral unicompartmental and bilateral unicompartmental knee arthroplasty by evaluating the results of the patients, whose clinical results were also examined in terms of the Oxford Knee Score and the International Knee Documentation Committee. They concluded that one-stage simultaneous bilateral Oxford medial unicompartmental knee arthroplasty was a safe and effective method with acceptable complication rates compared to those of unilateral surgery (20). Our study examined the reliability of simultaneous bilateral TKA; however, the lack of various scores evaluating the effectiveness of such surgery could be considered a limitation. In addition, the fact that the patients included in the study were operated by different orthopaedic surgeons and were followed up by different anaesthesia teams can also be considered as a limitation of the study, as this may have affected the results. The strength of our study rests on the evaluation of patients' mortality and morbidity when exposed to bilateral simultaneous TKA within a large patient population of >1000 people.

Contrary to some studies in the literature, it is undeniable that the mortality rates of patients who underwent simultaneous bilateral TKA in our study were lower because elderly patients with comorbidities, who underwent the procedure in our hospital, were mostly closely observed in the ICU on the first postoperative day.

CONCLUSION

In conclusion, the results of our study showed no statistically significant difference in terms of the need for intensive care admission, length of stay in the ICU, and mortality rates between patients who underwent unilateral TKA, simultaneous bilateral TKA, and staged bilateral TKA.

Most patients with arthritic knees have bilateral knee involvement. Just in the same way we implemented in our clinic, simultaneous bilateral TKA may be preferred over staged bilateral TKA in patients under 70 years of age with bilateral gonarthrosis, but without any significant comorbidities, considering that the former can be performed with a single administration of anaesthesia, and provides shorter surgical time, reduced painkiller use, shorter hospital stay, and lesser need of ES transfusion, in addition to the fact that it increases neither the rate and length of ICU hospitalisation, nor mortality. Finally, the attitude of an anaesthesiology and reanimation specialist in the postoperative follow-up and management of risky patients is as important as the choice of protocol by a surgeon for each patient.

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Competing interest

The authors declare that they have no conflict of interest.

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