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Effect of patellar resurfacing surgery on bleeding in total knee arthroplasty

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SUMMARY

OBJECTIVE: Postoperative bleeding is one of the most important factors affecting clinical and functional results in total knee arthroplasty. Therefore, many studies have been conducted on bleeding in arthroplasty patients. However, there are very few reports investigating the effect of patellar surface replacement on bleeding in knee arthroplasty. We, therefore, aimed to investigate the effect of patellar surface replacement on postoperative bleeding.

METHODS: In this retrospective study, 30 with patellar resurfacing were compared with 39 without patellar resurfacing among patients who had undergone total knee replacement due to primary osteoarthritis. Demographic data, amount of transfusion, preoperative and postoperative hemoglobin and hematocrit values, and total, visible, and hidden blood loss values were recorded.

RESULTS: No statistical difference was found between the two groups in terms of demographic values. There was no significant difference between the groups in terms of the amount of blood in the drain, total blood loss, hidden blood loss, and blood transfusion in patients who had and had not undergone patellar resurfacing. A positive significant correlation was found between postoperative drainage volume and total blood loss.

CONCLUSION: Patellar component application in patients who had undergone total knee arthroplasty does not change the blood loss of the patients.

KEYWORDS: Arthroplasty, replacement, knee. Postoperative hemorrhage. Patella. Hemarthrosis.

INTRODUCTION

Background

One of the important factors affecting the clinical and functional results of patients after total knee arthroplasty (TKA) operation is the amount of postoperative bleeding[1]. Blood loss after TKA can lead to postoperative anemia, need for transfusion and its related systemic complications, as well as complications affecting functional outcomes such as delayed mobilization and decreased knee flexion[2]. The number of studies on the reduction of postoperative bleeding after TKA is gradually increasing. Considering all types of arthroplasty, the number of articles examining postoperative bleeding and published in PubMed was 19 in 2010, while this number increased to 454 in 2020[3]. The main ones of these studies are those on the use of tourniquets, hypotensive anesthesia, as well as agents such as systemic or local tranexamic acid (TXA) and lidocaine-containing epinephrine[4,5].

Another factor affecting the functional results after the operation is the patellar resurfacing performed in TKA. However, there is still no consensus on whether patellar resurfacing should be routinely performed in every patient[6]. In this regard, surgeons are divided into three groups: routinely performing patellar resurfacing, not performing it routinely, and performing it in a selected patient group[7]. Although resurfacing has advantages such as reduction in anterior knee pain and reoperation rates, it has main disadvantages such as patellar fracture that may occur during the operation and loosening of the patellar component[8]. While there are articles stating that patellar resurfacing reduces revision surgery rates and has better results, there are articles claiming that complication rates increase by 10% due to patellar resurfacing alone[9,10].

Although the factors related to the attachment of the implant to the bone tissue come to the fore while evaluating the complications related to the use of the patellar component, the additional bleeding that will occur should also be considered[11]. It is expected that patellar resurfacing will not cause significant bleeding, but we could find very few studies investigating the effect of patellar resurfacing on bleeding[6,12,13]. We think that these studies do not provide sufficient evidence. Therefore, we planned our study with the hypothesis that patellar resurfacing would not cause significant bleeding in knee replacement patients.

METHODS

Study design and setting

We started the study after receiving ethics committee approval. Patients who had undergone total knee replacement (TKR)

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for primary knee osteoarthritis between June 2015 and June 2021 were included. A total of 103 patients operated by a single orthopedic surgeon using the same standard surgical procedures were included in this study. Thirty-four patients with a history of deep vein thrombosis (DVT) or pulmonary embolism (PE), bleeding diathesis, a history of renal failure, cardiovascular disease, a history of TXA allergy, a history of malignancy, hemorrhagic diathesis and coagulopathy, receiving anticoagulant therapy, preoperative hemoglobin values below 10 g/dl, traumatic osteoarthritis or inflammatory arthritis, peripheral vascular disease, liver failure, and a history of stroke were excluded from this study according to the exclusion criteria. Comparison was made between 30 patients who had undergone patellar resurfacing during the operation and 39 patients who had not.

First-generation cephalosporins reportedly had been given to all patients as 1 g just before the operation and 1 g every 8 h for every 24 h. Operations had been performed under spinal/epidural and general anesthesia. Cemented femoral component and cemented tibial component had been used in all patients. The cemented patellar component was additionally used in patients who underwent polyethylene insert patellar resurfacing. Notably, 10 mg/kg intraoperative TXA was administered intravenously to all patients, and the same dose was repeated at the third postoperative hour. At the end of the operation, a 10-gauge drain was placed intra-articularly. Surgical folds passed through the incision were closed in order anatomically. At the 24th postoperative hour, the drain was removed. The amount of blood accumulated in the drain reservoir was measured and recorded. Intraoperative blood loss was calculated as zero because tourniquets were used in all patients. Of note, 4,000 IU low-molecular-weight heparin (Oksapar; Kocak Farma, Turkey) was administered subcutaneously to all patients daily for thrombosis prophylaxis, and it was continued for 4 weeks. On the first postoperative day, they were mobilized with as much weight as they tolerated.

Patients' age, surgical side, body mass index (BMI, kg/m^2), the amount of transfusion, preoperative and postoperative hemoglobin (Hgb), hematocrit (Hct) values on the first, second, and third days, and the amount of blood from the postoperative drain were recorded. Total blood volume (TBV) was calculated as described by Nadler et al.[14]. Total blood loss (TBL) was calculated using the Gross[15] formula as follows:

TBL=TBV × (preoperative Hct – postoperative day 3 Hct) / Mean Hct

The amount of erythrocyte suspension (200 mL each) given to the patients in the postoperative period was added to the amount of TBL. Hidden blood loss (HBL) volume was obtained by subtracting the visible blood loss (VBL) volume from the TBL volume (Figure 1). Iron or

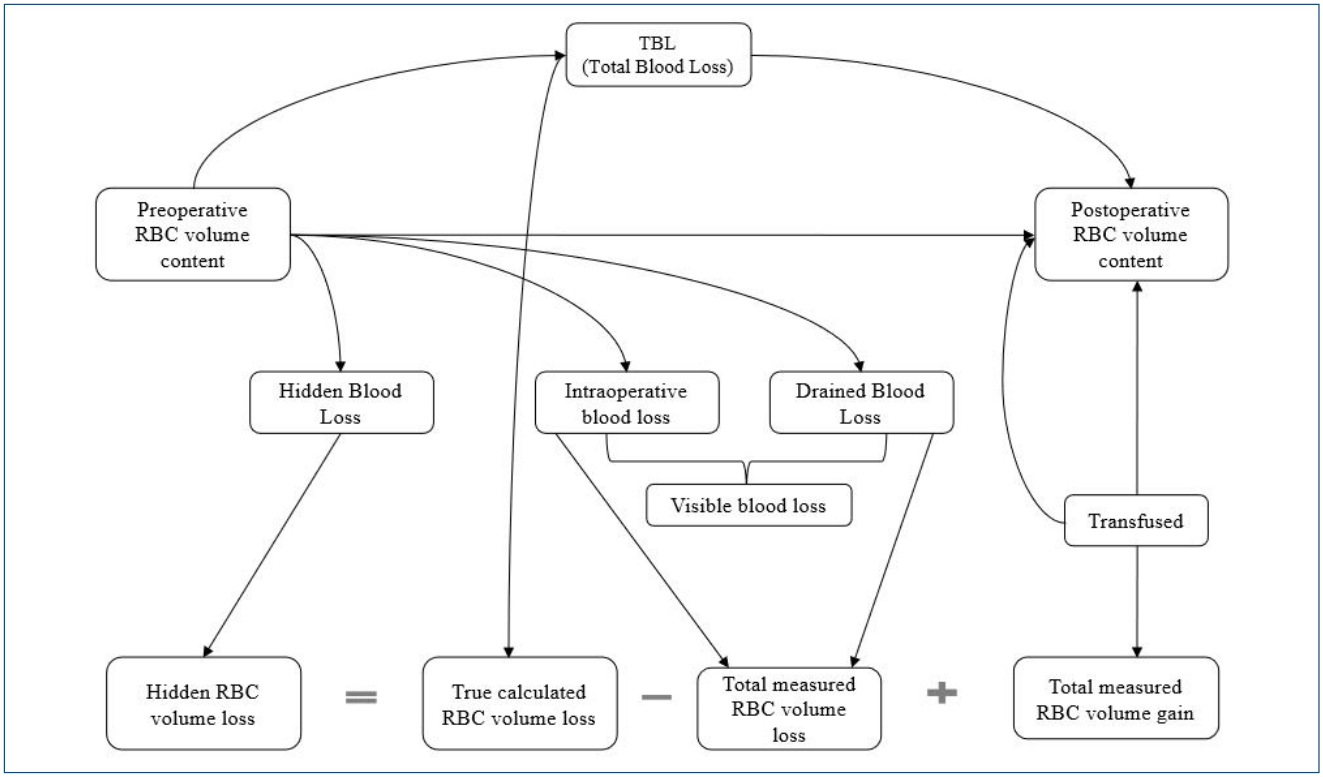

Figure 1. Flowchart of the movement of blood between compartments and calculation of blood loss parameters.

erythropoietin preparations were not used in any of the patients. In case of hemogram (Hgb) values being <8.5 g/dl in the follow-up of the patients or in clinical cases showing symptoms of tachycardia, hypotension, or anemia, blood transfusion was performed in consultation with the anesthesia team.

Statistical analysis

The Gpower (G*Power version 3.1.9.6; Germany) software was used for the adequacy test of the sample size. For calculation, data from a recently published similar article about bleeding[5] were used. In the 95% power and effect size range of 1.15, a minimum of 18 patients from both groups was calculated as a sufficient value (the number of patients in the groups in our study was 30 and 39). Statistical analysis was performed using IBM SPSS for Windows 23.0 software (IBM Corp., Armonk, NY, USA). Descriptive statistics for numerical variables were expressed as mean and standard deviation. Parametric test procedures on normal distribution were used in the Kolmogorov-Smirnov test. Independent two-sample t-tests were used to determine the relationships between parameters. Chi-square analysis was used to determine the relationship between categorical data. The correlation analysis between TBL and VBL and postoperative drainage volume was evaluated using the Pearson correlation coefficient. The results were evaluated within the 95% confidence interval, and $p<0.05$ was considered statistically significant.

RESULTS

Demographic data of the patients included in this study are given in Table 1. There was no statistically significant difference between the groups with and without patellar resurfacing in terms of age, operation side, BMI, TBV, preoperative Hgb values, and the type of anesthesia administered. There was no statistically significant difference between the hemoglobin values of the groups in the mean hemogram values on the first, second, and third postoperative days (Table 1).

There was no statistically significant difference between the groups in terms of the amount of blood in the drain, TBL, and VBL of the patients participating in this study. There was no statistically significant difference between the groups in terms of blood transfusion (Table 2). When the correlation between postoperative drainage volume and VBL was evaluated, there was no significant correlation ($r=0.025$, $p=0.837$), but a positive significant correlation was found between postoperative drainage volume and TBL ($r=0.262$, $p=0.029$).

DISCUSSION

The most important finding of our study is that no significant effect of patellar component change on TBL, VBL, and HBL was observed in patients who had undergone TKA. In the current literature, there are very few studies investigating the effect of patellar resurfacing on bleeding, and their results are inconsistent. In a comparative study investigating the effect of patellar resurface surgery on bleeding in patients undergoing TKA, no

Table 1. Demographic data and postoperative Hgb values of study patients.

	Resurfaced 30 patients		Not resurfaced 39 patients		p
	n	Mean±SD	n	Mean±SD	
Age		66.77±6.393		67.33±6.276	0.713
Gender					0.345
Female	21		23		
Male	9		16		
BMI (kg/m^2)	31.53		31.20		0.701
Side					0.387
Right	13		21		
Left	17		18		
Pre-op Hgb		13.24±0.79		13.50±0.82	0.195
Pre-op Hct		39.63±2.29		40.34±2.44	0.220
TBL (mL)		4891.18±585.96		4935.95±462.08	0.728
Post-op day 1 Hgb (g/dl)		11.93±0.76		12.06±0.81	0.499
Post-op day 2 Hgb (g/dl)		10.53±0.77		10.65±0.89	0.561
Post-op day 3 Hgb (g/dl)		9.04±0.78		9.16±0.89	0.561

Hgb: hemoglobin; SD: standard deviation; BMI: body mass index; Hct: hematocrit value; TBL: total blood volume.

Table 2. Comparison of groups in terms of bleeding-related parameters and transfusion amount.

Bleeding parameters	Resurfaced 30 patients	Not resurfaced 39 patients	
	Mean±SD	Mean±SD	p
Postoperative drain volume (mL)	443.00±128.952	474.10±104.974	0.273
Hidden blood loss (mL)	569.405±159.421	584.338±160.918	0.702
Total blood loss (mL)	716.665±161.851	744.704±163.000	0.480
Comparison of groups according to transfusion amount			
Transfusion (U)			**0.881**
1	10	9	
2	3	2	
3–4	0	0	

SD: standard deviation.

significant effect of patellar resurface surgery on bleeding was demonstrated[6]. However, in this study, it was stated that there was no difference in bleeding by evaluating only the Hct levels of the patients, whereas the methods calculated in the evaluation of bleeding were not used in the current literature[5,16,17]. In another study comparing patients with and without patellar resurfacing, only the difference in intraoperative bleeding was examined in terms of bleeding, and it was stated that there was no difference[12]. However, this information is not useful for many surgeons who use tourniquets during the operation, as in our clinic. Another study, which not only focusing on patellar resurfacing but also investigating the effect of many factors on bleeding, has stated that patellar resurfacing increases the amount of bleeding, but not the amount of transfusion[13].

Another important finding of our study is that there was no significant difference in the amount of blood transfused between the groups with and without patellar resurfacing. Expected TBL in patients who had undergone total joint arthroplasty ranges between 590 and 1,800 mL[18]. This situation should be taken into account when planning patellar resurfacing in elderly patients undergoing TKA and having various comorbidities[16]. There may also be medical conditions where blood transfusion may be contraindicated or patients who refuse blood transfusion for religious reasons, such as Jehovah's witnesses, or patients who cannot be transfused[6,19]. In such cases, if the surgeon prefers the patellar component, they should provide sufficient evidence to the patients that it will not increase bleeding and require additional transfusion. However, there are very limited studies on this subject in the current literature, and the results of the studies are contradictory. Therefore, we think that the results of our study will be beneficial for surgeons considering patellar resurfacing in patients who cannot receive blood transfusion.

In our study, we evaluated the relationship between postoperative drainage volume and HBL or TBL. A positive correlation was found between postoperative drainage volume and TBL. The reason for this positive correlation may be that TBL plays a major role in postoperative drainage volume. However, we did not find a significant correlation between postoperative drainage volume and HBL in our study. In a study investigating the effect of TXA on bleeding in patients undergoing TKA, a positive correlation between HBL and postoperative drainage volume was found, the finding inconsistent with our study[5]. In contrast, while TXA was used in only some of the patients in the mentioned study, TXA was used in all patients in our study.

The main limitation of our study is that it is retrospective and single centered. Moreover, the postoperative drainage volumes of the patients were obtained from the data in the patient file recorded by the clinical nurse on duty. Another limitation may be that the same person did not measure the postoperative drainage volumes. However, the homogeneity of the demographic data of the groups compared and the application of standard surgical procedures by a single orthopedic surgeon to the patients can be ranked among the strengths of our study.

CONCLUSION

Patellar component application in patients who underwent TKA does not change the blood loss of the patients.

AUTHORS' CONTRIBUTIONS

SA: Conceptualization, Data curation, Formal Analysis, Writing – original draft. **DC:** Data curation, Writing – review & editing. **SK**: Formal Analysis, Writing – original draft. **ZO**: Data curation, Writing – review & editing. **HO**: Writing – review & editing. **OB:** Writing – review & editing.

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