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The comparison of the effects of intraoperative bleeding control and postoperative drain clamping methods on the postoperative blood loss and the need for transfusion following total knee arthroplasty

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Objective: We aimed to determine and compare the effects of intraoperative bleeding control and two hours postoperative drain clamping method on postoperative wound drainage and the need for donor blood transfusion following total knee arthroplasty (TKA).

Methods: Seventy-one patients who underwent TKA were randomly assigned into two groups. Fourty-four knees of 32 patients comprised Group A and 51 knees of 39 patients comprised Group B. In Group A, no bleeding control was done and postoperatively, the drain was clamped for 2 hours. Then it was unclamped to begin aspiration after the 2nd hour. In Group B, the bleeding was controlled intraoperatively, and the drain was not clamped after the surgery. Drains were removed 48 hours after the surgery in both groups. Bilateral and unilateral arthroplasty patients were evaluated separately. The groups were compared for their preoperative and postoperative 3-day haemoglobin (Hb) levels, total drainage amount and total number of blood transfusions.

Results: The haemoglobin levels were similar in both groups preoperatively and at the 1st, 2nd and 3rd postoperative days. In Group A, the wound drainage was 696.1±235.4 ml in unilateral TKA patients and was 1010.8±535.5 ml in bilateral arthroplasty patients. In Group B, the wound drainage was 710.1±380.1 ml in unilateral TKA patients and was 878.3±489.6 ml in bilateral arthroplasty patients. The mean number of transfusions was 1.41 units with no significant differences between the groups.

Conclusion: The two hour drain clamping method without intraoperative bleeding control does not seem to affect the amount of blood loss and the need for transfusion when compared to intraoperative bleeding control in total knee arthroplasty patients. Hovewer, it is a simple and feasible method and can be used to decrease the operation time.

Key words: Bleeding control; blood loss; drain clamping; total knee arthroplasty.

Today, total knee arthroplasty (TKA) has become a common orthopedic procedure. A significant blood loss, up to 1000-1500 ml, can be seen during this operation and during the early postoperative period.[1,2] This loss can be compensated by blood transfusions, but the donor blood may lead to allergic reactions, and transmission of viral infections, such as hepatitis, and AIDS.[3] Therefore, various meth-

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ods, such as preoperative erythropoietin and iron supplementation, post-operative autotransfusion,[4,5] IV tranexamic acid infusion,[6] intraaarticular epinephrine injection,[7] the use of fibrin glue,[8] the use of an intramedullary femoral plug[9] and temporary drain clamping have been tried to reduce blood loss during and after TKA. After TKA, the hematoma develops within a confined space and is suctioned by the drain's vacuum. Although the vacuum drains the hematoma, it may prevent the tamponade effect, leading to increased bleeding.[10,11] Considered a simple and uncomplicated method, the temporary drain clamping can be used to reduce blood loss.

In this study, we aimed to compare the effects of two simple and easy to apply methods in decreasing the need for blood transfusion.

Patients and methods

Seventy-one patients (60 female and 11 male) who underwent TKA, in the last year, were randomly assigned into two groups, according to the order of presentation. Fourty-four knees of 32 patients (mean age: 65.5 years) comprised Group A and 51 knees of 39 patients (mean age: 64.1 years) comprised Group B. In Group A, no bleeding control was done and postoperatively, the drain was clamped for 2 hours. Then it was unclamped to begin aspiration after the 2nd hour. In group B, the bleeding was controlled intraoperatively, and the drain was not clamped after the surgery. Those subjects who had history of bleeding diathesis or abnormal coagulation tests and patients who previously had open-knee surgery such as, high tibial osteotomy, synovectomy, meniscectomy and arthroplasty, were not included into the study.

The surgery was performed under spinal or general anesthesia. An automatic pneumatic tourniquet was used in all cases. The type of anesthesia was decided according to the surgeon's and the patient's preferences. One suction drain was placed into the knee at the end of the operation.

In Group A, after wound closure, an elastic bandage was wrapped and then the tourniquet was released and the drain was kept clamped for 2 hours. In Group B, the tourniquet was released at the end of the operation and bleeding control was done using electrocautery. Then, the wound was closed over a drain and an elastic bandage was applied and the drain was set. In patients undergoing bilateral arthroplasties, the surgery of the second knee was started after the bandage application of the first knee.

Drains were removed 48 hours after surgery in both groups and the total amount of drainage was recorded. The hemoglobin (Hb) and hematocrit (Hct) levels were studied during the first three days after surgery. The indication for blood transfusion were as follows: Hb value less than 9 gr/dl, and symptoms such as tachycardia and/or, hypotension. The number of transfusions was recorded.

Pain control was done using 75 mg diclofenac sodium injections, twice a day and 50 mg intramuscular meperidine injections, when necessary. Rehabilitation began on the first postoperative day, and patients were ambulated on the second postoperative day.

Hb and Hct levels, platelet (PLT) count, prothrombin time (PT) and activated partial thromboplastin time (aPTT) were examined preoperatively. Low molecular weight heparin was started 12 hours before surgery and was continued for 3 weeks after the operation for thromboprophylaxis. Infection prophylaxis was done with intravenous administration of cefazolin sodium, beginning one hour before the surgery and continuing for 48 hours after surgery.

Patients were observed for wound problems (ecchymosis, hematoma, bulla), the clinical findings of deep vein thrombosis (thigh pain, thigh swelling) and range of motion of the knee joint. Ecchymoses which had a diameter of more than 5 cm were considered as spreaded or major ecchymoses. When the active range of motion was 90 degrees, the patients were discharged. They were called for a follow-up at postoperative 6 weeks and at 3 months.

The data were analyzed using SPSS (v.12.5) statistical software program. The total drainage amounts and Hb levels of the groups were compared with independent-sample t-test. The comparison of the proportions were analyzed with chi-square test. The p levels <0.05 was considered as significant.

Results

Both groups were homogenous for their demographic characteristics (Table 1).

In Group A, 18 patients had general anesthesia and, 14 had spinal. In Group B, 17 patients had general anesthesia, and 22 had spinal ($p=0.314$). The preoperative Hb values of the groups were similar. The blood drainage of bilateral arthroplasty cases was

more than unilateral cases, but there were no difference between the groups (Table 2).

In Group A, 11 patients did not need blood transfusion, and 21 patients received a total of 43 units (7 patients had 1, 7 patients had 2, 6 patients had 3 and 1 patient had 4 units) of blood transfusion. In Group B, 9 patients did not need any blood transfusions, and 30 patients received a total of 57 units (15 patients had 1, 6 patients had 2, 3 patients had 6 and 3 patients had 4 units) of blood transfusion. The mean number of blood transfusion per patient was 1.41. There was no significant difference between the groups, when the mean number of blood transfusions were compared (Table 2).

There widespread ecchymoses (larger than 5 cm) in 7 patients in Group A, and bullae occurred in 5 patients. There were widespread ecchymoses in 4 patients in Group B, and bullae occurred in 2 patients (p=0.204 and p=0.446 respectively). In Group A, there was one case with a hematoma and another with a prosthetic infection which required joint debridement. The patient with infection was debrided 25 days after the index surgery and the infection resolved completely after debridement and liner exchange. None of the patients developed necrosis at the wound site and none had signs of deep vein thrombosis and pulmonary embolism.

Table 1. Demographic data.

		Group A	Group B	P value
Number of patients (knees)		32 (44)	39 (51)	
Mean age (years)		65.5±8.6	64.1±8.2	
Gender	Female	27	33	0.615
	Male	5	6	
Operation	Unilateral	20	27	0.717
	Bilateral	12	12	

Discussion

Suction drains are commonly used after TKA, although this issue is still controversial. Studies supporting the use of drains in the knee report that it prevents the formation of hematoma, decreases bleeding into the soft tissues and reduces wound discharge.[11,12] However, the use of drains were reported to decrease the tamponade effect, thus increasing the blood loss through the wound.[13,14] It was shown that the use of drainage did not alter the rate of postoperative complications, the mean time of hospital stay, the need for transfusion and postoperative functional knee scores.[11-13,15,16] Our results suggested that temporary clamping of the drain may reduce the blood loss after TKA.

Drain clamping time varies among the previous studies. In our study, we closed the wound and wrapped an elastic bandage and kept the drains clamped for 2 hours. We did not observe a siginificant reduction in the amount of drainage, the levels of Hb and Hct and postoperative transfusion requirements. Sedna and et al.[17] clamped the drains for 1 hour after TKA and reported decreased postoperative blood loss. Roy and et al.[18] also applied 1-hour drain closure and in their study the blood loss was 732 (620-845) ml in drain closure group and was 1050 (728-1172) ml in the control group. Although

Table 2. The preoperative and postoperative hemoglobin values, drainage and transfusion rates.

		Operation	Group A	Group B	P
Hb values (g/dl)	Preoperatively	Unilateral	13.5±1.3	13.1±1.6	0.363
		Bilateral	13.3±1.4	13.6±1.6	0.558
	1st postoperative day	Unilateral	10.9±1.2	10.6±1.4	0.487
		Bilateral	10.5±0.9	10.8±1.1	0.360
	2nd postoperative day	Unilateral	10.2±1.1	10.1±1.1	0.805
		Bilateral	9.7±1.4	9.7±0.9	0.968
	3rd postoperative day	Unilateral	10.5±1.0	10.7±1.1	0.765
		Bilateral	9.6±0.9	9.7±0.8	0.810
Total drainage (ml)		Unilateral	696.1±235.4	710.1±380.1	0.721
		Bilateral	1010.8±553.5	878.3±489.6	0.541
Total blood transfusion (Units/patient)		Unilateral	0.6±0.7	1.0±0.1	0.072
		Bilateral	2.7±0.7	2.5±1.2	0.686

the blood loss was significantly reduced, the mean Hb decreases and the need for transfusion were not significantly different among groups.

Kiely et al.,[19] used a 2-hour drain clamping method and did not find a difference regarding blood loss, transfusion requirements and Hb levels. Stucinskas et al. and Shen et al.[20,21] clamped the drain for 4 hours postoperatively and found a significant reduction of blood loss. In both studies, the amount of postoperative blood transfusion decreased, but Stucinskas reported no difference in postoperative Hb, Hct levels. Raleign et al.[22] used an intermittent drain clamping method. They clamped the drains for 5 minutes every 2 hours during the first 6 postoperative hours and then clamped again at 12th and 24th hours for 5 minutes. Although the amount of drainage had decreased, there was no difference in the postoperative transfusion rate.

Prasad et al.[23] compared two different intermittent drain clamping methods. They kept the drains clamped in the first group for an hour. In the second group, they unclamped the drains every 2 hours for 10 minutes during the first 24 hours. The blood loss in the second group was significantly lower than the first, but there was no significant difference in postoperative blood transfusion rates and Hb levels. In our study, there were no significant differences in drainage, blood transfusion rates and Hb levels among the groups.

Most studies focused on the amount of postoperative blood loss through the drain, but the amount of bleeding after tourniquet release or bleeding into the tissues was not taken into account. Therefore, although there was a significant decrease in the amount of drainage, the reduction of Hb and Hct levels and postoperative transfusion rates were not different among the groups.[18,22,23] The meta-analysis done by Tai et al. supports this statement. They concluded that drain clamping for less than 4 hours did not reduce the drainage and that drain clamping did not alter the postoperative blood transfusion rates.[24]

Bleeding control after the tourniquet release or elastic bandage application before the tourniquet release are thought to decrease the amount of drainage. Lotke,[2] Ishii et Matsuda[25] and Bilgen et al.[26] did not find a significant difference in drainage. In our study, both groups were similar in terms of bleeding and we think that drain clamping without bleeding control may help shorten the operation time without increasing blood loss.

According to the previous reports, wound problems, infection, and deep vein thrombosis were not more common after drain clamping.[18-23] In our study, although we detected more wound complications in the drain clamping group, this was not statistically significant.

In conclusion, drain closure for 2 hours after TKA did not decrease postoperative blood loss and the need for transfusion, when compared to intraoperative bleeding control.

Conflicts of Interest: No conflicts declared.

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