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Original Article

A PROSPECTIVE STUDY TO EVALUATE THE ROLE OF INTRAVENOUS TRANEXEMIC ACID IN REDUCING THE BLOOD LOSS DURING TOTAL KNEE ARTHROPLASTY

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ABSTRACT

Objective: The goal of this research was to determine how well intravenous tranexamic acid works in minimizing excessive bleeding after total knee arthroplasty.

Methods: The study was done on 50 patients of different age groups. Patients were randomly separated into two groups of 25 each. Group 1 were those who received intravenous tranexamic acid and group 2 were those who did not receive intravenous tranexamic acid. SPSS software was used to keep track of everything that happened and assess the outcomes.

Results: Patients in Group A had a mean perioperative blood loss of 298.04 ml, whereas those in Group B lost 447.2 ml on average after surgery. When comparing the two groups statistically, it was shown that group A had considerably larger mean perioperative blood loss than group B.

Conclusion: Patients in group B had substantially lower mean hemoglobin than patients in group A at the postoperative day 1 and postoperative day 7 measurements.

Keywords: Arthroplasty, Tranexamic acid, Blood loss

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INTRODUCTION

The tibiofemoral joint generates pressure three to four times the body weight during walking and climbing, respectively, and transfer the body weight from the femur to the shin bone. The range of motion ranges from about 10 degrees of hyperextension to 140-150 degrees of hyperflexion in the sagittal plane. To increase knee flexion prior to impingement, the tibiofemoral contact point and femoral center of rotation shift posteriorly as flexion increases. 0 to 75 degrees is the required range of motion for normal gait [1]. Posterior stabilising implants, unicompartmental arthroplasty and cruciate retention are used as potential index procedure options. More constrained prosthetic components like semi-obliged, pivoted, or distal femoral substitution choices are given consideration in patients with significant varus/valgus instability, patients with preexisting poor bone quality, those undergoing revision surgery including component revisions, or on the other hand, in the setting of considerable bony deformities [2].

The antifibrinolytic tranexamic acid is an engineered lysine derivative that represses the change of plasminogen to plasmin by acting as a competitive inhibitor. At low concertation, it act as a competitive inhibitor of plasminogen initiation, however, at higher concentration it functions as a non-competitive inhibitor of plasmin like aminocaproic acid. As such, tranexamic acid is multiple times more powerful in vitro than aminocaproic corrosive since it ties all the more emphatically to plasminogen receptor sites. It does not cause platelet aggregation when administered at a dosage of 1 mg/ml. The synthesis and activity of plasmin may be inhibited, which may decrease angioedema assaults in individuals with Hereditory angioedema by decreasing plasmin-prompted activation of the first complement supplement protein (C1) [3]. Tranexamic acid binds competitively to the kringle domain of plasminogen and blocks its activation, lowering the production of plasmin (fibrinolysin), a protein that obliterates fibrinogen, fibrin clusters, and procoagulant factors V and VIII [3]. A few strategies have been developed to reduce blood misfortune during and after TKA. These incorporate the utilization of tourniquets, Computer-assisted sugeries, autologous blood transfusion, hypotensive sedation, and various meds. Discussions on the benefits and downsides of such approaches are common. Fibrinogen and fibrin sealants were found to be useless, but erythropoietin and TXA were proven to be effective with little adverse effects. However, tourniquets raised the risk of neurovascular damage, bruising, and metabolic disruption after surgery, even if they decreased blood loss during surgery [4]. Therefore, the reason for this study was to see whether regulating tranexamic acid intravenously may assist with diminishing blood loss during TKA.

MATERIALS AND METHODS

This investigation was carried out in a tertiary care facility over the course of 18 mo with the approval of the hospital's ethics board. Fifty patients with first and second-grade ASA (American Society of Anesthesiologists) undergoing knee arthroplasty were included.

Patients on prolonged anticoagulant medication, chronic kidney disease, previous deep venous thrombosis (DVT) history, revision surgery and simultaneous bilateral knee arthroplasty, having thrombocyte level below 150,000 and INR level above 1.4, and hematological diseases were excluded from our study.

The patients were partitioned in two groups by random distribution. Bunch 1-25 patients who were administered intravenous TXA and Group 2-25 patients who were not administered TXA. Patients were randomly allocated into odd and even groups. Odd ones were given the drug while even ones were not. The tourniquet was applied at appropriate pressure and for an appropriate duration. Tranexamic acid was given 30 min pre-operatively. Patients were mobilized with the utilization of crutches and partial weight bearing during the first 24 h following surgery. Patients' drainage was monitored at the 24- and 48 h marks. Twelve hours before surgery, a single subcutaneous injection of 0.4 ml (4000 IU) of enoxaparin was administered. Patients were administered acetylsalicylic acid at a dosage of 100 mg daily. Patient's demographic information, the amount of blood lost intra-operatively, the amount of erythrocytes infused, the patient's body mass index, their pre-and post-op haemoglobin and

hematocrit values, furthermore, how much blood depleted in the initial 24 and 48 (complete worth from initial 24-h period, in addition to extra volume estimated in second 24-h period) hours were analysed. To check the hypersensitivity of tranexamic acid, we injected the appropriate (0.1 ml) as a challenge dose intradermally and observed for 30 min for any adverse reactions. SPSS was used for data collection and analysis.

RESULTS

Patients in group A had a mean age of 64.28, whereas those in group B averaged 62.24. The distribution of ages of patients in the two groups was similar. There were more women than men among the patients in both Groups A and B (72 and 68 percent, respectively). The sex distribution of patients in both groups was similar. Patients in group A had an ASA Grade I prevalence of 76%, whereas patients in bunch B had a Grade II pervasiveness of 24%. Patients in bunch B had an ASA Characterization of I (84%), with a Classification of II (16%). When comparing ASA Grades, both groups were similar. Patients in Group A had a mean body mass index of 25.52 Kg/m2, whereas those in Group B had a mean BMI of 26.03 Kg/m2. Non-significant results were obtained while comparing the mean BMI among the patients of the two study groups.

Table 1: Clinical and demographic data

Variable		Group A	Group B	p-value
Mean age (years)		64.28	62.24	0.896
Gender (%)	Males	28	32	0.773
	Females	72	68	
ASA Grade	Grade I	76	84	0.671
	Grade II	24	16	
mean BMI (Kg/m^2)		25.52	26.03	0.312

Patients in Group A averaged 298.04 ml of blood loss during surgery, whereas those in Group B lost 447.2 ml on average after surgery. When comparing the two groups statistically, it was shown that group A had considerably larger mean perioperative blood loss than group B.

Table 2: Perioperative blood loss (ml)

Perioperative blood loss (ml)	Group A	Group B
mean	298.04	447.2
SD	51.72	82.62
p-value	0.001*	

*Significant, Group A patients had a mean postoperative blood loss of 588.96 ml, whereas group B patients lost 1071.64 ml. Group A subjects were associated with significantly lower amount of postoperative blood loss in comparison to Group B subjects.

Table 3: Total volume of postoperative blood loss

Postoperative blood loss (ml)	Group A	Group B
mean	588.96	1071.64
SD	96.98	132.23
p-value	0.001*	

*Significant, the average haemoglobin levels of group patients were 11.93 mg/dl before surgery, 10.88 mg/dl on postoperative day 1, and 11.42 mg/dl on postoperative day 7. Patients in group b had mean preoperative Hb 12.49 mg/dl, mean postoperative Hb 9.68 mg/dl, and mean postoperative Hb 10.18 mg/dl. At the time of comparison, it was observed that mean hemoglobin was significantly lower in bunch B patients on the main postoperative day and on the seventh postoperative day as compared to group a patients.

Table 4: Hemoglobin (mg/dl)

Hemoglobin (mg/dl)	Group A		Group B		p-value
	Mean	SD	Mean	SD	
Preoperative	11.93	1.06	12.49	1.05	0.730
Post-operative 1 day	10.88	1.05	9.68	0.68	0.044*
Post-operative 7 day	11.42	1.03	10.18	0.65	0.031*

*Significant

DISCUSSION

TKA is a quite common procedure in orthopedics. With the increase in life expectancy of the population and our ability to manage comorbidities more efficiently, the number of people undergoing replacement surgery has been increasing over the last few years [5-7]. Intravenous (IV) or intra-articular administration of TXA is known to reduce transfusion frequency and bleeding following surgery [5-7]. TXA, whether given intravenously (IV) or intra-articularly, is also known to lessen the need for blood transfusions and postoperative haemorrhage. TXA is an antifibrinolytic drug that induces blood clot formation to halt bleeding. Many prospective randomised trials, furthermore, meta-examinations have shown the viability of TXA to limit perioperative blood disaster and the requirement for allogenic and autologous blood holding in patients getting TKA since the first work of Hiippala and Benoni and colleagues. The most common method of dosing TXA is by administering it systemically [5-9]. Accordingly, the motivation behind this exploration was to survey whether intravenous tranexamic acid might assist with decreasing blood loss during knee arthroplasty.

Our research found that the normal perioperative blood loss for patients in Group A was 298.04 ml, while the typical perioperative blood misfortune for patients in Group B was 447.2 ml. When comparing the two groups statistically, it was shown that group A had considerably larger mean perioperative blood loss than group B. Group A patients had a mean postoperative blood loss of 588.96 ml, whereas group B patients experienced a mean postoperative blood

loss of 1071.64 ml. Group A subjects were associated with essentially lower measure of postoperative blood loss in contrast with Group B subjects. A study by Seo JG *et al.*, the mean blood loss among the patients of the IV tranexamic acid group and control group was 528 ml and 833 ml individually [7]. Hippala *et al.*, in another study, reported that the mean blood loss among the patients of the IV tranexamic acid group and control group was 847 ml and 1549 ml separately [8]. Goyal T *et al.* reported that mean intraoperative estimation of blood loss (ml) among the patients of the IV tranexamic acid group and control group was 200 ml and 208 ml individually [10]. Mean intraoperative blood loss in a past report by Jejani an *et al.* was 450 ml in the IV tranexamic acid group and 489 ml in the control group and postoperative blood loss in the IV tranexamic group was 163.67 ml and in the control group it was 205.43 ml [11].

Results showed that in the current investigation, the mean Hb for patients in group A was 11.93 mg/dl before surgery, 10.88 mg/dl on postoperative day 1, and 11.42 mg/dl on postoperative day 7. Patients in Group B had mean haemoglobin levels of 12.49 mg/dl before surgery, 9.68 mg/dl on postoperative day 1, and 10.18 mg/dl on postoperative day 7. On comparison, it was seen that mean Haemoglobin at postoperative day 1 and postoperative day 7 was essentially lower among patients of Group B in contrast with patients of Group A. In a past report led by Seol YJ *et al.*, authors also reported a significantly higher drop in haemoglobin postoperative levels among the patients of the control group in comparison to the patients of the IV tranexamic acid group [12]. In another studied conducted by Seo JG *et al.* and Konarski *et al.*, a significantly higher drop in haemoglobin postoperative levels was observed among the patients of the control group in comparison to the patients of the IV tranexamic acid group [7, 13].

CONCLUSION

Patients in whom TXA was not administered had substantially lower mean Haemoglobin levels at both Postoperative Day 1 and Postoperative Day 7 compared to those in whom TXA was administer. Administering Inj. TXA should be considered as important strategy which aims at reducing perioperative blood loss and transfusion requirements in the elderly population undergoing Total knee arthroplasty or any major surgeries to improve utilization of health care resources and patient outcomes.

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AUTHORS CONTRIBUTIONS

All the authors have contributed equally

CONFLICTS OF INTERESTS

Declared none

REFERENCES

1. Varacallo M, Luo TD, Johanson NA. Total knee arthroplasty techniques. StatPearls; 2022 Jan.
2. Gemayel AC, Varacallo M. Total knee replacement techniques. StatPearls; 2022.
3. National center for biotechnology information. PubChem Compound Summary for CID 5526. Tranexamic Acid; 2021.
4. Boutsiadis A, Reynolds RJ, Saffarini M, Panisset JC. Factors that influence blood loss and need for transfusion following total knee arthroplasty. Ann Transl Med. 2017;5(21):418. doi: 10.21037/atm.2017.08.11, PMID 29201870.
5. Bierbaum BE, Callaghan JJ, Galante JO, Rubash HE, Tooms RE, Welch RB. An analysis of blood management in patients having a total hip or knee arthroplasty. J Bone Joint Surg Am. 1999;81(1):2-10. doi: 10.2106/00004623-199901000-00002, PMID 9973048.
6. Bong MR, Patel V, Chang E, Issack PS, Hebert R, Di Cesare PE. Risks associated with blood transfusion after total knee arthroplasty. J Arthroplasty. 2004;19(3):281-7. doi: 10.1016/j.arth.2003.10.013, PMID 15067638.
7. Seo JG, Moon YW, Park SH, Kim SM, Ko KR. The comparative efficacies of intra-articular and IV tranexamic acid for reducing blood loss during total knee arthroplasty. Knee Surg Sports Traumatol Arthrosc. 2013;21(8):1869-74. doi: 10.1007/s00167-012-2079-2, PMID 22729012.
8. Hiippala S, Strid L, Wennerstrand M, Arvela V, Mantyla S, Ylinen J. Tranexamic acid (cyklokapron) reduces perioperative blood loss associated with total knee arthroplasty. Br J Anaesth. 1995 May;74(5):534-7. doi: 10.1093/bja/74.5.534, PMID 7772427.
9. Benoni G, Carlsson A, Petersson C, Fredin H. Does tranexamic acid reduce blood loss in knee arthroplasty. Am J Knee Surg. 1995;8(3):88-92. PMID 7552611.
10. Goyal T, Choudhury AK, Gupta T. Are three doses of intravenous tranexamic acid more effective than a single dose in reducing blood loss during bilateral total knee arthroplasty. Indian J Orthop. 2020 Aug 14;54(6):805-10. doi: 10.1007/s43465-020-00231-2, PMID 33133403.
11. Jejani A, Chaudhari A, Singam A, Nagpure P, Latwal B, Shrey S. Evaluation of role of tranexamic acid in reducing blood loss and transfusion rate in patients undergoing lower limb orthopaedic surgeries. J. 2020 Jan 20;9(3):142-7. doi: 10.14260/jemds/2020/32.
12. Noticewala MS, Nyce JD, Wang W, Geller JA, Macaulay W. Predicting need for allogeneic transfusion after total knee arthroplasty. J Arthroplasty. 2012 Jun;27(6):961-7. doi: 10.1016/j.arth.2011.10.008, PMID 22608172.
13. Konarski W, Pobozy T, Hordowicz M. Tranexamic acid in total knee replacement and total hip replacement a single center retrospective observational study. Orthop Rev (Pavia). 2022;14(3):33875. doi: 10.52965/001c.33875, PMID 35775036.