

Blood loss after intraarticular and intravenous tranexamic acid in total knee arthroplasty

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Abstract

Objective: To compare postoperative blood loss after intravenous and intraarticular tranexamic acid injection in patients of bilateral total knee arthroplasty.

Method: This comparative randomised study was conducted at Ghurki Trust Teaching Hospital, Lahore, between July 2015 and January 2016, and comprised all patients admitted for bilateral total knee replacement. Patients were randomly divided into two equal groups. Group-A received intraarticular while Group-B received intravenous injection of 1.5 gm tranexamic acid. All data was analysed using SPSS 17.

Results: The total 140 patients were divided into two equal groups of 70(50%) each. In Group-A there were 32(45.7%) males and 38(54.3%) females, while in Group-B, there were 28(40%) males and 42(60%) females. The mean ages were 64.39±9.07 years in Group-A and 63.30±9.51 years in Group B. Blood loss in Group-A was significantly lower than Group-B (p=0.01).

Conclusion: Intraarticular administration of tranexamic acid was more effective than intravenous administration in terms of reducing blood loss.

Keywords: Tranexamic acid, Osteoarthritis, Total knee arthroplasty, Intravenous, Intraarticular. (JPMA 68: 1434; 2018)

Introduction

Total knee arthroplasty (TKA) is a cost-effective and successful treatment modality for severe osteoarthritic knees.¹

Blood loss is the major preoperative and postoperative complication which is commonly allied with TKA which is then followed by substantial blood transfusions.^{2,3} Postoperative anaemia is also observed which seems to be prevalent.⁴

To avoid considerable blood loss and complications associated with blood transfusions, several alternatives are taken into account, such as haemodilution, perioperative blood salvage, and preoperative donation of blood for autologous transfusion are currently being used to meet the transfusion needs of patients having a discretionary orthopaedic procedure.⁵

Preoperative donation of blood for autologous transfusion has become a custom for patients undergoing an orthopaedic procedure, unless there is a definite contraindication. Other methods include Tranexamic acid (TXA) convention, temporary clamping of the drain with TXA, local injection of bupivacaine and epinephrine and the usage of high dose aprotinin.⁶ Plugging the intramedullary femoral canal with autologous bone plug

also reduces postoperative blood loss in TKA.⁷

TXA is a synthetic analogue of the amino acid lysine.⁸ It works as an antifibrinolytic by competitively inhibiting the activation of plasminogen to plasmin, by binding to specific sites of both plasminogen and plasmin, which is a molecule responsible for the degradation of blood clots.⁹

Numerous studies have reported that TXA topical or intraarticular (IA) application reduces the loss of blood postoperatively^{10,11} and also results in less number of blood transfusions needed after the surgical procedure.^{12,13}

In the last few years several studies are carried out in this context. One study had 150 patients who were prospectively allocated to IV, IA and placebo groups who underwent unilateral TKA. Results showed that the mean blood loss in IV, IA, and placebo groups were 528±227, 426±197, and 833±412 ml, respectively. Compared to IV administration, IA administration of TNA seemed to be more effectual in terms of plummeting blood loss and transfusion frequency.⁸

On the other hand, several studies have shown that TXA results in decreased blood loss during surgical procedures but is not helpful in reducing the number of transfusions.^{14,15}

However, one study found TXA did not modulate fibrinolytic variables or reduce postoperative bleeding or transfusion requirements after TKA.¹⁶

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In Pakistan, there is no study to date which has analysed the effect of IA and IVTXA on blood loss in patients undergoing conventional TKA. The current study was planned to study the effect of TNA in reducing blood loss in our geographic and demographic conditions undergoing conventional bilateral TKA. To our knowledge, this is the first local study on conventional and bilateral TKA using TXA after opening of tourniquet.

Material and Methods

This comparative randomised study was conducted at the Department of Orthopaedic and Spine, Ghurki Trust Teaching Hospital, Lahore, between July 2015 and January 2016, and comprised all patients admitted for bilateral total knee replacement after approval from the institutional ethics committee. All patients of either gender aged 40 years and above who were admitted for bilateral TKA were included, while those having coagulopathies, deranged renal function test (RFT), cardiovascular accidents, viral hepatitis and those who did not give consent were excluded (Figure). Demographic information, history and examinations were done. Patients had been informed about the procedure and were included in study after their informed consent. Subjects were divided in 2 equal groups by using simple random sampling technique i.e. the lottery method.

The same surgical team performed all the surgeries on both the groups. Group-A received IA TNA and Group-B received IV TNA. Both groups underwent conventional bilateral TKA. For patients in Group-B, 1.5 g of TNA in 100 cc of normal saline was given immediately after closing surgical site after opening of tourniquet. In Group-A, patients were given 1.5 g of TNA in 100 cc of normal saline directly into the knee joint cavity while suturing and immediately after opening of tourniquet. Both groups were given a single injection only. All the patients were kept in the intensive care unit (ICU) post-operation and were monitored closely. Blood loss was monitored by measuring the amount in the drain bottle for 48 hours postoperatively. The patients were divided into three groups on the basis of blood loss i.e. between 390-770ml, 771-1000ml and 1001-1500ml. The collected data was entered and analysed using SPSS 17. Qualitative variable like gender was presented in the form of frequency and percentage. All quantitative variables like age and total blood loss were expressed as mean and standard deviation. T-test was applied to compare the difference of mean blood loss in both groups. $P < 0.05$ was considered significant.

Results

The total 140 patients were divided into two equal groups of 70(50%) each. In Group-A there were 32(45.7%) males

Table-1: Frequency of Demographic and Clinical Characteristics of patients.

Characteristics	Group "A"		Group "B"	
		Number (Percent)		Number (Percent)
Age in years	40-60	23 (32.86%)		28 (40%)
	>60	47 (67.14%)		42 (60%)
Sex	Male	32 (45.70%)		28 (40%)
	Female	38 (54.30%)		42 (60%)
Place of living	Urban	48 (68.57%)		52 (74.29%)
	Rural	22 (31.43%)		18 (25.71%)
Addiction	Nil	21 (30.0%)		25 (35.73%)
	Smoking	27 (38.57%)		23 (32.86%)
	Snuffing	11 (15.72%)		8 (11.42%)
	Alcohol	4 (5.71%)		6 (8.57%)
	Sleeping pills	7 (10.0%)		8 (11.42%)
Grade of Arthritis	Grade 3	23 (32.86%)		27 (38.57%)
	Grade 4	47 (67.14%)		43 (61.43%)
Co-morbidities	Nil	38 (54.30%)		44 (62.86%)
	DM	12 (17.14%)		10 (14.29%)
	Cardiac issue	8 (11.42%)		5 (7.14%)
	HTN	6 (8.57%)		5 (7.14%)
	Others	6 (8.57%)		6 (8.57%)

DM: Diabetes Mellitus

HTN: Hypertension.

Table-2: Distribution of patients according to blood loss.

Blood Loss in ml	Group "A"	Group "B"
390-700	22(31.43%)	4(5.71%)
701-1000	47(67.14%)	49 (70.00%)
>1000	1(1.43%)	17 (24.29%)
Mean blood loss \pm S.Deviation	827 \pm 151.255	966 \pm 119.489
P-value	P=0.0005	

and 38(54.3%) females, while in Group-B, there were 28(40%) males and 42(60%) females. Male-to-female ratio was 1:1.2 in Group-A and 1:1.5 in Group-B.

The mean age was 64.39 \pm 9.07 years in Group A and 63.30 \pm 9.51 years in Group B.

Among the subjects 48(68.57%) and 52(74.29%) were residents of urban area while 22(31.43%) and 18(25.72%) were from rural area in Group-A and Group-B respectively. Out of all 21(30.0%) members of Group-A and 25(35.72%) of Group-B were not involved in any addiction. Smoking was found the most common form of addiction i.e. 27(38.57%) subjects in Group-A and 23(32.86%) in Group-B. Regarding the grades of arthritis, most patients were having grade 4 arthritis i.e. 47(67.14%) subjects among Group-A participants and 43(61.43%) among Group-B.

Besides, 38(54.30%) and 44(62.86%) patients in Group-A and B respectively had no co-morbidities. Diabetes

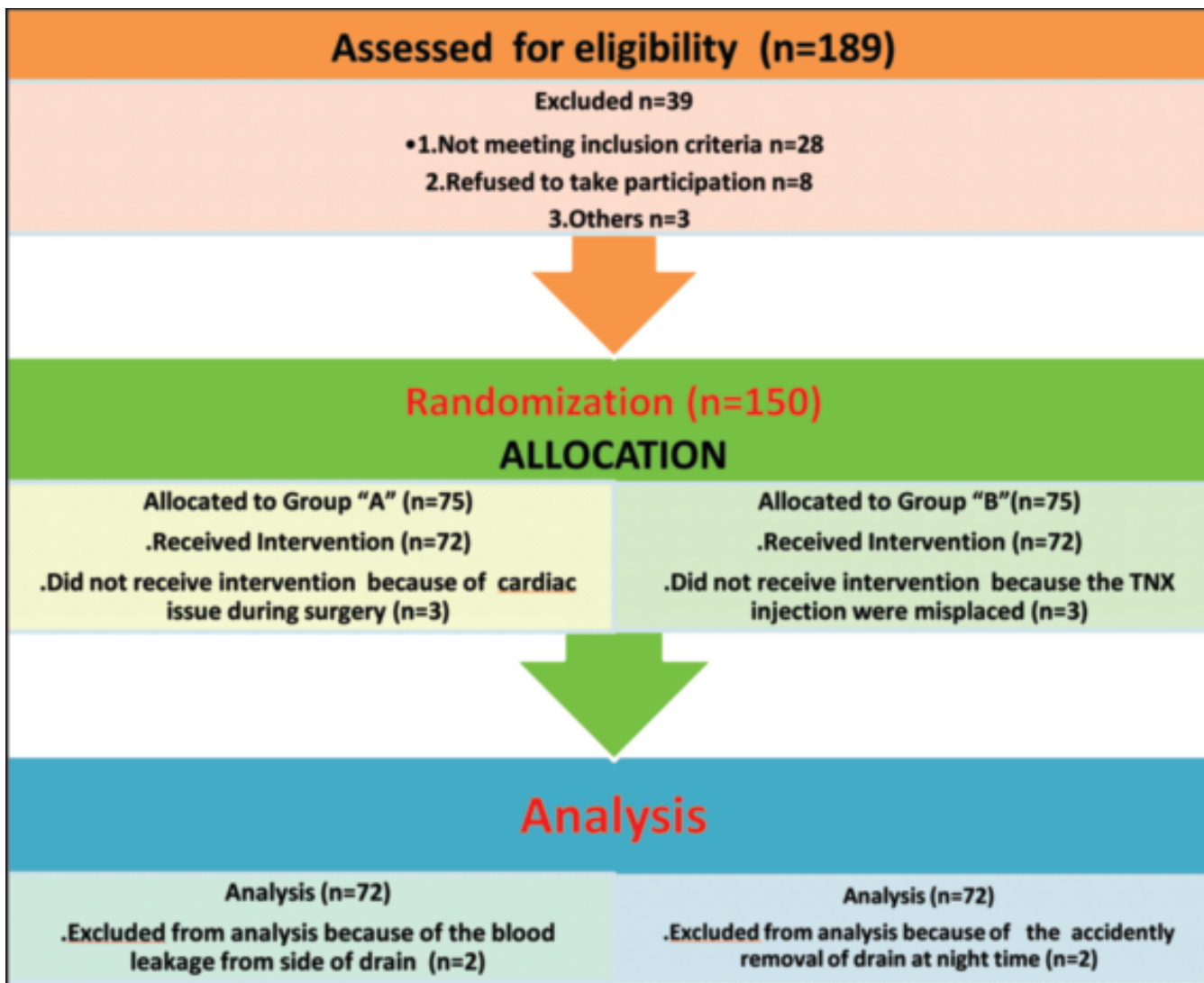


Figure: Participant flow chart.

Mellitus (DM) was the most common co-morbidity among the rest (Table-1).

In Group A, 22(31.40%) patients and 4(5.70%) in Group B had blood loss between 390-770ml. In Group A 47(67.20%) patients and 49(70%) in Group B had blood loss between 771-1000ml while in patients having blood loss above 1000ml only 1(1.40%) patient of Group A and 17(24.50%) patients of Group-B were included (Table-2). Mean blood loss was 827.81±151.26 ml in Group A while in Group B it was 966.11±119.49 ml (p=0.000). Haemoglobin level decreased by 1.9±0.6 in Group A while in Group-B it was 2.2±0.6.

Discussion

Blood loss is a major problem in the TKA surgery.¹ and

hence the need of blood transfusions and hazards associated with it. TXA either applied through IV or IA decreases the volume of blood loss. The current study was conducted to conclude whether IA or IVTXA is more efficient in reducing blood loss.

Another set of researchers conducted a similar study in which the blood loss in patients with IV injection of TXA were 528±227 and 426±197 in those with IA which is lower than what we found in our study.⁷ They also concluded that IA was more effective than IV injection. An earlier study found that combination of IV as well as IATXA was more effective in reducing blood loss compared to IV injection of TXA alone.¹⁶ Another study found that with IA injection the blood loss was less than IV but the mean blood loss in that study was higher than what was found

in our study.¹⁷ Another study found no statistical difference in the amount of blood loss after IV and IA injection in TKA surgeries, but it also gave preference to the IA injection of TXA in conclusion.¹⁸ Similarly another study concluded no statistical difference in blood loss between the two groups.¹

TXA is very effective in reducing blood loss during TKA surgery. IA is more effective than IV injection of TXA. However, there are few limitations in the present study. Comparisons were not made on IA injection and IV injection's efficacy with other routes of using TXA as well as the use of it before tourniquet application. Moreover, the study was conducted on patients with bilateral TKA, not in unilateral knee replacement. Further studies should be conducted on local population using different routes of using TXA, unilateral TKA surgeries as well as in other replacements to make best possible use of TXA.

Conclusion

TXA was found to significantly reduce amount of blood loss during TKA surgery and the rate of allogeneic blood transfusions. The IA injection of TXA is more effective in reducing blood loss than IV injection and should always be considered in every bilateral TKA surgery.

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Conflict of Interest: None.

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