



Effect of tranexamic acid in perioperative blood loss associated with total knee replacement: A KIMS experience

Ashwin Kumar AH¹, Gopinath Bandari^{1*} and Reddy IV¹

¹ Department of Orthopaedics, Krishna Institute of Medical Sciences, Minister Road, Secunderabad-500003, Telangana, India

Abstract

Introduction: Cost of allogenic blood transfusions and the associated risks mandate strategies to reduce blood loss in surgery. The objective of this study was to assess the efficacy of anti-fibrinolytic treatment in reducing perioperative blood loss during total knee replacement.

Materials and methods: A retrospective and prospective study was carried out on 148 patients undergoing total knee replacement. 88 patients received tranexamic acid (10 mg/kg, iv) just before the cementation, 3 hours and 6 hours post operatively. 60 patients did not receive tranexamic acid. Perioperative blood loss was measured by the amount of post-operative drain, and drop in hemoglobin levels. The number of patients who needed blood transfusion and the number of units transfused was recorded and possible postoperative thromboembolic complications were studied clinically.

Results: Amongst 88 patients (Group A) who were given tranexamic acid, only 35 (39.7%) were given blood transfusions and the average transfusion was 0.5 units. Amongst 60 patients (Group B) who were not given tranexamic acid, 45 (75%) were given blood transfusions and the average transfusions were 1.3 units. The average blood loss in the group of patients who were given tranexamic acid was 164.97ml while in the group which were not given, the average blood loss was 305.48ml. The average drop in Hemoglobin level in the group, which was given tranexamic acid was 1.5 grams%, and in the group, which was not given tranexamic acid was 1.8 grams%. Clinical assessment did not reveal any thromboembolic complications.

Conclusions: Antifibrinolytic agents significantly decrease the blood loss in patients undergoing total knee replacement, which is clinically reflected by the reduction in the number of blood transfusions required.

Keywords: tranexamic acid; perioperative blood loss; knee replacement

***Corresponding author:** Dr. Gopinath Bandari, Department of Orthopaedics, Krishna Institute of Medical Sciences, Minister Road, Secunderabad-500003, Telangana, India. Email: gopinath.bandari@gmail.com

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Introduction

The use of pharmacological therapies to reduce blood loss and blood transfusions in surgery has historically been restricted to antifibrinolytic agents like aprotinin, tranexamic acid and aminocaproic acid. Total knee replacement is associated with significant blood loss, which may result in need for allogenic blood transfusions in these patients (up to 97%) [1]. Postoperative anaemia following TKR has been shown to increase post-operative hospital stay, delay in mobilization and is poorly tolerated by patients with peripheral vascular disease and cardiovascular disease [2, 3].

Tourniquets are widely used in TKR surgeries for preventing peroperative blood loss. After any surgery fibrinolytic system is transiently activated, and use of tourniquet also induces local fibrinolysis in the operated limb. This increased fibrinolytic activity increase blood loss, at least during first postoperative hours. This justifies the use of antifibrinolytic agents in such surgeries.

Tranexamic acid (TA), a synthetic antifibrinolytic agent that is approximately seven to eight times more potent than aminocaproic acid, binds to lysine binding site of plasminogen and blocks binding of plasminogen to fibrin surface [4]. Thus plasminogen activation is prevented and fibrinolysis is delayed. Therapeutic plasma concentration of tranexamic acid, (5-10mg/L), can be achieved by bolus injections of 10mg/kg intravenously, followed by 1mg/kg/hr intravenous infusion [5]. Numerous studies have confirmed the efficacy of tranexamic acid to reduce blood loss & blood transfusion requirement in total knee replacement (TKR) [6-12].

In our study, we have aimed to study the efficacy of tranexamic acid in decreasing blood loss and requirement of blood transfusions in patients undergoing total knee replacement in our setup.

Materials and methods

For this retrospective and prospective study we have used our hospital (Krishna Institute of Medical Sciences Ltd, Secunderabad) arthroplasty database, containing information of patients who underwent total knee replacement surgeries from December 2014 to December 2015. Patients who underwent elective, unilateral, cemented TKR for bi or tri-compartmental primary osteoarthritis of knee joints

were included. Patients who underwent bilateral TKR, who have undergone same or opposite side total hip replacements recently, patients with history of coagulopathy, thrombosis, embolism and patients whose case sheets were incomplete in the hospital database, were excluded from the study. As there is a retrospective component in the study, the choice for giving TA or not was purely based on the surgeons preference and no randomization was done for the same. The patients were divided into two groups, Group A (patients receiving TA), Group B (patients not receiving TA).

All patients included in the study were evaluated by noting pre-operative and post operative hemoglobin, post-operative suction drain collection, need of blood transfusions, number of blood transfusions if needed, and whether tranexamic acid was given or not. 10mg/kg intravenous tranexamic acid was given just before cementation, 3 hours and 6 hours following surgery in Group A patients. Suction drains were opened 15 minutes after giving 3 hours postoperative dose of TA.

Statistical analysis

Primary outcome variables were estimation of blood loss and blood transfusion requirements. Secondary outcome variables included thromboembolic complications (pulmonary embolism, deep venous thrombosis). Correlation between TA and the primary outcome variables were assessed by Pearson's correlation.

Results

A total of 148 patients were included in the study (male=63, females=85). Mean age of the patients was 67.4 years (53-80 years). Among the 148 patients, 88 patients (59.45%) received TA and 60 patients (40.54%) did not receive TA. Only 35 patients (39.7%) in Group A were given blood transfusions, and the average transfusions were 0.5units of packed red blood cells. In Group B, 45 patients (75%) were given blood transfusions and the average transfusions were 1.3 units. The average blood losses were 164.97ml, 305.84ml in Group A and Group B, respectively. The average drop in hemoglobin was 1.5gm%, 1.8gm% in in Group A and Group B respectively (Table 1). None of the patients, in either of the groups had any thrombo-embolic complications.

Table 1: Effect of TA on drop in Hb and blood loss.

	Group A	Group B	p-value
Mean drop in Hb	1.5 gram%	1.8 gram%	<0.05
Average blood loss	164.97 ml	305.84 ml	<0.05

Abbreviations: Group A = patients receiving TA; Group B = patients not receiving TA.

Discussion

Antifibrinolytic agents (aprotinin, tranexamic acid and epsilon aminocaproic acid) have the best evidence supporting their use, especially in orthopaedic surgical procedures. Horrow and colleagues found that 10mg/kg was the minimum dosage needed to obtain the desired anti-hemorrhagic effect [5]. In the study carried out by Benoni et al., the investigators found 62% risk reduction in patients who required red blood cell transfusion with tranexamic acid, compared to placebo, but there was no difference, in measured blood losses [6]. In our study there was a significant difference noted in the amount of blood loss, number of patients needing blood transfusion and the number of transfusions, between the two groups ($p < 0.05$). There was no difference in the thromboembolic complications between both the groups.

Necessity for blood transfusion can be due to many factors post-operatively, data of which, is difficult to obtain in a study like ours. Therefore, lack of proper detailed clinical data and other unknown factors which can affect the outcomes, will remain as a problem for retrospective studies. Even having detailed clinical data would not ensure validity of the data due to unknown confounding variables. This limitation in our study could have been eliminated by a prospective randomized clinical trial. Further study with larger sample size would delineate the differences between the secondary variables of this study too. We would also like to perform a prospective randomized trial with a larger sample size, which would give more accurate results.

Conclusion

The results of our study indicate that antifibrinolytic treatment with tranexamic acid (TA) reduces blood loss in TKR which in turn reduces the number of blood transfusions required, without significant thromboembolic complications.

Conflicts of interest

Authors declare no conflicts of interest.

References

1. Mc Swiney MM, O'Farrell D, Joshi GP, Mc Carroll SM. Blood transfusion in total hip arthroplasty : guidelines to eliminate over transfusion. *Can J Anaesth.* 1993; 40(3):222-226.
2. Carson JL, Duff A, Berlin JA, Lawrence VA, Poses RM, et al. Perioperative blood transfusion and postoperative mortality. *JAMA.* 1998; 279(3):199-205.
3. Carson JL, Duff A, Berlin JA, Spence RK, Poses RM, Trout R, et al. Effect of anaemia and cardiovascular disease on surgical mortality and morbidity. *Lancet.* 1996; 348(9034):1055-1060.
4. Hoylaerts M, Lijnen HR, Collen D. Studies on the mechanism of antifibrinolytic action of tranexamic acid. *Biochem Biophys Acta.* 1981; 673(1):75-85.
5. Horrow JC, Van Riper DF, Strong MD, Grunewald KE, Parmer JL. The dose response relationship of tranexamic acid. *Anesthesiology.* 1995; 82(2):383-392.
6. Benoni G, Carlson A, Petersson C, Fredin H. Does tranexamic acid decrease blood loss in knee arthroplasty? *Am J knee surg.* 1995; 8(3):88-92.
7. Benoni G, Fredin H. Fibrinolytic inhibition with tranexamic acid reduces blood loss and blood transfusion requirement after knee arthroplasty. A Prospective randomized double blind study of 86 patients. *J Bone Joint Surg.* 1996; 78-B:433-440.
8. Hiippala S, Strid I, Wenersrand M, Arvela V, Mäntylä S, et al. Tranexamic acid reduces perioperative blood loss associated with total knee arthroplasty. *Br J Anaesth* 1995; 74(5):534-537.
9. Howes JP, Sharma V, Cohen AT. Tranexamic acid reduces blood loss after knee arthroplasty. *J Bone Joint Surg Br.* 1996; 78(6):995-996.
10. Hiippala S, Strid LJ, Wennerstand MI, Arvela JV, Niemelä HM, et al. Tranexamic acid radically decreases blood loss and transfusions associated with TKR. *Anaesth Analg.* 1997; 84(4):839-844.
11. Jansen AJ, Andreica S, Claeys M, D'Haese J, Camu, et al. Effect of tranexamic acid for effective blood conservation strategy after TKR. *Br J Anaesth.* 1999; 83(4):596-601.
12. Zohr E, Fredman B, Ellis M, Luban I, Stern A, et al. A comparative study of the postoperative blood sparing effect of tranexamic acid versus acute normovolemic haemodilution after TKR. *Anaesth Analg.* 1999; 89(6):1382-1387.