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# Role of intravenous tranexamic acid for the reduction of blood loss in total knee arthroplasty

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**Abstract**
Antifibrinolytic drug Tranexamic acid (TXA) administered intravenously has shown to significantly reduced the blood loss intraoperatively ($P$<0.01) and postoperatively ($P$<0.01) in patients undergoing bilateral total knee arthroplasty. Two groups of 50 patients each with similar demographic and health profile were selected to undergo this study. One group received the IV Tranexamic Acid (TXA group) while the control group did not received. To avoid complications associated with antifibrinolytic property of tranexamic acid. Strict patient selection criteria and dose regiment protocols were adhered to prevent hypercoagulable state with potential risk of DVT and renal Failure.

**Keywords:** Tranexamic Acid (TXA), total knee arthroplasty (TKA)

## Introduction
Various methods have been proposed and applied in reducing the allogenic blood transfusion and its associated potential risks such as viral transmission, organic lesions and ABO incompatibility [1, 2]. Tranexamic acid (TXA) is an antifibrinoltic drug whose administration during the preoperative period by intravenous route has shown to reliably reduce blood loss and need for transfusion in patients undergoing total knee arthroplasty which accounts for nearly 40% of transfusions in orthopedic patients [3]. Intravenous Tranexamic Acid (TXA) constitutes one of the most important components of perioperative blood management strategy [4], reducing post-operative morbidity and mortality [5, 6]. This has helped in mitigating one of the long standing concerns among the clinicians [7, 8].

## Methods and materials
A total of 100 patients of bilateral osteoarthritis knee were selected in this prospective cohort study which was conducted in our institute over duration of eight months from January 2017 to august 2017. 50 patients undergoing bilateral Primary Total knee Arthroplasty who received tranexamic acid (TXA group) and 50 other patients with similar preoperative demographic and health profile undergoing bilateral primary total knee arthroplasty who did not receive Tranexamic acid (control group) were included in this study. Number 14 Romovac suction drain was inserted before the wound closure in all 100 patients for blood loss measurement till 48 hours post operatively. Numbers of blood soaked spounges of standard size were used for measuring intraoperative blood loss.
Tranexamic acid (TXA) is an analogue of amino acid lysine [9] which has powerful antifibrinolytic potency through reversibly occupying the lysine-binding sites of plasminogen molecule thus preventing its binding to the surface of fibrin and activation, resulting in inhibition of fibrinolysis. Some authors have suggested in giving IV Tranexamic Acid (TXA) just before the tourniquet release [10] in order to prevent tourniquet induced activation of local fibrinolytic system [11].
A number of patient groups were excluded from clinical trials, Constituting exclusion criteria [12, 13]: 1) Hypersensitivity to TXA, 2) Coronary or vascular stent placed within the past 6 months, 3) DVT, PE, MI or ischemic stroke within the past 6 months, 4) Subarachnoid hemorrhage, 5) Bleeding disorders, 6) Hypercoagulable state/disorder, 7) Retinal vein or artery

occlusion, 8) Active intravascular clotting, 9) Concomitant use of clotting factor concentrates or anti-inhibitor concentrates. These patients are not recommended to receive IV tranexmic acid.

Patients undergoing primary total knee arthroplasty with no exclusion criteria [12, 13] were included in this study.

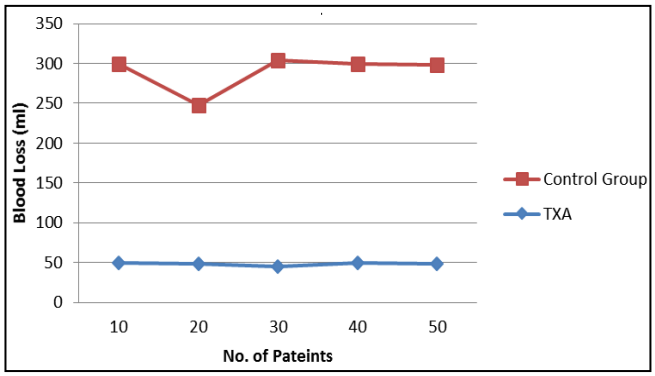
Since the pioneering work of Hippola and Benani *et al* [14, 15]. The most widely accepted dose regimen of IV Tranexamic Acid is one initial bolus preoperatively 10 to 15 minutes before incision followed by in other bolus 10 minutes before tourniquet release [16].

Intravenous dosage of tranexmic acid used in our study was 10 to 50mg per kg or 1 to 1.5gms. It was diluted in 100ml saline and infused slow over 45minutes and finished 15minutes before the incision. Similar additional dose was given intra-operatively 20minutes before the release of the tourniquet. The third dose was given 8 hours after the surgical wound closer.

## Observations and Results

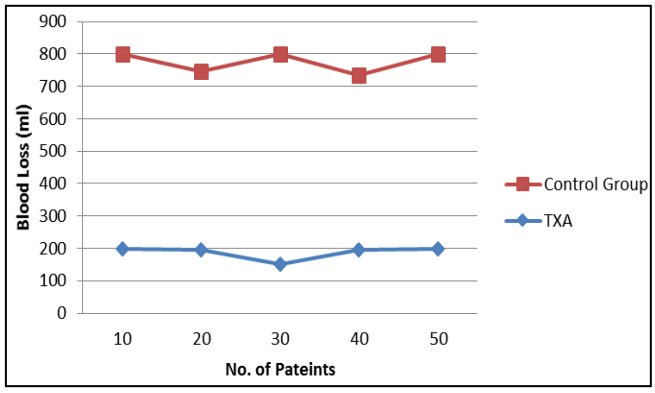
The total intra-operative blood loss in TXA group was on an average 50ml as compared to average blood loss of 300ml in the control group ($p$<0.01).

### Intra-operative Blood Loss



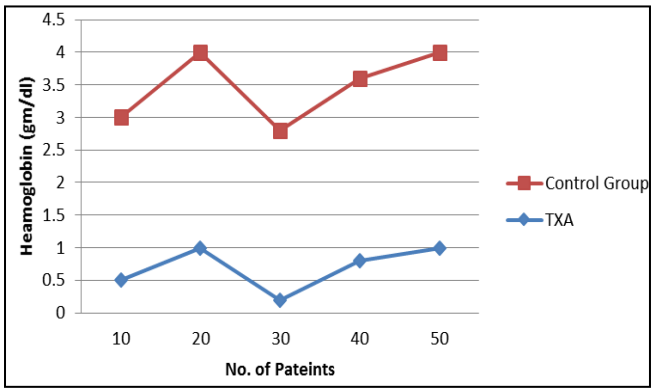

The total post-operative blood loss in first 48 hours in patients having received Tranexmic acid IV infusions was on an average 200ml as compared to average blood loss of 800ml in the control group which was quite significant ($p$<0.01).

### Post-operative Blood Loss



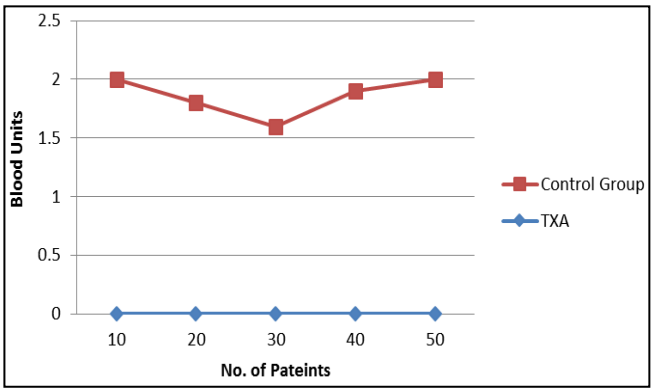

On the third postoperative period the drop in hemoglobin value was on an average 1gm from that of the preoperative value in patients having received IV infusion of Tranexmic acid. Whereas in the control group the drop in hemoglobin value was on an average 3gm from that of the preoperative value ($p$<0.01).

### Drop in Hemoglobin Value




No blood transfusion required in patients who received IV Tranexmic acid infusion whereas on an average 2 units of blood transfusion was required in the patients of control group.

### Blood Transfusion




The above stated results are comparable with studies by charoencholvanich *et al* [17], Gautam *et al* [18] and Lee *et al* [19]. These authors used similar dose regimen protocols as was used in this study.

There was no statistical difference in the Incidence of Deep vein thrombosis (DVT) and pulmonary embolism (PE) and renal failure in both the groups [20]. Hematoma was reported in 6 patients (12%) in TXA group and 3 (6%) in the control group. 4 (8%) patients In TXA group developed post-operative infective arthritis of the operated knee as compare to only 1 (2%) patient in the control group. 1 (2%) patient in the TXA group suffered from myocardial infarction whereas none in the control group. 2 (4%) patients in the TXA group suffered from pneumonia and respiratory failure and 1 (2%) patient died due to pulmonary embolism 2 weeks after the surgery. Similar complication rates were noted in this study and in the largest of the series analysis by poeran *et al* [21].

## Discussion and Conclusion

With the aging population on the arise so is the number of arthroplasties round the world [22] thus increasing the risk of allogenic blood transfusion and its burden on the public health system. This gave rise to the need to develop strategies aimed at reduction of perioperative blood loss and transfusion requirements. Antifibrinolytic drug tranaxemic acid constitutes one of the main stay components of blood management strategy.

Tranaxemic Acid is a very promising drug which is being used widely in reducing the blood loss and the need of blood

transfusion after total knee arthroplasty. This is evident from the results of this study in which Tranaxemic Acid significantly reduced the total blood loss ($P$<0.01) and post-operative blood loss ($P$<0.01). It reduced the proportion of patients who needed transfusion by 40% and decreased average volume of blood transfusion by 1 unit.

However, repeated administration of an antifibrinolytic drug in elderly patients undergoing surgery is of concern as it promotes a hypercoagulable state and who often are frail with multiple comorbidities putting them at increased risk of Deep Vein Thrombosis (eg. Diabetes Mellitus, obesity, cardiovascular diseases). So it is imperative to use Tranexmic acid by utilizing the guidance and interpretation in the clinical context of each individual patient.

**References**


1. Levy O, Martinowitz U, Oran A *et al*. The use of fibrin tissue adhesive to reduce blood loss and the need for blood transfusion after total knee arthroplasty. A prospective, randomized, multicenter study. J Bone Joint Surg Am. 1999; 81(11):1580-8.
2. Lemaire R. Strategies for blood management in orthopaedic and trauma surgery. J Bone Joint Surg Br. 2008; 90(9):1128-36.
3. Ponnusamy KE, KimTj, Khanuja HS. Perioperative blood transfusion in orthopaedic surgery. J Bone Joint Surg Am. 2014; 96:1836-44.
4. Practice guidelines for perioperative blood management: an update report by the American society of aneasthesiologists tack force on perioperative blood management. Anesthesiology. 20115; 122:241-75.
5. Wu WC, Smith TS, Henderson WG *et al*. Operative blood loss, blood Transfusion, and 30-day mortality in order patients after major noncardiac surgery. Ann Surg. 2010; 252:11-7.
6. Glance LG, Dick AW, Mukamel DB *et al*. Association between intraoperative blood transfusion and mortality and morbidity in patients undergoing noncardiac surgery. Aneasthesiology. 2011; 114:283-92.
7. Tobias JD. Strategies for minimizing blood loss in orthopaedic surgery. Semin Hematol. 2004; 41:145-56.
8. Moonen AF, Neal TD, Pilot P. Perioperative blood management in elective orthopaedic surgery. A critical review of the literature. Injury. 2006; 37:S11-6.
9. Astedt B. Cllinical pharmacology of tranexamic acid. Scand J Gastroenterol. 1987; 137:22-5.
10. Benoni G, Carlsson A, Petersson C *et al*. Deos tranexamic acid reduce blood loss in total knee arthroplasty? Am J knee surg. 1995; 8(3):88-92.
11. Burkart BC, Bourne RB, Rorabeck CH *et al*. The efficacy of tourniquet release in blood conservation after total knee arthroplasty. Clin Orthop Relat Res. 1994; (299):147-52.
12. Tranexamic Acid-Use in orthopedic Surgery. Washington DC: Pharmacy benefits Management Services, Medical Advisory Panel and VISN Pharmacist Executives, Veterans Health Administration, Department of Veterans Affairs, 2014.
13. Tranexamic Acid, 2013.
14. Hiippala S, Strid L, Wennerstrand M *et al*. Tranexamic Acid (Cyklokapron) reduces perioperative blood loss associated with total knee arthroplasty. Br J Anaesth. 1995; 74:534-7.
15. Benoni G, Carlsson A, Petersson C *et al*. Does tranexamic acid reduce blood loss in knee arthroplasty? Am J knee Surg. 1995; 8:88-92.
16. Ho KM, Ismail H. Use of intravenous tranexamic scid to reduce allogeneic blood transfusion in total hip and knee arthroplasty: a meta-analysis. Anaesth Intensive Care. 2003; 31:529-37.
17. Charoencholvanich K, Siriwattanaskul P. Tranexamic acid reduces blood loss and blood transfusion after TKA: a prospective randomized controlled trail. Clin orthop Relat Res. 2011; 469(10):2874-80.
18. Gautam PL, Katyal S, Yamin M *et al*. Effect of tranexamic acid on blood loss and blood transfusion requirement in total knee replacement in the Indian population: a case series. Indian J Anaesth. 2011; 55(6):590-93.
19. Lee SH, Cho KY, Khurana S *et al*. Less blood loss under concomitant administration of tranexamic acid and indirect factor Xa inhibitor following total knee arthroplasty: a prospective randomized controlled trail. Knee Surg Sports Traumatol Arthrosc, 2012, In press.
20. Henry DA, Carless PA, Moxey AJ *et al*. Anti-fibrinolytic use for minimizing perioperative allogeneic blood transfusion. Cochrane Database Syst Rev. 2011; (3):CD001886.
21. Poeran J, Rasul R, Suzuki S *et al*. Tranexamic acid use and postoperative outcomes in patients undergoing total hip or knee arthroplasty in the United States: retrospective analysis of effectiveness and safety. BMJ, 2014, 349:g4829.
22. Kurtz S, Ong K, Lau E *et al*. Projections of primary and revision hip and knee arthroplasty in the United States from 2005 to 2030. J Bone Joint Surg Am. 2007; 89:780-5.