International Journal of Research in Orthopaedics
Uganath SB et al. Int J Res Orthop. 2019 Jul;5(4):551-554
http://www.ijoro.org

Original Research Article

DOI: http://dx.doi.org/10.18203/issn.2455-4510.IntJResOrthop20192561

Effects of tranexamic acid in major orthopedic surgical procedures: a randomized comparative study

Uganath Subash B.*, Sundaramoorthy M.

Department of Orthopedics, Sri Muthukumaran Medical College Hospital and Research Institute, Chennai, Tamil Nadu, India

Received: 21 April 2019
Accepted: 20 May 2019

***Correspondence:**
Dr. Uganath Subash B.,
E-mail: ugasubash@gmail.com

ABSTRACT

Background: Despite modern healthcare system, major surgeries always cause economical constraints. Complications due to blood loss, long hospital stay are most common in major surgical procedures. Tranexamic acid (TXA), a synthetic derivative of lysine is used instead of blood transfusion to control bleeding peri and post operatively. Hence this study was planned to assess the effects of tranexamic acid on various orthopedic surgical procedures, in terms of blood loss, duration of surgical procedure and hospital stay.
Methods: Prospective randomized comparative study, among patients undergoing elective and emergency orthopedic surgery. Patients with multiple fractures, organ injury and CKD were excluded from this study. Patients were randomized to tranexamic acid (TXA) group and colloids, blood transfusion group based on computer generated random numbers. Thirty two patients were randomized to tranexamic acid group and thirty two in control group. Statistical analysis was done using SPSS V 20.
Results: The mean age group was 38.41±11.4 and 36.83±13.5 in TXA group and control group respectively. The mean SD for blood loss in TXA group was 321.5±124.7 and control group 482.7±189.6, the difference was found to be highly statistically significant with p=0.0002. Likewise the difference in postoperative Hb was found to be statistically significant with p<0.01. The p value for surgical site infection and hematoma was not statistically significant.
Conclusions: TXA significantly reduces blood loss and blood transfusion requirements in patients undergoing orthopedic surgery.

Keywords: Tranexamic acid, Orthopedic surgery, Blood loss, Blood transfusion, Hospital stay

INTRODUCTION

Despite modern healthcare system and advancements, major surgeries always cause economical constraints. Complications due to severe blood loss, long hospital stay are most common in major surgical procedures. Most of the orthopedic surgeries make peri-operative blood loss, which leads to post operative mortality and morbidity.

Hidden blood loss has not been evaluated in patients with fracture of the hip. They are usually elderly and are particularly vulnerable to anemia and hypovolaemia.[1-3]

Typical management of post-operative anemia is through blood transfusion, with major orthopedic surgery having been identified as the commonest indication.[4] There is, however, concern regarding a significantly increased risk of serious bacterial infection in hip fracture patients undergoing allogenic blood transfusion.[5] Tourniquet

application most of the times end up in thromboembolism.

Numerous methods of controlling bleeding such as thromboplastic agents; topical freezing saline; deliberate hypotension; and administration of fibrinolytic inhibitors (such as aprotinin and tranexamic acid) have been used in orthopedic surgery. But the actual blood loss during elective hip and knee replacement surgery has been found to be considerably larger than that observed during surgery and collected in drains postoperatively.[6]

In modern medicine tranexamic acid (TXA) is used instead of blood transfusion to control bleeding peri-operatively. Tranexamic acid (TXA), a synthetic derivative of lysine, competitively blocks lysine-binding sites on plasminogen, thus reducing the local degradation of fibrin by plasmin.[7] TXA has been used to cease bleeding in multiple surgeries.

TXA a more potent anti-fibrinolytic is used to reduce surgical morbidities due to excess blood loss, there is no much research and clarity in its usage in surgical procedures. Henceforth this prospective randomized study was aimed to assess the effect of tranexamic acid on various orthopedic surgical procedures, in terms of blood loss, duration of surgical procedure and hospital stay compared to the basic colloid versus blood transfusion.

Objectives

To assess the effects of tranexamic acid on various orthopedic surgical procedures, in terms of blood loss, duration of surgical procedure and hospital stay.

METHODS

This study was done as a prospective randomized comparative study, among patients undergoing elective and emergency orthopedic surgery in Sri Muthukumaran Medical College and Research Institute. Patients with multiple fractures, organ injury and CKD cases were excluded from this study. The study was conducted from June 2016 to May 2017.

Institutional Ethics Committee approval was obtained; written informed consent was gathered from the patients before the conduct of study. Patients were randomized to tranexamic acid group and colloids, blood transfusion group based on computer generated random numbers. Thirty two patients were randomized to tranexamic acid group and thirty two in control group.

Statistical analysis was done using SPSS Version 20, descriptive data was computed as frequency and percentage. mean and standard deviation for infection, hospital stay, blood loss in group A and B was analyzed and p value of less than 0.05 were considered as statistically significant.

RESULTS

Among 32 patients in group A (tranexamic acid) 34.4% of them were in the age group of 31-40 years and least was 15.6% patients in the age group of less than 30 years. In group B (colloids), 43.8% patients were found to be in 31-40 year age group and least was 15.6% in the age of above 50 years. In group A 78.1% were males and in group B 65.6% are male patients. The mean age group in our study was 38.41±11.4 and 36.83±13.5 in group A and B respectively. The p value was found to be not statistically significant (p>0.05). There was no association found between gender and the groups (p=0.266), shown in Table 1.

Table 1: Age and gender distribution (n=32).

	Group A	Group B	P value
	N (%)	N (%)	
Age group (in years)			
≤ 30 s	5 (15.6)	6 (18.8)	0.793
31-40	11 (34.4)	14 (43.8)	
41-50	9 (28.1)	7 (21.9)	
> 50	7 (21.9)	5 (15.6)	
Mean age	38.41±11.4	36.83±13.5	
Gender			
Male	25 (78.1)	21 (65.6)	0.266
Female	07 (21.9)	11 (34.4)	

The common orthopedic surgical procedure among the study population was fracture correction were 53.1% in group A and 59.4% in Group B were assigned, the next common surgery was malunion and non union procedures were 25% and 21.9% of Group A and B patients have undergone. There was no difference between surgical procedures and groups. The p value was found to be not statistically significant, shown in Table 2.

Table 2: Proportion of participants underwent different surgical procedures (n=32).

Procedures done	Group A	Group B	P value
	N (%)	N (%)	
Fracture correction	17 (53.1)	19 (59.4)	0.804
Knee arthroplasty	4 (12.5)	2 (6.3)	
Hip arthroplasty	3 (9.4)	4 (12.5)	
Non union and malunion	8 (25)	7 (21.9)	

The mean and SD values for Group A and group B for preoperative Hb, duration of surgery, duration of hospital stay and blood transfusion units were found to be statistically non significant. The mean SD for blood loss in group A was 321.5±124.7 and group B 482.7±189.6, the difference was found to be highly statistically significant with p value 0.0002. Likewise the difference

in postoperative Hb was found to be statistically significant with p<0.01.

Table 3: Hematological parameters and duration of stay in different groups (n=32).

Variables	Group A	Group B	P value
Pre op Hb (g/dl)	13.2±1.6	12.9±1.9	0.497
Duration of surgery (in mins)	106.4±21.8	124.1±36.3	0.0212
Blood loss (in ml)	321.5±124.7	482.7±189.6	0.0002
Post op Hb (g/dl)	10.7±3.1	8.8±2.4	0.008
Duration of hospital stay (in days)	12.4±6.4	16.1±4.9	0.0117
No. of units of blood transfused (U)	22	34	

In tranexamic group one patient had surgical site infection and hematoma, whereas in group B one patient was found to have surgical site infection and two patients with hematoma. The p value for surgical site infection and hematoma was not statistically significant.

Table 4: Proportion of complications in different groups (n=32).

Complications	Group A (N=32)	Group B (N=32)	P value
	N (%)	**N (%)**	
Surgical site			
Infection	1 (3.1)	1 (3.1)	1.0
Haematoma	1 (3.1)	2 (6.3)	0.548
Medical			
Deep vein thrombosis	0	1 (3.1)	-
Pulmonary embolism	1 (3.2)	2 (6.3)	0.548
Respiratory infections	2 (6.3)	3 (9.4)	0.647

Medical complication like deep vein thrombosis was noted in one patient in Group B, pulmonary embolism was seen in 1 and 2 patients of group A and group B respectively. Respiratory problems were observed in 2 and 3 patients of group A and group B respectively, as shown in Table 4.

DISCUSSION

Occult blood loss is a concern among patients undergoing hip surgery and fractures. Tranexamic acid (TXA) an anti fibrinolytic agent has shown positive results in reducing blood loss during total hip arthroplasty (THA) and most of the orthopedic procedures. Even though TXA has proved its effectiveness in controlling blood loss, its use is limited due to complications like myocardial infarction (MI), thromboembolic events, and seizures. These possible adverse effects have prevented the widespread use of TXA in the surgical community. Blood transfusion requirements and induced costs can be diminished by using TAX by proper administration protocol.

Most of the patients undergoing orthopedic surgery were males, as male population is highly mobile and more often victims of road traffic accidents, fracture etc. In this present study, fracture correction and replacement surgeries were the most common procedures which require blood transfusion as blood loss is higher.

In a study done by Zhuang et al found blood loss volume were significantly lower in TXA group, when compared to the control group, similar to our study where blood loss was found to be significant (p=0.0002).[8]

A retrospective study by Stoicea et al found difference in Hb and haematocrit and estimated blood loss with TXA group and transfusion rate was decreased, comparable to our study with significant postoperative Hb level.[9]

A meta- analysis concluded that the amount of blood loss and the number of blood transfusions per patient were significantly less and the proportion of patients who required a blood transfusion was smaller in the tranexamic acid group compared with the placebo group. No significant difference in prothrombin time, activated partial thromboplastin time, deep-vein thrombosis, and pulmonary embolism was detected between the tranexamic acid group and the placebo group.[10,11] Similar findings were recorded in this current study where no significance found in postoperative complications but the complication were on fall compared to control group.

Hiippala et al in their study found thrombotic complications are higher in control group. Another study done by Juan et al found tranexamic acid reduces blood losses and transfusion requirements even when a blood conservation program was used.[11,12] Good et al and in 2000, found the prophylactic administration of Tranexamic acid significantly reduced the postoperative total blood losses. Tranexamic acid decreased total blood loss by nearly 30%, drainage volume by ~50% and drastically reduced transfusion.[13]

Mehr-Aein et al found no difference in coagulation parameters but hospital stay was found to be significant.[14] In our study the duration of hospital stay was 12.4± 6.4 in TXA group and 16.1±4.9 in control group. They concluded that tranexamic acid significantly reduces blood loss during hip fracture surgery.

Poeran et al found TXA significantly decreased odds for allogeneic or autologous blood transfusions and no significantly increased risk for complications:

thromboembolic complications, acute renal failure and combined complications.[15]

TXA is contraindicated in patients with a history of arterial or venous thrombosis, fibrinolytic conditions following consumptive coagulopathy, acute renal failure, a history of seizures and/or in cases of hypersensitivity. TXA should not be administered intravenously, intrathecally or intra-cerebrally. In addition, intravenous administration should be carried out slowly and the dosage should be adjusted according to blood levels of creatinine in patients with mild or moderate renal impairment. Lastly, any risk factors for thromboembolic disease should always be investigated when considering the use of TXA.[16]

CONCLUSION

Extending tranexamic acid orthopedic surgery would be a useful measure to reduce costs and blood transfusions. TXA significantly reduces blood loss and blood transfusion requirements in patients undergoing orthopedic surgery. Scientific rationale suggests TXA has a good safety profile, but for many orthopedic surgeons, concerns remain about the risk of symptomatic thrombo-embolic events. Most of the time administering tranexamic acid was a useful and safe option for reducing requirement of blood transfusion postoperatively. Strong evidence that tranexamic acid lowers blood transfusion in surgery has been available for years. However, the effect of tranexamic acid on thromboembolic events and mortality remains uncertain. Surgical patients should be made aware of it in order that they make their choice.

ACKNOWLEDGEMENTS

I would like to thank all, who has guided me by extending their knowledge and experience right from the inception to the completion of this study. Last but not least I am thankful to my study participants, without whom, this study would not have been possible.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the institutional ethics committee

REFERENCES

1. Kannus P, Parkkari J, Sievanen H, Heinonen A, Vuori I, Järvinen M. Epidemiology of hip fractures. Bone. 1996;18(1):57-63.
2. Sharrock NE. Fractured femur in the elderly: intensive perioperative care is warranted. Br J Anaesth. 2000;84:139-40.
3. Swain DG, Nightingale PG, Patel JV. Blood transfusion requirements in femoral neck fracture. Injury. 2000;31:7-10.
4. Spahn DR. Anemia and patient blood management in hip and knee surgery: a systematic review of the literature. Anesthesiology. 2010;113:482–95.
5. Carson JL, Altman DG, Duff A, Noveck H, Weinstein MP, Sonnenberg FA, et al. Risk of bacterial infection associated with allogeneic blood transfusion among patients undergoing hip fracture repair. Transfusion. 1999;39:694–700.
6. Bannister GC, Young SK, Baker AS, Mackinnon JG, Magnusson PA. Control of bleeding in cemented arthroplasty. J Bone Joint Surg Br. 1990;72(3):444-6.
7. Hardy JF, Be´ lisle S. Natural and synthetic antifibrinolytics: inert, poisonous or therapeutic agents? Can J Anaesth. 1997;44:913.
8. Lei J, Zhang B, Cong Y, Zhuang Y, Wei X, Fu Y, et al. Tranexamic acid reduces hidden blood loss in the treatment of intertrochanteric fractures with PFNA: a single-center randomized controlled trial. J Orthop Surg Res. 2017;12(1):124.
9. Stoicea N, Moran K, Mahmoud AR, Glassman A, Ellis T, Ryan J, et al. Tranexamic acid use during total hip arthroplasty: A single center retrospective analysis. Medicine. 2018;97(21):e10720.
10. Yang ZG, Chen WP, Wu LD. Effectiveness and safety of tranexamic acid in reducing blood loss in total knee arthroplasty: a meta-analysis. JBJS. 2012;94(13):1153-9.
11. Hiippala S, Strid L, Wennerstrand M, Arvela V, Mäntylä S, Ylinen J, et al. Tranexamic acid (Cyklokapron) reduces perioperative blood loss associated with total knee arthroplasty. Br J Anaesthesia. 1995;74(5):534-7.
12. Álvarez JC, Santiveri FX, Ramos I, Vela E, Puig L, Escolano F. Tranexamic acid reduces blood transfusion in total knee arthroplasty even when a blood conservation program is applied. Transfusion. 2008;48(3):519-25.
13. Good L, Peterson E, Lisander B. Tranexamic acid decreases external blood loss but not hidden blood loss in total knee replacement. Br J Anaesthesia. 2003;90(5):596-9.
14. Sadeghi M, Mehr-Aein A. Does a single bolus dose of tranexamic acid reduce blood loss and transfusion requirements during hip fracture surgery? A prospective randomized double blind study in 67 patients. Acta Medica Iranica. 2007;45(6):437-42.
15. Poeran J, Rasul R, Suzuki S, Danninger T, Mazumdar M, Opperer M, 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;349:4829.
16. Agencia Espa˜nola del Medicamento y Productos Sanitarios. Ácido tranexámico (AMCHAFIBRIN), ficha técnica revisada endiciembre de. 2012.

Cite this article as: Uganath SB, Sundaramoorthy M. Effects of tranexamic acid in major orthopedic surgical procedures: a randomized comparative study. Int J Res Orthop 2019;5:551-4.