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Original Research Article

Role of Injection Tranexamic Acid in Reducing Blood Loss in Peri Trochanter Fracture Surgeries

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Abstract: ***Background***: For patients undergoing surgery for peritrochanteric fractures, blood loss is a big issue. The purpose of this study was to see if tranexamic acid (TXA) could reduce postoperative blood loss in individuals who had hip surgery for peritrochanteric fracture. ***Methods***: A total of 69 patients with intertrochanteric fractures were enrolled in this prospective study. Patients are randomly divided into two groups. Group A patients received 200 mL (1 g) of TXA intravenously before peritrochanter surgery and Group B patients did not receive an injection of TXA. Haemoglobin and hematocrit values were measured preoperatively and postoperatively at days 1 and 3. Visible and hidden blood loss volumes were calculated on postoperative day 3. ***Results***: The blood transfusion rate was reduced significantly in patients by injecting tranexamic acid before surgery. However, mean haemoglobin and hematocrit levels were not significantly different between patients who received injection tranexamic acid and those who did not receive injection tranexamic acid. ***Conclusion***: TXA significantly reduced postoperative blood loss in patients with Peritrochanteric fractures who underwent surgery.

Keywords: PeriTrochnateric fracture, Tranexamic acid, Mean hemoglobin, Hematocrit value, Hip Surgery, Hypovolemia, Intra-vascular Coagulation.

BACKGROUND

Globally, hip fracture is a frequent cause of morbidity and mortality, especially in elderly people [1, 2]. peritrochanteric fractures are the major types of hip fractures, comprising approximately half of all hip fractures. Peritrochanteric fracture usually occurs in patients with a history of falls or bone disease and results from a low-energy mechanism such as a fall from standing [3]. Patients typically present with pain and difficulty walking. Types of peri trochanteric fracture [4], and treatment [5], affect functional outcomes and mortality in patients with hip fractures. Patients with peri trochanteric fractures incur more blood loss than those with femoral neck fractures and have a higher rate of transfusion [6]. In addition, perioperative hemoglobin and hematocrit levels have implications for outcomes, as patients with hip fractures are usually frail and elderly and particularly prone to anemia and hypovolaemia [7–9]. Evidence suggests that total blood loss during hip fracture surgery may be much greater than that observed intraoperatively. One study showed that overall blood loss was 1473 mL greater than that observed intraoperatively in patients undergoing hip surgery [6], and another study [10], reported 277.2 ± 7.6 mL hidden blood loss in patients undergoing proximal femoral nail anti-rotation (PFNA) for intertrochanteric fractures. Hidden blood loss could aggravate functional outcomes and increase mortality in patients with hip fractures by lowering hemoglobin levels. Hidden blood loss should be minimized during surgery for peritrochanteric fracture.

Tranexamic acid (TXA) is a synthetic derivative of the amino acid lysine, with antifibrinolytic properties that competitively inhibit lysine-binding sites on plasminogen molecules. TXA has been used for hemostasis in orthopedic surgery [11–16]. Previous studies have shown that TXA reduced total blood loss and the need for transfusion in hip arthroplasty and hip fracture surgery [14- 17]. However, the majority of these studies focused on the hemostatic effect of TXA on visible blood loss in hip fracture surgery, rather than on postoperative hidden blood loss [18]. One study showed that TXA decreased external blood loss by 30%, but not hidden blood loss, in total knee re- placement [19]. Other reports in total knee arthroplasty show that TXA

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significantly reduced hidden blood loss and total blood loss [20–22], but there have been few studies investigating whether TXA can reduce hidden blood loss in surgery for intertrochanteric fractures [18- 23].

In this study, we hypothesized that TXA administration would lead to decreased postoperative hidden blood loss in patients with intertrochanteric fractures. This study aimed to investigate whether intravenous (i.v.) administration of 1 g TXA could reduce postoperative hidden blood loss in patients with intertrochanteric fractures.

METHODS

Study Population

This prospective study was a Prospective study conducted at a single center. Patients with stable and unstable peritrochanteric fractures admitted to our institution through the emergency department between February 2023 and September 2023 were eligible for this study. Inclusion criteria were (1) patients with a definite history of trauma, fall or traffic accident; (2) patients suffering from hip pain, tenderness, dysfunction, local swelling, and vertical percussion pain in the area of the greater trochanter, with limited function in the injured limb; (3) patients with a confirmed diagnosis of peritrochanteric fracture and fracture classified according to AO type on X-ray or computed tomography (CT) [24], and (4) patients eligible for peritrochanteric fracture surgery using the proximal femoral nail anti-rotation (PFNA) system as determined by the senior orthopedic surgeons at our institution.

Exclusion criteria were (1) patients with allergy to TXA; (2) patients with recent or ongoing thrombo-embolic events (deep venous thrombosis, pulmonary embolism, arterial thrombosis, or cerebral thrombosis stroke); (3) patients who were recently taking or who were taking anticoagulation therapy including vitamin K-antagonists, direct thrombin inhibitors, direct factor X-a inhibitors, and platelet aggregation inhibitors; (4) patients with disseminated intravascular coagulation or patients had hepatic or renal diseases with impairment of coagulation function; or (5) patients with a history of subarachnoid bleeding, malignancy, pathological fracture, or prior surgery on the injured hip.

This study was approved by the Ethics Committee of our college, and each patient provided written informed consent before surgery. This study was performed in line with the Declaration of Helsinki international ethical guidelines for studies involving human subjects [25].

Intervention

Patients were allotted to a TXA group or Non TXA group. If patients were anemic (defined as hemoglobin <90 g/L) on admission they received an i.v. infusion of RBC. After anesthesia, but before surgery, patients in the TXA group received i.v. TXA 1 g (200 mL). A single orthopedic surgeon (LJL) performed surgery on all included patients. Patients were placed in the supine position, the fractured bone fragments were identified by X-ray, and PFNA was performed.

Outcome Measurements

Patient demographic and clinical characteristics were recorded. Hemoglobin and hematocrit levels were measured 1 day before surgery and on postoperative Day 1 and 3; the duration of surgery; and visible blood loss was collected with a sterile plastic foil, a funnel, and gauzes. Complications associated with surgery—including hematoma, infection, deep vein thrombosis (examined by ultrasonography on day 3 post-operation), pulmonary embolism, myocardial infarction, ischemic cerebral infarction, respiratory infec- tion, and renal failure—were also recorded. Nadler's formulae for blood volume and visible and hidden blood loss were applied after surgery [26- 28].

Women bood volume (L) = ¼ height(m)3× 0:356
+ weight (kg) × 0:033
+ 0:183

Menbloodvolume (L) = ¼ height (m)3 × 0:356
+ weight (kg) × 0:032
+ 0:604

Total RBC loss (L) = ¼ blood volume
× (Hct*Preop*-Hct*Postop)*

Statistical Analysis

Data were analyzed using SPSS v18.0 statistical software (SPSS Inc., Chicago, IL, USA). According to previous literature [13], and a power analysis, at least 62 patients were required for this study. Descriptive data are presented as mean ± SD. The chi-squared test or Student's *t* test was used to compare demographic and clinical characteristics. A non-parametric test was used to evaluate ASA classification. $P < 0.05$ was considered statistically significant.

RESULTS

Between February 2023 and September 2023, 75 patients with peritertrochanteric fractures were admitted to our institution through the emergency department and OPD. Sixty-nine patients who met all of the inclusion criteria and none of the exclusion criteria were randomized to the TXA (n = 39) and Non TXA groups (n=30) (Fig. 1). Patients' demographic and clinical characteristics were similar be- tween the two groups as summarized in Table 1. Most patients (81.81%) were female aged 64 to 93 years. Upon admission, the hemoglobin level in 16 patients was <90 g/L; these patients received a total of 48.0 U of packed RBC by intravenous infusion. Four patients in the TXA group and four patients in the Non TXA group each received 4 U packed RBC. Before surgery, hemoglobin level in most patients was between 91 and 137 g/L and hematocrit was between 27.6 and 34.6%.

All surgeries were successful. Mean operative time and mean length of hospital stay were not significantly different between the TXA and non-XA groups. There was less surgical blood loss in the TXA group compared to the non-TXA group (138.85 ± 119.18 vs. 96.30 ± 59.10; *P* = 0.31), but the difference was not significant. However, the postoperative transfusion rate was significantly lower in the TXA group compared to the non-TXA group (TXA, 27.10% [2.0 U packed RBC in 10 patients, 4.0 U packed RBC in 1 person] vs. non-TXA, 58.09% [2.0 U packed RBC in 17 patients, 4.0 U packed RBC in 6 patients]; *P* = 0.01). In the NS group, three patients >90 years of age received an intraoperative transfusion of 2 U-packed RBCs each.

As shown in Table 2, on postoperative day 1, both mean hematocrit and mean hemoglobin levels were not significantly different in the TXA group compared to the non-XA group. Postoperative drainage at postoperative day 2 was also not significantly different between the TXA and Non-TXA groups (87.50± 43.77 mL vs. 89.73 ± 43.30 mL,

P = 0.98). On postoperative day 3, mean hemoglobin and mean hematocrit levels were comparable. But the calculated hidden RBC loss (210.09±202.14mL vs.359.35 ± 290.12 mL, *P* = 0.049) and total RBC loss (279.35 ± 209.11 mL vs. 417.89 ± 289.56 mL, *P* = 0.049) were significantly less in the TXA group compared to the Non TXA group (Table 2).

There were no systematic complications related to TXA administration. The incidence of adverse events in the TXA and NS group were not significantly different (Table 3). Patients with hematoma and infection at the surgical site were treated conservatively, but one patient required surgical debridement.

All patients were followed up for 30 days after surgery. Three patients were lost to follow-up due to death (2 of pulmonary embolism and 1 of renal failure). Deep vein thrombosis resolved spontaneously.

DISCUSSION

Hip fracture surgery may result in substantial blood loss in elderly and frail patients, exposing them to postoperative anemia, which could negatively impact clinical outcomes and mortality. Previous studies have shown that TXA reduced hidden blood loss associated with total knee arthroplasty [22]. However, it is not clear whether TXA decreases hidden blood loss in patients undergoing surgery for peritrochanteric fractures. Our results showed that both postoperative hidden blood loss and total blood loss were significantly reduced in patients with peritrochanteric fractures treated with TXA, suggesting TXA administration is an efficacious.

CONCLUSION

This study demonstrated that TXA could effectively reduce postoperative hidden blood loss in patients undergoing surgery for peritrochanteric fractures and may decrease the number of patients needing transfusion

Variables	**TXA study group (*n* = 39)**	**Non-TXA group (*n* = 30)**	***P* value**
Female (%)	32 (82.05)	33 (80.49)	0.86†
Age (year)	77.80 ± 9.75	79.18 ± 6.50	0.54*
BMI	23.79 ± 2.18	23.27 ± 2.93	0.61*
Side (right/left)	16/23	11/19	0.74†
Preop. hemoglobin level (g/L)	109.50 ± 15.07	112.15 ± 13.31	0.51
Preop. hematocrit level (%)	32.63 ± 4.28	33.79 ± 3.83	0.31
Preop. transfusion (mL)	220.00 ± 354.80	158.00 ± 315.30	0.51
AO fracture classification 31 A1	15	09	0.76†
31 A2	10	15	
31 A3	14	06	
ASA classification			
I	05	04	0.89^
II	14	12	
III	18	13	
IV	02	01	
Operative time (min)	81.90 ± 25.61	80.67 ± 29.44	0.88*
Hospital stay (days)	8.10 ± 1.74	9.03 ± 2.10	0.10*

	TXA study group (*n* = 39)	Non TXA group (*n* = 30)	*P* value*
Surgical site			
Hematoma	1	3	0.34
Infection	1	2	0.60
Medical			
Deep vein thrombosis	3	2	0.51
Pulmonary embolism	1	1	0.96
Myocardial infarction	0	0	
Ischemic cerebral infarction	0	0	
Respiratory infection	3	5	0.53
Renal failure	0	1	1.00

REFERENCES

1. Peeters, C. M., Visser, E., Van de Ree, C. L., Gosens, T., Den Oudsten, B. L., & De Vries, J. (2016). Quality of life after hip fracture in the elderly: a systematic literature review. *Injury*, *47*(7), 1369-1382.
2. Cooper, C., Cole, Z., Holroyd, C., Earl, S., Harvey, N., Dennison, E., Melton, L., Cummings, S., & Kanis, J. (2011). Epidemiology ICWGoF: secular trends in the incidence of hip and other osteoporotic fractures. *Osteoporos Int. 22*(5), 1277.
3. Ahn, J., & Bernstein, J. (2010). In brief: fractures in brief: intertrochanteric hip fractures. *Clinical Orthopaedics and Related Research®*, *468*, 1450-1452.
4. Carvajal-Pedrosa, C., Gómez-Sánchez, R. C., & Hernández-Cortés, P. (2016). Comparison of outcomes of intertrochanteric fracture fixation using percutaneous compression plate between stable and unstable fractures in the elderly. *Journal of Orthopaedic Trauma*, *30*(6), e201-e206.
5. Dhamangaonkar, A. C., Joshi, D., Goregaonkar, A. B., & Tawari, A. A. (2013). Proximal femoral locking plate versus dynamic hip screw for unstable intertrochanteric femoral fractures. *Journal of Orthopaedic Surgery*, *21*(3), 317-322.
6. Foss, N. B., & Kehlet, H. (2006). Hidden blood loss after surgery for hip fracture. *The Journal of Bone & Joint Surgery British Volume*, *88*(8), 1053-1059.
7. Kannus, P., Parkkari, J., Sievänen, H., Heinonen, A., Vuori, I., & Järvinen, M. (1996). Epidemiology of hip fractures. *Bone*, *18*(1), S57-S63.
8. Sharrock, N. E. (2000). Fractured femur in the elderly: intensive perioperative care is warranted. *British journal of anaesthesia*, *84*(2), 139-140.
9. Swain, D. G., Nightingale, P. G., & Patel, J. V. (2000). Blood transfusion requirements in femoral neck fracture. *Injury*, *31*(1), 7-10.
10. Yu, W., Zhang, X., Wu, R., Zhu, X., Hu, J., Xu, Y., ... & Liu, Y. (2016). The visible and hidden blood loss of Asia proximal femoral nail anti-rotation and dynamic hip screw in the treatment of intertrochanteric fractures of elderly high-risk patients: a retrospective comparative study with a minimum 3 years of follow-up. *BMC musculoskeletal disorders*, *17*(1), 1-10.
11. Wassilew, G. I., Perka, C., Janz, V., Krämer, M., & Renner, L. (2015). Tranexamic acid reduces the blood loss and blood transfusion requirements following peri-acetabular osteotomy. *The Bone & Joint Journal*, *97*(12), 1604-1607.
12. Wang, H., Shen, B., & Zeng, Y. (2015). Blood loss and transfusion after topical tranexamic acid administration in primary total knee arthroplasty. *Orthopedics*, *38*(11), e1007-e1016.
13. Tengberg, P. T., Foss, N. B., Palm, H., Kallemose, T., & Troelsen, A. (2016). Tranexamic acid reduces blood loss in patients with extracapsular fractures of the hip: results of a randomised controlled trial. *The bone & joint journal*, *98*(6), 747-753.
14. Poeran, J., Rasul, R., Suzuki, S., Danninger, T., Mazumdar, M., Opperer, M., Boettner, F., & Memtsoudis, S. G. (2014). 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*, *349*(aug12 8), g4829.
15. Perel, P., Ker, K., Morales, U. C. H., Roberts, I. (2013). Tranexamic acid for reducing mortality in emergency and urgent surgery. *Cochrane Database Syst Rev*, *1*(1), CD010245.
16. Gillespie, R., Shishani, Y., Joseph, S., Streit, J. J., & Gobezie, R. (2015). Neer Award 2015: a randomized, prospective evaluation on the effectiveness of tranexamic acid in reducing blood loss after total shoulder arthroplasty. *Journal of Shoulder and Elbow Surgery*, *24*(11), 1679-1684.
17. Farrow, L. S., Smith, T. O., Ashcroft, G. P., & Myint, P. K. (2016). A systematic review of tranexamic acid in hip fracture surgery. *British journal of clinical pharmacology*, *82*(6), 1458-1470.
18. Smith, G., Tsang, J., Molyneux, S., & White, T. (2011). The hidden blood loss after hip fracture. *Injury*, *42*(2), 133–5.
19. Good, L., Peterson, E., & Lisander, B. (2003). Tranexamic acid decreases external blood loss but not hidden blood loss in total knee replacement. *British journal of anaesthesia*, *90*(5), 596-599.
20. Chen, X., Zhu, X., Yang, S., Lin, W., & Wang, L. (2016). Tranexamic acid treatment decreases hidden blood loss in total knee arthroplasty. *American Journal of Therapeutics*, *23*(6), e1397-e1405.
21. Seol, Y. J., Seon, J. K., Lee, S. H., Jin, C., Prakash, J., Park, Y. J., & Song, E. K. (2016). Effect of

tranexamic acid on blood loss and blood transfusion reduction after total knee arthroplasty. *Knee Surgery & Related Research*, *28*(3), 188.

22. Xie, J., Ma, J., Yao, H., Yue, C., & Pei, F. (2016). Multiple boluses of intravenous tranexamic acid to reduce hidden blood loss after primary total knee arthroplasty without tourniquet: a randomized clinical trial. *The Journal of arthroplasty*, *31*(11), 2458-2464.
23. Drakos, A., Raoulis, V., Karatzios, K., Doxariotis, N., Kontogeorgakos, V., Malizos, K., & Varitimidis, S. E. (2016). Efficacy of local administration of tranexamic acid for blood salvage in patients undergoing intertrochanteric fracture surgery. *Journal of orthopaedic trauma*, *30*(8), 409-414.
24. Marsh, J. L., Slongo, T. F., Agel, J., Broderick, J. S., Creevey, W., DeCoster, T. A., ... & Audigé, L. (2007). Fracture and dislocation classification compendium-2007: Orthopaedic Trauma Association classification, database and outcomes committee. *Journal of orthopaedic trauma*, *21*(10), S1-S6.
25. Foster, C. G. (2002). International ethical guidelines for biomedical research involving human subjects. *J Med Ethics*, *10*(182), 17.
26. Gross, J. B. (1983). Estimating allowable blood loss: corrected for dilution. *The Journal of the American Society of Anesthesiologists*, *58*(3), 277-280.
27. Meunier, A., Petersson, A., Good, L., & Berlin, G. (2008). Validation of a haemoglobin dilution method for estimation of blood loss. *Vox sanguinis*, *95*(2), 120-124.
28. Nadler, S. B., Hidalgo, J. U., & Bloch, T. (1962). Prediction of blood volume in normal human adults. *Surgery*, *51*(2), 224-232.
29. Benoni, G., & Fredin, H. (1996). Fibrinolytic inhibition with tranexamic acid reduces blood loss and blood transfusion after knee arthroplasty. *Bone Joint J*, *78*(3), 434–40.
30. Syrovets, T., Lunov, O., & Simmet, T. (2012). Plasmin as a proinflammatory cell activator. *Journal of leukocyte biology*, *92*(3), 509-519.
31. Jimenez, J. J., Iribarren, J. L., Lorente, L., Rodriguez, J. M., Hernandez, D., Nassar, I., Perez, R., Brouard, M., Milena, A., & Martinez, R. (2007). Tranexamic acid attenuates inflammatory response in cardiopulmonary bypass surgery through blockade of fibrinolysis: a case control study followed by a randomized double-blind controlled trial. *Crit Care*, *11*(6), R117.
32. Hsia, T. Y., McQuinn, T. C., Mukherjee, R., Deardorff, R. L., Squires, J. E., Stroud, R. E., ... & Spinale, F. G. (2010). Effects of aprotinin or tranexamic acid on proteolytic/cytokine profiles in infants after cardiac surgery. *The Annals of thoracic surgery*, *89*(6), 1843-1852.
33. Wingerter, S. A., Keith, A. D., Schoenecker, P. L., Baca, G. R., & Clohisy, J. C. (2015). Does tranexamic acid reduce blood loss and transfusion requirements associated with the periacetabular osteotomy? *Clin Orthop Relat Res*, *473*(8), 2639–43.
34. Duncan, C. M., Gillette, B. P., Jacob, A. K., Sierra, R. J., Sanchez-Sotelo, J., & Smith, H. M. (2015). Venous thromboembolism and mortality associated with tranexamic acid use during total hip and knee arthroplasty. *The Journal of arthroplasty*, *30*(2), 272-276.
35. Yang, Z. G., Chen, W. P., & Wu, L. D. (2012). Effectiveness and safety of tranexamic acid in reducing blood loss in total knee arthroplasty: a meta-analysis. *JBJS*, *94*(13), 1153-1159.
36. Liu, Y., Meng, F., Yang, G., Kong, L., & Shen, Y. (2017). Comparison of intra-articular versus intravenous application of tranexamic acid in total knee arthroplasty: a meta-analysis of randomized controlled trials. *Archives of Medical Science*, *13*(3), 533-540.

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