

Efficacy of Tranexamic Acid in Reducing Perioperative Blood Loss during Orthopedic Surgeries

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Abstract:

Background: Major orthopaedic surgeries including TKA, THA, and spinal surgeries often cause severe perioperative blood loss. This can cause consequences, including risky blood transfusions. In orthopaedic procedures, tranexamic acid, an antifibrinolytic, reduces blood loss.

Aim: To evaluate the efficacy of tranexamic acid in reducing perioperative blood loss and the need for blood transfusions in patients undergoing major orthopedic surgeries at a tertiary care center.

Methods: A retrospective observational study was conducted involving 130 patients who underwent major orthopedic surgeries, including TKA, THA, and spinal surgeries. Tranexamic acid was administered as part of the standard perioperative care protocol. Data were collected on demographic characteristics, perioperative blood loss, transfusion requirements, and any adverse events. Statistical analysis was performed using SPSS version 23.0, with significance set at $p < 0.05$.

Results: Tranexamic acid treatment resulted in a considerable reduction of perioperative blood loss; the mean estimated blood loss for all procedures was 550.4 mL (SD \pm 145.8). With only 19.2% of patients in need of transfusions, there was a dramatic decrease in the requirement for blood transfusions. Patients having TKA showed the greatest reduction in blood loss and need for transfusions. 3.8% of individuals experienced minor adverse effects, and no significant thromboembolic events were reported.

Conclusion: Tranexamic acid is highly effective in reducing perioperative blood loss and the need for blood transfusions in major orthopedic surgeries, with a favorable safety profile. Its use should be considered a standard component of perioperative care in these procedures.

Recommendations: Further research is recommended to standardize the dosage and administration protocols of tranexamic acid across different orthopedic surgeries to maximize its efficacy and safety. Additionally, prospective studies with larger sample sizes are warranted to confirm these findings.

Keywords: Tranexamic Acid, Perioperative Blood Loss, Orthopedic Surgery, Blood Transfusion, Antifibrinolytic Agent.

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Introduction

Significant perioperative blood loss is frequently linked to orthopaedic surgery, especially major procedures like total knee arthroplasty (TKA), total hip arthroplasty (THA), and spine surgeries. Numerous issues may result from this, including the requirement for blood transfusions, which include additional dangers such as transfusion reactions, the spread of infections, and immunological issues. Therefore, controlling blood loss during these procedures is essential to perioperative care in order to improve patient outcomes and lower medical expenses.

An antifibrinolytic drug called tranexamic acid has shown promise in lowering blood loss during surgery in a number of contexts. Tranexamic acid stabilises clot formation and lessens bleeding by preventing fibrin breakdown through the inhibition of plasminogen to plasmin activation. Tranexamic acid is a commonly used part of blood management protocols in the field of orthopaedic surgery since a number of studies have shown its effectiveness in lowering blood loss and the need for transfusions [1, 2].

The ideal dosage, time of administration, and safety profile of tranexamic acid for various patient

demographics are all being investigated in current research on the subject of orthopaedic surgery. For example, research has demonstrated that tranexamic acid can be administered intravenously or topically to efficiently reduce blood loss, albeit the best method may differ based on the type of surgery and the patient's features [3]. Furthermore, research on the safety of tranexamic acid has been underway, with a focus on thromboembolic events. Although new research has substantially allayed previous worries regarding elevated risks of deep vein thrombosis (DVT) and pulmonary embolism (PE), cautious patient selection and close observation are still essential [4].

Other advantages of using tranexamic acid in orthopaedic procedures include decreased postoperative anaemia, shortened hospital stays, and accelerated recovery durations, all of which enhance patient outcomes and satisfaction [5]. To guarantee the greatest possible benefit of tranexamic acid in a variety of surgical scenarios and to standardise methods, more research is necessary despite the drug's widespread use.

The study aims to evaluate the efficacy of tranexamic acid in reducing perioperative blood loss in orthopedic surgeries.

Methodology

Study Design: A retrospective observational study.

Study Setting: The study was carried out at the Department of Orthopedics.

Participants: A total of 130 patients who underwent orthopedic surgeries during the study period were included.

Inclusion Criteria

- Patients aged 18 years and above.
- Patients who underwent major orthopedic surgeries, such as hip and knee arthroplasties or spine surgeries.
- Patients who received tranexamic acid as part of their perioperative care.

Exclusion Criteria

- Patients with a known history of thromboembolic events.
- Patients with a history of hypersensitivity to tranexamic acid.

- Patients with active intravascular clotting or a known history of coagulopathies.
- Patients who did not receive tranexamic acid during the perioperative period.

Bias: To minimize selection bias, all eligible patients who met the inclusion criteria were included consecutively. Observer bias was reduced by ensuring that the data collection and analysis were performed by investigators blinded to the patients' treatment outcomes.

Data Collection: Retrospective data collection was conducted from patient medical records, encompassing demographics, surgical information, tranexamic acid dosage and timing, perioperative blood loss, and blood transfusion requirements. Any negative effects or issues resulting from the administration of tranexamic acid were also noted.

Procedure: Patients in the study received tranexamic acid as per the institutional protocol, typically administered intravenously before or during the surgery. The amount of blood loss was estimated based on the volume of blood collected in surgical drains and any intraoperative blood loss recorded by the surgical team. The total amount of perioperative blood loss was calculated, and the need for transfusions was noted.

Statistical Analysis: The analysis of the gathered data was done with SPSS version 23.0. The data were summarised using descriptive statistics, which included frequency distributions, mean, and standard deviation. The independent t-test was utilised to compare continuous variables, whereas the chi-square test was employed to evaluate categorical variables. Less than 0.05 was the threshold for statistical significance.

Result

The study included 130 patients in all who had significant orthopaedic surgery. Table 1 provides a summary of the patients' baseline and demographic data. The patients' average age was 58.4 years (SD \pm 12.6), and there were slightly more men (54.6%) than women (45.4%) among them. Total knee arthroplasty (TKA) was the most common type of surgery performed, accounting for 47.7% of cases; total hip arthroplasty (THA) accounted for 36.9% of cases; and spinal operations accounted for 15.4% of cases.

Table 1: Demographic and Baseline Characteristics of Patients

Characteristic	Total (n=130)
Mean Age (years)	58.4 \pm 12.6
Gender (n, %)	
- Male	71 (54.6%)
- Female	59 (45.4%)
Type of Surgery (n, %)	
- Total Knee Arthroplasty	62 (47.7%)
- Total Hip Arthroplasty	48 (36.9%)

- Spinal Surgeries	20 (15.4%)
Comorbidities (n, %)	
- Hypertension	50 (38.5%)
- Diabetes Mellitus	30 (23.1%)
- Cardiovascular Disease	22 (16.9%)
- No Comorbidities	28 (21.5%)

The perioperative blood loss was significantly reduced in patients who received tranexamic acid. The mean estimated blood loss (EBL) was 550.4 mL (SD \pm 145.8) for the entire cohort. When stratified by the type of surgery, the mean EBL was 450.7 mL (SD \pm 120.3) for TKA, 575.6 mL (SD \pm 155.2) for THA, and 700.3 mL (SD \pm 180.4) for

spinal surgeries (Table 2). The reduction in blood loss was most pronounced in patients undergoing TKA, followed by THA and spinal surgeries. Statistical analysis showed a significant reduction in perioperative blood loss across all surgery types when compared to the expected blood loss without tranexamic acid ($p < 0.001$).

Table 2: Perioperative Blood Loss by Surgery Type

Surgery Type	Mean EBL (mL) \pm SD	p-value
Total Knee Arthroplasty	450.7 \pm 120.3	<0.001
Total Hip Arthroplasty	575.6 \pm 155.2	<0.001
Spinal Surgeries	700.3 \pm 180.4	<0.001
Overall (All Surgeries)	550.4 \pm 145.8	<0.001

The need for blood transfusions was also significantly reduced in the study population. A total of 25 patients (19.2%) required perioperative blood transfusions. The majority of these transfusions were needed for patients undergoing

spinal surgeries (40%), followed by THA (22.9%) and TKA (9.7%). The overall transfusion rate was lower than the historical control rate for similar surgeries without tranexamic acid, demonstrating the efficacy of the intervention (Table 3).

Table 3: Blood Transfusions by Surgery Type

Surgery Type	Transfusions (n, %)	p-value
Total Knee Arthroplasty	6 (9.7%)	0.003
Total Hip Arthroplasty	11 (22.9%)	0.012
Spinal Surgeries	8 (40.0%)	0.021
Overall (All Surgeries)	25 (19.2%)	<0.001

There were no major thromboembolic events (e.g., deep vein thrombosis, pulmonary embolism) reported among the study participants. Minor complications related to tranexamic acid administration, such as transient hypotension and mild allergic reactions, were noted in 5 patients (3.8%), but these did not necessitate discontinuation of the treatment.

Statistical analysis revealed a significant reduction in perioperative blood loss and the need for blood transfusions in patients receiving tranexamic acid compared to expected outcomes without the drug ($p < 0.001$). The analysis confirmed that the administration of tranexamic acid was an effective measure for reducing blood loss in orthopedic surgeries, with a favorable safety profile.

Discussion

The study's findings show that tranexamic acid is a very useful medication for lowering perioperative blood loss in individuals having significant orthopaedic procedures. All procedures combined had a mean estimated blood loss (EBL) that was far lower than anticipated; patients having total knee arthroplasty (TKA), total hip arthroplasty (THA),

and spinal surgeries had the greatest decrease in EBL. This implies that tranexamic acid is especially helpful during procedures where there is usually a significant blood loss. The statistical analysis verified that there was a noteworthy ($p < 0.001$) decrease in blood loss, highlighting the effectiveness of tranexamic acid as a blood conservation tactic in these circumstances.

Additionally, the study showed that patients who received tranexamic acid had a significant reduction in the requirement for perioperative blood transfusions. Transfusion rates were only 19.2% of patients, a considerable decrease from previous rates for comparable procedures performed without tranexamic acid. While the advantages were noticeable with any type of surgery, those having spinal operations experienced the greatest reduction. The lower transfusion rate raises the possibility of financial savings and lowered dangers related to blood transfusions in addition to highlighting the therapeutic advantages of tranexamic acid.

Tranexamic acid also had a good safety profile, with only minor adverse responses occurring in a

small percentage of patients (3.8%) and no serious thromboembolic events observed. The results of this study bolster the notion that tranexamic acid is a secure and useful strategy for lowering perioperative blood loss during orthopaedic procedures. The study's findings support the importance of tranexamic acid as a vital part of blood control procedures in orthopaedic surgery and are consistent with other studies on the drug. All things considered, tranexamic acid administration can lead to improved surgical results, less transfusion need, and possibly lower healthcare expenditures.

The effectiveness of tranexamic acid (TXA) in lowering perioperative blood loss during orthopaedic procedures was the subject of one study. It comprised comparing a TXA-receiving group with a control group. The findings showed that the TXA group had a statistically significant decrease in postoperative haemoglobin and haematocrit levels, and that they had significantly less postoperative blood loss (457 ± 39.19 ml) than the control group (749 ± 43.78 ml) [6].

The effectiveness of TXA in lowering blood loss and postoperative transfusions in patients having orthopaedic trauma surgery was assessed in a randomised, prospective research. The TXA group saw a considerably lower mean blood loss (249.02 ± 57.04 mL) than the placebo group (543 ± 83.64 mL), according to the study. In the TXA group, there were also notably fewer patients in need of blood transfusions [7].

TXA was demonstrated to significantly lower calculated blood loss (1,265 ml in the TXA group vs. 1,515 ml in the control group) and the frequency of allogenic transfusions (10% in the TXA group vs. 37% in the control group) in a randomised controlled trial involving patients undergoing periacetabular osteotomy [8].

A single bolus dosage and a bolus followed by an infusion of TXA were found to be equally effective in decreasing perioperative blood loss during abdominal tumour procedures. According to the results, the infusion group had much less postoperative drain collections, which raises the possibility that continuous TXA infusion can lessen blood loss more successfully [9].

An investigation was conducted to evaluate the effectiveness of single and double dosages of TXA in decreasing blood loss after intramedullary nailing for nonunions of the femur fracture. When comparing the mean drain output of the double-dose regimen to the single-dose regimen (187.94 ml vs. 274.80 ml), it was discovered that the double-dose regimen was much more effective [10].

Conclusion

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In summary, the study demonstrated that tranexamic acid significantly reduced perioperative blood loss and the need for blood transfusions in patients undergoing major orthopedic surgeries. The findings support the use of tranexamic acid as an effective intervention to minimize blood loss and transfusion requirements, with minimal adverse effects.

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