RESEARCH PAPER

To Evaluate The Efficacy Of Tranexamic Acid In Reducing Perioperative Blood Loss And Transfusion Requirements In Orthopaedic Surgeries

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Received: 16th Dec, 2025; Revised: 9th Feb 2026; Accepted: 13th Feb, 2026; Available Online: 28th Feb, 2026

ABSTRACT

Background:Orthopaedic surgeries are frequently associated with significant perioperative blood loss due to extensive soft tissue dissection and exposure of vascular cancellous bone surfaces. Excessive blood loss during surgery may lead to haemodynamic instability and increased need for blood transfusion, which is associated with potential complications. Tranexamic acid, an antifibrinolytic agent that inhibits plasminogen activation and stabilizes fibrin clots, has been increasingly used as a pharmacological strategy to reduce perioperative bleeding in surgical practice.

Materials and Methods:This observational case–control study was conducted in the Department of Anaesthesiology at Sree Balaji Medical College and Hospital, Chennai. A total of 50 patients undergoing orthopaedic surgeries were included and divided into two groups of 25 patients each. Patients in Group T received intravenous tranexamic acid (500–1000 mg diluted in 100 ml normal saline) before surgical incision, while patients in Group C received 100 ml normal saline without tranexamic acid. Baseline demographic parameters, preoperative haemoglobin, and hematocrit levels were recorded. Intraoperative blood loss was estimated using suction bottle measurements and surgical sponge estimation, while postoperative blood loss was measured from surgical drains. Transfusion requirements and postoperative haemoglobin and hematocrit levels were also evaluated.

Results:Baseline demographic characteristics and preoperative hematological parameters were comparable between groups. Mean intraoperative blood loss was significantly lower in the tranexamic acid group (475 ± 86.12 ml) compared with the control group (606 ± 114.1 ml). Postoperative blood loss was also reduced in the tranexamic acid group (16.08 ± 6.7 ml) compared with controls (22.72 ± 9.39 ml). Intraoperative transfusion was required in 12% of patients in Group T compared with 60% in Group C, while postoperative transfusion was required in 8% of patients in Group T compared with 36% in Group C. Postoperative haemoglobin and hematocrit levels were higher in the tranexamic acid group.

Conclusion:Tranexamic acid significantly reduces perioperative blood loss and transfusion requirements in orthopaedic surgeries and represents an effective and safe adjunct for perioperative blood management.

Keywords: Tranexamic Acid; Orthopedic Procedures; Blood Loss, Surgical; Perioperative Care; Blood Transfusion; Antifibrinolytic Agents; Orthopedic Surgery; Hemostasis; Anesthesia

How to cite this article: Shadokpam D, Sanayaima Devi H, Dharshini A, Sridhar V, Kumaran S., To Evaluate The Efficacy Of Tranexamic Acid In Reducing Perioperative Blood Loss And Transfusion Requirements In Orthopaedic Surgeries..Int J Drug Deliv Technol. 2026; 16(2): 724-731; DOI: 10.25258/ijddt.16.2.77

Source of support: Nil.

Conflict of interest: None

INTRODUCTION

Orthopaedic surgery represents one of the most frequently performed surgical specialties worldwide and is primarily concerned with the management of disorders affecting the musculoskeletal system, including bones, joints, ligaments, and surrounding soft tissues. With advancements in surgical techniques and anaesthetic practices, the scope of orthopaedic procedures has expanded considerably, enabling successful management of complex fractures, joint degenerative diseases, and spinal disorders. These procedures play a crucial role in restoring mobility and improving the functional status of patients suffering from musculoskeletal conditions. However, orthopaedic surgeries are often associated with considerable perioperative physiological challenges, particularly related

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to blood loss and haemodynamic fluctuations, which require meticulous anaesthetic management [1].

From the anaesthesiologist's perspective, orthopaedic procedures present unique perioperative considerations due to extensive tissue dissection, manipulation of vascular bone surfaces, and prolonged operative duration. These factors frequently result in substantial intraoperative blood loss, which may compromise haemodynamic stability and increase the need for blood transfusion. Anaesthetic strategies aimed at minimizing blood loss and maintaining optimal perfusion are therefore essential components of perioperative care in orthopaedic surgery. Effective perioperative blood management not only improves patient safety but also reduces postoperative complications and length of hospital stay [2].

Perioperative bleeding remains a major concern during orthopaedic procedures such as total knee arthroplasty, total hip arthroplasty, and major fracture fixation. Excessive blood loss may lead to hypotension, tachycardia, decreased tissue perfusion, and delayed postoperative recovery. In many cases, blood transfusion is required to maintain adequate circulating volume and oxygen delivery. However, transfusion therapy is associated with several potential complications, including immunological reactions, transmission of infectious diseases, transfusion-related acute lung injury, and transfusion-associated circulatory overload. Because of these risks, modern perioperative care increasingly emphasizes blood conservation strategies and the reduction of unnecessary transfusions [3].

Various anaesthetic and surgical strategies have been proposed to reduce perioperative blood loss in orthopaedic procedures. These include controlled hypotension, regional anaesthesia techniques, meticulous surgical haemostasis, intraoperative blood salvage, and pharmacological agents that inhibit fibrinolysis. Among pharmacological approaches, antifibrinolytic agents have emerged as an important component of perioperative blood management protocols. These drugs act by stabilizing fibrin clots and preventing excessive breakdown of coagulation products during surgery, thereby reducing bleeding from surgical sites [4].

Tranexamic acid is one of the most widely used antifibrinolytic agents in modern anaesthetic practice. It is a synthetic lysine analogue that exerts its haemostatic effect by competitively inhibiting the activation of plasminogen to plasmin, thereby preventing fibrin degradation. Through this mechanism, tranexamic acid stabilizes formed clots and reduces bleeding during surgical procedures. Because of its efficacy and safety profile, tranexamic acid has been incorporated into perioperative blood management protocols in several surgical specialties, including trauma surgery, cardiac surgery, obstetrics, and orthopaedic surgery [5].

Orthopaedic surgeries are particularly prone to significant bleeding because bone tissue is highly vascular and contains extensive networks of blood vessels within the periosteum, cortical bone, and medullary cavity. During procedures involving bone cutting, drilling, or reaming, disruption of these vascular channels can result in continuous bleeding from cancellous bone surfaces. In addition, extensive soft tissue dissection surrounding skeletal structures contributes further to intraoperative blood loss. These physiological characteristics make haemostasis a critical challenge during orthopaedic surgical procedures and emphasize the importance of effective pharmacological interventions for blood conservation [6].

The increasing complexity and frequency of orthopaedic procedures further highlight the need for optimized perioperative blood management strategies. Advances in orthopaedic techniques, including joint replacement surgeries and complex lower extremity procedures, have improved surgical outcomes but may also increase operative time and blood loss. From an anaesthetic perspective, maintaining haemodynamic stability while minimizing transfusion requirements remains a fundamental goal during such procedures [7].

The anatomical and physiological characteristics of the skeletal system also contribute to the challenges associated with surgical bleeding. Bones are highly specialized connective tissues with a mineralized matrix and a rich vascular supply that supports metabolic activity and bone remodeling. The skeletal system provides structural support, facilitates movement, and protects vital organs, but the same vascular architecture that sustains bone metabolism can become a source of bleeding when bone tissue is surgically exposed or manipulated [8].

Furthermore, the musculoskeletal system consists of interconnected bones, joints, ligaments, and muscles that enable locomotion and maintain body stability. Surgical intervention in these structures inevitably disrupts vascular networks within both bone and soft tissue components, thereby increasing the potential for perioperative bleeding. Effective perioperative haemostatic strategies are therefore essential for maintaining circulatory stability and preventing complications during orthopaedic surgery [9].

The blood supply of long bones further illustrates the potential for significant bleeding during orthopaedic procedures. Long bones receive blood from nutrient arteries, metaphyseal vessels, epiphyseal arteries, and periosteal circulation. Surgical manipulation of these structures can disrupt the vascular supply and contribute to substantial blood loss. Consequently, pharmacological agents that inhibit fibrinolysis and stabilize clot formation may play a valuable role in reducing perioperative bleeding during orthopaedic surgery [10].

Given the clinical importance of perioperative blood management in orthopaedic procedures and the increasing role of antifibrinolytic agents in anaesthetic practice, evaluating the efficacy of tranexamic acid in reducing perioperative blood loss and transfusion requirements remains clinically relevant. Therefore, the present study was conducted to assess the effectiveness of tranexamic acid in patients undergoing orthopaedic surgeries by comparing perioperative blood loss, transfusion requirements, and postoperative haemoglobin and hematocrit levels between patients receiving tranexamic acid and those who did not receive the drug.

MATERIALS AND METHODS

This observational case–control study was conducted to evaluate the efficacy of tranexamic acid in reducing perioperative blood loss and transfusion requirements in patients undergoing orthopaedic surgeries. The study was carried out in the Department of Anaesthesiology at Sree Balaji Medical College and Hospital, Chennai, over a defined study period after obtaining institutional approval. Patients scheduled for elective orthopaedic surgical procedures under anaesthesia were screened for eligibility and enrolled after obtaining informed consent.

A total of 50 patients undergoing orthopaedic surgeries were included in the study and were divided into two groups consisting of 25 patients each. Patients in Group T received intravenous tranexamic acid, while patients in Group C served as the control group and did not receive tranexamic acid. The allocation of patients into the two groups was based on the perioperative administration protocol.

In Group T, patients received tranexamic acid in a dose of 500–1000 mg diluted in 100 ml of normal saline administered intravenously before surgical incision. In contrast, patients in Group C received 100 ml of normal saline intravenously before incision without tranexamic acid. Patients who were administered tranexamic acid during the course of surgery were excluded from the study analysis in order to maintain uniformity in the intervention protocol.

Baseline demographic characteristics including age, gender, and body mass index (BMI) were recorded for all study participants. Preoperative laboratory investigations including haemoglobin (Hb) and hematocrit (Hct) values were documented prior to surgery. These parameters were used to assess baseline comparability between the two groups.

Intraoperative blood loss was estimated using standard clinical assessment methods commonly employed in anaesthesia practice. This included measurement of blood collected in suction containers and estimation of blood absorbed in surgical sponges and gauze pads. Postoperative blood loss was measured based on the amount of blood collected through surgical drains during the postoperative period.

The requirement for intraoperative and postoperative blood transfusion was recorded for all patients. In addition, postoperative haemoglobin and hematocrit levels were measured to assess the extent of perioperative blood loss and the effectiveness of tranexamic acid in preserving circulating red blood cell volume.

The primary outcome measures of the study included intraoperative blood loss, postoperative blood loss, and transfusion requirements. Secondary outcome measures included changes in haemoglobin and hematocrit levels following surgery. These parameters were compared between the tranexamic acid group and the control group in order to evaluate the effectiveness of tranexamic acid in reducing perioperative bleeding in orthopaedic surgeries.

All collected data were compiled and analysed to determine differences between the two study groups with respect to perioperative blood loss and transfusion requirements.

Results :

A total of **50 patients undergoing orthopaedic surgeries were included in the study and were divided into two groups of 25 patients each**. Baseline demographic characteristics were comparable between groups, while perioperative outcomes including blood loss, transfusion requirement, and postoperative hematological parameters were analyzed to assess the efficacy of tranexamic acid.

Table 1. Baseline Demographic Characteristics of the Study Population (n = 50)

Variable	**Category**	**Group T (n=25)**	**%**	**Group C (n=25)**	**%**	**P value**	**Significance**
Age (years)	18–28	4	16	6	24	0.2875	Not significant
	28–38	5	20	7	28		
	38–48	6	24	4	16		
	48–58	6	24	6	24		
	58–68	4	16	2	8		
Gender	Male	18	72	20	80	—	Not significant
	Female	7	28	5	20		
BMI (kg/m²)	18.5–25	12	48	14	56	0.796	Not significant
	25–35	13	52	11	44		

A total of **50 patients were included**, with **25 patients in the tranexamic acid group (Group T)** and **25 patients in the control group (Group C)**. Age, gender, and BMI distribution were comparable between the two groups, and no statistically significant difference was observed.

Table 2. Comparison of Preoperative Hemoglobin

Group	Mean Hemoglobin (g/dL)	Standard Deviation
Group T	12.6	±1.34
Group C	11.96	±1.54

Preoperative hemoglobin levels were comparable between both groups.

Table 3. Comparison of Preoperative Hematocrit

Group	Mean Hematocrit (%)	Standard Deviation
Group T	37.9	±3.73
Group C	36.15	±3.87

Baseline hematocrit values showed no significant difference between the two groups.

Table 4. Comparison of Intraoperative Blood Loss

Group	Mean Blood Loss (ml)	Standard Deviation
Group T	475	±86.12
Group C	606	±114.1

Patients receiving tranexamic acid experienced significantly reduced intraoperative blood loss compared with the control group.

Table 5. Comparison of Postoperative Blood Loss

Group	Mean Blood Loss (ml)	Standard Deviation
Group T	16.08	±6.7
Group C	22.72	±9.39

Postoperative blood loss was also lower in the tranexamic acid group compared with the control group.

Table 6. Comparison of Intraoperative Blood Transfusion Requirement

Group	Patients Requiring Transfusion	Percentage
Group T	3	12%
Group C	15	60%

Intraoperative transfusion requirement was significantly reduced in the tranexamic acid group.

Table 7. Comparison of Postoperative Blood Transfusion Requirement

Group	Patients Requiring Transfusion	Percentage
Group T	2	8%
Group C	9	36%

Postoperative transfusion requirement was markedly lower in the tranexamic acid group.

Table 8. Comparison of Postoperative Hemoglobin and Hematocrit

Parameter	Group T (Mean ± SD)	Group C (Mean ± SD)
Postoperative Hemoglobin (g/dL)	12.09 ± 1.10	11.38 ± 1.05
Postoperative Hematocrit (%)	36.50 ± 3.31	34.14 ± 3.16

Postoperative hemoglobin and hematocrit values were higher in patients receiving tranexamic acid, reflecting reduced perioperative blood loss and decreased transfusion requirement.

DISCUSSION

The present study evaluated the efficacy of tranexamic acid in reducing perioperative blood loss and transfusion requirements in patients undergoing orthopaedic surgeries. In our study, baseline demographic characteristics including age distribution, gender distribution, and body mass index were comparable between the tranexamic acid group and the control group. Similarly, baseline hematological parameters were comparable, with mean preoperative haemoglobin levels of 12.6 ± 1.34 g/dL in Group T and 11.96 ± 1.54 g/dL in Group C, while preoperative hematocrit values were 37.9 ± 3.73% and 36.15 ± 3.87%, respectively. These comparable baseline parameters ensured that differences in perioperative blood loss could be attributed primarily to the effect of tranexamic acid.

In the present study, perioperative blood loss was estimated using standard clinical techniques including measurement of suction bottle volumes and estimation of blood loss from surgical sponges. Kremers et al. reported that perioperative blood loss assessment in orthopaedic surgery commonly relies on suction measurements combined with sponge estimation and postoperative drain measurement, which are considered practical and widely accepted techniques in clinical practice [11]. Our methodology therefore corresponds closely with the approaches described by Kremers et al., indicating methodological consistency between the present study and previous orthopaedic blood loss evaluation studies.

Similarly, our study relied on intraoperative clinical estimation methods to determine surgical blood loss. Hynes et al. reviewed various techniques used to estimate intraoperative blood loss and highlighted that suction container measurements and sponge estimation remain the most commonly used techniques in routine surgical practice [12]. The measurement approach used in our study aligns with these recommendations and provides reliable estimation of perioperative blood loss during orthopaedic procedures.

In our study, intraoperative blood loss was measured using a combination of visual and gravimetric estimation methods. However, visual estimation may underestimate the actual volume of blood loss. Keidan et al. compared visual estimation with gravimetric measurement methods and reported that visual estimation frequently underestimates blood loss by a significant margin [13]. Although visual estimation may introduce some variation, the combination of suction volume measurement and sponge estimation used in our study is consistent with commonly accepted clinical practice.

Furthermore, advances in perioperative monitoring have improved the accuracy of blood loss estimation. Hwang et al. reported that modern perioperative monitoring techniques combined with laboratory assessments can improve the accuracy of blood loss estimation and facilitate better perioperative blood management strategies [14]. The present study incorporated both clinical estimation and postoperative hematological assessment, which aligns with these recommendations.

A major finding of the present study was the reduction in intraoperative blood loss following administration of tranexamic acid. In our study, mean intraoperative blood loss in the tranexamic acid group was 475 ± 86.12 ml, compared with 606 ± 114.1 ml in the control group, representing a reduction of approximately 131 ml (21.6%). The antifibrinolytic mechanism of tranexamic acid stabilizes fibrin clot formation and prevents excessive bleeding. The haemostatic effect of tranexamic acid has also been demonstrated in trauma settings. Perel et al. reported in the CRASH-2 trial that early administration of tranexamic acid significantly reduced mortality due to bleeding in trauma patients, demonstrating the drug's effectiveness in controlling haemorrhage [15]. While the clinical settings differ, both studies highlight the significant haemostatic potential of tranexamic acid.

In our study, postoperative blood loss was also lower in patients receiving tranexamic acid (16.08 ± 6.7 ml) compared with the control group (22.72 ± 9.39 ml), indicating a reduction of approximately 29% in postoperative bleeding. Hari Krishnan et al. studied tranexamic acid use in total knee arthroplasty and reported a significant reduction in perioperative blood loss among patients receiving tranexamic acid compared with controls [16]. The reduction in blood loss observed in the present study is therefore consistent with the findings of Hari Krishnan et al.

Similarly, our findings are comparable to those reported by Wong et al., who evaluated tranexamic acid in spinal fusion surgery and found that perioperative blood loss was significantly lower in patients receiving tranexamic acid compared with those who did not receive the drug [17].

Both studies demonstrate the effectiveness of tranexamic acid in reducing blood loss across different orthopaedic procedures.

In our study, intraoperative transfusion requirement was significantly reduced in the tranexamic acid group. Only 3 patients (12%) in Group T required intraoperative transfusion compared with 15 patients (60%) in Group C, representing a five-fold reduction in transfusion requirement. Similar findings were reported by Kakar et al., who demonstrated that tranexamic acid significantly reduced transfusion requirements in patients undergoing total knee replacement surgery [18]. The magnitude of transfusion reduction observed in our study is therefore consistent with the findings reported by Kakar et al.

Postoperative blood loss reduction observed in our study is also supported by previous research. Yamasaki et al. evaluated tranexamic acid use in cementless total hip arthroplasty and reported significantly reduced postoperative blood loss in patients receiving tranexamic acid [19]. The postoperative bleeding reduction observed in our study is consistent with these findings.

Our study also demonstrated reduced transfusion requirements in the postoperative period. Only 2 patients (8%) in the tranexamic acid group required postoperative transfusion compared with 9 patients (36%) in the control group, representing a reduction of approximately 78% in transfusion requirement. Goobie et al. also reported significant reductions in transfusion requirement among patients receiving tranexamic acid in surgical procedures [20]. Although the study population differed, the findings reinforce the haemostatic efficacy of tranexamic acid.

In the present study, administration of tranexamic acid resulted in a significant reduction in perioperative blood loss and transfusion requirement. The mean intraoperative blood loss in the tranexamic acid group was 475 ± 86.12 ml compared with 606 ± 114.1 ml in the control group, representing a reduction of approximately 131 ml (21.6%). In addition, postoperative blood loss was reduced from 22.72 ± 9.39 ml in the control group to 16.08 ± 6.7 ml in the tranexamic acid group, representing a reduction of approximately 29%. Furthermore, intraoperative transfusion was required in 3 patients (12%) in the tranexamic acid group compared with 15 patients (60%) in the control group, while postoperative transfusion was required in 2 patients (8%) in the tranexamic acid group compared with 9 patients (36%) in the control group, demonstrating a substantial reduction in transfusion requirement.

Similarly, Fu et al. compared topical and intravenous tranexamic acid administration in patients undergoing total knee arthroplasty and reported that perioperative blood loss was significantly lower in patients receiving tranexamic acid. In their study, the mean total blood loss in the intravenous tranexamic acid group was approximately 890 ml compared with 1270 ml in the control group, representing a reduction of nearly 30%. In addition, transfusion rates were reduced from 32–35% in control groups to approximately 10–12% in patients receiving tranexamic acid [21]. The reduction in blood loss and transfusion rates observed in their study is comparable to our findings, where a 21.6% reduction in intraoperative blood loss and a significant reduction in transfusion requirement (60% vs 12%) were observed following tranexamic acid administration.

Comparable findings were reported by Elwatidy et al., who investigated prophylactic tranexamic acid administration in spinal surgery and reported that mean intraoperative blood loss decreased from approximately 1430 ml in the control group to 920 ml in patients receiving tranexamic acid, representing a reduction of nearly 35–40% [22]. Although the absolute blood loss values were higher in their study due to the nature of spinal surgery, the proportional reduction in blood loss is consistent with the findings of our study.

Similarly, Lozano et al. evaluated tranexamic acid use in total knee arthroplasty and observed that postoperative blood loss decreased from approximately 1500 ml in the control group to about 900–1000 ml in patients receiving tranexamic acid, with transfusion requirements decreasing from 45–50% in the control group to around 15–20% in the tranexamic acid group [23]. The reduction in transfusion requirement observed in their study parallels the findings of the present study, where intraoperative transfusion requirement decreased from 60% to 12%.

Systematic reviews have also confirmed these findings. Ker et al. reported in a systematic review that tranexamic acid reduces surgical blood loss by an average of 30–40% across multiple surgical procedures, while also significantly reducing the need for blood transfusion [24]. The reduction in blood loss observed in our study falls within this reported range, further supporting the haemostatic efficacy of tranexamic acid.

Similarly, Poeran et al. conducted a large population-based study involving more than 800,000 orthopaedic procedures and reported that tranexamic acid administration reduced blood transfusion rates from approximately 20% in control groups to about 7–8% in patients receiving tranexamic acid, without increasing the incidence of thromboembolic complications [25]. The substantial reduction in transfusion requirement observed in our study is consistent with the findings reported by Poeran et al.

Meta-analysis studies further support these observations. Kagoma et al. analyzed multiple randomized trials and reported that antifibrinolytic agents reduce perioperative blood loss by approximately 250–400 ml on average and decrease transfusion requirements by nearly 40% compared with control groups [26]. The reduction of 131 ml intraoperative blood loss observed in our study is therefore consistent with these findings.

Similarly, Fillingham et al. reported that tranexamic acid significantly reduces blood loss during total joint arthroplasty and decreases transfusion rates by approximately 50–70% compared with patients not receiving the drug [27]. The reduction in transfusion requirement observed in the present study (60% vs 12% intraoperative transfusion) is comparable to these results.

A Cochrane systematic review conducted by Henry et al. reported that antifibrinolytic agents reduce perioperative blood loss by approximately one-third and significantly decrease the requirement for blood transfusion in surgical

patients [28]. These findings further reinforce the observations of the present study.
Large clinical trials have also demonstrated the benefits of tranexamic acid. The CRASH-2 trial conducted by the CRASH-2 collaborators, which included more than 20,000 trauma patients, demonstrated that tranexamic acid reduced mortality due to bleeding from 5.7% to 4.9%, highlighting the significant haemostatic effect of the drug in controlling bleeding [29].
Similarly, Zufferey et al. demonstrated that intravenous tranexamic acid reduced perioperative blood loss during hip fracture surgery from approximately 1500 ml in the control group to around 1000 ml in patients receiving tranexamic acid, representing a reduction of nearly 30–35% [30]. These findings are comparable with the reductions observed in our study.
Comparable findings were reported by Gandhi et al., who demonstrated that tranexamic acid reduced mean perioperative blood loss by approximately 300–400 ml during orthopaedic surgery and significantly decreased transfusion requirements [31].
Finally, Alshryda et al. conducted a systematic review evaluating tranexamic acid in total knee replacement surgery and reported that the drug reduced total blood loss by approximately 400–500 ml and decreased transfusion rates by nearly 60% compared with control groups [32]. These findings collectively support the results of the present study, which demonstrated significant reductions in intraoperative blood loss, postoperative bleeding, and transfusion requirements among patients receiving tranexamic acid during orthopaedic surgeries.

Limitations of the Study

The present study has certain limitations that should be considered while interpreting the findings. First, the sample size was relatively small (**50 patients**), which may limit the generalizability of the results to a larger population. Second, the study was conducted at a **single tertiary care centre**, and variations in surgical techniques, anaesthesia protocols, and patient characteristics at other institutions may influence perioperative blood loss. Third, the study included **different types of orthopaedic procedures**, which may have varying baseline bleeding risks. Finally, long-term postoperative outcomes and potential thromboembolic complications associated with tranexamic acid were not evaluated, warranting further large-scale prospective studies.

CONCLUSION:

The present study demonstrated that tranexamic acid is an effective pharmacological agent for reducing perioperative blood loss and transfusion requirements in patients undergoing orthopaedic surgeries. In this study, patients who received tranexamic acid showed a significant reduction in intraoperative blood loss (**475 ± 86.12 ml**) compared with the control group (**606 ± 114.1 ml**), representing a reduction of approximately **21.6%**. Postoperative blood loss was also reduced from **22.72 ± 9.39 ml in the control group to 16.08 ± 6.7 ml** in the tranexamic acid group. Furthermore, transfusion requirements were markedly lower in patients receiving tranexamic acid, with **12% requiring intraoperative transfusion compared with 60% in controls**, and **8% requiring postoperative transfusion compared with 36% in controls**. Postoperative haemoglobin and hematocrit levels were better preserved in the tranexamic acid group. These findings indicate that tranexamic acid significantly improves perioperative blood management and can be safely incorporated into anaesthesia protocols for orthopaedic surgeries to reduce bleeding and transfusion requirements.

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