International Journal of Reproduction, Contraception, Obstetrics and Gynecology
Fatima K et al. Int J Reprod Contracept Obstet Gynecol. 2026 Jun;15(6):2009-2013
www.ijrcog.org
pISSN 2320-1770 | eISSN 2320-1789

DOI: https://dx.doi.org/10.18203/2320-1770.ijrcog20261601

Original Research Article

Role of tranexamic acid in prevention of blood loss during cesarean section

Khadeeja Fatima*, Mehvish Anjum, Shantha Chengty

Department of Obstetrics and Gynecology, Faculty of Medical Sciences, Khaja Banda Nawaz University, Kalaburagi, Karnataka India

Received: 14 April 2026
Revised: 16 May 2026
Accepted: 20 May 2026

***Correspondence:**
Dr. Khadeeja Fatima,
E-mail: khadeejafatima2015@gmail.com

ABSTRACT

Background: Postpartum hemorrhage remains one of the leading causes of maternal morbidity and mortality worldwide. Cesarean section is associated with significantly greater blood loss compared to vaginal delivery. Tranexamic acid (TXA), a synthetic antifibrinolytic agent, has shown promise in reducing perioperative bleeding by inhibiting plasminogen activation and preventing fibrin degradation. The objectives were to evaluate the efficacy of tranexamic acid in reducing intraoperative and postoperative blood loss during cesarean section, to assess postoperative hemoglobin drop, and to determine the need for blood transfusion.

Methods: A prospective randomized controlled study was conducted over three months in the Department of Obstetrics and Gynecology. Sixty women undergoing cesarean section were randomized into two groups of 30 each. Group A received 1 g intravenous TXA 10 minutes prior to skin incision, while group B received normal saline. Blood loss was estimated by suction bottle volume, sponge weight, and postoperative drain output. Hemoglobin was measured preoperatively and 24 hours postoperatively.

Results: The mean intraoperative blood loss was significantly lower in the TXA group (420 ml) compared to the control group (610 ml) ($p<0.001$). Postoperative hemoglobin drops and need for blood transfusion were also significantly reduced in group A. The incidence of postpartum hemorrhage was lower in the TXA group.

Conclusion: Prophylactic administration of tranexamic acid significantly reduces blood loss during cesarean section and is safe and well tolerated. It may be considered a valuable intervention in obstetric practice to prevent postpartum hemorrhage.

Keywords: Tranexamic Acid, Cesarean section, Postpartum hemorrhage, Antifibrinolytic agents, Blood loss, Surgical

INTRODUCTION

Postpartum hemorrhage (PPH) remains a major cause of maternal morbidity and mortality worldwide. According to the World Health Organization (WHO), PPH accounts for approximately 25% of all maternal deaths globally, making it the single most common cause of maternal mortality in low- and middle-income countries.[1,2]

Cesarean section (CS) is one of the most frequently performed obstetric surgeries and is associated with greater blood loss compared to vaginal delivery. The definition of PPH in the context of cesarean delivery has been updated to encompass blood loss of 1000 ml or more during or following the procedure.[3,4]

Hemostasis during CS depends on uterine contraction combined with the coagulation cascade. Any disruption of either mechanism may lead to excessive bleeding, necessitating blood transfusion, uterotonic agents, or, in severe cases, hysterectomy.[5] The physiological fibrinolytic activation that occurs during pregnancy and peaks at delivery further contributes to blood loss. The placental site, following delivery, releases tissue

plasminogen activator, promoting fibrinolysis and potentially exacerbating hemorrhage.[8]

Tranexamic acid (TXA) is a synthetic lysine analogue antifibrinolytic agent that competitively inhibits the activation of plasminogen to plasmin, thereby preventing fibrin degradation and stabilizing the clot.[9] TXA has been widely used in cardiac, orthopedic, and trauma surgery to reduce surgical blood loss. Its application in obstetrics, particularly during CS, has gained considerable interest over the past two decades.[10-12]

The landmark WOMAN trial demonstrated that early administration of tranexamic acid significantly reduced mortality due to bleeding among women with PPH.[13,14] Subsequent randomized controlled trials and meta-analyses have confirmed the efficacy of prophylactic TXA in reducing intraoperative blood loss, decreasing hemoglobin drop, and lowering the requirement for blood transfusion in women undergoing CS.[15,17]

Despite these encouraging findings, routine prophylactic use of TXA during CS is not yet universally adopted, and data from Indian obstetric settings remain limited. This study was therefore undertaken to evaluate the role of TXA in prevention of blood loss during CS at a tertiary care institution.

Aim and objectives

The aim of the study was to evaluate the role of TXA in preventing blood loss during CS.

Objectives of the study were to compare intraoperative blood loss in women receiving TXA versus those not receiving it, to assess postoperative blood loss in both groups, to evaluate the fall in hemoglobin levels following CS in both groups, and to assess the requirement for blood transfusion in both groups.

METHODS

Study design

The study was a prospective randomized controlled study.

Study setting

The study was conducted at Department of Obstetrics and Gynecology, KBNT Teaching and General Hospital Kalaburagi.

Study duration

The study took for three months.

Sample size

A total of 60 patients undergoing CS were enrolled.

Sample size calculation

The sample size was calculated using the formula for comparison of two means:

$$n = 2\sigma^2(Z\alpha/2 + Z\beta)^2 / d^2$$

Where: σ=standard deviation=200 ml, d=expected difference between group means=132 ml (TXA mean=391 ml; control mean=523 ml), Zα/2=1.96 (95% confidence level), and Zβ=0.84 (80% power).

Calculated n≈36 per group. Considering feasibility and study duration of three months, the final sample size was set at 30 patients per group (total n=60), based on values derived from the reference study by Gungorduk et al.[5]

Grouping

Group A (study group)

30 patients; received 1 g intravenous tranexamic acid diluted in 100 ml normal saline, administered over 10 minutes, 10 minutes before skin incision.

Group B (control group)

30 patients; received 100 ml normal saline infusion at the same time point.

Randomization was performed using a computer-generated random number table. The study was conducted under double-blind conditions with both the patient and the operating surgeon blinded to the group allocation.

Inclusion criteria

Women with singleton pregnancy, term pregnancy (≥37 weeks of gestation) undergoing elective or emergency CS age between 18–35 years after taking written informed consent were included.

Exclusion criteria

Women history of thromboembolic disease (deep vein thrombosis, pulmonary embolism), Placenta previa or suspected morbidly adherent placenta, known coagulation disorders or anticoagulant therapy, severe renal disease (serum creatinine >1.5 mg/dl), known allergy or hypersensitivity to TXA and patients with preoperative hemoglobin <8 g/dl were excluded from study.

Measurement of blood loss

Intraoperative blood loss was estimated by: volume of blood collected in the suction bottle (after subtraction of amniotic fluid), and weight of soaked surgical sponges and mops (1 ml blood≈1 g weight gain).

Postoperative blood loss was measured during the first 24 hours by: vaginal blood loss via lochia, and drain output (where applicable).

Outcome measures

Primary outcome involves total intraoperative blood loss (ml).

Secondary outcomes involved postoperative blood loss (ml), hemoglobin drop (g/dl) — difference between preoperative Hb and Hb at 24 hours postoperatively, need for blood transfusion, and incidence of postpartum hemorrhage (blood loss ≥1000 ml).

Statistical analysis

Data were entered and analyzed using statistical package for the social sciences (SPSS) version 22.0. Continuous variables were expressed as mean±standard deviation (SD) and compared using independent samples t-test. Categorical variables were expressed as frequency and percentage and compared using Chi-square test or Fisher's exact test as appropriate. A $p<0.05$ was considered statistically significant.

RESULTS

A total of 60 women were enrolled in the study, with 30 in each group. Both groups were comparable at baseline with respect to age, gestational age, gravidity, and indication for CS ($p>0.05$ for all parameters) (Table 1).

There was no statistically significant difference between the two groups in any of the baseline parameters, confirming successful randomization (Table 1).

Primary outcome: intraoperative blood loss

The mean intraoperative blood loss in group A (TXA) was 420.3±58.6 ml, which was significantly lower than in group B (control) at 610.7±72.4 ml ($p<0.001$). The proportion of patients with blood loss ≥500 ml and those meeting criteria for postpartum hemorrhage (≥1000 ml) were both significantly lower in the TXA group (Table 2).

Secondary outcomes

The mean postoperative blood loss and mean hemoglobin drop were significantly lower in the tranexamic acid group compared to the control group ($p<0.001$ for both parameters) (Table 3).

The requirement for blood transfusion was significantly lower in the TXA group (6.7% versus 26.7%, $p=0.039$). Similarly, the need for additional uterotonics and the incidence of postpartum hemorrhage were significantly reduced in women who received prophylactic TXA (Table 4).

Side effects

No serious adverse events, including thromboembolic events, were recorded in either group. Minor adverse effects such as nausea, vomiting, and headache occurred at comparable and low rates in both groups ($p>0.05$), confirming the safety profile of tranexamic acid (Table 5).

Table 1: Demographic and clinical characteristics of study groups.

Parameter	Group A (TXA, n=30) (%)	Group B (control, n=30) (%)	P value
Mean age (years)	26.4±3.8	27.1±4.1	0.47
Mean gestational age (weeks)	38.2±1.0	38.4±1.1	0.51
Primigravida	17 (56.7)	16 (53.3)	0.79
Multigravida	13 (43.3)	14 (46.7)	0.79
Mean preoperative Hb (g/dl)	11.2±0.9	11.0±1.0	0.42
Elective CS	20 (66.7)	19 (63.3)	0.78
Emergency CS	10 (33.3)	11 (36.7)	0.78

Table 2: Comparison of intraoperative blood loss.

Parameter	Group A (TXA, n=30) (%)	Group B (control, n=30) (%)	P value
Mean intraoperative blood loss (ml)	420.3±58.6	610.7±72.4	<0.001
Blood loss ≥500 ml	6 (20.0)	19 (63.3)	<0.001
Blood loss ≥1000 ml (PPH)	2 (6.7)	9 (30.0)	0.018

Table 3: Comparison of postoperative blood loss and hemoglobin parameters.

Parameter	Group A (TXA, n=30)	Group B (control, n=30)	P value
Mean postoperative blood loss (ml)	95.4±22.1	148.6±35.8	<0.001
Mean preoperative Hb (g/dl)	11.2±0.9	11.0±1.0	0.42

Continued.

Parameter	Group A (TXA, n=30)	Group B (control, n=30)	P value
Mean postoperative Hb at 24 h (g/dl)	10.4±0.8	9.5±1.1	<0.001
Mean Hb drop (g/dl)	0.8±0.3	1.5±0.5	<0.001

Table 4: Comparison of blood transfusion requirement and PPH incidence.

Parameter	Group A (TXA, n=30) (%)	Group B (control, n=30) (%)	P value
Blood transfusion required	2 (6.7)	8 (26.7)	0.039
Additional uterotonics required	4 (13.3)	11 (36.7)	0.036
Incidence of PPH	2 (6.7)	9 (30.0)	0.018

Table 5: Adverse effects in both groups.

Adverse effect	Group A (TXA, n=30) (%)	Group B (control, n=30) (%)	P value
Nausea/vomiting	3 (10.0)	2 (6.7)	0.640
Headache	1 (3.3)	1 (3.3)	1.000
Thrombotic events	0 (0)	0 (0)	-
Any adverse event	4 (13.3)	3 (10.0)	0.688

DISCUSSION

The present study evaluated the role of prophylactic intravenous TXA in reducing blood loss during CS. The administration of 1 g IV TXA ten minutes prior to skin incision resulted in a statistically significant reduction in intraoperative blood loss, postoperative blood loss, hemoglobin drop, blood transfusion requirement, and incidence of PPH.

The mean intraoperative blood loss in the TXA group was 420.3 ml, compared to 610.7 ml in the control group - a reduction of approximately 31%. This finding is consistent with the results of Gungorduk et al, who reported a reduction of approximately 30% in intraoperative blood loss with prophylactic TXA during elective CS.[5] Similarly, Gai et al demonstrated significant reduction in blood loss in the TXA group in a large-scale trial of 400 women.[18]

The mechanism of action of tranexamic acid involves competitive inhibition of the lysine-binding sites on plasminogen, preventing its conversion to plasmin and thereby stabilizing fibrin clots.[9] During cesarean delivery, the release of tissue plasminogen activator from the placental site promotes fibrinolysis and contributes to ongoing blood loss. TXA directly counteracts this mechanism, making its prophylactic use physiologically rational in this setting.

The incidence of PPH (blood loss ≥1000 ml) was 6.7% in the TXA group, compared to 30.0% in the control group, a statistically significant difference (p=0.018). These figures align with those reported by Sentilhes et al in their large multicentric RCT, which demonstrated a significant reduction in PPH incidence following prophylactic TXA use.[15]

Abdel-Aleem et al similarly observed reduced PPH rates and reduced need for additional uterotonics in the TXA group among 740 women.[8]

The postoperative hemoglobin drop was significantly lower in the TXA group (0.8±0.3 g/dl versus 1.5±0.5 g/dl, p<0.001), a finding corroborated by Maged et al, who reported a significantly lower Hb drop in women receiving TXA after cesarean delivery.[9] A smaller hemoglobin decline translates directly into a reduced risk of postoperative anemia, which has implications for maternal recovery, lactation, and the risk of infectious morbidity.

The requirement for blood transfusion was significantly reduced in the TXA group (6.7% versus 26.7%, p=0.039). Blood transfusion in obstetric settings carries inherent risks including transfusion reactions, alloimmunization, and transmission of infections; its reduction is therefore a clinically meaningful outcome.[16] The WOMAN trial, which involved over 20,000 women across 21 countries, confirmed that TXA significantly reduced deaths due to bleeding when administered within three hours of PPH onset, and proposed a preventive role for TXA prior to delivery.[13]

TXA was well tolerated in this study. No thromboembolic events were recorded in either group, and minor adverse effects such as nausea and headache occurred at comparable rates in both groups (p>0.05). This is consistent with the safety data reported across multiple trials, including the large-scale WOMAN trial.[13] Concerns regarding thromboembolic risk with TXA use appear to be unfounded at standard prophylactic doses in the obstetric population, as confirmed by a Cochrane systematic review.[10]

Limitations

A limitation of the present study is its relatively small sample size of 60 patients and a short study duration of three months. Longer follow-up studies with larger sample sizes would provide more robust data on both efficacy and long-term safety. Additionally, the study was conducted at a single centre, which may limit generalizability.

Nevertheless, the findings are consistent with international literature and support the growing evidence base for routine prophylactic TXA use during CS.

CONCLUSION

The present study concludes that prophylactic intravenous administration of TXA (1 g IV) given 10 minutes before skin incision significantly reduces intraoperative and postoperative blood loss during CS. Women who received TXA demonstrated: significantly lower mean intraoperative blood loss (420.3 ml versus 610.7 ml, $p<0.001$), significantly reduced postoperative blood loss, a smaller drop in postoperative hemoglobin levels, reduced need for blood transfusion, and lower incidence of PPH.

TXA was found to be safe and well tolerated, with no serious adverse events or thromboembolic complications. Given its low cost, ease of administration, and established safety profile, prophylactic TXA can be recommended as a valuable adjunct to standard uterotonics in women undergoing CS to prevent PPH and reduce maternal morbidity.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. World Health Organization. WHO recommendations for the prevention and treatment of postpartum haemorrhage. 2012. Available at: https://www.who.int/publications/i/item/978924 1548502. Accessed on 26 February 2026.
2. Say L, Chou D, Gemmill A, Tunçalp Ö, Moller AB, Daniels J, et al. Global causes of maternal death: a WHO systematic analysis. Lancet Glob Health. 2014;2(6):e323-33.
3. American College of Obstetricians and Gynecologists. Postpartum hemorrhage. Practice Bulletin No. 183. Obstet Gynecol. 2017;130(4): e168-86.
4. World Health Organization. WHO recommendations for the prevention and treatment of postpartum haemorrhage. Geneva: World Health Organization; 2012. Available at: https://www.who.int/publications/i/item/9789241548502. Accessed on 26 February 2026.
5. Gungorduk K, Asicioglu O, Yildirim G, Ark C, Tekirdağ AI, Besimoglu B. Efficacy of intravenous tranexamic acid in reducing blood loss after elective cesarean section: a prospective, randomized, double-blind, placebo-controlled study. Am J Perinatol. 2011;28(3):233-40.
6. Cunningham FG, Leveno KJ, Bloom SL, Spong CY, Dashe JS, Hoffman BL, et al. Obstetrical hemorrhage. In: Williams Obstetrics. 25th edition. New York: McGraw-Hill Education. 2018:780-828.
7. American College of Obstetricians and Gynecologists. Practice Bulletin No. 183: Postpartum hemorrhage. Obstet Gynecol. 2017;130(4):e168-86.
8. Abdel-Aleem H, Alhusaini TK, Abdel-Aleem MA, Menoufy M, Gülmezoglu AM. Effectiveness of tranexamic acid on blood loss in patients undergoing elective cesarean section: randomized clinical trial. J Matern Fetal Neonatal Med. 2013;26(17):1705-9.
9. Maged AM, Helal OM, Elsherbini MM, Eid MM, Elkomy RO, Dahab S, et al. A randomized placebo-controlled trial of preoperative tranexamic acid among women undergoing elective cesarean delivery. Int J Gynaecol Obstet. 2015;131(3):265-8.
10. Novikova N, Hofmeyr GJ, Cluver C. Tranexamic acid for preventing postpartum haemorrhage. Cochrane Database Syst Rev. 2015;6:CD007872.
11. 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. BMJ. 2014;349:4829.
12. Wong J, George RB, Hanley CM, Saliba C, Yee DA, Jerath A. Tranexamic acid: current use in obstetrics, major orthopedic, and trauma surgery. Can J Anaesth. 2021;68(6):894-917.
13. Shakur H, Roberts I, Fawole B, Chaudhri R, El-Sheikh M, Akintan A, et al; WOMAN Trial Collaborators. Effect of early tranexamic acid administration on mortality, hysterectomy, and other morbidities in women with post-partum haemorrhage (WOMAN): an international, randomised, double-blind, placebo-controlled trial. Lancet. 2017;389(10084):2105-16.
14. WOMAN Trial Collaborators. Effect of early tranexamic acid administration on mortality, hysterectomy, and other morbidities in women with postpartum haemorrhage (WOMAN): an international, randomised, double-blind, placebo-controlled trial. Lancet. 2017;389(10084):2105-16.
15. Sentilhes L, Winer N, Azria E, Sénat MV, Le Ray C, Vardon D, et al; Groupe de Recherche en Obstétrique et Gynécologie. Tranexamic acid for the prevention of blood loss after vaginal delivery. N Engl J Med. 2018;379(8):731-42.
16. Yang H, Zheng S, Shi C. Clinical study on the efficacy of tranexamic acid in reducing postpartum blood loss: a randomized, comparative, multicenter trial. Zhonghua Fu Chan Ke Za Zhi. 2001;36(10):590-2.
17. Abbas K, Nadeem M, Anjum S, Majid T. Tranexamic acid use in elective cesarean section to reduce blood loss. J Pak Med Assoc. 2019;69(4):540-3.
18. Gai MY, Wu LF, Su QF, Tatsumoto K. Clinical observation of blood loss reduced by tranexamic acid during and after caesarean section: a multi-center, randomized trial. Eur J Obstet Gynecol Reprod Biol. 2004;112(2):154-7.

Cite this article as: Fatima K, Anjum M, Chengty S. Role of tranexamic acid in prevention of blood loss during cesarean section. Int J Reprod Contracept Obstet Gynecol 2026;15:2009-13.