

DOI: <https://dx.doi.org/10.18203/2320-1770.ijrcog20263978>

Original Research Article

A comparative study of efficacy of tranexamic acid in reducing blood loss during and after cesarean section: a randomised control study

Shivani Prashant Khodaskar*, Nilofer I. Yelulkar, Meena N. Satia, Vijaya R. Badhwar

Department of Obstetrics and Gynecology, Dr D. Y. Patil Hospital, Navi Mumbai, Maharashtra, India

Received: 11 June 2026

Revised: 29 September 2026

Accepted: 02 October 2026

*Correspondence:

Dr. Shivani Prashant Khodaskar,

E-mail: shivani.khodaskar12@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Excessive bleeding during and after cesarean section is a major cause of maternal morbidity. TXA acid has been proposed as an effective intervention to reduce blood loss, but evidence from randomized trials is limited. This study aimed to evaluate the efficacy and safety of TXA acid in decreasing intraoperative and postpartum hemorrhage following cesarean delivery.

Methods: This prospective, randomized, controlled trial enrolled 120 women undergoing cesarean section at a tertiary care hospital. Participants were randomly assigned to receive either intravenous tranexamic acid (15 mg/kg in 100 ml Ringer's lactate solution, n=60) or placebo (plain Ringer's lactate, n=60) after cord clamping. The primary outcome was total blood loss from placental delivery until 2 hours postpartum. Secondary outcomes included change in hemoglobin levels, blood pressure, and adverse events.

Results: The tranexamic acid group had significantly lower intraoperative blood loss (421.9 ± 27.9 ml compared to controls (845.9 ± 256.6), $p < 0.001$). Postpartum blood loss from end of surgery to 2 hours was also lower with tranexamic acid (30.8 ± 3.7 ml versus 41.28 ± 3.6 ml, $p < 0.001$). Number of mops and drapes soaked were also less in the interventional group compared to control. Postoperative hemoglobin remained stable in the tranexamic acid group but dropped in controls ($p < 0.001$). No significant differences in adverse events were observed between groups.

Conclusions: Prophylactic administration of TXA acid significantly reduced intraoperative and postpartum blood loss following cesarean section while maintaining postoperative hemoglobin levels, without increasing adverse effects. These findings support the use of tranexamic acid as an effective adjunct for hemorrhage prevention in cesarean deliveries.

Keywords: Blood loss, Caesarean section, Hemoglobin, Postpartum hemorrhage, Tranexamic acid

INTRODUCTION

Caesarean section remains one of the most common abdominal surgeries for women globally. Despite advances in anesthesia and surgical techniques that have made modern caesarean sections safer than in previous eras, they continue to be associated with intraoperative and postoperative complications, including bleeding, infection, and longer hospital stays compared to vaginal deliveries.¹

Postpartum hemorrhage (PPH) is responsible for approximately 35% of global maternal mortality. The Millennium Development Goal 3 aimed to reduce maternal mortality by 75% by 2015, while Sustainable Development Goal Target 3.1 seeks to reduce the global maternal mortality ratio to less than 70 per 100,000 live births by 2030.²⁻⁴ Primary and secondary post-partum hemorrhage represent significant complications of caesarean births that can affect both mother and infant, potentially increasing maternal mortality and morbidity.

Tranexamic acid (TXA), a synthetic derivative of the amino acid lysine, has antifibrinolytic properties as it can reversibly inhibit plasminogen molecules' lysine binding sites.⁵ It provides an effective means of supporting hemostasis by blocking the enzymatic action of plasmin on fibrin. The fibrinolytic system is activated during placental delivery and remains active for 6-10 hours postpartum, which can lead to increased bleeding. In this study, we examined the efficacy of tranexamic acid in reducing blood loss during and after caesarean section procedures, with the goal of decreasing maternal mortality following caesarean sections through minimizing both intraoperative and postoperative bleeding.

METHODS

This prospective, randomized controlled trial was conducted in the department of obstetrics and gynecology at D. Y. Patil Medical College, Hospital and Research Center, Nerul, Navi Mumbai over December 2023 to November 2025. The study included 120 women undergoing caesarean section (both elective and emergency cases) who were randomly assigned to one of two groups: the intervention group (n=60) received tranexamic acid 15 mg/kg in 100ml Ringer's lactate solution administered over 10-15 minutes before skin incision, while the control group (n=60) received plain Ringer's lactate solution. Both groups received 10 units of oxytocin intramuscularly after delivery of the baby.

Inclusion criteria were singleton term pregnancies undergoing caesarean section. Patients with allergies to tranexamic acid, severe medical conditions (cardiac, renal, or liver diseases), history of thromboembolic disorders, or

pregnancy complications that increased PPH risk (such as preeclampsia, placenta previa, anemia with Hb<9 gm%, polyhydramnios, multiple pregnancy, fetal macrosomia, or prolonged labor) were excluded.

Blood loss was measured by weighing soaked mops and drapes, measuring the volume in the suction bottle after placental delivery, and weighing pads used after completion of LSCS up to 2 hours postpartum. Hemoglobin levels were checked before surgery and on the third postoperative day. Vital signs and adverse events were monitored throughout the procedure and recovery period.

Statistical analysis was performed using SPSS version 22. Data was presented as Mean±SD, and comparisons between groups were made using the unpaired t-test, Mann-Whitney U test, one-way ANOVA, or Chi-square test as appropriate, with p≤0.05 considered significant.

RESULTS

Demographic and baseline characteristics

Table 1 shows the demographic and baseline characteristics of both study groups. The mean age, parity distribution, gestational age, indications for caesarean section, and duration of surgery were similar between the intervention and control groups, with no statistically significant differences (p>0.05). The majority of patients in both groups (approximately 80%) were between 21-30 years of age, and most were primigravida (88.3% in the intervention group and 90% in the control group).

Table 1: Demographic and baseline characteristics of study participants.

Characteristics	Interventional group (n=60) (%)	Control group (n=60) (%)	P value
Age (years)			0.75
<20	3 (5)	5 (8.3)	
21-30	48 (80)	47 (78.3)	
>30	9 (15)	8 (13.3)	
Parity			0.76
Primigravida	53 (88.3)	54 (90)	
Multigravida	7 (11.7)	6 (10)	
Gestational age			0.84
37-38 weeks	41 (68.3)	40 (66.7)	
39-40 weeks	19 (31.7)	20 (33.3)	
Type of LSCS			0.71
Elective	32 (53.3)	30 (50)	
Emergency	28 (46.7)	30 (50)	
Indication for LSCS			0.98
Fetal distress	21 (35)	21 (35)	
CPD	14 (23.4)	13 (20)	
Previous LSCS	12 (20)	11 (18.3)	
Failure to progress	7 (11.7)	8 (13.3)	
Breech presentation	6 (10)	7 (11.7)	
Duration of LSCS (minutes)	58.33±15.4	60±15.2	0.55

Table 2: Comparison of blood loss between groups.

Parameter	Interventional group (n=60)	Control group (n=60)	P value
Number of soaked mops	2.5±0.49	4.6±0.72	<0.001
Weight of soaked mops (kg)	0.064±0.009	0.43±0.31	<0.001
Weight of soaked drapes (kg)	0.57±0.04	0.70±0.12	<0.001
Suction volume (ml)	84.4±9.1	148.9±12.9	<0.001
Weight of soaked pads (kg)	0.07±0.008	0.09±0.008	<0.001
Blood loss from placental delivery to end of LSCS (ml)	421.9±27.9	845.9±256.6	<0.001
Blood loss at end of LSCS to 2 hours postpartum (ml)	30.8±3.7	41.28±3.6	<0.001

Blood loss measurements

Table 2 demonstrates the significant difference in blood loss between the two groups. The mean blood loss from placental delivery to the end of caesarean section was significantly lower in the tranexamic acid group (421.9±27.9 ml) compared to the control group (845.9±256.6 ml) ($p<0.001$). Similarly, blood loss from the end of surgery to 2 hours postpartum was also significantly reduced in the intervention group (30.8±3.7 ml versus 41.28±3.6 ml in the control group, $p<0.001$). The number of soaked mops was also significantly lower in the intervention group (2.5±0.49) compared to the control group (4.6±0.72) ($p<0.001$).

Hemoglobin levels

Table 3 shows the comparison of hemoglobin levels between groups. In the intervention group, the pre-

operative hemoglobin (10.7±0.69 gm/dl) and post-operative day 3 hemoglobin (10.5±0.54 gm/dl) were not significantly different ($p=0.07$), indicating minimal blood loss. In contrast, the control group showed a significant drop from pre-operative (11.6±1.05 gm/dl) to post-operative day 3 (10.59±0.89 gm/dl) hemoglobin levels ($p<0.001$).

Table 3: Comparison of hemoglobin levels between groups.

Time Point	Interventional group (n=60)	Control Group (n=60)
Pre-operative Hb (gm/dl)	10.7±0.69	11.6±1.05
Post-operative day 3 Hb (gm/dl)	10.5±0.54	10.59±0.89
P value	0.07	<0.001

Table 4: Comparison of blood pressure between groups.

Parameters	Interventional group (n=60)	Control group (n=60)	P value
Systolic BP (mmHg)			
Pre-operative	114.5±5.9	115.6±4.9	0.24
Post-operative	114.6±5.03	111±5.7	<0.001
Diastolic BP (mmHg)			
Pre-operative	74.33±4.9	74.1±4.9	0.85
Post-operative	74.33±4.9	73.8±4.9	0.58

Vital signs and adverse events

Table 4 presents the comparison of blood pressure between groups. While pre-operative systolic blood pressure was similar between groups ($p=0.24$), post-operative systolic blood pressure was significantly higher in the intervention group (114.6±5.03 mmHg) compared to the control group (111±5.7 mmHg) ($p<0.001$). No significant differences were observed in diastolic blood pressure either pre-operatively or post-operatively ($p>0.05$). Minor adverse

effects like nausea and vomiting were observed in both groups, but there were no serious adverse events reported.

DISCUSSION

Our study demonstrated that prophylactic administration of tranexamic acid (15 mg/kg) significantly reduced blood loss during and after caesarean section. The mean intraoperative blood loss in the tranexamic acid group was 421.9±27.9 ml compared to 845.9±256.6 ml in the control group, representing an approximately 50% reduction. This

finding aligns with the results reported by Gobbur et al, who found a 20% decrease in blood loss and an 18% reduction in postpartum hemorrhage incidence with tranexamic acid.⁶ Similarly, a comparable trial by Gai et al revealed a 30% decrease in blood loss and a 25.7% decrease in postpartum hemorrhage incidence.⁷ Our results also corroborate with the findings of Gohel et al, Sekhavat et al, Shanatakumari et al, and Abdel-Aleem M et al, all of whom reported significant reductions in blood loss with tranexamic acid use.⁸⁻¹¹

Importantly, our study found that postoperative hemoglobin levels remained relatively stable in the tranexamic acid group (10.7 ± 0.69 gm/dl preoperatively vs. 10.5 ± 0.54 gm/dl on postoperative day-3), while there was a significant drop in the control group (11.6 ± 1.05 gm/dl preoperatively vs. 10.59 ± 0.89 gm/dl after postoperative day-3). This suggests that tranexamic acid not only reduces visible blood loss but also helps maintain hemoglobin levels, potentially reducing the need for blood transfusions. These findings are consistent with previous studies by Xu et al, Bhavana et al, and Gungorduk et al, who also observed smaller decreases in postoperative hemoglobin levels in tranexamic acid groups compared to control groups.¹²⁻¹⁴

Regarding safety, we found no significant increase in adverse events with tranexamic acid use. While there was a statistically significant difference in postoperative systolic blood pressure between groups, this was not clinically significant and did not necessitate intervention. No thromboembolic complications were observed in either group. These safety findings align with the existing evidence supporting the favorable safety profile of tranexamic acid in obstetric populations as reported by multiple studies.^{8,15-18} However, our study has limitations, including a relatively small sample size that may have limited our ability to detect rare adverse events, and a short follow-up period of only 2 hours postpartum. Larger studies with longer follow-up periods are warranted to further evaluate the long-term safety and potential cost-effectiveness of this intervention in obstetric practice.

CONCLUSION

This randomized controlled trial provides robust evidence that prophylactic administration of tranexamic acid significantly reduces blood loss during caesarean section and in the immediate postpartum period. The drug effectively maintained postoperative hemoglobin levels without increasing the risk of adverse events.

Our findings support the inclusion of tranexamic acid in protocols for hemorrhage prevention during caesarean deliveries. The significant reduction in blood loss demonstrated in this study could potentially reduce maternal morbidity associated with postpartum hemorrhage and decrease the need for blood transfusions.

Future research should focus on larger multi-center trials with longer follow-up periods to further evaluate the long-term safety profile of tranexamic acid in obstetric patients and its potential cost-effectiveness in various healthcare settings.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

- Potter JE, Berquó E, Perpétuo IH, Leal OF, Hopkins K, Souza MR, et al. Unwanted caesarean sections among public and private patients in Brazil: prospective study. *BMJ*. 2001;323(7322):1155-8.
- Raina N, Khanna R, Gupta S, Jayathilaka CA, Mehta R, Behera S. Progress in achieving SDG targets for mortality reduction among mothers, newborns, and children in the WHO South-East Asia Region. *Lancet Reg Health-Southeast Asia*. 2023;18.
- SDG Target 3.1 Maternal Mortality. Available from: <https://www.who.int/data/gho/data/themes/topics/sdg-target-3-1-maternal-mortality>. Accessed on 14 July 2024.
- "Progress in Reducing Maternal Mortality Has Stagnated and We Are Not on Track to Achieve the SDG Target: New UN Report." *World Bank Blogs*. 2023.
- Thorsen S, Clemmensen I, Sottrup-Jensen L, Magnusson S. Adsorption to fibrin of native fragments of known primary structure from human plasminogen. *Bioch Biophys Acta Protein Str*. 1981;668(3):377-87.
- Gobbur VR, Shiragur SS, Jhanwar UR, Tehalia MJ. Efficacy of tranexamic acid in reducing blood loss during lower segment caesarean section. *Int J Reprod Contracept Obstet Gynecol* 2014;3:414-7.
- Gai MY, Wu LF, Su QF, Tatsumoto K. Clinical observation of blood loss reduced by tranexamic acid during and after caesarian section: a multi-center, randomized trial. *Eur J Obstet Gynecol Reprod Biol*. 2004;112(2):154-7.
- Gohel M, Purvi P, Ashoo G, Pankaj D. Efficacy of tranexamic acid in decreasing blood loss during and after cesarean section: a randomized case controlled prospective study. *J Obstet Gynecol India*. 2007;57(3):227-30.
- Sekhvat L, Tabatabaai A, Dalili M, Farajkhoda T, Tafti AD. Efficacy of tranexamic acid in reducing blood loss after cesarean section. *J Matern Fetal Neonatal Med*. 2009;22(1):72-5.
- Sampathkumari S, Arulmozhi, Priya R, Mahalaxmi V. A study on efficacy of prophylactic tranexamic acid in reducing blood loss during elective LSCS. *IOSR J Dent Med Sci*. 2018;17(2):59-63
- Abdel-Aleem H, Alhusaini TK, AbdelAleem MA, Menoufy M, Gülmezoglu AM. Effectiveness of tranexamic acid on blood loss in patients undergoing

- elective cesarean section: Randomized clinical trial. *J Matern Fet Neonat Med.* 2013;26(1):1705-9.
12. Xu J, Gao W, Ju Y. Tranexamic acid for the prevention of postpartum hemorrhage after cesarean section: a double-blind randomization trial. *Arch Gynecol Obstet.* 2013;287(3):463-8.
 13. Bhavana G, Abhishek MV, Mittal S. Efficacy of prophylactic tranexamic acid in reducing blood loss during and after caesarean section. *Int J Reprod Contracept Obstet Gynecol.* 2016;5(6):2011-7.
 14. Gungorduk K, Yildirim G, Asicioglu O, Ark C. Efficacy of intravenous Tranexamic acid in reducing blood loss after elective cesarean section: a prospective randomized double blind placebo controlled study. *Am J Prenatal.* 2011;28(3):233-40.
 15. Ducloy-Bouthors AS, Jude B, Duhamel A, Broisin F, Huissoud C, Keita-Meyer H, et al. High-dose tranexamic acid reduces blood loss in postpartum haemorrhage. *Crit Care.* 2011;15(2):R117.
 16. Shakur H, Roberts I, Fawole B, Chaudhri R, El-Sheikh M, Akintan A, et al. 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.
 17. Simonazzi G, Bisulli M, Saccone G, Moro E, Marshall A, Berghella V. Tranexamic acid for preventing postpartum blood loss after cesarean delivery: a systematic review and meta-analysis of randomized controlled trials. *Acta Obstet Gynecol Scand.* 2016;95(1):28-37.
 18. Tabatabaie SS, Alavi A, Bazaz M. Comparison of the effect of tranexamic acid and misoprostol on blood loss during and after cesarean section: a randomized clinical trial. *Razavi Int J Med.* 2021;9(1).

Cite this article as: Khodaskar SP, Yelulkar NI, Satia MN, Badhwar VR. A comparative study of efficacy of tranexamic acid in reducing blood loss during and after cesarean section: a randomised control study. *Int J Reprod Contracept Obstet Gynecol* 2026;15: 4362-6.