Section: Obstetrics and Gynaecology

Original Research Article

COMPARATIVE STUDY OF PROPHYLACTIC INTRAVENOUS TRANEXAMIC ACID AND SUCTION CANNULA APPLICATION IN PREVENTING POSTPARTUM HAEMORRHAGE DURING NORMAL VAGINAL DELIVERY AMONG HIGH-RISK PREGNANCIES

S. Monisha[1], Anitha Roselyn.P[2], A. Kavitha[3]

[1]Senior Resident, Department of Obstetrics and Gynaecology, Government Medical College, The Nilgiris, Tamil Nadu, India.
[2]Assistant Professor, Department of Obstetrics and Gynaecology, Government Medical College, The Nilgiris, Tamil Nadu, India.
[3]Senior Resident, Department of Obstetrics and Gynaecology, Madurai Medical College, Madurai, Tamil Nadu, India.

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Corresponding Author:
Dr. S. Monisha,
Senior Resident, Department of Obstetrics and Gynaecology, Government Medical College, The Nilgiris, Tamil Nadu, India.
Email: monishasubramanian50@gmail.com

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ABSTRACT

Background: Postpartum haemorrhage (PPH) remains one of the leading causes of maternal morbidity and mortality worldwide, particularly in low- and middle-income countries. Preventive strategies during the third stage of labour are essential to reduce maternal complications. Pharmacological agents such as tranexamic acid and mechanical methods like suction cannula application have been used to reduce blood loss. However, comparative evidence between these two approaches remains limited. **Objective:** To compare the efficacy of prophylactic intravenous tranexamic acid and suction cannula application in reducing blood loss during normal vaginal delivery among high-risk pregnant women.

Materials and Methods: A prospective interventional study was conducted in the Department of Obstetrics and Gynaecology at Coimbatore Medical College Hospital over a one-year period from December 2021 to December 2022. A total of 200 pregnant women with gestational age between 37 and 42 weeks and identified risk factors for postpartum haemorrhage were included. Participants were divided into two groups: 100 women received prophylactic intravenous tranexamic acid during the third stage of labour, while 100 underwent suction cannula application. Blood loss during delivery, haemodynamic parameters, haemoglobin and packed cell volume (PCV) changes, requirement for blood transfusion, adverse effects, and neonatal Apgar scores were assessed. Statistical analysis was performed using SPSS version 23, with $p < 0.05$ considered statistically significant.

Results: Most participants were aged 21–30 years, and 77% were multigravida. Anaemia was the most common high-risk factor observed. Haemodynamic parameters showed better stability in the suction cannula group compared to the tranexamic acid group. Reduction in haemoglobin and PCV levels was comparatively lower in the suction group. Although the distribution of blood loss categories between groups was not statistically significant ($p = 0.27$), the need for blood transfusion was significantly lower in the suction group (2%) compared to the tranexamic acid group (9%) ($p = 0.02$). Adverse effects were minimal in both groups. Neonatal outcomes, measured by Apgar scores, were comparable between the two groups.

Conclusion: Both prophylactic intravenous tranexamic acid and suction cannula application are effective in reducing postpartum haemorrhage during normal vaginal delivery in high-risk pregnancies. However, suction cannula

application demonstrated better haemodynamic stability and significantly reduced the requirement for blood transfusion. Given its simplicity, cost-effectiveness, and ease of implementation, suction cannula application may serve as a useful preventive strategy for postpartum haemorrhage, particularly in resource-limited healthcare settings.
Keywords: Postpartum haemorrhage, Tranexamic acid, Suction cannula, Vaginal delivery, Maternal outcomes, High-risk pregnancy.

INTRODUCTION

Postpartum haemorrhage (PPH) continues to be one of the most significant causes of maternal morbidity and mortality worldwide. It is responsible for a substantial proportion of preventable maternal deaths, particularly in low- and middle-income countries where access to emergency obstetric care may be limited.[1] PPH is commonly defined as blood loss exceeding 500 mL following vaginal delivery within 24 hours. Despite advances in obstetric care, it remains a major clinical challenge and a leading cause of maternal complications.[2] Uterine atony, the failure of the uterus to contract effectively after delivery, is the most common cause of PPH.[3]

During normal labour, uterine contractions play a crucial role in compressing the blood vessels at the placental site, thereby reducing bleeding. When this mechanism fails, rapid blood loss can occur, leading to hypovolemic shock, multiorgan dysfunction, disseminated intravascular coagulation, and even maternal death.[4] The first two hours following delivery are often considered the "golden period," as severe bleeding during this time can rapidly become life-threatening if not managed promptly and effectively.[5] Several risk factors contribute to the development of PPH, including prolonged labour, obstructed labour, multiple pregnancy, polyhydramnios, anaemia, previous history of PPH, and overdistended uterus. However, PPH can also occur unexpectedly in women without identifiable risk factors, making universal preventive strategies essential. Anaemia, which is highly prevalent in developing countries, further worsens outcomes by reducing the physiological reserve to tolerate blood loss.[6,7] Management of PPH follows a stepwise approach, beginning with preventive measures during the third stage of labour. Standard preventive strategies include active management of the third stage of labour (AMTSL), uterotonic agents, uterine massage, and mechanical techniques such as uterine tamponade.[8] Pharmacological agents like tranexamic acid have gained importance in recent years. Tranexamic acid is an antifibrinolytic drug that inhibits the breakdown of fibrin clots by blocking plasminogen activation. It has been shown to reduce blood loss and decrease the need for blood transfusion when administered prophylactically or therapeutically. Its advantages include stability at room temperature, low cost, and ease of administration.[9] In addition to pharmacological interventions, mechanical methods have also been explored to enhance uterine contraction and reduce bleeding. Suction cannula application during the third stage of labour is a simple mechanical approach that may promote uterine contraction and haemostasis.[10] In resource-limited settings, where access to advanced interventions may be restricted, cost-effective and easy-to-implement strategies are particularly valuable.[11] Although several studies have evaluated tranexamic acid and mechanical methods independently, comparative data between prophylactic tranexamic acid and suction cannula application remain limited. Understanding their relative effectiveness is important for guiding clinical practice, especially in high-risk pregnancies.[12,13] Therefore, this study was undertaken to compare the efficacy of intravenous tranexamic acid and prophylactic suction cannula application in reducing blood loss during normal vaginal delivery among high-risk pregnant women. The findings aim to contribute evidence toward optimizing preventive strategies for postpartum haemorrhage and improving maternal outcomes, particularly in low-resource healthcare settings.

MATERIALS AND METHODS

Study Design

This was a prospective interventional study conducted to compare the efficacy of prophylactic intravenous tranexamic acid and suction cannula application in reducing blood loss during normal vaginal delivery.

Study Setting

The study was carried out in the Department of Obstetrics and Gynaecology, Coimbatore Medical College Hospital, Coimbatore, a tertiary care teaching hospital.

Study Duration

The study was conducted over a period of one year, from 1st December 2021 to 31st December 2022.

Study Population

Pregnant women with gestational age between 37 and 42 weeks admitted to the labour ward and identified as having risk factors for postpartum haemorrhage (PPH) were included in the study.

Sample Size

A total of 200 participants were enrolled based on inclusion and exclusion criteria:

- 100 participants received intravenous tranexamic acid
- 100 participants received prophylactic suction cannula application

Participants were recruited consecutively during the study period.

Inclusion Criteria

- Gestational age between 37–42 weeks
- High-risk pregnancy conditions such as:
  - Anaemia complicating pregnancy
  - Prolonged labour
  - Obstructed labour
  - Multiple pregnancy
  - Polyhydramnios
  - Premature rupture of membranes (PROM) >18 hours
  - Overdistended abdomen

Exclusion Criteria

- Suspected traumatic postpartum haemorrhage
- Non-high-risk pregnancies

Ethical Considerations

Prior approval was obtained from the Institutional Ethics Committee. Written informed consent was taken from all participants after explaining the purpose, procedures, benefits, and possible risks of the study. Confidentiality was maintained throughout the study. Ethical principles of autonomy, beneficence, and justice were strictly followed.

Study Procedure

After admission to the labour ward, detailed history and clinical examination were performed. Demographic details such as age, parity, socioeconomic status, education, and occupation were recorded. Obstetric history was obtained. General physical examination and assessment of vital signs including blood pressure, pulse rate, respiratory rate, oxygen saturation, and urine output were carried out. Abdominal examination was done to assess uterine height, fetal presentation, lie, and fetal heart rate.

Laboratory Investigations

Venous blood samples were collected for blood group and Rh typing, cross-matching, haemoglobin estimation, complete blood count (CBC), peripheral smear examination, and lipid profile.

Intervention Protocol

Participants in the tranexamic acid group received intravenous tranexamic acid prophylactically during the third stage of labour, administered immediately after delivery of the anterior shoulder as per institutional protocol. Participants in the suction group underwent prophylactic suction cannula application during the third stage of labour. Both groups received standard active management of the third stage of labour.

Outcome Measures

The primary outcome was estimation of blood loss during delivery. Secondary outcomes included changes in maternal vital parameters before and after delivery, changes in haemoglobin and packed cell volume (PCV), requirement of blood transfusion, incidence of adverse effects such as nausea, vomiting, headache, and fever, and neonatal Apgar scores at 1 and 5 minutes.

Blood Loss Assessment

Blood loss was estimated and categorized as less than 100 mL, 100–200 mL, 200–300 mL, and more than 300 mL.

Statistical Analysis

Data were entered into Microsoft Excel (Windows 10) and analysed using SPSS version 23. Continuous variables were expressed as mean ± standard deviation, while categorical variables were expressed as frequency and percentage. Student's t-test and ANOVA were used for comparison of continuous variables, and the Chi-square test was used for categorical variables. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Age wise distribution

A total of 200 participants were included in the study, with 100 in the tranexamic acid group and 100 in the suction cannula group. Baseline characteristics were comparable between the two groups (Figure 1). The majority of participants (43%) were in the age group of 21–25 years, followed by 26–30 years (34%). Only a small proportion (6%) were above 31 years. This indicates that most women in the study were in the early reproductive age group.

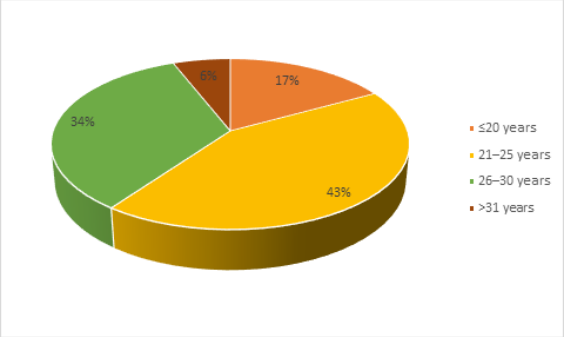

Figure 1: Age Distribution of Study Participants

Education Status of the Study Population

The education status of the study population is presented in Figure 2. Among the 200 participants included in the study, 48 respondents (24%) were illiterate. A majority of the participants, 128 (64%), had completed school-level education. Meanwhile, 24 respondents (12%) were graduates. These findings indicate that most of the study population had attained school education, while a smaller proportion had higher education and about one-fourth of the participants were illiterate.

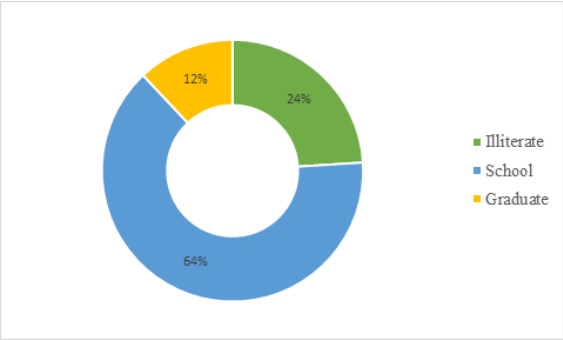

Figure 2: Education Status of the Study Population

Occupation of the Study Population

The occupation of the study population is presented in figure 3. Among the 200 participants included in the study, 144 respondents (72%) were homemakers. Participants engaged in skilled labor accounted for 24 (12%) of the study population. Meanwhile, 32 respondents (16%) were involved in unskilled labor. These findings indicate that the majority of the study population were homemakers, while a smaller proportion were engaged in skilled and unskilled occupations.

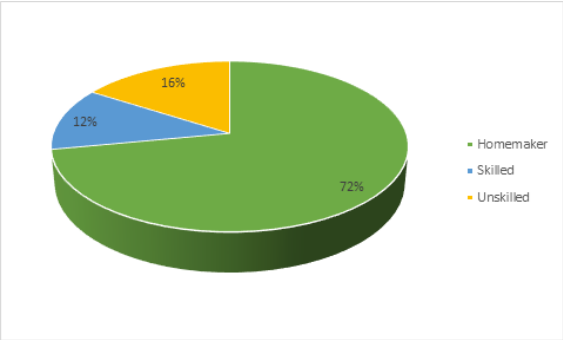

Figure 3: Occupation of the Study Population

Obstetric Status of the Study Population

The obstetric status of the study population is presented in figure 4. Among the 200 participants included in the study, 154 respondents (77%) were multigravida, while 46 respondents (23%) were primigravida. These findings indicate that the majority of the study population consisted of women who had experienced previous pregnancies.

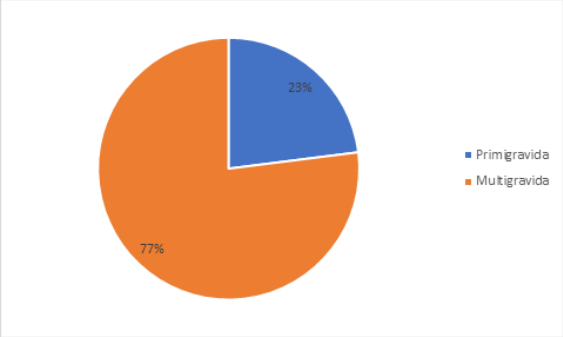

Figure 4: Obstetric Status of the Study Population

High risk case distribution among the study population

The distribution of high-risk factors among the study population is presented in figure 5. Among the 200 participants, anaemia was the most common high-risk factor observed in 42 respondents (21%). Previous postpartum haemorrhage was reported in 8 participants (4%). Uterine fibroid was present in 6 respondents (3%), while multiple pregnancy and polyhydramnios were each observed in 4 participants (2%). Grand multiparity was noted in 3 respondents (1.5%). These findings indicate that anaemia was the predominant high-risk factor among the study population, while other obstetric conditions were observed in smaller proportions.

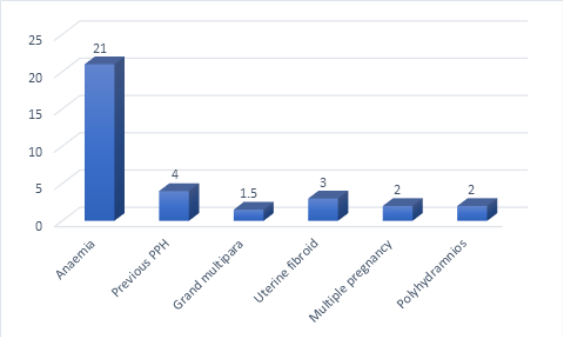

Figure 5: High-Risk Factors among the Study Population

Comparison of maternal factors among the two study groups

The comparison of haemodynamic parameters between the tranexamic acid group and suction group is presented in Table 1. The mean systolic blood pressure was 110 ± 3.1 mmHg in the tranexamic acid group and 110 ± 8.2 mmHg in the suction group, showing a statistically significant difference ($p = 0.01$). The mean diastolic blood pressure was 72 ± 5.2 mmHg in the tranexamic acid group and 75 ± 3.2 mmHg in the suction group ($p = 0.01$). The mean pulse rate was 89.30 ± 8.3 beats per minute in the tranexamic acid group and 85.40 ± 8.42 beats per minute in the suction group, which was statistically significant ($p = 0.001$). The oxygen saturation (SpO_2) was 97.3 ± 8.42 in the tranexamic acid group compared to 99.12 ± 7.4 in the suction group ($p = 0.01$). The mean urine output was 107.31 ± 6.3 ml in the tranexamic acid group and 108.15 ± 8.3 ml in the suction group ($p = 0.01$). These findings indicate that the suction group demonstrated better haemodynamic stability compared to the tranexamic acid group.

Table 1: Comparison of Haemodynamic Parameters between Tranexamic Acid and Suction Groups

Parameter	Tranexamic Acid (Mean ± SD)	Suction (Mean ± SD)	p-value
Systolic BP	110 ± 3.1	110 ± 8.2	0.01
Diastolic BP	72 ± 5.2	75 ± 3.2	0.01
Pulse Rate	89.30 ± 8.3	85.40 ± 8.42	0.001
SpO_2	97.3 ± 8.42	99.12 ± 7.4	0.01
Urine Output	107.31 ± 6.3	108.15 ± 8.3	0.01

Comparison of Haemoglobin and PCV Levels between Tranexamic Acid and Suction Groups

The comparison of haemoglobin (Hb) and packed cell volume (PCV) levels between the tranexamic acid group and suction group is presented in Table 2. The mean pre-intervention haemoglobin level was 10.52 ± 2.3 g/dL in the tranexamic acid group and 10.30 ± 1.3 g/dL in the suction group, which showed statistical significance (p = 0.001). The mean post-intervention haemoglobin level was 10.21 ± 1.0 g/dL in both groups. The mean pre-intervention packed cell volume was 39 ± 2.3% in the tranexamic acid group and 38 ± 8.6% in the suction group (p = 0.01). The mean post-intervention PCV was 38 ± 9.2% in the tranexamic acid group and 37 ± 1.5% in the suction group. These findings indicate that the reduction in haemoglobin and PCV levels was comparatively lower in the suction group, suggesting better preservation of blood indices.

Table 2: Haemoglobin and PCV Levels between Tranexamic Acid and Suction Groups

Parameter	Tranexamic Acid (Mean ± SD)	Suction (Mean ± SD)	p-value
Hb Pre	10.52 ± 2.3	10.30 ± 1.3	0.001
Hb Post	10.21 ± 1.0	10.21 ± 1.0	—
PCV Pre	39 ± 2.3	38 ± 8.6	0.01
PCV Post	38 ± 9.2	37 ± 1.5	—

Distribution of Blood Loss between Suction and Tranexamic Acid Groups

The distribution of blood loss among the study participants is presented in Table 3. In the suction group, 4 participants had blood loss of less than 100 mL, while 2 participants in the tranexamic acid group fell within this category. Blood loss between 100–200 mL was observed in 44 participants in the suction group and 40 participants in the tranexamic acid group. Blood loss of 200–300 mL was recorded in 32 participants in the suction group and 30 participants in the tranexamic acid group. In the category of more than 300 mL blood loss, 20 participants were from the suction group compared to 28 participants in the tranexamic acid group. Although the suction group had fewer cases with higher blood loss (>300 mL), the overall difference between the two groups was not statistically significant (p = 0.27).

Table 3: Blood Loss Distribution between Suction and Tranexamic Acid Groups

Blood Loss	Suction (n=100)	Tranexamic Acid (n=100)	p-value
<100 mL	4	2	0.27
100–200 mL	44	40	
200–300 mL	32	30	
>300 mL	20	28	
Total	**100**	**100**	

Blood Transfusion Requirement between Tranexamic Acid and Suction Groups

The requirement for blood transfusion among the study participants is presented in Table 4. In the tranexamic acid group, 9 participants required blood transfusion, whereas only 2 participants in the suction group required transfusion. The majority of participants did not require transfusion, with 91 cases in the tranexamic acid group and 98 cases in the suction group. This difference was found to be statistically significant (p = 0.02), indicating a lower need for blood transfusion in the suction group compared to the tranexamic acid group.

Table 4: Blood Transfusion Requirement between Tranexamic Acid and Suction Groups

Transfusion	Tranexamic Acid (n=100)	Suction (n=100)	p-value
Yes	9	2	0.02
No	91	98	
Total	**100**	**100**	

Side Effects Observed between Suction and Tranexamic Acid Groups

The distribution of side effects among the study participants is presented in Table 5. In the suction group, only one participant experienced fever, while no cases of nausea, vomiting, or headache were reported. In the tranexamic acid group, mild side effects were observed, including nausea in 1 participant, vomiting in 2 participants, and headache in 2 participants. No cases of fever were reported in

this group. The difference in side effects between the two groups was not statistically significant, indicating that both interventions were generally well tolerated.

Table 5: Side Effects between Suction and Tranexamic Acid Groups

Side Effect	Suction (n=100)	Tranexamic Acid (n=100)	p-value
Nausea	0	1	0.39
Vomiting	0	2	0.15
Fever	1	0	0.5
Headache	0	2	0.15
Total	**100**	**100**	

Neonatal Apgar Score in Suction and Tranexamic Acid Groups

The neonatal Apgar scores for both study groups are presented in Table 6. In the suction group, 96 neonates had an Apgar score of ≥8, while 4 neonates had a score of <8. In the tranexamic acid group, 95 neonates had scores ≥8, and 5 neonates had scores <8. There was no statistically significant difference between the two groups (p = 0.73), indicating comparable neonatal outcomes.

Table 6: Neonatal Apgar Score between Suction and Tranexamic Acid Groups

Apgar Score	Suction (n=100)	Tranexamic Acid (n=100)	p-value
≥8	96	95	0.73
<8	4	5	
Total	**100**	**100**	

DISCUSSION

Postpartum haemorrhage (PPH) continues to be a major contributor to maternal morbidity and mortality worldwide, particularly in low- and middle-income countries. Early prevention and timely management during the third stage of labour are crucial in reducing maternal complications. The present study compared the efficacy of prophylactic intravenous tranexamic acid and suction cannula application in reducing blood loss during normal vaginal delivery among high-risk pregnant women. In the present study, the majority of participants were between 21 and 30 years of age, with a mean age of approximately 25 years. Similar findings have been reported by Abhishek 2016, where most women experiencing PPH were within the reproductive age group of 19–33 years.[14] Likewise, Makhija et al. reported a comparable age distribution ranging from 22–36 years among women undergoing vaginal delivery.[15] These findings indicate that obstetric complications such as PPH are commonly observed in women in the active reproductive age group. Regarding obstetric status, most participants in the present study were multigravida (77%). This finding is comparable with the study conducted by Yildirim et al., where multigravida women constituted nearly 72% of the study population.[16,17] Higher parity is considered an important risk factor for uterine atony, which is the most common cause of postpartum haemorrhage. Anaemia was the most common high-risk factor identified among the study participants. Maternal anaemia is widely recognized as an important contributor to postpartum complications, as reduced haemoglobin levels decrease the mother's ability to tolerate blood loss. Similar observations have been reported in studies conducted in developing countries where anaemia remains a significant public health concern among pregnant women.[18] In the present study, the comparison of maternal vital parameters showed that the suction cannula group demonstrated better haemodynamic stability compared to the tranexamic acid group. Significant differences were observed in systolic and diastolic blood pressure, pulse rate, oxygen saturation, and urine output. This suggests that suction cannula application may facilitate faster control of uterine bleeding and help maintain maternal physiological stability during the postpartum period. The reduction in haemoglobin and packed cell volume levels was significantly lower in the suction group compared to the tranexamic acid group, indicating better preservation of blood indices. Mechanical interventions such as suction cannula may promote rapid uterine contraction and facilitate immediate control of bleeding. Although the distribution of blood loss categories did not show a statistically significant difference between the two groups, the proportion of women with higher blood loss (>300 mL) was slightly greater in the tranexamic acid group. Similar findings have been reported in some studies evaluating prophylactic tranexamic acid during vaginal delivery, where the difference in mean blood loss between groups was not statistically significant.[4,19] However, several previous studies have demonstrated that tranexamic acid can significantly reduce postpartum bleeding. The WOMAN trial, a large multicenter randomized controlled trial, showed that early administration of tranexamic acid significantly reduced death due to bleeding in women with postpartum haemorrhage without increasing the risk of thromboembolic complications.[20] Similarly, a systematic review and meta-analysis by Al-Dardery et al. reported that tranexamic acid significantly reduced total blood loss and the incidence of postpartum haemorrhage.[21]

In the present study, the requirement for blood transfusion was significantly higher in the tranexamic acid group compared to the suction group. This

finding suggests that suction cannula application may provide more rapid control of bleeding and reduce the need for additional interventions such as blood transfusion.

The incidence of adverse effects in the present study was minimal. A few participants in the tranexamic acid group experienced mild side effects such as nausea, vomiting, and headache, whereas only one participant in the suction group reported fever. These findings are consistent with previous studies that have reported tranexamic acid to be a safe and well-tolerated drug with minimal side effects.[22] Neonatal outcomes assessed by Apgar scores were similar in both groups, with the majority of newborns having Apgar scores greater than or equal to eight. This indicates that both interventions are safe and do not adversely affect neonatal wellbeing. Similar findings have been reported in studies conducted in tertiary care hospitals where tranexamic acid administration during delivery did not significantly affect neonatal outcomes.[4,19] Overall, the findings of the present study indicate that both tranexamic acid and suction cannula are effective methods for reducing postpartum haemorrhage during normal vaginal delivery. However, suction cannula application demonstrated better haemodynamic stability and significantly reduced the need for blood transfusion. Considering its simplicity, cost-effectiveness, and rapid action, suction cannula may serve as a useful frontline intervention in preventing atonic postpartum haemorrhage, particularly in resource-limited settings.

CONCLUSION

Postpartum haemorrhage remains a significant cause of maternal morbidity and mortality, particularly among high-risk pregnancies. The present study compared the effectiveness of prophylactic intravenous tranexamic acid and suction cannula application during the third stage of labour in preventing excessive blood loss during normal vaginal delivery. Both interventions were found to be safe and effective in reducing postpartum bleeding and were well tolerated by the participants. However, the suction cannula group demonstrated comparatively better haemodynamic stability, smaller reductions in haemoglobin and packed cell volume, and a significantly lower requirement for blood transfusion compared to the tranexamic acid group. Although the overall distribution of blood loss between the groups did not show a statistically significant difference, the mechanical effect of suction cannula may facilitate rapid uterine contraction and haemostasis. Considering its simplicity, cost-effectiveness, and minimal side effects, suction cannula application may serve as a useful preventive strategy for postpartum haemorrhage, particularly in high-risk pregnancies and resource-limited healthcare settings.

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