Original Article

Comparison of the Mean Blood Loss during Cesarean Section with 15mg/Kg Versus 10 Mg/Kg Intravenous Tranexamic Acid in Anemic Women Undergoing Lower Segment Cesarean Section

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Abstract

Objective: To compare the mean blood loss during cesarean section with 15mg/kg versus 10 mg/kg intravenous tranexamic acid (TXA) in anemic women undergoing lower segment cesarean section.

Methodology: A randomized controlled trial conducted at the Department of Gynecology at Recep Tayyip Erdogan Hospital, Muzaffargarh, from May 2023 to October 2024. Anemic women undergoing emergency lower segment cesarean section with singleton pregnancy, aged 18 to 40 years and gestational age >37 weeks were enrolled. Patients were randomly assigned into two groups using the lottery method: Group I received 15 mg/kg and Group II received 10 mg/kg of intravenous TXA administered 20 minutes before surgery. Blood loss during LSCS was measured using the gravimetric method by weighing surgical materials before and after the procedure, while hemoglobin levels were monitored preoperatively and 24 hours postoperatively. All collected data were entered and analyzed using SPSS version 25.0.

Results: Overall mean age of the participants was 26.85 +4.97 years and mean gestational age was 38.60 + 1.16 weeks. Group I (15 mg/kg) had a slightly higher postoperative HB level (9.09 g/dL vs. 8.78 g/dL, p = 0.074) compared to Group I. Estimated blood loss was also lower in Group I versus Group II (491.36 mL vs. 521.89 mL, p = 0.079), suggesting a higher dose showed a trend toward better outcomes, while the differences were not statistically significant (p=>0.05).

Conclusion: The higher dose TXA showed a tendency toward lower estimated blood loss and better postoperative hemoglobin levels compared to the lower dose, suggesting that a higher intravenous tranexamic acid dose may offer better hemostatic control. However, there was lack of statistical significance across the doses.

Keywords: LSCS, TXA, Blood loss.

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Introduction

The cesarean section (CS) is a critical obstetric intervention and the preferred method for safe delivery in numerous clinical scenarios.[1] Emergency cesarean sections, in particular, are time-sensitive procedures that require rapid surgical execution.[1] As one of the most commonly performed obstetric surgeries worldwide,[2] the incidence of lower segment cesarean sections has doubled globally over the past two decades. Although elective CS can be life-saving when medically indicated,[3] the procedure carries significant risks, including surgical complications such as hemorrhage, infection, venous thromboembolism (VTE), visceral injury, and transfusion requirements.[2]

Postpartum hemorrhage (PPH) remains a leading cause of maternal mortality, accounting for 25% of maternal deaths worldwide, with 12% of survivors developing severe anemia.[3,4] Severe PPH is clinically defined by a hematocrit decline >10% or the necessity

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for blood transfusion,[35] with reported incidence rates of 3.9% following vaginal delivery versus 6.6% after cesarean delivery.[35] In Pakistan, escalating CS rates have become a major public health challenge, disproportionately contributing to maternal mortality through childbirth-related hemorrhage. Emerging evidence indicates this trend stems from intersecting socio-demographic and clinical determinants. Precise quantification of intraoperative blood loss during CS is therefore essential both for mitigating surgical complications and avoiding transfusion-associated risks.[6]

Various uterotonic drugs have been effectively utilized for both the prevention and management of blood loss during and after cesarean section.[7] These medications play a vital role in promoting uterine contractions, reducing excessive blood loss, and minimizing the risk of severe maternal complications. Tranexamic acid has the potential to decrease blood loss during cesarean deliveries, with greater benefits observed in high-risk patients. It is a powerful antifibrinolytic agent, was initially introduced by Okamoto and is structurally similar to lysine. It works by inhibiting plasminogen activation, thereby preventing its conversion to plasmin, which is responsible for breaking down blood clots. By blocking the lysine-binding sites on plasminogen, tranexamic acid effectively stabilizes clot formation.[7]

The drug acts rapidly, with an onset of action within 5–15 minutes and a duration of effect lasting up to three hours. It is commonly used as a first-line treatment for heavy menstrual bleeding and has been administered intravenously for years to minimize blood loss during and after surgical procedures.[7,8] However, due to the limited availability of high-quality evidence, definitive conclusions regarding its effectiveness cannot yet be established.[7,9]

Tranexamic acid has been reported to effectively reduce blood loss and the need for blood transfusions in anemic patients undergoing lower segment cesarean section (LSCS) when administered at doses of 10 mg/kg and 15 mg/kg.[10] Both dosages have demonstrated a favorable safety profile, with the 15 mg/kg dose proving to be more effective without a significant increase in adverse effects.[10] Additionally, recent studies have shown that a 1 g dose of TXA significantly reduces blood loss during and after LSCS.[11] However, there is ongoing debate regarding the optimal dosage of TXA for preventing hemorrhage, particularly in different clinical settings. Given the existing controversies and the need for region-specific data, this study aims to compare the mean blood loss during LSCS in anemic women receiving either 15 mg/kg or 10 mg/kg of intravenous TXA. The findings will provide valuable insights to optimize TXA dosing, enhance maternal safety, and improve clinical decision-making in local healthcare settings.

Methodology

This randomized controlled trial was conducted at the Department of Gynecology, Recep Tayyip Erdogan Hospital, Muzaffargarh, over a six-month period from May 2023 to October 2024, following approval from the institutional review board (IRB no. IHHN-IRB_2021_08_011). The study enrolled 60 anemic women (hemoglobin <11 g/dL) aged 18–40 years undergoing emergency lower-segment cesarean section for singleton pregnancies at >37 weeks gestation, selected via non-probability consecutive sampling. Exclusion criteria comprised thromboembolic disorders, placental abnormalities (placenta previa or accreta spectrum), coagulopathies, hepatic or renal dysfunction, anticoagulant use, or patient refusal. Prior to enrollment, written informed consent was obtained from all participants or their guardians after detailed explanation of the study's objectives, procedures, and potential risks in their native language, with guarantees of data confidentiality and secure storage. Participants were randomized using a lottery method into two intervention groups: Group I received 15 mg/kg intravenous tranexamic acid (TXA) 20 minutes preoperatively, while Group II received 10 mg/kg intravenous TXA at the same timepoint. All surgical procedures were performed by consultant gynecologists with a minimum of five years' experience.

Primary outcome measures included intraoperative blood loss (quantified gravimetrically by weighing surgical materials before and after the procedure), operative duration, pre- and postoperative hemoglobin levels (assessed at 24 hours), and the requirement for blood transfusion. Data analysis was performed using SPSS version 25.0.

Results

Overall descriptive statistics of the demographic and clinical numeric variables indicating that the mean age of the participants was 26.85 $\pm$4.97 years, ranging from 20 to 35 years. Mean gestational age was 38.60 $\pm$ 1.16 weeks. An average of estimated blood loss was

Table I: Overall descriptive statics of demographic and clinical numeric variables. (n=60)

Statistics	Age	Gestational age	Estimated blood loss	Pre- HB	Post- HB
Mean	26.85 years	38.60 weeks	506.62 ml	10.06 g/dl	8.93 g/dl
Std. Deviation	4.97 years	1.16 weeks	67.37 ml	0.705 g/dl	1.681 g/dl
Minimum	20 yrs	37 weeks	368.58 ml	7.88 g/dl	6.96 g/dl
Maximum	35 yrs	40 weeks	652.42 ml	10.98 g/dl	10.13 g/dl

506.62±67.37 ml. Overall, mean preoperative and postoperative hemoglobin levels were 10.06±0.70 g/dL and 8.93±1.68 g/dL respectively. (Table I)

According to the residential status, the majority of the patients (53.30%) were from urban areas, while the remaining 46.70% belonged to rural areas. This distribution highlights a slightly higher proportion of urban residents compared to rural ones. (Figure 1)

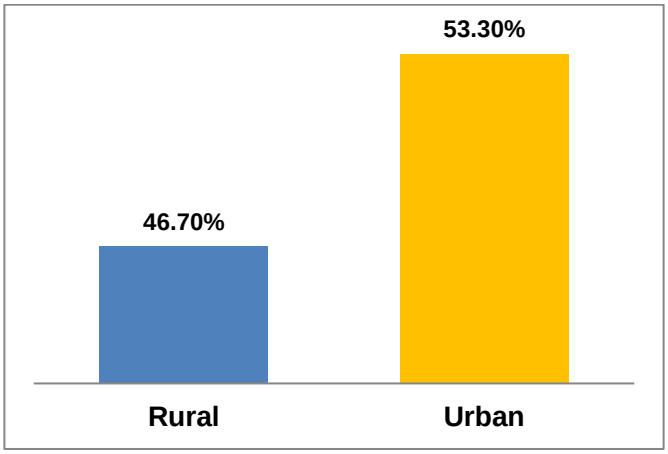

Figure 1: Residential status of the patients. (n=60)

According to parity distribution, 67% of the women were primiparous, while 33**%** were multiparous. This indicates that a larger proportion of the study participants were experiencing childbirth for the first time compared to those who had previous deliveries. (Figure 2)

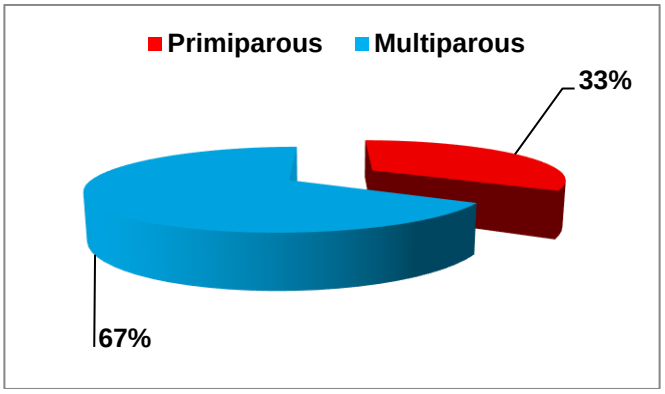

Figure 2: Parity of the patients. (n=60)

On the comparison of preoperative and postoperative hemoglobin (HB) levels and estimated blood loss between two groups receiving 15 mg/kg (Group II) and 10 mg/kg (Group I) tranexamic acid**.** The preoperative Hb levels were slightly higher in Group II (10.18 g/dL) compared to Group I (9.94 g/dL), though the difference was not statistically significant (p = 0.200). Postoperatively, Group I had a higher Hb level (9.09 g/dL) than Group II (8.78 g/dL), but this difference also lacked statistical significance (p = 0.074). Similarly, estimated blood loss was lower in Group I (491.36 mL) than in Group II (521.89 mL), with a p-value of 0.079. While the higher dose of tranexamic acid showed a trend toward better outcomes in terms of blood conservation. (Table II)

Table II: Pre-operative and post-operative HB and blood loss level across the study groups. (n=60)

Variables	Mean	SD	p-value
Preoperative HB level			
Group I (N=30)	9.94g/dl	0.80 g/dl	0.200
Group II (N=30)	10.18 g/dl	0.57 g/dl	
Post-operative HB level			
Group I(N=30)	9.09 g/dl	0.53 g/dl	0.074
Group II (N=30)	8.78 g/dl	0.77 g/dl	
Estimated blood loss			
Group I (N=30)	491.36 ml	74.57 ml	0.079
Group II (N=30)	521.89 ml	56.48 ml	

Group I= 15 mg/kg tranexamic acid. **Group II**= 10 mg/kg tranexamic acid

Discussion

The global cesarean section rate has risen significantly around 25–30% in many regions, with Pakistan reporting a CS rate of 25%.[12] One of the major concerns associated with cesarean deliveries is obstetric hemorrhage, which can be life-threatening if not managed effectively. Minimizing blood loss during and after lower segment cesarean section is crucial to reducing maternal morbidity and mortality.[12] This study, conducted on 60 anemic women with a mean age of 26.85 ± 4.97 years and a mean gestational age of 38.60 ± 1.16 weeks, aimed to evaluate the effectiveness of tranexamic acid (TXA) at two different doses (10 mg/kg and 15 mg/kg) in controlling intraoperative and postoperative blood loss.

Our findings were consistent with those of Oseni RO et al[13], who reported a mean age of 27.6 ± 4.6 years and a mean gestational age of 39.2 ± 1.1 weeks, indicating a comparable patient population. Similarly, Shahid A et al[12] observed a mean age of 24.18 ± 3.93 years and a

mean gestational age of 38.32 ± 0.80 weeks among women administered TXA before cesarean section, which aligns closely with our study's gestational age data.

However, our findings differ slightly from those reported by Soliman AA et al[14], who observed a younger patient population with a mean age of 21.46 ± 2.71 years and a mean gestational age of 39.34 ± 0.47 weeks. This variation in age distribution may be attributed to differences in study population characteristics, regional demographics, or inclusion criteria. Despite these minor discrepancies, the gestational ages across all studies remain relatively consistent, supporting the reliability of TXA administration in similar clinical settings.

Population of this study consisted of 53.30% urban and 46.70% rural residents. In terms of parity, 67% were primiparous and 33% were multiparous, indicating a higher proportion of first-time mothers, which aligns with studies linking cesarean delivery rates to primi-parity. Comparatively in the study by Soliman AA et al14 the mean parity was 0.66 ± 0.47.

This study compared hemoglobin (Hb) levels and estimated blood loss (EBL) between two groups receiving different doses of tranexamic acid (TXA): 15 mg/kg (Group I) and 10 mg/kg (Group II). Although Group I demonstrated marginally higher postoperative Hb levels and lower EBL than Group II, the differences were not statistically significant ($p > 0.05$). Nonetheless, these findings suggest a potential clinical benefit of the higher TXA dose.

Our results are consistent with existing literature supporting TXA's efficacy in reducing blood loss during and after cesarean sections. For instance, Xu et al. [15] conducted a randomized, double-blinded, case-controlled trial involving 174 primiparous women undergoing cesarean delivery. Among them, 88 participants received 10 mg/kg of TXA preoperatively. The study reported a significant reduction in blood loss between the completion of surgery and two hours postpartum in the TXA group compared to the control group ($p < 0.01$). However, no significant difference was observed in blood loss from placental delivery to the end of surgery ($p = 0.17$), implying that TXA may be more effective in mitigating postpartum bleeding than intraoperative blood loss.

Similarly, Oseni et al. [13] evaluated TXA's impact on intraoperative blood loss and found that women who received 1 g (10 mL) of intravenous TXA had significantly lower EBL (414.0 mL vs. 773.8 mL in controls; $p = 0.01$). Postoperative Hb levels were also higher in the TXA group (10.1 g/dL vs. 9.5 g/dL; $p = 0.01$), further underscoring its hemostatic benefits.

Additionally, Sahu et al. [16] reported that total blood loss (intraoperative and postoperative) was significantly reduced in the TXA group ($p < 0.05$). Notably, only 6% of women in the control group developed postpartum hemorrhage (PPH), suggesting that TXA may play a role in preventing excessive postpartum bleeding.

Importantly, no adverse effects were observed in either the mothers or neonates, affirming its safety profile. Additionally, Omawumi D et al[17] demonstrated that the mean total blood loss from cesarean section to two hours post-surgery was significantly lower in the tranexamic acid group (624.88 ± 200.76 mL) compared to the placebo group (864.24 ± 229.09 mL, p = 0.001). These findings support the efficacy of tranexamic acid in reducing blood loss during and after cesarean delivery, reinforcing its role as an effective hemostatic agent. Several other studies have also highlighted the benefits of tranexamic acid in cesarean deliveries. In women who received prophylactic uterotonic agents, the addition of tranexamic acid significantly reduced the incidence of estimated blood loss.[18-19] However, all the aforementioned studies included control groups, whereas only one study, similar to the current research, compared different doses of tranexamic acid. This study confirmed that both dosages demonstrated a favorable safety profile, with the 15 mg/kg dose proving more effective without a significant increase in adverse effects.[10] The consistent findings across multiple studies highlight tranexamic acid as a valuable adjunct in reducing perioperative hemorrhage, improving maternal outcomes, and potentially minimizing the need for blood transfusions. However, due to the limited literature on dosage comparisons and certain significant limitations of this study, particularly the very small sample size, further research is recommended to validate the findings and strengthen the existing literature.

Conclusion

The higher dose (15 mg/kg) showed a tendency toward lower estimated blood loss and better postoperative hemoglobin levels compared to the lower dose (10 mg/kg), suggesting that a higher intravenous tranexamic acid dose may offer better hemostatic control. However, due to the lack of statistical significance across the doses and certain study limitations, further larger-scale studies with adequate

statistical power are required to determine whether these observed patterns translate into clinically significant benefits.

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