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Original Article

Obstetrics and Gynaecology Section

Effect of Intravenous Tranexamic Acid Administration on Blood Loss during and after Caesarean Delivery: A Randomised Controlled Study

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ABSTRACT

Introduction: India remains a major contributor to maternal deaths in the world. Haemorrhage after delivery (both vaginal & caesarean) is the leading cause. To reduce the haemorrhage, oxytocics are routinely used. In heavy bleeding, blood transfusion may be required and in few cases obstetric hysterectomy may have to be done. Tranexamic Acid (TXA) injection has been shown to be very effective in reducing blood loss in various surgeries including Caesarean Section (CS).

Aim: To know the efficacy of intravenous TXA administration in reducing blood loss during and 2 hours after caesarean delivery.

Materials and Methods: It was a randomised, placebo controlled, clinical study in which patients scheduled for CS in the District hospital, Nadia were randomised into two groups, using a random number table list to receive either 1 gm (in 10 mL) of intravenous TXA dissolved in 20 mL of 5% dextrose solution (study group; n=50) or placebo, i.e., 30 mL of 5% dextrose solution (control group; n=50). Infusion was given 20 minutes before spinal anaesthesia. Categorical (number & percentage of patients) and continuous (Mean±Standard Deviation) variables were compared across the groups using the Chi-Square test for Independence of Attributes and unpaired t-test, respectively.

Results: The mean intraoperative, postoperative, and total blood loss were significantly lower in the study group (512.58, 65.06 & 577.64 mL, respectively) than the control group (731.68, 114.82 & 846.5 mL, respectively), p-value <0.001. There were five cases (10%) with postpartum haemorrhage in control group, requiring excess (>35 units) oxytocin infusion. There was significant difference in pre and postoperative pallor (24 vs 37 patients in study & control group respectively, p-value- 0.008), pulse rate (mean difference 4.96/min in study group & 11.14/min in control group, p-<0.001), haemoglobin (mean difference 0.13 gm% in study & 1.28 gm% in control group, p-<0.001) level & packed cell volume (mean difference 1% in study group & 3.34% in control group, p-<0.001). Other vital parameters were not comparable. None of the babies required admission in NICU. No sign of thrombosis was noted in any mother of either group. Incidence of postoperative nausea (15 and 12 patients in study & control groups, p -0.499), vomiting (10 and 9 patients in study & control groups, p=0.799) were insignificant. No cases of diarrhoea occurred in any group.

Conclusion: Preoperative treatment with intravenous TXA significantly reduces blood loss related to caesarean delivery without any significant adverse effects to both mother and newborn.

Keywords: Antifibrinolytic, Caesarean section, Clinical trial, Pregnancy, Postpartum haemorrhage, Tranexamic acid

INTRODUCTION

Everyday 830 women die from pregnancy or child birth related complications worldwide [1]. Out of this, 181 mothers are from southern Asia, including 123 from India. In other way 303000 maternal deaths occurred in 2015 among which India contributed 45000 deaths (15%). Although Maternal Mortality Ratio (MMR) has reduced greatly from 1990 to present times, India remains a major contributor to maternal deaths in the world. As per recent goals, India is committed to reducing its MMR to less than 70/lac live birth by 2030 [2]. Obstetric haemorrhage accounts for 27.1% of maternal mortality globally and Postpartum Haemorrhage (PPH) is the most common cause (15%) [3].

PPH can be defined as an estimated blood loss in excess of 500 mL and 1000 mL following vaginal birth & caesarean birth, respectively [4], but clinically it can be defined as any amount of bleeding which adversely affects the general condition of the mother. ACOG defines PPH as “cumulative blood loss equal to 1000 mL or more along with signs or symptoms of hypovolemia within 24 hours after delivery (including intrapartum loss), regardless of route of delivery” [5].

It is noted that the first 24 hour postpartum and the first postpartum week are both decisive periods, with 45% of postpartum death taking place within 1 day of delivery, more than 65% within 1 week and in excess of 80% within 2 weeks [6].

PPH can reach to terrible extent during CS. The incidence of CS has increased to as high as 25% to 30% in many areas of the world [7]. In India as per District Level Household Survey 3 (DLHS), CS rate is 28.1% in private sector and 12% in public sector health facilities [8]. The haematocrit falls by 4.6% [9] to 5.49% [10] and blood transfusion is required in 3% of women undergoing caesarean delivery [11].

Oxytocic administration is a routine to prevent blood loss after delivery of baby [12]. Sometimes blood transfusion is required [13]. In uncontrolled cases, obstetric hysterectomy may be helpful.

Radical measures like hysterectomy can have a profound impact on the psyche and health of the mother [14]. Blood loss frequently leads to transfusion of allogeneic blood products, which expose patients to the risk of transfusion related adverse effects [15]. This further will lead to increased maternal mortality and morbidity. Concern about blood safety has brought us to consider other ways to reduce transfusion requirements before and after surgery. Prophylactic use of antifibrinolytic drugs like TXA is one such option.

TXA is a synthetic derivative of the amino acid lysine that prevents activation of plasminogen to plasmin, a molecule responsible for the degradation of fibrin [16]. Due to the anti-fibrinolytic property, in different surgeries TXA has proved its efficiency in reducing the blood loss [17] viz., coronary artery bypass surgery, scoliosis surgery and knee arthroplasty [18].

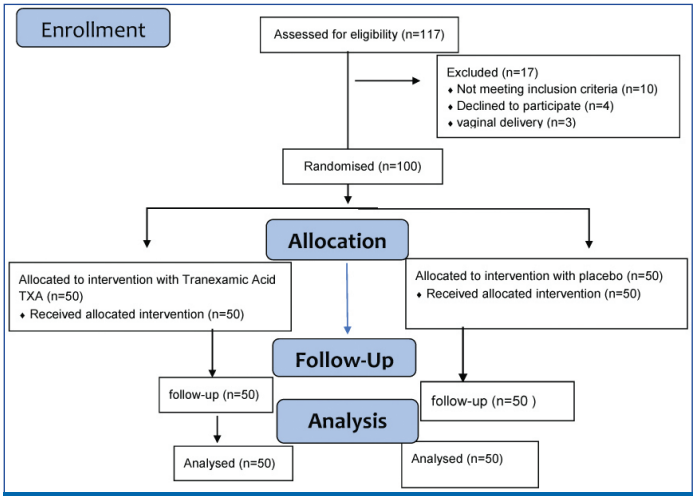
Although there are studies showing effectiveness of TXA in reducing blood loss in different surgeries [19,20], but such studies are lesser in number in the field of CS. So, the aim of this present study was to assess the effect of intravenous TXA on blood loss during and after CS and its clinical implications in larger population in a low resource country like ours.

MATERIALS AND METHODS

A randomised controlled study was carried out in the Dept. Of Obstetrics and Gynaecology, Nadia District Hospital, West Bengal after getting approval from Institutional Ethics Committee of College of Medicine and JNM Hospital, WBUHS, Kalyani (Ref. No.F24/Pr/COMJNMH/IEC/16/1211 dt 01/08/2016), West Bengal. Before commencement of the trial written informed consent was obtained from each participants.

This study was conducted in a period of one year from December 2015 to November 2016.

It was a randomised, placebo controlled, clinical study in which patients were randomised into two groups, study and control, using a random number table list after assessing eligibility criteria [Table/Fig-1]. The inclusion and exclusion criteria were same in both study and control groups. Study population was selected from admitted patients in labour ward of District Hospital, Nadia. Women aged 20-40 years with a singleton pregnancy at term without any medical, surgical, haematological complications were included, whereas women not fulfilling inclusion criteria and with complications like pre-eclampsia, polyhydramnios, macrosomia; abnormal placentation & allergy to TXA were excluded from the study.



[Table/Fig-1]: CONSORT Diagram.

Sample size was calculated assuming that difference of 100 mL of total (intra and postoperative) blood loss would be a clinically important difference between the two groups. It was calculated that 48 subjects would be required per group in order to detect this difference with 90% power and 5% probability of Type 1 error. Standard deviation was assumed to be 150 from earlier study [21].

Clinical examination was done after taking proper history and checking of antenatal records. Patients were allocated randomly into study and control groups of 50 patients each. The study group received TXA (1gm in10 mL, dissolved in 20 mL of 5% Dextrose) and control group received placebo (30 mL of 5% Dextrose) infusion over 5 minutes; 20 minutes before spinal anaesthesia. CS was performed under spinal anaesthesia as it was the most common method.

Following delivery of the baby, all patients received total 35 units of oxytocin infusion with iv fluids (10 units each in first two bottles in 40-60 minutes, then 5U in each next three bottles over a period of 12 hours postoperatively). During CS, after complete drainage of amniotic fluid and delivery of placenta, blood was drained in a separate suction container. With the use of electronic weighing machine the weight of dry and wet mops and sheets were obtained. Calculation of mean blood loss from mops and sheets was done by clinical gravimetric methods used by Gai MY et al., [22]

{Weight of soaked material (gm) – Weight of dry material (gm)}/1.05

(specific gravity of blood at 37°C=1.05.)

To calculate total intraoperative blood loss, the blood drained in the suction container after delivery of placenta was added.

At second postoperative hours, blood loss was calculated from the soaked pads by the same formula.

Vitals (pallor, pulse, respiration & blood pressure) and haematological parameters (haemoglobin, total RBC, PCV, platelet count, BT, CT) were compared between the preoperative status with those at 24 hours postoperation.

STATISTICAL ANALYSIS

The statistical software SPSS version 20, Microsoft Excel 13 had been used for the analysis. Categorical variables like gravida, parity, indication of LSCS, APGAR score, postoperative nausea, vomiting, and diarrhea were expressed as number of patients and percentage of patients and compared across the groups using Pearson's Chi Square test for Independence of Attributes. Continuous variables like Age, Weight, Height, Period of Gestation, Pre-Operative & Postoperative Hemoglobin (gm%) & its difference, PCV (%) & its difference, total RBC, blood in Suction (mL), Postoperative volume of blood in Mops + Sheet (mL), Intraoperative & Postoperative blood loss (mL), BT, CT are expressed as Mean±Standard Deviation and compared across the 2 groups using unpaired t-test. An alpha level of 5% had been taken, i.e., if any p-value was less than 0.05 it had been considered as significant.

RESULTS

The gravida, parity, mean age, weight, height & period of gestation were similar in both study & control groups and the difference in the means of both groups were insignificant. Maximum number of patients was nullipara in both the groups [Table/Fig-2].

Sl no	Parameter		Case (n=50)	Control (n=50)	p-value	significance
1	Age (years) (Mean±Std. deviation)[a]		23.1±3.05	23.7±3.65	0.407	Not Significant
2	Weight in (kg) (Mean±Std. deviation)[a]		64.44±5.62	64.44±8.05	1.000	Not Significant
3	Height (meter) (Mean±Std. deviation)[a]		1.56±0.05	1.56±0.06	0.972	Not Significant
4	Period of gestation (weeks) (Mean±Std. deviation)[a]		38.98±1.36	39.02±1.9	0.904	Not Significant
5	Gravida[b]	1	24	26	0.353	Not Significant
		2	24	24		
		3	2	0		
6	Parity[b]	0	27	28	0.360	Not Significant
		1	21	22		
		2	2	0		

[Table/Fig-2]: Distribution of patients according to demographic characteristics[a,b]. a: unpaired t-test; b: chi-square test

There was no statistical significant difference in indication of LSCS between the two groups. The p-value is 0.963 [Table/Fig-3].

Sl no	Indication of Lower Segment Caesarean Section (LSCS)	Case (n=50) (no/%)	Control (n=50) (No/%)	Total (%)	p-value
1	Cephalo Pelvic Disproportion (CPD)	7 (14)	8 (16)	15 (15)	0.963
2	Non progress of labour	11 (22)	14 (28)	25 (25)	
3	Post dated (induction failure)	2 (4)	1 (2)	3 (3)	
4	Previous LSCS with abnormal presentation	2 (4)	1 (2)	3 (3)	
5	Previous LSCS with CPD	16 (32)	17 (34)	33 (33)	
6	Previous LSCS with scar tenderness	4 (8)	4 (8)	8 (8)	
7	Primigravida with breech	4 (8)	3 (6)	7 (7)	
8	Premature rupture of membranes (PROM)	4 (8)	2 (4)	6 (6)	

[Table/Fig-3]: Distribution with respect to indication of LSCS in both groups[b].
b: chi-square test

In the control group mean postoperative pulse, Hb%, PCV and difference in Hb% & PCV between two groups were significant as p-value <0.001 [Table/Fig-4].

There was a significant difference between case and control group regarding postoperative pallor as the p-value is 0.008. Pallor was more in the control group [Table/Fig-5].

Total intra operative (blood collected in suction and in mops & sheets), postoperative & total blood loss in the control group were significantly more, p-value is <0.001 [Table/Fig-6].

No sign of thrombosis was noted in any mother of either group. It shows there is significantly more need of excess oxytocin requirement (more than scheduled total 35 unit after delivery of the baby) in the control group than in the study group (p-value 0.222). There were 5 patients among 50 patients in the control group who showed more than 1 litre of bleeding & needed excess dose of oxytocin [Table/Fig-7].

DISCUSSION

During delivery of placenta, fibrinogen and fibrin are quickly tainted, whereas plasminogen activators and Fibrin Degradation Products (FDP) rise due to activation of fibrinolytic system. TXA exerts its antifibrinolytic effect by preventing the binding of plasminogen and plasmin to the fibrin substrate & by inhibiting conversion of plasminogen to plasmin by blocking plasminogen activators [16].

Present study shows no significant differences with respect to demographic characteristics and CS indications between the two groups. Study by Roy I et al., and Dhivya Lakshmi SJ showed similar results [23,24].

Intrapartum patients in the study group had mean blood loss of 512.58±63.47 mL, while patients in the control group had mean blood loss of 731.68±100 mL (p<0.001), respectively. Two hours postoperatively, mean blood loss were 65.06±7.61 mL, and 114.82±14.44 mL (p<0.001) in study and control group respectively. Combining the two results, patients in the study & control groups had mean total blood loss of 577.64±64.97 mL, and 846.5±108.07 mL respectively. Thus, there was reduction in blood loss by about 32% (p <0.001). There were five cases with postpartum haemorrhage (10%) in the control group, requiring excess oxytocin infusion, while none of the patients in the TXA group had postpartum haemorrhage.

Roy I et al., did a similar study on 100 patients. Their results showed intraoperative blood loss was 499.11±111.2 mL and 690.85±198.41 mL in the TXA and control group respectively (p<0.001) while the postoperative loss was 59.93±12.5 mL and110.06±13.47 mL (p<0.001), respectively [23]. Study by Sahu J and Mishra N showed total blood loss was 436.5±118.07 mL in the study group and 616.5±153.34 mL in the control group (p≤0.05) [25]. Both studies were comparable to the present study. The studies by Lakshmi SD and Abrahams R also showed significant reduction of blood loss from placental delivery to completion of surgery i.e., 347.17 mL and 517.72 mL in the study and control group, respectively (p<0.001) [24]. Those results were comparable to index study.

Gai MY et al., in China studied the efficacy of TXA in reducing bleeding from the time of delivery of placenta to 2 hours postpartum. The intervention led to less bleeding 2 hours postoperatively, 42.75±40.45 mL in the study group vs. 73.98±77.09 mL in the control group (p=0.001) but did not show any decrease in postplacental delivery blood loss [22]. This was probably due to the fact that, TXA was administered only 10 minutes before the skin incision. In the present study TXA is administered 20 minutes before spinal anaesthesia.

Sl no	Parameter (Mean±Std. deviation)	Case		control		p-value		significance	
		Preop	Postop	Preop	Postop	Preop	Postop	Preop	Postop
1	Pulse (/min)	81.12±7.17	86.08±6.52	81.24±7.07	92.38±4.13	0.933	<0.001	Not significant	significant
2	Systolic Blood Pressure (SBP) (mmHg)	114.84±6.58	112.08±6.48	114.88±6.79	111.14±6.85	0.976	0.483	Not significant	Not significant
3	Diastolic Blood Pressure (DBP) (mmHg)	74±4.71	70.68±4.09	74.2±4.65	70.06±4.24	0.831	0.459	Not significant	Not significant
4	Respiratory Rate (RR/min)	13.74±1.82	13.68±1.86	13.68±1.86	13.74±1.82	0.871	0.871	Not significant	Not significant
5	Haemoglobin (gm%)	10.25±1.21	10.12±1.16	10.19±1.2	8.91±1.16	0.791	<0.001	Not significant	significant
6	Haemoglobin Difference (gm%) (pre & post op)		0.13±0.1		1.28±0.45		<0.001	Not significant	significant
7	Packed Cell Volume (PCV) (%)	35.2±3.69	34.20±3.49	35.02±3.69	31.68±3.33	0.808	<0.001	Not significant	significant
8	Packed cell volume difference (PCV) (%) (pre & post op)		1.00±0.53		3.34±1.51		<0.001	Not significant	significant
9	Total RBC (million cells/cc)	4.01±0.4	3.94±0.38	3.96±0.34	3.90±0.28	0.518	0.509	Not significant	Not significant
10	Platelet Count (lac/cc)	2.2±0.45	2.01±0.43	2.2±0.45	2.01±0.42	1.000	1.000	Not significant	Not significant
11	Bleeding Time (BT) (minute)	3.19± 0.79	3.23±0.74	3.2±0.74	3.22±0.73	0.917	0.914	Not significant	Not significant
12	Clotting Time (CT) (minute)	9.74 ±1.05	9.8±0.98	9.76±1.08	9.87±1.09	0.918	0.729	Not significant	Not significant
13	APGAR 1 minute		6.74± 1.48		6.52± 1.18		0.414	Not significant	Not significant
14	APGAR 5 minutes		8.68± 0.91		8.4±1.12		0.175	Not significant	Not significant

[Table/Fig-4]: Distribution of patients based on pre & postoperative vitals & haematological parametersa & APGAR score of new born.
a: unpaired t-test; b: chi-square test

Sl no	Side effects		Case (no/%)	Control (no/%)	Total (no/%)	p-value	Signifi-cance
1	Preoperative pallor	absent	28 (56)	27(54)	55	0.841	Not significant
		present	22 (44)	23 (46)	45		
2	Postoperative pallor	absent	26 (52)	13 (26)	39	0.008	Significant
		present	24 (48)	37 (74)	61		

[Table/Fig-5]: Preoperative & postoperative distribution of pallor in the study and control groups.
b: chi-square test

Sl no	Parameters (Mean±Std. de-viation)	Case (n=50)	Control (n=50)	p-value	Signifi-cance
1	Blood in suction	100.17±16.32	230.36±36.58	<0.001	Significant
2	Blood in mops+sheets	412.41±54.42	501.32±73.56	<0.001	Significant
3	Total Intra operative blood loss	512.58±63.47	731.68±100	<0.001	Significant
4	Postoperative blood loss	65.06±7.61	114.82±14.44	<0.001	Significant
5	Total blood loss intra+postoperative	577.64±64.97	846.5±108.07	<0.001	Significant

[Table/Fig-6]: Distribution of patients based on intraoperative blood loss (from delivery of placenta to skin closure), postoperative blood loss (from skin closure to 2 hours postoperative) and total blood loss (intraoperative + postoperative)[a].
a: unpaired t test

Sl. no	Side effects		Case (no/%)	Control (no/%)	Total (no/%)	p-value	Signifi-cance
1	Nausea	absent	35 (70)	38 (76)	73 (73)	0.499	Not significant
		present	15 (30)	12 (24)	27 (27)		
2	Vomiting	absent	40 (80)	41(82)	81 (81)	0.799	Not significant
		present	10 (20)	9 (18)	19 (19)		
3	Diarrhoea	absent	48 (96)	49 (98)	97 (97)	0.558	Not significant
		present	2 (4)	1(2)	3 (3)		
4	Signs of thrombosis	absent	50 (100)	50 (100)	100 (100)	NA	NA
5	Need of excess oxytocin	no	50 (100)	45 (90)	95 (95)	0.022	Significant
		yes	0 (0)	5 (10)	5 (5)		

[Table/Fig-7]: Distribution of patients based on side effect profile and need of excess (above 35 unit)[b].
b: chi-square test

In the present study, postoperatively, there was significant increase in pallor (37 vs 24 patients, p<0.008) and pulse (92/min vs 86/min, p<0.001) in the control group. Study by Kamel H et al., also showed significant increase in pulse in the control group postoperatively (p<0.001) [26]. In the study by Gai MY et al., the findings were not similar to ours as there was no significant increase in pulse as also the other postoperative vitals [22].

The difference between the preoperative and postoperative haemoglobin (0.13±0.1 gm% in study group vs 1.28±0.45 gm% in control group, p<0.001) & PCV (1.00±.53 in study and 3.34±1.51 in control group, p-value<0.001) were significant. Study by Sahu J et al., showed haemoglobin difference of 0.494±0.12 gm% in the study group and 0.594±0.16% (p≤0.05) in the control group [24]. Study by Roy I et al., also showed haemoglobin difference of 0.26±0.22 gm% and 0.99±0.48 gm% in the study and control groups, respectively [23]. Both the study results are comparable to our study. Study by Kamel H et al., on 300 patients (150 each in study and control group) showed significantly higher postoperative haemoglobin and haematocrit values in the study group than the control group (p-<0.001 and <0.017, respectively) [26]. These results were comparable in respect of postoperative haemoglobin change with the study by Gai MY et al., but their study did not comment on change in packed cell volume postoperatively [22].

Side effects of TXA like nausea, vomiting and diarrhoea were not significantly more in the study group. These results are similar with previous studies [23-25].

In our study, not a single patient developed signs of thrombosis. A meta-analysis by Li C et al., (25 articles, 4747 patients) also showed no increased risk of deep vein thrombosis [27]. Similar results were found in studies by Gai MY et al., [22].

All data demonstrated that TXA can be used safely without increasing the occurrence of thrombosis, but still need more cases to be observed for the occurrence of thrombosis. The safety of giving TXA (1 gm) while the foetus was still in utero was a key concern. In the current study, the mean APGAR scores at 1 and 5 minutes were 6.74±1.48 and 8.68±.91 in the study group and 6.52±1.18 and 8.4±1.12 in the control group. Thus, there was no significant difference in the APGAR values at 1 minute (p=0.414) and also at 5 minutes (p=0.175) among the two groups. Study by Roy I et al., showed similar result with APGAR values in the study & control groups after 1 minute (7.06±1.25, 7.18±1.35, p-0.559) and after 5 minutes (8.66±1.00,8.64±0.98, p-0.910) [23]. None of the babies required NICU admission.

Limitation(s)

Present study involves a particular group of patients with lesser sample size and duration. Multigravida, patients with different obstetric, medical complications were not involved. To comment on thromboembolic manifestations prolonged study duration is required.

CONCLUSION(S)

Being a cost-effective, easily available medicine, prophylactic TXA injection can cause significant reduction of intra & postoperative blood loss, lesser need of blood transfusion & oxytocin requirement in CS.

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REFERENCE

[1] WHO. Media centre Fact sheet; updated Nov,2016:http://www.who.int/mediacentre/factsheets/fs348/en/ accessed on 15/11/2016
[2] "WHO-UN Sustainable Development Summit 2015".
[3] Global causes of maternal death: a WHO systematic analysis. The lancet Global Health. volume 2, issue 6, PE323-E333, June 1,2014
[4] Weeks A. The prevention and treatment of postpartum haemorrhage: what do we know, and where do we go to next? BJOG: An International Journal of Obstetrics and Gynaecology. 2015;122(2):202-10.
[5] ACOG practice bulletin. No-183, Oct2017 http://journals.lww.com/greenjournal/fulltext/2014/07000/Executive_Summary_of_the_reVITALize_Initiative_.21.aspx
[6] Li XF, Fortney JA, Cotelchuck M, Glover LH. The postpartum period: the key to maternal mortality. Int Journal of Gynaecology & Obstetrics. 1996;54(1):1-10
[7] Kambo I, Bedi N, Dhillon BS. A critical appraisal of caesarean section rates at teaching hospitals in India. Int J Gynecol Obstet. 2002;79:151-58.
[8] District level household & facility survey (DLHS-3) [Internet]. Mumbai: International Institute for Population Sciences. Available from: http://rchiips.org/PRCH-3.html [Last accessed 17 Jan 2017].
[9] Anzaku AS, Edem BE, Ngwan SD, Galadima SJ. Do patients require routine hematocrit testing following uncomplicated cesarean delivery? Afr J Med Health Sci. 2015;14:24-28.
[10] Singh B, Adhikari N, Ghimire S, Dhital S. Postoperative drop in hemoglobin and need of blood transfusion in cesarean section at Dhulikhel Hospital, Kathmandu University Hospital. Kathmandu Univ Med J (KUMJ). 2013;11:144-46.
[11] Combs CA, Murphy EL, Laros Jr RK. Factors associated with Haemorrhage in cesarean deliveries. Obstet Gynecol. 1991;77(1):77-82.
[12] Kellie FJ. Medical methods for preventing blood loss at caesarean section. Cochrane Database Syst Rev. 2018;2018(2):CD007576.
[13] Eyelade OR, Adesina OA, Adewole IF, Adebowale SA. Blood transfusion requirement during caesarean delivery: Risk factors. Ann Ib Postgrad Med. 2015;13(1):29-35.

[14] Bălălău D-O, Sima RM, Bacalbaşa N, Ples L, Stănescu AD. Emergency peripartum hysterectomy, physical and mental consequences: a 6-year study. J Mind Med Sci. 2016;3(1):65-70.
[15] Kopko PM, Marshall CS, MacKenzie MR, Holland PV, Popovsky MA. Transfusion-related acute lung injury: report of a clinical look-back investigation. JAMA. 2002;287(15):1968-71. doi:10.1001/jama.287.15.1968
[16] Astedt B. Clinical pharmacology of tranexamic acid. Scandinavian Journal of Gastroenterology. 1987;22:22-25.
[17] Hunt BJ. The current place of tranexamic acid in the management of bleeding. Anaesthesia. 2015;70 Suppl 1:50-e18. doi:10.1111/anae.12910
[18] Kim C, Park SS, Davey JR. Tranexamic acid for the prevention and management of orthopedic surgical hemorrhage: current evidence. J Blood Med.2015;6:239-44. Published 2015 Aug 25. doi:10.2147/JBM.S61915
[19] Ker K, Edwards P, Perel P, Shakur H, Roberts I. Effect of tranexamic acid on surgical bleeding: systematic review and cumulative meta-analysis BMJ. 2012;344:e3054.
[20] Vijay BS, Bedi V, Mitra S, Das B. Role of tranexamic acid in reducing postoperative blood loss and transfusion requirement in patients undergoing hip and femoral surgeries. Saudi J Anaesth. 2013;7(1):29-32. doi:10.4103/1658-354X.109803
[21] Magann EF, Evans S, Hutchinson M, Collins R, Lanneau G, Morrison JC. Postpartum Haemorrhage after cesarean delivery: an analysis of risk factors. South Med J. 2005; 98(7):681-85.
[22] 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, randomised trial. Eur J Obstet Gynecol Reprod Biol. 2004;112(2):154-57.
[23] Roy I, Chakraborty S, Mukhopadhyay S. Role of intravenous tranexamic acid on cesarean blood loss: A prospective randomised study. Trop J Obstet Gynaecol. 2018;35:49-53.
[24] Dhivya Lakshmi SJ, Abraham R. Role of prophylactic tranexamic acid in reducing blood loss during elective caesarean section: a randomised controlled study. J Clin Diagn Res. 2016;10(12):QC17-QC21.
[25] Sahu J, Mishra N. Role of intravenous tranexamic acid in reducing blood loss during caesarean section: Study at tribal-dominated area hospital in Chhattisgarh. India. 2019;45(4):841-48.
[26] Kamel HEH, Farhan AM, Abou Senna HF, Khedr MA, Albhairy AA. Role of prophylactic tranexamic acid in reducing blood loss during elective caesarean section in rural area. The Egyptian Journal of Hospital Medicine. 2018;73(6):6886-96. doi: 10.12816/ejhm.2018.16939.
[27] Li C, Gong Y, Dong L, Xie B, Dai Z. Is prophylactic tranexamic acid administration effective and safe for postpartum hemorrhage prevention?: A systematic review and meta-analysis. Medicine (Baltimore). 2017;96(1):e5653.

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