Biomedical & Pharmacology Journal Vol. **4**(1), 231-235 (2011)

Efficacy of Tranexamic Acid in Decreasing Blood Loss During and After Cesarean Section

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(Received: May 01, 2011; Accepted: June 07, 2011)

ABSTRACT

The aim of present investigation is to study the efficacy and safety of tranexamic acid in reducing blood loss during and after cesarean section. Tranexamic acid is a competitive inhibitor of plasminogen activation, and at much higher concentrations, a noncompetitive inhibitor of Plasmin. Plasmin may be formed by conformational changes in plasminogen, it's binding to and dissolution of the fibrin matrix is inhibited. Tranexamic acid significantly reduces the amount of blood loss during and after the lower segment cesarean section. The use of tranexamic acid was not associated with any side effects or complication like thrombosis, nausea, vomiting and diarrhea.

Key words: Tranexamic acid, Side effects, Blood loss, Cesarean Section.

INTRODUCTION

The incidence of cesarean section is increasing day by day**.** The incidence of complications is much higher as compared with normal vaginal delivery. Out of these complications primary and secondary postpartum hemorrhage is most common. It leads to increased maternal morbidity and mortality. Effect of this complication is reduced by reducing the amount of blood loss during and after cesarean section.

The aim of this study is to study the efficacy and safety of tranexamic acid in reducing blood loss during and after cesarean section.[1]

Tranexamic acid (a synthetic derivative of the amino acid lysine) is an antifibrinolytic that competitively inhibits the activation of plasminogen to plasmin. Tranexamic acid is a competitive inhibitor of plasminogen activation, and at much higher concentrations, a noncompetitive inhibitor of plasmin.

Mechanism of Action

Tranexamic acid is a synthetic lysine amino acid derivative, which diminishes the dissolution of hemostatic fibrin by plasmin. In the presence of tranexamic acid, the lysine receptor binding sites of plasmin for fibrin are occupied, preventing binding to fibrin monomers, thus preserving and stabilizing fibrin's matrix structure. The antifibrinolytic effects of tranexamic acid are mediated by reversible interactions at multiple binding sites within plasminogen. The high affinity lysine site of plasminogen is involved in its binding to fibrin. Saturation of the high affinity binding site with tranexamic acid displaces plasminogen from the surface of fibrin. Although plasmin may be formed by conformational changes in plasminogen, it's binding to and dissolution of the fibrin matrix is inhibited.

MATERIAL AND METHODS

The present study is a prospective randomized case controlled study.The study was

conducted on 100 subjects of age group between 20 – 30 years at Teerthankar Medical College, Moradabad from October 2009 to September 2010.The subjects were randomized into two groups- (A)-those recieving tranexamic acid,considered as study group (50) and (B) those not recieving tranexamic acid,taken as control group (50) .In 50 subjects of group A tranexamic acid was given immediately before cesarean section and blood loss during and after cesarean section was compared with 50 subjects of group B to whom tranexamic acid was not given.Subjects with full term primipara and multipara with single pregnancy being delivered by cesarean section were included in this study and subjects with medical disorders and having blood disorders were excluded from this study.Subjects with history of thromboembolic disorders, hypersensitivity to tranexamic acid ,multiple pregnancy, polyhydromnios and those with anemia requiring blood transfusion were also excluded from this study.

In the study group 1 gm of tranexamic acid was given slowly over 5 minutes immediately before cesarean section.Inj.tranexamic acid was prepared by diluting 1 gm of tranexamic acid with 20 ml of 5% glucose solution.Tranexamic acid was not given to the control group. After delivery of neonate 20 units of oxytocin in a 5% dextrose (500 ml) at a rate of 12-14 drops / minute and methyl ergometrine were given intravenously to both the study and the control groups.

The vital parameters (blood pressure, heart rate and respiratory rate) were checked and noted before the surgery, immediately after placental delivery and 1 and 2 hrs after birth of the neonate. The amount of blood loss was measured following placental delivery to the end of the surgery. The blood loss was also measured from the end of the operation to 2 hrs after birth of the neonate. Any side effects of tranexamic acid and maternal and neonatal manifestations were noted.

Measuring blood loss

Amount of total blood loss (ml) = (weight of used materials during surgery and 2 hrs after surgery – weight of the materials prior to the surgery)

The amount of fluid sucked (ml) in the suction bottle after placental delivery and the pads used after completion of cesarean section to 2 hrs postpartum were also included in the total amount of blood loss.

The amount of amniotic fluid and blood loss before placental delivery was not included in measuring blood loss in present study.

Blood collected from the suction container (the volume was measured in ml as marked on the container) was noted and soaked mops, pads, and operation table sheet were weighed by electronic scale before and after the surgery.

Hemoglobin, liver function (Sr. Bilirubin, SGOT, SGPT, Alkaline phosphatase), renal function (Blood urea, Sr. creatinine) and urine analysis were noted before surgery and on the 3rd day after surgery.

RESULTS

In Table I two groups (study and control) were considered. Both the groups were similar and there is no significant statistical difference between two groups. There was also no significant difference in regard to obstetrical complications such as

Table 1: Distribution according to subject characteristics in study and control groups

Group	Age(years) (mean ± SD)	Height (cm.) (mean ± SD)	Weight (kg.) (mean ± SD)	Gestational age(wks) (mean ± SD)	Gravidity (mean±D)
Study (n=50)	25.63 ±3.72	153.02 ±4.73	50.11 ± 3.54	39.25 ±0.99	2.21 ± .84
Control (n=50)	25.88 ±3.89	152.56 ±4.63	50.52 ± 3.54	39.06 ±1.12	2.18 ±0.72
p-value	0.98	0.991	0.829	0.771	0.35

Table 2: Comparison of vital signs after placental delivery in both the groups

Vital signs	Immediate after placental delivery			One hour after placental delivery			Two hours after placental delivery		
	Study	Control	p-value	Study	Control	p-value	Study	Control	p-value
Heart rate(beat/min)	94.52 ± 9.25	96.62 ± 8.68	0.511	95.22 ± 12.45	91.56± 11.25	0.598	94.99 ± 11.15	97.65 ± 10.51	0.423
Respiratory rate(breaths/min)	20.22 ± 2.96	22.56 ± 3.46	0.425	23.52 ± 3.56	25.82 ± 4.25	0.201	21.38 ± 93.67	22.12 ± 2.59	0.34
Systolic BPMean(mmHg)	121.32 ± 12.34	126.86 ± 9.36	0.645	135.19 ± 10.56	122.45 ± 12.35	0.532	122.45 ± 12.23	123.15 ± 11.36	0..496
Diastolic BPMean (mmHg)	75.56 ± 10.25	79.64 ± 12.54	0.735	80.73 ± 10.96	81.12 ± 9.36	0.654	78.91 ± 10.55	80.25 ± 8.35	0.769

pregnancy induced hypertension (PIH), intrauterine growth retardation (IUGR),premature rupture of membrane (PROM).There was also no significant difference with regards to poor obstetric history and indications of LSCS including pregnancy with complication; abnormal presentation, abnormal pelvis, fetal distress, previous LSCS between the two groups. All LSCS were done under spinal anesthesia. There was no significant difference in uterine contractions after placental delivery between two groups, indicating that bleeding caused by uterine inertia was similar in both the groups. There was no significant statistical difference in the time period required to complete the lower segment caesarian section (LSCS) in both study and control groups. Bleeding caused by uterine inertia was similar in both the groups as after placental delivery there was no significant difference in uterine contractions.

Table 2 shows that if we consider the heart rate, respiratory rate, systolic BP and diastolic BP in both the study and control groups, Immediate after placental delivery, 1 hour after placental delivery and 2 hours after placental delivery, it was found that there was no significant statistical difference.

As shown in Table 3 ,in both the study groups there was no statistical difference in the quantity of the blood loss from the time of placental delivery to the end of LSCS ($p = 0.052$). There was statistically significant difference in the quantity of the blood loss from end of LSCS to 2 hours postpartum ($p = 0.001$) and quantity of the blood loss from the time of placental delivery to 2 hours postpartum ($p = 0.003$)

Table 4 shows that if we compare the incidence of post-partum hemorrhage (PPH) between both study and control groups, it was found that the incidence of post-partum hemorrhage (>500mL) was more in the control group than in the study group (p-value = 0.048).

On comparison of the two groups regarding hemoglobin status, liver function tests and renal function tests, there was no significant statistical difference .Also there were no complications regarding to the use of tranexamic acid.

Table 3: Comparison of PPH with respect to time duration during LSCS in the study and control groups

Group	Placental delivery to the end of LSCS (mL)	The end of LSCS to 2 hours post partum (mL)	Placental delivery to 2 hours post partum (mL)
Study	302.45 ± 26.64	79.56 ± 14.37	378.43 ± 39.32
Control	341.23 ± 31.52	135.35 ± 18.32	481.39 ±36.25
p- value	0.052	0.001	0.003

Table 4: Comparison of amount of blood loss (PPH) in study and control groups

Blood loss from placental delivery to 2 hours postpartum (ml)	Study	Control	p – value
<500mL	44	35	0.753
>500mL	06	15	0.048

DISCUSSION

At the time of placental delivery there is activation of the fibrinolytic system which leads to rapid degradation of fibrinogen and fibrin. There is also increase in plasminogen activators and fibrin degradation products (FDP). This activation can last up to 6-10 hours postpartum, causing more bleeding .As we know that tranexamic acid acts as an antifibrinolytic agent, so in this study we used tranexamic acid to reduce post LSCS bleeding.

During this study we found that the amount of blood loss is very much reduced from the time of placental delivery to 2 hours postpartum in lower segment cesarean section (Table 3).With the use of tranexamic acid it was found that there was significant decrease in the incidene of > 500 mL blood loss in the study group as compared to control group.

After administration of tranexamic acid there was no significant alteration in the vital signs of study group.The changes in haemoglobin levels, liver function, renal function and urine analysis were also nonsignificant.

CONCLUSION

Tranexamic acid significantly reduces the amount of blood loss during and after the lower segment cesarean section. The use of tranexamic acid was not associated with any side effects or complication like thrombosis, nausea, vomiting and diarrhea.

So after this study we conclude that tranexamic acid can be used safely and effectively in subjects undergoing lower segment cesarean section (LSCS).

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