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ORIGINAL ARTICLE

Assessment of the Effects of Tranexamic Acid (TXA) in Reducing Bleeding Loss during and After Cesarean Section (CS)

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ABSTRACT

Postpartum hemorrhage (PPH) is responsible for around 25% of maternal mortality worldwide, and approximately 12% of women who survive PPH will have severe anemia. Most serious complications associated with CS are blood loss. Therefore, in order to reduce maternal morbidity and mortality due to blood loss, it is necessary to use some techniques of treatment and medicines to prevent or reduce the volume of blood lose during CS and prevent maternal mortality. In the cases of tissue injury, increased fibrinolysis and influence on homeostatic balance, leads to coagulopathy and blood loss, and also during CS and placental separation, fibrin degradation and plasminogen products released that will be increased bleeding tendency. Thus, according to results of recent studies, it is showed that tranexamic acid as an antifibrinolytic drug has an effective role in reducing blood loss during CS, this study aimed to compare and assess the effect of intravenous tranexamic acid on blood loss volume during and after CS. This double-blind study was conducted on 65 women who were candidates for CS have satisfaction and inclusion criteria. At first, participants were matched in age, and a questionnaire which contained demographic and obstetric history was completed. The Ethics Committee of the Mashhad University of Medical Sciences approved our study.Then patients were divided into two groups: cases group (n=32) and control group (n=33). The case group were received 1 g of tranexamic acid simultaneously with the induction of anesthesia during and after CS, and 30 doses of intravenous oxytocin was administered after placenta. The control group were anesthetized as the case group, and 30 doses of intravenous oxytocin was administered for them after placenta. To measure the amount of blood loss, each complete bloody sponge was defined as about 15 cc, completely bloody large sponge were defined as 50 cc, and also the amount of blood on consuming pad after surgery was determined by observation of pad. So, 1.3 of a bloody pad was defined as 10cc, 2.3 of a bloody pad was considered as 25cc, and a whole bloody pad was considered as 55cc. The amount of blood loss after the placenta was determined during surgery, the vaginal bleeding was determined during the first six hours, and the total bleeding volume was determined during the first six hours. Vital signs including pulse and blood pressure were recorded before CS, 2 hours and 24 hours after surgery. Hemoglobin and hematocrit levels, and platelet count were measured and determined before CS, 2 hours and 24 hours after surgery. If it is needed to transfusion in any of the patients, liquid volume received recorded in their questionnaire form. There was no significant difference between two groups in terms of the average age and parity. Total gas consumption was more in control group than case group and there was a significant difference (p=0.045). But no significant difference was observed between bloody large sponge and the blood volume within the suction and total bleeding (p=0.372). There was no significant difference in the bleeding volume after the placental removal during surgery (p=0=372), the vaginal bleeding volume during the first six hours (p=0.827), and the total bleeding volume during the first six hours between two groups (p=0.382). Also, there was no significant difference in the pulse rate values before surgery(p=0.47), 2 hours after surgery (p=0.309), 24 hours after surgery (p=0.066), systolic blood pressure before surgery (p=0.134), 2 hours after surgery (p=0.753), 24 hours after surgery (p=0.3) and diastolic blood pressure before surgery (p=0.196), 2 hours after surgery (p=0.562), 24 hours after surgery (p=0.261) and hemoglobin levels before surgery (p=0.242), 2 hours after surgery (p=0.559), 24 hours after surgery (p=0.98), and hematocrit levels before surgery (p=0.156), 2 hours after surgery (p=0.623), 24 hours after surgery (p=0.622), and platelet count before surgery (p=0.156), 2 hours after surgery (p=0.457), 24 hours after surgery (p=0.883) between two groups. Intravenous tranexamic acid during CS has no effective role in reducing the amount of blood loss after surgery.

Keywords*: Tranexamic acid, Cesarean Section, Bleeding*

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INTRODUCTION

Recently, rates of cesarean section (CS) has seriously increased in many regions beyond the world, so that cesarean delivery rate has increased from 4.5 percent of all deliveries to 31.8 percent from 1970 to 2007 in U.S., and it can cause complications. One of this complications is more blood loss during CS compared to vaginal delivery [1]. Postpartum hemorrhage (PPH) is responsible for around 25% of maternal mortality worldwide, and approximately 12% of women who survive PPH will have severe anemia. Most serious complications associated with CS are blood loss. Therefore, in order to reduce major morbidity and mortality rates of cesarean delivery, it seems vitally to reduce the severe bleeding volume [2]. Tranexamic acid is a fibrinolytic drugs that are bound to the lysine- binding sites of plasminogen by competitive mechanism and block and delay fibrinolysis and thereby lead to the stability and resistance of the clot. Tranexamic acid that are able to reduce bleeding rate during surgery is used in various surgical procedures such as coronary artery bypass and knee arthroplasty surgeries [3,4]. According to the increasing number of cesarean sections around the world, some of recent studies showed the effects of tranexamic acid in reducing bleeding during cesarean delivery. Since tranexamic acid is an anti-fibrinolytic agent, it may be compensated the effect of fibrin degradation products and plasminogen that is released in placental. The objective of present study was to assess the effect of intravenous tranexamic acid on the blood volume loss during and after cesarean section.

METHODS AND MATERIALS

This double-blind study was conducted on 65 pregnant women admitted to Omolbanin hospital who had the inclusion criteria and also signed a consent form. At first, patients were divided into two groups: case group (n=32) and control group (n=33), so that surgeons and participants did not know about case and control groups. Participants in the study were matched according to age. First, a questionnaire which contained demographic and obstetric history was completed for each of them. Then the case group were received 1 g of tranexamic acid simultaneously with the induction of spinal anesthesia, and 30 units of intravenous oxytocin was administrated after the expulsion of placenta. The control group were anesthetized as the case group, and 30 units of intravenous oxytocin was administrated for them after the expulsion of placenta. Surgery start time, the time of expulsion of placenta and the end of cesarean section as noted by a nurse as a collaborator in operating room. An anesthesiologist helped to measure the volume of blood loss after the expulsion of placenta during surgery by measuring total blood volume in the suction (cc), the number of consuming bloody sponge (each consuming sponge is equivalent to 15 cc), and the number of consuming large sponge (each consuming large sponge is equivalent to 50 cc), also, the vaginal bleeding was determined during the first six hours based on consuming dry and bloody cotton pads weights (the difference of dry and bloody cotton pads weights on 1.05) , and totally bleeding volume after the delivery and 6 hours after cesarean section was determined by the total sum of bleeding after the expulsion of placenta during surgery and the vaginal bleeding volume during the first six hours of surgery, respectively. Vital signs including pulse rate, blood pressure, hemoglobin and hematocrit levels, and platelet count were measured and determined before cesarean section, 2 hours and 24 hours after surgery. The data were described in charts and statistical tables, and chi-square tests, t-test, independent test or compare mean test were used for statistical analysis. A general linear models were used to control for confounding variables. SPSS V.11.5 was used for statistical analysis, and the significance level was 5% in all tests.

RESULTS

In this study, a total of 65 patients were studied in two groups of case and control. Of 65 participants, 32 patients participating in case group had a mean of 30.41 years and 33 patients participating in control group had a mean age of 30.24 years, that after conducting statistical tests, there was no significant difference in average age between two groups (p=0.890). As well, there was no significant difference between two groups in terms of the average age and parity. (Table 1)

Table 1. The mean of parity and the number of previous cesarean in case and control group

Variables	Case	Control	P value
Parity	2.59	2.54	0.463
The number of previous cesarean	1.44	1.12	0.069

To evaluate the effect of tranexamic acid on bleeding control, the average blood loss in CS after the expulsion of the placenta (it is equivalent to the volume of consuming bloody sponge consuming bloody large sponge and blood volume in the suction), the average of vaginal bleeding during the first six hours

after surgery based on difference of cotton pads weights (the difference of dry and bloody pads weights on 1.05) and the average of total bleeding volume after the delivery and 6 hours after surgery (sum of bleeding after the expulsion of the placenta during surgery and the vaginal bleeding volume during six hours after surgery) were studied and assessed in both case and control groups, that no significant difference was observed in any of the cases.

Table 2. The average of bleeding volume during surgery, vaginal bleeding during the first six hours, and the total volume of bleeding after the delivery until six hours after surgery in both case and control groups, and evaluating the effect of tranexamic acid in bleeding during and after cesarean section

Groups Blood loss volume	Case	Control	P
The average of bleeding volume during surgery	457.19	381.67	0.372
Vaginal bleeding during the first six hours	34.86	36.07	0.827
The total volume of bleeding after the delivery until six hours after surgery	492.66	419.55	0.382

Furthermore, to evaluate the effect of tranexamic acid on vital signs and blood parameters, the average of systolic blood pressure, diastolic blood pressure, pulse rate, hemoglobin and hematocrit levels, and platelet count before surgery, 2 hours and 24 hours after surgery were measured and assessed in both case and control groups, that no significant difference was observed in any of the cases. (Table 3).

Table3. the average of systolic blood pressure, diastolic blood pressure, pulse rate, hemoglobin and hematocrit levels, and platelet count before surgery, 2 hours and 24 hours after surgery in both case and control groups, and evaluating the effect of tranexamic acid in bleeding during and after cesarean section

Time	Before surgery			2 hours after surgery			24 hours after surgery		
Groups Criteria	Case	Control	P	Case	Control	P	Case	Control	P
systolic blood pressure	104.4	110	0.134	106.4	105.8	0.753	103.9	106.21	0.3
diastolic blood pressure	64.81	69	0.196	66.25	67.5	0.562	63.81	67.57	0.261
pulse rate	82.12	83.09	0.47	80.81	82	0.309	82.75	78	0.066
hemoglobin levels	12.27	12.59	0.24	12.63	12.8	0.559	11.37	11.83	0.981
hematocrit levels	35.41	36.51	0.156	36.95	37.3	0.623	34.47	34.86	0.622
platelet count	208.91	192.61	0.156	195.43	186.09	0.457	198.65	197	0.883

DISCUSSION

According to the results of the present study, it was observed that there was no significant difference in average age between bleeding volume during cesarean section, vaginal bleeding during the first six hours after cesarean section, and the total volume of bleeding after the expulsion of the placenta until six hours after surgery (sum of bleeding during surgery and the vaginal bleeding volume during six hours after surgery) in case group who received 1 g of tranexamic acid simultaneously with the induction of anesthesia and control group who did not received tranexamic acid. According to the conducted studies, a study which is examined and evaluated like this procedures has not been still published, but the results of this study are consistent with those similar studies by Gai *et al*. [5], DR. Movategh [6] and study that examined the total bleeding volume after surgery by sum of bleeding volume during and 2 hours after surgery, perhaps various reasons including the time interval between injection of tranexamic acid, cesarean section and period measurement volume of postoperatively bleeding are likely to be the possible causes of this consistency. In additional, after reviewed some conducted studies, a similar study confirmed that present study was not affected on reducing the total volume of bleeding after cesarean section has not been still published, but findings of this study are not consistent with investigations by Gai *et al*. [5] and Xu *et al*. [8] due to the effect of tranexamic acid in reducing bleeding volume during cesarean section, that the injection of tranexamic acid during surgery is likely to be one of possible causes of this consistency in these studies. The results of this study showed that there is no significant difference between both case and control groups in terms of systolic blood pressure, diastolic blood pressure and pulse rate 2 hours and 24 hours after surgery, but the findings of this study are inconsistent with the study of Dr. Movafegh et al. that administration of tranexamic acid did not effect on systolic and diastolic blood pressure immediately after surgery [6].

It can be concluded that there was no significant difference between the average of hemoglobin amount and hematocrit percentage before surgery, 2 hours and 24 hours after surgery in both case and control groups, that these results are consistent with limited study of this field. For example, Abdel-Aleen [7] and

Senturk [9] have concluded that there was a significant decreased in patient's hemoglobin and hematocrit in 24 hours after surgery who received tranexamic acid. As mentioned before, the time interval between injection of tranexamic acid and cesarean section are likely to be the possible causes of this inconsistency. Besides, it is observed that there is no significant difference in platelet count after surgery between both case and control groups that these results are consistent completely with Gai [5] and DR. Movafegh studies [6]. Halder *et al*. study is one of the most recent published studies in this field that conducted to evaluate the efficiency and low complications of tranexamic acid in bleeding during and after cesarean section (delivery) based on hemoglobin levels before and after surgery. The findings of this randomized prospective study indicated that tranexamic acid significantly reduces the amount of blood loss from placenta to 2 days after delivery and decreased hemoglobin level was significantly higher in control group than in the tranexamic acid group, also no adverse and side effects in the mother and baby were reported for any of two groups [10], that the findings of this study were similar with the DR. Sekhavat et al. study [11] in terms of the role of tranexamic acid in reducing blood loss volume and decreased hemoglobin, but it was consistent with present study that this in consistency of two studies show to study more on tranexamic acid.

CONCLUSIONS

There is no significant difference in the amount of blood loss after the expulsion of the placenta during surgery, vaginal bleeding volume during 6 hours after surgery and total bleeding after the expulsion of the placenta during the first 6 hours and vital signs (blood pressure and pulse rate) and blood criteria (hemoglobin, hematocrit and platelets count) between the group received tranexamic acid during surgery and the group who did not receive tranexamic acid during surgery. Based on these findings, further studies are required to evaluate the relationship between preoperative injection of tranexamic acid and bleeding volume and vital signs.

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