

The Prophylactic Role of Tranexamic Acid to Reduce Blood Loss during Radical Surgery: A Prospective Study.

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Abstract: **Background:** The radical surgical procedures are associated with perioperative blood loss. This study was aimed to evaluate the clinical efficacy and safety of tranexamic acid in reducing perioperative blood loss in patients undergoing radical surgery. **Materials and Methods:** 20 ASA class I and II adult consented patients, scheduled for elective radical surgery and met the inclusion criterion, were blindly randomized into two groups to receive either intravenous 1 g tranexamic acid 20 min before skin incision or an equivalent volume of normal saline as placebo (P). All patients' total blood loss was measured and recorded perioperatively at the 12th h postoperatively. The preoperative and postoperative hemoglobin, hematocrit values, serum creatinine, prothrombin time, and symptoms of pulmonary embolism were comparatively evaluated. **Conclusion:** The prophylactic administration of tranexamic acid has effectively reduced the blood loss and transfusion needs during radical surgery without any adverse effects or complication of thrombosis

Keywords: Tranexamic, radical surgery, transhiatal esophagectomy

1. Introduction

- The radical surgical procedures are associated with excessive perioperative blood loss and necessitate the blood transfusion in the absence of blood conservation strategies. Surgery affects the coagulation systems and the fibrinolytic system shuts down due to increased release of plasminogen activator inhibitor.
- Blood transfusions are known to increase complications and morbidity. In order to reduce the amount of bleeding during radical surgery, the technical operative measures and antifibrinolytic agents are required to improve haemostasis.
- Tranexamic acid is a competitive inhibitor of plasminogen activation. The intravenous tranexamic acid has been shown to be very useful in reducing blood loss hence blood transfusion during coronary artery bypass, spinal surgery, maxillofacial surgery, orthotopic liver transplantation and total hip or knee arthroplasty.
- This study was aimed to evaluate the clinical efficacy and safety of tranexamic acid to reduce the blood loss and on the coagulation and fibrinolysis profile during radical surgery

2. Materials and Methods

- 20 adult female patients of 30 to 60 years of ASA class I and II, scheduled for either elective modified radical mastectomy or transhiatal esophagectomy, were enrolled for the present prospective randomized study, carried out from Nov 2014 to Jan 2015.

Exclusion criterion

- Allergy to medication (tranexamic acid),
- Anemia, preoperative hepatic or renal dysfunction, serious cardiac or respiratory disease,
- Congenital or acquired coagulopathy or a history of deep vein thrombosis/thromboembolic disease.
- Patient's randomization was done by the rule of odds and even into two groups of 10 patients each to receive either 1 g tranexamic acid as slow intravenous bolus (TXA) 20 min prior to skin incision or equal volume of normal saline as placebo (P). Tranexamic acid injection was prepared by diluting 1 g (10 mL) tranexamic acid with 20 mL of 5% glucose.
- Intraoperative quantity of blood losses were measured by measuring the volumes in the suction bottles after surgery and by measuring the drain collectors in post anesthesia care unit.
- All patients' preoperative and 12th hour postoperative blood samples were analyzed for hemoglobin, hematocrit, platelet count, prothrombin time.
- Doppler ultrasound of lower limbs was done pod 2 in all patients for signs of deep vein thrombosis (DVT)

3. Results

Table 1: Demographic profile, preoperative hemoglobin and coagulation parameters

Parameters	Group P	Group TA
Age (years)	46.3 ± 18.2	47.9 ± 13.1
Weight (kg)	74.5 ± 11.4	78.4 ± 12.7
Type of surgery		
Modified radical mastectomy	4	7
Transhiatal esophagectomy	6	3
Duration of surgery (min)	135.4 ± 23.5	129.7 ± 21.4

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Parameters	Group P	Group TA
Hemoglobin (g dL ⁻¹)	12.4 ± 2.8	12.1 ± 2.5
Hematocrit (%)	36.12 ± 1.5	35.26 ± 2.1
Platelet count (x103 u/L)	309.36 ± 42	284.72 ± 44
Prothrombin time (sec)	12.8 ± 1.1	13.1 ± 0.8

Table 2: Comparative values of measured blood loss, blood transfusions, hemoglobin and coagulation profile:

Parameters	Group P	Group TA
Measured blood loss (mL)	523 ± 74	316 ± 53
Blood transfusions (n)	8	1
Hemoglobin (gm·dL ⁻¹)	Preoperative	12.4 ± 2.8
	Postoperative	09.8 ± 1.3
Hematocrit (%)	Preoperative	36.12 ± 1.5
	Postoperative	29.36 ± 1.8

Parameters	Group P	Group TA
Platelet count (x103u/L)	Preoperative	309.36 ± 42
	Postoperative	264.46 ± 34
Prothrombin time (sec)	Preoperative	12.8 ± 1.1
	Postoperative	13.9 ± 0.8

- There was no significant difference in demographic data between groups.
- No significant difference was present between groups in mean hemoglobin, hematocrit, platelet count, and coagulation parameters.
- All radical surgeries were done under general anesthesia and standardized anesthetic technique was used for all patients of both groups.
- The total measured blood loss (316 ± 53 mL) in tranexamic acid group was significantly less than control group (573 ± 74 mL) (P<0.01)
- The need for blood transfusion was more in the control group. Only one patients in tranexamic acid group required allogeneic blood transfusion.
- There were no clinically relevant differences in the vital signs in patients following tranexamic acid administration

and no thromboembolic complications were detected in either group during hospitalization.

4. Discussion

- This study has evaluated the efficacy and safety of tranexamic acid to decrease blood loss during radical surgery.
- Hemostasis depends on a successful balance between the coagulation, complement and fibrinolytic pathways with complex interactions between plasma protein, platelets, blood flow and viscosity and the endothelium.
- Bleeding can increase the duration of hospital stay, re-operations and necessitate blood transfusion to restore blood loss and to reduce the morbidity after such operations.
- The risk of hemolytic reaction, anaphylaxis, acute lung injury and infection transmission, are associated with blood transfusion. Transfusion can have potential of adverse immune consequences and end organ effects.
- In this study, the prophylactic administration of tranexamic acid has shown significant decrease in total measured blood loss during radical surgeries and has reduced the need of blood transfusion.
- Primary hyperfibrinolysis that occurs during surgery plays a significant role in blood loss and is the basis for the use of antifibrinolytic agents to reduce perioperative blood loss and transfusion requirements
- Antifibrinolytic drugs, epsilon aminocaproic acid (EACA), aprotinin, and tranexamic acid have shown to decrease bleeding of major surgical procedures.
- Our data confirmed that tranexamic acid treated patients showed decrease in blood loss. It has not induce platelet activation, indeed the platelet count were similar in both groups. Extrinsic coagulation (PT) were unaffected by tranexamic acid and has ranged within their reference limits.
- Celebi *et al.* recommended the use of tranexamic acid administration for decreasing the need for blood transfusion in gynecologic cancer surgery, in view of the negative effects of blood transfusions.
- Chauhan *et al.* reported that epsilon-aminocaproic acid and tranexamic acid are equally effective to decrease bleeding in pediatric cardiac surgery.
- Rapid intravenous administration of tranexamic acid may cause hypotension and should therefore be administered slowly as infusion. In our study, no case of intraoperative thromboembolism was reported with tranexamic acid while in a recent review the incidence of venous thromboembolic events with tranexamic acid was 0.7%, with aprotinin 1.4% and with placebo 1.5%.

5. Conclusion

Tranexamic acid has significantly reduced the amount of total blood loss and need of blood transfusion during radical surgery with no apparent effect on blood coagulation parameters. Its prophylactic use is inexpensive with adequate safe profile.

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