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Original Article

The role of Tranexamic acid in the Reduction of Bleeding in Abdominal Aortic Aneurysm Surgery

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ABSTRACT

Objective: To determine the effects of Tranexamic acid on intraoperative blood loss.
Study Design: Quasi-experimental study.
Place and Duration of Study: Combined Military Hospital, Rawalpindi Pakistan, from Jun to Oct 2021.
Methodology: A total of 96 patients from both genders undergoing elective open abdominal aortic aneurysm surgery under general anaesthesia enrolled in the study after random distribution to Drug and Control Groups. The primary determinant was intraoperative blood loss. Additionally, determining variables were intraoperative and postoperative blood transfusions, thromboembolic episodes, and postoperative mortality rate.
Results: A total of 96 patients enrolled in the study, out of which 90(93%) were males, whereas 6(7%) were females, with a mean age of 65.37±7.01 (55–75 years). Of 96 participants, 52(54%) patients were from ASA Class II and 44(46%) were from ASA Class III. There was no significant correlation between surgical time (*p*-value 0.45), clamping time (*p*-value 0.34), and intraoperative and postoperative transfusions (*p*-value 0.56 and 0.28, respectively). However, a statistically significant reduction in intraoperative and postoperative blood loss was recorded (*p*-value <0.001).
Conclusion: Tranexamic acid significantly impacts the reduction of intraoperative and postoperative bleeding in elective open abdominal aortic aneurysm surgeries under general anaesthesia.

Keywords: Aneurysm, Bleeding, Blood transfusion, Fibrin.

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INTRODUCTION

Abdominal aortic aneurysm (AAA) is a prevalent condition with an approximate incidence of 4–7%, commonly affecting groups of age range 65–74 years with a greater propensity for the male gender.[1,2] Despite surgical advancements such as endovascular aneurysm repair, open abdominal aortic aneurysm repair is a considerably accepted treatment with a better prognosis and fewer contraindications.[3,4] Bleeding and blood transfusions are major determinants of mortality and morbidity.[5] To ensure bleeding control in vascular surgery, a multifarious and intricate approach is required, which encompasses microvascular bleeding and fibrinolytic system regulation.[6]

Tranexamic acid is synthetically derived from the amino acid lysine. Its mechanism of action involves the reversible binding of plasminogen with fibrin, resulting in the inhibition of plasminogen to plasmin, which ultimately prevents the degradation of fibrin.[7,8] This property is liberally utilized in haemorrhage prevention in several surgical interventions such as cardiac and gynaecological procedures, in addition to beneficial adjuvant for bleeding control in trauma patients.[9] Occasional inadvertent thrombosis limits its utility in vascular surgeries, which already poses patients to greater risk.[10] The study aimed to see if intraoperative and postoperative blood loss could be improved using a cost-effective drug, Tranexamic acid, improving patient outcomes and reducing hospital costs.

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METHODOLOGY

The quasi-experimental study was conducted at Combined Military Hospital, Rawalpindi Pakistan. In order to assess the mortality rate, the last patient was enrolled in October 2020; hence, a follow-up period of one year was completed in October 2021. The sample size was calculated using the WHO sample size calculator, taking the reported prevalence of abdominal aortic aneurysm was calculated to be 5.5%.[11]

Inclusion Criteria: Patients of either gender, aged 55-75 years belonging to American Society of Anesthesiologists (ASA) Class I, II, and III undergoing open abdominal aortic aneurysm surgery under general anaesthesia were included in the study.

Exclusion Criteria: Patients who were subjected to emergency surgery, mentally incapacitated, and past pertinent history (e.g. allergy to the study drug contents, coagulation disorders, thrombosis, chronic kidney disease) were excluded.

Ninety-six participants were randomly distributed using random tables in two uniform groups, Group–A (Tranexamic Acid Group) and Group–B (Placebo), with non-probability consecutive sampling (Figure).

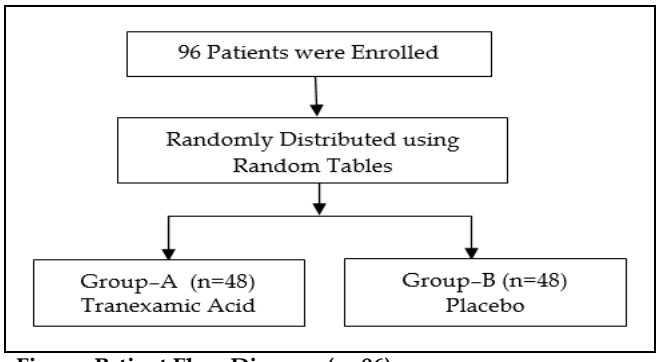

Figure: Patient Flow Diagram (n=96)

The pre-anesthesia assessment was performed per guidelines (standard laboratory test, chest x-ray, echocardiography) before scheduling surgery and reevaluated by a senior consultant anaesthetist on the day of surgery. Antiplatelet agents, Warfarin, and oral anticoagulants were stopped before surgery. To encounter thromboembolic events, 4000 units of Low molecular weight heparin was prescribed once daily from the day before surgery until four weeks elapsed postoperatively.

General anaesthesia was given to the patient per standard protocols after ensuring mandatory monitoring parameters. Thoracic epidural catheter passed between T8–T10 under aseptic conditions after assuring the absence of contraindications. Induction was performed with intravenous Propofol (1.5–2.5 mg per Kg), whereas maintenance was ensured with Isoflurane and neuromuscular blocking agent Atracurium. 5000 IU of Unfractionated Heparin was administered before the application of the cross-clamp. Transfusion of Fresh Frozen Plasma was restricted for patients with INR >1.5, and Packed Red Blood cell transfusion was instituted at Hemoglobin 8 gm/dl. At the end of the surgery, the neuromuscular blockade was antagonized by Neostigmine + Glycopyrrolate. Patients were shifted toward the stabilization of vitals in the post-anesthesia care unit. Early recovery and mobilization were ensured postoperatively.

The Drug Group was given an intravenous loading dose of 500mg of Tranexamic acid over 20 minutes, followed by an incessant intravenous infusion of 250 mg per hour till the termination of surgery. Group-B (Placebo) was given the same volumes of Normal Saline. The primary determinant was intraoperative blood loss. Additionally, determining variables were intraoperative and postoperative blood transfusions, thromboembolic episodes, and postoperative mortality rate.

Statistical Package for Social Sciences (SPSS) version 25.0 was used for the data analysis. Quantitative variables were expressed as Mean±SD and qualitative variables were expressed as frequency and percentages. Chi-square test and Independent sample t-test were applied to explore the inferential statistics. The *p*-value of ≤0.05 was set as the cut-off value for significance.

RESULTS

A total of 96 patients enrolled in the study, out of which 90(93%) were males, whereas 6(7%) were females with a mean age of 65.37±7.01 (55–75 years). Of 96 participants, 52(54%) patients were from ASA status II and 44(46%) were from ASA Status III. Patients with a positive smoking history had a frequency of 29.76 (62%) individuals in Group-A, whereas 37.44(78%) individuals were smokers from Group-B. Hypertension, Diabetes Mellitus and Ischemic Heart Disease was roughly the same in both groups. Of note is the frequency of the Transient Ischemic Attacks in these patients (Table–I).

Table–I: Medical History of Patients (n=96)

Medical History	Group–A (n=48)	Group–B (n=48)
Smoking	29.76(62%)	37.44(78%)
Hypertension	34.56(72%)	35.52(74%)
Diabetes Mellitus	5.76(12%)	3.84(8%)
Ischemic Heart Disease	14.4(30%)	15.36(32%)
Previous History of Transient Ischemic Attack or Stroke	2.88(6%)	3.84(8%)
Dyslipidemias	19.2(40%)	20.16(42%)
Chronic Kidney Disease	46.56(97%)	45.6(95%)

Statistically significant reduction in intraoperative blood loss was recorded (*p*-value <0.001). A mean of 416.14+20.73ml of blood loss was recorded intraoperatively in the Group that received Tranexamic acid compared to 568.54+41.10 in the Group that received placebo. Data recorded intra-operatively is elaborated in Table–II. A statistically significant reduction in postoperative blood loss was recorded (*p*-value <0.001) in the first 24 hours. A mean of 190.83+11.03 ml of blood loss was recorded intraoperatively in the Group that received Inj Tranexamic acid compared to 283.02+33.14 ml in the Group that received placebo.

Data of the patients recorded postoperatively is elaborated in Table-III.

Table–II: Intraoperative Findings of the Patients (n=96)

	Group–A (n=48)	Group–B (n=48)	*p*-value
Surgical Time (min)	137±52	138±49	0.45
Clamping Time (min)	36±13	37±14	0.34
Intraoperative Blood loss(ml)	416.14±20.73	568.54±41.10	<0.001*
Blood Products Transfusion	1.92(4%)	2.88(6%)	0.56

Table–III: Postoperative Findings of the Patients (n=96)

	Group–A (n = 48)	Group–B (n = 48)	*p*-value
Blood loss 0–24 hours after surgery	190.83±11.03	283.02±33.14	<0.001*
Red Blood Cells Transfusion	5.76(12%)	9.6(20%)	0.28
Thrombosis	-	-	-
Postoperative Hospital Stay	6±1.5	6±1.2	0.99
Mortality (One year Follow up)	0	2.88(6%)	0.24

DISCUSSION

In this quasi-experimental study designed to investigate the role of Tranexamic acid in open abdominal aortic aneurysm surgery, we found that the drug in question has a significant role in the reduction of intraoperative and postoperative blood loss with no significant adverse impacts such as thrombosis and increased mortality. Life-threatening haemorrhage in open abdominal aortic aneurysm surgery has dreadful implications with apprehended expanded mortality rate. Vulnerable diseased aortic tissue and multifactorial coagulation disorders owing to blood exposure to thromboplastin in atherosclerotic plaques.[12,13]

Monaco *et al.* analyzed the utility of Tranexamic acid in the control of intraoperative and postoperative bleeding in major vascular surgery such as open abdominal aortic aneurysms. No significant role was recorded in diminishing intraoperative blood loss (*p*-value 0.44), which contradicts this study. However, they reported a reduction in postoperative blood loss (*p*-value 0.002) with no significant adverse effects compatible with this study's results.[14]

The study's secondary objective was to evaluate the reduction in blood product transfusions. Imprudent haemorrhage requires transfusion of blood products, which adds to inadvertent surgical outcomes. There is a linear correlation between intraoperative or postoperative transfusions and 30-day mortality and morbidity, as reported by Obi *et al.*and Osborne *et al*.[15,16] However, no significant reduction in blood product transfusions was recorded in the drug group compared with the placebo group.

The role of Tranexamic acid in reducing bleeding and transfusions has also been evaluated in other surgeries. Lundin *et al*. found a significant reduction of blood loss and transfusions in the Tranexamic acid Group compared to the Placebo Group (*p*-value 0.03) and (*p*-value 0.02), respectively. In contrast, in our study, the only notable impact was on blood losses.[17]

Due to a limited number of vascular surgery setups in Pakistan, extensive data about the reduction of Tranexamic acid in intraoperative and postoperative blood loss during and after abdominal aortic aneurysm surgery in our setups has yet to exist. This study is a step in that direction to fill that gap. Tranexamic acid, an economical and easily available drug with recognized hemostatic properties, can reduce blood loss and transfusions with relatively favourable adverse effects.[18] Therefore, the current study provides guidelines for using this drug to reduce intraoperative and postoperative blood losses; however, more studies with larger sample sizes and longer surveillance of patients are to be conducted to establish an affirmative guideline.

LIMITATIONS OF STUDY

Realtime coagulation parameters could not be assessed due to the unavailability of Thromboelastography.

CONCLUSION

Tranexamic acid has a significant impact on the reduction of intraoperative and postoperative bleeding in elective open abdominal aortic aneurysm surgeries under general anaesthesia.

Conflict of Interest: None.

Authors Contribution

Following authors have made substantial contributions to the manuscript as under:

KMY & MS: Conception, study design, drafting the manuscript, approval of the final version to be published.

BY & KA: Data acquisition, data analysis, data interpretation, critical review, approval of the final version to be published.

NN: Data acquisition, drafting the manuscript, critical review, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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