Effect of Tranexamic Acid On Intraoperative Blood Loss and Transfusion Requirements in Major Abdominal Surgeries.

Gul sharif[1], Ihtisham Ul Haq[2], Sajjad Ahmed[3]

1. Assistant professor surgery Lady Reading hospital Peshawar Khyber Pakhtunkhwa, Pakistan.
2. Assistant professor surgery Lady Reading hospital Peshawar Khyber Pakhtunkhwa, Pakistan.
3. House officer Dhq Hospital Charsadda City, District Charsadda, Khyber Pakhtunkhwa, Pakistan.

Corresponding Author: Ihtisham ul haq

Abstract

Background: Tranexamic acid (TXA) is an antifibrinolytic medication which prevents fibrinolysis, promotes clotting stability and lessens blood loss. Its application in significant abdominal surgeries has gained interest in the possibility of reducing the intraoperative bleeding and transfusion need. Its effectiveness in other abdominal surgical scenarios is, however, still being investigated and therefore needs further clinical evaluation.

Objectives: This paper assesses the efficacy of tranexamic acid in lessening intraoperative blood loss and the need for transfusion during significant abdominal operations and compares the outcomes of patients who use tranexamic acid with those of patients undergoing the procedure using a placebo.

Methodology: this prospective observational study done on 100 patients who were undergoing major abdominal surgeries, colectomy, gastrectomy and hepatectomy. The participants were randomly assigned to receive 1 g of tranexamic acid intravenously or a placebo 30 minutes before surgery. The amount of intraoperative blood loss was measured, and the blood transfusions needed were calculated. SPSS version 26.0 was used to perform statistical analysis, and Chi-square tests were applied to categorical variables with independent t-tests on continuous variables. All the participants gave informed consent, and ethical approval was received.

Results: 100 patients, with a mean age of 58.2 ± 12.4 years. Of these, 50 received TXA, and 50 received a placebo. In the TXA group, the mean intraoperative blood loss was significantly lower at 250 mL (SD ± 70), compared to 450 mL (SD ± 100) in the placebo group ($p < 0.001$). The transfusion rate in the TXA group was reduced to 12%, while the placebo group required transfusions in 28% of cases ($p = 0.03$). The total amount of blood transfused was significantly lower in the TXA group (300 mL, SD ± 90) compared to the placebo group (600 mL, SD ± 150). No significant differences were found in the incidence of adverse events, including thromboembolic complications ($p = 0.78$).

Conclusion: Tranexamic acid plays a major part in reducing intraoperative blood loss and the need to transfuse in major abdominal surgeries. These results imply that TXA is an affordable and safe alternative to reduce bleeding in the operating room, to support the use of this agent in all patients, and to enhance patient outcomes. Nonetheless, its role in other surgical settings needs to be

investigated in further large-scale studies, and its long-term effects on recovery and complications should be assessed.

Keywords: Tranexamic acid, blood loss, transfusion, and abdominal surgeries.

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Introduction

An antifibrinolytic protein, Tranexamic acid (TXA), is an antibiotic with applications in reducing intraoperative blood loss in diverse surgical practices. TXA prevents exudation of fibrin, a major protein of clotting, and makes clots stable, minimizing excessive bleeding [1]. Its potential to reduce the blood loss has seen it be extensively used in various forms of surgeries, such as cardiac, orthopedic, and obstetric surgeries [2]. The use of TXA in major abdominal surgeries (colectomy, gastrectomy, hepatectomy, and pancreatic resections) is a contentious topic, however, which needs additional study. Such procedures are normally linked to extensive blood loss because of the complexity of the surgeries and the use of extremely vascular structures [3]. Blood loss management during abdominal surgery is a vital issue of saving the life of the patient and preventing the risk of postoperative complications, including infections, failure of the wound, and an extended recovery period [4]. Although lifesaving, blood transfusion may be accompanied by possible risk factors, such as infection, immunological response and increased length of stay [5]. Thus, it is of utmost importance that effective ways to decrease intracurative blood loss and transfusion are discovered to increase patient outcomes. The effects of TXA on major abdominal surgeries have not been properly studied, although it has been proven that the agent can make blood transfusion unnecessary and decrease blood loss in other surgical situations, including pelvic, knee joint, and spine surgical procedures [6]. Nevertheless, there are fewer studies dedicated directly to abdominal surgeries, which are associated with the large vascular fields and need special attention to hemostasis [7]. The existing evidence indicated that TXA could be useful in the prevention of blood loss and transfusions in abdominal surgery, but additional prospective observational study are required to ascertain its applicability in this context [8]. Some past study has given conflicting findings about the efficacy of TXA in relation to major abdominal operations [9]. Certain studies have reported a high rate of blood loss and transfusion reduction, whereas others have recorded insignificant positive outcomes. The following variability may be explained by the difference in study design, patients, and surgical procedures, and the dosing regimen of TXA. As a way of resolving these discrepancies, more clinical studies are necessary based on uniform methodology and a wide patient population in order to have a clear picture of the real efficacy of TXA in abdominal operations [10]. Due to these gaps in the literature, the proposed study will attempt to present a multifaceted assessment of the impact of TXA on intraoperative blood loss and transfusion during major abdominal surgeries. This trial will be able to understand whether TXA can play an important role in reducing the number of transfusions needed as well as improving the overall surgical outcomes in this high-risk group of patients by comparing patients who undergo TXA and a control group.

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The hypothesis is that the administration of TXA will result in a reduction in blood loss and decreased transfusion in patients who have undergone major abdominal surgery.

Study Objectives

To assess the efficacy of tranexamic acid in the prevention of intraoperative blood loss and transfusion needs during major abdominal operations, and compare the clinical outcomes between patients who were treated with TXA and those who received a placebo.

Materials and Methods

Study Design & Setting

This prospective observational study that was carried out at Department of surgery Lady Reading hospital Peshawar Khyber Pakhtunkhwa, Pakistan. From jan 2020 to Dec 2020.

Participants

A total of 100 adult patients (18-80 years old) who were undergoing major abdominal surgeries, including colectomy, gastrectomy, and hepatectomy, were included in the study. Those who had thromboembolic events or renal failure and could not be given TXA because of an allergy were eliminated. Pregnant and lactating women, and those with contraindications to antifibrinolytic drugs, were also excluded. Informed consent was taken from all the participants.

Sample Size Calculation

A standard power analysis was used to calculate the sample size with an alpha of 0.05 and a power of 80. Following the findings of the previous study that 30 per cent of the blood loss can be reduced by the use of TXA, 50 patients in each group were considered enough to identify a significant difference in the blood loss between the TXA and placebo groups.

Inclusion criteria

Adults between 18 and 80, planned to have a major abdominal operation, and no contraindications to TXA.

Exclusion criteria

Patients with past thromboembolic disease history, renal failure, TXA allergy, pregnant or lactating women, and contraindicated patients to antifibrinolytic therapy.

Diagnostic and Management Strategy

Preoperative testing comprised clinical examinations, laboratory (CBC, coagulation profile), and imaging tests when needed. The procedures were carried out by highly qualified surgeons under

normal procedures. The TXA group was given 1 g of intravenous TXA before incision, with the control arm being given a placebo.

Statistical Analysis

SPSS version 26.0 was used to analyse the data. Independent t-tests were used to compare the continuous variables, and Chi-square tests were used to compare categorical data. The p-value was below 0.05, which was considered statistically significant. The data was verified for its normality, and the tests were selected according to the distribution.

Ethical Approval

This study was conducted following approval from the institutional ethical review committee. All procedures adhered to the principles outlined in the Declaration of Helsinki. Informed consent was obtained from all participants prior to inclusion. Confidentiality and anonymity of participant data were strictly maintained throughout the research process, ensuring ethical compliance.

Results

The study involved 100 patients, with a mean age of 58.2 ± 12.4 years. Fifty patients received tranexamic acid, and 50 received a placebo. The results revealed a significant reduction in intraoperative blood loss in the TXA group, with a mean blood loss of 250 mL (SD ± 70), compared to 450 mL (SD ± 100) in the placebo group ($p < 0.001$). Additionally, the TXA group showed a reduced transfusion requirement, with 12% requiring a blood transfusion, compared to 28% in the placebo group ($p = 0.03$). The total volume of blood transfused was 300 mL (SD ± 90) in the TXA group, significantly lower than the 600 mL (SD ± 150) in the placebo group. The incidence of adverse events, including thromboembolic complications, was low in both groups, with no significant differences ($p = 0.78$). The TXA group demonstrated fewer postoperative complications, including infections and delayed wound healing, compared to the placebo group. These findings suggest that tranexamic acid significantly reduces both intraoperative blood loss and the need for blood transfusions, with no increase in adverse events. The overall safety profile of TXA in abdominal surgery was favorable.

Intervention Outcome

It was found that the use of tranexamic acid was able to greatly decrease the amount of intraoperative blood loss and the necessity of blood transfusion during major abdominal surgeries. These results emphasise the possibility of TXA as a good and safer alternative to reduce blood loss and decrease the risk of transfusion, and improve the overall surgical outcome without raising the rate of complications.

Table 1: Baseline Characteristics of Study Participants

Characteristic	TXA Group (n=50)	Placebo Group (n=50)	p-value
Age (mean ± SD)	58.2 ± 12.4	59.5 ± 11.2	0.47
Gender (Male/Female)	25/25	26/24	0.89
Surgical Procedure			
Colectomy	15	16	0.78
Gastrectomy	18	17	0.72
Hepatectomy	17	17	1.00
Comorbidities			
Hypertension	18	20	0.74
Diabetes	14	16	0.82

Table 1 presents the baseline characteristics of patients in both the tranexamic acid (TXA) and placebo groups. There were no significant differences between the two groups in terms of age, gender distribution, surgical procedure, or comorbidities, ensuring that randomization was effective.

Table 2: Intraoperative Blood Loss and Transfusion Rates

Outcome	TXA Group (n=50)	Placebo Group (n=50)	p-value
Mean Blood Loss (mL)	250 ± 70	450 ± 100	< 0.001
Transfusion Requirement	12% (6 patients)	28% (14 patients)	0.03
Total Transfused Volume (mL)	300 ± 90	600 ± 150	< 0.001

Table 2 compares intraoperative blood loss and transfusion requirements between the TXA and placebo groups. TXA significantly reduced blood loss and transfusion requirements, with the TXA group experiencing both lower blood loss and a lower transfusion rate compared to the placebo group.

Table 3: Adverse Events and Postoperative Complications

Adverse Event	TXA Group (n=50)	Placebo Group (n=50)	p-value
Thromboembolic Events	1 (2%)	2 (4%)	0.78
Infections	3 (6%)	5 (10%)	0.60
Wound Healing Delays	2 (4%)	4 (8%)	0.68

Renal Complications	0 (0%)	1 (2%)	0.67

Table 3 shows the adverse events and postoperative complications observed in both groups. The incidence of thromboembolic events, infections, and delayed wound healing was low and comparable between the TXA and placebo groups, suggesting that TXA did not increase the risk of complications.

Table 4: Statistical Summary of Intraoperative Outcomes

Outcome Measure	TXA Group (n=50)	Placebo Group (n=50)	p-value
Mean Blood Loss (mL)	250 ± 70	450 ± 100	< 0.001
Mean Transfusion Volume (mL)	300 ± 90	600 ± 150	< 0.001
Number of Patients Transfused	6 (12%)	14 (28%)	0.03
Adverse Events (Total)	6 (12%)	10 (20%)	0.37

Table 4 summarizes key statistical outcomes related to intraoperative blood loss, transfusion volume, and adverse events. The TXA group showed a significantly lower mean blood loss and transfusion volume compared to the placebo group, with no significant difference in adverse event rates.

Discussion

This paper was to assess the efficacy of tranexamic acid (TXA) in the prevention of intraoperative blood loss and blood transfusion requirement during major abdominal surgeries, including colectomy, gastrectomy, and hepatectomy. The findings have shown that the extent of blood loss and transfusion requirements in the TXA group are significantly reduced as compared to the placebo group, as had been reported by a number of studies carried out recently [11]. As per our results, another study reviewed the use of TXA in colorectal surgery and found a considerable decrease in blood loss and the necessity of blood transfusion, which was also the case with our study [12]. Patients who received TXA lost half the blood loss of the control group in their study, with a major reduction in the rate of transfusion, which supports our results of lowering transfusion demands (12% vs. 28) in the TXA group. In addition, there are also systematic reviews and meta-analyses, such as Zhang et al [13]. (2019), which support the application of TXA in significant cases of abdominal surgeries like gastrointestinal and hepatic surgeries. In their review, they found that the use of TXA resulted in a reduction of blood loss by up to 40 per cent in several surgical procedures of the abdomen, and this led to a significantly reduced requirement of transfusion postoperatively. These conclusions can be made based on our results, where the mean blood loss of the TXA was 250ml versus 450ml in the placebo group, which further reinforces the usefulness of TXA in curbing blood loss during abdominal operations. But it should also be mentioned that the effect of TXA on the results of the surgery may not be the same among the varied types of

abdominal operations. An investigation on gastrectomy patients reported a slight decrease in blood loss, still not as significant as that of our study and other studies conducted by Zhang et al [14,15]. They have explained this by the differences in the technique of surgery and the application of adjunctive interventions such as hemostatic agents. Although surgical processes differed in our study, TXA had positive outcomes, which implies that it might be a useful addition to the reduction of blood loss in most types of major abdominal surgeries. In a few studies, the safety profile of TXA has been of concern [16]. undertook a randomised trial study in the area of liver resections, and found that no increment of thromboembolic complications was observed with the use of TXA and that the incidence of adverse events, including thromboembolic events, was low and similar in the TXA and placebo groups ($p = 0.78$) [17]. This supports the conclusion that TXA is mostly safe in the application of major abdominal surgery, if the right patient selection is undertaken [18]. Methodological rigour was also one of the most important issues in our study since a balanced sample of patients was used and randomisation was applied to reduce bias [19]. This is unlike previous study, including has shown mixed results because of weaker inclusion and exclusion criteria [20]. A study by Jiang involving a wider spectrum of surgical operations reported that TXA is useful in reducing the amount of blood loss, but did not support its use in a surgery with great intraoperative bleeding that would include pancreatic resection. In our study, we particularly focused on large abdominal surgeries that had a high risk of bleeding and could have made stronger conclusions on the usefulness of TXA in this surgical scenario [21]. The theoretical aspects that may explain the efficacy of TXA in the prevention of blood loss consist of the blockage of fibrinolysis and the stabilisation of the clot formation process in the operating room. In summary, the results that we obtained can be used to justify the standard practice of using TXA as a safe and effective mechanism for preventing intraoperative bleeding and blood transfusion in major abdominal surgeries [22,23]. Such a conclusion is in line with the recent study works that have emphasised the high positive impact of TXA in different surgical practices. Nevertheless, additional, large-scale, multicenter study is necessary to establish its long-term efficacy, the best dosage schedules, and its benefits in various subgroups of abdominal surgery patients. The results of this study contribute to the growing evidence that indicates that TXA is an inexpensive and safe intervention in abdominal surgery.

Limitations

The limitations of this study are that this work is a single-centre study; this could restrict the externalisation of the findings to larger populations. Its sample size was rather small, whereas the period of the follow-up was confined to intraoperative results. Also, the differences in surgical methods and patient factors may have contributed to the outcomes, and more multicenter studies should be carried out to prove it.

Conclusion

Tranexamic acid has proven to be very effective in preventing intraoperative blood loss and transfusion during major abdominal surgery. The presented findings indicate that TXA is an effective and safe intervention that can be used to decrease blood loss during surgery. It needs to be studied on a large scale to confirm its long-term benefits and provide standardised protocols for its use in the future.

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Authors Contributions

Concept & Design of Study: **Gul sharif[1]**

Drafting: **Ihtisham Ul Haq[2]**

Data Collection & Data Analysis:**Sajjad Ahmed[3]**

Critical Review: **Sajjad Ahmed[3]**

Final Approval of version: **All Mention**

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