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Original Research Article

Role of Local Tranexamic Acid for The Prevention of Surgical Bleeding in Soft-Tissue Surgery

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Abstract: *Surgical bleeding is a common concern in soft-tissue procedures, often necessitating interventions to minimise blood loss and associated complications. Tranexamic acid (TXA), an antifibrinolytic agent, has been widely used to reduce surgical bleeding. However, the comparative effectiveness of local versus systemic TXA administration remains an area of ongoing investigation.* ***Objective:*** *The present study aims to evaluate the role of local tranexamic acid in preventing surgical bleeding in soft-tissue surgery.* ***Methods:*** *After the ethical approval from the institutional review board, this retrospective observational study was conducted at Kulsum Bai Valika Hospital, Karachi, from 1st April 2023 to 30th April 2024. Through non-probability sampling, a sample of 100 patients, aged 20-80 years, either gender, who underwent different soft tissue surgeries that included general surgery, orthopaedics, and gynaecology, were included in the present study. TXA treatment was grouped according to the type of surgery involved and the method used to apply the TXA. The three groups were local TXA, systemic TXA, and no-TXA groups. Local TXA meant that TXA was applied directly to the surgery site, while systemic TXA was given through a drip.* ***Results:*** *The mean blood loss was 499.16 mL in the Local TXA group, 557.84 mL in the Systemic TXA group, and 552.45 mL in the No TXA group (p= 0.668). However, the incidence of postoperative bleeding was significantly lower in the Local TXA group (26%) compared to the Systemic TXA (33%) and No TXA groups (57%) (p=0.0025)* ***Conclusion:*** *In conclusion, the present study is confirmative of the effectiveness of local TXA application in the reduction of postoperative bleeding in soft tissue surgery procedures.*
Keywords: Local Tranexamic Acid, Blood Loss, Soft Tissue Surgery, Post-Operative Bleeding

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Introduction

TXA application in soft-tissue surgery has been on the rise, especially in the localised use for controlling bleeding (1). TXA is a synthetic antifibrinolytic agent that acts by blocking plasmin formation from the plasminogen, hence strengthening the stability of the fibrin clots and lessening bleeding (2). Even though the utilisation of systemic TXA has already been established in numerous surgical specialities, recent investigations provide information regarding selected studies that depend on the efficacy and safety of local TXA in the operations of soft tissues (3).

Regarding topical TXA application, numerous studies have shown that local TXA helps minimise intraoperative and postoperative bleeding in various soft tissue surgeries. For example, a systematic review conducted by Ker et al. (2016) indicated that Local use of TXA in surgical procedures, including skin grafting and maxillofacial surgeries, reduces blood loss. Because of this review, they pinpointed that the localised application of TXA increases surgical outcomes by increasing the visibility of the surgical field and shortening the operation time (4).

In plastic and reconstructive surgery, reports suggest that local TXA can significantly reduce postoperative complications like hematomas and seromas, translating to better cosmetic results (5). Shakur et al. (2017) investigated breast as well as abdominal surgeries; local TXA application was done with a reduction in postoperative bleeding without any elevation of the thromboembolic risks (6). This is in line with meta-analyses that have further recommended an increased reduction of blood loss by 30 to 50 percent when TXA is locally administered during the surgical process (7).

Local TXA also has a favourable safety profile. Henry et al. (2011) conducted a review that showed that the risk of developing side effects such as thromboembolic events is small when given locally because of the small amount of the drug absorbed systemically (8). This makes local TXA a realistic proposition that could even be used in high-risk patients regarding bleeding risk. In soft tissue surgery, the literature affirms the use of local TXA as a safe and effective antifibrinolytic option to manage surgical bleeding, enhance postoperative performance and reduce adverse sequelae. Thus, the present study aims to evaluate the role of local tranexamic acid in preventing surgical bleeding in soft-tissue surgery.

Methodology

After the ethical approval from the institutional review board, this retrospective observational study was conducted at Kulsum Bai Valika Hospital, Karachi, from 1st April 2023 to 30th April 2024. Through non-probability sampling, a sample of 100 patients, aged 20-80 years, either gender, who underwent different soft tissue surgeries that included general surgery, orthopaedics, and gynaecology, were included in the present study. Patients with severe bleeding disorders and patients on long-term anticoagulants were excluded from the present study. TXA treatment was grouped according to the type of surgery involved and the method used to apply the TXA. The three groups were local TXA, systemic TXA, and no-TXA groups. Local TXA meant that TXA was applied directly to the surgery site, while systemic TXA was given through a drip. For each patient, several variables were documented, including age, sex, type of surgery, type of TXA administration, estimated surgical blood loss, the drop in postoperative haemoglobin levels, duration of the operation, postoperative haemorrhage occurrence, the requirement for blood transfusion, length of hospital stay, postoperative wound infection, and mortality. Blood loss in millilitres was the primary endpoint, whereas secondary endpoints were postoperative morbidity regarding bleeding, infection, blood transfusion requirement, length of hospital stay and mortality. Information was obtained from patient files and operation notes; estimated blood loss was obtained from the operating team. Baseline and postoperative haemoglobin levels were obtained to

determine the actual decrease in haemoglobin and, consequently, the degree of blood loss. The patient's postoperative bleeding was determined in the subsequent days, and the requirement for blood transfusions was noted. The duration of hospitalisation was considered to ascertain the timeframe to recovery, while wound infection incidence and mortality formed an aspect of the operative outcomes. SPSS version 26 was utilised for the data analysis

Results

In this study, 100 patients were divided into three groups based on the type of tranexamic acid (TXA) application: Local TXA (n=31), Systemic TXA (n=32), and no TXA (n=37). Table 1 shows the demographic parameters of the study participants. The mean age across the groups was similar, with the Local TXA group averaging 46.19 years, the Systemic TXA group 55.5 years, and the No TXA group 47.24 years, with a P value of 0.072, indicating no significant difference in age. Gender distribution was also comparable across the groups (P = 0.676), with males comprising 55% of the Local TXA group, 66% of the Systemic TXA group, and 62% of the No TXA group. Regarding the type of surgery, there was no significant difference between the groups (P = 0.521). In the Local TXA group, 52% of patients underwent general surgery, 29% orthopaedic surgery, and 19% gynaecological surgery. In the Systemic TXA group, these proportions were 44%, 25%, and 31%, respectively. In the No TXA group, 59% underwent general surgery, 11% orthopaedic surgery, and 30% gynaecological surgery. The clinical parameters of the study participants were analysed across the three groups and presented in Table 2. The mean blood loss was 499.16 mL in the Local TXA group, 557.84 mL in the Systemic TXA group, and 552.45 mL in the No TXA group, with a P value of 0.668, indicating no significant difference. The decrease in haemoglobin levels postoperatively was slightly lower in the Local TXA group (1.85 g/dL) compared to the Systemic TXA (2.15 g/dL) and No TXA groups (2.27 g/dL), with a P value of 0.23. The duration of surgery averaged 159.77 minutes for the Local TXA group, 164.71 minutes for the Systemic TXA group, and 180.43 minutes for the No TXA group, with no significant difference (P = 0.468). However, the incidence of postoperative bleeding was significantly lower in the Local TXA group (26%) compared to the Systemic TXA (33%) and No TXA groups (57%), with a P value of 0.025, indicating a statistically significant reduction in bleeding. The requirement for blood transfusions was highest in the Systemic TXA group (45%), followed by the No TXA group (38%) and the Local TXA group (23%). However, this difference was not statistically significant (P = 0.13). The average hospital stay was shortest in the Local TXA group (6.6 days) and longest in the No TXA group (8.05 days), but this difference was not significant (P = 0.284).

Table 1: Demographic characteristics of the study participants

Parameters	Local TXA (n=31)	Systemic TXA (n=32)	None (n=37)	P Value
Age (Years)	46.19±17.7	55.5±17.1	47.24±18.21	0.072
Gender				0.676
Male	17 (55%)	21(66%)	23 (62%)	
Female	14 (45%)	11 (34%)	14(38%)	
Surgery type				0.521
General Surgery	16 (52%)	14(44%)	22 (59%)	
Orthopedic	9 (29%)	8 (25%)	4 (11%)	
Gynaecology	6 (19%)	10 (31%)	11 (30%)	

Table 2: Clinical parameters of the study participants

Parameters	Local TXA (n=31)	Systemic TXA (n=32)	None (n=37)	P value
Blood Loss (mL)	499.16±295	557.84±266	552.45±299.3	0.668
Hemoglobin decrease (g/dL)	1.85±0.9	2.15±1.09	2.27±1.02	0.23
Surgery duration	159.77±73.05	164.71±71.2	180.43±73.4	0.468
Postoperative bleeding n (%)	8 (26%)	11 (33%)	21 (57%)	0.025*
Transfusion required	7 (23%)	15 (45%)	14 (38%)	0.13
Hospital stay (days)	6.6±3.6	7.125±3.3	8.05±4.02	0.284
Wound Infection	15 (48%)	19 (58%)	18 (49%)	0.606
Mortality	8 (26%)	15 (45%)	16 943%)	0.188

Discussion

Thus, the results of this study support the hypothesis that the use of local TXA may be valuable in eliminating the risk of postoperative bleeding in soft tissue surgery. However, no other clinical parameters, including blood loss and the degree of haemoglobin drop and hospital stay, have shown any marked differences. The study outcomes indicated that the Local TXA group had a lesser postoperative bleeding rate than the Systemic TXA and the No TXA groups with a p-value <0. 025. This concurs with other studies showing that local TXA prevents surgical bleeding while keeping minimal levels of TXA in systemic circulation with few adverse impacts.

The effect measured has been positive across most studies and supported the prescription of local TXA in several surgical environments. A systematic review by Ker et al. 2012 revealed that local application of TXA reduced blood loss and the requirement for blood transfusion in patients undergoing surgery, most notably in orthopaedic and cardiac procedures (4). In a plastic surgery study by Wong et al. (2008), local TXA decreased intraoperative and postoperative blood loss and promoted patients' faster recovery and minimal use of blood transfusions (9). These studies support the present work, indicating that local application of TXA can be helpful in the management of surgical bleeding.

In the present work, the mean blood loss did not vary significantly between the two groups, with a 'P' value of 0.668. This may be due to the challenges of managing all factors contributing to blood loss during surgery, such as the surgeon's skill, the patient's condition, and the type of surgery done. Nevertheless, the lower rate of postoperative bleeding in the Local TXA group is essential from the clinical point of view because it means a lower rate of complications such as hematoma formation, which may result in prolonged recovery time or need for other interventions (10).

Interestingly, the Systemic TXA group patients had higher incidences of requiring blood transfusions (45%) as compared to the Local TXA group (23%) patients, though again, the difference was non-significant (P" = 0. 13). This may therefore imply that the application of systemic TXA though effective may be less efficient in some types of surgeries maybe because of the variation in drug deposition and concentration at the site of operation. Existing research suggests that systemic TXA is used

universally and proven in minimising bleeding during different surgical operations, however, its effects are thought to be better if used locally, especially in soft tissue surgeries where the direct application allows a higher concentration of the drug at the site of haemorrhage (11).

The study also gave results for other variables, including the duration of surgery, the days of stay in the hospital, wound infection and mortality, all showing no considerable variance. These results concur with prior research, which described similar results when comparing local and systemic use of TXA. For example, their review of TXA by Franchini et al. (2018) determined that even though the drug proves efficient in preventing bleeding, it is still not clear if it can effectively minimise other complications, such as infection and mortality rates because of the composite nature of these effects (12).

Regarding wound infection, the rates are comparable in all arms (P = 0.606), and this should not be a cause of concern, particularly about the proposition that TXA supplementation may affect the wound healing process or the prevalence of thromboembolic complications. For example, a randomised controlled study done by Khanna et al. (2021), as earlier stated, has revealed that the adverse effects of TXA include the non-significant risks of wound infections or thromboembolic complications when used appropriately (13).

Last but not least, the mortality rates in this study were also similar between the groups (P = 0.188), corroborating the findings from large-scale RCTs and meta-analysis on the safety of the TXA, whether administered systemically or locally. For instance, the CRASH-2 trial, a large randomised trial looking at the use of TXA in the trauma population, did not show an increase in mortality in patients who were administered TXA (14).

Conclusion

In conclusion, the present study confirms the effectiveness of local TXA application in reducing postoperative bleeding in soft tissue surgery procedures. However, additional investigations are warranted to evaluate the effect of local TXA on other clinical consequences, the results of present studies show that local application of the TXA is safe and effective for managing intraoperative bleeding without affecting adverse events.

Declarations

Data Availability statement

All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department concerned. (IRBEC-LNMC-0741-24)

Consent for publication

Approved

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Not applicable

Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

***ZS** (Resident)**, MG** (Consultant General Surgery and HOD)*
Review of Literature, Data entry, Data analysis, and drafting article.
Manuscript drafting, Study Design, Development of Research Methodology Design
***MNS** (Resident), **WNZ** (Resident)*
Study Design, manuscript review, critical input, Conception of Study.

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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