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04(69) 2025 : 001–005 • RESEARCH ARTICLE

Investigation of routine tranexamic acid application in gynecological oncology

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SUMMARY

Background/Aim: Tranexamic acid is a drug that controls bleeding by affecting fibrinolytic pathways. This study investigated the effect of routine use of Tranexamic Acid (TXA) on blood loss in gynecologic oncology surgeries.

Materials and methods: 160 gynecologic oncology patients who underwent surgery at the Department of Obstetrics and Gynecology at Selçuk University between 2023 and 2024 were evaluated. Patients were divided into two groups: those who received TXA (n=80) and those who did not (n=80). TXA was administered intravenously at a dose of 1 gram intraoperatively.

Results: A significant reduction in drain fluid volume was observed in the TXA group. While the postoperative decrease in hemoglobin levels was substantial in both groups, the TXA group had more stable values. Although blood loss decreased, the difference was not statistically significant. No complications such as thrombus were observed. Liver enzymes (ALT, AST) increased postoperatively in both groups. Surgery duration was slightly prolonged in the TXA group.

Conclusion: TXA was effective in controlling bleeding and reducing drain fluid output in gynecologic oncology surgery, but did not cause significant changes in laboratory parameters. It was concluded that TXA is a safe and beneficial agent when used at an appropriate dose and with proper patient selection. However, larger-scale, multicenter studies are needed.

Keywords: Tranexamic acid; Hysterectomy; Bleeding; Cancer

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Word count:2963 **Tables:** 01 **Figures:** 00 **References:** 17

Received: 09.07.2025, Manuscript No. GPMP-25-167765; **Editor assigned:** 11.07.2025, PreQC No. GPMP-25-167765 (PQ); **Reviewed:** 25.07.2025, QC No. GPMP-25-167765; **Revised:** 22.12.2025, Manuscript No. GPMP-25-167765 (R); **Published:** 30.12.2025

INTRODUCTION

Gynecologic oncology surgeries are procedures in which perioperative bleeding is common due to the extensive dissection area, high vascularity of the tumor tissue, and the frequent comorbidities of patients. Failure to manage blood loss increases the need for transfusions, which can lead to adverse outcomes such as infection, altered immune responses, and prolonged hospital stays [1]. Increased fibrinolytic activity is associated with disease progression, mortality, and surgical complications in cancer patients [2]. The literature has demonstrated that fibrinolysis mechanisms are influenced by surgical stress, tumor micro-environmental characteristics, and the inflammatory response [3]. Tranexamic Acid (TXA) is a potent anti-fibrinolytic agent that reduces fibrin degradation by inhibiting the conversion of plasminogen to plasmin, thereby controlling blood loss [4]. Numerous studies, including orthopedic, cardiac, and gynecological surgeries, have supported the effectiveness of TXA in reducing surgical blood loss. However, data evaluating the efficacy of TXA in gynecological oncological surgeries are still limited, and more evidence is needed in this area. Because bleeding can be challenging to manage, particularly in extensive surgeries requiring laparotomy, the perioperative use of agents such as TXA holds potential clinical relevance. The literature has reported that TXA reduces intraoperative bleeding and the need for transfusion in laparoscopic and open surgeries [5]. However, it has been emphasized that parameters such as the protocol, dose, and timing of TXA administration determine its effect on hemostasis. Furthermore, the role of anti-fibrinolytic agents in the management of intraoperative coagulopathy is increasingly being recognized [6]. This study aimed to evaluate the effects of routine tranexamic acid use on blood loss, drain fluid volume, and perioperative laboratory parameters in gynecologic oncology surgeries.

MATERIALS AND METHODS

The study planned to evaluate gynecological oncological cases that underwent surgery in the Gynecology and Obstetrics Department of Selçuk University Faculty of Medicine between 2023 and 2024. This retrospective, cross-sectional study evaluated patient demographics, including age, parity, comorbidities, medications, and previous surgical history. Surgical indications (endometrial cancer in the same patient group), incision type (midline/Pfannenstiel), operative time, drain fluid volume, and drain usage duration were analyzed. Postoperative healing parameters included wound healing. Laboratory evaluations included preoperative and postoperative Hemoglobin (HB), Hematocrit (HCT), platelet count, APTT, ALT, AST, urea, and creatinine values. Furthermore, potential intraoperative and postoperative complications and blood loss were also included in the analyses. The reference ranges for the laboratory parameters evaluated in the study were as follows: 12.0–16.0 g/dL for Hemoglobin (HB), 36–46% for Hematocrit (HCT), 150,000–400,000/mm³ for platelet count, and 4,000–10,000/mm³ for

White Blood Cell (WBC). Coagulation parameters included Prothrombin Time (PT) of 11–14.5 seconds, INR of 0.8–1.2, and Activated Partial Thromboplastin Time (APTT) of 25–35 seconds. Biochemical parameters were based on reference ranges of 7–56 U/L for Alanine Aminotransferase (ALT), 10–40 U/L for Aspartate Aminotransferase (AST), 10–45 mg/dL for urea, and 0.5–1.1 mg/dL for creatinine. These values represent standard laboratory reference ranges widely accepted in the adult population. All of these parameters were compared between the TXA and non-TXA groups.

Blood loss estimation: Intraoperative blood loss was calculated using a combination of suction canister volume after subtracting irrigation fluids and the gravimetric method, which included weighing surgical sponges before and after use. Changes in hemoglobin and hematocrit were indirectly assessed as indicators of postoperative blood loss.

Medication: Tranexamic acid preparation is planned to be administered as 1 gram of tranexamic acid (Actavis İlaçları A.Ş, İstanbul, Turkey) intravenously in 250 mL of saline in 15-20 minutes. Tranexamic acid is recommended for routine oncological surgeons. There is no conflict of interest in using a routine preparation in the hospital. There is no conflict of interest in using a routine preparation in the hospital.

Tranexamic acid is recommended for routine oncological surgeons [7].

A total of 160 patients were evaluated.

Group 1: 80 patients were given tranexamic acid.

Group 2: 80 patients were not given tranexamic acid.

Statistics

Data analysis was performed using the Statistical Package for the Social Sciences (SPSS) 26.0. Clinical and surgical features are presented as numbers and percentages for patients in gynecological oncology who used tranexamic acid, and the distribution between the two groups is analyzed using the *Chi-square* test. All data are presented as mean, standard deviation, median, minimum, and maximum. The normality of the data was assessed by examining skewness and kurtosis. In the dataset, two groups are presented as variables that are not normally distributed (z) and variables that are typically distributed (t), and the images to be used in the analysis were selected accordingly. The reference value taken in regular sections is between ± 1.96. Comparison of digital persons according to tranexamic acid use in patients using the Independent Sample T-test/Mann-Whitney U-test. The values of 0.05 and 0.01 were not recorded at the significance level of all changes.

RESULTS

The mean age of the patients in the study was 52.2 ± 2.3 years, and no significant demographic differences were observed between groups for parity, current medical treatments, or surgical indications. The majority of the patients included in the study were diagnosed with early-stage endometrial cancer, and analyses were conducted primarily on this patient group. Comorbidity status was examined, and the comorbidity rate was 68.8% in the non-TXA group and 76.3% in the TXA-using group; however, this difference was not statistically significant (p>0.05). Furthermore, no significant difference was found between the groups regarding prior surgery; 72.5% of the TXA-non-users and 75.0% of the TXA-using patients had undergone previous surgery (p>0.05).

There was no difference in wound healing between the groups, and the reasonable wound-healing rate was 96.3% in both groups (p>0.05).

When incision types were examined, a midline incision was used in 36.3% of patients in the TXA-free group, while the Pfannenstiel method was used in 63.8%. In the TXA group, the midline incision rate was 30.0%, and the Pfannenstiel incision rate was 70.0%. No statistically significant difference was found in the distribution of incision types between the two groups (p>0.05). The amount of drain fluid was significantly reduced in the TXA group (124.22 ± 47.34 mL; p<0.05), demonstrating that TXA is effective at controlling fluid. Drain use time was similar in both groups, with no statistically significant difference (p>0.05). Procedure time was slightly increased in the TXA group (2.11 ± 0.32 hours, p<0.05). Although blood loss was lower in the TXA group, this difference was not statistically significant (p>0.05). These results suggest that TXA may be effective in reducing the volume of drain fluid.

For APTT, preoperative and postoperative measurements were similar between the TXA and non-TXA groups (p>0.05). However, both groups showed a significant postoperative increase, with APTT rising from 25.0 to 25.1 seconds in the TXA group and from 25.0 to 25.2 seconds in the non-TXA group (p<0.05). Regarding hemoglobin levels, no preoperative difference was observed between the groups (p>0.05). Postoperatively, Hb levels significantly declined in both groups, decreasing from 12.8 to 11.3 g/dL in the TXA group and from 12.7 to 11.1 g/dL in the non-TXA group (p<0.05). No significant perioperative change in hematocrit was observed, with values decreasing slightly from 38% to 37.6% in the TXA group and from 38.9% to 37.4% in the non-TXA group (p>0.05).

A significant increase in platelet count was detected only in the non-TXA group, rising from 248 to 292 × 10^3/μL (p<0.05). In contrast, the TXA group showed a minimal change from 254 to 258 × 10^3/μL, which was not statistically significant (p>0.05). Although urea levels remained stable in both groups (TXA: 27 → 26 mg/dL, non-TXA: 28 → 27 mg/dL), creatinine levels significantly decreased postoperatively in both groups, from 0.78 to 0.62 mg/dL in the TXA group and from 0.80 to 0.64 mg/dL in the non-TXA group (p<0.05).

ALT values increased significantly in both groups, rising from 22 to 33 U/L in the TXA group and from 23 to 37 U/L in the non-TXA group (p<0.05). Similarly, AST levels increased from 22 to 37 U/L in the TXA group and from 24 to 34 U/L in the non-TXA group (p<0.05). These findings indicate that while TXA had minimal impact on overall laboratory parameters, specific biomarkers—particularly platelet count and liver enzymes—showed perioperative fluctuations related to the surgical process rather than to TXA (**Tab. 1.**).

Tab. 2. Comparison of baseline characteristics, intraoperative outcomes, laboratory parameters, and postoperative outcomes between TXA and Non-TXA groups.

Variables	TXA group (n=80)	Non-TXA group (n=80)	p-value
Baseline characteristics			
Age (years), mean ± SD	52.1 ± 2.4	52.3 ± 2.2	>0.05
Parity, median (min–max)	Similar	Similar	>0.05
Comorbidity, n (%)	61 (76.3)	55 (68.8)	>0.05
Previous surgery, n (%)	60 (75.0)	58 (72.5)	>0.05
Indication (Endometrial cancer), n (%)	Majority	Majority	>0.05
Incision type			
a) Midline, n (%)	24 (30.0)	29 (36.3)	>0.05
b) Pfannenstiel, n (%)	56 (70.0)	51 (63.8)	
Intraoperative outcomes			
Operative time (hours), mean ± SD	2.11 ± 0.32	1.98 ± 0.28	<0.05
Estimated blood loss (mL), mean ± SD	Lower	Higher	>0.05
Drain fluid volume (mL), mean ± SD	124.2 ± 47.3	Higher	<0.05
Drain usage duration (days), mean ± SD	Similar	Similar	>0.05
Laboratory parameters			
Hemoglobin (g/dL)			
a) Preoperative	12.8	12.7	>0.05
b) Postoperative	11.3	11.1	<0.05*
Hematocrit (%), pre → post	38 → 37.6	38.9 → 37.4	>0.05
Platelet (× $10^3/\mu$L), pre → post	254 → 258	248 → 292	<0.05*
APTT (sec), pre → post	25.0 → 25.1	25.0 → 25.2	<0.05*
ALT (U/L), pre → post	22 → 33	23 → 37	<0.05*
AST (U/L), pre → post	22 → 37	24 → 34	<0.05*
Creatinine (mg/dL), pre → post	0.78 → 0.62	0.80 → 0.64	<0.05*
Postoperative outcomes			
Wound healing (normal), n (%)	77 (96.3)	77 (96.3)	>0.05
Thromboembolic events	None	None	—

Note: Data are presented as mean ± standard deviation, median (minimum–maximum), or number (percentage), as appropriate. *p values indicate within-group comparisons (preoperative vs postoperative). TXA: Tranexamic Acid; SD: Standard Deviation; APTT: Activated Partial Thromboplastin Time

DISCUSSION

In this study, findings from gynecologic oncology surgeries using tranexamic acid demonstrated a significant benefit of TXA, particularly in reducing the volume of drain fluid. The absence of significant differences between groups in age, parity, comorbidities, surgical indications, and incision type supports the study's homogeneous patient group. While drainage volume was significantly reduced in patients receiving TXA, procedure time was slightly prolonged. Although blood loss was lower in the TXA group, this difference was not statistically significant. Laboratory parameters showed similar postoperative decreases in Hemoglobin (Hb), increases in APTT, and increases in ALT and AST in both groups. Furthermore, no significant difference was observed between the groups in wound healing. Although hemoglobin values decreased significantly in both groups postoperatively, the decrease was slightly less pronounced in the TXA group; however, this difference did not reach statistical significance. Through its antifibrinolytic effect, TXA reduces microvascular bleeding during and after surgery, thereby supporting hemostasis. This effect can be explained by TXA's inhibition of plasminogen activation, thereby preventing fibrin degradation. Our findings are consistent with those of previous studies in similar surgeries, which have reported that TXA significantly reduces both intraoperative and postoperative blood loss [8]. The significant reduction in drain fluid and the more limited decrease in hemoglobin in the current study are consistent with these effects reported in the literature. Therefore, this study further demonstrates both the safety and the potential benefit of TXA in limiting blood loss. Given that gynecologic oncology surgeries typically involve greater blood loss, the role of TXA in this field becomes even more significant. Some studies have demonstrated that TXA use reduces drainage volume, decreases the need for transfusion, and does not impact postoperative morbidity [9]. The incidence and risk factors for thromboembolism in several orthopedic procedures have been studied, and it has been demonstrated that oncology patients are at significant risk for postoperative thrombotic complications. The study emphasized that the primary risk factors are the tumor's biological behavior, the duration of surgery, the patient's general condition, and associated comorbidities. This study demonstrates that cancer increases thrombosis, underscoring the need for selective use of agents that affect hemostasis. The absence of thromboembolic complications in the TXA group in the current study demonstrates that TXA use does not pose an additional risk of thrombosis, despite its high risk profile. Findings demonstrating the safety of TXA are clinically significant, particularly in gynecologic oncology surgeries, as the risk of thrombosis can increase due to extensive dissection and lengthy operations. In this study, the significantly reduced drain volume and more stable Hb levels associated with TXA further support these positive effects. Moreover, the absence of thromboembolic

complications at the administered doses suggests that TXA is a safe agent in this patient group. However, some sources have highlighted the already elevated risk of thrombosis in oncologic patients and have advised careful consideration of TXA use in such cases [10]. evaluated the efficacy and safety of a single dose of tranexamic acid in reducing blood loss in patients undergoing Hyperthermic Intraperitoneal Chemotherapy (HIPEC) after cytoreductive surgery. This study demonstrated that TXA significantly reduced intraoperative blood loss, particularly in major and complex oncologic surgeries, without causing serious thromboembolic complications. This finding supports the potential benefit of TXA in gynecologic oncology surgeries involving extensive dissection. Contrary opinions suggest that TXA may not be equally effective across all surgical procedures. Some randomized studies have reported no significant difference in drainage fluid volume or transfusion requirements with TXA administration and even ineffectiveness in specific sub-groups [11]. Particularly in advanced-stage tumors requiring prolonged and extensive dissection, the efficacy of TXA may vary depending on the duration of surgery and the extent of the surgical field. Therefore, studies involving more homogeneous patient groups are needed to standardize the effects of TXA. A key point is that while TXA reduces bleeding, it may not be equally effective in all patients, and treatment protocols should be tailored to patient characteristics. The current study's findings also support this view: TXA's lack of significant change in laboratory parameters, but its reduction in drain fluid, suggests that its effectiveness may vary depending on the pathophysiology of the operation. This supports its role as a valuable hemostatic agent in oncology, but emphasizes that its effectiveness may vary across patient subgroups and different types of surgery. Therefore, it appears that protocols for TXA use should be tested with larger, more homogeneous patient groups. On the other hand, meta-analyses of TXA use in elective gynecologic surgery have shown significant reductions in postoperative blood loss and transfusion rates [12]. The World Health Organization (WHO) also recommends the early use of TXA in the management of surgical bleeding. The positive outcomes in our study support this general clinical approach. As a low-cost, effective agent, TXA offers a particular advantage in centers with limited access to blood products. The results of meta-analyses reported in the literature indicate that TXA significantly reduces blood loss and transfusion requirements in myomectomy surgeries, findings consistent with the decrease in drain fluid volume and more stable hemoglobin values in our study, and supporting the fact that TXA is a generally effective and safe hemostatic agent in gynecological surgeries. The literature emphasizing the effectiveness of TXA in reducing blood loss, decreasing the volume of drain fluid, and limiting the need for transfusion in gynecological surgery parallels our findings and supports the use of TXA as a safe and useful complementary agent in gynecological oncology surgeries [13,14].

The literature demonstrating that TXA reduces blood loss by suppressing hyperfibrinolysis in trauma patients is consistent with TXA's ability to limit drain fluid volume and blood loss, supporting its potential benefit in major oncologic surgeries where fibrinolysis is increased. Thoracic surgery meta-analyses have shown that TXA is highly effective at reducing drainage and blood loss; this finding is consistent with the significant reduction in drain fluid in the TXA group in our study. The literature, which emphasizes that TXA has a strong overall safety profile but that seizure and potential thrombotic risks should be carefully considered at high doses, is consistent with the absence of any complications associated with TXA use in our study, supporting the safe use of TXA in gynecologic oncology surgery when administered at appropriate doses [15-17].

CONCLUSION

This study demonstrates that tranexamic acid use contributes to hemostasis by reducing drainage volume and limiting decreases in hemoglobin levels during gynecologic oncology surgeries. This study supports the safe use of TXA, provided appropriate patient selection and accurate dosing are used. Furthermore, more comprehensive, multicenter, and prospective studies will better define the role of TXA in gynecologic oncology and provide more substantial evidence for clinical practice.

LIMITATIONS

This study has several limitations. First, it was conducted at a single center. Some factors that may influence clinical outcomes, such as surgical difficulty, tumor stage, surgeon experience, and intraoperative bleeding rates, were not fully standardized. Finally, the study focused only on short-term laboratory and surgical parameters, and long-term outcomes of TXA use could not be evaluated.

Future studies are recommended to be conducted with multicenter, prospective designs and larger sample sizes. It is essential to include subgroup analyses to more clearly demonstrate the effects of TXA on patients with different surgical difficulty levels, tumor stages, and comorbidities. Finally, health economics-based studies evaluating the cost-effectiveness of TXA use are also believed to guide clinical practice.

ETHICAL APPROVAL

Ethical approval was received, and it complies with the Declaration of Helsinki. Ethical Selçuk University Faculty of Medicine Ethic Committee Number: E-70632468-050.01-1103926.

CONFLICT OF INTEREST

No conflict of interest.

FUNDING

No funding.

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