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Efficacy of Preoperative Intravenous Tranexamic Acid to Reduce Blood Loss in Difficult Abdominal Hysterectomy for Benign Gynecological Disease: A randomized double-blind placebo-controlled trial

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ABSTRACT

Objectives: To determine the efficacy of tranexamic acid (TXA) in reducing intraoperative blood loss in difficult abdominal hysterectomy for benign gynecological disease.

Materials and Methods: A double-blind randomized controlled trial was conducted. Women who were at risk of a difficult abdominal hysterectomy for benign gynecological disease, with or without adnexal surgery, were included. The participants were randomly assigned into two groups, comprising an intervention group who received intravenous TXA 10mg/kg (diluted with normal saline up to 100 ml), and a control group who received 100 ml of normal saline 15 minutes before skin incision.

Results: Ninety-two eligible participants were randomly allocated into the intervention group (n = 46) and control groups (n = 46) between September 2024 and July 2025. Intraoperative measurement of blood loss was comparable between the TXA group and control group (median [interquartile range]: 239 [104–384] vs 280 [187–400] mL, $p = 0.24$), and the incidence of blood loss exceeding 500 mL did not differ significantly between the groups (11.1% vs 22.2%, $p = 0.26$). There were no statistically significant differences, including changes in hemoglobin levels and blood transfusion requirements. Additional perioperative TXA in the TXA group was significantly lower than in the control group (4.4% vs 22.2%, $p = 0.03$). No serious adverse effects were observed.

Conclusion: Preoperative intravenous TXA did not reduce blood loss in cases of difficult abdominal hysterectomy for benign gynecological disease.

Keywords: tranexamic acid, difficult hysterectomy, bleeding prophylaxis.

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ประสิทธิภาพของยาทรานแซมิกเอซิด (TXA) แบบฉีดทางหลอดเลือดก่อนการผ่าตัดเพื่อลดการเสียเลือดขณะผ่าตัดมดลูกแบบเปิดหน้าท้องในสตรีที่ไม่ใช่มะเร็งกลุ่มที่ผ่าตัดยาก : การทดลองแบบสุ่มที่มีกลุ่มควบคุม

จินต์จุทา จินดาหลวง, เจษฎา วุฒิธรรมสุข, ทูมวดี ตั้งศิริวัฒนา

บทคัดย่อ

วัตถุประสงค์: เพื่อศึกษาประสิทธิภาพของการให้ยาทรานแซมิกเอซิด ก่อนผ่าตัดมดลูกแบบเปิดหน้าท้องชนิดที่ไม่ใช่มะเร็งเพื่อลดการเสียเลือดระหว่างผ่าตัดในสตรีที่มีความเสี่ยงสูงต่อการผ่าตัดยาก

วัสดุและวิธีการ: เป็นการศึกษาแบบสุ่มชนิดปกปิดข้อมูลสองทาง โดยศึกษาในอาสาสมัครที่ต้องผ่าตัดมดลูกทางหน้าท้องและมีความเสี่ยงต่อการผ่าตัดยาก ได้รับการแบ่งสุ่มเป็นสองกลุ่ม คือกลุ่มทำการทดลองจะได้รับยาทรานแซมิกเอซิดปริมาณ 10 มิลลิกรัมต่อน้ำหนักตัว 1 กิโลกรัม (ผสมละลายในนอร์มอลซาลินจ์จนครบ 100 มิลลิลิตร) ทางหลอดเลือดดำก่อนลงมีดผ่าตัด 15 นาที และกลุ่มควบคุมได้รับ นอร์มอลซาลินจ์ปริมาณ 100 มิลลิลิตร ทางหลอดเลือดดำที่ 15 นาที ก่อนลงมีดผ่าตัดเช่นเดียวกัน

ผลการศึกษา: อาสาสมัครจำนวน 92 ราย ระหว่างเดือนกันยายน พ.ศ.2567 ถึง กรกฎาคม พ.ศ.2568 แบ่งสุ่มเป็นกลุ่มที่ได้รับยาทรานแซมิกเอซิดจำนวน 46 รายและกลุ่มควบคุมจำนวน 46 ราย ปริมาณการสูญเสียเลือดระหว่างผ่าตัดในกลุ่มทรานแซมิกเอซิดและกลุ่มควบคุมไม่มีความแตกต่างกันอย่างมีนัยสำคัญ (ค่ามัธยฐาน 239 มิลลิลิตร [พิสัยระหว่างควอไทล์ 104, 384] และ 280 มิลลิลิตร [187, 400] ตามลำดับ, $p = 0.24$) เช่นเดียวกับจำนวนผู้ที่เสียเลือดมากกว่า 500 มิลลิลิตร ซึ่งพบว่าไม่มีความแตกต่างกันอย่างมีนัยสำคัญทางสถิติระหว่างสองกลุ่ม (ร้อยละ 11.1 และร้อยละ 22.2, $p = 0.26$) ไม่มีความแตกต่างกันอย่างมีนัยสำคัญทางสถิติสำหรับการเปรียบเทียบความต่างก่อนและหลังผ่าตัดของระดับฮีโมโกลบินในเลือดและอุบัติการณ์การได้เลือดระหว่างผ่าตัด อย่างไรก็ตามพบว่าการให้ยาทรานแซมิกเอซิดเสริมระหว่างผ่าตัดลดลงในกลุ่มที่ได้รับยาทรานแซมิกเอซิดเมื่อเทียบกับกลุ่มควบคุม (ร้อยละ 4.4 เปรียบเทียบกับร้อยละ 22.2, $p = 0.03$) และไม่พบรายงานผลข้างเคียงที่สัมพันธ์กับการใช้ยาทรานแซมิกเอซิดในการศึกษานี้

สรุป: การให้ยาทรานแซมิกเอซิดก่อนผ่าตัดไม่มีประสิทธิผลในการลดการเสียเลือดในสตรีกลุ่มเสี่ยงที่จะผ่าตัดยากที่ได้รับการผ่าตัดมดลูกแบบเปิดหน้าท้องชนิดที่ไม่ใช่มะเร็ง

คำสำคัญ: ยาทรานแซมิกเอซิด, การผ่าตัดมดลูกแบบเปิดหน้าท้องชนิดผ่าตัดยาก, การลดการเสียเลือดระหว่างผ่าตัด

Introduction

A total abdominal hysterectomy (TAH) is a common gynecologic procedure, with over 600,000 cases performed annually⁽¹⁾. At Khon Kaen Hospital, benign TAH procedures are performed approximately 500 times per year, with indications such as uterine leiomyoma, adenomyosis, and adnexal tumors.

Excessive intraoperative hemorrhage represents the most prevalent complication documented across multiple studies, with reported incidence rates spanning from 2.4% to 55.3%⁽²⁾. A consistent correlation has been observed; whereby greater volumes of blood loss are associated with increased rates of complications and resource utilization. The median estimated blood loss in these studies ranges from 238 to 660.5 mL⁽³⁾.

In 2009, research on hysterectomy patients established that an estimated blood loss of over 500 mL is a critical threshold linked to a higher risk of complications and increased need for blood transfusions and reoperations⁽²⁾. To control intraoperative bleeding during a TAH, surgeons use multiple techniques. These include pharmacological agents like intramyometrial vasopressin⁽⁴⁾, rectal misoprostol suppository⁽⁵⁾ and intravenous tranexamic acid⁽⁶⁾, as well as surgical methods such as uterine artery ligation⁽⁷⁾.

Tranexamic acid (TXA) is a lysine derivative that reduces bleeding by inhibiting fibrinolysis and stabilizing blood clots. To be effective, an initial concentration of 10 mg/L is necessary, and this therapeutic level is maintained for approximately 2.9 hours after the transfusion ends⁽⁸⁾. TXA has a half-life of approximately 2 hours, with 95% of the drug excreted renally. A 2022 meta-analysis demonstrated that the prophylactic administration of TXA significantly reduces intraoperative blood loss during benign hysterectomies⁽⁶⁾.

Evidence supporting the effectiveness of TXA is limited in certain patient groups, especially those undergoing 'difficult operations.' A difficult hysterectomy is defined as a procedure performed on patients with risk factors that distort pelvic anatomy or complicate

surgical access including previous abdominal surgery, previous cesarean section (CS), uterine weight over 250 grams (or a size equivalent to a 12-week pregnancy), body mass index (BMI) above 25 kg/m², and endometriosis or tubo-ovarian abscess (TOA) history, which can contribute to increased surgical difficulty and a higher risk of complications^(2, 9, 10).

Accordingly, this research aimed to evaluate the effectiveness of TXA in reducing intraoperative loss during difficult surgical procedures as the primary objective. The secondary objectives were the rate of massive intraoperative blood loss more than 500 mL, blood transfusion and any associated adverse events, including gastrointestinal, cardiovascular, cutaneous, and neurological manifestations^(11, 12).

Materials and Methods

The double-blind randomized controlled trial was conducted at the Department of Obstetrics and Gynecology, Khon Kaen Hospital, from September 2024 to July 2025. The protocol was reviewed and ethically approved by the Khon Kaen Hospital Institute Review Board for Human Research (KEF67012) and registered to the Thai Clinical Trials Registry (TCTR20250206001). All patients provided informed consent before enrollment.

This study enrolled a total of 316 women, aged 18 years or older, who were scheduled for a benign abdominal hysterectomy, with or without adnexal surgery, and presented with one or more risk factors for a difficult procedure. These risk factors were defined as a BMI ≥ 25 kg/m², diagnosis of endometriosis or TOA, uterine weight over 250 g or a size equivalent to a 12-week pregnancy, determined by bimanual examination or calculated using the geometric formula for a prolate ellipsoid ($\text{gm} = 0.5236 \times \text{Length (L)} \times \text{Width (W)} \times \text{Anteroposterior diameter (AP)}$)⁽¹³⁾, and previous abdominal surgery. Exclusion criteria included (a) active cardiovascular diseases, (b) uncontrolled hypertension (blood pressure $> 180/110$ mmHg), (c) end-stage renal disease (creatinine clearance < 30 ml/min), (d) hematologic coagulopathies, (e) gynecologic malignancies confirmed pathologically, (f)

receipt of anticoagulant drugs, (g) tranexamic acid allergy, (h) previous case of a venous thromboembolism event, or (i) receipt of enoxaparin prophylaxis before surgery.

The participants were randomly assigned to the TXA or the control group using a computer-generated sequence with block of 4. Allocation concealment was performed using an opaque, sealed envelope. According to the randomization protocol, a pharmacist prepared the study drug or placebo in identical syringes containing either 1 gram (20 mL) of TXA or 20 mL of normal saline, using standard sterile techniques. To ensure an unbiased outcome, the participants, surgeons, anesthesiologists, and outcome assessors were appropriately blinded.

On the day of surgery, the assigned nurse opened the opaque envelope, then added the anonymous solution from identical syringes that contained either 1 gram (20 mL) of TXA or 20 mL of normal saline in normal saline solution up to 100 mL. The prepared solution was transferred to the operating room in a concealed plastic container to ensure that the intervention was blinded for the surgical team. Before surgery, the study group received 10 mg/kg tranexamic acid (maximum 1 g) in normal saline, administered intravenously at 100 mL over 15 minutes before skin incision. The control group received 0.2 mL/kg of normal saline diluted with normal saline to 100 mL via an intravenous infusion 15 minutes before incision with slow infusion by an anesthesiologist. All surgical procedures (TAH, with or without adnexal surgery) were performed by randomly attending staff using standard surgical techniques. Additional TXA was administered intraoperatively when the surgeon assessed that excessive bleeding had occurred or hemostasis was difficult to achieve despite standard surgical techniques. The recommended dosage was 10 mg/kg (maximum 1 g), administered 30 minutes after the initial dose^(14, 15).

The primary outcome, intraoperative blood loss, was measured by trained and standardized operative nurses using the gravimetric method. This technique calculates total blood loss by determining the difference

between the weight of a blood-soaked and dry surgical sheet, with the volume of blood collected in a suction bottle, based on a conversion rate of 1 gram per 1 mL^(13, 16, 17).

Secondary outcomes included pre- and post-operative hemoglobin levels (assessed 24 hours after surgery), operative time, and the incidence of blood transfusions (administered when hemoglobin levels were less than 7 g/dL).

Postoperatively, adverse effects associated with TXA during hospitalization, including symptoms such as abdominal pain, nausea, vomiting, diarrhea, and thrombotic events, were documented within 24 hours after drug administration. Participants were discharged after meeting specific criteria for a minimum of 24 hours, including stable vital signs, a body temperature of 37.8 °C or less, independent ambulation, and tolerance of a regular diet. Additionally, they had to be free of symptoms such as vaginal bleeding, signs of infection, or other complications.

$$n = \frac{2(Z_{\alpha/2} + Z_{\beta})^2 \sigma^2}{(X_1 - X_2)^2}$$

$$\sigma^2 = \text{pool variance} = \frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{n_1 + n_2 - 2}$$

The sample size for this study was determined from a pilot study involving 30 patients, with 15 patients allocated to each group. The calculation was conducted with power at 80% at an alpha level of 0.05 and included a 5% dropout rate. The average intraoperative blood loss in the TXA group was 271.59 mL with a standard deviation (SD) of 214.65 mL, whereas the control group demonstrated a mean blood loss of 449.06 mL with an SD of 358.7 mL. Ultimately, a total of 92 women were included in the final analysis, with 46 in each group.

Statistical analysis was conducted using an intention-to-treat approach with R (version 4.5.1). Continuous variables were analyzed using the student's t-test or Wilcoxon rank-sum test and were reported as mean (SD) or median (interquartile range, IQR) for skewed data. Categorical variables were

analyzed using the chi-squared test or Fisher's exact test and are reported as percentages. A p value of < 0.05 was considered statistically significant.

Results

Between September 2024 and July 2025, 94 participants were assessed for eligibility. Two of these participants were excluded prior to randomization due to the cancellation of their operations. The remaining 92 women, who had benign gynecological conditions and risk factors for difficult hysterectomies, were then randomized. One

participant from each group was withdrawn from the study after a postoperative pathological diagnosis of malignancy. Consequently, 45 participants from the TXA group and 45 from the control group were included in the final analysis (Fig. 1).

The demographic data and clinical characteristics between the groups were similar, including age, weight, height, body mass index, underlying diseases, history of previous abdominal surgery, uterine size and weight, operation type, operative time, and surgeon experience, except for the type of skin incision (Table 1).

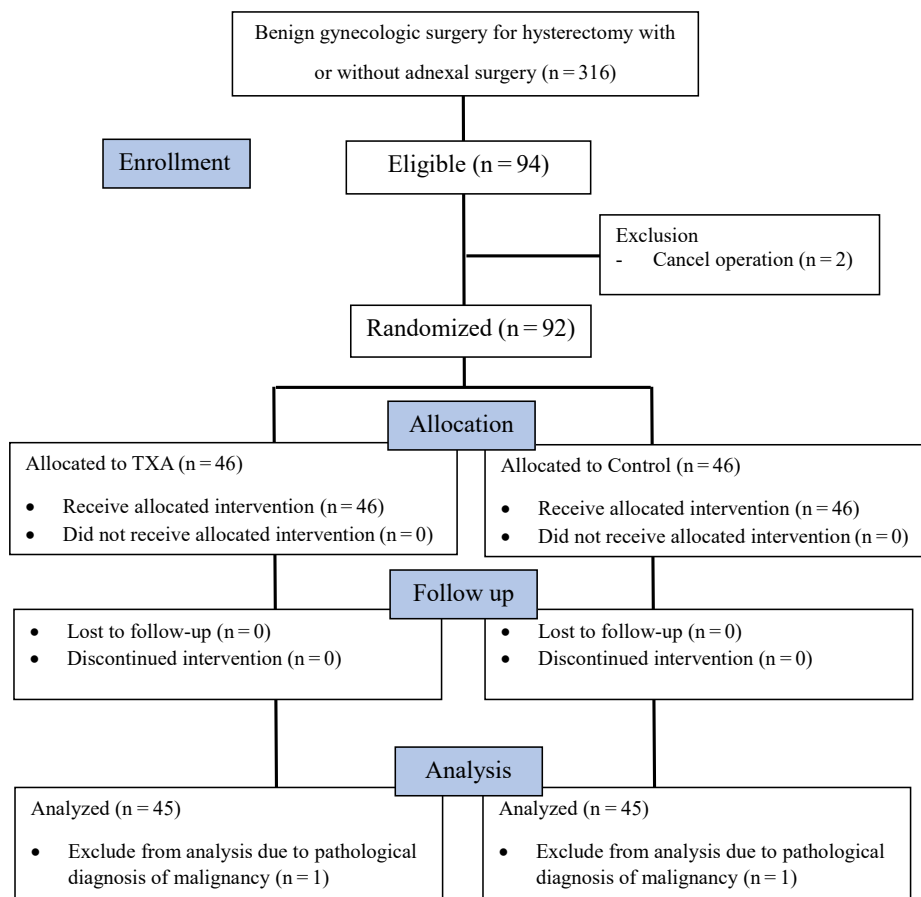


Fig. 1. Consort flow diagram.

Table 1. Baseline characteristics.

	TXA group (n = 45)	Control group (n = 45)	p value
Age (years), mean $\pm$ SD	45.6 $\pm$ 5.1	47.0 $\pm$ 6.6	0.247
Body weight (kg), mean $\pm$ SD	65.3 $\pm$ 10.2	67.7 $\pm$ 13.3	0.349
Height (cm), median (IQR)	156 (153,160)	158 (152,160)	0.339
BMI (kg/m ²), median (IQR)	27.5 (23.8, 29.4)	27.3 (24.0, 29.4)	0.942
Co-morbid diseases, n (%)			
Diabetes mellitus	2 (4.4)	6 (13.3)	0.266
Hypertension	9 (20.0)	8 (17.8)	0.788
Dyslipidemia	1 (2.2)	1 (2.2)	1.000
Others	6 (13.3)	11 (24.4)	0.281
Indication for surgery, n (%)			
Leiomyoma	26 (57.7)	34 (75.5)	0.117
Leiomyoma with endometriosis	5 (11.1)	6 (13.3)	1.000
Adenomyosis	7 (15.6)	3 (6.7)	0.315
Adenomyosis with endometriosis	4 (8.9)	0 (0.0)	0.117
Endometrioma	3 (6.7)	2 (4.4)	1.000
Previous abdominal surgery, n (%)	33 (73.3)	30 (66.7)	0.646
major surgery, n (%)	23 (51.1)	19 (42.2)	0.526
Operation, n (%)			
TAH with BS	9 (20)	9 (20)	1.000
TAH with BSO	31 (68.9)	33 (73.3)	0.642
TAH with unilateral SO	5 (11.1)	3 (6.7)	0.459
Uterine size by ultrasound, median (IQR)	409 (239, 748)	528 (306, 816)	0.516
Uterine weight (gm), median (IQR)	509 (281, 872)	506 (315, 852)	0.597
Incision type, n (%)			
Low midline	14 (31.1)	25 (55.6)	0.03
Pfannenstiel	31 (68.9)	20 (44.4)	
Surgeon Experience, n (%)			
> 5 years	33 (73.3)	31 (68.9)	0.816

TXA: tranexamic acid, IQR: interquartile range, cm: centimeter, kg/m²: kilograms per meters squared, SD: standard deviation, dL: deciliter, gm: gram; TAH: total abdominal hysterectomy, BS: bilateral salpingectomy, SO: salpingo-oophorectomy, BSO: bilateral salpingo-oophorectomy

The primary outcome, the measurement of intraoperative blood loss, did not differ between the TXA group and the control group (median [IQR]: 239 [104, 384] mL vs 280 [187, 400] mL, $p = 0.24$) (Table 2). Regarding the secondary outcomes, the mean difference in pre- and postoperative hemoglobin levels between the TXA and control groups was 0.3 g/dL, $p = 0.59$ (0.9 ± 1.5 vs 1.2 ± 1.5 g/dL). Moreover, the mean difference in hematocrit between the TXA and control groups was 0.5%, $p = 0.61$ (3.1 ± 4.9 vs $3.6 \pm 4.9\%$).

These data are presented in Table 2.

There was no significant difference in the incidence of intraoperative blood loss ≥ 500 mL (11.1% vs 22.2%, $p = 0.26$), and no difference in blood transfusion rates (8 vs 6 patients, $p = 0.84$). However, the TXA group demonstrated a significant reduction in the need for additional perioperative tranexamic acid injections (4.4% vs 22.2%, $p = 0.03$). No thromboembolic or adverse events were reported. These findings are presented in Table 2.

Table 2. Primary and secondary outcomes.

	TXA group (n = 45)	Control group (n = 45)	95%CI	p value
Measurement of blood loss (mL), median (IQR)	239 (104, 384)	280 (187, 400)	(-207.9, 40.4)	0.242
Measurement of blood loss ≥ 500 mL, n (%)	5 (11.1)	10 (22.2)	(0.63, 9.29)	0.258
Hemoglobin level (g/dL), mean $\pm$ SD	0.9 ± 1.5	1.2 ± 1.5	(-0.93, 0.33)	0.355
Hematocrit (%), mean $\pm$ SD	3.1 ± 4.9	3.6 ± 4.9	(-2.62, 1.53)	0.607
Operative time (min), mean $\pm$ SD	110.8 ± 34.9	110.7 ± 29.4	(-13.40, 13.60)	0.984
Additional tranexamic acid, n (%)	2 (4.4)	10 (22.2)	(1.17, 60.21)	0.026
Blood transfusion, n (%)	8 (17.8)	6 (14.0)	(0.19, 2.75)	0.842

TXA: tranexamic acid, mL: milliliter, dL: deciliter, IQR: interquartile range, SD: standard deviation, g/dL: grams per deciliter, min: minutes, MD: mean difference

Discussion

Preoperative TXA did not reduce intraoperative blood loss (239 mL vs 280 mL). However, the TXA group showed a significant reduction in the need for additional perioperative TXA, supporting its role as a beneficial adjunct in perioperative blood management. The absence of thromboembolic and other serious adverse events affirmed the safety of the drug.

These results aligned with the findings of Bahadori et al⁽¹⁸⁾, whose study investigated the effects of 1 g of prophylactic tranexamic acid in 80 women undergoing abdominal or vaginal hysterectomies for benign or malignant indications and reported no significant differences in hemoglobin levels between the two groups, before and after surgery (12 ± 1.5 vs

12.1 ± 1.6 g/dL, $p = 0.91$). However, the tranexamic acid group had significantly lower transfusion requirements and a shorter recovery stay. This study also revealed that preoperative TXA did not reduce intraoperative blood loss.

Topsoee et al⁽¹⁹⁾ administered 1 g of prophylactic TXA to 332 women undergoing hysterectomy. Their study demonstrated a significant reduction in blood loss, both subjectively (98.4 mL vs 134.8 mL, $p = 0.006$) and objectively (100.0 mL vs 166.0 mL, $p = 0.004$). The rate of blood loss of 500 mL or more was also lower in the tranexamic acid group (6 vs 21 cases, $p = 0.003$). However, they investigated overall benign hysterectomies with all routes of hysterectomy, not specifically complex cases such as those examined in our study. Nonetheless, the current

study's findings (11.1% vs 22.2%) were consistent with their results.

Additionally, in this study, the findings on prophylactic TXA showed a non-significant trend toward reduced blood loss, in contrast to the significant reduction reported by Nandi et al⁽²⁰⁾, which involved 108 women undergoing abdominal or vaginal hysterectomies, who received 1 gram of intravenous tranexamic acid preoperatively. The results showed a significant reduction in blood loss, with a decrease of 259 mL compared to 185.6 mL in their control group, ranging from 141.8 to 229.5 mL ($p < 0.001$). This discrepancy is likely due to differences in the patient populations. The current study focused on difficult hysterectomy cases, often characterized by a BMI ≥ 25 kg/m², whereas Nandi et al included patients with smaller uterine sizes (14 weeks or less). These variations in patient characteristics, which directly affect surgical complexity and intraoperative blood loss, likely explain the varying outcomes.

Similarly, Arthi et al⁽²¹⁾ conducted a randomized controlled trial comparing 15mg/kg of tranexamic acid intravenous 15 minutes before incision with a placebo in 100 women undergoing elective abdominal hysterectomy. They reported that the mean blood loss was significantly lower in the TXA group (mean 360 mL) compared to the placebo group (540 mL) ($p = 0.0001$).

The previous study aligned with the study by Sirithunyalak et al, which conducted a double-blind randomized controlled trial evaluating a single 15 mg/kg intravenous dose of TXA in women who were diagnosed with endometrial cancer and undergoing surgical staging, demonstrated that intraoperative blood loss was significantly lower in the TXA group compared to the placebo group (295.88 mL vs 613.94 mL, $p < 0.001$)⁽²²⁾. The doses of TXA used in their study were higher than those used in our study and included additional procedures, which might have affected the outcomes.

In contrast, our study suggested that variations in TXA dosage may influence its efficacy in reducing blood loss. Yang et al studied cytoreductive surgery

in ovarian cancer patients to compare high-dose TXA (20 mg/kg of TXA followed by 5 mg/kg/hr continuous infusion) with low-dose TXA (10 mg/kg of TXA followed by 1 mg/kg/h). The results indicated that higher doses of TXA were more effective in mitigating intraoperative bleeding and the subsequent need for blood transfusions⁽²³⁾. Our results found that a lower dose (10 mg/kg) only showed a trend toward reduction without statistical significance for the primary outcome ($p = 0.24$).

Furthermore, Sirithunyalak et al highlighted that in malignancy surgeries, there was a significant correlation with massive intraoperative blood loss, making the hemostatic effect of TXA more easily detectable⁽²²⁾. The present study demonstrated a significant difference in the need for additional perioperative TXA in the intervention group (4.4% vs 22.2%, $p = 0.03$). This suggests that preoperative TXA stabilizes early clot formation and improves the surgical field, thereby reducing clinicians' reliance on adjunct hemostatic measures. However, our study focused on difficult operations characterized by dense adhesions and large uterine size, which often result in persistent capillary oozing and ongoing microvascular bleeding. Nonetheless, these factors may not always lead to significant volumetric differences.

Furthermore, Wongjariyakul et al demonstrated that 1 gram of preoperative TXA in women at high risk for postpartum hemorrhage who were scheduled for cesarean section was effective in reducing intraoperative blood loss compared to a placebo⁽²⁴⁾.

In addition, using meta-analyses, Ahmed Abu-Zaid et al⁽⁶⁾ demonstrated that preoperative tranexamic acid was safe and showed a trend toward reducing estimated intraoperative blood loss. This current study focused specifically on difficult abdominal hysterectomy cases involving factors such as prior abdominal surgery, large uterine size, high BMI, and pelvic adhesions. These conditions might increase blood loss and necessitate additional perioperative TXA. The variability among participants in the two studies might explain the different outcomes.

In the current study, the Pfannenstiel incision was observed at a higher rate in the TXA group. The median [IQR] uterine weight was 509 [281, 872] g in the TXA group and 506 [315, 852] g in the control group. These values reflect the complexity of the procedure, which often involves large uterine sizes, a characteristic of difficult hysterectomies. In particular, a uterine weight of over 500 g is associated with intraoperative blood loss exceeding 500 ml. Thus, a larger uterine size and a different incision might restrict the ability to identify a statistically significant reduction in blood loss, despite observing a clinical benefit.

Finally, Phupong provided a comprehensive review of the role of TXA in obstetrics and gynecology, noting its established efficacy in treating postpartum hemorrhage and heavy menstrual bleeding. Nevertheless, the evidence supporting its benefit in broad gynecological surgeries remains limited, and further studies are thus necessary in order to solidify its routine use in this field⁽²⁵⁾.

The strengths of the current study included its randomized, double-blind, placebo-controlled design, low dropout rate, and the measurement of intraoperative blood loss using a validated and precise formula. Additionally, the trial demonstrated a significant reduction in the additional perioperative tranexamic acid injections, suggesting that tranexamic acid provides a meaningful hemostatic benefit, even in high-risk hysterectomy cases. A limitation of this study was that it did not determine whether differences between the surgeons (general gynecologists and oncologic gynecologists) might affect surgical techniques. Therefore, it is recommended that further studies should be conducted in order to explore various approaches to hysterectomy.

Conclusion

Prophylactic intravenous TXA did not reduce intraoperative blood loss or transfusion requirements in difficult abdominal hysterectomy for benign gynecological disease. However, it significantly reduced the use of additional perioperative TXA, and

no serious adverse events were observed.

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Potential conflicts of interest

The authors declare no conflicts of interest.

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