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Original Research Article

Role of topical tranexamic acid in reducing post-TURP hematuria: a randomized controlled study

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ABSTRACT

Background: Postoperative hematuria is a common and clinically significant complication following transurethral resection of the prostate (TURP). Tranexamic acid (TXA), an antifibrinolytic agent, has been investigated to reduce perioperative bleeding in various surgical settings. This study aimed to evaluate the efficacy and safety of topical TXA added to irrigating fluid during monopolar TURP in reducing postoperative hematuria and related outcomes.
Methods: This prospective randomized controlled study was conducted at Dinajpur Medical College Hospital from July 2024 to December 2025. 50 men undergoing monopolar TURP for benign prostatic hyperplasia (BPH) were randomly assigned (1:1) into two groups. The TXA group received 1.5% glycine irrigation with 500 mg/l topical TXA, while the control group received standard 1.5% glycine irrigation. Primary outcomes included duration of gross hematuria and postoperative hemoglobin drop. Secondary outcomes were clot retention, duration of bladder irrigation, catheterization, hospital stay and blood transfusion rate. Data were analyzed using SPSS version 26.
Results: The TXA group demonstrated a significantly shorter duration of gross hematuria (18.6±6.3 vs. 31.4±8.2 hours; $p<0.001$) and a smaller postoperative hemoglobin reduction (0.9±0.4 vs. 1.6±0.6 g/dl; $p<0.001$). Fewer patients required bladder irrigation beyond 24 hours (12.0% vs. 36.0%; $p=0.04$). Differences in clot retention (8.0% vs. 28.0%; $p=0.07$) and blood transfusion rates (4.0% vs. 16.0%; $p=0.16$) were not statistically significant.
Conclusions: Topical TXA in irrigating fluid during TURP effectively reduces postoperative hematuria and hemoglobin loss without significant adverse effects, making it a safe and cost-effective adjunct in BPH surgery.

Keywords: Antifibrinolytic, Benign prostatic hyperplasia, Postoperative hematuria, Tranexamic acid, TURP

INTRODUCTION

Benign prostatic hyperplasia (BPH) is one of the most common urological conditions in ageing men worldwide, with a histological prevalence of more than 50% in men older than 60 years and more than 80% in men older than 80 years of age.[1] The condition is defined as being characterised by progressive LUTS which significantly affect the quality of life, including urinary frequency, urgency, nocturia and obstructive voiding difficulties.[2] While there are a variety of pharmacological options for management, a good proportion of patients who have moderate-to-severe symptoms or complications, including urinary retention, eventually need surgical intervention. TURP has been used for BPH as the gold standard surgical procedure for several decades.[3] It provides good relief of bladder outlet obstruction with proven long-term effects. However, despite technical refinements and the introduction of bipolar TURP, perioperative bleeding and postoperative hematuria remain clinically significant problems.[4] Postoperative hematuria not only increases the length of stay of catheterization and hospitalization but may also require blood transfusion in a subset of patients,

adding to the morbidity and cost of care The pathophysiology of post-TURP bleeding involves several mechanisms, including disruption of prostatic vasculature, local activation of fibrinolysis by urokinase-type plasminogen activator present in urine and release of tissue plasminogen activator from the resected prostatic tissue.[5] These processes together encourage clot dissolution and continue the process of bleeding beyond the initial intraoperative period. Strategies to neutralize local fibrinolysis are therefore a rational way to reduce post-TURP hematuria. TXA is a synthetic lysine analogue that competes with plasminogen activation and consequently stabilizes fibrin clots to reduce fibrinolysis.[6] It has been thoroughly proven to be an effective hemostatic agent in various surgical and trauma settings. Systemic administration of TXA has been investigated in relation to TURP and has been shown to reduce the amount of blood loss during the operation, but concerns about possible complications of thromboembolism and systemic adverse effects have prevented this from gaining widespread use.[7]

Topical application of TXA directly to the surgical field is a very attractive alternative because it keeps local concentrations high and systemic absorption with its associated risks low.[8] Several specialties of surgery, such as Orthopedics and cardiac surgery, have shown the safety and efficacy of topical TXA in the reduction of perioperative hemorrhage.[9] In the urological setting, the addition of TXA to the irrigating solution during TURP can be seen as a mechanism of local drug delivery to specifically target the local fibrinolytic environment of the resection bed. Despite the physiologic rationale and emerging evidence, there is a paucity of rigorously designed randomized controlled studies assessing topical TXA specifically in the TURP setting, especially in terms of results regarding postoperative hematuria, duration of catheterization and length of hospital stay. This study was therefore designed to evaluate the efficacy and safety of topical TXA administered with irrigating fluid during monopolar TURP in the reduction of postoperative hematuria and to improve perioperative outcomes in patients with symptomatic BPH.

METHODS

This prospective randomised controlled study was carried out at Dinajpur Medical College Hospital from July 2024 to December 2025. Eligible participants were adult males with lower urinary tract symptoms refractory to medical therapy or chronic urinary retention secondary to BPH with prostate volume less than 100 g on ultrasonography.

Patients were excluded if they had any prostate pathology other than BPH, prior open or endoscopic prostate surgery, active urinary tract infection, selective serotonin reuptake inhibitors within the preceding 12 weeks or heavy systemic comorbidities, such as advanced hepatic, cardiovascular or haematological disease. Based on a power analysis, 60 patients were recruited, of whom 50 completed the study (n=25 per group). Participants were randomly assigned in a 1:1 ratio by sealed opaque envelopes into two groups. The TXA group had monopolar TURP with 1.5% glycine irrigation with topical tranexamic acid 500 mg per liter. The control group was given standard 1.5% glycine irrigation only. All the procedures were performed under spinal anesthesia by a single experienced surgeon.

Baseline variables assessed included age, prostate volume, preoperative hemoglobin, PSA, international prostate symptom score (IPSS), maximum urine flow rate (Qmax) and relevant comorbidities. Intraoperative variables were operative time, weight of resected tissue, irrigation volume and intraoperative blood loss (estimated spectrophotometrically from the irrigation fluid collected). Postoperative variables were duration of gross hematuria, clot retention, requirement for prolonged bladder irrigation (>24 hours), postoperative drop in hemoglobin, duration of catheter, hospitalization and blood transfusion requirement. A one-month follow-up visit included assessment of IPSS and quality-of-life scores.

Statistical analysis was conducted with the aid of the statistical package, which is known as the Statistical Package for social science (SPSS) version 26. Continuous variables are reported as mean±standard deviation and compared with an independent samples t-test or Mann-Whitney U test, respectively. Categorical variables are exponentially represented as frequencies and percentages and are compared using the chi-square or Fisher's exact test. Normality was tested by the Kolmogorov-Smirnov test. A p-value of <0.05 was regarded as having statistical significance.

RESULTS

The mean ages of the TXA and control groups were 67.3±7.5 and 68.1±8.0 years, respectively, suggesting a similar age profile in both cohorts. The majority of the study patients were in both age brackets (60-69 years) (36.0% TXA vs. 40.0% control), which is consistent with the common demographic of surgical candidates for BPH (Table 1).

Baseline clinical parameters were statistically similar between the TXA and control groups and no significant differences were observed between groups. Prostate volume (58.6±10.4 vs. 60.1±11.2 ml, p=0.62), preoperative hemoglobin level (12.5±1.1 vs. 12.3±1.2 g/dl, p=0.53), serum prostate specific antigen (PSA) level (4.8±2.0 vs. 5.1±2.3 ng/ml, p=0.64), IPSS (23.1±3.5 vs 22.7±3.9) and Qmax was 7.2±1.5 vs 7.4±1.6 (Table 2).

Hypertension was the most common comorbidity among both study groups (40.0% TXA vs. 44.0% control), followed by diabetes mellitus (32.0% vs. 28.0%). Ischemic heart disease and chronic kidney disease were less common in both groups. About one-third of patients in each group had no registered comorbidity. The pattern of comorbidities differed widely between groups, supporting

balanced allocation or reducing the risk of confounding by the baseline burden of disease (Table 3). Operative time, resected prostatic tissue weight and volume of irrigation fluid used were statistically similar between both groups, demonstrating uniformity of the procedure.

However, intraoperative blood loss was significantly less in the TXA group (210±65 ml vs. 275±72 ml, p=0.004), showing a significant hemostatic benefit of topical tranexamic acid during the resection phase of surgery itself, while maintaining similar surgical scope and efficiency between both groups (Table 4).

Topical TXA also significantly shortened the duration of gross hematuria (18.6±6.3 vs. 31.4±8.2 hours; p<0.001) and postoperative hemoglobin drop (0.9±0.4 vs. 1.6±0.6 g/dl p<0.001). The requirement for bladder irrigation beyond 24 hours was significantly less common in the TXA group (12.0 vs. 36.0 per cent; p=0.04). While clot retention was less in the TXA group (8.0% vs. 28.0%), the difference between groups was not statistically significant (p=0.07), which could be due to limited statistical power at the current sample size (Table 5).The TXA group showed significantly less catheterization duration (2.6 plus-0.7 vs 3.5 plus-1.0 days; p=0.002) and hospital stay (3.4 plus-0.9 vs. 4.5 plus-1.2 days; p=0.001) than controls. Blood transfusion was needed in one TXA patient (4.0%) compared to four control patients (16.0%), although this was not statistically significant (p=0.16), again probably limited by sample size.

These findings have added up to meaningful improvements in postoperative recovery with topical TXA (Table 6). A combined analysis of these three key outcome measures confirmed the superiority of topical TXA in all domains. The mean difference in duration of hematuria was -12.8 hours (p<0.001), in hemoglobin drop was -0.7 g/dl (p<0.001) and in duration of catheterization was -0.9 days (p=0.002).

These statistically significant and clinically significant differences support the therapeutic value of TXA as an irrigant additive in reducing the hemorrhagic burden and speeding patient recovery following TURP (Table 7).

Table 1: Distribution of patients according to age group (years) (n=50).

Age group (in years)	TXA group N (%) (n=25)	Control group N (%) (n=25)
50–59	6 (24.0)	5 (20.0)
60–69	9 (36.0)	10 (40.0)
70–79	8 (32.0)	7 (28.0)
≥80	2 (8.0)	3 (12.0)
Mean±SD	67.3±7.5	68.1±8.0

Table 2: Baseline clinical characteristics of the study participants (n=50).

Variables	TXA group (mean±SD)	Control group (mean±SD)	P value
Prostate volume (ml)	58.6±10.4	60.1±11.2	0.62
Preoperative Hb (g/dl)	12.5±1.1	12.3±1.2	0.53
Preoperative PSA (ng/ml)	4.8±2.0	5.1±2.3	0.64
IPSS score	23.1±3.5	22.7±3.9	0.71
Qmax (ml/sec)	7.2±1.5	7.4±1.6	0.66

Table 3: Distribution of patients according to comorbidities (n=50).

Comorbidity	TXA group N (%)	Control group N (%)
Hypertension	10 (40.0)	11 (44.0)
Diabetes mellitus	8 (32.0)	7 (28.0)
Ischemic heart disease	3 (12.0)	4 (16.0)
Chronic kidney disease	2 (8.0)	1 (4.0)
No comorbidity	9 (36.0)	8 (32.0)

Table 4: Intraoperative characteristics during TURP (n=50).

Variables	TXA group mean±SD	Control group mean±SD	P value
Operative time (in minutes)	62.4±11.5	64.1±12.3	0.59
Resected prostate tissue (g)	28.6±8.3	29.2±9.0	0.81
Intraoperative bleeding (ml)	210±65	275±72	0.004
Irrigation fluid used (l)	15.1±2.5	16.4±2.8	0.09

Table 5: Postoperative hematuria outcomes (primary outcome) (n=50).

Outcome	TXA group N (%)/mean±SD	Control group N (%)/mean±SD	P value
Duration of gross hematuria (hours)	18.6±6.3	31.4±8.2	<0.001
Clot retention	2 (8.0)	7 (28.0)	0.07
Bladder irrigation >24 hrs	3 (12.0)	9 (36.0)	0.04
Postoperative Hb drop (g/dl)	0.9±0.4	1.6±0.6	<0.001

Table 6: Postoperative recovery outcomes (n=50).

Variables	TXA group N (%)/mean±SD	Control group N (%)/mean±SD	P value
Catheterization duration (in days)	2.6±0.7	3.5±1.0	0.002
Hospital stays (in days)	3.4±0.9	4.5±1.2	0.001
Blood transfusion required	1 (4.0)	4 (16.0)	0.16

Table 7: Statistical comparison of key outcomes (n=50).

Outcome variable	TXA group mean±SD	Control group mean±SD	Mean difference	P value
Hematuria duration (in hours)	18.6±6.3	31.4±8.2	-12.8	<0.001
Hemoglobin drops (g/dl)	0.9±0.4	1.6±0.6	-0.7	<0.001
Catheterization duration (in days)	2.6±0.7	3.5±1.0	-0.9	0.002

DISCUSSION

This study demonstrated that the addition of topical tranexamic acid to the irrigating solution during monopolar TURP is a significant factor in reducing postoperative hematuria, perioperative hemoglobin loss, catheterization duration and hospital stay. These findings are of clinical significance in the context that postoperative bleeding is one of the most significant complications of TURP and often complicates patient recovery and increases healthcare resource utilization The considerable reduction in intraoperative blood loss in the TXA group (210±65 ml vs 275±72 ml, p=0.004) is consistent with the antifibrinolytic mechanism of TXA that inhibits the conversion of plasminogen to plasmin, preserving the integrity of the clot at the resection bed.[10] The local fibrinolytic activity of prostatic tissue mediated in large part by urokinase-type plasminogen activator and tissue plasminogen activator released during resection is well-established as a cause of post-TURP hemorrhage.[11]

Administering TXA directly from the irrigant results in high local concentrations at the site of surgery as well as local reduction in the systemic exposure accompanying intravenous routes. The significant decrease in the duration of hematuria (18.6±6.3 vs. 31.4±8.2 hours; p<0.001) is of particular interest because prolonged duration of gross hematuria is a major determinant of prolonged catheterization and delayed hospital discharge. Similar reductions in duration of hematuria have been illustrated in a study by He et al giving external validity to the results.[12] The much less pronounced decrease in hemoglobin (0.9±0.4 vs. 1.6±0.6 g/dl, p<0.001) gives further support to the hemostatic efficacy of topical TXA, consistent with Aguilera et al who showed reliably reduces the amount of blood products needed.[13] Bladder irrigation for more than 24 hours was needed in significantly fewer TXA patients (12.0% vs. 36.0%; p=0.04), indicative of less clot burden and timely urine clarification. This result has direct implications on nursing workload, patient comfort and infection risk.[14]

Although clot retention was not statistically significant (8.0% vs. 28.0%; p=0.07), the tendency favor TXA and is in line with Myles et al who documented lower rates of clot-related complications with antifibrinolytic therapy.[15] Differences in duration of catheterization (2.6±0.7 vs. 3.5±1.0 days; p=0.002) and hospital stay (3.4±0.9 vs. 4.5 ±1.2 days; p=0.001) are outcomes that have significant economic implications. Shortened hospital stays are a cost-saving in direct healthcare costs and free up resources for other surgical cases.[16]

These benefits have been replicated in meta-analyses of TXA use in TURP, which have consistently shown length of stay reductions as a downstream consequence of improved hemostasis.[17] A major strength of this study is the randomized controlled design, single surgeon operating, reducing operator-dependent variability and objective spectrophotometric measurement of intraoperative blood loss. The application of topical, rather than systemic, TXA also resolves the issue of safety, which has previously inhibited the widespread adoption of TXA. Topical TXA has a favorable safety profile, having negligible systemic absorption when applied to mucosal surfaces and no thromboembolic events, seizures or renal

complications were recorded in either group in this study.[18,19] To sum up, topical tranexamic acid added to glycine irrigant during monopolar TURP is a safe and effective intervention which significantly is able to reduce the postoperative hematuria, hemoglobin loss, catheterization duration and duration of hospital stay. These results favour its use in routine perioperative protocols for TURP.

Limitations

The sample size used in this study (50 patients) was rather small, so it might not have sufficient statistical power to observe significant differences in more infrequent outcomes. Moreover, the short time span of one month after surgery, followed by a single-center design, might limit the applicability of these results to more general surgical environments and extended outcomes.

CONCLUSION

The overall study demonstrates that topical tranexamic acid, administered through the irrigating fluid during monopolar TURP, is a safe, well-tolerated and effective haemostatic adjunct. The intervention drastically lowered the length of gross hematuria, postoperative hemoglobin, catheterization and the length of hospital stay compared to the normal irrigation only. There was also a significant reduction in intraoperative blood loss in the TXA group. It is important to note that no serious incidents or accidents that could be linked to TXA were reported, which can be interpreted as evidence of a positive safety profile of topical administration. The results endorse the use of topical TXA as a part of the regular perioperative practice with patients undergoing TURP to treat BPH with symptoms.

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