

Predictors of Early Postoperative Complications Following Transurethral Resection of the Prostate: A Prospective Observational Study

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Abstract:

Background: Transurethral resection of the prostate (TURP) remains an established surgical treatment for men with symptomatic benign prostatic hyperplasia (BPH) requiring operative management. Although advances in surgical technique, anaesthesia and perioperative care have reduced morbidity, early postoperative complications including bleeding, clot retention, urinary tract infection, postoperative urinary retention and electrolyte disturbances continue to occur. Identification of patients at increased risk may facilitate perioperative optimization and postoperative surveillance.

Aim: To determine the incidence and predictors of early postoperative complications following TURP in patients with symptomatic BPH.

Materials and Methods: A prospective observational study was conducted in the Department of Urology, Anugrah Narayan Magadh Medical College Hospital, Gaya, Bihar, India, from July 2024 to July 2026. A total of 300 consecutive patients undergoing TURP for symptomatic BPH were included. Demographic characteristics, comorbidities, preoperative haemoglobin, prostate volume, ASA physical status, operative duration, resected tissue weight and perioperative variables were recorded. Early postoperative complications occurring during hospitalization or within 30 days of surgery were assessed. Multivariable logistic regression was performed to identify independent predictors of complications.

Results: Among 300 patients, 67 (22.3%) developed at least one early postoperative complication. The most frequent complications were urinary tract infection (24, 8.0%), clot retention requiring intervention (18, 6.0%), bleeding requiring blood transfusion (15, 5.0%), postoperative urinary retention (12, 4.0%) and fever without documented infection (10, 3.3%). On multivariable analysis, operative duration >60 minutes (adjusted OR [aOR] 2.74, 95% CI 1.53–4.91; $p=0.001$), ASA III–IV (aOR 2.29, 95% CI 1.25–4.20; $p=0.007$), prostate volume >80 mL (aOR 1.96, 95% CI 1.08–3.56; $p=0.027$), age ≥ 75 years (aOR 1.88, 95% CI 1.01–3.49; $p=0.046$) and diabetes mellitus (aOR 1.82, 95% CI 1.01–3.28; $p=0.047$) were independently associated with postoperative complications.

Conclusion: Early postoperative complications occurred in approximately one-fifth of patients undergoing TURP. Advanced age, diabetes mellitus, higher ASA class, larger prostate volume and prolonged operative duration were independently associated with increased postoperative risk. These factors may assist in perioperative risk stratification and postoperative monitoring.

Keywords: Benign Prostatic Hyperplasia; Transurethral Resection of Prostate; TURP; Postoperative Complications; Predictors; Bleeding; Urinary Tract Infection.

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Introduction

Benign prostatic hyperplasia is one of the most common urological conditions affecting ageing men and may result in bothersome lower urinary tract symptoms and bladder outlet obstruction. When symptoms are refractory to medical treatment or complications of obstruction develop, surgical treatment may be required. TURP has historically been regarded as a standard surgical treatment for

obstructive lower urinary tract symptoms attributable to BPH. [1,2]

Despite improvements in instrumentation, anaesthesia, perioperative care and irrigation technology, TURP remains associated with clinically relevant postoperative morbidity. Reported complications include bleeding, blood

transfusion, clot retention, urinary tract infection, failure to void, electrolyte disturbances and, less commonly, TUR syndrome. [2,3]

A large prospective multicentre evaluation involving more than 10,000 patients reported important short-term morbidity following TURP, with failure to void, surgical revision, urinary tract infection and bleeding among the principal complications. [3] Earlier multicentre work similarly demonstrated increased morbidity in association with advanced age, larger gland size, acute urinary retention and prolonged resection time. [4]

Patient-related characteristics may influence postoperative outcomes. Advanced age and pre-existing comorbidities may increase perioperative risk, whereas larger prostate volume may increase resection burden and operative complexity. [4] Operative duration is also clinically relevant because prolonged procedures may reflect greater prostate volume, increased technical difficulty or greater tissue removal. [5]

Recent observational evidence has further suggested that prolonged operative time, higher ASA class, larger prostate volume, advanced age and diabetes mellitus may be associated with postoperative complications. [6] Thus, postoperative morbidity following TURP is likely multifactorial rather than attributable to a single variable. [2,5,7]

Institution-specific prospective data remain valuable because patient characteristics, surgical expertise and perioperative protocols differ between healthcare settings. The present study therefore evaluated the incidence of early postoperative complications following TURP and assessed demographic, clinical and operative factors associated with these complications.

Aim: To determine the incidence and predictors of early postoperative complications following TURP.

Objectives

1. To determine the incidence of early postoperative complications following TURP.
2. To identify the common types of postoperative complications.
3. To assess the association between demographic and clinical characteristics and postoperative complications.
4. To evaluate the effect of prostate volume and operative duration on postoperative complications.
5. To identify independent predictors of early postoperative complications using multivariable logistic regression.

Materials and Methods

Study Design and Setting: A prospective observational study was conducted in the Department of Urology, Anugrah Narayan Magadh Medical College Hospital, Gayaji, Bihar, India.

The study period was from July 2024 to July 2026.

Study Population: All patients undergoing TURP for symptomatic BPH during the study period were included.

Sample Size and Sampling: A total of 300 patients were included using consecutive sampling. All eligible patients undergoing TURP during the study period were considered until the required sample size was achieved.

Inclusion Criteria

- Men aged ≥ 50 years.
- Clinically diagnosed BPH with an indication for TURP.
- Patients undergoing TURP for bladder outlet obstruction or lower urinary tract symptoms attributable to BPH.
- Patients providing informed consent.

Exclusion Criteria

1. Known prostate malignancy.
2. Previous prostate surgery.
3. Active untreated urinary tract infection at the time of surgery.
4. Known bleeding disorder.
5. Severe renal failure requiring dialysis.
6. Simultaneous major urological procedures.
7. Patients unwilling to participate.

Preoperative Assessment

Clinical evaluation included age, medical history, lower urinary tract symptoms, history of acute urinary retention and relevant comorbidities including diabetes mellitus and hypertension.

Routine investigations included complete blood count, renal function tests, coagulation profile, urine examination and urine culture where clinically indicated.

Prostate volume was assessed by ultrasonography and/or other routine preoperative imaging.

Operative Parameters

The following variables were recorded:

1. Type of TURP.
2. Anaesthesia.
3. Operative duration.
4. Resected tissue weight.
5. Estimated blood loss.
6. Irrigation volume.
7. Intraoperative complications.

Definition of Early Postoperative Complication

An early postoperative complication was defined as any clinically significant adverse event occurring during hospitalization or within 30 days following TURP.

Complications assessed included bleeding requiring transfusion, clot retention requiring intervention, urinary tract infection, postoperative urinary retention, fever, electrolyte disturbance/TUR syndrome, reoperation and cardiovascular or thromboembolic complications.

Statistical Analysis: Continuous variables were expressed as mean $\pm$ standard deviation and categorical variables as frequencies and percentages. The chi-square test or Fisher's exact test was used for categorical variables, while the independent-samples t-test was used for continuous variables where appropriate.

Variables demonstrating clinically relevant or statistically significant associations were entered

into a multivariable logistic regression model. Adjusted odds ratios with 95% confidence intervals were reported.

A two-sided p-value <0.05 was considered statistically significant.

Results

Participant Characteristics: A total of 300 patients undergoing TURP were included. The mean age was 68.4 ± 8.2 years (range, 51–86 years). Diabetes mellitus was present in 82 (27.3%) patients and hypertension in 141 (47.0%). Chronic kidney disease without dialysis was present in 29 (9.7%) patients.

The mean prostate volume was 63.7 ± 22.8 mL and the mean operative duration was 56.8 ± 18.7 minutes. Baseline demographic, clinical and operative characteristics are presented in Table 1.

Table 1: Baseline demographic, clinical and operative characteristics

Characteristic	Overall (n=300)
Age, years, mean $\pm$ SD	68.4 ± 8.2
Age ≥ 75 years, n (%)	74 (24.7)
Diabetes mellitus, n (%)	82 (27.3)
Hypertension, n (%)	141 (47.0)
Chronic kidney disease, n (%)	29 (9.7)
ASA I–II, n (%)	244 (81.3)
ASA III–IV, n (%)	56 (18.7)
Prostate volume, mL, mean $\pm$ SD	63.7 ± 22.8
Prostate volume >80 mL, n (%)	72 (24.0)
Preoperative haemoglobin, g/dL	12.8 ± 1.4
Operative duration, min	56.8 ± 18.7
Operative duration >60 min, n (%)	118 (39.3)
Resected tissue weight, g	38.6 ± 18.9

Incidence and Pattern of Early Postoperative Complications: Among the 300 patients, 67 (22.3%) developed at least one early postoperative complication.

The most frequent complication was urinary tract infection in 24 (8.0%), followed by clot retention

requiring intervention in 18 (6.0%), bleeding requiring transfusion in 15 (5.0%), postoperative urinary retention in 12 (4.0%) and fever without documented infection in 10 (3.3%).

The distribution of complications is presented in Table 2 and illustrated in Figure 1.

Table 2: Early postoperative complications following TURP

Complication	n (%)
Any postoperative complication	67 (22.3)
Urinary tract infection	24 (8.0)
Clot retention requiring intervention	18 (6.0)
Bleeding requiring transfusion	15 (5.0)
Postoperative urinary retention	12 (4.0)
Fever without documented infection	10 (3.3)
Electrolyte disturbance/TUR syndrome	3 (1.0)
Reoperation	4 (1.3)
Cardiovascular/thromboembolic complication	2 (0.7)

Some patients may have experienced more than one complication.

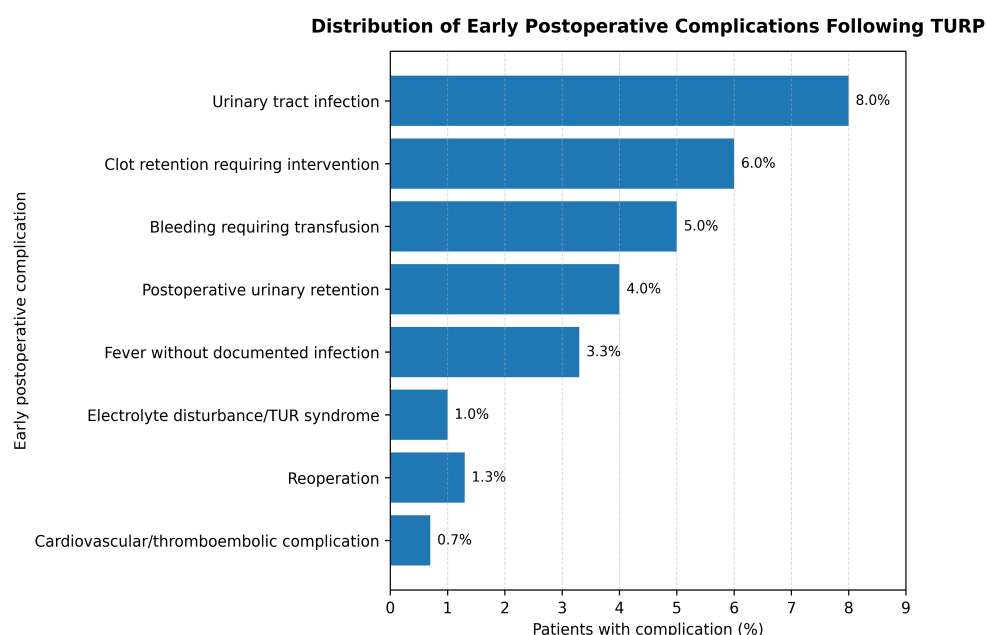


Figure 1: Distribution of early postoperative complications following TURP.

Factors Associated with Postoperative Complications: Patients who developed postoperative complications were older and more frequently had diabetes mellitus, ASA III–IV status, prostate volume >80 mL and operative duration >60 minutes.

The association between selected patient and operative factors and postoperative complications is presented in Table 3.

Table 3: Association between patient/operative factors and postoperative complications

Variable	Complication n/N (%)	No complication n/N (%)	p-value
Age ≥ 75 years	26/74 (35.1)	48/226 (21.2)	0.001
Diabetes mellitus	25/82 (30.5)	42/218 (19.3)	0.036
ASA III–IV	24/56 (42.9)	43/244 (17.6)	<0.001
Prostate volume >80 mL	24/72 (33.3)	43/228 (18.9)	0.008
Operative duration >60 min	42/118 (35.6)	25/182 (13.7)	<0.001
Preoperative Hb <11 g/dL	12/39 (30.8)	55/261 (21.1)	0.19

Multivariable Analysis: Multivariable logistic regression demonstrated that operative duration >60 minutes was the strongest independent predictor of postoperative complications (aOR 2.74, 95% CI 1.53–4.91; $p=0.001$).

ASA III–IV status, prostate volume >80 mL, age ≥ 75 years and diabetes mellitus also remained independently associated with postoperative complications.

The multivariable analysis is presented in Table 4 and graphically illustrated in Figure 2.

Table 4: Multivariable logistic regression analysis of predictors of early postoperative complications

Predictor	Adjusted OR	95% CI	p-value
Age ≥ 75 years	1.88	1.01–3.49	0.046
Diabetes mellitus	1.82	1.01–3.28	0.047
ASA III–IV	2.29	1.25–4.20	0.007
Prostate volume >80 mL	1.96	1.08–3.56	0.027
Operative duration >60 min	2.74	1.53–4.91	0.001

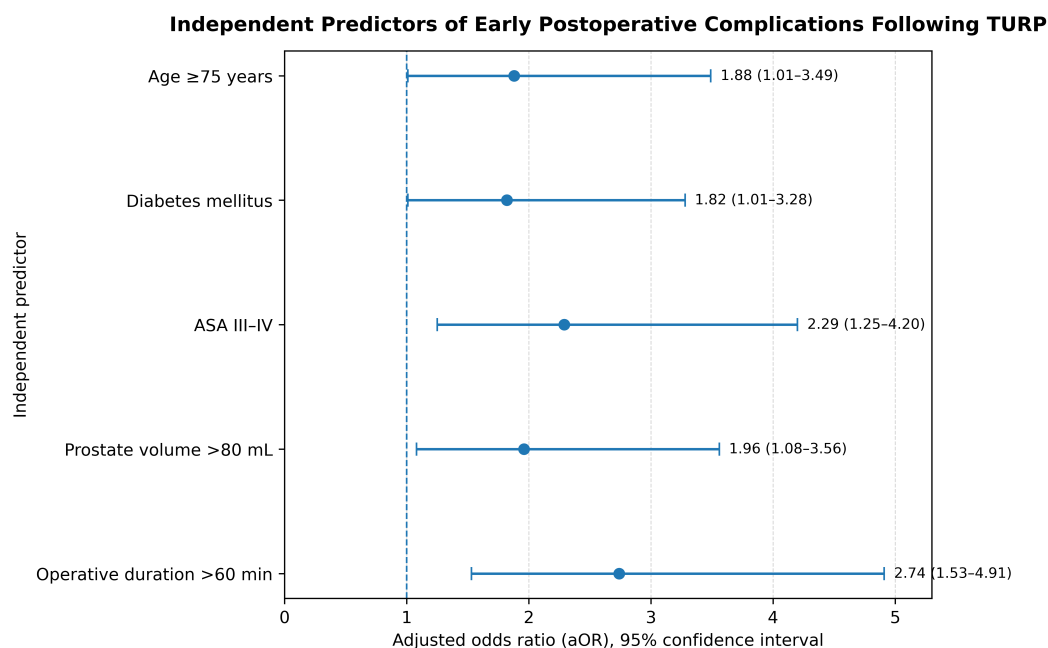


Figure 2: Independent predictors of early postoperative complications following TURP.

Adjusted odds ratios with 95% confidence intervals from the multivariable logistic regression model.

Discussion

In this prospective observational study, 22.3% of patients undergoing TURP developed at least one early postoperative complication. Urinary tract infection, clot retention and bleeding requiring transfusion were the most frequently observed complications.

The complication burden observed in the present study is consistent with the established literature demonstrating that TURP remains an effective but potentially morbid procedure. Reich et al., in a prospective multicentre evaluation of 10,654 patients, reported clinically important short-term morbidity following TURP, with failure to void, surgical revision, urinary tract infection and bleeding among the principal complications. [3] Earlier multicentre work by Mebust et al. also demonstrated increased morbidity associated with advanced age, larger prostate size, acute urinary retention and prolonged resection time. [4]

Urinary tract infection was the most common complication in the present study. Catheterization, instrumentation and postoperative urinary stasis may contribute to infectious complications. A systematic review of TURP trials has similarly demonstrated urinary tract infection as an important postoperative adverse event. [7]

Bleeding and clot retention represented other important complications. TURP-related blood loss may be influenced by prostate size, resected tissue volume, operative duration and preoperative urinary infection. ElMalik et al. reported that resected

prostate weight, prostate size and operative time were associated with blood loss, while preoperative urinary infection represented a potentially modifiable factor. [8]

Operative duration >60 minutes was the strongest independent predictor in the present study. This finding is supported by large database analyses demonstrating an increase in postoperative morbidity with increasing operative duration. [5] Longer procedures may reflect greater prostate volume, technical complexity, increased tissue removal or greater bleeding risk.

Advanced age was another independent predictor. Elderly patients may have a greater burden of comorbid disease and reduced physiological reserve, potentially increasing susceptibility to postoperative infection, bleeding and cardiovascular complications. Previous prospective studies have similarly identified age as an important determinant of postoperative morbidity. [3,4]

Diabetes mellitus was also independently associated with complications. Diabetes may increase the risk of infection and impair tissue healing. The association observed in the present study is consistent with recent prospective observational evidence identifying diabetes among clinically important predictors of postoperative complications after TURP. [6]

Larger prostate volume was associated with increased postoperative morbidity. Larger glands generally require greater resection and may result in prolonged operative duration and increased bleeding. Nevertheless, evidence indicates that TURP can be performed safely in appropriately

selected patients with large prostate glands when performed by experienced surgeons. [9]

Taken together, these findings support a multifactorial approach to postoperative risk assessment. Identification of high-risk patients before surgery may allow optimization of comorbidities, appropriate counselling, careful haemostatic management and closer postoperative surveillance.

Limitations

The single-centre design may limit generalizability. Operator-related variability and residual confounding may also influence outcomes. The study assessed early complications and therefore does not provide information regarding long-term functional outcomes or late complications.

Conclusion

Early postoperative complications following TURP remain clinically relevant. Advanced age, diabetes mellitus, higher ASA class, larger prostate volume and prolonged operative duration were independently associated with postoperative complications. Identification of these risk factors may assist in perioperative counselling, optimization and postoperative surveillance.

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