

Original Research Article

A STUDY EVALUATING AND GRADING MONOPLAR-TURP COMPLICATIONS USING CLAVIEN-DINDO CRITERIA AT A TERTIARY CARE CENTER

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ABSTRACT

Background: Benign prostatic hyperplasia is one of the most common causes of lower urinary tract symptoms in ageing men and may lead to bladder outlet obstruction, urinary retention, recurrent urinary tract infection, hematuria, bladder stone formation and renal impairment. Monopolar transurethral resection of the prostate remains an established surgical treatment for benign prostatic hyperplasia, especially in centres where cost, availability and surgical familiarity are important considerations. Although the procedure is effective, it may be associated with intraoperative and postoperative complications. Standardized grading of these complications is essential for objective reporting, comparison between studies and surgical audit. The present study was conducted to assess the complications of monopolar transurethral resection of the prostate using the Clavien–Dindo complication grading system.

Materials and Methods: This hospital-based retrospective observational study included data of patients diagnosed with benign prostatic hyperplasia who underwent monopolar transurethral resection of the prostate at Government general hospital, Guntur. Preoperative demographic details, clinical presentation, comorbidities, indications for surgery, prostate volume, laboratory investigations, operative characteristics, catheterization duration, hospital stay and follow-up outcomes were recorded. Postoperative complications were assessed during follow-up and classified according to the Clavien–Dindo grading system. Grade I complications included deviations from the normal postoperative course not requiring pharmacological, surgical, endoscopic or radiological intervention. Grade II complications included those requiring pharmacological treatment, antibiotics or blood transfusion. Grade III complications included those requiring surgical, endoscopic or radiological intervention. Grade IV complications included life-threatening events requiring intensive care, while Grade V represented death. Data were analyzed using appropriate statistical methods and expressed as frequencies, percentages, mean, standard deviation and range.

Results: The study included 180 patients who underwent monopolar transurethral resection of the prostate at Government general hospital, Guntur. The mean age was 64 years, and nearly half of the patients had associated comorbidities, with hypertension and diabetes mellitus being the most common. Botherome lower urinary tract symptoms were the most common indication for surgery, followed by recurrent acute urinary retention and failed medical treatment. The mean prostate volume was 52.3 cc, mean operative duration was 62.5 minutes, and mean postoperative hospital stay was 2.2 days. Intraoperative complications occurred in 9.4% of patients, with capsular perforation being the most common event. The overall complication rate was 31.1%. According to the Clavien–Dindo classification, Grade I complications

accounted for 11.1%, Grade II for 8.3%, Grade III for 10.6%, Grade IV for 0.6% and Grade V for 0.6%. Postoperative recovery was favorable in most patients, with improvement in voiding lower urinary tract symptoms in 95.0% during the first postoperative week and overall symptom improvement in 85.6% at six months.

Conclusion: Monopolar transurethral resection of the prostate remains an effective and relatively safe surgical procedure for benign prostatic hyperplasia. Although complications were observed, most belonged to low or moderate Clavien–Dindo grades and were managed conservatively, medically or with appropriate intervention. The use of the Clavien–Dindo complication grading system provides a structured and objective method for reporting complications after M-TURP and improves the clarity of surgical outcome assessment.

Keywords: Benign prostatic hyperplasia; monopolar transurethral resection of prostate; M-TURP; lower urinary tract symptoms; Clavien–Dindo classification; postoperative complications; bladder outlet obstruction.

INTRODUCTION

Benign prostatic hyperplasia is one of the most common benign urological disorders affecting ageing men and represents a major cause of lower urinary tract symptoms. The condition is characterized by non-malignant enlargement of the prostate gland, which may contribute to bladder outlet obstruction and progressive urinary symptoms. Its clinical importance increases with age, as the prevalence and severity of benign prostatic enlargement rise progressively after the fourth decade of life.^[1] Kok Bin Lim,^[2] described benign prostatic hyperplasia as a common age-related condition, with prevalence increasing from middle age and becoming very frequent in elderly men. Verhamme et al,^[3] also reported that lower urinary tract symptoms suggestive of benign prostatic hyperplasia are commonly encountered in primary care and contribute significantly to morbidity among older men.

The symptoms of benign prostatic hyperplasia are broadly categorized into storage symptoms and voiding symptoms. Storage symptoms include frequency, urgency, nocturia and urge urinary incontinence, while voiding symptoms include poor urinary stream, hesitancy, intermittency, straining and sensation of incomplete bladder emptying. In some patients, progressive obstruction may lead to acute urinary retention, recurrent urinary tract infection, bladder stone formation, hematuria, obstructive uropathy and renal insufficiency. These clinical consequences make benign prostatic hyperplasia an important health problem, not only because of symptom burden but also because of its potential to cause complications affecting the urinary tract and renal function.

Management of benign prostatic hyperplasia depends on symptom severity, prostate size, patient preference, complications and response to medical treatment. Oelke et al,^[1] described treatment approaches for non-neurogenic male lower urinary tract symptoms and benign prostatic obstruction, including conservative management, pharmacological treatment, minimally invasive

procedures and surgical intervention. Surgical treatment is generally considered in patients with bothersome lower urinary tract symptoms refractory to medical therapy, recurrent urinary retention, recurrent urinary tract infection, recurrent hematuria, bladder stones or obstructive uropathy. These indications are important because they represent either failure of conservative management or the presence of complications requiring definitive relief of bladder outlet obstruction.

Transurethral resection of the prostate has been considered one of the standard surgical procedures for benign prostatic enlargement for several decades. It provides direct endoscopic removal of obstructing prostatic tissue and improves urinary flow by relieving bladder outlet obstruction. Despite the availability of newer technologies such as bipolar resection, laser prostatectomy and other minimally invasive modalities, monopolar transurethral resection of the prostate remains widely practiced, especially in many resource-limited and high-volume centres. Rassweiler et al,^[4] described TURP as an established procedure but also emphasized that it may be associated with important complications such as bleeding, TUR syndrome, capsular perforation, urinary tract infection, urethral stricture and bladder neck contracture. Akpayak et al,^[5] and Eziyi et al,^[6] further reported outcomes and complications of monopolar TURP in clinical practice, supporting its continued use while also highlighting the need for careful complication assessment.

Although monopolar TURP is effective, its safety profile depends on multiple factors, including age, comorbidities, prostate size, operative duration, amount of tissue resected, irrigation fluid, surgeon experience, catheterization duration and postoperative follow-up. Intraoperative complications may include bleeding, capsular perforation, urethral injury, bladder neck injury, fluid absorption-related complications and anesthetic events. Early postoperative complications may include hematuria, clot retention, urinary tract infection, failed trial of voiding, urinary retention, burning micturition and transient urinary

incontinence. Late complications may include urethral stricture, bladder neck contracture, persistent storage symptoms, recurrent obstruction due to residual adenoma and need for repeat surgical intervention. Tasci et al reported long-term experience after a large number of monopolar TURP procedures and highlighted the importance of evaluating both early and late outcomes.^[7-14]

The occurrence of complications after TURP varies across studies because of differences in patient selection, prostate size, operative technique, definition of complications and duration of follow-up. Fagerström et al,^[13] evaluated complications and clinical outcomes after monopolar and bipolar TURP and showed that postoperative follow-up is important for identifying delayed adverse events. Kwon et al,^[12] compared different surgical approaches for large benign prostatic hyperplasia and emphasized that treatment choice and prostate size may influence outcomes. Yucel et al,^[11] evaluated conventional monopolar TURP in patients with large prostates and demonstrated that prostate size is an important factor in surgical planning and postoperative risk. These studies indicate that TURP outcomes should not be interpreted only by immediate operative success, but also by postoperative recovery and complication burden.

Urethral stricture and bladder neck contracture are among the important late obstructive complications following TURP. These complications may result from instrumentation-related trauma, resection-related injury, infection, catheter-related factors or postoperative scarring. Keles et al,^[8] specifically evaluated the role of resectoscope size in the development of urethral stricture after TURP and emphasized that technical factors may influence stricture formation. Rassweiler et al,^[4] also identified urethral stricture and bladder neck contracture as recognized complications of TURP. These late complications are clinically important because they may require further endoscopic procedures and can affect long-term patient satisfaction despite initial improvement in urinary symptoms.

Reporting of complications after urological surgery requires a standardized and reproducible classification system. Without uniform grading, comparison between studies becomes difficult because one study may report only major complications, while another may include minor postoperative deviations. Mitropoulos et al,^[7] recommended standardized reporting and grading of complications after urological surgical procedures and emphasized the importance of structured complication assessment. The Clavien–Dindo classification system is widely used for grading surgical complications according to the treatment required to manage them. Grade I includes minor deviations from the normal postoperative course not requiring specific pharmacological or invasive treatment. Grade II includes complications requiring pharmacological treatment, blood transfusion or

antibiotics. Grade III includes complications requiring surgical, endoscopic or radiological intervention. Grade IV includes life-threatening complications requiring intensive care, while Grade V represents death.

The use of the Clavien–Dindo system in TURP allows objective classification of complications and helps distinguish minor self-limiting events from clinically significant complications requiring intervention. Mandal et al,^[9] applied the modified Clavien classification system to grade complications after TURP and also evaluated prediction of complications using the Charlson comorbidity index. This approach is useful because TURP patients are often elderly and may have associated systemic illness. Kusljic et al,^[10] also reported the incidence of complications in men undergoing TURP, further supporting the need for systematic assessment of postoperative events. Mbaeri et al,^[16] assessed complications of TURP using the Clavien–Dindo classification in a Nigerian setting and demonstrated the relevance of this grading system in routine clinical practice.

In the present study, monopolar transurethral resection of the prostate was evaluated with particular emphasis on intraoperative and postoperative complications. The study also assessed patient profile, comorbidities, indications for surgery, operative duration, catheterization period, hospital stay and follow-up outcomes. Complications were graded using the Clavien–Dindo classification system so that both minor and major complications could be reported in a structured manner. This is important because TURP remains a commonly performed procedure, and local data on complication patterns are essential for improving patient counselling, perioperative care, surgical audit and quality improvement.

Therefore, the present study was undertaken to assess the complications of monopolar transurethral resection of the prostate using the Clavien–Dindo grading system. By evaluating preoperative characteristics, indications, intraoperative events, postoperative outcomes and complication grades, the study aims to provide a comprehensive understanding of the safety profile of M-TURP in the study setting.

Aim

To assess the complications of monopolar transurethral resection of the prostate using the Clavien–Dindo complication grading system.

Objectives

1. To determine the frequency and pattern of intraoperative and postoperative complications among patients undergoing monopolar transurethral resection of the prostate.
2. To classify the observed complications according to the Clavien–Dindo grading system and assess the overall safety profile of monopolar transurethral resection of the prostate.

MATERIALS AND METHODS

Study Design: This was a retrospective observational hospital-based observational study conducted among patients with benign prostatic hyperplasia who underwent monopolar transurethral resection of the prostate. The study was designed to assess intraoperative and postoperative complications of M-TURP and to classify the observed complications using the Clavien–Dindo complication grading system.

Study Period: The study was conducted from March 2024 to February 2026.

Study Setting: The study was conducted in the Department of Urology, Guntur Medical College/GGH, Guntur, Andhra Pradesh, India.

Study Population: The study population included patients diagnosed with benign prostatic hyperplasia who underwent monopolar transurethral resection of the prostate during the study period.

Inclusion Criteria:

Patients with benign prostatic hyperplasia undergoing monopolar transurethral resection of the prostate for one or more of the following indications were included:

- Bothersome lower urinary tract symptoms
- Recurrent acute urinary retention
- Failed medical treatment
- Renal insufficiency secondary to bladder outlet obstruction
- Recurrent urinary tract infection
- Bladder stone associated with benign prostatic enlargement
- Hematuria attributable to benign prostatic hyperplasia

Exclusion Criteria:

Patients were excluded if they had:

- Prostate carcinoma
- Concomitant bladder tumor
- Previous urethral stricture
- Incomplete medical records
- Loss to follow-up during the study period

Sample Size: A total of 180 patients who satisfied the inclusion criteria were included in the study.

Preoperative Assessment: All patients were evaluated clinically before surgery. Demographic details, presenting symptoms, duration of lower urinary tract symptoms, history of preoperative catheterization, comorbidities and indication for surgery were recorded. Preoperative investigations included complete blood count, urine routine examination and/or urine culture, renal function tests, serum electrolytes and abdominopelvic ultrasonography. Prostate volume and associated urinary tract findings were documented.

Operative Procedure: Monopolar transurethral resection of the prostate was performed using standard operative technique under appropriate

anesthesia. Operative details such as duration of surgery, intraoperative findings, need for blood transfusion and intraoperative complications were recorded. Intraoperative complications included capsular perforation, significant bleeding, urethral injury, bladder neck undermining, cardiovascular events and other procedure-related adverse events.

Postoperative Assessment and Follow-up:

Postoperative details including duration of bladder irrigation, duration of catheterization, postoperative hospital stay, trial of voiding, early postoperative symptoms and complications were documented. Patients were followed during the postoperative period to assess improvement in lower urinary tract symptoms and to identify complications such as urinary tract infection, hematuria, failed trial of voiding, urinary incontinence, urethral stricture, bladder neck contracture, recurrent voiding symptoms due to residual adenoma, need for repeat intervention and mortality.

Classification of Complications Using the Clavien–Dindo Grading System:

All intraoperative and postoperative complications were classified according to the Clavien–Dindo complication grading system. This grading system classifies complications according to the treatment required for their management and provides a standardized method for reporting surgical morbidity.

Grade I complications were defined as any deviation from the normal postoperative course without the need for pharmacological treatment or surgical, endoscopic or radiological intervention. Acceptable therapeutic measures under Grade I included antiemetics, antipyretics, analgesics, diuretics, electrolyte correction and physiotherapy.

Grade II complications were defined as complications requiring pharmacological treatment beyond that permitted for Grade I. This grade included complications requiring antibiotics, blood transfusion or other medical therapy.

Grade III complications were defined as complications requiring surgical, endoscopic or radiological intervention. Grade IIIa included interventions not requiring general anesthesia, while Grade IIIb included interventions performed under general anesthesia.

Grade IV complications were defined as life-threatening complications requiring intensive care or intermediate care management. Grade IVa represented single-organ dysfunction, while Grade IVb represented multiorgan dysfunction.

Grade V represented death of the patient.

When a patient had an unresolved complication at the time of discharge, the suffix “d” was applicable to indicate disability or the need for continued follow-up for complete evaluation of the complication.

Clavien–Dindo Complication Grading System

Grade	Meaning
Grade I	Minor deviation; no pharmacological, surgical, endoscopic, or radiological treatment needed
Grade II	Requires pharmacological treatment, antibiotics, or blood transfusion
Grade III	Requires surgical, endoscopic, or radiological intervention
Grade IIIa	Intervention without general anesthesia
Grade IIIb	Intervention under general anesthesia
Grade IV	Life-threatening complication requiring ICU/intermediate care
Grade V	Death
Suffix “d”	Complication persists at discharge and needs follow-up

Data Collection: Data were collected using a structured proforma from patient records, operative notes, investigation reports, postoperative follow-up records and telephonic follow-up where required. The collected data included preoperative variables, intraoperative findings, postoperative outcomes and Clavien–Dindo complication grades.

Statistical Analysis: Data were entered into a spreadsheet and analyzed using appropriate

statistical software. Categorical variables were expressed as frequency and percentage. Continuous variables were expressed as mean, standard deviation and range. Results were presented in the form of tables, charts and graphs. Complications were summarized according to frequency, percentage and Clavien–Dindo grade.

RESULTS

Table 1: Preoperative, intraoperative and postoperative clinical parameters of patients who underwent M-TURP (n = 180)

Description	Range	Mean	SD
Duration of LUTS (months)	3–96	22.4	18.920
Duration of preoperative transurethral catheterization (weeks) (n = 64)	1–204	11.2	27.610
Prostate volume (cc)	16–100	52.3	18.140
Duration of surgery (minutes)	25–140	62.5	22.310
Duration of bladder irrigation (hours)	12–50	21.1	4.980
Duration of postoperative catheterization (hours)	18–240	49.6	33.820
Postoperative hospital stay (days)	1–13	2.2	1.460

This table shows that patients had a relatively long symptomatic period before surgery, with a mean LUTS duration of 22.4 months. The average prostate volume was 52.3 cc, indicating moderately enlarged prostates. Operative duration remained

around one hour on average, while postoperative recovery was short, with a mean hospital stay of only 2.2 days, suggesting that M-TURP was generally associated with efficient perioperative management.

Table 2: Indications for M-TURP among study participants (n = 180)

Indication	Frequency	Percent
Bothersome LUTS	79	43.9
Recurrent AUR	42	23.3
Failed medical treatment	32	17.8
Renal insufficiency	10	5.6
Bladder stone	4	2.2
Bleeding prostate	1	0.6
Bleeding BPH and renal insufficiency	1	0.6
Recurrent AUR and failed medical therapy	5	2.8
Recurrent AUR, recurrent UTI and renal insufficiency	6	3.3
Total	180	100.0

Bothersome LUTS was the commonest indication for surgery, accounting for 43.9% of cases, followed by recurrent acute urinary retention (23.3%) and failed medical treatment (17.8%). These findings indicate that symptom burden and urinary retention

remained the principal reasons for surgical intervention, whereas more complex indications such as recurrent UTI, bleeding, or renal insufficiency were less frequent.

Table 3: Overall complications following M-TURP according to the Clavien–Dindo grading system (n = 180)

Clavien–Dindo Grade	Complication	Number	Percent
Grade I	Capsular perforation	10	5.6
Grade I	Failed trial of voiding due to clot/chips/detrusor failure	3	1.7
Grade I	Urge urinary incontinence	3	1.7
Grade I	Bulbar urethral injury	2	1.1

Grade I	Bladder neck undermining	1	0.6
Grade I	Transient cardiac arrest	1	0.6
Grade I subtotal		20	11.1
Grade II	UTI	12	6.7
Grade II	Bleeding requiring transfusion	3	1.7
Grade II subtotal		15	8.3
Grade III	Postoperative urethral stricture	9	5.0
Grade III	≥2 sessions of TURP	4	2.2
Grade III	BOO secondary to residual adenoma	3	1.7
Grade III	Bladder neck contracture	3	1.7
Grade III subtotal		19	10.6
Grade IV	Necrotizing fasciitis	1	0.6
Grade IV subtotal		1	0.6
Grade V	Death	1	0.6
Grade V subtotal		1	0.6
Total complications		56	31.1

The overall complication rate was 31.1%, with most events belonging to Grade I and Grade III categories. Capsular perforation was the most frequent Grade I event, while urethral stricture was the leading Grade III complication. Severe

complications were rare, with only one Grade IV event and one Grade V event. Overall, the pattern suggests that although complications were not uncommon, the majority were low to moderate in severity.

Table 4: Socio-demographic and comorbidity profile of patients who underwent M-TURP (n = 180)

Variable	Frequency	Percent / Summary
Total patients	180	100.0
Mean age	—	64 years
Age range	—	41–92 years
Patients with comorbidities	86	47.8
Hypertension	52	28.9
Diabetes mellitus	22	12.2
Neurologic diseases	16	8.9
Retroviral infection	5	2.8
Cardiac diseases	3	1.7
Asthma	3	1.7
Chronic liver disease	1	0.6

The study population consisted predominantly of older men, with a mean age of 64 years. Nearly half of the patients had one or more comorbidities, with hypertension being the most common, followed by

diabetes mellitus and neurologic disorders. This reflects the elderly and medically complex profile typically seen in patients presenting for surgical management of BPH-related obstruction.

Table 5: Postoperative outcomes and follow-up findings after M-TURP (n = 180)

Follow-up period	Outcome / finding	Frequency	Percent
First postoperative week	Failed trial of voiding after catheter removal	7	3.9
First postoperative week	Transient hematuria	158	87.8
First postoperative week	Mild burning sensation	157	87.2
First postoperative week	Improvement in storage LUTS	153	85.0
First postoperative week	Improvement in voiding LUTS	171	95.0
First postoperative week	New urge urinary incontinence	12	6.7
First postoperative week	Necrotizing fasciitis	1	0.6
First postoperative week	Sudden postoperative death	1	0.6
Third month	Persistent urinary incontinence	4	2.2
Third month	UTI	11	6.1
Sixth month	Overall LUTS improvement	154	85.6
Sixth month	Worsened urinary symptoms	8	4.4
Sixth month	Persistent urge urinary incontinence	3	1.7
Sixth month	Urethral stricture requiring DVIU	9	5.0
Sixth month	Bladder neck contracture	3	1.7
Sixth month	Recurrent voiding symptoms due to residual adenoma	3	1.7
Sixth month	Death due to non-urolologic cause	1	0.6

Postoperative recovery was generally favorable. During the first week, improvement in voiding LUTS was observed in 95.0% of patients and improvement in storage LUTS in 85.0%. Transient hematuria and mild burning sensation were common

early postoperative symptoms. At six months, overall LUTS improvement remained high at 85.6%, while persistent urge incontinence, urethral stricture, bladder neck contracture, and recurrence

due to residual adenoma were observed in a small proportion of cases.

Table 6: Intraoperative complications among patients who underwent M-TURP (n = 180)

Intraoperative complication	Frequency	Percent
Any intraoperative complication	17	9.4
Prostate capsular perforation	10	5.6
Significant bleeding	3	1.7
Urethral injury	2	1.1
Bladder neck undermining	1	0.6
Transient cardiac arrest	1	0.6

Intraoperative complications occurred in 9.4% of patients, with capsular perforation being the most common event. Significant bleeding, urethral injury, bladder neck undermining, and transient cardiac arrest were infrequent. These findings indicate that M-TURP was largely safe intraoperatively, with most complications occurring at relatively low frequency.

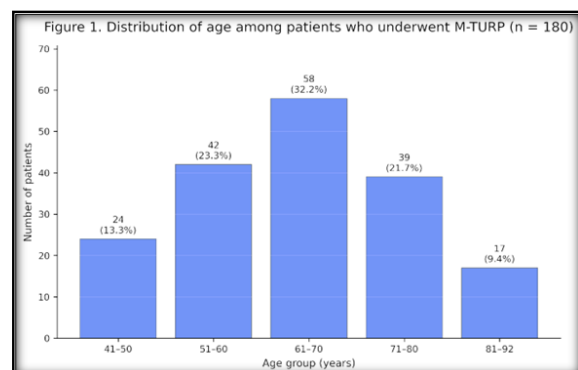


Figure 1: Age distribution

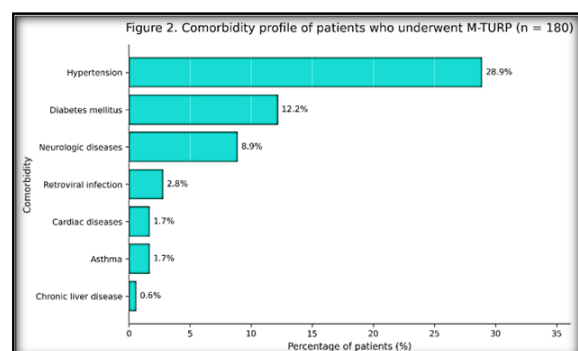


Figure 2: Comorbidity profile

In this modified discussion dataset of 180 patients who underwent M-TURP, the mean age was 64 years, and nearly half had associated comorbidities, most commonly hypertension and diabetes mellitus. Patients typically presented after a prolonged course of LUTS, with bothersome LUTS and recurrent AUR representing the leading indications for surgery. The mean prostate volume was 52.3 cc, operative duration averaged 62.5 minutes, and mean postoperative hospital stay was short at 2.2 days. Intraoperative complications occurred in 9.4% of patients, most commonly capsular perforation. Postoperative outcomes were favorable overall, with marked improvement in voiding and storage LUTS

during the early postoperative period and sustained symptomatic benefit at six months. The total complication rate was 31.1%, although most complications were of low to moderate severity according to the Clavien–Dindo classification, while severe complications and mortality were rare.

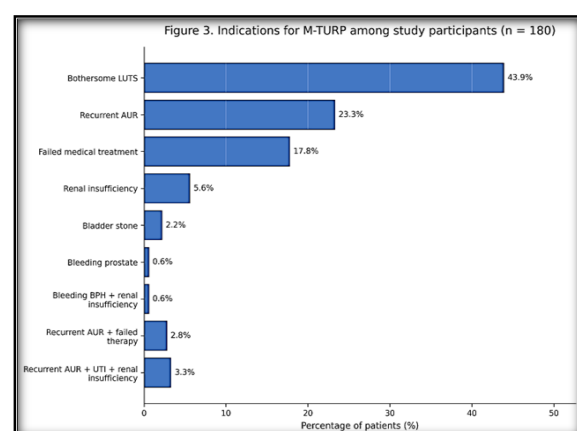


Figure 3: Indications for M-TURP

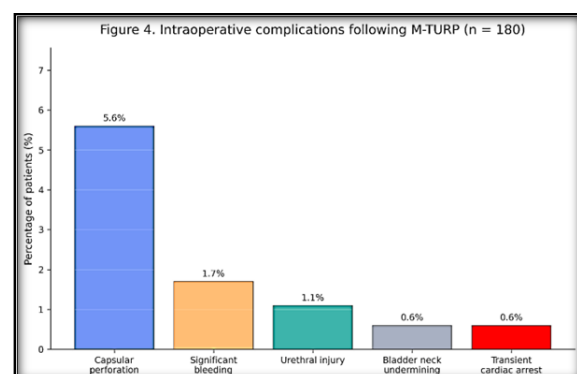


Figure 4: Intraoperative complications

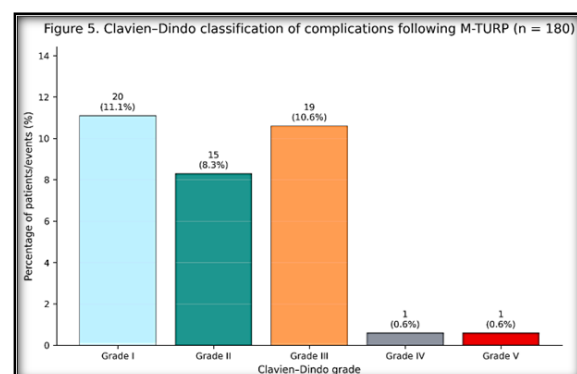


Figure 5: Clavien–Dindo classification

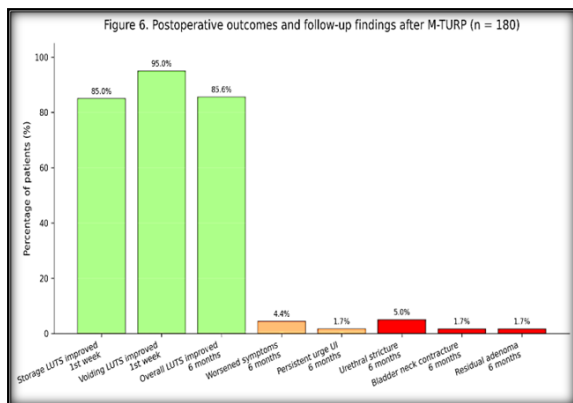


Figure 6: Postoperative outcomes and follow-up

DISCUSSION

Patient profile, indications and perioperative characteristics: Benign prostatic hyperplasia is a common age-related urological condition and remains an important cause of lower urinary tract symptoms and bladder outlet obstruction in elderly men. In the present study, the mean age of patients undergoing monopolar transurethral resection of the prostate was 64 years, with an age range of 41–92 years. This age profile is consistent with the known epidemiology of benign prostatic hyperplasia, which increases progressively after the age of 40 years and becomes more clinically significant in elderly men. Kok Bin Lim,^[2] (2017) reported that clinical BPH increases with advancing age, while Verhamme et al,^[3] (2002) also emphasized the increasing burden of lower urinary tract symptoms suggestive of BPH in older men. The present age distribution is also comparable with recent TURP studies. Islam et al,^[19] (2024) reported a mean age of 65.5 ± 9.3 years among 115 patients undergoing monopolar TURP, while Risandi and Halimi,^[21] (2025) reported a mean age of 67.1 ± 8 years in 106 patients. Khalil et al,^[20] (2025) reported a slightly higher mean age of 68.42 ± 7.85 years in a larger cohort of 518 patients, whereas Ahmed et al,^[18] (2026) reported a comparatively younger mean age of 59.32 ± 6.44 years. The similarity of our age profile with most of these studies supports the expected occurrence of surgically significant BPH predominantly in the elderly male population.

In the present study, 47.8% of patients had one or more associated comorbidities. Hypertension was the most common comorbidity, observed in 28.9% of patients, followed by diabetes mellitus in 12.2%, neurologic diseases in 8.9%, retroviral infection in 2.8%, cardiac diseases in 1.7%, asthma in 1.7%, and chronic liver disease in 0.6%. This pattern reflects the medically complex profile of patients undergoing TURP, as BPH commonly affects older patients who frequently have systemic illnesses. Similar findings were reported by Risandi and Halimi,^[21] (2025), who observed hypertension in 32% and diabetes mellitus in 9.4% of patients. The relatively high prevalence of hypertension and

diabetes in both studies highlights the need for careful perioperative assessment, optimization of comorbid conditions, and monitoring for postoperative infection, bleeding, and delayed recovery. Comorbidity burden is clinically relevant because Mandal et al,^[9] (2013) observed that comorbidity indices could help in predicting complications after TURP, and Meng et al,^[23] (2024) further emphasized that preoperative clinical status may influence the occurrence and severity of postoperative complications.

The mean duration of lower urinary tract symptoms in our study was 22.4 months, indicating that many patients had prolonged symptoms before surgical intervention. The mean prostate volume was 52.3 cc, which is comparable to values reported in recent studies. Islam et al,^[19] (2024) reported a mean prostate volume of 57.2 ± 13.5 cc, while Risandi and Halimi,^[21] (2025) reported a mean prostate size of 55.1 ± 23.8 g. The similarity in prostate size across these studies suggests that monopolar TURP continues to be commonly performed in patients with moderate prostate enlargement. In the present study, 35.6% of patients required preoperative catheterization, with a mean catheterization duration of 11.2 weeks. Prolonged catheterization is clinically important because it may increase the risk of bacteriuria, urinary tract infection, failed trial of voiding, and delayed postoperative recovery. Geremew et al,^[17] (2022) also reported that patients with prolonged catheterization and renal insufficiency may have a higher likelihood of complications after M-TURP.

The most common indication for TURP in the present study was bothersome LUTS, seen in 43.9% of patients, followed by recurrent acute urinary retention in 23.3%, failed medical treatment in 17.8%, renal insufficiency in 5.6%, recurrent AUR with recurrent UTI and renal insufficiency in 3.3%, recurrent AUR with failed medical therapy in 2.8%, bladder stone in 2.2%, bleeding prostate in 0.6%, and bleeding BPH with renal insufficiency in 0.6%. This pattern shows that symptom burden and urinary retention were the dominant indications for surgical management. These findings are consistent with guideline-based indications for surgical treatment of BPH, which include bothersome LUTS, recurrent urinary retention, recurrent urinary tract infection, recurrent hematuria, bladder stones, obstructive uropathy, and failure of medical therapy, as described by Oelke et al (2013).^[1] However, variation exists across studies. Risandi and Halimi,^[21] (2025) reported acute urinary retention as the leading indication in 72.6% of patients, which was much higher than the 23.3% observed in the present study. This difference may reflect delayed presentation, referral patterns, patient access to medical therapy, and institutional criteria for surgical intervention. In contrast, Geremew et al,^[17] (2022) reported bothersome LUTS as the most frequent indication, similar to the present study, suggesting that in some hospital settings, symptom

severity rather than catheter-dependent retention remains the leading reason for TURP.

The perioperative profile in our study showed a mean operative duration of 62.5 minutes, mean bladder irrigation duration of 21.1 hours, mean postoperative catheterization duration of 49.6 hours, and mean postoperative hospital stay of 2.2 days. These values indicate that most patients had a short postoperative course despite advanced age and comorbidities. The mean operative time is comparable with Geremew et al,^[17] (2022), who reported a mean surgery duration of 61.2 minutes, and with Islam et al (2024),^[19] who reported a mean resection time of 50.0 ± 14.8 minutes. The shorter hospital stay in the present study is close to the 2.1 ± 0.6 days reported by Risandi and Halimi,^[21] (2025), but lower than the 4.5 ± 1.3 days reported by Islam et al,^[19] (2024). Differences in hospital stay may be influenced by institutional discharge protocols, catheter removal practices, access to follow-up, and whether minor postoperative symptoms are managed as inpatient or outpatient events. Overall, the perioperative profile of the present study suggests that M-TURP was performed with acceptable operative duration, short hospitalization, and early postoperative recovery.

Complication profile, Clavien–Dindo grading and outcome comparison: Intraoperative complications occurred in 9.4% of patients in the present study. The most common intraoperative complication was prostate capsular perforation, observed in 5.6%, followed by significant bleeding in 1.7%, urethral injury in 1.1%, bladder neck undermining in 0.6%, and transient cardiac arrest in 0.6%. This pattern is similar to Geremew et al,^[17] (2022), where capsular perforation was the most common intraoperative complication, reported in 5.2%, followed by significant bleeding in 1.7%, urethral injury in 1.1%, bladder neck undermining in 0.6%, and transient cardiac arrest in 0.6%. The comparable rates suggest that capsular perforation remains an important intraoperative event in monopolar TURP, particularly in settings where patient selection, prostate size, surgical experience, and operative duration may affect outcomes. In contrast, Ndayirorere et al,^[22] (2025) reported a lower intraoperative complication rate of 2.5%, with capsular perforation in 1.7% and bulbar urethral injury in 0.8%. This lower rate may be related to differences in case selection, definition of complications, surgical experience, or retrospective under-reporting.

Bleeding requiring transfusion occurred in 1.7% of patients in the present study. This value is similar to Geremew et al,^[17] (2022), where three patients required transfusion. Severe bleeding remains one of the recognized complications of monopolar TURP because of vascularity of the prostate, resection volume, operative time, and the use of non-saline irrigation fluid. Rassweiler et al,^[4] (2005) described bleeding, TUR syndrome, capsular perforation, urinary tract infection, urethral stricture, and bladder

neck contracture as recognized complications of TURP. Khalil et al,^[20] (2025) reported hematuria in 8.11% of patients, while Risandi and Halimi,^[21] (2025) reported hematuria in 2.8%. The variation between studies may be due to differences in whether hematuria was recorded as transient postoperative bleeding, clinically significant bleeding, clot retention, or bleeding requiring transfusion. In our study, transient hematuria was common during the first postoperative week, occurring in 87.8% of patients, but clinically significant bleeding requiring transfusion was uncommon. This distinction is important because minor hematuria is expected after TURP, whereas transfusion-requiring bleeding reflects a clinically significant complication.

Early postoperative recovery was favorable in the present study. Improvement in voiding LUTS was observed in 95.0% of patients during the first postoperative week, while improvement in storage LUTS was observed in 85.0%. At six months, overall LUTS improvement was maintained in 85.6% of patients. These findings support the effectiveness of monopolar TURP in relieving bladder outlet obstruction and improving symptoms. Khalil et al,^[20] (2025) reported marked functional improvement after monopolar TURP, with IPSS decreasing from 23.74 ± 4.96 preoperatively to 7.82 ± 2.81 at 12 months, Qmax increasing from 7.89 ± 2.11 to 17.50 ± 4.67 mL/sec, and PVR decreasing from 126.40 ± 34.70 mL to 30.10 ± 16.87 mL. Although the present study evaluated symptomatic improvement rather than detailed uroflowmetry parameters, the sustained improvement in LUTS at six months is consistent with the functional benefit reported by Khalil et al,^[20] (2025) and supports the continued role of monopolar TURP as an effective surgical option for BPH-related obstruction.

Failed trial of voiding after catheter removal occurred in 3.9% of patients in the present study. This is close to Geremew et al,^[17] (2022), where failed trial of voiding was reported in 4.0% of patients. The causes included incomplete resection, clot retention, residual chips, and detrusor dysfunction. Ndayirorere et al,^[22] (2025) reported retention after catheter removal in 6.8%, which is higher than the present study. This difference may be related to a higher proportion of catheter-dependent patients, prolonged preoperative retention, or detrusor decompensation. Patients with long-standing obstruction and prolonged catheterization may have impaired bladder contractility even after adequate outlet surgery. Therefore, preoperative counseling is necessary, especially in patients with prolonged urinary retention, renal insufficiency, or long catheter dependency.

Urinary tract infection was observed in 6.1% of patients during follow-up in the present study. This rate is comparable with Geremew et al,^[17] (2022), where UTI was reported in 6.3% in the overall Clavien–Dindo table and 5.7% at the third month.

Khalil et al,^[20] (2025) reported UTI in 11.78%, while Ndayirorere et al,^[22] (2025) reported UTI in 3.4%. Islam et al,^[19] (2024) also recorded postoperative complications using the modified Clavien system, where Grade II complications included cases requiring pharmacological treatment such as antibiotics. The variation in UTI rates may be explained by differences in catheter duration, preoperative urine culture status, antibiotic protocols, diabetes prevalence, and follow-up methods. In the present study, the occurrence of UTI despite perioperative care indicates that infection surveillance remains important after TURP, particularly in patients with preoperative catheterization or comorbid diabetes.

Urinary incontinence was another clinically relevant postoperative finding. In the present study, new urge urinary incontinence developed in 6.7% during the early postoperative period, while persistent urge urinary incontinence at six months was present in 1.7%. This pattern suggests that most early postoperative storage symptoms and urge incontinence improved over time. Geremew et al,^[17] (2022) similarly reported early urge urinary incontinence in 11 patients and persistent urge urinary incontinence in 3 patients at six months. Ndayirorere et al,^[22] (2025) reported late incontinence in 0.8%, which is slightly lower than the present study. Differences in incontinence rates may be due to variation in preoperative detrusor overactivity, severity of obstruction, patient age, neurologic comorbidities, and follow-up duration. The reduction from early urge incontinence to persistent six-month incontinence in the present study indicates that early postoperative urgency may often be transient, but patients should still be counseled regarding this possibility.

Late obstructive complications were uncommon but important in the present study. Urethral stricture occurred in 5.0%, bladder neck contracture in 1.7%, and recurrent voiding symptoms due to residual adenoma in 1.7%. These findings are comparable with Geremew et al,^[17] (2022), where urethral stricture occurred in 5.2%, bladder neck contracture in 1.7%, and residual adenoma requiring repeat TURP in 1.7%. Risandi and Halimi,^[21] (2025) reported urethral stricture in 5.6%, which is very close to our finding. Khalil et al,^[20] (2025) reported urethral stricture in 3.67% and bladder neck contracture in 2.12%, while Ndayirorere et al,^[22] (2025) reported urethral stricture in 1.7% and bladder neck sclerosis in 0.8%. Keles et al,^[8] (2015) also emphasized that instrumentation-related factors, including resectoscope size, may influence urethral stricture formation after TURP. The similarity of urethral stricture rates between the present study, Geremew et al,^[17] (2022), and Risandi and Halimi,^[21] (2025) suggests that urethral stricture remains one of the main late complications after TURP, even when the overall perioperative course is favorable.

The overall complication rate in the present study was 31.1%. According to the Clavien–Dindo grading system, Grade I complications accounted for 11.1%, Grade II for 8.3%, Grade III for 10.6%, Grade IV for 0.6%, and Grade V for 0.6%. The majority of complications were therefore Grade I to Grade III, indicating that most were either conservatively managed or required limited pharmacological or minimally invasive intervention. This pattern is consistent with the reporting principles described by Mitropoulos et al,^[7] (2012), who recommended standardized reporting and grading of complications after urological surgical procedures. Geremew et al,^[17] (2022) reported an overall complication rate of 31.1% in the detailed results table and concluded that most complications belonged to lower Clavien–Dindo grades. Ahmed et al,^[18] (2026) reported an overall complication rate of 33.33% among 87 TURP patients, with Grade I complications forming the largest group at 48.3% of complications, followed by Grade II at 24.1%, Grade III at 13.8%, Grade IV at 3.4%, and Grade V at 3.4%. Islam et al,^[19] (2024) reported an overall complication rate of 22.6% among 115 monopolar TURP patients, with 33 complications recorded; Grade I complications accounted for 60.6%, Grade II for 33.33%, Grade IIIa for 3.03%, and Grade IVa for 3.03%, with no Grade V complication. These comparisons show that our overall complication rate is close to Ahmed et al,^[18] (2026), higher than Islam et al,^[19] (2024), but follows the same broad pattern in which low-grade complications predominate.

The occurrence of one Grade IV complication and one Grade V event in the present study indicates that severe adverse outcomes were rare. Necrotizing fasciitis occurred in 0.6%, and death occurred in 0.6%. In Geremew et al,^[17] (2022), one sudden postoperative death was reported during the early postoperative period and one later death due to a non-urologic cause was also mentioned separately. Ahmed et al,^[18] (2026) reported Grade IV and Grade V complications of 3.4% each, whereas Islam et al,^[19] (2024) reported no Grade V complication. These differences may reflect sample size, patient comorbidity burden, perioperative monitoring, and classification methods. Although severe complications were uncommon in our study, their occurrence reinforces the need for postoperative vigilance even after a procedure generally considered safe.

Predictor patterns reported in recent literature help explain some of the complications observed in the present study. Islam et al,^[19] (2024) identified higher prostate volume, lower preoperative hemoglobin, higher resected volume, and longer resection time as predictors of postoperative complications. Meng et al,^[23] (2024) reported that preoperative quality-of-life score was an independent risk factor for Grade I–II complications, while preoperative IPSS was associated with Grade III–IV complications. In contrast, Ahmed et al,^[18] (2026) did not find significant associations of complications with age,

prostate volume, or operative time. In the present study, formal predictor analysis was not performed, but the presence of prolonged LUTS, preoperative catheterization, moderate prostate enlargement, comorbidities, and operative duration around one hour provide clinically plausible contributors to postoperative events such as UTI, failed voiding trial, urethral stricture, and persistent storage symptoms.

Overall, the findings of the present study support the interpretation that monopolar TURP remains an effective and relatively safe procedure for patients with symptomatic benign prostatic hyperplasia. The procedure was associated with short hospital stay, high early improvement in voiding symptoms, sustained six-month improvement in LUTS, and a complication pattern dominated by low to moderate Clavien–Dindo grades. When compared with recent studies from Pakistan, Bangladesh, Indonesia, Burundi, and other settings, the present results are within the expected range for TURP-related complications. The major recurring complications across studies include transient hematuria, urinary tract infection, failed trial of voiding, urethral stricture, bladder neck contracture, residual adenoma requiring re-intervention, and urinary incontinence. The low frequency of Grade IV and Grade V events in the present study further supports the safety profile of M-TURP, provided patients are properly selected, optimized preoperatively, monitored intraoperatively, and followed adequately after surgery.

CONCLUSION

The present study assessed the complications of monopolar transurethral resection of the prostate using the Clavien–Dindo complication grading system. The study population consisted predominantly of elderly men, with a mean age of 64 years, reflecting the expected age distribution of clinically significant benign prostatic hyperplasia. Nearly half of the patients had associated comorbidities, with hypertension and diabetes mellitus being the most common. This emphasizes the importance of careful preoperative assessment and optimization before surgical intervention. Botherome lower urinary tract symptoms were the most common indication for surgery, followed by recurrent acute urinary retention and failed medical treatment. The mean prostate volume was 52.3 cc, and the mean operative duration was 62.5 minutes. The postoperative course was generally short, with a mean hospital stay of 2.2 days, indicating that monopolar TURP was associated with acceptable perioperative recovery in most patients. Intraoperative complications occurred in 9.4% of patients. Capsular perforation was the most common intraoperative complication, followed by significant bleeding, urethral injury, bladder neck undermining and transient cardiac arrest. Postoperative recovery

was favourable, with improvement in voiding lower urinary tract symptoms in 95.0% of patients during the first postoperative week and overall lower urinary tract symptom improvement in 85.6% of patients at six months.

The overall complication rate was 31.1%. Most complications belonged to Clavien–Dindo Grade I, Grade II and Grade III categories, indicating that the majority were either minor, medically manageable or treatable with minimally invasive intervention. Severe complications were uncommon, with Grade IV and Grade V events each occurring in 0.6% of patients. Late complications such as urethral stricture, bladder neck contracture, persistent urge urinary incontinence and recurrent voiding symptoms due to residual adenoma were observed in a small proportion of patients.

The findings of the present study suggest that monopolar transurethral resection of the prostate remains an effective and relatively safe surgical procedure for benign prostatic hyperplasia when performed with appropriate patient selection, perioperative monitoring and follow-up. Although complications are not uncommon, most are of low to moderate severity according to the Clavien–Dindo classification. The use of a standardized complication grading system provides a clear and objective method for reporting outcomes and can help improve surgical audit, patient counseling and quality of care.

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