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RESULTS OF URODYNAMIC ASSESSMENT FOR DETRUSOR UNDERACTIVITY IN INDIVIDUALS UNDERGOING TRANSURETHRAL RESECTION OF THE PROSTATE (TURP)

Original Research

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ABSTRACT

Background: Benign prostatic enlargement (BPE) is a prevalent cause of bladder outlet obstruction (BOO) in aging males, often presenting with lower urinary tract symptoms (LUTS). Transurethral resection of the prostate (TURP) remains the gold standard for managing BOO. However, in patients with detrusor underactivity (DU), a condition characterized by impaired bladder muscle contractility, surgical outcomes are less predictable. Limited data exist regarding TURP efficacy in patients with concurrent BPE and DU, necessitating further investigation into its clinical utility.

Objective: To evaluate the effectiveness of TURP in men diagnosed with DU and BPE by comparing preoperative and postoperative urodynamic parameters and quality-of-life outcomes.

Methods: This prospective observational study was conducted at the Institute of Kidney Diseases, Peshawar, from June 2024 to December 2024. Sixty male patients with LUTS due to BPE and confirmed DU (bladder contractility index [BCI] <100) were enrolled following ethical approval. All patients underwent clinical evaluation, ultrasonography, and urodynamic testing including detrusor pressure at maximum flow (pdetQmax), maximum flow rate (Qmax), post-void residual volume (PVR), and BCI. TURP was performed under spinal anesthesia, and follow-up assessments were conducted at 3 months postoperatively. Data were analyzed using SPSS version 23, with statistical significance set at $P \leq 0.05$.

Results: The mean age of participants was 61.4 ± 9.6 years. Preoperative values included pdetQmax of 27.2 ± 6.0 cm H_2O, Qmax of 11.9 ± 3.8 ml/s, BCI of 86.8 ± 22.9, and PVR of 210.8 ± 63.5 ml. Postoperatively, pdetQmax rose to 30.6 ± 6.8 cm H_2O (p=0.08), Qmax increased to 16.0 ± 4.5 ml/s (p=0.002), BCI improved to 110.8 ± 26.8 (p=0.2), and PVR decreased to 102.6 ± 44.0 ml (p=0.01). Clean intermittent catheterization was required in 23.3% (n=14) of patients due to persistent elevated PVR.

Conclusion: TURP is a viable treatment option in patients with DU and coexisting BOO. Although improvement in bladder contractility is not guaranteed, significant symptomatic relief and better voiding parameters can still be achieved with careful patient selection.

Keywords: Bladder Outlet Obstruction, Detrusor Underactivity, Lower Urinary Tract Symptoms, Post-Void Residual Urine, Prostatic Hyperplasia, Transurethral Resection of Prostate, Urodynamics.

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INTRODUCTION

Urinary retention in men is frequently attributed to bladder outlet obstruction, commonly resulting from benign prostatic hyperplasia (BPH). When pharmacological interventions fail to alleviate symptoms, surgical options such as transurethral resection of the prostate (TURP) are often recommended (1). TURP remains a standard and widely performed surgical treatment aimed at relieving obstructive urinary symptoms associated with prostate enlargement. However, a significant subset of patients present with lower urinary tract symptoms (LUTS) not solely due to obstruction but also due to impaired bladder contractility. This condition, known as detrusor underactivity (DU) or underactive bladder (UAB), is characterized by diminished strength and duration of bladder contractions, which leads to incomplete bladder emptying and associated symptoms (2). According to the International Continence Society, UAB manifests as a slow urinary stream, hesitancy, straining to void, the sensation of incomplete emptying, and occasionally urinary leakage, among other storage-related symptoms (3). In clinical practice, the differentiation between obstruction and poor bladder contractility is often challenging, and the presence of DU in men undergoing TURP introduces complexity in predicting surgical outcomes. While TURP effectively improves voiding symptoms in patients with BPH, its efficacy in men with coexisting DU remains uncertain and subject to ongoing debate (4). Studies suggest that DU is more prevalent in elderly men and those with chronic urinary retention, and is associated with less favorable postoperative outcomes, including persistent voiding difficulties and higher rates of catheter dependence (5). Evidence from a prospective study involving 60 men aged 44 to 90 years with DU revealed that 81% were able to void spontaneously within a year following TURP, while 19% continued to experience urinary retention (6). Similarly, a retrospective review of 174 men undergoing TURP for BPH with concomitant DU demonstrated that 13% remained catheter-dependent postoperatively, despite 87% showing improved urinary function (7). These findings underscore the need for improved patient selection and preoperative assessment to better anticipate outcomes in men with dual pathology.

Despite the frequency of TURP procedures, there remains a paucity of prospective and high-quality evidence specifically evaluating its outcomes in patients with both BPH and DU. The existing literature is largely retrospective, with limited data on how preoperative bladder function influences postoperative recovery (8). As such, there is a critical need to clarify whether DU, as identified before surgery, can serve as a predictor of functional outcomes following TURP in this patient population (9). The objective of this study is to evaluate whether the presence of detrusor underactivity alongside benign prostatic hyperplasia can reliably predict urinary outcomes after transurethral resection of the prostate. This investigation aims to support evidence-based surgical decision-making and provide clearer guidance to urologists managing patients with complex lower urinary tract dysfunction.

METHODS

This prospective observational study was conducted at the Department of Urology, Institute of Kidney Diseases, Peshawar, between June 2024 to December 2024, following approval from the Institutional Review Board. Informed written consent was obtained from all participants prior to inclusion, ensuring compliance with ethical standards in human research. The objective was to assess urinary outcomes following transurethral resection of the prostate (TURP) in male patients diagnosed with benign prostatic obstruction (BPO) and concomitant detrusor underactivity (DU). A total of 60 male patients were recruited using consecutive non-probability sampling. Inclusion criteria comprised patients presenting with lower urinary tract symptoms (LUTS) due to benign prostate enlargement and confirmed detrusor underactivity on urodynamic evaluation. Exclusion criteria were the presence of congenital or acquired neurological disorders, neurogenic bladder, spinal or pelvic trauma, previous pelvic or spinal surgery, advanced diabetic complications, urethral pathology or prior urethral surgery, and prostate cancer.

Baseline clinical evaluation included a detailed history focused on LUTS, digital rectal examination for prostate assessment, and investigations such as ultrasonography to determine prostate volume and post-void residual volume (PVRV). Renal function tests were also performed. Symptoms were categorized into obstructive symptoms—such as hesitancy, weak stream, straining, and incomplete emptying—and storage symptoms like urgency, frequency, urgency incontinence, and nocturia. Uroflowmetry and urodynamic studies were conducted to evaluate bladder performance. Key parameters recorded were detrusor pressure at maximum flow (pdetQmax), maximum urine flow rate (Qmax), and bladder contractility index (BCI), which was calculated using the formula: BCI = pdetQmax + 5

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× Qmax. A BCI value below 100 indicated detrusor underactivity, while values of 100 or above suggested normal contractility (7). All subjects underwent TURP under spinal anesthesia using a standardized technique. The procedure commenced with diagnostic cystourethroscopy, followed by systematic resection of the prostate tissue. Resection was performed beginning at the 1 o'clock position on the left lateral lobe and extended to the 4 o'clock position along the capsular plane. The apical mucosa was incised using monopolar current, with tissue mobilized toward the bladder to facilitate detachment. A strip at the 12 o'clock position was preserved to minimize postoperative incontinence. The right lobe was resected from the 11 o'clock to the 8 o'clock position, and the median lobe and adjacent tissue were resected until the bladder neck fibers were clearly visualized. Adequate hemostasis was achieved throughout the procedure. Tissue chips were removed, a Foley catheter was inserted, and continuous bladder irrigation was initiated using normal saline (10).

Postoperative follow-up was carried out at three months. This included repeat ultrasonography for PVRV assessment and repeat uroflowmetry and urodynamic testing to evaluate Qmax, pdetQmax, and BCI. Additionally, symptom severity and quality of life were reassessed using the International Prostate Symptom Score (IPSS), specifically its quality of life (QoL) domain. Patients completed the IPSS QoL component independently, providing a subjective assessment of treatment impact (11). All patients were preoperatively counseled regarding possible outcomes of TURP, including the risk of persistent voiding difficulties and the potential need for clean intermittent catheterization (CIC) postoperatively. Data were analyzed using SPSS version 23. Continuous variables, such as age, prostate size, Qmax, pdetQmax, PVRV, BCI, and QoL scores, were expressed as means ± standard deviation (SD). Pre- and post-intervention parameters were compared using paired statistical tests, and Chi-square or Fisher's exact tests were applied where appropriate. A p-value of ≤ 0.05 was considered statistically significant, and data were presented in tables and graphs for clarity.

RESULTS

The study included 60 male participants with a mean age of 61.4 ± 9.6 years, ranging from 48 to 87 years. One of the most frequent indications for undergoing transurethral resection of the prostate (TURP) was recurrent episodes of acute urinary retention and repeated failed attempts to void spontaneously. The average prostate weight recorded preoperatively was 63.4 ± 17.1 grams, with a range of 30 to 100 grams. Baseline symptom burden was considerable, with a preoperative mean Quality of Life (QoL) score of 5.2 ± 0.9 based on the International Prostate Symptom Score (IPSS) questionnaire. Preoperative urodynamic assessments revealed a mean detrusor pressure at maximum flow (pdetQmax) of 27.2 ± 6.0 cm H_2O (range: 16.2 to 40.3 cm H_2O), and a mean maximum flow rate (Qmax) of 11.9 ± 3.8 ml/s (range: 6.6 to 20.2 ml/s). The mean post-void residual volume (PVRV) was 210.8 ± 63.5 ml (range: 100 to 365 ml). The calculated bladder contractility index (BCI) had a preoperative mean of 86.8 ± 22.9, ranging from 54.8 to 140.8, consistent with a diagnosis of detrusor underactivity in the study population.

At three months following TURP, notable improvements were observed across several objective and subjective parameters. The QoL score significantly improved to a mean of 2.8 ± 1.2, indicating a substantial reduction in symptom-related discomfort. Postoperative detrusor pressure at maximum flow increased slightly to 30.6 ± 6.8 cm H_2O (range: 18.0 to 47.8 cm H_2O). The mean Qmax increased to 16.0 ± 4.5 ml/s (range: 8.1 to 24.9 ml/s), while the mean PVRV decreased markedly to 102.6 ± 44.0 ml (range: 23 to 250 ml), reflecting improved bladder emptying. The mean BCI improved to 110.8 ± 26.8 (range: 69.0 to 169.0), indicating an enhancement in overall bladder contractility postoperatively. Despite improvements, 23.3% of patients (n = 14) continued to require clean intermittent catheterization (CIC) due to significant post-void residual urine, highlighting that a subset of patients with detrusor underactivity may still face voiding difficulties even after surgical decompression. To further elucidate the predictive value of detrusor underactivity (DU) severity on transurethral resection of the prostate (TURP) outcomes, patients were stratified based on their preoperative bladder contractility index (BCI). Those with a BCI less than 70 were categorized as having severe DU, while those with BCI values between 70 and 99 were grouped under mild-to-moderate DU. Out of the total 60 subjects, 14 (23.3%) were identified with severe DU and 46 (76.7%) with mild-to-moderate DU. Postoperative improvements in maximum flow rate (Qmax) were observed in both subgroups. In the severe DU group, mean Qmax increased by 4.35 ml/s, while in the mild-to-moderate group, the increase was 3.72 ml/s. Notably, the mean postoperative BCI improvement was substantially greater in the severe DU group (increase of 48.56) compared to the mild-to-moderate group (increase of 21.46), suggesting that even patients with severely compromised detrusor function may experience functional gains after TURP. These stratified findings provide a nuanced understanding of outcome variability and offer potential utility in preoperative patient counseling and surgical planning.

INSIGHTS-JHR
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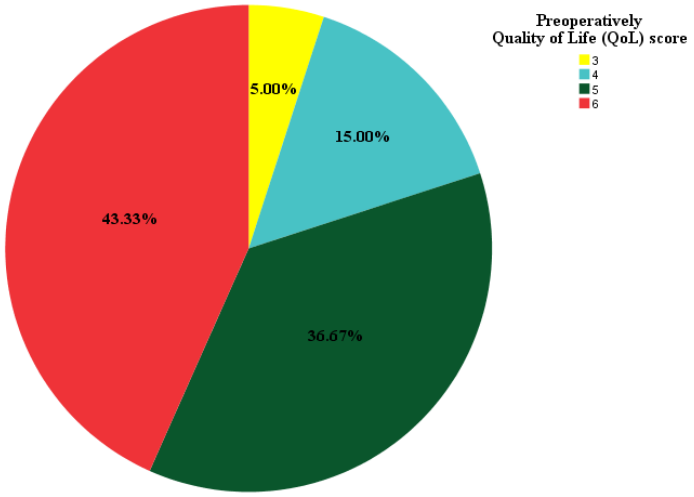
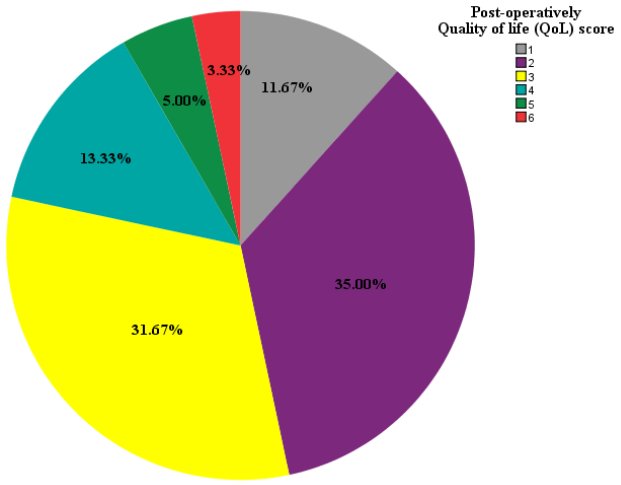
Table 1: Comparison of different parameters before and after transurethral resection of the prostate (TURP) in men with diagnosis of detrusor underactivity (DU)

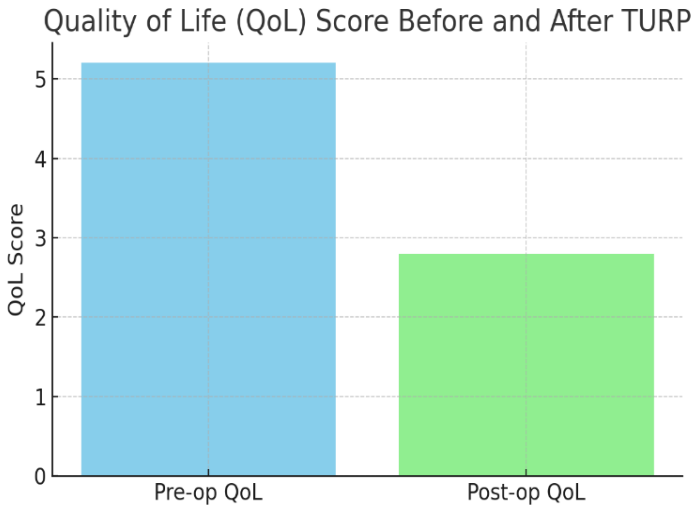
Parameters	Pre-operative (Mean, SD)	Post-operative (Mean, SD)	Difference (Mean, SD)	p-value
Detrusor pressure at maximum flow ($PdetQ_{max}$) (cm of H_2O)	27.2 ± 6.0	30.6 ± 6.8	3.4 ± 1.8	0.08
Bladder contractility index (BCI)	86.8 ±22.9	110.8 ±26.8	23.9 ±8.2	0.2
Maximum flow rate (Q_{max}) (ml/s)	11.9 ± 3.8	16.0 ± 4.5	4.1 ± 1.6	*0.002*
Postvoid residual volume (PVRV) (ml)	210.8 ± 63.5	102.6 ± 44.0	108.2 ± 36.4	*0.01*

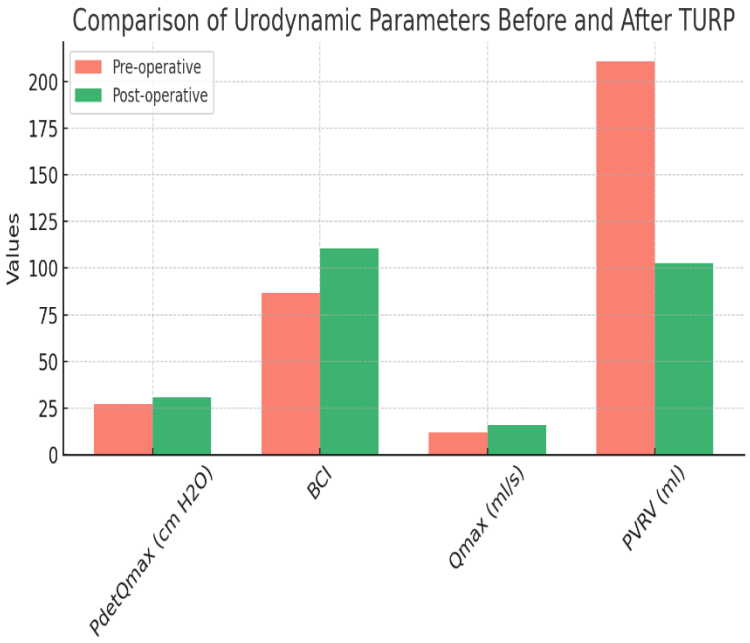
Table 2: Stratified TURP Outcomes Based on DU Severity

	Severe DU	Mild-Moderate DU
Pre_ BCI_ mean	91.7	56.9
Pre_ BCI_ std	15.2	6.3
Post_ BCI_ mean	113.2	105.5
Post_ BCI_ std	22.9	23.8
Pre_ Qmax_ mean	12.6	10.9
Pre_ Qmax_ std	3.8	3
Post_ Qmax_ mean	16.4	15.3
Post_ Qmax_ std	4.2	3.9









DISCUSSION

The primary goal of transurethral resection of the prostate (TURP) in the context of bladder outlet obstruction (BOO) is to alleviate lower urinary tract symptoms (LUTS) resulting from benign prostatic obstruction (BPO). However, the presence of detrusor underactivity (DU) presents a clinical dilemma, as this condition, characterized by impaired bladder contractility, can obscure or coexist with BOO, thereby complicating diagnosis and treatment (12). DU is not uncommon among men investigated for LUTS, with reported prevalence reaching up to 48% in certain urodynamic assessments (6,13). Despite its frequent occurrence, the role of surgical intervention in this subgroup remains controversial due to limited and often conflicting data. The findings of this study add meaningful insight into this area of debate. While TURP resulted in significant improvements in parameters such as maximum flow rate (Qmax) and post-void residual volume (PVRV), the change in bladder contractility index (BCI) was variable, especially when stratified by DU severity (14). Patients with severe DU (preoperative BCI < 70) demonstrated a greater absolute increase in BCI postoperatively compared to those with mild-to-moderate DU, indicating that even markedly impaired detrusor function may exhibit some reversibility or compensatory improvement after obstruction relief (15). Nonetheless, a considerable portion of these patients, 23.3%, continued to

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

require clean intermittent catheterization (CIC), emphasizing that TURP alone may not fully restore functional voiding in all individuals with DU.

The observed improvements in Qmax and reduction in PVRV are in alignment with prior reports suggesting that surgical removal of obstruction can alleviate voiding symptoms despite ongoing detrusor weakness (16). One study noted a reduction in residual volume from 175 ml to 37.5 ml, which is comparable to the decrease from 210.8 ml to 102.6 ml observed in the present analysis (17). These changes are clinically meaningful, as they correlate with the relief of the sensation of incomplete emptying and contribute to enhanced patient satisfaction. Quality of life (QoL) also improved significantly in most patients following TURP, further confirming the potential benefit of surgical intervention even in the setting of DU (18). However, persistent voiding dysfunction in a subset of patients reinforces the need for cautious selection and preoperative counseling. The pathophysiological underpinnings of DU in the setting of chronic BOO are complex (19). Long-standing obstruction may lead to detrusor decompensation due to ischemia, inflammation, remodeling of the extracellular matrix, and impaired afferent signaling, including altered expression of muscarinic and purinergic receptors (12–14). These mechanisms may reduce the capacity for functional recovery postoperatively, especially in advanced stages. Consequently, while TURP effectively removes the anatomical obstruction, it does not directly address the contractile deficit of the bladder, which may persist in cases of irreversible detrusor damage (20).

A strength of this study lies in its prospective design and the objective evaluation of urodynamic parameters pre- and post-operatively. The inclusion of BCI as a stratification tool enhances the clinical relevance of findings, offering practical value for predicting postoperative outcomes. However, the study also has limitations. The sample size, although adequate for primary analysis, limits the statistical power for subgroup comparisons. Follow-up was limited to three months, which may not fully capture long-term bladder function recovery. Furthermore, the lack of invasive re-evaluation beyond the early postoperative period prevents a definitive conclusion on the permanence of urodynamic improvements. Future research should explore the long-term trajectories of bladder function in patients with DU following TURP, including assessment of factors predicting sustained catheter independence. Larger multicentric trials are warranted to validate the predictive utility of BCI stratification and to evaluate the role of adjunctive therapies—pharmacologic or rehabilitative—for enhancing outcomes in patients with detrusor underactivity. In summary, TURP can significantly improve voiding parameters and quality of life in men with DU and BPO, even among those with severely impaired detrusor function. However, the persistence of CIC dependence in a subset of patients indicates the need for individualized treatment planning, careful preoperative evaluation, and consideration of bladder contractility as an important determinant of surgical success.

CONCLUSION

This study concludes that detrusor underactivity should not be viewed as an absolute barrier to performing transurethral resection of the prostate in men with coexisting bladder outlet obstruction. TURP can offer meaningful symptomatic relief and functional improvement even in patients with compromised detrusor contractility, provided that the obstruction is clearly defined. While the removal of obstruction does not guarantee full restoration of bladder muscle strength, the varying degrees of postoperative recovery observed underscore the importance of thoughtful patient selection. These findings highlight the clinical value of preoperative urodynamic assessment and support a tailored, evidence-based approach when considering surgical intervention for individuals with overlapping features of BPO and DU.

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Author Contributions

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Muhammad Idrees Khan	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Ahmad Nawaz*	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Sulaiman Shah	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Muzzamil Sohail	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Zulfiqar Saeed	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Himayat Ullah	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

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