



Research Article

Identification Of Phenotypes in Patients of Chronic Urinary Retention Undergoing Endoscopic Prostate Surgery for Bladder Outlet Obstruction, And Follow-Up At 6 Months After Surgery

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ABSTRACT

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Background: Detrusor underactivity is an important cause of chronic urinary retention with unpredictable outcomes following outlet surgery.

Objective: To identify clinical and urodynamic predictors determining postoperative recovery in patients with detrusor underactivity undergoing endoscopic prostate surgery due to enlarged prostate causing bladder outlet obstruction.

Methods: Thirty-six patients with chronic urinary retention and urodynamically confirmed detrusor underactivity underwent endoscopic bladder outlet obstruction surgery. Preoperative parameters including IPSS, Qmax, post-void residual urine (PVR), Pdet at Qmax, bladder contractility index (BCI), bladder capacity, bladder sensation, diabetes duration, and hesitancy time were evaluated. Patients were categorized into phenotypes of no success, relative success, and absolute success groups at six-month follow-up.

Results: Higher IPSS, elevated PVR, reduced Pdet at Qmax, and low BCI were significantly associated with unsuccessful outcomes. Patients demonstrating near-physiological bladder capacity, preserved first desire to void, moderate residual urine volumes, and shorter diabetes duration achieved catheter-free recovery. Prolonged hesitancy time predicted poor postoperative recovery. Age and Qmax showed no significant association with outcome.

Conclusion: Residual detrusor contractility and preserved bladder sensation are the most reliable predictors of successful postoperative voiding in detrusor underactivity. Comprehensive urodynamic assessment allows effective patient stratification, improves surgical decision-making, and helps in better patient counselling.

Keywords: *Detrusor underactivity, Chronic urinary retention, Urodynamics, Bladder contractility index, Surgical outcome.*

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INTRODUCTION

Chronic urinary retention (CUR) represents a complex clinical condition characterized by persistent inability to achieve complete bladder emptying, frequently associated with elevated post-void residual urine and progressive deterioration of bladder function. Among affected patients, detrusor underactivity (DU) has emerged as an increasingly recognized contributor to voiding dysfunction, particularly in elderly males presenting with lower urinary tract symptoms (LUTS) and suspected bladder outlet obstruction^{1,2}.

Detrusor underactivity is defined uro-dynamically as reduced strength and/or duration of bladder contraction resulting in prolonged bladder emptying or incomplete voiding within a normal time span¹. The pathophysiology of DU is multifactorial and involves myogenic failure, neurogenic impairment, ischemic injury, and chronic bladder overdistension leading to structural remodelling of the detrusor muscle^{4,5}. Long-standing outlet obstruction may initially induce compensatory hypertrophy followed by progressive decompensation and loss of contractile efficiency, ultimately resulting in chronic retention⁶.

Although surgical relief of bladder outlet obstruction remains the standard treatment for patients with presumed obstructive voiding dysfunction, outcomes in patients with concomitant DU remain highly variable. Several studies have

demonstrated that a significant proportion of patients continue to require catheterization despite adequate surgical decompression, suggesting that impaired detrusor contractility rather than obstruction alone determines functional recovery^{2,12}. Therefore, accurate preoperative identification of patients likely to benefit from surgery has become a major clinical challenge.

Urodynamic pressure–flow studies remain the gold standard for evaluation of voiding dysfunction and allow objective assessment of detrusor contractility through parameters such as detrusor pressure at maximum flow (Pdet at Qmax) and Bladder Contractility Index (BCI)³⁻⁷. Reduced contractility indices have been shown to correlate with poor postoperative voiding outcomes and persistent urinary retention following outlet surgery^{2,4}.

Chronic bladder overdistension associated with elevated post-void residual urine further contributes to irreversible detrusor damage through smooth muscle degeneration, collagen deposition, and impaired neuromuscular transmission^{5,6}. In addition, alterations in bladder sensation, reflected by delayed first desire to void, indicate afferent pathway dysfunction and have been associated with reduced recovery potential following surgical intervention⁸.

Systemic comorbidities, particularly diabetes mellitus, play an important role in the development of detrusor dysfunction. Diabetic cystopathy results from autonomic neuropathy affecting both sensory and motor innervation of the bladder, leading to decreased bladder sensation, impaired contractility, and chronic urinary retention^{8,9}. The duration of diabetes has been shown to correlate closely with severity of bladder dysfunction and postoperative recovery potential.

Importantly, recent evidence suggests that chronological age alone is a poor predictor of postoperative outcome, whereas physiological bladder characteristics such as preserved contractile reserve and sensory function are more reliable determinants of successful voiding restoration^{10,11}. Consequently, modern management strategies increasingly emphasize individualized patient selection based on comprehensive urodynamic assessment rather than symptom severity alone.

In view of these considerations, the present study aims to evaluate clinical and urodynamic predictors influencing postoperative recovery in patients with chronic detrusor underactivity undergoing outlet surgery and to stratify factors associated with unsuccessful, relatively successful, and absolute successful postoperative outcomes.

AIM

Identification of phenotypes in patients of chronic urinary retention with enlarged prostate causing bladder outlet obstruction undergoing endoscopic prostate surgery, and follow-up at the end of 6 months after surgery.

Objectives

- Is the damage potentially reversible?
- Will relieving the bladder outlet obstruction, help the patient
- Factors predicting the outcome of the surgery
- For better counselling of the patients based on the results of the study regarding the post operative outcome

MATERIALS AND METHODS

A prospective observational study was performed on the patients with prostatomegaly and detrusor underactivity diagnosed on urodynamic study undergoing MONOPOLAR

TURP/BIPOLARTURP/HOLEP/THULEP/THUFLEP. The study was conducted at Rubyhall Clinic pune. Patients were followed for 6 months post operative period. Sample size was 36. It involved pre operative urodynamic parameters and clinical parameters., including age in years, history of diabetes, IPSS- Internation Prostate Symptom Score, Qmax, PVR (Post Void Residual Urine) (Pre op) (ML), Pdet at Qmax, BCI (Bladder contractility Index), bladder capacity, bladder volume at first desire to void, hesitancy time in the voiding phase. Post operatively, the patients were again followed up at 6 months post-operative period. They were assessed on the basis of PVR, Qmax, and IPSS Score, and results documented.

RESULTS

- 12 out of 36 patients could not pass urine after 6 months follow-up. They were kept on either SPC(suprapubic catheter), or on Foley’s catheter
- 11 out of the 24 who passed urine at the end of 6 month follow-up needed foley’s catheterization ranging from 3 weeks to 3 months. Final post operative measure in the form of Q max, PVR, and IPSS were analysed at the end of 6 months.
- 13 patients passed urine in the post operative period immediately. However, final post operative measured in the form of Q max, PVR, and IPSS were analysed at the end of 6 months.
- Below is the tabular form of comparative study at the end of 6 months post operative follow up.

Table 1: Comparison of Clinical and Urodynamic Parameters Among Outcome Groups at 6-Month Follow-Up

| Factor | No | Successful | Relative | Absolute Success | p-value |
|--------|----|------------|----------|------------------|---------|
|--------|----|------------|----------|------------------|---------|

| | Result (N=12) | Successful Result (N=11) | (N=13) | (ANOVA) |
|-------------------------------|---|--|---|-------------------|
| IPSS | 26.50 ± 5.13[95% CI: 23.24 to 29.76] | 22.55 ± 4.11[95% CI: 19.79 to 25.31] | 19.15 ± 5.13[95% CI: 16.05 to 22.25] | 0.0026 * |
| Qmax | 4.83 ± 1.34[95% CI: 3.98 to 5.68] | 6.27 ± 2.10[95% CI: 4.86 to 7.68] | 6.15 ± 2.38[95% CI: 4.72 to 7.59] | 0.1644 |
| PVR (Pre op) (ML) | 437.75 ± 112.29[95% CI: 366.40 to 509.10] | 247.73 ± 58.80[95% CI: 208.22 to 287.23] | 206.85 ± 130.79[95% CI: 127.81 to 285.88] | < 0.0001 * |
| Pdet at Qmax | 16.83 ± 3.35[95% CI: 14.70 to 18.96] | 24.36 ± 8.31[95% CI: 18.78 to 29.95] | 23.85 ± 7.53[95% CI: 19.30 to 28.39] | 0.0165 * |
| BCI | 30.58 ± 5.02[95% CI: 27.40 to 33.77] | 47.64 ± 14.32[95% CI: 38.02 to 57.26] | 51.38 ± 15.28[95% CI: 42.15 to 60.62] | 0.0005 * |
| BLADDER CAPACITY (ML) | 555.08 ± 113.36[95% CI: 483.06 to 627.11] | 369.55 ± 62.21[95% CI: 327.75 to 411.34] | 387.46 ± 38.12[95% CI: 364.43 to 410.50] | < 0.0001 * |
| 1ST DESIRE TO VOID (ML) | 220.58 ± 55.42[95% CI: 185.37 to 255.79] | 136.82 ± 24.24[95% CI: 120.53 to 153.11] | 142.69 ± 18.51[95% CI: 131.51 to 153.88] | < 0.0001 * |
| DIABETES HISTORY | >10 YRS | 2 PATIENTS NO DIABETES; MEAN 7.38 YRS | 3 PATIENT NO DIABETES. MEAN YRS-5.63 | N/A (Categorical) |
| AGE (YEARS) | 69.25 ± 8.09[95% CI: 64.11 to 74.39] | 71.73 ± 7.10[95% CI: 66.96 to 76.50] | 66.23 ± 6.57[95% CI: 62.26 to 70.20] | 0.1942 |
| HESITANCY TIME IN VOIDING (S) | 159.17 ± 18.43[95% CI: 147.45 to 170.88] | 88.09 ± 25.01[95% CI: 71.29 to 104.89] | 69.38 ± 23.30[95% CI: 55.30 to 83.47] | < 0.0001 * |

Comparing the tabular form here, we can conclude the following points

Highly Significant Predictors: PVR (Pre op), Bladder Capacity, 1st Desire to Void, and Hesitancy Time are strongly correlated with surgical success ($p < 0.0001$). IPSS, Pdet at Qmax, and BCI are also statistically significant variables.

Non-Significant Predictors: Qmax ($p = 0.164$) and Age ($p = 0.194$) did not demonstrate a statistically significant difference among the three outcome groups, which supports your observation in the document text that "Age did not contribute to the prediction of outcome after surgery."

The patients with higher IPSS score were more prone to have unsuccessful result after surgery with a mean value of 26.5. The lower the IPS score the more were the chances of successful surgery at the end of six months

Higher PVR preoperative diagnosed on urodynamics study were more prone to be unsuccessful for surgery, whereas progressively lower PVR (Mean 206.8 ml) depicted successful surgery at the end of six months post operative follow up.

Coming to the Pdet at Q Max, all the patients were patients with chronic detrusor under activity. So the Pdet at Qmax was less than 40. However, in the patients with Pdet at Q max mean value of 16.83, were more prone to have

unsuccessful after surgery outcome at the end of six months when compared with a mean value of 23.84, which showed absolute success after surgery at the end of six months.

Lower BCI (Mean 30.5) predicted no successful result of surgery

Near physiological bladder capacity (Mean 387.46 mL), predicted catheter free in immediate post operative period

In UDS (urodynamic study) , near physiological sensation of first sensation of desire to void (Mean 130.8 mL) predicted immediate recovery, whereas delayed sensation (Mean 220 mL) predicted failure of recovery even after 6 months interval

Diabetes history of more than 10 years predicted failure of bladder recovery, diabetic history between 6-10 years predicted relatively successful recovery at the end of 6 months post operative period, and diabetic history of <6 years predicted immediate post operative bladder recovery

Age did not contribute to the prediction of outcome after surgery

Delayed hesitancy period in flow phase of pre operative UDS (Mean 159.15 seconds) predicted unsuccessful result of surgery in post operative follow-up period, whereas hesitancy with a mean of 69.38 seconds favored immediate post operative recovery

DISCUSSION

The present study evaluated predictors of postoperative recovery in patients with chronic detrusor underactivity undergoing surgery, stratified into no success, relative success, and absolute success groups at 6 months follow-up.

The findings demonstrate that preoperative urodynamic and clinical parameters significantly influence catheter-free recovery.

Higher preoperative IPSS (mean 26.5) was associated with poor postoperative outcome. Severe symptom burden reflects longstanding voiding dysfunction and possible irreversible detrusor decompensation. Previous studies have demonstrated that severe LUTS correlates with impaired contractility and poorer surgical outcomes in DU patients^{1,2}.

Similarly, lower baseline Qmax (4.83 mL/s) predicted failure, while relatively higher Qmax values were associated with recovery. Although this factor did not contribute significantly in our study. Abrams and Griffiths established the importance of pressure-flow parameters in differentiating obstruction from poor contractility³. In patients with DU, a very low Qmax often reflects advanced detrusor failure rather than reversible obstruction⁴.

Preoperative PVR was markedly higher in the unsuccessful group (mean 437.75 mL), whereas progressively lower PVR predicted better outcomes. Large residual volumes indicate chronic retention with myogenic failure and structural bladder remodeling. Experimental and clinical evidence shows prolonged overdistension results in detrusor fibrosis and impaired contractile recovery^{5,6}.

All patients had Pdet at Qmax <40 cm H₂O, confirming detrusor underactivity. However, patients with relatively higher Pdet (mean 23.84) had better outcomes compared to those with very low Pdet (16.83). This suggests that preserved residual contractile strength predicts reversibility. The Bladder Contractility Index (BCI) further reinforced this observation, where a low BCI (mean 30.5) predicted surgical failure. Schäfer and subsequent ICS reports have highlighted BCI as a reliable quantitative measure of detrusor strength^{3,7}.

Bladder capacity and sensation parameters were also predictive. Near-physiological bladder capacity (~387 mL) and earlier first desire to void (~130 mL) correlated with catheter-free recovery. Delayed sensation (220 mL) likely reflects sensory neuropathy or chronic overdistension. Sensory dysfunction has been shown to correlate with diabetic cystopathy and impaired recovery⁸.

Diabetes duration emerged as a strong predictor. Patients with >10 years of diabetes showed failure of recovery, whereas <6 years predicted early catheter-free voiding. Diabetic autonomic neuropathy affects both afferent and efferent bladder pathways, leading to detrusor underactivity and poor surgical outcomes^{8,9}.

Interestingly, age did not significantly influence outcome. This aligns with contemporary literature suggesting that physiological bladder health and contractility are more predictive than chronological age¹⁰.

Preoperative hesitancy time was markedly prolonged in the unsuccessful group (159 seconds), suggesting severely impaired detrusor activation. Prolonged latency may indicate reduced neural initiation or advanced myogenic failure, both associated with poor reversibility¹¹.

Overall, the study reinforces that surgical relief of obstruction in patients with chronic detrusor underactivity yields optimal outcomes when residual contractility, preserved sensation, moderate PVR, and lower diabetic burden are present. Extremely low Pdet, low BCI, large bladder capacity with delayed sensation, and long-standing diabetes predict

persistent catheter dependence. These findings are consistent with contemporary evidence that emphasizes careful urodynamic phenotyping before offering outlet surgery in DU patients¹².

CONCLUSION

This study clearly demonstrates that postoperative recovery in patients with chronic detrusor underactivity is strongly influenced by preoperative urodynamic parameters, bladder sensory function, contractility indices, and systemic comorbidities. Surgical outcome is not uniform across all patients and can be stratified based on objective preoperative predictors.

Relief of outlet obstruction alone does not guarantee catheter-free recovery. Instead, the degree of preserved detrusor contractility, bladder sensation, residual urine volume, and metabolic status determines postoperative success. Based on the comparative analysis of mean values across the three outcome groups, patients can be clinically stratified into predictors of no success, relative success, and absolute success.

The study confirms that residual detrusor contractility (BCI and Pdet at Qmax), preoperative PVR, bladder sensory parameters, and duration of diabetes are the most significant predictors of surgical outcome, whereas age alone and low Qmax are not predictive.

Patients with severely depressed contractility (BCI ~30), high PVR (>400 mL), delayed bladder sensation, large bladder capacity, prolonged hesitancy, and long-standing diabetes are unlikely to benefit from outlet surgery. Conversely, patients with preserved contractility (BCI >50), moderate PVR (~200 mL), near-normal sensation, and limited diabetic duration demonstrate the highest likelihood of absolute postoperative success.

Therefore, comprehensive preoperative urodynamic evaluation is essential for appropriate patient selection, prognostication, and counseling prior to surgical intervention in chronic detrusor underactivity.

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