

Original Research Article

Preoperative clinical and urodynamic factors influencing the short-term outcome of transurethral resection of the prostate for benign prostatic hyperplasia: a prospective observational study

Apoorva Saxena*, Sudipta Saha, Om Prakash Pathania, Nain Singh

Department of General Surgery, Lady Hardinge Medical College and Associated Hospitals, New Delhi, India

Received: 23 August 2026

Accepted: 05 October 2026

*Correspondence:

Dr. Apoorva Saxena,

E-mail: apoorv1111@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background. Although transurethral resection of the prostate remains the surgical mainstay for benign prostatic hyperplasia, a substantial minority of patients report an unsatisfactory result. This prospective observational study evaluated which preoperative clinical and urodynamic parameters influenced the short-term outcome of the procedure.

Methods. Thirty-five men with lower urinary tract symptoms due to benign prostatic hyperplasia, an International Prostate Symptom Score above 13, a maximum urinary flow rate below 15 mL/s and at least one absolute indication for surgery underwent monopolar transurethral resection of the prostate at a tertiary-care teaching hospital. Preoperative prostate volume, post-void residual urine, serum prostate-specific antigen, duration of catheterisation, uroflowmetry and multichannel urodynamics were recorded. The outcome at one month was graded by the International Prostate Symptom Score, the quality-of-life score and the maximum urinary flow rate, and was classified as effective or non-effective.

Results. The outcome was effective in 27 patients (77.1%) and non-effective in 8 (22.9%). A smaller prostate (43.3 ± 8.4 versus 54.6 ± 11.0 ml), catheterisation exceeding six weeks, a lower maximum detrusor pressure (30.0 ± 19.2 versus 60.4 ± 46.1 cm H₂O) and a lower bladder compliance (13.5 ± 12.0 versus 37.7 ± 29.7 ml/cm H₂O) were significantly associated with a non-effective outcome. Age, serum prostate-specific antigen, the presence of refractory retention and post-void residual urine showed no significant association.

Conclusions. A small prostate, prolonged preoperative catheterisation, a low detrusor pressure and poor bladder compliance predicted a less favourable short-term outcome. Preoperative urodynamic assessment is advisable in men with a small gland or prolonged retention, both to refine the indication for surgery and to counsel patients about the likely benefit.

Keywords: Benign prostatic hyperplasia, Transurethral resection of prostate, Urodynamics, Bladder compliance, Detrusor pressure, Treatment outcome

INTRODUCTION

Benign prostatic hyperplasia (BPH) is a histological proliferation of the smooth-muscle and epithelial cells of the prostatic transition zone and is one of the commonest disorders of the ageing man. Microscopic BPH is present in roughly half of men in their sixties and in the great majority by the ninth decade, and an increasing

proportion become symptomatic with age. The resulting lower urinary tract symptoms (LUTS), a combination of voiding and storage complaints, are distressing and reduce quality of life.^{1,2}

Medical therapy with alpha-adrenergic antagonists and 5-alpha-reductase inhibitors has become first-line treatment, yet about 30% of men eventually require

surgery for refractory symptoms or for complications such as recurrent retention, recurrent infection, haematuria, bladder calculi or renal impairment.^{3,4} Transurethral resection of the prostate (TURP) remains the surgical reference standard for glands of moderate size. Despite its established efficacy, the result is unfavourable or below patient expectation in 5 to 35% of cases.⁵

Several preoperative and intraoperative variables have been proposed as determinants of outcome, including prostate volume, post-void residual urine, the duration of preoperative catheterisation and a number of urodynamic indices; prolonged catheterisation and a large residual volume may stretch the detrusor and impair its contractility, a change best demonstrated objectively on urodynamic study.⁶ Identification of such predictors allows more careful patient selection and more honest preoperative counselling. The present study therefore examined the influence of a panel of preoperative clinical and urodynamic factors on the short-term outcome of TURP performed for BPH.

METHODS

Study design and setting

This prospective observational study was conducted in the Department of General Surgery of a tertiary-care teaching hospital in New Delhi. Consecutive men undergoing TURP for BPH were enrolled between November 2018 and March 2020. The study was approved by the Institutional Ethics Committee for Human Research (reference number LHMC/ECHR/2018/101), was performed in accordance with the 1964 Declaration of Helsinki and its later amendments, and written informed consent was obtained from every participant.

Participants

Men presenting with LUTS attributable to BPH who had at least one absolute indication for surgery (refractory urinary retention after a failed trial without catheter, recurrent haematuria, recurrent urinary tract infection, inadequate response to medical therapy, or renal compromise), an International Prostate Symptom Score (IPSS) greater than 13 and a maximum urinary flow rate (Q_{max}) below 15 ml/s were eligible. Men with urethral stricture, a prostate larger than 80 g, incomplete resection, or those converted to open prostatectomy were excluded. Of 40 men assessed, four were excluded before surgery (urethral stricture one, prostate larger than 80 g one, prostate malignancy two). Thirty-six underwent TURP; one was converted to open prostatectomy for intraoperative bleeding and clot retention and was excluded, leaving 35 men for outcome analysis (Figure 1).

Sample size

A correlation-based calculation (alpha 0.05, power 80%) yielded a target of approximately 85 patients; owing to logistic constraints, 35 patients were finally included, a limitation acknowledged below.

Preoperative evaluation

Each patient underwent a structured history with IPSS and quality-of-life (QOL) scoring, digital rectal examination, urinalysis with culture and sensitivity, and measurement of serum creatinine and serum prostate-specific antigen (PSA). Where PSA was elevated, transrectal ultrasound-guided biopsy was performed to exclude malignancy. Ultrasonography of the kidneys, ureters and bladder documented prostate volume (prolate-ellipsoid formula), post-void residual urine (PVR) and any upper-tract changes. Uroflowmetry (Q_{max}, average flow rate and voided volume) was performed in patients who were not catheter-dependent.

Urodynamic study

Multichannel urodynamics comprising filling cystometry and a pressure-flow study were carried out using a urethral double-lumen catheter and a rectal balloon catheter, with saline filling at 50 ml/min. Maximum detrusor pressure, bladder compliance and urethral pressure were recorded; the bladder outlet obstruction index (BOOI, calculated as P_{det}@Q_{max} minus twice Q_{max}) and the bladder contractility index (BCI, calculated as P_{det}@Q_{max} plus five times Q_{max}) were derived from the pressure-flow data.

Operative procedure

TURP was performed under regional anaesthesia using a 25-Fr resectoscope and monopolar resection with 1.5% glycine irrigation. After diagnostic cystoscopy and identification of the ureteric orifices and verumontanum, the median lobe (when present) and then the lateral lobes were resected to the level of the capsular fibres, stopping proximal to the verumontanum to protect the external sphincter. Haemostasis was secured and a three-way catheter with continuous bladder irrigation was placed.

Outcome assessment

The IPSS, QOL score and Q_{max} were reassessed one month after surgery. Using a previously described grading system (Table 1), the result for each parameter was graded as excellent, good, fair or none;⁷ the composite outcome was classified as effective (excellent or good) or non-effective (fair or none). The following preoperative factors were correlated with the dichotomised outcome: age, prostate volume, serum PSA, presence of refractory retention, duration of catheterisation, PVR, maximum detrusor pressure, bladder compliance, BOOI and BCI.

Statistical analysis

Analyses were performed with SPSS version 17.0 (SPSS Inc., Chicago, Illinois). Continuous variables were expressed as mean with standard deviation (SD) and categorical variables as frequency and percentage.

Normally distributed continuous variables were compared with the unpaired t-test and non-normally distributed variables with the Mann-Whitney U-test; categorical variables were compared with the chi-square test or the Fisher exact test. A two-tailed p-value below 0.05 was considered statistically significant.

Table 1: Grading of each parameter and the composite-outcome criteria used to classify the result of transurethral resection of the prostate.

Parameters	Excellent	Good	Fair	None
IPSS (post/pre ratio; post score)	<0.2 and ≤7	≤0.6 and ≤13	≤0.8 and ≤19	>0.8 or ≥ 20
Qmax (post/pre ratio; post value)	≥18 ml/s	≥1.3 and ≥12 ml/s	≥1.3 and ≥ 6ml/s	< 1.3 or < 6 ml/s
Composite outcome	Effective: excellent or good in ≥ 2 of the 3 parameters. Non-effective: excellent or good in < 2 of the 3 parameters.			

IPSS: international prostate symptom score; Qmax: maximum urinary flow rate; pre: preoperative; post: postoperative

RESULTS

Baseline characteristics

The mean age was 64.4±7.1 years (range 52 to 80) and the mean prostate volume was 52.0±11.4 ml (range 29 to 75). Four men (11.4%) had a preoperative urinary tract infection that was treated to a negative culture before

surgery. The mean serum PSA was 4.96±5.63 ng/ml; three men with a PSA above 14 ng/ml underwent biopsy that confirmed benign disease. Refractory retention was present in 25 men (71.4%); the remaining 10 (28.6%) were operated for inadequate response to medical therapy. Renal function was normal in all patients. Among the 10 men who were not in retention, the mean Qmax on uroflowmetry was 10.4±2.3 ml/s. Baseline data are summarised in Table 2.

Table 2: Baseline characteristics of the study population (n=35).

Parameters	Value
Number of patients analysed	35
Age (years), mean±SD (range)	64.4±7.1 (52–80)
Prostate volume (ml), mean±SD (range)	52.0±11.4 (29–75)
Serum PSA (ng/ml), mean±SD (range)	4.96±5.63 (0.71–23.5)
Preoperative urinary tract infection, n (%)	4 (11.4)
Refractory urinary retention, n (%)	25 (71.4)
PVR in non-catheterised patients (ml), mean±SD	102.3±58.6
Qmax on uroflowmetry (ml/s), mean±SD	10.4±2.3
Maximum detrusor pressure (cm H ₂ O), mean±SD	57.4±45.4
Bladder compliance (ml/cm H ₂ O), mean±SD	22.3±19.6
BOOI, mean±SD	42.4±46.6
BCI, mean±SD	106.1±43.8
Number of patients analysed	35
Age (years), mean±SD (range)	64.4±7.1 (52–80)
Prostate volume (ml), mean±SD (range)	52.0±11.4 (29–75)
Serum PSA (ng/ml), mean±SD (range)	4.96±5.63 (0.71–23.5)
Preoperative urinary tract infection, n (%)	4 (11.4)

Outcome

At one month the outcome was effective in 27 patients (77.1%) and non-effective in 8 (22.9%) (Table 3). The only major complication was clot retention in the single patient converted to open surgery; four patients (11.4%) had transient catheter blockage which was relieved by

flushing. No patient developed transurethral resection syndrome, urethral injury or sepsis, and none required transfusion.

Factors associated with outcome

Four preoperative factors differed significantly between the effective and non-effective groups (Table 4). The

prostate was larger in patients with an effective outcome (54.6 ± 11.0 versus 43.3 ± 8.4 ml; $p=0.011$). Catheterisation for more than six weeks was far commoner in the non-effective group (50% versus 3.7%; $p=0.017$). The maximum detrusor pressure was higher in the effective

group (60.4 ± 46.1 versus 30.0 ± 19.2 cm H₂O; $p=0.043$), as was bladder compliance (37.7 ± 29.7 versus 13.5 ± 12.0 ml/cm H₂O; $p=0.045$). Age, serum PSA, the presence of refractory retention, PVR, BOOI and BCI showed no significant association with outcome.

Table 3: Overall outcome of transurethral resection of the prostate at one month (n=35).

Outcomes	Frequency	Percentage
Effective (excellent or good)	27	77.1
Non-effective (fair or none)	8	22.9
Total	35	100

Table 4: Association of preoperative factors with the outcome of transurethral resection of the prostate.

Factors	Effective (n=27)	Non-effective (n=8)	P value
Prostate volume (ml)	54.6 ± 11.0	43.3 ± 8.4	0.011*
Serum PSA (ng/ml)	5.47 ± 6.37	3.25 ± 1.80	0.724
PVR (ml)	104.7 ± 67.9	98.3 ± 18.2	0.926
Maximum detrusor pressure (cm H ₂ O)	60.4 ± 46.1	30.0 ± 19.2	0.043*
Bladder compliance (ml/cm H ₂ O)	37.7 ± 29.7	13.5 ± 12.0	0.045*
BOOI	45.7 ± 48.6	31.3 ± 40.3	0.335
BCI	106.5 ± 43.5	105.0 ± 48.0	0.798
Refractory retention present, n (%)	19 (70.4)	6 (75.0)	1.000
Catheterisation > 6 weeks, n (%)	1 (3.7)	4 (50.0)	0.017*

Values are mean $\pm$ SD unless otherwise stated. *statistically significant ($p<0.05$). PSA: prostate-specific antigen; PVR: post-void residual urine; BOOI: bladder outlet obstruction index; BCI: bladder contractility index.

DISCUSSION

In this prospective cohort, TURP produced an effective short-term result in just over three-quarters of patients (77.1%), consistent with the favourable rates reported in larger series and with the observation that the outcome disappoints in a substantial minority.^{5,7} Of the variables examined, four (prostate volume, duration of catheterisation, detrusor pressure and bladder compliance) distinguished effective from non-effective outcomes.

A larger prostate was associated with a better result, while a small gland predicted failure. This apparent paradox is well documented; men with smaller prostates have been shown to derive less symptomatic benefit from resection, presumably because their symptoms are less often due to mechanical obstruction and more often due to detrusor dysfunction or a non-obstructive cause that resection cannot relieve.^{8,9} Prostate size correlates poorly with symptom severity and is not in itself an indication for surgery; the present finding therefore argues for urodynamic confirmation of obstruction before resecting a small gland, and for cautious counselling of such patients.

Prolonged preoperative catheterisation, beyond six weeks in the present series, was strongly linked with a poor outcome, whereas the mere presence of refractory

retention was not. Chronic high-volume retention and long-standing bladder drainage overstretch the detrusor and may cause irreversible loss of contractility, so that voiding does not normalise once the obstruction is relieved. Good results have been reported in only about 53 to 59% of men with chronic retention and prolonged catheterisation.^{10,11} The duration, rather than the fact, of retention therefore appears to carry the prognostic weight.

The urodynamic findings reinforce this theme. A higher maximum detrusor pressure was associated with an effective result, consistent with the observation that treatment failures had lower maximum and voiding detrusor pressures, a signature of an overstretched, weakened bladder.¹² Not all reports agree, and no difference in eventual voiding between obstructed and unobstructed men has also been described.¹³ A low bladder compliance was likewise significantly commoner among non-effective outcomes; poor compliance reflects a fibrotic, low-capacity bladder and has been reported as among the most predictive urodynamic markers of an unfavourable result after prostatectomy.¹⁴ Taken together, these findings suggest that the state of the detrusor, more than the obstruction itself, governs the short-term success of TURP in this selected population.

Several widely cited variables were not predictive in the present cohort. Age showed no relationship with outcome, although advanced age has elsewhere been

associated with long-term failure requiring catheterisation.¹⁵ Serum PSA, a marker chiefly of value in excluding malignancy, did not predict outcome. The PVR, proposed as a strong predictor in some reports but found non-predictive in a large cooperative study, was not significant here, perhaps because most patients were catheter-dependent and the residual volume could be measured in only a minority.^{16,17} The BOOI and BCI also failed to reach significance, probably reflecting the small sample and the fact that opening detrusor pressure could not be obtained in catheterised men. Because the mean maximum urinary flow rate was below 15 ml/s in both groups by design, uroflowmetry could not discriminate outcomes in this already obstructed cohort.^{18,19}

The principal clinical message is that a small prostate, prolonged catheterisation, a low detrusor pressure and poor bladder compliance should temper expectations of TURP and should prompt preoperative urodynamic evaluation. Such assessment can help confirm obstruction, characterise detrusor function and support a more informed, individualised discussion with the patient about the likely benefit of surgery.

Limitations

The single-centre sample of 35 patients fell well short of the calculated target of 85 and limits statistical power, so the non-significant associations should be interpreted cautiously and the significant ones regarded as hypothesis-generating. Most patients were operated for retention and were catheter-dependent, which precluded preoperative uroflowmetry and measurement of residual volume in the majority and may have biased those analyses. Follow-up was limited to one month, so the durability of benefit and late failures were not captured. Larger, multicentre studies with longer follow-up are needed to confirm these predictors.

CONCLUSION

Transurethral resection of the prostate produced an effective short-term outcome in 77.1% of men operated for benign prostatic hyperplasia. A smaller prostate volume, preoperative catheterisation exceeding six weeks, a lower maximum detrusor pressure and a lower bladder compliance were each significantly associated with a non-effective result, whereas age, serum prostate-specific antigen, the presence of refractory retention, post-void residual urine and the obstruction and contractility indices were not. Preoperative urodynamic study is recommended in men with a small gland or a long duration of retention, both to confirm the indication for surgery and to counsel patients realistically. These findings warrant validation in a larger study with longer follow-up.

ACKNOWLEDGEMENTS

The authors thank the surgical residents, anaesthetists and nursing staff of the department and the patients who participated in the study

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: All procedures performed in this study were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki Declaration and its later amendments. The study was approved by the Institutional Ethics Committee for Human Research, Lady Hardinge Medical College and Associated Hospitals, New Delhi (reference number LHMC/ECHR/2018/101)

REFERENCES

1. Lepor H. Pathophysiology of benign prostatic hyperplasia in the aging male population. *Rev Urol.* 2005;7(Suppl 4):S3-12.
2. Lin PH, Freedland SJ. Lifestyle and lower urinary tract symptoms: what is the correlation in men? *Curr Opin Urol.* 2015;25(1):1-5.
3. Muruganandham K, Dubey D, Kapoor R. Acute urinary retention in benign prostatic hyperplasia: risk factors and current management. *Indian J Urol.* 2007;23(4):347-53.
4. van Rij S, Gilling P. Recent advances in treatment for benign prostatic hyperplasia. *F1000Res.* 2015;4:1482.
5. Lee HS, Kim SJ, Song JM, Kim KJ, Chung HC. Comparative analysis of outcomes after transurethral resection of the prostate according to prostate shape shown by transrectal ultrasonography. *Korean J Urol.* 2010;51(7):483-7.
6. Suhani, Gupta S, Gupta A, Saha S, Mahapatra L, Srivastava UK. Outcome of surgery for benign prostatic hyperplasia: is it predictable? *J Clin Diagn Res.* 2013;7(12):2859-62.
7. Milonas D. Significance of operative parameters on outcomes after transurethral resection of the prostate. *Medicina (Kaunas).* 2010;46(1):24-9.
8. Hakenberg OW, Pinnock CB, Marshall VR. Does evaluation with the International Prostate Symptom Score predict the outcome of transurethral resection of prostate? *J Urol.* 1997;158(1):94-9.
9. Arai Y, Aoki Y, Okubo K, Maeda H, Terada N, Matsuta Y, et al. Impact of interventional therapy for benign prostatic hyperplasia on quality of life and sexual function: a prospective study. *J Urol.* 2000;164(4):1206-11.
10. Abrams PH, Dunn M, George N. Urodynamic findings in chronic retention of urine and their relevance to results of surgery. *Br Med J.* 1978;2(6147):1258-60.
11. George NJR, Feneley RCL, Roberts JBM. Identification of the poor-risk patient with

- prostatism and detrusor failure. *Br J Urol.* 1986;58(3):290-5.
12. Djavan B, Madersbacher S, Klingler C, Marberger M. Urodynamic assessment of patients with acute urinary retention: is treatment failure after prostatectomy predictable? *J Urol.* 1997;158(5):1829-33.
 13. Radomski SB, Herschorn S, Naglie G. Acute urinary retention in men: a comparison of voiding and non-voiding patients after prostatectomy. *J Urol.* 1995;153(3 Pt 1):685-8.
 14. Akino H, Gobara M, Okada K. Bladder dysfunction in patients with benign prostatic hyperplasia: relevance of cystometry as prognostic indicator of the outcome after prostatectomy. *Int J Urol.* 1996;3(6):441-7.
 15. Losco G, Mark S, Jowitt S. Transurethral prostate resection for urinary retention: does age affect outcome? *ANZ J Surg.* 2013;83(4):243-5.
 16. Javle P, Jenkins SA, Machin DG, Parsons KF. Grading of benign prostatic obstruction can predict the outcome of transurethral prostatectomy. *J Urol.* 1998;160(5):1713-7.
 17. Wasson JH, Reda DJ, Bruskewitz RC, Elinson J, Keller AM, Henderson WG. A comparison of transurethral surgery with watchful waiting for moderate symptoms of benign prostatic hyperplasia. *N Engl J Med.* 1995;332(2):75-9.
 18. Jensen KM, Bruskewitz RC, Iversen P, Madsen PO. Spontaneous uroflowmetry in prostatism. *Urology.* 1984;24(4):403-9.
 19. Gerstenberg TC, Andersen JT, Klarskov P, Ramirez D, Hald T. High flow infravesical obstruction in men: symptomatology, urodynamics and the results of surgery. *J Urol.* 1982;127(5):943-6.

Cite this article as: Saxena A, Saha S, Pathania OP, Singh N. Preoperative clinical and urodynamic factors influencing the short-term outcome of transurethral resection of the prostate for benign prostatic hyperplasia: a prospective observational study. *Int Surg J* 2026;13:2164-9.