



Modified transurethral resection of the prostate for the management of BPH-related refractory lower urinary tract symptoms in patients with a history of pelvic fracture urethral injury reconstruction

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Abstract

Introduction To evaluate the impact of a modified transurethral resection of prostate (mTURP) in patients with a history of pelvic fracture urethral injury (PFUI) status post-urethroplasty, and subsequent lower urinary tract symptoms (LUTS) refractory to medical therapy caused by benign prostatic hyperplasia (BPH).

Methods Five patients were identified with a history of PFUI and a successful reconstruction of the urethra, who developed severe LUTS. After maximal medical therapy failed, these patients underwent a mTURP. Their continence status and voiding parameters were recorded before and after surgery.

Results Significant improvements in both post-void residual (172 ± 137.36 mL vs. 26.6 ± 24.44 mL), $p = 0.026$, and International Prostatic Symptom Score (23.6 ± 4.82 vs. 7.6 ± 4.30), $p = 0.002$ were observed in the study. Although maximum flow rate was not statistically significant, there was an overall improvement in Q_{\max} in all patients (8.92 ± 3.71 vs. 16.78 ± 6.44 mL/sec). Furthermore, all patients remained continent after this modified intervention.

Conclusion Our modified TURP provides an adjunctive option in the management of severe LUTS secondary to BPH in patients with a history of PFUI urethroplasty who are refractory to medical management. In our experience, the patients experienced a lasting response with no incontinence.

Keywords Pelvic fracture urethral injury · Bladder outlet obstruction · Transurethral resection of bladder neck · Reconstructive urology

Abbreviations

PFUI	Pelvic fracture urethral injury
BPH	Benign prostatic hyperplasia
mTURP	Modified transurethral resection of prostate
LUTS	Lower urinary tract symptoms
PVR	Post-void residual
IPSS	International Prostate Symptom Score

TRUS	Transrectal ultrasound
IPP	Intravesical prostatic protrusion
TURP	Transurethral resection of prostate

Introduction

Pelvic fracture urethral injuries (PFUI) may compromise a patient's continence due to damage to the external sphincter, internal sphincter, or both [1–3]. As a result, the urologist must be vigilante in preserving residual sphincteric function during any reconstructive efforts [4]. Over time, patients with previously successful PFUI repairs may develop physiologic lower urinary tract symptoms (LUTS) secondary to benign prostatic hyperplasia (BPH). Management of BPH in these patients poses a unique challenge as the external sphincter function is usually compromised by the injury and/or the urethroplasty, and the urinary continence is maintained by the internal sphincter located at the bladder neck. Therefore, traditional BPH surgery poses a high risk of

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rendering the patient incontinent by removal of the internal sphincter mechanism [3–5]. For this reason, expert opinion on the matter endorses maximizing medical management of BPH in these patients [6].

Herein we present a cohort of five such individuals who presented with PFUIs. They were successfully managed for their initial insult and did well; however, over the course of their follow-up, they developed progressive LUTS secondary to BPH. A trial of medical therapy was performed in an attempt to avoid invasive instrumentation of their bladder necks; however, these patients ultimately failed medical therapy. To avoid further decompensation of their bladder, and to relieve obstructive symptoms, surgical intervention was indicated. In this report, we aim to highlight the principles of managing patients with PFUI and LUTS who are refractory to medical management. To our knowledge, this cohort of patients has not been previously reported.

Materials and methods

Patients at a high volume, tertiary referral center specializing in work related to urethral trauma were identified. All patients reported a history of PFUI with a successful urethral reconstruction and acceptable lasting voiding parameters; however, they later developed progressively severe lower urinary tract symptoms (LUTS). All screened patient further underwent cystoscopic and urodynamic evaluation to exclude recurrence of urethral stricture, or neurogenic dysfunction. Patients were included in the study if the diagnosis of BPH was established after a thorough evaluation.

All eligible patients were first trialed on medical therapy for LUTS. Patients who failed maximal dual medical therapy (tamsulosin/dutasteride) were referred for surgical intervention. Specific voiding parameters including uroflowmetry for maximum flow (Q_{\max}), post-void residual (PVR), and International Prostate Symptom Score (IPSS) were obtained pre- and post-intervention. Additionally, transrectal ultrasound (TRUS) was performed to evaluate the prostate size (grams), and to grade the intravesical prostatic protrusion (IPP) [7–9].

Patients were maintained on medical therapy up to the time of their transurethral resection of prostate (TURP). A modified TURP (mTURP) was performed incorporating a conservative resection of the median lobe or one of the lateral lobes if no median lobe was present. Extreme care was taken to avoid resection of the circular fibers at the bladder neck presumed to be part of the internal sphincter. As in the standard TURP technique, no resection was performed distal to the *veru montanum*. Routine post-operative care was provided. Patients were re-evaluated for Q_{\max} , PVR, and IPSS after surgery. They were maintained on their dual medical therapy after surgery.

Descriptive information is presented as mean \pm SD for normally distributed variables. Paired *t* test was performed to analyze pre- and post-operative outcomes. Stata 15.1 statistical software (College Station, Tx) was utilized for the analysis.

Results

A total of five patients were identified who met the inclusion criteria. Table 1 describes the age at time of injury, duration of medical therapy, time between urethroplasty and mTURP, prostate parameters, surgical intervention performed, and duration of follow-up. One patient was in complete urinary retention. The mean size of the prostate was 67.2 ± 21.1 mL. Mean time between urethroplasty and mTURP was 139.74 months or 11.6 years, with patients presenting with PFUI at younger age experiencing longer duration from PFUI to mTURP (223.55 months) as compared to patients who presented at a later age (> 50 years) with PFUI (83.88 months).

All patients had an IPP grade of III (> 10 mm) on TRUS. The mean prostate tissue resection was 7.4 ± 2.9 g. Conservative resection of the median lobe was performed in three out of five patients, with the other two receiving unilateral lobe resection. The mean follow-up was 37.1 ± 24.8 months and all patients have had a documented encounter within the last 4 months of this study being performed.

Tables 2 and 3 demonstrate the pre-operative and post-operative voiding parameters in the cohort. Significant improvements in both PVR (172 ± 137.36 mL vs. 26.6 ± 24.44 mL), $p = 0.026$ and International Prostatic Symptom Score (23.6 ± 4.82 vs. 7.6 ± 4.30) $p = 0.002$ were observed in the study. Although maximum flow rate was not statistically significant, there was an overall improvement in Q_{\max} in all patients (8.92 ± 3.71 mL/sec vs. 16.78 ± 6.44 mL/sec).

Figure 1 demonstrates the change in IPSS and Q_{\max} for the cohort. Figure 2 demonstrates the difference in the pre- and post-operative PVRs. There was no incontinence reported in any of these patients and symptomatic BPH regrowth has also not been observed.

Discussion

Management of LUTS secondary to BPH in patients with a previous history of PFUI reconstruction poses a unique challenge as the urologist must de-obstruct the urinary channel while preserving the patient's continence. Pelvic fracture may have a concurrent posterior urethral injury in 2–25% of the patients [10]. The concern for urinary incontinence is well justified as we know that the membranous urethra is at

Table 1 Patients' demographics and operative characteristics

Patient	Age at time of injury (years)	Time between urethroplasty and mTURP (months)	Duration of medical therapy (months)	Prostate size on TRUS (grams)	Pre-operative PSA	Monopolar or Bipolar	Operative time (min)	IPP grade*	Lobe resected	Grams of tissue resected	Catheterization days	Post-op complications	Time when parameters in Tables 2 and 3 are measured (months)	Total follow-up (months)
1	33.1	288.8	24	64	1.19	Bipolar	63	III	Median	10	6	Post-op bleeding needing catheter replacement and irrigation for 3 days	23	41
2	44.5	158.3	156	100	1.75	Bipolar	35	III	Left lateral	9	5	None	52	64
3	51.4	243.27	96	42	3.49	Bipolar	40	III	Median	9	17	None	25	57
4	73	5.6	3	70	0.21	Monopolar	35	III	Median	3	2	None	6	6
5	59.3	2.77	2.5	60	0.84	Monopolar	34	III	Right lateral	6	4	None	3	18

mTURP modified transurethral resection of prostate, TRUS transrectal ultrasound

*IPP intravesical prostatic protrusion Grade I < 5 mm, Grade II 5–10 mm, Grade III > 10 mm

Table 2 Voiding parameters before and after mTURP

Voiding parameters	1	2	3	4	5
Pre-surgical PVR (mL)	120	160	150	400	30
Post-surgical PVR (mL)	0	30	5	40	58
Pre-surgical IPSS	18	26	26	29	19
Post-surgical IPSS	2	8	6 ^a	9	13
Pre-surgical Q_{max} (mL/sec)	15	8	6	0 ^b	9.6
Post-surgical Q_{max} (mL/sec)	25	10.7	15	11.2	22

Q_{max} maximal flow on uroflowmetry

PVR post-void residual

IPSS International Prostate Symptom Score

^aValue derived from ROS from patient note

^bPatient presented in retention

Table 3 Pre-and post-operative changes in voiding parameters*

Variable	Pre-operative	Post-operative	<i>p</i> value
Post-void residual (mean ± SD) ml	172 ± 137.36	26.6 ± 24.44	0.039
IPSS (mean ± SD)	23.6 ± 4.82	7.6 ± 4.30	0.002
Q_{max} (mL/sec) (mean ± SD)	8.92 ± 3.71	16.78 ± 6.44	0.99

*Paired *t* test

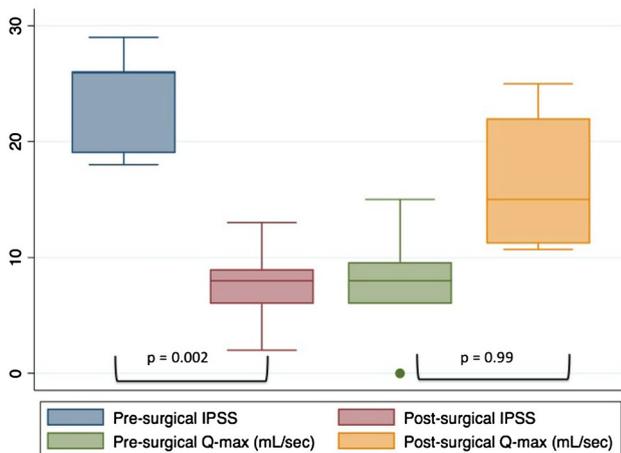


Fig. 1 Pre-operative and post-operative differences in IPSS and Q_{max} scores. Q_{max} maximal flow on uroflowmetry, IPSS International Prostate Symptom Score

a particularly higher risk of injury during PFUI [3–5]. The reason for this is because this location tethers the posterior urethra to the pubic arch by the puboprostatic ligament, and it serves as the fixation to the perineal membrane [6].

Single-stage anastomotic posterior urethroplasty is highly effective in PFUI patients; however, the patients should be adequately counseled on the risks of incontinence. Previous studies have demonstrated approximately 90% or higher

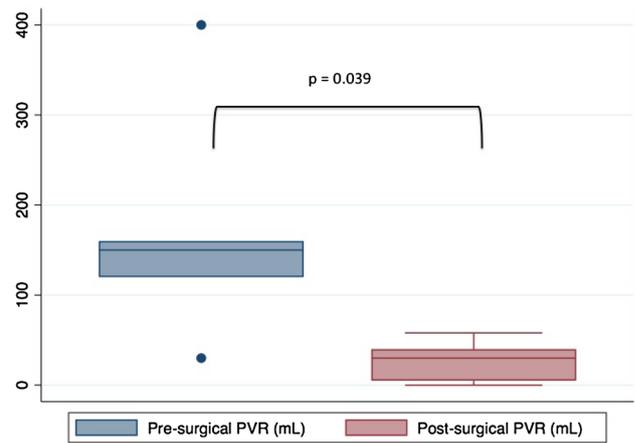


Fig. 2 Pre-operative and post-operative differences in PVR. PVR post-void residual

continence rates in this population. However, the managing provider must recognize that the post-operative patients have an altered anatomy, and continence in these patients is tenuous. The primary continence is provided by the bladder neck and the supramontanal urethra [1]. Therefore, traditional means of surgical de-obstruction via TURP carries a significant risk of compromising the competence of the bladder neck, thereby rendering these patients floridly incontinent. For this reason, experts recommend managing these patients with medical therapy unless surgical intervention is absolutely indicated. Herein we present a cohort of patients with a history of PFUI reconstruction, who failed medical management of their LUTS and required a modified TURP. Our study provides the first evaluation of these patients in the current literature.

The five patients in the cohort were evaluated with a validated questionnaire (IPSS) before and after mTURP was performed. The findings demonstrated a significant improvement in their symptoms score by 16 ± 5.8 points ($p = 0.002$; Table 3). Additionally, objective evaluations of PVR also demonstrated a significant improvement in these voiding parameters (Tables 2 and 3). While we did not find a significant difference in the Q_{max} between the pre- and post-surgery uroflowmetry, we identified that every patient had an improvement in their Q_{max} . In fact, one of the patients who presented in urinary retention was able to void with a Q_{max} of 11.2 mL/sec. Ultimately, the premium of these interventions lies heavily upon the improvement in patient-reported symptoms, preserving full continence.

Our follow-up also shows lasting response in voiding parameters with an average follow-up of 37.1 ± 24.8 months (Table 1).

While the management of this sub-selected cohort may offer an exceptional challenge, with judicious management from their initial reconstructive intervention to their

subsequent follow-ups, they can maintain continence and acceptable voiding parameters. Upon development of LUTS, it is crucial to evaluate the patient for recurrent stricture, bladder neck obstruction, or unidentified bladder/neurogenic pathology from the initial insult [2, 11]. Once these etiologies have been ruled out, then the diagnosis of BPH may be ascertained. In our experience, we always attempt to manage the patients on maximal medical therapy (tamsulosin and dutasteride) prior to surgical intervention. Furthermore, the medical therapy is continued after the modified TURP to maximize the benefits of medical therapy while minimizing regrowth of the prostate using the 5 α -reductase inhibitor.

Prior to the planned intervention, the prostatic anatomy should be evaluated by TRUS and cystoscopy. We utilize the intravesical prostatic protrusion grade to characterize the median lobe in these patients [7–9]. Often, a gentle resection of the median lobe may provide adequate de-obstruction; however, the lateral lobes may be the etiology of the obstruction in other cases. Although it has not been necessary thus far in our experience, we endorse for repeat staged procedures in case of failed improvement in symptoms rather than risking incontinence due to an aggressive resection. Particular care is taken to avoid deep resection at the bladder neck or distal to the *veru montanum*.

Based on our highlighted experience, we find that an mTURP in a select group of PFUI patients may be a feasible option for management of severe medical refractory LUTS. While a major limitation in our study is the small number of patients, the drastic improvement in urinary symptoms with a lasting response seen in all five patients may hold a promising option for interventions in these patients with limited options. Ultimately, a prospective study with more patients would be needed to definitively establish this practice.

Conclusion

The cautious application of our mTURP of the median lobe or unilateral lobe with sparing of the circular fibers at the bladder neck may provide an advanced management strategy in this unique subset of patients, whose voiding parameters and continence mechanism may be tenuous. Pre-operative planning for these patients must be meticulous with close attention to their prostatic anatomy as well as their bladder neck competence. Maintenance of medical therapy seems important to avoid symptomatic BPH recurrence.

Author contributions Mishra: data analysis, manuscript writing/editing, Cristina Baeza: data analysis, protocol/project management,

Laura Bukavina: data analysis, manuscript writing/editing, Reynaldo G. Gómez: protocol/project management, data analysis, manuscript writing/editing.

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Compliance with ethical standards

Conflict of interest All authors declare that they have no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

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