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Evaluation and Management of Lower Urinary Tract Symptoms After Outlet Surgery for Benign Prostatic Hyperplasia

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Abstract

There are many options available in the surgical treatment of outlet obstruction secondary to benign prostatic hyperplasia (BPH). While most patients exhibit improvement in their lower urinary tract symptoms (LUTS) following intervention, up to 35 % of patients may exhibit persistent or recurrent LUTS. In the present review, we discuss the patho-physiology of LUTS after bladder outlet surgery and discuss considerations in evaluating and managing such patients. We highlight the crucial role of thorough evaluation with complete urodynamics testing, as pure obstruction only accounts for a minority of post-operative LUTS. Hence, detrusor contractility, detrusor overactivity, urethral sphincter function, and urinary incontinence must be assessed to appropriately guide subsequent therapy and improve patients' quality of life.

Keywords

Benign prostatic hyperplasia; Lower urinary tract symptoms; Bladder outlet obstruction; Transurethral resection of prostate

Introduction

Benign prostatic hyperplasia (BPH) is a common entity that demonstrates an age-dependent prevalence, affecting an estimated 70 % of US men between the ages of 60 and 69, and approximately 80 % of those over 70 years of age [1]. Lower urinary tract symptoms (LUTS), which encompass storage, voiding, and post-micturition symptoms [2], similarly increase with age at a rate of approximately 10 % per decade from 40–79 years [3], with an estimated prevalence of 35 % in men aged 60–69 years [4]. BPH can lead to LUTS from both direct bladder outlet obstruction (BOO) and increased smooth muscle tone, and it may coexist with or cause detrusor overactivity (DO) [5]. Indeed, LUTS arising from BPH can significantly affect patients' quality of life (QoL) [1].

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While initial management of LUTS secondary to BPH entails behavioral modifications and medications, patients with LUTS refractory to such conservative methods may require surgical intervention. Direct benefits from surgery include mechanical relief of obstruction with improvement of voiding symptoms, while storage symptoms may also improve indirectly. The armamentarium of surgical options available continues to grow as newer technologies are introduced. Currently employed options include transurethral electrosurgical resection (TURP); transurethral incision (TUIP); transurethral vaporization (TUVP); transurethral needle ablation (TUNA); transurethral microwave thermotherapy (TUMT); holmium laser ablation (HoLAP), enucleation (HoLEP), or resection (HoLRP); photoselective vaporization (PVP) or other laser ablative techniques; or simple prostatectomy, which can be performed open or using minimally invasive approaches.

Despite intervention, however, up to 35 % of patients may exhibit persistent or recurrent LUTS either immediately or after some delay following outlet surgery [6-9,10•, 11]. These patients deserve special attention, as the underlying etiology of their LUTS may not have been adequately addressed by surgery, and their QoL remains compromised. In the present review, we discuss the pathophysiology, evaluation, and contemporary management of patients with persistent or recurrent LUTS after outlet surgery for BPH.

Pathophysiology

The development of LUTS after BPH surgery is a heterogeneous and incompletely understood process, and may be the result of hypoxic insult, changes in neuroplasticity, and/or progressive detrusor hypertrophy from chronic outlet obstruction over time [12, 13•, 14, 15]. Mechanical distension of the bladder from BOO may cause epithelial and smooth muscle cells in the bladder wall to undergo modifications of gene expression and protein synthesis via several transduction mechanisms; this process, in turn, alters the ultrastructure and physiology of cell membranes, cytoskeleton, contractile proteins, mitochondria, extracellular matrix, and neuronal networks [13•]. The result is smooth muscle hypertrophy and collagenous deposition that eventually create a thickened bladder wall with poor contractility, small capacity, and low compliance. It is also believed that BOO elevates nerve growth factor, triggering a neurotrophic effect on intrinsic bladder neurons to help overcome outlet resistance during micturition [12, 15-17]. Following sudden relief of BOO, however, these hyperactive neuronal pathways may persist and be the source of irritative storage symptoms and DO. Alternatively, vascular compression from chronic bladder distension may compromise perfusion to the bladder wall and cause hypoxia-induced neuronal death and subsequent patchy denervation that may be irreversible [12, 14]. Such patterns may account for LUTS related to detrusor underactivity.

BOO can exist either with or without symptoms characteristic of the overactive bladder (OAB) complex, including urgency, frequency, and nocturia [5]. In coexistent cases, OAB symptoms should theoretically disappear following relief of obstruction if they are entirely caused by the BOO; if, however, they are not, then they may persist following surgery [18-20]. Hence, correct pre-operative diagnosis and characterization of LUTS is crucial before offering surgical intervention to relieve BOO. Machino et al. noted that post-operative persistent DO was more frequently noted in patients without clear obstruction per the pre-

operative Abrams-Griffiths nomogram (60 %) than in those who were obstructed (27 %) [19], and this phenomenon may be associated with reduced bladder perfusion [20]. In fact, Javle et al. found that of 62 patients awaiting initial TURP, only 23 (37 %) were obstructed per the Abrams-Griffiths nomogram, while the remainder were either not obstructed (5 %) or equivocal (58 %) with weak detrusor contractility in half, suggesting that the decision to pursue TURP may have been inappropriate in a significant proportion of patients [21].

Multiple studies suggest that recurrent or persistent obstruction accounts for only a minority of LUTS cases after TURP [10••, 22, 23]. In a retrospective study of 185 patients who experienced persistent LUTS following TURP, Kuo et al. attempted to classify post-operative urodynamic (UDS) findings into one of six different patterns [22]. They found substantial heterogeneity in the UDS tracings, which included low detrusor contractility (18.7 %), pure DO (9.6 %), DO with low contractility (14.4 %), poor relaxation of the urethral sphincter (19.3 %), BOO (27.8 %), or a normal tracing (9.1 %).

In an earlier study on 50 men with voiding dysfunction at a mean interval of 58 months following TURP, Nitti et al. similarly found that only 16 % were obstructed per the Abrams-Griffiths nomogram, while 62 % were unobstructed and 22 % were equivocal [10••]; 86 % of patients had some UDS abnormality, which included DO (54 %), obstruction with or without DO (16 %), sphincteric insufficiency (8 %), detrusor hypocontractility (4 %), or sensory urgency (4 %). Likewise, in a study on 129 men with post-TURP voiding symptoms, Seaman et al. reported obstruction in only 38 % of patients, while 25 % of the patients had impaired contractility and 8 % had intrinsic sphincter deficiency [23]. They also noted that DO was present in 60 % of the patients, including half of those without and over ¾ths of those with neurologic disorders. Fifteen patients had failed a second TURP procedure in their cohort, with evidence of DO in 80 %, obstruction in 27 %, impaired contractility in 27 %, and sphincteric incontinence in 20 %.

In a retrospective multivariate predictive model, Han et al. attempted to identify pre-, intra-, and post-operative risk factors associated with persistent LUTS requiring medical therapy after TURP [24]. They found that age >70 years, history of diabetes, history of cerebrovascular accident, any previous LUTS/BPH medication use, and previous antimuscarinic use were independently associated with LUTS persistence post-operatively, while prostate volume, uroflowmetry parameters, history of acute urinary retention, and total international prostate symptom score (IPSS) were not significant univariate predictors. Together, these studies underscore the importance of UDS assessments in patients with persistent LUTS following BOO surgery.

Cases of direct surgery failure (persistent obstruction), prostatic regrowth (recurrent obstruction), or other strictures (bladder neck contracture, urethral stricture, meatal stenosis) can nonetheless occur and require repeat intervention. In an epidemiologic study involving 54,067 patients across three different countries, Roos et al. reported the rates for repeat surgery after initial TURP in 2.3–4.3 % of patients at 1 year, 8.9–9.7 % at 5 years, and 12.0–15.5 % at 8 years, while reintervention rates after initial open simple prostatectomy were 0.6–1.2 % at 1 year, 1.1–3.4 % at 5 years, and 1.8–4.5 % at 8 years [25]. Data concerning post-operative LUTS or UDS evaluation following initial or repeat intervention were not

presented, however, and thus, the indications for or success after reintervention are not known. In another study, Kuntz and Lehrich randomized 120 urodynamically obstructed patients with prostate size >100 g to either HoLEP or open simple prostatectomy and found that 5 patients (4.2 %) developed anatomical BOO at 6 months post-operatively, either attributable to apical tissue requiring resection, bladder neck contracture, or urethral stricture [26].

Evaluation

Chughtai et al. note that patients may experience worsening of urinary symptoms for a period of up to 4–6 weeks following BOO surgery, while durable voiding outcomes are generally achieved at approximately 3 months [27]. During this time period, reassurance is often sufficient. Persistent or recurrent LUTS beyond this time frame may benefit from further evaluation.

The evaluation of LUTS after surgery for BOO proceeds in a fashion similar to that outlined by the American Urological Association (AUA) guideline on BPH/LUTS [28•]. The important underlying principle in recurrent or persistent cases, however, is to strongly consider non-obstructive etiologies of LUTS, in that obstruction should be more of an exclusionary diagnosis. Patient history including past medical history and neurologic disorders, duration since BOO surgery, and type of BOO surgery, with attention to operative reports and likelihood of complete resection, should be elicited. An assessment of LUTS including severity and bother using a validated questionnaire such as the AUA symptom index (AUA-SI) is certainly helpful, along with a frequency/volume chart for nocturia-predominant symptoms. Physical examination should include genital exam, digital rectal exam, and neurologic evaluation. Laboratory testing can also provide clues to alternative etiologies of LUTS, such as infection (urinalysis with microscopy, culture) or malignancy (urinary cytology, prostate-specific antigen), as clinically indicated.

An important distinction between the AUA guideline for initial evaluation of LUTS and recurrent/persistent LUTS after surgery is the imperative role for UDS in the latter. As aforementioned, numerous studies have shown that recurrent or persistent BOO only accounts for a minority of LUTS cases after surgery, and symptoms alone are unreliable in predicting UDS findings with respect to BOO and detrusor instability after surgery [10•, 22–24]. Hence, with rare exceptions, we strongly recommend complete UDS assessment (with or without video) in patients with persistent or recurrent LUTS after BOO surgery to elucidate the nature of LUTS and guide appropriate subsequent therapy. Pressure-flow studies are indeed required to evaluate detrusor function and exclude obstruction as the source of voiding symptoms in order to avoid performing an unwarranted repeat prostatic resection surgery that may fail again. Clinicians may wish to maintain a lower threshold to perform other forms of invasive testing as well, such as cystourethroscopy, transrectal ultrasound, or retrograde urethrography.

Management

Management of LUTS following BOO surgery should be directed based on a combination of subjective bother from LUTS and UDS findings, taken in the context of other clinical data. UDS should help determine the underlying cause of LUTS as illustrated in Fig. 1, and determination of whether or not obstruction is present takes precedent. Detrusor contractility, urethral sphincter function, the presence of DO, and incontinence will undoubtedly affect the nature of subsequent treatment. In some instances, optimal management may entail a multifactorial approach.

As with managing the initial presentation of LUTS [28••], it is not unreasonable to trial conservative methods such as behavioral/lifestyle modifications, changes in fluid intake, or reevaluation of other potentially confounding medications, especially if the UDS tracing is normal, as seen in nearly 10 % of cases post-TURP [22]. Should these fail, pharmacotherapy or surgical intervention may be necessitated per the clinical picture. Patients should also be counseled on the possibility of persistent LUTS despite secondary intervention [23].

If obstruction is highly suspected as the underlying etiology of LUTS, then it would be prudent to determine whether urethral/meatal stricture or bladder neck contracture have developed, as these entities may require endoscopic resection/incision, dilation, or more complex re-construction. If incomplete prostatic resection or regrowth is evident, however, medical management with an alpha adrenergic antagonist and/or 5-alpha-reductase inhibitor is a reasonable first step to assess for symptomatic improvement [26, 28••]. In refractory cases with persistent obstruction suspected, there remains a role for secondary prostatic intervention [26], preferably TURP as the gold standard [9] or simple prostatectomy for larger glands, though this latter approach may be more challenging in a reoperative setting. The effectiveness of other endoscopic technologies in secondary prostatic operations remains poorly understood.

If non-obstructive, non-retentive DO with or without incontinence is suspected and differential considerations (infection, malignancy, neurologic processes) have been excluded or addressed, then pharmacologic management with anticholinergic medications or mirabegron is reasonable [22, 29]. If symptomatology in refractory cases remains consistent with OAB after an appropriate duration of therapy, then consideration can be given to minimally invasive interventions such as intradetrusor onabotulinumtoxinA injections or neuromodulation (sacral or percutaneous tibial) following patient counseling and selection. In rare cases, patients with end-stage bladders may consider more extreme measures such as urinary diversion or augmentation cystoplasty.

Management of detrusor hypocontractility (underactivity) has unfortunately met limited success with pharmacotherapy such as cholinergic agonists (bethanechol), alpha adrenergic antagonists, and cholinesterase inhibitors. A timed- and double-voiding regimen can be attempted, but depending on the severity of hypocontractility, these patients may likely require clean intermittent catheterization (CIC), suprapubic cystostomy, or chronic urethral catheterization to ensure bladder emptying [30].

While urinary incontinence after BOO surgery for benign indications is more likely due to bladder dysfunction, stress incontinence (SUI) may be the result of sphincteric injury or deficiency [6]. In a Japanese survey, surgery for BPH was noted to represent 10.3 % of all male SUI cases [31], with lower incidences reported in other series: less than 3 % after TURP [28••], 3.7–5.4 % after open simple prostatectomy [32, 33], and 4.9 % at 3 months after HoLEP [34]. Management of post-operative SUI is similar to management of male SUI secondary to other etiologies, beginning with conservative approaches (pads, pelvic floor exercises, biofeedback) and proceeding to surgical approaches such as periurethral injections, slings, or artificial urinary sphincters.

Conclusion

Newer technologies continue to emerge in the surgical treatment of BPH. While most patients exhibit improvement in their LUTS following intervention, persistent or recurrent LUTS remains a prevalent issue in a sizable subset of patients. As pure obstruction only accounts for a minority of post-operative LUTS, thorough evaluation with complete UDS is crucial to assess detrusor contractility, urethral sphincter function, the presence of DO, and incontinence. Such data is important to appropriately guide subsequent therapy and improve patients' QoL.

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Fig. 1.

A simplified proposed algorithm in evaluating and managing LUTS after BOO surgery based on UDS findings (shown in *red text*). Abbreviations: *LUTS* lower urinary tract symptoms, *BOO* bladder outlet obstruction, *H&P* history and physical examination, *AUA-SI* American Urological Association symptom index, *UDS* urodynamics study, *TRUS* transrectal ultrasound, *RUG* retrograde urethrography, *5-ARI* α -reductase inhibitor, *DO* detrusor overactivity, *DU* detrusor underactivity, *BNC* bladder neck contracture, *UTI* urinary tract infection, *CIC* clean intermittent catheterization, *SPT* suprapubic tube