Recent Advances in the Application of Urodynamic Testing in Men - A Review

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Although the incidence of urinary incontinence in men is generally considered to be much lower than in women, the incidence of lower urinary tract symptoms (LUTS) including overactive bladder (OAB) in men increases with age [1]. Women are more likely to be affected by OAB than men. Both men and women with bothersome OAB are significantly more likely to seek treatment, and report the lowest levels of health-related quality of life [2]. Recent concepts of male incontinence have shifted from benign prostatic obstruction (BPO), bladder outlet obstruction (BOO) and post-radical prostatic surgery to other bladder conditions. Other important pathological conditions such as nocturnal enuresis and post-micturition dribbling are also clinically relevant [3]. Herein we review recent advances in the application of urodynamic testing for investigation and treatment of incontinence or related LUTS in men.

URODYNAMIC TESTING OF DETRUSOR OVERACTIVITY AND OVERACTIVE BLADDER IN MEN

It has been estimated that 29.8 million adults aged ≥40 years in the United States have bothersome OAB symptoms. The prevalence of OAB symptoms at least "sometimes" was 27.2% in men [3]. The prevalence of moderate/severe urinary incontinence was 4.5% (95% confidence interval [CI] 3.8, 5.4) in men. Prevalence increased with age from 0.7% (95% CI 0.4, 1.6) at 20 to 34 years old, to 16.0% (95% CI 13.0, 19.4) at 75 years old or older ($p<0.001$) [4]. Among LUTS, storage LUTS was more prevalent than voiding or post-micturition LUTS in men (44.6%, 28.5%, and 15.9%, respectively). The most prevalent LUTS was nocturia (36.6%) in men [5]. There was a significant negative correlation between the pretreatment mean score on the International Consultation on Incontinence Questionnaire, Short-Form and the first sensation to void and a positive correlation between the same score and maximum detrusor pressure [6].

Men with LUTS commonly experience coexisting storage, voiding, and postmicturiton symptoms [7] LUTS, OAB, urinary incontinence, and LUTS/BOO are highly prevalent conditions, emphasizing the need for comprehensive urological assessment of LUTS in men [7,8]. Treatment options for urinary incontinence are rapidly expanding. Initial management includes basic diagnostic tests to exclude an underlying disease or condition such as urinary tract infection. Treatment is mostly conservative (lifestyle interventions, physiotherapy, physical therapy, pharmacotherapy) and is of an empirical nature [9].

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OAB and urinary incontinence symptom severity progress dynamically and are also sustained over time. Although symptom severity progresses dynamically, for many individuals, symptoms also persist over long time periods [10]. The overall incidence of detrusor overactivity (DO) was 76.1% in male OAB patients, and 63% of men with urgency (OAB dry) had DO, while 93% of men with urgency and urgency urinary incontinence (OAB wet) had DO. There was a better correlation in results between OAB symptoms and the urodynamic diagnosis of DO in men than in women, and more so in OAB wet than in OAB dry [11]. A high urgency severity score recorded in conjunction with a voiding diary and OAB wet were strongly associated with urodynamic DO [12].

DO involves enhanced detrusor contraction strength levels, particularly in patients who feel urgency, suggesting detrusor contraction velocity may have a role in causing urgency and urgency may have a role in enhancing and sustaining involuntary voiding detrusor contractions in patients with DO [13]. Fifty-two of 84 patients with benign prostatic hyperplasia (BPH)-DO reported urgency. BPH patients with DO may neglect urgency because of abnormal bladder sensation, or negate the symptom by subconscious sphincter contraction to abort the overactivity [14]. The first sensation ratio and bladder urgency velocity statistically significantly correlated with the Urgency Perception Score.

Urodynamic variables correlated with bladder sensation questionnaire scores and may be an objective method to assess sensory dysfunction [15]. Increased bladder sensation without DO occurs mainly in peripheral and central sensory pathway lesions, as well as in basal ganglia lesions and psychogenic bladder dysfunction. Reduced bladder sensation is defined as a bladder volume at the first sensation >300 mL. Increased bladder sensation is defined as a bladder volume at the first sensation <100 mL. Neuropathies are the most common cause of reduced bladder sensation (33.3%-43.8% in diabetic neuropathy. In contrast, myelopathies are the most common cause of increased bladder sensation without DO (25.0%-40.0% in spinal forms of systemic lupus erythematosus, Sjogren's syndrome) [16].

Idiopathic detrusor underactivity implies a two-stage development [17]. Patients with this condition could be divided into 3 groups. Group 1, with a low maximum possible detrusor contraction velocity, low isovolumetric detrusor pressure and a bladder emptying efficiency less than 67%, group 2, with a low maximum possible detrusor contraction velocity, low isovolumetric detrusor pressure and a bladder emptying efficiency of 67% or greater, and group 3 with a low maximum possible detrusor contraction velocity, normal isovolumetric detrusor pressure and a bladder emptying efficiency of 67% or greater [18].

During filling cystometry, rectal contractions are frequently detected, but their clinical significance has not been investigated. Bladder compliance was decreased and bladder trabeculations were more common in patients with rectal contractions. The occurrence of rectal contractions was correlated with the development of cerebrovascular accidents in men, indicating an intact reflex arc and cross talk between the lower urinary tract and lower bowel tract [19]. Ambulatory urodynamics is the most sensitive tool to detect or exclude DO. Therefore, the method is valuable when all other diagnostic means have failed to detect the underlying lower urinary tract dysfunction [20].

LUTS in men is highly prevalent [3,4] and storage LUTS is more prevalent than voiding or postmicturition symptoms [5]. Although OAB wet is usually associated with urodynamic DO, OAB symptoms might involve other bladder dysfunctions or outlet disorders. Initial treatment based on predominant symptoms without urodynamic testing is encouraging, but a urodynamic test is recommended when the initial management fails to resolve storage LUTS.

LOWER URINARY TRACT SYMPTOMS RELATED TO BLADDER DYSFUNCTION

The prevalence of incontinence ranges from 11% to 34% among community-dwelling men > or =65 years old. BPH-related incontinence may be related to progression of BPH or could be a postsurgical complication [21]. Significantly more patients (14%) reported reduced sexual activity and decreased enjoyment of sexual activity because of LUTS, and significantly fewer cases were satisfied with their sex lives compared with controls [22].

Among 1,418 men investigated (median age: 63 yr), 864 (60.9%) had DO. In univariate analysis, men with DO were significantly older, and had more obstruction, larger prostates, higher irritative International Prostate Symptoms Score (IPSS) subscores, a lower voiding volume on free uroflowmetry, and a lower bladder capacity on cystometry than men without DO. In patients with clinical BPH, DO was independently associated with age and BOO [23].

LUTS is not equal to BOO due to BPH, young men presenting with LUTS have different underlying etiologies than older men. Urodynamic study is useful in the evaluation of this group of patients. Abnormal urodynamics study variables were noted in 36 (72%) of 50 young men in one study, including DO in 9 (18%), detrusor underactivity (DU)/ acontractility in 5 (10%) and BOO in 21 (42%). Fourteen (28%) had primary bladder neck dysfunction and five (10%) had BPH [24].

LUTS can result from a complex interplay of pathophysiologic features that can include bladder dysfunction and bladder outlet dysfunction such as BPO or poor relaxation of the urethral sphincter. About one third of men with LUTS who were older than 55 years of age had BPO. Patients younger than 55 years old were more likely to have poor relaxation of the urethral sphincter as a likely cause of LUTS [25]. In a group of men with LUTS and small prostates (mean prostate volume 29.2 +/- 7.2 mL and mean IPSS 13.5 +/- 4.6) BOO was the main finding, affecting 42 (50.0%) patients, followed by DU in 41 (48.8%) and DO in 28 (33.3%) patients. The results emphasize the value of urodynamics in this population, especially when invasive treatments are being considered [26].

Recent studies have demonstrated the time to flow is an effective uroflometric parameter demonstrating urinary hesitancy [27]. When evaluating uroflowmetry in elderly male patients with LUTS, relatively strong relationships were found between the average flow rate and scores of intermittency, weak stream and total and voiding symptom scores, suggesting that the time-dependent function in micturition interferes with the manifestation of LUTS in elderly men who have borderline or pathologic maximum flow rates [28].

In a retrospective study of 384 patients one year after they had undergone transurethral resection of the prostate (TURP) for symptomatic benign prostatic enlargement, Seki et al showed that the baseline DO negatively affected outcomes as assessed by the IPSS and quality of life index [29]. However, in another study, 95% of men had improved flow rates 12 months after TURP regardless of whether they had a preoperative urodynamic diagnosis of BOO and bladder dysfunction. The results suggest urodynamic study does not improve the outcome after TURP [30].

After holmium laser enucleation of the prostate, 29 patients (16.2%) had de novo urinary incontinence, most of which resolved within 1-6 months; the maximum urethral closure pressure on baseline urodynamics was an independent predictor of de novo urinary incontinence after surgery [31]. Urodynamics study was used to assess functional outcomes following photoselective vaporization of the prostate. All patients showed significant improvement in the IPSS in urinary peak flow and detrusor pressure at peak flow. Detrusor contractility was also not affected in any patients [32].

Urodynamics study should be used for investigation of new treatment modalities and establishment of diagnoses whenever they are in doubt. Urodynamics study does not appear to be necessary before pelvic floor muscle training, medical treatment of LUTS/BPO or OAB, surgical treatment of primary female stress urinary incontinence (SUI) or prolapse [33]. Silodosin appears to improve DO and the obstruction grade in patients with BPH. With silodosin treatment, LUTS could be managed effectively for more than a year in at least 44% of the patients [34].

Urodynamic testing is frequently used to evaluate the therapeutic effects of pharmacological treatment on DO or OAB. A significant increase in bladder capacity during cystometric study was shown only in patients with DO. However, no statistically significant improvement was shown in patients without DO. It is important to conduct a urodynamic study in patients with OAB, to check for DO. Treatment with solifenacin was shown to be effective only in patients with involuntary detrusor contractions on cystometric study [35].

One study assessing whether urodynamics is a prerequisite for the treatment of OAB revealed that urodynamics status could not predict treatment outcomes between patients treated with tolterodine-ER or a placebo. The authors reported that anticholinergic treatment may be initiated in patients with OAB symptoms without the need for urodynamics studies [36].

An assessment of neurogenic bladder dysfunction in patients with spinal cord injury, showed that 18.8% of patients underwent surgery in a long term follow-up. For protection of the upper urinary tract and maintenance of continence, regular urodynamic follow-up is warranted [37]. A detrusor leak point pressure of more than 75 cmH_2O was found to be a statistically significant risk factor ($p=0.04$) for upper urinary tract deterioration in patients with neurogenic detrusor overactivity [38].

Male LUTS may originate from bladder dysfunction or bladder outlet disorders. DO and urethral sphincter dysfunction should also be considered in young men with LUTS or small prostates. Urodynamic testing is indicated especially when male patients with LUTS are ready to undergo invasive therapy for LUTS, such as TURP or laser prostatectomy. More clinically objective parameters should be investigated to provide high correlation with urodynamic results such as BOO or DO to achieve a higher success rate in the treatment of LUTS in men.

POST-PROSTATECTOMY INCONTINENCE

Kondo et al [39] found the most common etiology of urinary incontinence following surgery for BPH or prostatic cancer was sphincter weakness (causing urodynamic stress incontinence, 34%), followed by sphincter weakness plus DO (33%), and DO incontinence alone (26%). Urinary incontinence was more prevalent in men who were obese and physically inactive (59% incontinent) after prostatectomy. The best outcomes were in men who were nonobese and physically active (16% incontinent). Pre-prostatectomy physical activity and obesity may be important factors in post-prostatectomy continence levels [40].

Preoperative DO was not associated with worse postoperative outcomes. Men with urodynamic SUI and DO may also be considered for a male sling procedure [41]. Because obesity and physical inactivity are important factors for postprostatectomy incontinence, pelvic floor exercise might be encouraged to improve incontinence after prostatectomy.

Kuo evaluated 185 men from 55 to 91 years old who had variable LUTS after TURP and were refractory to conventional treatment. He found that urinary incontinence was present in 74 patients (40%) and that BOO and DO with impaired contractility were the most common findings associated with post-prostatectomy incontinence, followed by DO [42]. Since these diagnoses imply quite different treatments, urodynamic investigation has an important role.

Post-prostatectomy incontinence is usually caused by sphincter damage as a complication of the surgery, but may result from other causes. In one study, urodynamics showed no significant changes in filling or voiding parameters. The increases in maximum urethral closure pressure and functional urethral length were not statistically significant [43]. After holmium laser enucleation of the prostate, 29 patients (16.2%) had de novo urinary incontinence, most of which resolved within 1-6 months; 11 had SUI, 12 had urgency urinary incontinence, and the remaining 6 had mixed urinary incontinence. The maximum urethral closure pressure on baseline urodynamics was found to be an independent predictor of de novo urinary incontinence after surgery [31].

In a study of functional outcome following photoselective vaporization of the prostate assessed by urodynamic study, all patients showed significant improvement in the IPSS in urinary peak flow and detrusor pressure at peak flow. The mean post-void residual urine volume decreased, while erectile function and libido scores remained unaffected by the procedure according to the international index of erectile dysfunction. Detrusor contractility was also not affected in any of the patients [32].

Postprostatectomy LUTS might be due to either bladder dysfunction or bladder outlet disorders. Urinary incontinence is likely caused by DO or urethral incontinence. Therefore, urodynamic testing is recommended to search for the underlying pathophysiology.

RADICAL PROSTATECTOMY AND RADIOTHERAPY

With the evolution of surgical techniques, an increasing number of radical prostatectomies for early prostatic cancer are being performed. Radical retropubic prostatectomy for prostatic cancer results in a much higher incidence of post-prostatectomy incontinence than TURP. A nerve sparing (NS) technique used during radical cystoprostatectomy was shown to improve the continence outcome of orthotopic diversion in patients with invasive bladder carcinoma. Better urethral pressure profile parameters were found in patients in the NS group. Significantly longer functional urethral length (34.8 mm) was detected in NS group than in the non-NS group (30.1 mm). Moreover, the maximum urethral pressure was higher in the NS group but not to a statistically significant level [44].

The main cause of incontinence after retropubic radical prostatectomy is sphincter weakness. In the continent group, those who became immediately continent had significantly higher maximum urethral closure pressure values at rest and during voluntary sphincter contractions even before the surgery. Ten patients (15.9%) were immediately continent after catheter removal. Urodynamic stress incontinence was detected in 18 (28.6%), and DO incontinence in 2 (3.2%) patients 2 months after surgery [45].

Male stress incontinence is mainly caused by sphincter lesions, representing the majority of incontinent patients after retropubic radical prostatectomy. In one study, two-thirds of patients were continent after 6 months, whereas one-third still suffered from incontinence. The maximum urethral closure pressure and functional profile length in the stress incontinence group had decreased significantly compared with the continent group (66.2 +/- 26.4 vs 21.0 +/- 13.6 cmH_2O, p< or = 0.001; and 11.4 +/- 3.7 and 8.2 +/- 3.7 mm, p=0.05), accompanied by a characteristic urethral pressure profile configuration. Postoperative urodynamics after 6 months may be predictive of persistent incontinence at the bladder, the sphincter, and both [46]. For men leaking with and without a urethral catheter, the abdominal leak point pressure (ALPP) was significantly different, 86.3 and 67 cmH_2O, respectively (p =0.002). The men who leaked only in the absence of the urethral catheter had significantly higher ALPPs (p<0.001) [47].

Another study investigated if ALPP correlates with objective incontinence severity in patients suffering from post-prostatectomy SUI. There was only a weak inverse correlation between the ALPP and 24-hr pad weight which was not statistically significant. Age and time from prostatectomy did not significantly correlate with the ALPP. The ALPP was considered a relatively poor predictor of incontinence severity and, therefore, has limited clinical value in the urodynamic evaluation of post-prostatectomy incontinence [48].

Several series on robot-assisted radical prostatectomy have reviewed the impact of the initial learning curve on perioperative outcomes. Outcomes between groups (consecutive cases 1-300, 301-500, and 501-700) were compared. Self-reported and questionnaire-assessed continence rates improved to 93% and 75%, respectively, for cases 501-700 (p<0.05). Furthermore, significant improvement in continence rates between consecutive case groups was observed at all postoperative time points. Urinary continence improves with increased RARP experience in robot-assisted radical prostatectomy [49]. The main cause of urinary incontinence after retropubic radical prostatectomy is sphincter weakness whereas DO only slightly contributes to urinary incontinence. A high maximal urethral closure pressure or ALPP indicates greater urethral sphincter resistance. An NS surgical technique provides a better continence rate after this procedure. Although urinary incontinence after retropubic radical prostatectomy improves with time, postoperative urodynamics after 6 months may be predictive of persistent incontinence at the bladder, the sphincter, and both [46].

The pathophysiology and severity of persistent LUTS in men after brachytherapy differs from that of men with LUTS in the general population. Men had much higher incidences of DO, prostatic and urethral strictures and prostatic urethral stones after brachytherapy in one study. DO was present in 252 of 541 (47%) men with unselected causes of LUTS vs 28 of 33 (85%) in men with LUTS due to brachytherapy, (p <0.001); urethral obstruction was seen in 374 of 541 (69%) unselected cases vs 24 of 33 (73%) brachytherapy patients (p=0.85) [50].

The quality of life was assessed following radical prostatectomy, high dose external beam radiation therapy and brachytherapy iodine implantation as monotherapies for localized prostate cancer. There was better urinary continence in those who underwent radiation-based therapies, and better bowel function and less urinary irritation in those who underwent surgery. Sexual function was impaired across all monotherapies but higher scores were seen in men who selected brachytherapy [51].

ARTIFICIAL URINARY SPHINCTER AND MALE SLING

The presence of adverse preoperative urodynamic features did not negatively affect the continence results after artificial urinary sphincter (AUS) implantation in patients with postprostatectomy incontinence. Poor bladder compliance <10 mL/cm, the presence of DO, early sensation of bladder filling at <75 mL, an early first desire to void at <125 mL, reduced cystometric capacity of <200 mL, low ALPP of <30 cmH_2O, low peak flow of <10 mL/s, low detrusor pressure at peak flow of <10 cm, or a bladder contractility index of <100 did not negatively affect the post-AUS daily pad use (p>0.05) [52].

Recent advances in the male suburethral sling have greatly increased the continence rate of patients with postprostatecomy incontinence. After a median followup of 27 months (range 14 to 57) the Argus sling was successful in 72% of patients (68 of 95). Mild incontinence (1 to 2 pads per 24 hours) was treated in 13 patients, moderate incontinence (3 to 5 pads per 24 hours) in 46 and severe incontinence (more than 5 pads per 24 hours) in 41. Success rates stratified to degree of incontinence were 92% (12 of 13), 67% (29 of 43) and 67% (26 of 39), respectively [53].

Transobturator tape, a novel procedure for treatment of post-radical prostatectomy incontinence, was shown to be effective and well accepted by patients. The mean urethral closure pressure improved from 13.2 (8-22) to 86.4 (70-100) cmH_2O following placement of the tape. The membranous urethral length increased from a mean 3 (0-7) to 17.2 (10-22) mm following tensioning of the tape [54].

At the 12-month follow-up, 73.7% of the men with postprostatectomy incontinence treated with a transobturator retroluminal repositioning sling were cured, 16.9% improved, and 9.3% were still incontinent. The detrusor voiding pressure, postvoid residual urine volume and maximal flow rates remained unchanged, while the Valsalva leak-point pressure improved significantly (p<0.01) [55].

The newly designed AdVance male sling is a treatment option for postprostatectomy incontinence, with the goal of eliminating urinary incontinence without affecting voiding parameters. A concern of any procedure in treating men with postprostatectomy incontinence is whether the treatment induces obstruction and causes retention. The Valsalva leak point pressure improved significantly (p=0.032), but the detrusor voiding pressure, post void residual volume, and maximal and average flow rates remained relatively unchanged. At 3 and 6 months postoperatively, incontinence qualitiy of life scores had improved significantly compared with preoperative scores (p<0.01) [56].

The fixed urethral resistance of the perineal male sling for the treatment of stress incontinence does not cause significant BOO or de novo voiding dysfunction. The average maximum flow rate did not change significantly (17.7 +/- 6.5 vs 19.2 +/- 9.7 mL per second, p=0.6) and there was no significant change in detrusor pressure at maximum flow rate (40.3 +/- 9.2 vs 45.8 +/- 14.7 cm water, p=0.3). However, the pad use, leak point pressure, and urinary incontinence scores were significantly improved after sling surgery [57].

Overall, urodynamic variables do not provide predictive value for incontinence surgery for male postprostatectomy incontinence. Urodynamic variables also do not show significant changes after suburethral sling procedures or AUS implantation. Nevertheless, the leak point pressure and degree of urinary incontinence are significantly improved after antiincontinence operations.

NEUROGENIC VOIDING DYSFUNCTION

In a study of patients after stroke during post-acute rehabilitation, the admission prevalence for isolated urinary incontinence was 12.4%, for isolated fecal incontinence 7.6% and for double incontinence 33%. At discharge, the prevalence had decreased, to 8.1% for isolated urinary incontinence, 4.9% for isolated fecal incontinence and 15.1% for double incontinence. Double incontinence was more prevalent than isolated incontinence in these patients [58]. The post-stroke urinary incontinence was a predictor of greater mortality at 1 week, 6 months and 12 months after stroke. Patients who regained normal bladder control in the first week had have a prognosis comparable to patients who do not have micturition disturbances following stroke [59].

Evaluation of the stroke type may be helpful in determining the type of urinary dysfunction and deciding the appropriate bladder management. Patients with ischemic strokes had higher rates of DO (70.7%), and lower rates of DU (29.3%), compared with those with hemorrhagic strokes (DO, 34.6%; DU 65.4%) (p=0.003) [59]. In patients with stroke and voiding dysfunction, careful urodynamic study should be performed to identify BOO or dysfunctional voiding. Voiding dysfunction is also a significant problem in patients with head injury. Bladder hyperreflexia is seen in patients with injuries above the pontine micturition center. The voiding abnormality has good prognosis and resolves spontaneously [60]. Twenty-five (62.5%) of 36 patients with stroke and overactive detrusor (OD), had OD without sphincter dyssynergy and 11 (27.5%) had OD with sphincter dyssynergy. Urodynamic study is a useful tool to assess and manage the bladder following stroke with urinary incontinence. No significant correlation was found between urodynamic study findings and the site of the lesion [61].

A urodynamic study of bladder dysfunction was done in patients with idiopathic normal pressure hydrocephalus. LUTS were seen in 93% of the patients, with storage symptoms (93%) being more common than voiding symptoms (71%) and urinary urgency (OAB) (64%)/ frequency (64%) being more common than urinary incontinence (57%). Although the majority of patients had normal bladder volumes at the first sensation (mean 134 mL), bladder capacity was small (mean 200 mL) and DO was seen in 95% of patients [62].

The most prevailing urinary symptom in one study of idiopathic Parkinson's disease was nocturia (77.5%) followed by urgency (36.7%) and frequency (32.6%). Urodynamic tests revealed neurogenic detrusor overactivity in 33 patients (67.3%), DU in 6 patients (12.2%), and normal detrusor function in 10 (20.4%) patients. However, there was no significant correlation with any of the urodynamic parameters or disease severity. Irritative urinary symptoms manifesting urodynamically as neurogenic detrusor overactivity are more common than obstructive symptoms in patients with idiopathic Parkinson's disease [63].

Urinary dysfunction, manifesting primarily as storage disorders with subclinical voiding disorders and normal anal-sphincter electromyography, occurs in early and untreated Parkinson's disease patients. Urodynamic studies showed abnormal findings in the storage phase in 84%, with DO and increased bladder sensation without DO in 58.0% and 12.0% of patients, respectively. In the voiding phase, DU, impaired urethral relaxation such as detrusor sphincter dyssynergia, and BOO were present in 50.0%, 8.0% and 16% of patients, respectively. In patients with both storage and voiding phase abnormalities, DO+DU was the most common finding [64,65].

One study investigated LUTS and urodynamic and cystometric findings in patients with Parkinson's disease, dementia with Lewy bodies, and Alzheimer disease. Urgency and urge incontinence suggested DO, which was more prevalent in dementia with Lewy bodies than in Parkinson disease and Alzheimer disease, whereas the mean voided volume, free flow, cystometric bladder capacity, and detrusor pressor were similar in the groups; DO was seen in 92% of the patients with dementia with Lewy bodies, 46% of the patients with Parkinson's disease, and 40% of the patients with Alzheimer disease [66].

DIABETES MELLITUS

Men with diabetes mellitus (DM) and LUTS can present with varied urodynamic findings, apart from the classic sensory or motor cystopathy. Urody-namic studies showed impaired first sensation (>250 mL), increased capacity (>600 mL), DU, DO, high postvoid residual urine volume (more than one third of capacity), and BOO (Abrams-Griffiths number >40) in 23.1%, 25.0%, 78.8%, 38.5%, 65.4%, and 28.8% of men, respectively [67].

One study reevaluated urodynamic findings of bladder dysfunction in type 2 diabetic patients with patient characteristics and concomitant chronic complications. Bladder dysfunction was present in 74.07% of men (diabetic cystopathy, 50%; BOO, 25%; DO, 25%). Diabetic cystopathy was the most frequent finding in patients. Ageing, duration of diabetes, worse metabolic control, post void residual ≥100 mL, cardiac, esophageal and gastric parasympathetic autonomic neuropathies, retinopathy, and microalbuminuria provided a means to predict bladder dysfunction in patients in order to investigate by urodynamics [68]. Patients with DM who undergo a radical cystoprostatectomy take longer to regain daytime and, even more so, nighttime continence than nondiabetic patients [69].

There is a relatively low prevalence of BOO in diabetic patients with prostate enlargement and LUTS. Twenty-three of the 50 (46%) patients in one study had BOO. There was no correlation between the IPSS, uroflowmetry, post-voiding residual urine or prostate volume and the presence of BOO (p>0.05). Non-invasive tests did not allow the identification of these subjects. Only urodynamic evaluation was able to determine symptom etiology [70].

Men with DM and LUTS can present with varied urodynamic findings, including DO, DU and BOO. Non-invasive tests do not allow the identification of these subjects. Only urodynamic evaluation is able to determine symptom etiology [70].

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