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Original Article - Voiding Dysfunction

# Chronic Lower Urinary Tract Symptoms in Young Men Without Symptoms of Chronic Prostatitis: Urodynamic Analyses in 308 Men Aged 50 Years or Younger

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**Purpose:** We investigated the etiologies of lower urinary tract symptoms (LUTS) and compared urodynamic characteristics between different diagnostic groups in young men with chronic LUTS.
**Materials and Methods:** We reviewed the medical records of 308 men aged 18 to 50 years who had undergone a urodynamic study for chronic LUTS (≥6 months) without symptoms suggestive of chronic prostatitis.
**Results:** The men's mean age was 40.4 (±10.1) years and their mean duration of symptoms was 38.8 (±49.2) months. Urodynamic evaluation demonstrated voiding phase dysfunction in 62.1% of cases (primary bladder neck dysfunction [PBND] in 26.0%, dysfunctional voiding [DV] in 23.4%, and detrusor underactivity [DU]/acontractile detrusor [AD] in 12.7%) and a single storage phase dysfunction in 36.4% of cases (detrusor overactivity [DO] in 13.3%, small cystometric capacity in 17.9%, and reduced bladder sensation in 5.2%). Most of the demographic characteristics and clinical symptoms did not differ between these diagnostic groups. Whereas 53.9% of patients with voiding dysfunction had concomitant storage dysfunction, 69.6% of those with storage dysfunction had concomitant voiding dysfunction. Men with DV or DU/AD exhibited lower maximum cystometric capacity than did those with normal urodynamics. Low bladder compliance was most frequent among patients with PBND (10.0%, p=0.025). In storage dysfunctions, men with DO exhibited higher detrusor pressure during voiding than did those with other storage dysfunctions (p<0.01).
**Conclusions:** Because clinical symptoms are not useful for predicting the specific urodynamic etiology of LUTS in this population, urodynamic investigation can help to make an accurate diagnosis and, potentially, to guide appropriate treatment.

***Keywords:*** *Age groups; Men; Prevalence; Urinary bladder disease; Urodynamics*



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## INTRODUCTION

The prevalence of lower urinary tract symptoms (LUTS) in men has been clearly shown to increase with age [1]. Although the etiologies of LUTS in aged men are well understood, relatively little research effort has been devoted to studying LUTS in adolescents and young men. Chronic LUTS in young men often pose a diagnostic dilemma. Obtaining a clinical diagnosis on the basis of the history of symptoms and physical examination alone is often not possible for chronic LUTS in adolescents and young men [2]. However, detailed investigations are often not performed in the belief that they will be inconclusive. Therefore, diagnosis is often empiric, and most patients are diagnosed with nonbacterial prostatitis, simple overactive bladder syndrome, or psychogenic voiding dysfunction.

Recent research has focused on bladder and urethral dysfunction as a cause of LUTS and pelvic pain in young men, and urodynamic investigation has enhanced awareness of possible etiologies of chronic LUTS in adolescents and young men. To date, some specific urodynamic etiologies have been described as a cause of chronic LUTS in adolescents and young men [2-8]. Of these, primary bladder neck dysfunction (PBND) has been reported to be the most frequent, followed by dysfunctional voiding (DV), detrusor overactivity (DO), and detrusor underactivity (DU)/acontractile detrusor (AD). Because the management strategy differs for each urodynamic diagnosis, accurate diagnosis with urodynamic testing may be helpful in counseling the patient on the most appropriate treatment.

Previous studies concerning this issue considered only small populations and focused on young men who had previously been diagnosed with chronic prostatitis. We investigated the etiologies of LUTS and compared the urodynamic characteristics between different diagnostic groups in young men with chronic LUTS who did not have symptoms suggestive of chronic prostatitis. To the best of our knowledge, there have been no large studies of LUTS in young men without symptoms suggestive of chronic prostatitis. In addition, we examined the treatment patterns in this population.

## MATERIALS AND METHODS

We reviewed the medical records of male patients aged 18 to 50 years who had undergone a urodynamic study for work-up of LUTS at our institution between May 2003 and May 2013. The institutional review board of our institution approved the study protocol. All of the cases were reviewed, and patients who had experienced symptoms for less than 6 months and those with a neurogenic abnormality, diabetes mellitus, or interstitial cystitis that affected micturition function; a history of surgery on the lower urinary tract; anatomical deformation of the lower urinary tract such as urethral stricture; or impairment of general health that affected voiding, such as having recently undergone surgery, were excluded. In addition, patients with pelvic or inguinal pain or bacterial infection or more than 10 leukocytes in expressed prostatic secretions (EPS) at any time before the urodynamic study were excluded from the study population.

The initial evaluation of patients presenting with LUTS at our institution consists of taking a history of the LUTS and performing a physical examination, followed by having the patient document an International Prostate Symptom Score (IPSS), overactive bladder symptom score (since 2008), and a 3-day frequency-volume chart (FVC), including the urinary sensation scale at every voiding [9]. Episodes of urgency were defined as those with a urinary sensation scale rating of $\geq 3$. Free uroflowmetry (DABA, Endo tech, Seongnam, Korea) and measurement of the postvoid residual volume (BladderScan BVI-3000, Verathon Inc., Bothell, WA, USA) were performed before urodynamic evaluation. The result showing a higher maximum flow rate (Qmax) was selected from two sets of uroflowmetry measures with a voided volume over 150 mL.

After discontinuation of all drugs that could possibly affect micturition function for at least 3 to 7 days, a multichannel urodynamic study (UD-2000, Medical Measures System B.V., Enschede, The Netherlands), including a pressure-flow study (PFS), was carried out in accordance with the guidelines of the International Continence Society [10]. A 6-Fr double-lumen catheter and a 9-Fr balloon catheter were used to measure the transurethral intravesical and abdominal pressures in all of the urodynamic studies. Pelvic floor electromyography was performed by using surface electrodes attached near the anus at the 3 and 9 o'clock positions. Intravesical pressure was recorded under conditions of room-temperature saline infusion at 50 mL/min. However, the filling rate was decreased to 20 mL/min in patients with severe storage symptoms or a lower functional bladder capacity according to the results of the 3-day FVC. Bladder compliance was considered reduced when the $\Delta V/\Delta pdet$ was $\leq 20$ mL/cm $H_2O$. During the PFS, the patient was instructed to void in a standing or sitting position under quiet and relaxed circumstances. If the first voiding trial failed, an additional trial was performed to allow for the possibility that the failure was due to cortical inhibition.

The patterns of initial treatment after a specific urodynamic diagnosis were examined. Because the present study was conducted retrospectively, the treatment efficacy data retrieved had not been collected according to uniform criteria. Therefore, we excluded the relevant data from the analyses.

The clinical urinary symptoms were divided into 3 categories: storage LUTS ($\geq 8$ episodes of frequency per day, $\geq 2$ episodes of nocturia per night, or $\geq 3$ episodes of urgency or urgency urinary incontinence on a 3-day FVC), voiding LUTS (intermittency score $\geq 3$, weak stream score $\geq 3$, or straining score $\geq 3$ on the IPSS), and postmicturitional LUTS (incomplete emptying score $\geq 3$ on the IPSS).

The findings of urodynamic testing were classified as storage and voiding phase abnormalities. PBND, DV, DU, and AD were considered to represent voiding phase dysfunction and DO, small cystometric capacity, and reduced bladder sensation were considered to represent storage phase disorders. The urodynamic diagnosis was made on the basis of the retrospective interpretation by the two investigators (S.J.J and S.C.L.) who were blinded to the patients' clinical characteristics. Both of two investigators agreed if the patient had a specific urodynamic diagnosis. PBND was diagnosed if bladder outlet obstruction, defined as an Abrams-Griffith (AG) number of 40 or greater or 20–39.9 with a slope of the linear passive urethral resistance ratio of $>2$ cm $H_2O$/mL/s, where the AG number was calculated as the detrusor pressure at Qmax (PdetQmax)–2Qmax [11], was present concomitant with electromyography evidence of external sphincter relaxation, and neither urethral stricture nor prostatic enlargement was observed in urethrocystoscopy and transrectal ultrasonography (TRUS) [12], which were performed only in suspected cases in our young population.

DV was diagnosed on the basis of the electromyography activity of the external sphincter/pelvic floor during voiding in the absence of abdominal straining. If DV was diagnosed during a PFS, a free uroflow measurement was performed in a private setting to identify undulating intermittent increases and decreases in flow. If patients exhibited DV in a PFS and free uroflow, we repeated the same procedure in an effort to reduce false positive results caused by performance anxiety or bashful voiding during the urodynamic evaluation [7]. We performed an additional voiding cystourethrography (VCUG) in cases with equivocal findings of PBND or DV during PFS.

DU was diagnosed when the AG number was less than 20 and the Qmax was less than 12 mL/s during a PFS and no obstruction was recognized in urethrocystoscopy or TRUS [2]. For the purpose of classification of cases with the absence of a detrusor contraction during 2 consecutive PFS, patients with a measureable uroflow during free uroflow were considered to have DU and those who did not generate a measureable uroflow in free uroflow were regarded as having an AD [6].

Patients were regarded as positive for idiopathic DO if a spontaneous or provoked involuntary detrusor contraction was observed during the filling cystometry [10]. Maximum cystometric capacity was defined as the volume at which the patient felt that he could no longer delay micturition [13] and small bladder capacity was defined as a maximum cystometric capacity of $<350$ mL [8]. Reduced bladder sensation was defined as a diminished bladder sensation during filling cystometry [13].

After assessment of the urodynamic etiologies of LUTS, comparisons among specific urodynamic etiologies were analyzed by a one-way analysis of variance with Scheffe's method for multiple comparisons or by linear by linear association depending on the type of variable. The collected data were presented as the mean±standard deviation or as the number (percentage). The IBM SPSS ver. 19.0 (IBM Co., Armonk, NY, USA) was used, and a 2-tailed p value of $<0.05$ was determined to indicate statistical significance.

## RESULTS

A total of 308 young men who did not meet any of the exclusion criteria were included for analysis. Mean age was 40.4 (±10.1) years and mean symptom duration was 38.8 (±49.2) months. Storage LUTS were present in 247 men (80.2%), voiding LUTS in 166 men (53.9%), and postmicturitional LUTS in 129 men (41.9%). Table 1 shows the urodynamic diagnoses categorized by voiding phase and storage phase dysfunctions in all patients. Seventy-nine patients (25.6%) had normal urodynamic findings. Among the total patient population, the incidence of PBND was highest among those in their 30s (p=0.04) and that of DO was highest among those in their 40s (p=0.03) (Fig. 1). In addition, small bladder capacity was more prevalent among men under 40 years of age (p=0.03). DV was more frequent among those under 40 years of age, but the difference was not significant (p=0.18).

The clinicodemographic and urodynamic characteristics of men with urodynamically defined voiding phase and storage phase dysfunction are shown in Tables 2, 3. The demographics and types of clinical symptoms were not significantly different between the diagnostic groups except for storage LUTS in distinguishing the type of storage ur-

**TABLE 1.** Urodynamic diagnoses in 308 young men with chronic lower urinary tract symptoms

| Variable | No. (%) |
|---|---|
| Voiding phase dysfunction | |
| PBND | |
| Total | 80 (26.0) |
| Alone | 43 (14.0) |
| With storage dysfunctions | 37 (12.0) |
| With other voiding dysfunctions | 0 (0) |
| DV | |
| Total | 72 (23.4) |
| Alone | 25 (8.1) |
| With storage dysfunctions | 47 (15.3) |
| With other voiding dysfunctions | 0 (0) |
| DU/AD | |
| Total | 34/5 (12.7) |
| Alone | 17/3 (6.5) |
| With storage dysfunctions | 17/2 (6.2) |
| With other voiding dysfunctions | 0 (0) |
| Storage phase dysfunction | |
| DO | |
| Total | 70 (22.7) |
| Alone | 11 (3.6) |
| With other storage dysfunctions | 5 (1.6) |
| With voiding dysfunctions | 30 (9.7) |
| With both other storage and voiding dysfunctions | 24 (7.8) |
| SC | |
| Total | 83 (26.9) |
| Alone | 15 (4.9) |
| With other storage dysfunctions | 5 (1.6) |
| With voiding dysfunctions | 40 (13.0) |
| With both other storage and voiding dysfunctions | 23 (7.4) |
| RBS | |
| Total | 18 (5.8) |
| Alone | 8 (2.6) |
| With other storage dysfunctions | 0 (0) |
| With voiding dysfunctions | 8 (2.6) |
| With both other storage and voiding dysfunctions | 2 (0.6) |

Seventy-nine patients (25.6%) had normal urodynamic findings. Low bladder compliance ($\leq 20$ mL/cm $H_2O$) was found in 16 patients and all these cases were associated with voiding phase or storage phase urodynamic dysfunctions.
PBND, primary bladder neck dysfunction; DV, dysfunctional voiding; DU, detrusor underactivity; AD, acontractile detrusor; DO, detrusor overactivity; SC, small bladder capacity; RBS, reduced bladder sensation.

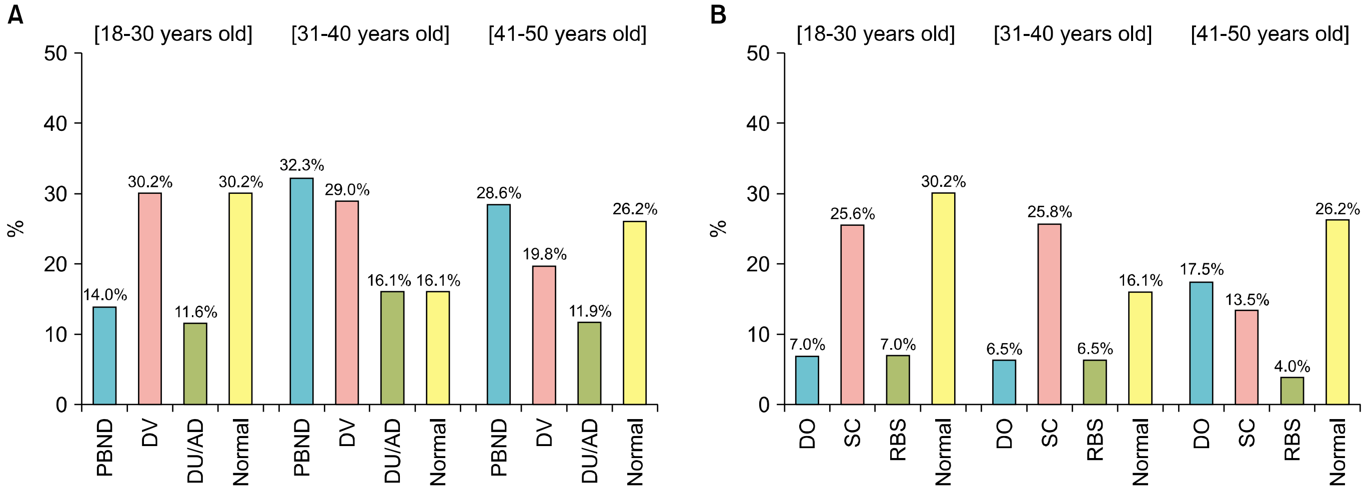


**FIG. 1.** Change in incidence of each specific urodynamic etiology according to patient age. (A) Voiding phase dysfunction, (B) storage phase dysfunction. Among the total patient population, the incidence of PBND was highest among those in their 30s (p=0.04) and that of DO was highest among those in their 40s (p=0.03). SC was more prevalent in men under 40 years of age (p=0.03). PBND, primary bladder neck dysfunction; DV, dysfunctional voiding; DU, detrusor underactivity; AD, acontractile detrusor; DV, dysfunctional voiding; DU, detrusor underactivity; AD, acontractile detrusor; DO, detrusor overactivity; SC, small bladder capacity; RBS, reduced bladder sensation.

**TABLE 2.** Clinicodemographic and urodynamic characteristics of young men with urodynamically defined voiding phase dysfunction

| Characteristic | PBND | DV | DU/AD | Normal urodynamics | p-value |
|---|---|---|---|---|---|
| Patient no. | 80 | 72 | 39 | 79 | |
| Age (y) | 42.6±8.8 | 38±10.4 | 40.4±10.2 | 40.4±10.8 | 0.162 |
| Symptom duration (mo) | 41.5±59.5 | 36.9±40.7 | 47.6±61.4 | 33.5±43.0 | 0.678 |
| Clinical urinary symptom | | | | | |
| Storage symptoms | 64 (80.0) | 57 (79.2) | 34 (87.2) | 57 (72.2) | 0.460 |
| Voiding symptoms | 57 (71.3) | 35 (48.6) | 19 (48.7) | 46 (58.2) | 0.093 |
| Postmicturition symptoms | 37 (46.3) | 29 (40.3) | 11 (28.5) | 43 (54.4) | 0.147 |
| Coexistence of a urodynamically defined storage dysfunction | 37 (46.3) | 47 (65.3) | 19 (48.7) | 0 (0) | <0.001 |
| Free uroflowmetry | | | | | |
| Qmax (mL/s) | 12.0±6.6[a] | 15.3±8.3[a,b] | 12.4±6.4[a] | 16.1±6.8[b] | 0.014 |
| PVR (mL) | 52.1±104.3 | 25.4±36.9 | 28.9±32.5 | 26.6±36.8 | 0.137 |
| Urethral pressure profilometry | | | | | |
| MUCP (cm $H_2O$) | 95.0±34.5 | 128.4±152.4 | 90.0±37.4 | 94.4±28.3 | 0.120 |
| Bladder sensation and capacity during filling CMG | | | | | |
| First desire to void (mL) | 222.4±79.4 | 212.8±104.5 | 190.3±81.2 | 247.8±104.7 | 0.075 |
| Strong desire to void (mL) | 283.6±85.2[a] | 255.0±113.5[a] | 276.9±109.3[a] | 337.0±99.2[b] | 0.001 |
| Maximum capacity (mL) | 359.3±90.8[a,b] | 327.7±124.0[a] | 329.7±108.4[a] | 408.6±68.0[b] | <0.001 |
| Bladder compliance | | | | | |
| ≤20 (mL/cm $H_2O$) | 8 (10.0) | 5 (6.9) | 2 (5.1) | 0 (0) | 0.025 |
| DO | 23 (28.8) | 23 (31.9) | 8 (20.5) | 0 (0) | <0.001 |
| Pressure-flow study | | | | | |
| Qmax (mL/s) | 9.4±4.5[a] | 16.8±9.0[b] | 8.9±2.1[a] | 16.2±5.8[b] | <0.001 |
| Pdet open (cm $H_2O$) | 56.4±37.8[a] | 40.5±18.0[b] | 28.1±9.6[c] | 31.0±9.0[c] | <0.001 |
| PdetQmax (cm $H_2O$) | 56.9±26.8[a] | 41.6±13.5[b] | 26.9±8.1[c] | 34.1±9.6[c] | <0.001 |

Values are presented as mean±standard deviation or number (%).
PBND, primary bladder neck dysfunction; DV, dysfunctional voiding; DU, detrusor underactivity; AD, acontractile detrusor; Qmax, maximum flow rate; PVR, postvoid residual; MUCP, maximum urethral closing pressure; CMG, cystometry; DO, detrusor overactivity; Pdet open, opening detrusor pressure; PdetQmax, detrusor pressure at maximum flow rate.
[a-c]: The same superscript alphabet indicate nonsignificant difference.

**TABLE 3.** Clinicodemographic and urodynamic characteristics of young men with urodynamically defined storage phase dysfunction

| Characteristic | DO | SC | RBS | Normal urodynamics | p-value |
|---|---|---|---|---|---|
| Patient no.[a] | 41 | 55 | 16 | 79 | |
| Age (y) | 43.4±9.3 | 36.6±10.8 | 37.1±12.1 | 40.4±10.8 | 0.074 |
| Symptom duration (mo) | 27.2±26.4 | 50.1±64.6 | 28.6±34.6 | 33.5±43.0 | 0.216 |
| Clinical urinary symptom | | | | | |
| Storage symptoms | 35 (85.4) | 50 (90.0) | 8 (50.0) | 57 (72.2) | 0.015 |
| Voiding symptoms | 21 (51.2) | 24 (43.6) | 11 (68.8) | 46 (58.2) | 0.314 |
| Postmicturition symptoms | 14 (34.1) | 24 (43.6) | 6 (37.5) | 43 (54.4) | 0.147 |
| Coexistence of an urodynamically defined voiding phase dysfunction | 30 (73.2) | 40 (72.7) | 8 (50.0) | 0 (0) | <0.001 |
| Free uroflowmetry | | | | | |
| Qmax (mL/s) | 16.6±8.9[b] | 11.7±5.8[c] | 17.3±8.8[b] | 16.1±6.8[b] | 0.018 |
| PVR (mL) | 60.1±91.4[b] | 12.5±15.7[c] | 36.8±54.4[b,c] | 26.6±36.8[b,c] | 0.006 |
| Urethral pressure profilometry | | | | | |
| MUCP (cm $H_2O$) | 133.0±199.8 | 105.5±44.9 | 82.5±37.6 | 94.4±28.3 | 0.352 |
| Bladder sensation and capacity during filling CMG | | | | | |
| First desire to void (mL) | 243.6±86.6[b] | 137.4±41.2[c] | 360.9±116.2[d] | 247.8±104.7[b] | <0.001 |
| Strong desire to void (mL) | 319.2±69.5[b] | 174.8±46.3[c] | 416.2±82.0[d] | 337.0±99.2[b] | <0.001 |
| Maximum capacity (mL) | 409.7±63.6[b] | 238.4±46.2[c] | 463.8±62.6[d] | 408.6±68.0[b] | <0.001 |
| Bladder compliance | | | | | |
| ≤20 (mL/cm $H_2O$) | 3 (7.3) | 3 (5.5) | 2 (12.5) | 0 (0) | 0.254 |
| Pressure-flow study | | | | | |
| Qmax (mL/s) | 16.4±11.8 | 12.1±4.9 | 16.6±7.7 | 16.2±5.8 | 0.061 |
| Pdet open (cm $H_2O$) | 65.7±48.6[b] | 34.7±10.9[c] | 38.5±16.0[c] | 31.0±9.0[c] | <0.001 |
| PdetQmax (cm $H_2O$) | 58.2±35.7[b] | 37.6±11.6[c] | 43.1±10.0[c] | 34.1±9.6[c] | <0.001 |

Values are presented as mean±standard deviation or number (%).

DO, detrusor overactivity; SC, small bladder capacity; RBS, reduced bladder sensation; Qmax, maximum flow rate; PVR, postvoid residual; MUCP, maximum urethral closing pressure; CMG, cystometry; Pdet open, opening detrusor pressure; PdetQmax, detrusor pressure at maximum flow rate.

[a]:Men with only a single urodynamically defined storage phase dysfunction were selected regardless of coexistence of voiding phase dysfunction in order to contrast findings among each storage phase dysfunction. Therefore, 29 men with DO, 28 men with SC, and 2 men with RBS were excluded from Table 1. [a-c]: The same superscript alphabet indicate nonsignificant difference.

odynamic dysfunctions. Whereas 53.9% of patients (103/191) with voiding phase dysfunction had concomitant storage dysfunction (Table 2), 69.6% (78/112) of those with storage dysfunction were found to have concomitant voiding dysfunction (Table 3). Sixty-five and 73.2% of patients with DV and DO had concomitant other storage phase and voiding phase dysfunctions ($p<0.01$). Qmax did not differ significantly between men with DV and those with normal urodynamics, but was significantly lower in men with PBND or DU/AD than in those with normal urodynamics. Men with DV or DU/AD exhibited lower maximum cystometric capacity than did those with normal urodynamics ($p<0.001$, respectively). Low bladder compliance was most frequent among men with PBND (Table 2). Of the storage phase dysfunctions, only small bladder capacity was associated with a lower free Qmax than in men with normal urodynamics; however, the Qmax during a PFS was not significantly different. The free postvoid residual was higher in patients with DO than in those with small bladder capacity. Bladder capacity was similar between men with DO and those with normal urodynamics. Men with DO were shown to have higher detrusor pressure during voiding than that in men with other storage phase dysfunctions.

The patterns of initial treatment after determination of the specific urodynamic diagnosis were examined. Medications were administered in 83.1% of men and α-blockers were the most frequently prescribed, followed by anticholinergics, muscle relaxants, and cholinergics. Interestingly, no treatment was chosen in 46.8% of men with normal urodynamics, as abnormal findings were not demonstrated in their urodynamic evaluation despite their symptoms. However, the other urodynamically normal patients received treatment for LUTS.

## DISCUSSION

Although chronic LUTS are not uncommon in young men, they have received little scientific attention. Because the incidence and clinical implications of each urodynamic etiology for chronic LUTS of young men remain largely unknown, the proper diagnosis and management of each condition is challenging for physicians. Furthermore, these young men frequently experience the recurrence of symptoms despite various medications such as antibiotics, α-blockers, and anticholinergics.

Our study showed that most demographics and types of clinical symptoms did not differ among patients with specific urodynamic etiologies of LUTS. Glassberg et al. [14] insisted that in young men with PBND, DV, DO, or DU, clinical features frequently overlap and are not as defining as they are often presumed to be. Therefore, treatment of young men on the basis of a presumed diagnosis from presenting LUTS is less likely to be successful, because the sensitivity of LUTS for the prediction of any specific urodynamically defined condition is not strong. Urodynamic investigation seems to be justified in adolescents and young men with chronic LUTS to confirm the correct diagnosis and avoid unnecessary and ineffective treatment.

The incidence of PBND has been reported as 40% to 50% among young men with refractory LUTS [15]. Also, the reported incidence of DV was found to be 14% to 43% [2,4,6,8]. Table 4 compares the incidence of each urodynamic etiology between our study and previously published studies. In our study, incidences of PBND and DV were 26% and 23.4%, showing a relatively lower rate among young men with chronic LUTS. We believe that this was because our population differed from those in the previous studies. Unlike previous studies that focused on men who had been previously diagnosed with nonbacterial chronic prostatitis [2,3,6,16], we studied young men with chronic LUTS who did not have positive EPS findings or pelvic or perineal pain responsible for nonbacterial chronic prostatitis. LUTS are usually present in young men with nonbacterial chronic prostatitis [17]. The etiology of nonbacterial chronic prostatitis may be similar to the etiology of LUTS in young men. Abnormalities of pelvic floor muscle relaxation and poor relaxation of bladder neck during voiding have been suggested as the etiology of nonbacterial chronic prostatitis and chronic LUTS in adolescents and young men [2,18,19]. Therefore, young men with nonbacterial chronic prostatitis appear to have more voiding phase dysfunctions than storage phase dysfunctions.

Our results demonstrated that PBND was the most frequent single specific dysfunction, followed by DV and DU/AD. As a whole, PBND and DV accounted for about 50% of the specific diagnoses. While approximately half of patients with voiding phase dysfunction had concomitant storage dysfunction, storage phase dysfunction was associated with concomitant voiding dysfunction in over two-thirds of cases. Similarly, Nitti et al. [2] reported that the majority of men with DO (85%) also had voiding phase abnormalities and stated that primary DO without voiding phase dysfunction would appear to be unusual in young men.

Men with DV or DU/AD exhibited lower maximum cystometric capacity than that in men with normal urodynamics, and men with DO displayed higher detrusor pressure during voiding than did those with other storage dysfunction. Although the plausible reasons for these findings need more investigations, similar results were demonstrated in our previous research with female overactive bladder patients [20].

DU is one such age-related change in the urinary bladder. The etiology of DU in aged persons is degeneration of muscle cells and axons [21]. However, the mechanism of DU in young men is not fully understood. The prevalence of DU is known to be high among the institutionalized elderly [22]. Therefore, it is somewhat interesting to find that 12.7% of our young men had DU/AD. However, previous studies reported similar incidences of DU/AD [2,4-6,8]. While cholinergic agonists may be used to facilitate voiding efficacy in aged patients who have DU without bladder outlet obstruction, the impact of such treatment on voiding efficacy has not been explored in young men with DU without neurogenic abnormalities.

The reported prevalence of DO among young men with

**TABLE 4.** Comparison of results on the incidence of each urodynamic diagnosis among young men with chronic lower urinary tract symptoms

| Study | No. of patients | Age (y) | Population | Symptom duration (mo) | Diagnostic tool | Urodynamic diagnosis (%) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | PBND | DV | DO | DU/AD | Normal |
| Kaplan et al. [6] | 137 | 21–50 | Chronic LUTS with treatment as CP/CPPS | - | VUDS | 54 | 24 | 49 | 17/5 | 12 |
| Nitti et al. [2] | 85 | 35.1 | Chronic LUTS (CP/CPPS 38%) | 53.8 | VUDS | 47 | 14 | 6 | 9 | 13 |
| Wang et al. [4] | 90 | 37.5 | Chronic LUTS & Qmax <15 | 28.3 | VUDS | 41 | 43 | - | 10 | - |
| Toh and Ng [5] | 50 | 38.1 | Chronic LUTS diagnosed as CPPS, OAB or BPH | - | UDS | 28 | 2 | 18 | 10 | 28 |
| Karami et al. [8] | 456 | 25.8 | Untreated LUTS | 3–18.5 | UDS+EPS | 21 | 15.1 | 13.6 | 2.4/10.5 | 18.6 |
| Present study | 308 | 40.4 | Chronic LUTS without symptoms of CP/CPPS | 38.8 | UDS±VCUG | 26 | 23.4 | 22.7[a] | 12.7 | 25.6 |

PBND, primary bladder neck dysfunction; DV, dysfunctional voiding; DO, detrusor overactivity; DU, detrusor underactivity; AD, acontractile detrusor; LUTS, lower urinary tract symptoms; CP, chronic prostatitis; CPPS, chronic pelvic pain syndrome; VUDS, video-urodynamic study; Qmax, maximum flow rate; OAB, overactive bladder syndrome; BPH, benign prostatic hyperplasia; EPS, expressed prostatic secretion; VCUG, voiding cystourethrography.

[a]:84.2% of men with DO had other storage phase or voiding phase dysfunctions in urodynamic evaluation.

refractory LUTS is found to be 6% to 18% [2,5,8]. Although the diagnosis of overactive bladder syndrome is based on subjective symptoms [13] rather than objective criteria, overactive bladder syndrome is frequently described clinically as a condition associated with urodynamic DO, with the latter potentially responsible for the clinical symptoms. In general, urodynamic DO is detected in approximately 50% of women with symptoms of overactive bladder [23,24]. In the present study, the incidence of DO was 22.5% as a storage phase dysfunction.

Several limitations of our study deserve mention. First, the present study was a retrospective study and therefore had several potential shortcomings, in particular being prone to several forms of selection bias. Second, we did not perform fluoroscopic assessment when diagnosing PBND or DV. The robust method for the diagnosis of PBND may be video-urodynamic. Unfortunately, our urodynamic system is not equipped with fluoroscopy. However, PBND can also be determined indirectly by the urodynamic findings of bladder outlet obstruction with obstructive symptoms in the absence of urethral stricture, prostatic enlargement, and striated sphincter dyssynergia [8,12]. Our patients were aged 50 years or less and we performed an additional VCUG in cases with equivocal findings of PBND during a PFS (26 cases). The diagnosis of PBND was eventually made when VCUG demonstrated narrowing only at the bladder neck. Similarly, for the cases with equivocal results for the diagnosis of DV in a PFS (13 cases), DV was finally diagnosed when VCUG demonstrated brief and intermittent closing at the level of the membranous urethra during voiding. Third, for the purpose of classification of cases with the absence of a detrusor contraction during two consecutive PFS, patients with a measureable uroflow in free uroflow were arbitrarily considered to have DU, and those who did not generate a measureable uroflow in free uroflow were regarded as having an AD. However, the number of these patients was small (6.0%). Last, our findings were derived from a single tertiary referral center. A multicenter, prospective study would be required to confirm our results.

We recommend that it is essential to perform urodynamic evaluation to investigate the possible etiologies of LUTS in young men with chronic LUTS, especially in those with refractory symptoms. A high index of suspicion for possible etiologies for LUTS may be important for accurate and timely diagnosis of treatable LUTS in young men. We need to learn more about the natural history of PBND, DV, and other possible etiologies of LUTS in young men.

## CONCLUSIONS

Chronic LUTS among young men have a variety of underlying etiologies. As a single specific dysfunction, PBND is the most frequent, followed by DV and DU/AD. Storage dysfunction was frequently associated with concomitant voiding phase dysfunction. Urodynamic investigation in this population is helpful in making an accurate diagnosis and may guide adequate treatment, because clinical symptoms are not useful in predicting a specific urodynamic etiology.

## CONFLICTS OF INTEREST

The authors have nothing to disclose.

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