# *Urodynamic characterization of lower urinary tract symptoms in women less than 40 years of age*

Asha E. Jamzadeh, MD,[1] Donghua Xie, MD,[1] Melissa A. Laudano, MD,[1] Dean S. Elterman, MD,[1] Stephan Seklehner, MD,[1,2] Lucien Shtromvaser, MD,[3] Richard Lee, MD,[1] Steven A. Kaplan, MD,[1] Alexis E. Te, MD,[1] Renuka Tyagi, MD,[1] Bilal Chughtai, MD[1]

[1]Department of Urology, Weill Cornell Medical College of Cornell University, New York, New York, USA
[2]Department of Urology, Landesklinikum Baden-Mödling, Baden, Austria
[3]Laborie Medical Technologies, Mississauga, Ontario, Canada

JAMZADEH AE, XIE D, LAUDANO MA, ELTERMAN DS, SEKLEHNER S, SHTROMVASER L, LEE R, KAPLAN SA, TE AE, TYAGI R, CHUGHTAI B. Urodynamic characterization of lower urinary tract symptoms in women less than 40 years of age. *Can J Urol* 2014;21(5):7460-7464.

***Introduction:*** *Lower urinary tract symptoms (LUTS) in young women is becoming a more recognized urologic issue that can arise from many causes, each with their own management strategy. The purpose of this study was to determine the rates of various etiologies for LUTS in women under 40 years of age.*

***Materials and methods:*** *Video urodynamic studies (VUDS) were performed in 70 women age 40 years or less with LUTS for greater than 6 months between March 2005 and June 2012 at Weill Cornell Medical College. Patients with culture-proven bacterial urinary tract infections, pelvic organ prolapse greater than grade I, symptoms for less than 6 months, a history of neurologic disease, or previous urological surgery affecting voiding function, were excluded from the analysis.*

***Results:*** *The mean age of the patients was 31.95 ± 5.57. There were 48 patients that presented with more than one urinary symptom (68.57%). The most frequent complaints included: urinary frequency (n = 42, 34.15%), incontinence (n = 26, 21.14%), and urinary urgency (n = 22, 17.89%). The most common urodynamic abnormality was dysfunctional voiding (n = 25, 28.74%), detrusor overactivity (n = 15, 20.00%), bladder outlet obstruction (n = 8, 11.43%). There were no significant differences seen in complaints or AUA symptom and quality of life scores across diagnosis groups.*

***Conclusions:*** *Persistent LUTS can present in younger women with an unclear etiology, which may be characterized using VUDS. The most common etiology found is dysfunctional voiding followed by detrusor overactivity. This study shows that the etiology can be more accurately determined using VUDs, which can assist in management.*

**Key Words:** young women, urodynamics, lower urinary tract symptoms, dysfunctional voiding, bladder outlet obstruction

## Introduction

Lower urinary tract symptoms (LUTS) are prevalent in women and increase in frequency with age. However, despite its known predominance among older women, LUTS is also seen frequently in a younger demographic. The recent EPIC study, a large population based survey conducted by the International Continence Society in 2002, found that 58.7% of women age 39 and under complained of at least one lower urinary tract symptom.[1] However, research on young women with LUTS is lacking, especially with regard to identifying the underlying diagnosis. LUTS is divided into storage symptoms (daytime urinary frequency, urgency, nocturia, urinary incontinence), voiding symptoms (slow stream, intermittency, hesitancy, straining) and post-micturition symptoms (sensation of incomplete emptying, post-micturition dribble).[2]

Accepted for publication July 2014

Address correspondence to Dr. Bilal Chughtai, Department of Urology, Weill Cornell Medical College of University, 425 East 61st Street, 12th Floor, New York, NY 10065 USA

There are a variety of disorders that can produce LUTS. However, patients' complaints of LUTS cannot often be used solely to determine the underlying cause. Given the availability of effective treatments for various etiologies of LUTS, the ability to accurately diagnose this understudied group of women will be beneficial in guiding management. Our aim is to use video urodynamic studies (VUDS) to characterize the various underlying etiologies of voiding dysfunction in this select cohort of patients. This study presents the VUDS findings of 70 women age 40 years or less with ongoing LUTS for greater than 6 months.

## Materials and methods

A cohort of 70 female patients age 40 and younger with LUTS of more than 6 months duration despite attempted treatment with medical therapy who underwent VUDS from March 2005 to June 2012 at Weill Cornell Medical College were retrospectively analyzed. Patients with previously diagnosed neurologic disease, pelvic organ prolapse greater than grade I, previous urological surgery affecting voiding function, and uncomplicated stress urinary incontinence were excluded from the analysis. All patients filled out American Urological Association (AUA) Symptom Index and Quality of Life scores.

Patients underwent synchronous video-pressure-flow urodynamic evaluation as per International Continence Society (ICS) standards.[3] Fluoroscopy was used to determine the anatomic site of obstruction or narrowing of the urethra, as previously described.[4,5] All VUDS were performed with 7F transurethral and rectal balloon catheters, as previously described.[4,5] A diagnosis of dysfunctional voiding (voluntary closure of the membranous urethra during voiding) was made based on a number of criteria, including electrical activity of the external sphincter during voiding in the absence of abdominal straining, and brief or intermittent closing of the membranous urethra during voiding. This was detected by both electromyography (EMG) and fluoroscopy. In addition, to make the diagnosis of dysfunctional voiding, a uroflow measurement performed in a private setting showing intermittent increases and decreases of flow in an undulating fashion was required.[4,5] Detrusor overactivity is a urodynamic observation characterized by involuntary detrusor contractions during the filling phase which may be spontaneous or provoked.[4,5] Primary bladder neck obstruction was defined as failure of the bladder neck to open adequately (remained closed or narrow on fluoroscopic images) during voiding, resulting in obstruction of urinary flow in the absence of other causes of obstruction or increased striated sphincter activity, as previously described.[3,4] Detrusor underactivity is defined as a contraction of reduced strength and/or duration, resulting in prolonged bladder emptying and/or a failure to achieve complete bladder emptying within a normal time span.[4,5] A contractile detrusor was considered a lack of contraction during urodynamic studies.[4,5] Reduced bladder sensation is defined as a diminished bladder sensation during filling cystometry.[4] Bladder oversensitivity is defined as increased perceived bladder sensation during bladder filling with: an early first desire to void; an early strong desire to void, which occurs at low bladder volume; a low maximum cystometric bladder capacity; no abnormal increases in detrusor pressure.[4]

Unless otherwise stated, the results are expressed as mean ± standard deviation (SD). The mean values for the measured parameters were compared across the groups with analysis of variance (ANOVA). If the overall F-test for the ANOVA was at least of borderline significance ($p < 0.05$), post hoc comparisons between group means were performed using a Dunnett's multiple comparison test and a $p < 0.05$ was considered statistically significant.

## Results

The mean age of the patients was 31.95 ± 5.57. There were 48 patients that presented with more than one urinary symptom (68.57%). Overall, the most frequent complaints included problems associated with the storage of urine: urinary frequency (n = 42, 34.15%), urinary incontinence (n = 26, 21.14%), and urinary urgency (n = 22, 28.74%). There were no significant differences in AUA Symptom Index and quality of life scores between the various diagnostic groups based on the video urodynamic results, Table 1.

TABLE 1. **Frequency of lower urinary tract symptom complaints in cohort**

| Complaints | Number | Percentage |
|---|---|---|
| Urinary frequency | 42 | 34.15% |
| Incontinence | 26 | 21.14% |
| Urinary urgency | 22 | 17.89% |
| Difficulty with urination | 18 | 14.63% |
| Infection | 15 | 12.20% |
| Total | 123 | |

TABLE 2. **Frequency of overall video urodynamic study (VUDS) diagnosis**

| Overall VUDS diagnosis | n (percentage) |
|---|---|
| Dysfunctional voiding | 31 (26.70%) |
| Detrusor overactivity | 17 (14.41%) |
| Incomplete bladder emptying | 17 (14.41%) |
| Reduced bladder sensation | 14 (11.86%) |
| Large or small bladder capacity | 11 (9.32%) |
| Bladder oversensitivity | 11 (9.32%) |
| Bladder outlet obstruction | 9 (7.63%) |
| Detrusor underactivity | 8 (6.78%) |

The leading primary urodynamic diagnosis was dysfunctional voiding (n = 25, 28.74%), followed by detrusor overactivity (n = 15, 20.00%), and primary bladder neck obstruction (n = 8, 11.43%), Table 2 and Table 3. A summary of urodynamic findings is listed in Table 4. There were significant differences in maximal flow (p = 0.033), average flow (p = 0.002), and post-void residuals (p = 0.045) across the three groups. There were no differences seen across the groups in volume at first desire to void, volume at normal desire to void, cystometric capacity, and detrusor pressure at maximal flow, Table 4.

There were 49 patients that demonstrated VUDS findings consistent with more than one diagnosis (70.00%). Overall in women who had multiple diagnoses, dysfunctional voiding was present in 31 women (26.70%), detrusor overactivity was present in 17 women (14.41%), incomplete bladder emptying was present in 17 women (14.41%), reduced bladder sensation was present in 14 women (11.86%), bladder oversensitivity was present in 11 women (9.32%), large or small bladder capacity was present in 11 women (9.32%), primary bladder neck obstruction was present in 9 women (7.63%), and detrusor underactivity was present in 8 women (6.78%), Table 2.

The frequency of urinary symptoms in each of the three most common primary VUDS diagnosis is listed in Table 5. Urinary frequency was reported in 17 women (68.00%) with dysfunctional voiding,

TABLE 3. **Urodynamic, AUA symptom and quality of life data**

| Most frequent primary VUDS diagnosis | Dysfunctional voiding | Detrusor overactivity | Bladder outlet obstruction | p value |
|---|---|---|---|---|
| n (percentage) | 25 (35.71%) | 15 (20.00%) | 8 (11.43%) | |
| AUA symptom score | 12.95 ± 7.90 | 20 ± 8.32 | 18 ± 4.60 | 0.084 |
| Quality of life score | 4.57 ± 0.81 | 4.55 ± 0.52 | 4.43 ± 0.79 | 0.327 |

TABLE 4. **Urodynamic differences among the most frequent primary video urodynamic study (VUDS) diagnoses**

| | DV | DO | BOO | p value |
|---|---|---|---|---|
| Volume at first desire to void (mL) | 141.18 ± 65.57 | 127.96 ± 88.55 | 124.46 ± 51.59 | 0.493 |
| Volume at normal desire to void (mL) | 262.95 ± 119.90 | 258.58 ± 137.65 | 213.21 ± 54.74 | 0.574 |
| Cystometric capacity (mL) | 393.58 ± 114.77 | 318.92 ± 164.68 | 308.61 ± 67.36 | 0.073 |
| Qmax (mL) | 20.24 ± 13.17 | 20.13 ± 9.93 | 7.13 ± 3.93 | 0.033* |
| Average flow (mL) | 6.72 ± 3.61 | 7.11 ± 4.62 | 1.56 ± 0.78 | 0.002* |
| PdetQmax (cm $H_2O$) | 37.57 ± 17.87 | 35.42 ± 20.11 | 35.05 ± 7.41 | 0.061 |
| PVR (mL) | 48.25 ± 97.22 | 66.4 ± 123.63 | 150.51 ± 128.74 | 0.045* |

DV = dysfunctional voiding; DO = detrusor overactivity; BOO = bladder outlet obstruction; Qmax = maximum flow; PdetQmax = detrusor pressure at maximum flow; PVR = postvoid residual.
*statistically significant

TABLE 5. **Lower urinary tract symptoms by video urodynamic study (VUDS) diagnosis**

| Primary VUDS diagnosis | n (%) | Urinary frequency | Incontinence | Urinary urgency | Difficulty with urination |
|---|---|---|---|---|---|
| Dysfunctional voiding | 25 (35.71%) | 17 (68.00%) | 5 (20.00%) | 8 (32.00%) | 4 (16.00%) |
| Detrusor overactivity | 15 (20.00%) | 10 (66.67%) | 7 (46.67%) | 7 (46.67%) | 6 (40.00%) |
| Bladder outlet obstruction | 8 (11.43%) | 4 (50.00%) | 0 (0%) | 1 (12.50%) | 2 (25.00%) |

10 women (66.67%) with detrusor overactivity, and 8 women (11.43%) with bladder outlet obstruction. Incontinence was reported in 5 women (20.00%) with dysfunctional voiding, 7 women (46.67%) with detrusor overactivity, and 0 (0%) women with bladder outlet obstruction. Urinary urgency was reported in 8 women (32.00%) with dysfunctional voiding, 7 women (46.67%) with detrusor overactivity, and 1 woman (12.50%) with bladder outlet obstruction. Difficulty with urination was reported in 4 women (16.00%) with dysfunctional voiding, 6 women (40.00%) with detrusor overactivity, and 2 women (25.00%) with bladder outlet obstruction, Table 5

## Discussion

Young women with LUTS can be a difficult group of patients to diagnosis and effectively manage. Very few studies have investigated the etiology of LUTS in young women as well as the effectiveness of VUDS in determining a primary diagnosis. In 2004, Rosenblum et al reported a similar study describing LUTS in 57 premenopausal nulliparous women who underwent urodynamic studies.[5] Our findings provide an updated series with a larger cohort of patients.

In our study, there was no statistical difference in Qmax or AUA symptom score, Table 3. Additionally, urinary complaints of urinary frequency, incontinence, urinary urgency, and difficulty with urination were reported across the three most common primary diagnoses, making determination of a diagnosis from symptoms alone challenging, Table 5. Therefore, without VUDS the etiology of LUTS in these young women would remain undiagnosed.

In our study, dysfunctional voiding is the most common primary diagnosis (29.76%) of LUTS and present in 36.9% of women overall. Rosenblum et al similarly found 26.31% of patients with dysfunctional voiding, although they did not clarify if this is based on primary or overall diagnosis.[5] The etiology of dysfunctional voiding, also previously called pseudo-dyssynergia, has been related to aberrant constriction of the internal urethral sphincter striated muscle during voiding in neurologically normal individuals.[2,6] Dysfunctional voiding is currently treated with behavioral modification and biofeedback techniques, which have been successful in the pediatric population. Pelvic floor biofeedback therapy has also been efficacious in adults.[6,7]

Detrusor overactivity is the second most common primary diagnosis (17.86%) by VUDS and seen in 21.43% of women overall. Rosenblum et al reported bladder dysfunction in 43.86% of patients. They defined bladder dysfunction as both detrusor overactivity and/or impaired compliance, which may explain why they found a much higher percentage of patients. Unfortunately, they do not specify the percent of patients with primary detrusor activity.[5] Of the 15 women with primary detrusor activity, 8 (53.33%) also had reduced bladder sensation. First-line management of detrusor activity is anticholinergic medications.[8] Additional management possibilities include botulinum neurotoxin type A intra-detrusor injection, neuromodulation, and transurethral detrusorotomy.[9-12]

Bladder outlet obstruction is the third most common primary diagnosis (9.52%) that was found in 10.71% of overall women. Rosenblum et al only found bladder outlet obstruction in 2 women (3.35%).[5] This discrepancy may be due to the small cohorts in both studies and exemplifies the need for further research into these patients. Data for this cohort was collected from patients seen at a tertiary referral center, which may alter the frequency of diagnoses noted. Finally, the diagnosis of bladder outlet obstruction in women may be underestimated in the literature due to the wide range of presenting symptoms, including both storage and emptying symptoms. This diagnosis may be missed if VUDS is not performed. In VUDS, bladder outlet obstruction had significant difference in Qmax in comparison to the other diagnoses (7.13 mL ± 3.93 mL), which was on average lower than others ($p = 0.033$). The etiology of bladder outlet obstruction in women is unclear. Possible treatment options for bladder outlet obstruction include transurethral incision of the bladder neck, urethral calibration, or alpha blockade.[13]

Our goal was to diagnose the cause of ongoing LUTS in young women under 40 using VUDS in order to better manage their symptoms. One limitation of our study is that it is retrospective in nature. Additionally, as a center specializing in the treatment of LUTS, there is the potential for selection bias. Our patient population likely includes women with the most severe symptoms, for which they are willing to undergo VUDS testing. However, when compared to cohorts from tertiary referral centers, our results are similar to Rosenblum et al indicating both the consistency of the distribution of LUTS diagnosed in young women and the usefulness of VUDS in determination of those diagnoses.[5]

## Conclusion

Voiding dysfunction can present in young women with a variety of etiologies, the most common of which is dysfunctional voiding followed by detrusor overactivity. This study shows that the etiology of LUTS is difficult to determine based on patient symptoms and AUA symptom score alone. In complex patients in whom the diagnosis is unclear, VUDS can be used to accurately characterize the underlying pathology. This knowledge can be useful to guide selection of the appropriate management strategy in these women. □

References


1. Irwin DE, Milsom I, Hunskaar S et al. Population-based survey of urinary incontinence, overactive bladder, and other lower urinary tract symptoms in five countries: results of the EPIC study. *Eur Urol* 2006;50(6):1306-1315.
2. Abrams P, Cardozo L, Fall M et al. The standardisation of terminology of lower urinary tract function: report from the standardization sub-committee of the international continence society. *Neurourol Urodyn* 2002;21(2):167-178.
3. Haylen BT, de Ridder D, Freeman RM et al. An International Urogynecological Association (IUGA)/International Continence Society (ICS) joint report on the terminology for female pelvic floor dysfunction. *Neurourol Urodyn* 2010;29(1):4-20.
4. Brucker BM, Fong E, Shah S et al. Urodynamic differences between dysfunctional voiding and primary bladder neck obstruction in women. *Urology* 2012;80(1):55-60.
5. Rosenblum N, Scarpero HM, Nitti VW. Voiding dysfunction in young, nulliparous women: symptoms and urodynamic findings. *Int Urogynecol J* 2004;15(6):373-377.
6. Kaplan SA, Santarosa RP, D'Alisera PM, Fay BJ, Ikeguchi EF, Hendricks J, Klein L, Te AE. Pseudodyssynergia (contraction of the external sphincter during voiding) misdiagnosed as chronic nonbacterial prostatitis and the role of biofeedback as a therapeutic option. *J Urol* 1997;157(6):2234-2237.
7. He W, Chen M, Zu X, Li Y, Ning K, Qi L. Chronic prostatitis presenting with dysfunctional voiding and effects of pelvic floor biofeedback treatment. *BJU Int* 2010;105(7):975-977.
8. Andersson KE, Chapple CR, Cardozo L et al. Pharmacological treatment of overactive bladder: report from the International Consultation on Incontinence. *Curr Opin Urol* 2009;19(4):380-394.
9. Gomez CS, Kanagarajah P, Gousse A. The use of botulinum toxin A in idiopathic overactive bladder syndrome. *Curr Urol Rep* 2010;11(5):353-359.
10. Davis T, Makovey I, Guralnick ML, O'Connor RC. Sacral neuromodulation outcomes for the treatment of refractory idiopathic detrusor overactivity stratified by indication: Lack of anticholinergic efficacy versus intolerability. *Can Urol Assoc J* 2012;10:1-3.
11. Leicht W, Hampel C, Thüroff J. Botulinum toxin versus sacral neuromodulation for idiopathic detrusor overactivity. *Urologe A* 2012;51(3):348-351.
12. Zuban' ON, Lebedev AA. Surgical correction of overactive bladder resistant to standard therapy. *Urologiia* 2010;(4):11-5
13. Padmanabhan P, Nitti VW. Primary bladder neck obstruction in men, women, and children. *Curr Urol Rep* 2007;8(5):379-384.