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Original Research Article

Study of Lower Urinary Tract Symptoms in Female Patients with Special Emphasis on Urodynamic Study

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Abstract:

Objectives: The study aims diagnose LUTS in women and investigate the urodynamic patterns from pressure-flow studies, to correlate them with clinical presentations and postvoid residual urine volume for enhanced diagnostic and management approaches.

Methods: The study, conducted at PARAS HMRI Hospital, Patna, for over one year, focused on women patients who were presenting symptoms of LUTS. Around 60 patients were categorized based on the symptoms experienced into 3 groups. The study compared parameters like bladder outlet obstruction, maximal flow, residual volume, and voided volume in each group. The research also analyzed urodynamic patterns obtained from pressure-flow studies to correlate them with clinical presentations and postvoid residual urine volume.

Results: The study focused on females with lower urinary tract symptoms (LUTS), revealing a mean age of 44.97 ± 12.47 years, with a significant representation from the post-menopausal age group. Among the LUTS cases, 53.3% exhibited clinical obstruction, 35% presented with irritative LUTS, and 11.7% reported LUTS with suprapubic pain. Urodynamic study identified obstructive LUTS in 26.7% of cases based on criteria of Qmax <15 ml/s and pdet-Qmax > 20 cm H_2O, emphasizing the diverse clinical presentations of obstructive LUTS in females.

Conclusion: This study highlights the complexities in diagnosing and managing lower urinary tract symptoms (LUTS) in females, and provides insights for improved diagnostic assessments and therapeutic interventions.

Keywords Lower Urinary Tract Symptoms (LUTS), Women, Urodynamic Evaluation, Aetiology.

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Introduction

The diagnosis of Lower Urinary Tract Symptoms (LUTS) in females is a very challenging task when compared to males due to various contributing factors [1]. Most often, this occurs due to less suspicion of bladder outlet obstruction, whether anatomical or functional, in females [1]. Although anatomical causes like obstruction post-sling surgery or pelvic prolapse are visibly apparent, understanding the functional causes requires better understanding of voiding dysfunction. Moreover, unlike males, females less frequently express classic obstructive symptoms, and are often unfamiliar with the dynamics of their urinary stream during voiding [1,2].

Women encountering urinary difficulties usually show symptoms of storage-related LUTS, like urgency, urinary frequency, recurrent urinary tract infections (UTI), and urge incontinence [2,3]. However, despite this diagnosis of LUTS in females is difficult owing to the absence of universally accepted urodynamic criteria, that is typically present in males. Furthermore, the voiding dynamics in females varies drastically as it is influenced by factors such as pelvic floor muscles, pelvic organ prolapse (POP), or bladder neck mobility, thereby emphasizing the need for enhanced diagnostic criteria and increased suspicion for obstruction [1].

A spectrum of functional and anatomical factors poses as the aetiology of LUTS in females. The absence of a standardized diagnostic definition further contributes to the underestimation of the incidence rates of LUTS in women. Additionally, the criteria for diagnosis that is applicable to males may not be universally applicable to females, resulting in the difficulty to define obstructive LUTS as per urinary flow rate or detrusor pressure alone [4-9]. The evaluation of LUTS in women usually encompasses scrutinization of the patient's medical history, such as voiding symptom details, and a comprehensive physical examination. The other vital parameters examined involve neurological assessments, intake and voiding diaries, routine urinalysis, postvoid residual determination, non-invasive uroflowmetry, voiding cystourethrogram

(VCUG), and pressure-flow analysis through urodynamic study (UDS) [5-7].

Conventionally, obstructive LUTS in women is characterized by identification of a high voiding detrusor pressure (>20 cm H_2O) and a low maximum urinary flow rate (<15 mL/s) in pressure-flow studies [6,7]. However, there is ongoing debate, with some suggesting that low urine flow concomitant with normal or low detrusor pressure might be indicative of relative obstruction [8].

The present study aims to establish the practical urodynamic patterns for the diagnosis of obstructive LUTS in females by correlating the pressure-flow study (PFS) findings with clinical presentations and postvoid residual urine volume (PVRV). This study was carried out to address the distinctive challenges encountered in defining LUTS in women and to identify a method for establishing a standard diagnostic criteria in these patients.

Methods

This present study into the discernment of lower urinary tract symptoms (LUTS) in women took place at the department of urology of the PARAS HMRI Hospital, Patna, India for 1 year. A prospective observational study design was utilized for this study which enrolled a total of 60 women aged 20 to 65 years with LUTS. Women with neurological disorders, bladder or cervix malignancies, stone diseases, or urinary tract infections, were excluded from the study.

The symptoms experienced by the patients as well as their clinical findings were well documented, by carrying out local, abdominal, gynecological, neurological, and rectal examinations. Following this, a thorough analysis of urine routine examination and culture, urodynamic study (UDS), voiding cystourethrogram (VCUG), urethrocystoscopy, USG-KUB (Kidney, Urinary bladder) with PVR, and uroflowmetry was conducted.

This study was approved by the Scientific Review Board and Ethical Committee of the

institution and followed the guidelines laid down by Indian Council of Medical Research. For carrying out the study, the patients were categorized based on the predominant symptoms shown into 3 groups – group I (predominantly showing obstructive LUTS), group II (predominantly showing irritative LUTS), and group III (predominantly showing LUTS with vague suprapubic pain).

The urodynamic details of 60 women participants with LUTS were carefully examined. Owing to the absence of standard urodynamic definitions for LUTS in women, the study considered obstructive LUTS on the basis of a persistently low maximum free flow rate (<15 mL/s) in repeated non-invasive uroflow studies, along with a detrusor pressure at maximum measured flow rate (pdet-Qmax) exceeding 20 cm H_2O in the pressure uroflow study.

Before the examination, all participants were asked to void privately using a standard toilet. The non-invasive uroflowmetry measurements were repeated twice throughout the study for consistency. A multi-channel urodynamic study (UDS) that followed the recommendations of the International Continence Society, and a pressure-flow study (PFS) utilizing a transurethral 6 F double lumen urethral catheter with a medium infusion rate was performed on all patients. Contrary to conventional recommendations, all the participants were not asked to inhibit micturition during the filling phase but were instructed to report such sensations to the examiner.

The severe urgency, urgency, sensations, stability, bladder capacity, and compliance during the filling phases were also recorded. At capacity, participants were prompted to void, and the pressure-flow studies, voiding phases for detrusor pressure and obstruction using Bladder Contractility Index (BCI) and Bladder Outlet Obstruction Index (BOOI) were conducted. Identification of urethral obstruction was carried out using urethrocystoscopy based on the visible signs such as a gripping sensations on the cystoscope, external compression of the bladder neck and proximal urethra, or narrowed urethra, similar to those seen in men with benign prostatic hyperplasia.

Statistical Methods

The data was analyzed using SPSS 18 software, employing the student t-test or chi-square test, with a significance level set at $p < 0.05$.

Results

Out of the 60 women enrolled in this study, around 50% of the women were from the postmenopausal age group. All the patients participating in this study were residents of Bihar, India. The mean age of the patient cohort was 44.9667 while the major identified causes for LUTS were prolapse with cytocoele, caruncle, or urethral stenosis. Idiopathic causes were also noted to account for over 11.7 % of the cases. Furthermore, as per the symptoms shown, it was identified that 32 (53.33 %) patients had obstructive LUTS, 21(25 %) had irritative LUTS and 7 (11.70 %) had LUTS with suprapubic pain (Table 1).

Table 1: General characteristics and symptoms experienced by the patients

Parameters	LUTS cases
Age (Yrs)	
21-30	12 (20 %)
31-40	7 (11.7 %)
41-50	18 (30 %)
>50	23 (38.3 %)
Mean age	44.9667 ± 12.4736
Etiologies for Obstructive LUTS	
Urethral stenosis	17(28%)
Prolapse with cystocoele	6(10%)
Idiopathic	7(11.7%)
Caruncle	2(3.3%)
Symptoms	
Obstructive LUTS	32 (53.33 %)
Irritative LUTS	21 (35 %)
LUTS with Suprapubic pain	7 (11.70 %)

In patients with LUTS, the urodynamic parameters were also studied. For obstructive LUTS, the mean maximum flow rate (Qmax) was 13.38, maximum voided volume (MVV) was 255.75, and maximum cystometric capacity (MCC) was 424.09. In contrast, slightly higher values were seen in irritative LUTS cases which exhibited Qmax at 15.40, MVV at 259.71, and MCC at 411.10. LUTS with Suprapubic pain, however, showed elevated Qmax at 17.69, MVV at 326.43, and MCC at 383.29. Cystoscopic findings revealed that 46.7% of the patients showed normal grade values pertaining to the muscle bundle. Over 30% of the patients showed Grade 1 values, while 18.3% showed Grade 2, and the remaining 5.0% exhibited Grade 3 results. External urethral meatus (EUM) mean Qmax was also recorded with senile meatus contributing to 10 cases, stenosed meatus to 7 patients and normal accounting for 43 patients (Table 2).

Table 2: UDS findings in patients

	Obstructive LUTS, n (mean ± SD)	Irritative LUTS, n (mean ± SD)	LUTS with Suprapubic pain, n (mean ± SD)
Maximum flow rate (Qmax)	32 (13.3813 ± 7.29880)	21 (15.3952 ± 8.41187)	7 (17.6857 ± 3.91043)
Maximum voided Volume (MVV)	32 (255.7500 ± 145.07862)	21 (259.7143 ± 155.15739)	7 (326.4286 ± 46.43223)
Maximum cystometric capacity (MCC)	32 (424.0938 ± 99.64659)	21 (411.0952 ± 154.72812)	7 (383.2857 ± 52.22297)
Mean pdet@Qmax	32 (29.3719 ± 24.26426)	21 (32.3810 ± 33.12624)	7 (26.1429 ± 5.01427)
Mean Post void residual volume (PVR)	32 (150.8750 ± 149.74791)	21 (145.0476 ± 200.97400)	7 (51.5714 ± 30.38013)
Cystoscopy findings, n (%)			
Grade 1	18 (30 %)		
Grade 2	11 (18.3%)		
Grade 3	3 (5.0 %)		
Normal	28 (46.7 %)		
External urethral meatus (EUM) - Mean of Qmax, n (mean ± SD)			
Senile	10 (13.4300 ± 7.2856)		
Stenosed	7 (12.7857 ± 7.3558)		
Normal	43 (15.1512 ± 7.61216)		
Total	60 (14.5883 ± 7.46272)		
External urethral meatus (EUM) - Mean of PVR, n (mean ± SD)			
Senile	10 (123.4000 ± 85.9188)		
Stenosed	7 (203.8571 ± 230.9649)		
Normal	43 (129.6279 ± 165.12117)		
Total	60 (137.2500 ± 162.97599)		

The analysis of urodynamic parameters revealed notable differences based on the presence of prolapse and cystocele in individuals experiencing Lower Urinary Tract Symptoms (LUTS). In particular, the mean maximum flow rate (Qmax) was higher in cases with prolapse (18.0750) in

comparison to those without prolapse (14.1870), indicating a potential impact of prolapse on urinary flow. Similarly, an inverse relationship was noted between mean detrusor pressure at maximum flow rate (pdet@Qmax) and prolapse, suggesting a distinct urodynamic profile in these patients. The mean post-void residual volume (PVR), in contrast was lower in cases with cystocele (51.0000) compared to those without cystocele (144.0741) (Table 3).

Table 3: UDS findings in patients with prolapse and cytocoele

	n (mean ± SD)
Mean of Qmax	
Prolapse	4 (18.0750 ± 4.3138)
No Prolapse	54 (14.1870 ± 7.68206)
Cystocoele	2 (18.4500 ± 3.88909)
Total	60 (14.5883 ± 7.46272)
Mean of pdet@Qmax	
Prolapse	4 (18.5000 ± 6.45497)
No Prolapse	54 (31.2574 ± 27.31805)
Cystocoele	2 (20.5000 ± 10.60660)
Total	60 (30.0483 ± 26.22745)
Mean of PVR	
Prolapse	4 (88.2500 ± 46.35641)
No Prolapse	54 (144.0741 ± 170.10506)
Cystocoele	2 (51.0000 ± 8.48528)
Total	60 (137.2500 ± 162.97599)

Discussion

Lower Urinary Tract Symptoms (LUTS) in females poses a significant diagnostic challenge when compared to males, with their diverse causes largely contributing towards the complexity in prognosis [10]. Anatomical obstruction, such as prior incontinence surgery, urethral strictures, urethral diverticulum, cystocele, and functional sphincteric obstruction, are some of the aetiological factors contributing towards the generation of LUTS [10]. Moreover, the varying incidence rates of obstructive LUTS in women, ranging from 2.7% to 23% as mentioned in earlier studies, further emphasizes the necessity of standardized diagnostic definitions [10,11]. Our study underscores the need for consistent diagnostic criteria, as variations in reported prevalence might be attributed to the lack of an established criteria.

The mean age of patients LUTS in the present study was 44.96 ± 12.47 years, with 50 % of the cases belonging to the post-menopausal age group. This finding corelates with the previous studies and indicates the prevalence of LUTS in postmenopausal women [12,13]. Clinically, 53.3% of patients exhibited obstructive LUTS, while 35% showed irritative symptoms and 11.6% with suprapubic pain. Notably, 26.7% of LUTS females in this study met the criteria for obstruction based on urodynamic studies, hinting a strong correlation between the symptomatic presentation and the established objective evaluation [14,15]. However, this overlooked the incidence rates of obstruction in women with LUTS, particularly in cases with vague symptoms. Furthermore, as the patients were natives of a particular demographic, this study cannot be employed for correlating demographic variability in women with LUTS.

Within the clinically obstructed group, 41% showed significant causes like genito-uterine prolapse, caruncle, or urethral stenosis, aligning with the findings of previous studies [14-17]. Focused local examinations, particularly in menopausal patients, helped in diagnosing specific causes such as senile urethral changes. Moreover, uroflowmetry and ultrasonography highlighted the differences in maximum flow rates (Qmax) between various LUTS groups, with obstructive LUTS depicting a mean Qmax of 13.38 ± 7.29 ml/s. Interestingly, the maximum cystometric capacity (MCC) increased in cases of obstructive LUTS, potentially due to the delayed presentation of the disease.

In the current study, 50% of the patients showed detrusor overactivity, and 15% exhibited detrusor instability, contrary to the findings of Chow et al [18]. Urodynamic criteria, including Qmax <15 mL/s and pdet@Qmax > 20 cm H_2O, consistently validated obstructive LUTS, emphasizing the importance of objective assessments. Voiding cystourethrography (VCUG) performed in this study helped to understand the activity of detrusor and sphincter muscles, with 28.3% showing obstruction on findings such as a closed bladder neck during micturating phase. Urethrocystoscopy further confirmed the diagnoses, with 41.7% of obstructive LUTS cases attributed to senile urethral changes, genito-uterine prolapse, cystocele, and caruncle.

While previous studies proposed various urodynamic parameters for diagnosing obstructive

LUTS in females, our study aligns with the importance of Qmax and pdet@Qmax in determining obstruction [19-21]. However, variations in threshold values continue to hinder standardized definitions [20-25]. The present study however reveals statistically significant differences in Qmax, MCC, and PVR measurements in the obstructed group, reinforcing the diagnostic utility of these parameters. The sensitivity and specificity of the set criteria in this study were 10% and 100%, respectively, further highlighting the importance of refined diagnostic thresholds in women with LUTS.

Conclusion

The present study on the diagnosis and management of LUTS in women underscores the challenges associated with diagnosing and managing bladder outlet obstruction (BOO) in females. It emphasizes the need for comprehensive evaluations, incorporating urodynamic studies and urethrocystoscopy, to understand the complexities of lower urinary tract symptoms in women. The findings of this study significantly contribute towards better understanding of the diverse aspects of female urology, and offers valuable insights that can help in improving diagnostic approaches and therapeutic interventions.

Limitations

The study is limited by its focus on a particular demographic which restricts its generalizability toward other populations.

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