

Urodynamic Findings of The Patients with Interstitial Cystitis/ Bladder Pain Syndrome: A Single Tertiary Center Results

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ABSTRACT

Objective: Patients with interstitial cystitis/bladder pain syndrome (IC/BPS) exhibit a wide range of symptoms. Urodynamics-pressure flow study (UD-PFS) results may show that these patients have urgency, decreased bladder capacity, and pelvic pain worsening as the volume increases. UD-PFS examinations may contribute to analyzing the pathophysiology of lower urinary tract symptoms (LUTS). This study aimed to evaluate the demographic and clinical findings of IC/BPS patients and the results of UD-PFS examinations.

Methods: The data of 132 IC/BPS patients between 2010 and 2020 were examined retrospectively, and UD-PFS was applied to 63 patients whose LUTS did not benefit from medical treatment. The patients' clinical and demographic data and UD-PFS findings were evaluated separately.

Results: Of the patients who underwent UD-PFS, 7 were men, and 56 were women. The first urine sensation in UD was 74.0 ± 32.22 cc, and the maximum cystometric capacity was 288.4 ± 181.2 cc. Seven patients had a hypo-compliant bladder, and 42 had a normo-compliant bladder. In PFS, Qmax and maximum detrusor pressure in the voiding phase were 18.87 ± 8.21 mL/sec and 33.93 ± 14.78 cmH₂O, respectively. Stress urinary incontinence was detected in 7 patients. For detrusor function, neurogenic detrusor overactivity was detected in 18 patients, and normal UD-PFS was detected in 45 patients, whereas reflexive detrusor was not observed. Cystoscopy revealed Hunner's ulcer in 7 patients.

Conclusion: Urodynamic variables associated with early sensations, first urge, intense desire, and a reduced maximum cystometric capacity were significantly related to the severity of the IC/BPS symptoms. Urodynamic testing is not often a definitive diagnostic method for IC/BPS, although it may assist in the diagnosis process.

Keywords: Urodynamic examination, Pressure Flow Study, Bladder Pain Syndrome, Interstitial Cystitis

1. INTRODUCTION

Interstitial cystitis/bladder pain syndrome (IC/BPS) is a medical condition that is diagnosed based on clinical symptoms. These symptoms include increased frequency of urination, urgency, pain, pressure, or discomfort in the bladder. It is important to note that these symptoms are present without any other underlying pathological findings (1). It is a complex and hard-to-deal health issue with unknown pathology that affects approximately 10% to 15% of the female population (2). Urgency is the most common symptom of IC/BPS with an overactive bladder. It should prompt a referral to a provider with the requisite knowledge and expertise in this disease state.

Certain patients with IC/BPS exhibited distinct urodynamic characteristics, including sensory urgency and instability,

decreased bladder capacity, and pain during bladder filling at low volumes (3). However, there is limited literature regarding the urodynamic characteristics of patients with IC/BPS. In order to understand the pathophysiology of this disease, provide differential diagnosis, and be more precise in diagnosis, urodynamic-cystometric examinations and pressure flow studies (UD-PFS) provide clinical contributions. Although it is not recommended for all patients, it should be applied to selected patients with neurogenic bladder symptoms.

Urodynamics-PFS is not uniformly mandated for all patients with IC/BPS patients. It is particularly beneficial when the diagnosis is ambiguous, symptoms coincide with other

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urinary conditions (such as overactive bladder), or when first therapies are ineffective (4). Urodynamics-PFS results may differentiate IC/BPS from disorders like idiopathic overactive bladder. IC/BPS patients often have reduced bladder capacity and compliance and do not demonstrate involuntary bladder contractions, in contrast to those with an overactive bladder. Urodynamics-PFS may provide further insights to corroborate a diagnosis of IC/BPS, particularly in intricate cases, but it should be integrated with clinical data and other diagnostic modalities (5). Urodynamics-PFS can objectively assess bladder function alterations after intravesical therapies; nevertheless, its regular use for this purpose remains unestablished (6).

Based on these data, one can conclude that UD-PFS is not generally required for all patients with IC/BPS; nevertheless, it may serve as a valuable adjunct in complicated or ambiguous situations, especially when symptoms coincide with other urinary diseases. This study evaluated the demographic and clinical findings of IC/BPS patients with the UD-PFS examinations.

2. METHODS

The retrospective analysis included examining data from 132 patients with IC/BPS symptoms who received follow-up care at our clinic from 2010 to 2020. This study was conducted with the agreement of a local ethics committee (Tekirdağ Namik Kemal University, Non-interventional Clinical Trials Ethical Committee), under protocol number 2021.18.01.18. A written informed consent was obtained from participants (for the ones under age 18, a written informed consent was obtained from their parent/legal guardian/next of kin) to participate in the study. All procedures performed in this study followed the institutional and/or national research committee's ethical standards and the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

The research excluded patients who did not meet the diagnostic criteria for IC/BPS or had other medical conditions that may account for their symptoms. All patients with sterile urine and with no abnormal physical examination (n:89) had a flexible cystoscopy under local anesthesia to rule out the possible etiology. UD-PFS was applied to 63 IC/BPS patients who did not benefit from the medical treatment of lower urinary tract symptoms (LUTS). The flowchart used to determine the patient group that underwent urodynamic evaluation is shown in Figure 1. Patients with early feeling of urgency, overactive bladder, or low bladder capacity had antimuscarinic therapy (Solifenacin succinate 5 mg daily) before urodynamics. Patients who did not benefit from this 1-month treatment were given an additional 1-month Mirabegron 50 mg combination and were followed up for three more months with dual therapy. Patients who did not benefit from the 3-month combination treatment were classified as treatment failure and were referred to urodynamics.

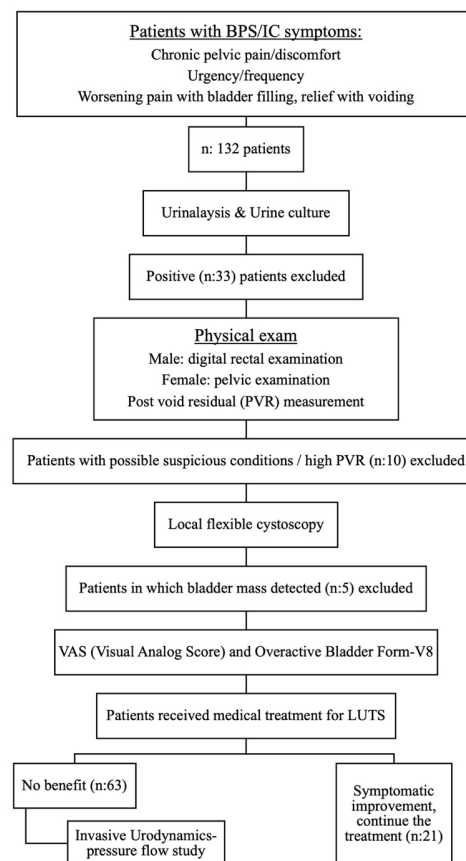


Figure 1. Study flowchart for urodynamics in BPS/IC patient group

The urodynamic investigations were conducted according to the guidelines recommended by the International Continence Society (ICS) (4). Patients were instructed to empty their bladders before the examination, and the first stage was to measure the postvoid residual (PVR) volume using a urethral catheter. Filling cystometry was then performed at 10 mL/min with saline solution or at reduced rates in cases of severe detrusor overactivity (DO) or known limited functional capacity. Following the urodynamic evaluation, a PFS was then performed. Following the pressure-flow study, the PVR was reevaluated with a urethral catheter. An expert in urodynamics evaluated all of the urodynamic traces. The study aimed to investigate the demographic characteristics (age, gender, follow-up period) and clinical data (incontinence, urgency) of the patients, as well as their urodynamic findings based on ICS guidelines (4). Specifically, the following parameters were examined separately: first urinary sensation of the filling bladder (mL), maximum cystometric capacity (mL), maximum detrusor pressures during the filling and voiding phases (cm H₂O), post-voiding residual volumes (mL), and pressure flow study parameters (Q_{max}, mL/sec, and P_{det}Q_{max}, cm H₂O).

3. RESULTS

A cohort of 63 individuals, including seven male (11.1%) and 56 (88.9%) females, underwent UD-PFS. The mean ages of the participants in the study were found to be 47.6 years, while

the average duration of follow-up was determined to be 49.4 months. Most patients had urgency symptoms (52.4%) and incontinence (66.7%). Seven individuals (7.9%) were found to have Hunner ulcers during cystoscopy, while others (92.1%) had normal bladder mucosal appearance. Table 1 presents the demographic information of the patients.

Table 1. Patient demographics of the BPS patients with UD examinations

Variable	Value
Age (mean \pm SD)	47.6 \pm 15.3
Gender (n, %)	Male 7 (11.1%)
	Female 56 (88.9%)
Follow up period (months) (mean \pm SD)	49.4 \pm 36.2
Body-Mass Index (BMI) (mean \pm SD)	27.6 \pm 3.8
Urgency (n, %)	Yes 18 (28.6%)
	No 45 (71.4%)
Urge Incontinence (n, %)	Yes 16 (25.4%)
	No 47 (74.6%)
Stress-Incontinence (n, %)	Yes 7 (14.3%)
	No 54 (85.7%)

SD: standard deviation, BPS: Bladder Pain Syndrome, BMI: Body Mass Index

The average first urinary feeling of the patients was 74.0 mL. Most individuals with IC/BPS had normal-compliant bladders, whereas 14 patients had a hypercompliant bladder. The average maximal cystometric capacities were 288.4 mL, and the post-voiding residual volumes were 22.57 mL. The detrusor pressure reached a maximum of 23.75 cm H₂O during the filling phase and 48.925 cm H₂O during the voiding phase. The maximum flow rate (Q_{max}) was 18.87 mL/sec. A total of 4 patients, constituting 6.3%, had obstruction during urinating. The patients' UD-PFS results are shown in Table 2.

Table 2. Urodynamic findings of the IC/BPS patients

Variable	Value
First urinary sensation (mL) (mean \pm SD)	74.0 \pm 32.22
First urge sensation (mL) (mean \pm SD)	134.5 \pm 34.56
Strong desire to void (mL) (mean \pm SD)	245.8 \pm 88.98
Maximum Cystometric Capacity (mL) (mean \pm SD)	288.4 \pm 181.2
Maximum Detrusor Pressure at filling (cm H ₂ O) (mean \pm SD)	23.75 \pm 19.15
Maximum Detrusor Pressure at voiding (cm H ₂ O) (mean \pm SD)	48.25 \pm 30.88
Compliance (n, %)	Hypo-compliant 7 (11.1%)
	Normo-compliant 42 (66.7%)
	Hyper-compliant 14 (22.2%)
Post-voiding Residual Volumes (mL) (mean \pm SD)	22.57 \pm 18.45
Q _{max} (mL/sec) (mean \pm SD)	18.87 \pm 8.21
Detrusor pressure at maximum flow (cm H ₂ O) (mean \pm SD)	33.93 \pm 14.78

SD: standard deviation, n: 63, Q_{max}: maximum measured rate of flow

Urodynamic overactivity, decreased maximum cystometry capacity, and compliance disorder was detected in 21 of the patients who underwent urodynamics. These patients were treated by changing their medication or switching to intravesical botulinum toxin injection.

4. DISCUSSION

Interstitial cystitis/BPS is clinically diagnosed by the presence of urgency/frequency symptoms and bladder or pelvic discomfort. As clinicians and researchers, we still define, diagnose, and treat IC/BPS. Various studies have sought to investigate the urodynamic findings in patients with IC/BPS, aiming to understand the underlying mechanisms better and improve diagnostic accuracy and treatment strategies for this condition. However, urodynamics' usefulness in IC/PBS has been debated.

The urodynamic evaluation of the IC/BPS patients showed that frequent and small voiding is the predominant symptom. Teichman et al. (8) also found similar results. The lowered threshold for first feeling, initial desire, and awake bladder capacity aligns with bladder hypersensitivity, leading to urgency and frequent urination (8). Teichman et al. (8) found that maximum cystometric capacity (MCC) is lower than 300 mL, which is in correlation with our study. Detrusor overactivity was seen in 18% of the patients in this study, a lower percentage than ours. Individuals with IC/BPS and Hunner ulcers often experience increased frequency of urination and reduced amount of urine voided (9). Urodynamic measurements may not be necessary for diagnosis but reveal a consistent pattern of frequent voiding of tiny volumes in most individuals with interstitial cystitis (10). Interstitial cystitis/BPS should be included in the list of possible diagnoses for patients experiencing urgency, frequency, nocturia, dysuria, or pelvic pain and discomfort. Various clinical situations may need additional considerations and tests. Performing a urinalysis on all patients to rule out pyuria and hematuria and conducting a culture on any patient suspected of a urinary tract infection is crucial.

Urodynamic studies may assess bladder feeling, compliance, and capacity as the bladder fills. Detrusor contractility and uroflow rate may be assessed simultaneously. These examinations are beneficial for diagnosing voiding dysfunction, such as neuropathic bladder and bladder outlet blockage, in both men and women. The significance of urodynamic investigations in individuals with IC is uncertain (11). More randomized controlled studies are needed in this patient group. More recent research has been conducted. More needs to be done to examine the function of urodynamics in IC/PBS. Early research revealed that most patients with IC/PBS had first sensations quickly during UD-PFS (12). In their investigation, Perez-Marrero et al. (13) discovered bladder hypersensitivity (initial feeling <100 mL) in all 50 patients, similar to our study results. Steinkohl et al. (12) conducted a retrospective study of 41 patients with IC/PBS who had undergone UD. They discovered that all patients had "sensory instability," feeling the first urge or discomfort

when their bladder was filled to an average capacity of 74 mL.

The elimination of other pathologies and symptoms of urgency, frequency, pain, pressure, or discomfort during bladder filling is the main emphasis of the current paradigm for diagnosing IC/BPS (14). With an average symptom duration of 5 to 8 years before diagnosis, the absence of objective data in detecting IC/BPS often causes delays in diagnosis (1). On average, patients with IC/BPS have symptoms for five years before being diagnosed (15). The patient with IC/BPS usually suffers symptom progression, where the early-phase illness worsens with time. Some of the research reports that 8% of his adult patients had a history of urinary problems that began in childhood. Our study's relatively low age of disease onset also confirms this data.

Documentation of other significant lower urinary tract anomalies, such as detrusor instability and urge or stress urinary incontinence, is made easier with urodynamic examination. Although many diseases can cause bladder dysfunction (16), possible bladder effects may also occur in IC/BPS patients. Stress urinary incontinence has a substantial impact on both the physical and emotional well-being, as well as the overall quality of life, of affected individuals (17). Urodynamics may provide helpful, objective documentation of the lower urinary tract's reaction to different treatment procedures as IC/BPS research advances.

Studies investigating the relationship between PVR volume and LUTS are crucial for evaluating bladder emptying dynamics. A previous study demonstrated a significant association between the sensation of incomplete bladder emptying and PVR volume in women across all age groups. In contrast, this relationship was observed only in men over 60. The same study reported that PVR volume increased with age in men and that voiding symptoms and urgency were significantly correlated with higher PVR volumes (18). These findings support the role of PVR measurement in assessing IC/BPS patients and underscore the necessity of a comprehensive analysis of the voiding function.

Some of the study's limitations include the absence of a bladder diary to show the severity of IC/BPS, the retrospective and cross-sectional research design that restricts generalizability, and the limited sample size of patients that may lead to selection bias. Furthermore, urodynamic testing is a sensitive test that may be affected by several variables, such as patient stress and anxiety, and individual and environmental factors can also impact the results. Also, the IC/BPS patient group is diverse and has multiple clinical presentations. The fact that this was single-center research from a tertiary referral facility affected our results. The minimal sample size and intrinsic lack of statistical power prevented us from conducting multivariate analysis to investigate success and complication prediction more thoroughly. The literature indicates that even urology clinics with significant patient volumes could publish their findings with modest sample sizes. Other multicentric studies recording national data like ours will enhance national literature. Given this, the study's participant count

contributes substantial scientific data to the national data bank. Finally, one significant limitation might be the need for more assessment of the potential impact of urodynamic data on treatment choices and outcomes.

5. CONCLUSION

According to this research, urodynamic measures linked to early initial feeling, first urge, strong desire, and a lower MCC were substantially correlated with the severity of the symptoms. The urodynamic study is generally not a conclusive diagnostic tool for IC/BPS, but it may aid in the process. Nevertheless, we should be conscious that there are no definite diagnostic criteria for the disease.

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Research idea: MFŞ, MA, AM

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Acquisition of data for the study: MA, AM

Analysis of data for the study: AM, SŞ, MFŞ

Interpretation of data for the study: ÇD, MFŞ

Drafting the manuscript: SŞ, OÖ

Revising it critically for important intellectual content: MSK, OÖ

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