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RESEARCH ARTICLE
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ANALYSIS OF URODYNAMICS IN MEN WITH THE COMMON SYMPTOMS OF LOWER URINARY TRACT- A CLINICAL STUDY

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Abstract:
Lower urinary tract symptoms (LUTS) are the urological manifestation that increases with age and affects the quality of life in 60 percent of the population. Bladder storage and voiding are due to a specialized physiological process. Urodynamic evaluation includes recording of vesical and abdominal pressures while filling, and also uroflow during the voiding phase.

Key Words: Urodynamics, Uroflowmetry, Detrusor Activity, Lower Urinary Tract Activity (LUTS).

INTRODUCTION:

The complaints of lower urinary tract-related pathology increase with age. Mechanisms and the aging process are important in the evaluation of older men with lower urinary tract symptoms. Since many geriatric diseases are multifactorial in origin, proper assessment of the functional disturbances of the lower urinary tract and its associated medical illness. Lower urinary tract illness usually presents with the three urodynamic abnormalities, including bladder outlet obstruction, detrusor overactivity, and detrusor underactivity

AIM:

This study aims to assess the clinical and urodynamic characteristics of elderly patients presenting with lower urinary tract symptoms, to achieve an accurate diagnosis and optimize management strategies.

BACKGROUND:

Urodynamic evaluation is the study of the functional status of the lower urinary tract using techniques guided by the International Continence Society. It includes measurement of vesical pressure, urethral pressure profile, pressure flow studies, uroflowmetry, Electromyography (EMG) of the pelvic floor, and simultaneous fluoroscopic visualization through video cystometrogram. These findings, analyzed individually or together, help evaluate functional status.

Methods:
1. Conventional studies: Conducted in the lab with artificial bladder filling.
2. Ambulatory studies: Functional studies during natural bladder filling under daily conditions.

The evaluation involves measuring intravesical pressure and abdominal pressure via the vagina, rectum, or stoma. Detrusor pressure reflects passive and active forces on the bladder wall. Cystometry assesses the volume-pressure relationship during filling. A physiologic filling rate is less than body weight (kg) divided by 4.
In a normal pattern, minimal detrusor activity is noted during filling, with sphincter relaxation initiating voiding. Abnormal urodynamic patterns reflect detrusor function, compliance, and outflow status. A positive urethral closure pressure during bladder filling, despite increased abdominal pressure, indicates a competent closure mechanism. Incompetence leads to leakage without detrusor contraction.
Opening pressure marks the start of urine flow. The lowest pressure at maximum flow is called pressure at maximum flow.

Components of Urodynamic Study:
Uroflowmetry: A noninvasive study of urine flow over time; a bell-shaped curve indicates normal flow. Qmax (<12 mL/s with voided volume >160 mL) may indicate bladder outlet obstruction (BOO) or detrusor underactivity (DO). These are distinguished via pressure flow studies (PFS). In older patients, flow measurements can be difficult due to small voided volumes or environmental factors.
Even with obstruction, detrusor compensation may maintain flow. However, uroflowmetry doesn't provide a definitive diagnosis. It is widely used as the first evaluation step and is paired with post-void residual (PVR) volume to assess pathology.
Post-Void Residual (PVR): Measures urine remaining post-void, indicating bladder emptying status. Elevated PVR may suggest poor detrusor function. It does not establish a diagnosis but helps in identifying high-risk patients and monitoring progression. In patients without BOO but with PVR >100 mL, poor contraction is suspected.
Electromyography (EMG): Measures electric potentials from muscle depolarization. Urethral pressure profile (UPP) shows intraluminal pressure along the urethra. Urethral pressure is the fluid pressure to open a closed urethra, assessed by withdrawing a catheter with a pressure sensor.
Filling Cystometry: Assesses bladder pressure during filling, identifying involuntary detrusor contractions, bladder sensation, compliance, capacity, and leak point pressure. Detrusor pressure (Pdet) is calculated as: Pdet = Pves - Pabd
Involuntary contractions during filling cause urgency or incontinence.
Video Cystometrogram (VCMG): Uses radiopaque contrast during filling cystometry for fluoroscopic visualization. Though complex and costly, VCMG is reserved for specific cases like anatomical anomalies, failed surgeries, or neurological issues. It has limited use in elderly patients.
Detrusor Overactivity (DO): Defined by involuntary detrusor contractions during filling. DO may be neurogenic or idiopathic. In elderly patients, DO is common and can occur even without symptoms. It manifests as urgency or incontinence. DO and low compliance are prevalent in older bladders and may improve after relieving obstruction. These changes may be due to aging rather than obstruction. Patients with detrusor hyperactivity and impaired contractile function often have high PVR and cannot void effectively. UDS may show no BOO or sphincter issues. This condition must be differentiated from BOO as both cause high PVR and may involve DO.
Pressure-Flow Studies (PFS): Assess voiding phase by measuring intravesical and abdominal pressures, allowing Pdet calculation. Around 48% of patients over 60 are obstructed. Three voiding patterns are observed:
1. Obstructed: Low flow, high detrusor pressure.
2. Unobstructed: Normal flow, low detrusor pressure.
3. Hypocontractility: Low flow, low detrusor pressure.

Bladder Outlet Obstruction Index (BOOI): BOOI = Pdet@Qmax - 2 x Qmax
- 40: Obstructed
- 20–40: Equivocal
- <20: No obstruction

Bladder Contractility Index (BCI): BCI = Pdet@Qmax + 5 x Qmax BCI <100 indicates detrusor underactivity.

Lower Urinary Tract Symptoms (LUTS) in Elderly Men: Often multifactorial: impaired contractility, BOO, sensory urgency, DO. Symptoms may include urgency, frequency, weak stream, and hesitancy. DO with or without BOO causes urge incontinence. Aging and obstruction can coexist and worsen symptoms.

Role of UDS in LUTS Management: UDS helps guide management decisions, especially before surgery like TURP. Though debatable, UDS provides valuable insights in complex cases. Even after relieving obstruction (e.g., TURP), irritative symptoms may persist due to overlapping conditions. Hence, UDS helps predict symptom improvement.

MATERIALS AND METHODS:

100 individuals aged above 50 years who were reported in the Department of Urology, Kilpauk Medical College, with the chief complaint of urinary tract symptoms. The regular medical history was obtained from each patient, and informed consent was also obtained to participate in this study. The patients were divided into irritative and obstructive symptom groups according to their chief complaints. Irritative symptoms are urinary frequency, nocturia, urgency, and or urge incontinence. Obstructive symptoms include straining, weak stream, intermittency, and incomplete emptying. All Patients were required to complete 24 24-hour voiding diary and pad test for 3-day frequency volume chart in order to document urinary volume, incontinence, and urgency episodes, and daytime and nighttime frequencies. The International prostate symptoms score has been calculated for the cases. Urinalysis, Urine culture, non-invasive free flow uroflowmetry, and post-void residual urine volume measurement were performed.

All patients are subjected to Urodynamic evaluation using the Aymed UDE Locum Wireless System v. 0.2.34 machine. A laxative was given the night prior study. Patient is confirmed to be culture-free and was started on antibiotics before the procedure. Before catheterization and initiation of UDE, the patient is asked to void. The UDE machine is primed every time before use. A single urinary catheter of size 6 Fr, which has two channels, one for the measurement of Pves and the other for bladder filling, was used. The catheter is fixed after insertion.

The rectal catheter 6 F is introduced, using lubricant, through the anus so that the tip is positioned 10 cm to 15 cm above the anal verge. The perianal area should be dried and the catheter taped as close as possible to the anal verge. Filling cystometry was done at a rate of 25-40 ml. per minute using normal saline at room temperature with the patient reclining. Voiding is also done in the same position once capacity is achieved.

During bladder filling, bladder sensation (first sensation of filling, normal desire to void, strong desire to void, urgency, or pain), detrusor activity, bladder compliance, bladder capacity, and leak point pressure are assessed. During voiding, the voided volume, maximum flow rate (Q max), the average flow rate, the maximum Pdet (max pdet), and the Pdet on maximum flow were recorded.

Results:

Out of the total 100 patients evaluated, 60 patients presented with irritative LUTS and 40 patients presented with obstructive LUTS. The maximum age group falls under the 70-75 category. [Table 1] [Chart 1] The mean age in the Irritative group is 68.2, while on the obstructive group it is 71.9. The overall mean age was 70.8. [Table 2]

Characteristics of Participants	
Irritative LUTS	60
Obstructive LUTS	40
Total	100
Age Distribution	
50-55 years	6
55-60 years	11
60-65 years	15
65-70 years	28
70-75 years	90
More than 75 years	10

Table 1: Participant Characteristics

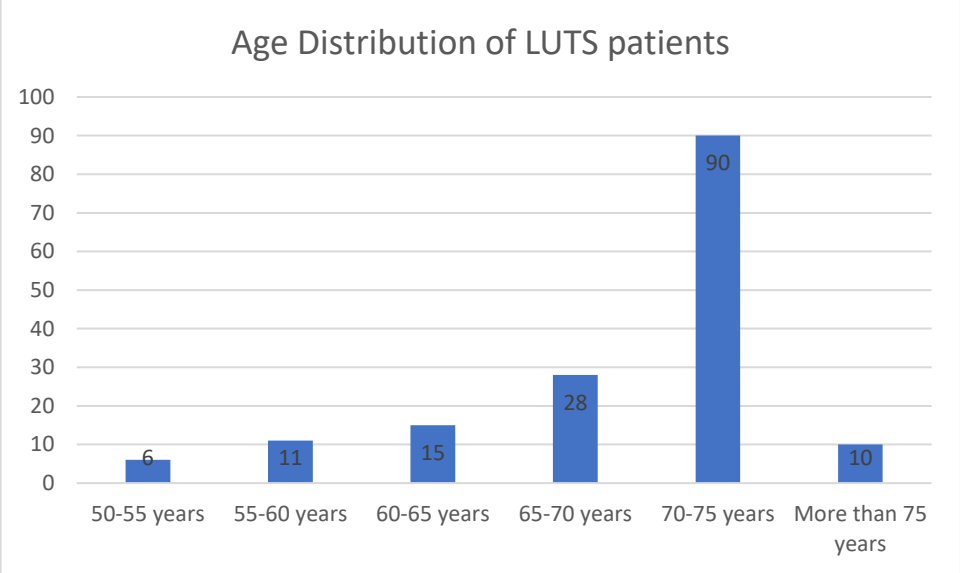

Chart 1: Age Distribution of LUTS Patients

IPSS score showed mean score of 24.5 in irritative LUTS group whereas 21.2 in obstructive LUTS group and the overall mean score being 23.4. The mean value of maximum flow rate (Q max) is 16.5 in irritative LUTS group whereas 8.4 in case of obstructive LUTS. Overall mean Q max being 13.2. The mean value of bladder capacity is 320.8 ml in irritative LUTS group whereas 364.6 ml in case of obstructive LUTS group. Overall mean bladder capacity being 341.7 ml. The mean value of PVR is 68.4 ml in irritative LUTS group whereas 84.5ml in the case of the obstructive LUTS group. Overall mean PVR is 78.4 ml. The mean value of p det Qmax is 31.9 cm H2O in the irritative LUTS group, whereas it is 30.1 cm H2O in the case of the obstructive LUTS group. Overall mean Pdet Qmax is 31.2 cm H2O. [Table 2]

Parameter	Irritative LUTS	Obstructive LUTS	Overall	p-value NS Non-significant S - Significant
Mean Age (years)	68.2	71.9	70.8	0.67 (NS)
Mean IPSS Score	24.5	21.2	23.4	0.14 (NS)
MeanQmax (ml/sec)	16.5	8.4	13.2	0.03 (S)
Mean Bladder Capacity (ml)	320.8	364.6	341.7	0.34 (NS)
Mean PVR (ml)	68.4	84.5	78.4	0.24 (NS)

Mean Pdet @ Qmax (cmH_2O)	31.9	30.1	31.2	0.34 (NS)

Table 2: Value of mean of parameters of Irritative LUTS and Obstructive LUTS

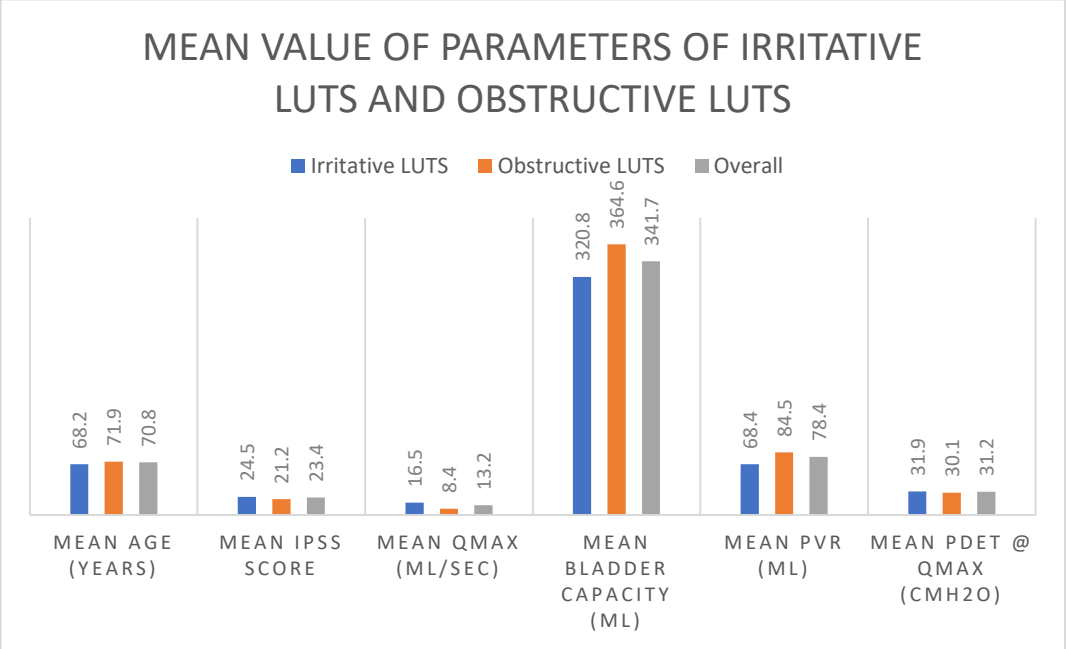

Chart 2: Parameters of Irritative LUTS and Obstructive LUTS

Out of 100 patients, 43 were diagnosed with bladder outlet obstruction (BOO), with 23 from the obstructive LUTS group and 20 from the irritative group. BOO combined with detrusor overactivity (DO) was observed in 12 patients (5 obstructive, 7 irritative). Detrusor underactivity (DU), assessed using the bladder contractility index (BCI <100), was identified in 50 patients—20 with obstructive and 30 with irritative LUTS. BOO with DU was seen in 16 patients (6 obstructive, 10 irritative), while 21 patients had both DO and DU (11 obstructive, 10 irritative). [Table 3] [CHART 3]

Condition	Irritative LUTS	Obstructive LUTS	Total
DO	46	28	18
BOO	20	23	43
BOO + DO	7	5	12
DU	30	20	50
BOO +DU	10	6	16
DO + DU	10	11	21

Table 3: No of Patients from Irritative LUTS and Obstructive LUTS with conditions BOO – Bladder Outlet Obstruction; DO – Detrusor Overactivity; DU – Detrusor Underactivity.

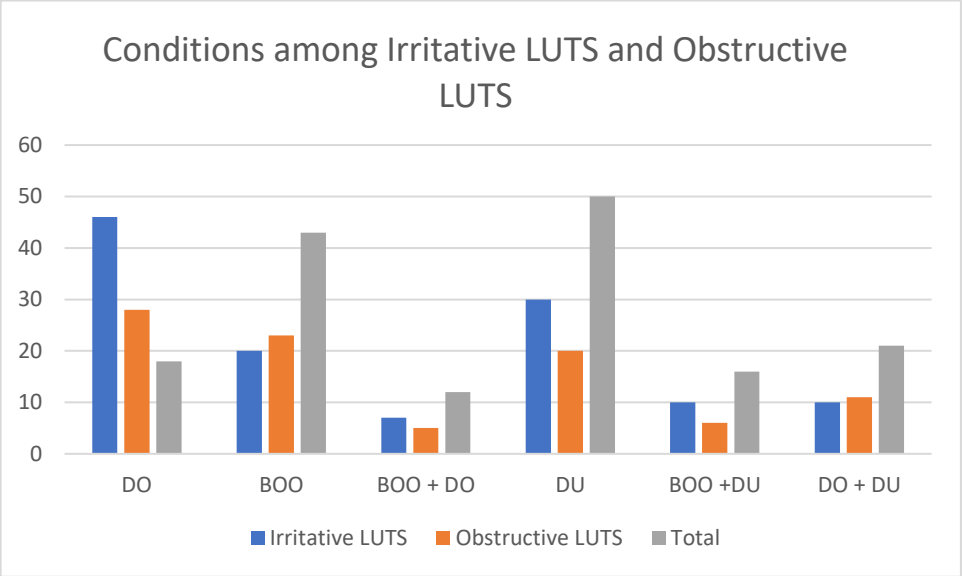

Chart 3: Conditions among Irritative LUTS and Obstructive LUTS. BOO – Bladder Outlet Obstruction; DO – Detrusor Overactivity; DU – Detrusor Underactivity.

Clinical and urodynamic parameters were compared, particularly concerning DO. Patients with DO had a mean 24-hour urinary frequency of 11.26, compared to 11.01 in those without DO. The mean 24-hour urine output in patients with DO was 1764.54 ml, while it was 1784.49 ml in those without DO. The mean maximum voided volume in the DO group was 337.5 ml compared to 383.93 ml in non-DO patients. The mean minimum voided volume was 3.88 ml in DO patients versus 55.73 ml in those without DO. [Table 4] [Chart 4]

Parameter	With DO	Without DO	p-value
24-Hour Frequency (mean)	11.26	11.01	0.613
24-Hour Urine Output (ml)	1764.54	1784.49	0.82
Max Voided Volume (ml)	337.5	383.93	0.27
Min Voided Volume (ml)	3.88	55.73	0.428

Table 4: Detrusor Overactivity with relation to Frequency and Urine Output

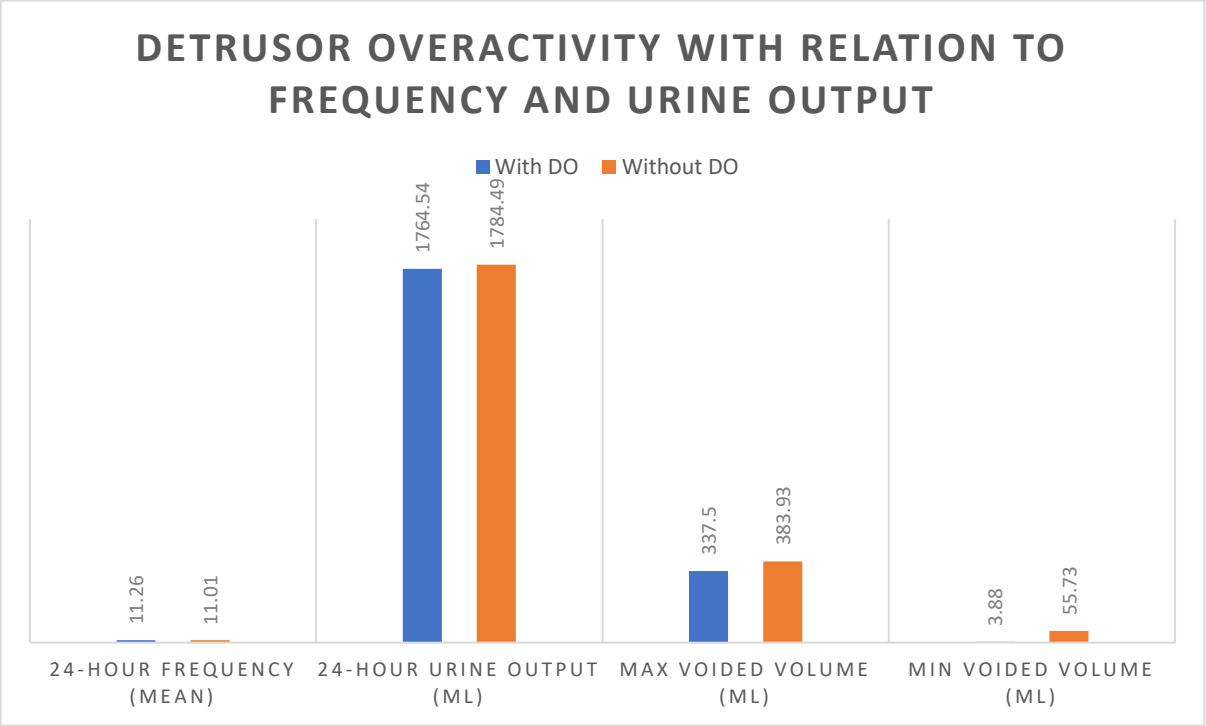

Chart 4: Detrusor Overactivity with relation to Frequency and Urine Output

DISCUSSION:

Lower urinary tract symptoms (LUTS) affect up to 80% of elderly men and have a complex, multifactorial origin. Weak urinary stream is a common complaint. Initial evaluation should include medical history, symptom assessment, examination, and urine analysis before considering urodynamic studies (UDS).

Urinary flow rate (Qmax) is a non-invasive, valuable tool to assess and monitor treatment. However, over one-third of older men with LUTS show no urodynamic evidence of bladder outlet obstruction (BOO). Additionally, 30% of patients with low Qmax have detrusor hypocontractility rather than obstruction, and 8% with Qmax >15 ml/s still have BOO. Hence, Qmax alone is insufficient for diagnosis.

Pressure-flow studies (PFS) are essential before surgical intervention, particularly if Qmax >10 ml/s. For Qmax <10 ml/s, obstruction is likely, and PFS may be omitted. UDS improves diagnostic accuracy and surgical outcomes in patients with proven BOO. In men over 80, PFS is especially valuable due to increased surgical risks and the possibility of non-obstructive symptoms due to aging.

This study confirms age-related changes: mean bladder capacity of 341.7 ml, mean PVR 78.4 ml, and mean Qmax 13.2 ml/s. The mean detrusor pressure at Qmax was 31.2 cm H_2O. Detrusor overactivity (DO) was the most significant finding, seen in 46% of patients—28 from the irritative group and 18 from the obstructive group ($p < 0.01$). BOO and detrusor underactivity (DU) were not statistically significant.

In total, 75% of patients showed detrusor dysfunction: 50 had DU, 21 had DO + DU, and 16 had BOO + DU. BOO was seen in 43%, and DO in 46%. Previous studies, including Lee (1999) and Thomas & Abrams (2000), support these findings, showing overlap between BOO and DO.

UDS helps differentiate causes of voiding dysfunction, which may be due to BOO, DU, or DO. Idiopathic DO is common in elderly men and often overlaps with BOO. While UDS is invasive, its use in elderly patients—especially those with neurologic disease, prior surgeries, high PVR, or persistent symptoms—is justified. Ultimately, careful selection of patients and proper timing of UDS improve diagnostic accuracy and guide effective management, particularly in complex or refractory LUTS cases.

CONCLUSION:

This study supports the use of urodynamic studies in the evaluation of elderly men more than 50 years old presenting with LUTS.

A significant proportion of elderly patients was found to have urodynamic abnormalities such as detrusor overactivity (DO)or detrusor under activity (DU) or bladder outlet obstruction (BOO) and additionally, the urodynamic abnormalities are widely differing, reflecting the variation in underlying etiologies

Detrusor overactivity in patients with LUTS significantly affects their symptom score and perception of quality of life. Moreover, it is strongly affected by the degree of obstruction on uroflowmetry, post-void residual urine estimation as assessed by pressure flow study.

So urodynamic study plays an important role in establishing a correct diagnosis in elderly patients with LUTS and deciding on additional treatments.

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