



Post-Void Residual Urine and Bladder Function Assessment in Patients with Chronic Urinary Retention

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KEYWORDS

Post-void residual, chronic urinary retention, bladder function, detrusor underactivity, urodynamic assessment

ABSTRACT:

Background: Chronic urinary retention (CUR) is characterized by incomplete bladder emptying and persistently elevated post-void residual (PVR) urine volume. It is a common condition among elderly patients and those with bladder outlet obstruction or detrusor underactivity. This study aimed to assess the post-void residual urine volume and bladder function in patients with chronic urinary retention who attended a tertiary care hospital in Bangladesh.

Methods: A cross-sectional observational study was conducted on 60 patients diagnosed with CUR at the Department of Urology, Bangladesh Medical University, from June 2024 to July 2025. Sociodemographic characteristics, bladder volumes, and urodynamic parameters were collected using standardized protocols. Post-void residual urine was measured using ultrasound, and urodynamic studies were performed following the International Continence Society guidelines. Data were analyzed using SPSS version 25.0.

Results: The majority of participants were male (80%) and aged between 50 and 69 years. The mean post-void residual urine volume was 185 ± 75 mL, with a mean bladder voiding efficiency of 62.5%. Detrusor underactivity was identified in 61.7% of the patients, and 48.3% exhibited bladder outlet obstruction. Reduced bladder compliance was observed in 26.7% of the participants.

Conclusion: Elevated postvoid residual urine and suboptimal bladder voiding efficiency are prevalent in patients with chronic urinary retention. Detrusor underactivity and bladder outlet obstruction are the principal mechanisms underlying BPH. Comprehensive bladder assessment using ultrasound and urodynamic testing is essential for accurate diagnosis and effective management of bladder dysfunction.

INTRODUCTION

Chronic urinary retention (CUR) is a urological condition characterized by persistent incomplete bladder emptying and elevated post-void residual urine (PVR) volume [1]. It commonly results from bladder

outlet obstruction (BOO), detrusor underactivity (DUA), or a combination of both mechanisms [2]. CUR poses significant health risks, including recurrent urinary tract infections (UTIs), bladder decompensation, and renal impairment [3]. Accurate assessment of



bladder function and PVR volume is, therefore, essential in evaluating the severity of retention and guiding management [4].

Measurement of PVR volume is a non-invasive diagnostic tool that provides an objective indication of bladder emptying efficiency. According to standardized definitions, a PVR exceeding 100–150 mL suggests inadequate bladder evacuation and may indicate underlying detrusor dysfunction or obstruction [5]. Recent advancements in ultrasonographic measurement techniques have improved the precision and reproducibility of PVR estimation, supporting its role in both outpatient and hospital-based evaluations [6]. Despite these technological developments, there is still variation in interpreting PVR thresholds and their clinical implications across populations, particularly in low-resource settings such as Bangladesh [7].

Previous studies have documented that elevated PVR is associated with detrusor underactivity, benign prostatic hyperplasia (BPH), and diabetic cystopathy [8]. Studies also highlight the correlation between age, sex, and PVR volume, with older men showing a higher prevalence of retention due to progressive bladder outlet obstruction [4]. In contrast, women often develop retention secondary to impaired detrusor contractility or postoperative bladder dysfunction [9]. However, limited regional data exist on chronic urinary retention patterns, especially among South Asian populations, where comorbidities like diabetes and hypertension are prevalent [10].

Chronic urinary retention significantly impacts quality of life and healthcare utilization [11]. In Bangladesh, where access to specialized urodynamic evaluation is limited, patients often present late with severe bladder distension and complications. The integration of bladder scanning and urodynamic testing can provide early diagnostic insight and guide individualized treatment strategies [12]. Moreover, studies emphasize the necessity of evaluating both voiding efficiency and urodynamic parameters to differentiate detrusor underactivity from outlet obstruction, ensuring appropriate therapeutic intervention [13].

The present study aims to evaluate post-void residual urine and bladder function among patients with chronic urinary retention attending a tertiary care hospital in Bangladesh. Through structured analysis of bladder volumes and urodynamic parameters, this study intends to establish baseline data relevant to the Bangladeshi context and enhance the understanding of voiding dysfunction patterns in this population. Findings from this study may contribute to developing more effective

diagnostic and management algorithms for chronic urinary retention, promoting better clinical outcomes and patient care.

METHODOLOGY & MATERIALS

This cross-sectional observational study was conducted in the Department of Urology, Bangladesh Medical University (BMU), Dhaka, Bangladesh, from June 2024 to July 2025. The study population consisted of 60 adult patients diagnosed with chronic urinary retention (CUR) attending the outpatient and inpatient urology services during the study period.

Selection Criteria:

Inclusion Criteria:

- Adults aged ≥ 40 years presenting with chronic urinary retention.
- Patients with measurable post-void residual urine volume on ultrasound (>100 mL).

Exclusion Criteria:

- Patients with neurogenic bladder secondary to spinal cord injury.
- History of pelvic malignancy or pelvic surgery affecting bladder function.
- Pregnant women or those with postpartum urinary retention.

Data Collection Procedure

All participants underwent detailed clinical evaluation and urodynamic assessment. Data were collected using a structured case record form that included demographic variables, clinical symptoms, comorbidities, and relevant laboratory investigations. Post-void residual (PVR) urine volume was measured using a portable ultrasound scanner (transabdominal method) immediately after voluntary voiding. Bladder capacity and voided volume were documented to calculate bladder voiding efficiency. Urodynamic studies were performed using standard pressure-flow measurements, recording parameters such as detrusor pressure at maximum flow ($P_{det@Q_{max}}$), bladder compliance, and Q_{max} . Each measurement followed the International Continence Society (ICS) protocol for consistency and accuracy. Informed consent was taken from each participant, and confidentiality was maintained throughout the study.

Statistical Analysis

Collected data were analyzed using SPSS Statistics version 25.0. Descriptive statistics, including mean, standard deviation, frequencies, and percentages, were used for quantitative and categorical variables. Statistical significance was considered at $p < 0.05$.



RESULTS

Table 1: Baseline Characteristics of Study Participants (N = 60)

Variable	Category	Frequency (n)	Percentage (%)
Age Group (years)	40–49	10	16.7
	50–59	18	30.0
	60–69	20	33.3
	≥70	12	20.0
Gender	Male	48	80.0
	Female	12	20.0
Duration of Symptoms (months)	<6	14	23.3
	6–12	20	33.3
	>12	26	43.4
Comorbidities	Diabetes Mellitus	22	36.7
	Hypertension	28	46.7
	Both	10	16.6
History of Recurrent UTI	Yes	18	30.0
	No	42	70.0

Table 1 presents the baseline sociodemographic and clinical characteristics of the participants. Most participants were male (80%) and aged between 50-69 years (63.3%). Urinary symptoms exceeded 12 months in 43.4% of patients, indicating chronic retention before

the presentation. Hypertension (46.7%) and diabetes mellitus (36.7%) were the most frequent comorbidities, and 30% of the patients reported recurrent urinary tract infections.

Table 2: Distribution of Post-Void Residual (PVR) and Related Parameters

Parameter	Mean ± SD	Minimum	Maximum
Pre-void bladder volume (mL)	510 ± 120	320	800
Post-void residual volume (mL)	185 ± 75	60	360
Voided volume (mL)	325 ± 95	160	550
Bladder capacity (mL)	680 ± 130	450	920
Bladder voiding efficiency (%)	62.5 ± 15.3	35	88

Table 2 shows the descriptive statistics for bladder volume and voiding efficiency. The mean pre-void bladder volume was 510 ± 120 mL, and the mean post-void residual urine (PVR) volume was 185 ± 75 mL,

ranging from 60 to 360 ml. The mean bladder capacity was 680 ± 130 mL, and the mean bladder voiding efficiency was 62.5%, showing variable but reduced bladder emptying.

Table 3: Urodynamic Findings of Study Population

Urodynamic Parameter	Mean ± SD	Normal Range	Abnormal Cases n (%)
Detrusor pressure at Qmax (cm H ₂ O)	32.4 ± 10.8	40–70	44 (73.3)
Maximum flow rate (Qmax, mL/s)	8.9 ± 3.7	>15	49 (81.7)
Compliance (mL/cm H ₂ O)	38.6 ± 12.2	>30	16 (26.7)
Detrusor underactivity			37 (61.7)
Bladder outlet obstruction (BOO)			29 (48.3)

Table 3 summarizes the urodynamic parameters. The mean detrusor pressure at maximum flow was 32.4 ± 10.8 cm H₂O, and the mean maximum urinary flow rate (Qmax) was 8.9 ± 3.7 mL/s. Abnormal detrusor pressure and Qmax occurred in 73.3% and 81.7% of the cases, respectively. Detrusor underactivity was observed in 61.7% of patients, and 48.3% showed bladder outlet obstruction. Reduced bladder compliance (<30 mL/cm H₂O) was observed in 26.7% of the participants.

DISCUSSION

The findings of this study provide insights into the bladder function profile of patients with chronic urinary retention (CUR) within a Bangladeshi tertiary-care context. The mean post-void residual (PVR) volume of 185 mL observed in this study aligns with previous findings from Rubilotta et al., who reported similar residual volumes among patients with chronic lower urinary tract symptoms (LUTS) [1]. This reinforces the reliability of PVR measurement as a quantitative marker



for incomplete bladder emptying. The predominance of male patients (80%) corresponds with the global trend, where benign prostatic obstruction remains the leading cause of CUR in older adults, as noted by Cicione et al. [2].

The present data demonstrate a mean bladder voiding efficiency of 62.5%, suggesting suboptimal emptying in most patients. Comparable findings were described by Yono et al., who reported a similar voiding efficiency in underactive bladder cohorts, emphasizing that both detrusor underactivity (DUA) and outlet obstruction contribute significantly to incomplete emptying [8]. The high prevalence of DUA (61.7%) in this study also parallels earlier observations by Lee et al., who identified detrusor underactivity as a key pathophysiological mechanism in male patients with bladder outlet obstruction [14]. This overlap between underactivity and obstruction complicates diagnosis and highlights the importance of urodynamic evaluation for accurate differentiation.

Urodynamic assessment in this study revealed a mean detrusor pressure at maximum flow ($P_{det@Q_{max}}$) of 32.4 cm H₂O and a mean Q_{max} of 8.9 mL/s, both of which are below standard thresholds, indicating impaired voiding dynamics. Similar observations were made by Alhelal et al. in their evaluation of chronic retention following holmium laser enucleation of the prostate, where low flow rates correlated with residual obstruction and reduced detrusor contractility [15]. The finding that nearly half (48.3%) of participants exhibited bladder outlet obstruction (BOO) is consistent with data from Bosch et al., who reported that prolonged obstruction leads to detrusor hypertrophy and subsequent contractile failure [13].

The co-occurrence of hypertension (46.7%) and diabetes mellitus (36.7%) among participants likely influenced bladder function, given the established link between chronic metabolic disorders and neurogenic bladder dysfunction. Braffett et al. demonstrated that patients with long-standing diabetes exhibit elevated PVR and impaired bladder sensation, consistent with the diabetic cystopathy pattern [11]. This may explain the higher prevalence of detrusor underactivity among older individuals in the current study, as aging and comorbidities further impair bladder contractility. Similar demographic trends were observed by Lim et al., who noted age- and sex-dependent variations in normal PVR among healthy individuals, underscoring the importance of context-specific reference values [4].

In addition to detrusor and outlet dynamics, bladder compliance was reduced (<30 mL/cm H₂O) in 26.7% of cases. This is comparable to the results from Rubilotta et al., who found low compliance in patients with long-standing obstruction and recurrent urinary tract

infections [1]. Reduced compliance increases the risk of high storage pressures, potentially affecting upper urinary tract function. The presence of recurrent UTIs in 30% of the study population aligns with findings by Maramba et al., who reported a positive association between increased PVR and infection risk, emphasizing the clinical consequences of persistent residual urine [16].

In summary, the study findings are consistent with existing international data while contributing region-specific insights into CUR patterns. The elevated PVR values, predominance of male patients, and frequent presence of detrusor underactivity and bladder outlet obstruction demonstrate the complex interplay of factors leading to chronic retention. These observations highlight the clinical importance of integrating ultrasound-based PVR measurement with urodynamic assessment to ensure precise diagnosis and management. Establishing standardized PVR benchmarks for the Bangladeshi population could enhance diagnostic accuracy and inform national urological guidelines for chronic retention management.

Limitations of the study

1. The study was conducted at a single tertiary-care center with a limited sample size, which may restrict generalizability.
2. Advanced neurophysiological and imaging assessments were not performed, limiting etiological precision.

CONCLUSION

This study demonstrated that most patients with chronic urinary retention present with significantly elevated post-void residual urine and reduced bladder voided efficiency. Detrusor underactivity and bladder outlet obstruction are the predominant causes, often associated with comorbid conditions such as diabetes and hypertension. These findings highlight the importance of combined ultrasound and urodynamic assessment in clinical evaluation and management planning, emphasizing the need for standardized diagnostic criteria in the Bangladeshi healthcare setting.

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Conflicts of interest

There are no conflicts of interest.



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