

## Abstract

We aimed to evaluate the relationship between voiding patterns in uroflowmetry (UF) and post-void residual urine (PVR). Demographic data, UF parameters and PVR results of all patients presenting to our outpatient clinic with LUTS between retrospectively collected. Patients were divided into 5 groups based on voiding patterns. Age, gender, voided volume, flow rate and residual urine volumes were compared between patterns. There was a significant difference in voiding patterns when compared with Qmax and gender. But there was no significant difference in voiding patterns concerning age, voided volume and PVR results. Although no statistically significant difference was found in PVR comparisons between groups divided according to UF patterns, UF patterns are considered an important parameter in the diagnosis and follow-up of lower urinary tract symptoms.

## Introduction

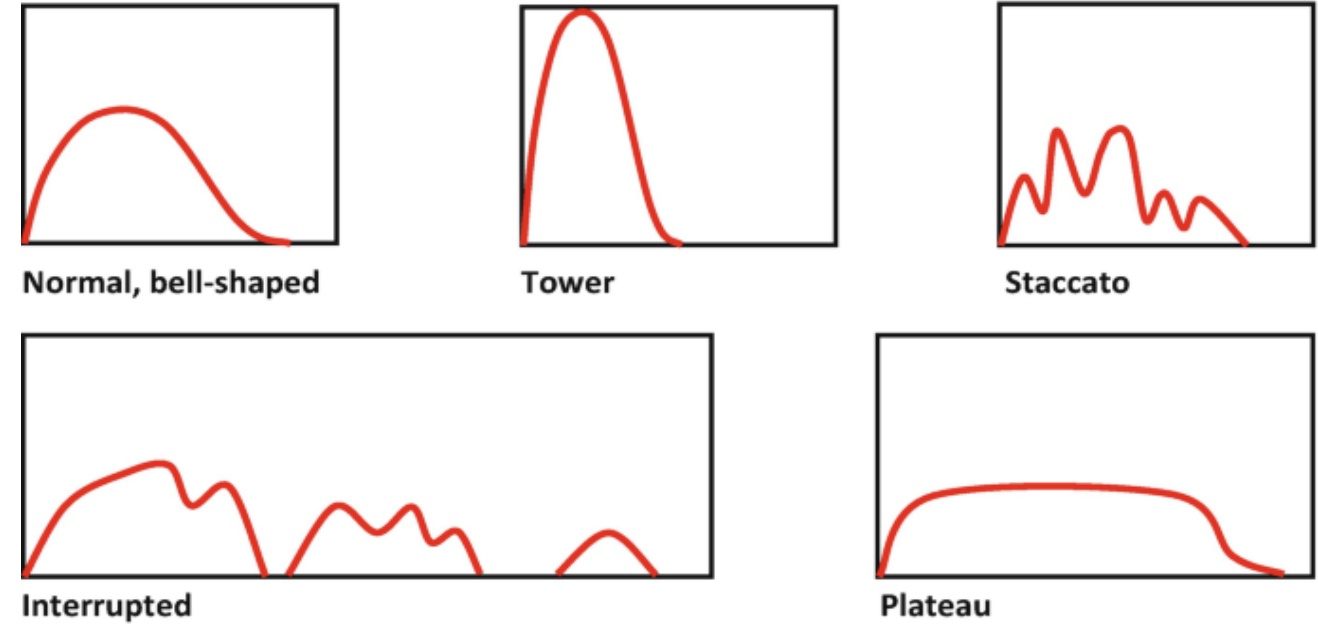
Uroflowmetry (UF) and post-void residual urine (PVR) measurement are two important non-invasive tests used in the evaluation of patients with lower urinary tract symptoms (LUTS). It is known that in uroflowmetry, not only flow rates but also voiding patterns play an important role in differential diagnosis.

## Methods and Materials

The study included 120 adult patients who presented to us with LUTS such as frequency, straining, weak stream, urgency, hesitancy and nocturia. Of these patients, 74 (61.6%) were male, and 46 (38.4%) were female. Demographic data, UF parameters, and PVR results of all patients presenting to our outpatient clinic with LUTS between 01.01.2022 and 01.08.2023 were retrospectively evaluated. Patients with missing data, UF voided volume less than 150 ml, and a history of neurological deficit were excluded from the study. Uroflowmetry evaluations were performed by a single observer, based on ICS standardization. Patients were divided into 5 groups based on voiding patterns: normal, intermittent, tower, staccato, plateau. Post-void residual urine volumes were measured using pelvic ultrasonography with the formula anteroposterior diameter × oblique diameter × transverse diameter × 0.52. Age, gender, voided volume, flow rate and residual urine volumes were compared between patterns.

Figure 1.

Uroflow curve types



## Results

The mean age of the 120 patients included in the study was 53.02 ± 13.3 years. Seventy-four patients (61.6%) were male and forty-six (38.4%) were female. The median PVR value was calculated as 40 ml in the normal group, 50 in the intermittent group, 60 in the tower group, 92 in the staccato group and 60 in the plateau group. There was no significant difference in voiding patterns concerning age, voided volume and PVR results (p: 0.074, p: 0.167, p: 0.599). However, there was a significant difference in voiding patterns when compared with Qmax and gender (p:<0,001, p: 0.017) (Table 1).

## Discussion

Uroflowmetry is non-invasive tool for evaluation of patients with lower urinary tract dysfunction. The pattern of the flow curve, maximum flow rate, voided volume are the important features of this study. No relationship was found between UF curves in children and PVR urine [1]. Evidence correlating parameters obtained in UF with PVR in adults similar to those in children has not been obtained [2]. In addition, studies have compared the voiding patterns and obtained PVR values between patients voiding with high voided volumes and those voiding with normal volumes using UF. It has been shown that patients voiding with high volumes in UF have significantly higher PVR values and a higher rate of abnormal UF patterns [3].

## Conclusions

Although no statistically significant difference was found in PVR comparisons between groups divided according to UF patterns, UF patterns are considered an important parameter in the diagnosis and follow-up of LUTS. Further studies with larger sample sizes and longer follow-up periods are needed in this regard.

Table 1. Results

	Normal (n=57)	Intermittent (n=12)	Tower (n=19)	Staccato (n=9)	Plateau (n=23)	P value
Age (median (min-max))	52 (29-75)	45 (18-72)	50 (30-71)	62 (33-69)	57 (23-82)	0,074
Gender	Male (n) (%)	32 (56,1)	9 (75)	7 (36,8)	8 (88,9)	0,017
	Female (n) (%)	25 (43,9)	3 (25)	12 (63,2)	1 (11,1)	
Q max (ml/s) (median (min-max))	17 (9-42)	15 (6-21)	28 (9-94)	9 (6-15)	9 (3-19)	<0,001
Voided volume (ml) (median (min-max))	312 (150-835)	325,5 (150-642)	350 (150-1081)	322 (150-517)	171 (150-612)	0,167
PVR (ml) (median (min-max))	40 (0-270)	50 (0-450)	60 (20-170)	92 (0-168)	60 (0-300)	0,599

## References

1. Bartkowski, D.P. and R.G. Doubrava, *Ability of a normal dysfunctional voiding symptom score to predict uroflowmetry and external urinary sphincter electromyography patterns in children.* J Urol, 2004. **172**(5 Pt 1): p. 1980-5; discussion 1985.
2. Lim, L.Y. and S.S. Yang, *Normal postvoid residual urine in healthy adults.* Neurourol Urodyn, 2024. **43**(1): p. 81-87.
3. Chang, S.J., S.S. Yang, and I.N. Chiang, *Large voided volume suggestive of abnormal uroflow pattern and elevated post-void residual urine.* Neurourol Urodyn, 2011. **30**(1): p. 58-61.