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Original Article

Surgery Section

Ideal Timing of Prostate Operation in Chronic Urinary Retention due to Benign Prostatic Hyperplasia by Serial Urodynamic Study: A Prospective Longitudinal Study

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ABSTRACT

Introduction: Chronic Urinary Retention (CUR) due to prostatomegaly causes impaired detrusor function, secondary to obstruction-related changes in the bladder wall. Urodynamic study is the "gold standard" to determine detrusor function in CUR patients. Traditional management of all CUR patients due to Benign Prostatic Hyperplasia (BPH) is temporary catheter drainage of the urinary bladder, so that detrusor impairment may be corrected. There is no consensus regarding the ideal timing of prostate operation in Bladder Outlet Obstruction (BOO) patients presenting with CUR due to BPH.

Aim: To assess the ideal timing of Transurethral Resection of the Prostate (TURP) in chronic urinary retention patients due to BPH.

Materials and Methods: This was a prospective, longitudinal study of 57 eligible patients with non neurogenic lower urinary tract symptoms, who presented with chronic urinary retention due to benign prostatic hyperplasia and attended the Department of Urology, Institute of Post-Graduate Medical Education and Research and Seth Sukhlal Karnani Memorial Hospital (IPGME&R SSKM) hospital, Kolkata, West Bengal, India from August 2019 to July 2022. Four serial Urodynamic Studies (UDS) were performed after initial catheterisation in sterile urine culture on the day 5, day 14, day 30, and at 6th week. As per UDS findings, patients were classified into Preserved Detrusor function group (n=18), at peak flow rate (Qmax) {Detrusor Pressure (Pdet) at peak flow rate} >30 cm H_2O and Impaired Detrusor function group (n=39), Pdet at Qmax ≤30 cm H_2O. Descriptive statistics were performed as means, standard deviations and ranges using Microsoft Excel software. For categorical variables percentages were used. The Student's paired-test and Chi-square test were used for statistical analysis. The p-value <0.05 was considered statistically significant.

Results: In the present study, mean age of preserved detrusor function group was 56.17 years and impaired detrusor function group was 67.08 years. In preserved detrusor function group (n=18), 83.3% patients had upper urinary tract changes and in impaired detrusor function group (n=39) only 15.4% patients had upper tract changes (p-value <0.05). On the urodynamic study done 6 th week after initial catheterisation, in impaired detrusor function group, n=36 (92.30%) patients had Pdet at Qmax>30 cm H_2O and only n=3 (7.7%) patients had Pdet at Qmax≤ 30 cm H_2O (p-value<0.001).

Conclusion: Urodynamic study is the gold standard to determine detrusor function in chronic urinary retention patients. It is ideal to wait till six weeks or beyond, for TURP in chronic urinary retention patients due to BPH after initial catheterisation.

Keywords: Bladder outlet obstruction, Catheter, Lower urinary tract symptoms, Transurethral resection of the prostate

INTRODUCTION

Lower Urinary Tract Symptoms (LUTS) due to benign prostatic enlargement, represent one of the most common clinical complaints in older men. As age increases, the prevalence of LUTS increases. LUTS have a major impact on quality of life and are associated with societal costs [1]. LUTS can be divided into storage, voiding, postmicturition symptoms, and has traditionally been related to bladder outlet obstruction (BOO), as a result of the prostate which is often caused by Benign Prostatic Hyperplasia (BPH) resulting in urinary retention [1,2]. Retention can be acute or chronic.

Chronic Urinary Retention (CUR) typically describes a non painful, persistent inability to completely empty the bladder, despite maintaining an ability to urinate, resulting in elevated Post-void Residual (PVR) urine volumes [3,4]. Research studies often use PVR volume greater than 300 mL to diagnose CUR [4,5]. In the initiation phase of bladder outlet obstruction, detrusor muscle undergoes hypertrophy with increased collagen deposition in the stroma of the urinary bladder. This increase in Detrusor Pressure (Pdet) helps to overcome obstruction and to maintain the urine flow. With the time of continued retention, changes occur in vascular supply and neural innervations of the detrusor muscle, leading to reduced detrusor muscle sensitivity and contractility, and thus, leading to detrusor weakness or detrusor failure in Chronic Urinary Retention (CUR) [6,7]. Thus, the traditional management of all CUR patients due to BPH is temporary catheter drainage of the urinary bladder so that detrusor impairment may be corrected. There is no consensus regarding the ideal timing of prostate operation in bladder outlet obstruction patients presenting with CUR due to BPH. Hence, the present study was conducted with the aim to know the ideal timing of Transurethral Resection of the Prostate (TURP) in chronic urinary retention patients due to BPH.

MATERIALS AND METHODS

This was a prospective longitudinal study conducted the Department of Urology in a tertiary care hospital, Institute of Post-Graduate Medical Education and Research and Seth Sukhlal Karnani Memorial Hospital (IPGME&R SSKM) hospital, Kolkata, West Bengal, India from August 2019 to July 2022. Ethical permission for the study was obtained from the Institutional Ethical Committee (IEC no. 2022/020). Informed consent was obtained by all subjects when they were enrolled.

Inclusion criteria: Male patients attended to the Urology Outpatient Department, presented with non neurogenic LUTS with chronic urinary retention, having a post-void residual volume of urine >300 mL measured on ultrasonography or >300 mL urine drained on catheterisation due to BPH were included in the study.

Exclusion criteria: Patients who refused to give consent, patients with spinal cord injury or cerebrovascular accident or neurological disease, patients with long-term uncontrolled diabetes mellitus or peripheral neuropathy, and patients with continuous urinary drainage through Per Urethral Catheter (PUC)/ Suprapubic Catheter (SPC) were excluded from the study. Patients having prostate cancer, patients unsuitable for operative treatment or having urinary tract infection and patients who were not ambulatory or having stricture urethra were excluded from the study.

Study Procedure

The selected patients were evaluated for lower urinary tract symptoms presented with chronic urinary retention, in the form of history taking, clinical examination for palpable urinary bladder, digital rectal examination, basic biochemical tests, serum PSA and urine routine examination, and microscopic examination and culture with appropriate inclusion and exclusion criteria. Ultrasonography was done in all cases. Additional tests like Voiding Cystourethrography (VCUG), Intravenous Pyelogram (IVP), Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) were done if necessary. Uroflowmetry was done twice in each patient and the best one was taken. After obtaining proper informed consent, patients underwent multichannel Urodynamic Study (UDS), according to the recommendations of the International Continence Society (ICS) [2]. Sterile urine culture was ensured before the study. After initial catheterisation, the volume of urine drained was recorded. UDS was performed on the 5th day after catheterisation and recorded as the first UDS. As per UDS findings, patients were classified into preserved detrusor function group Pdet at Qmax (detrusor pressure at peak flow rate) >30 cm H_2O (n=18) and impaired detrusor function group Pdet at Qmax ≤30 cm H_2O (n=39) based on Osman NI et al., and Abarbanel J and Marcus EL, study [7,8]. Patients with CUR would measure in what percentage of patients' detrusor impairment was seen. A second UDS was done on the 14th day, thereafter, a third UDS on the 30th day, and subsequently a fourth UDS in 6th week. The symptoms and the clinical findings of patients were recorded along with a focused neurological, abdominal, and rectal examination, and this was followed by a detailed serial urodynamic evaluation and enumeration of findings. American Urological Association (AUA) symptom index was taken as a reference guide for the evaluation of symptoms during the initial assessment [9]. Intravesical Pressure (Pves), Pdet, uroflowmetry parameters like peak flow rate (Qmax), Post-void Residue (PVR) of urine were recorded on a defined serial UDS report card.

STATISTICAL ANALYSIS

Descriptive statistics were performed as means, standard deviations, and ranges using Microsoft Excel software. For categorical variables percentages were used. Student's paired t-test, Chi-square test and IBM Statistical Package for the Social Sciences (SPSS) software version 27.0 were used for statistical analysis. The p-value <0.05 was considered statistically significant.

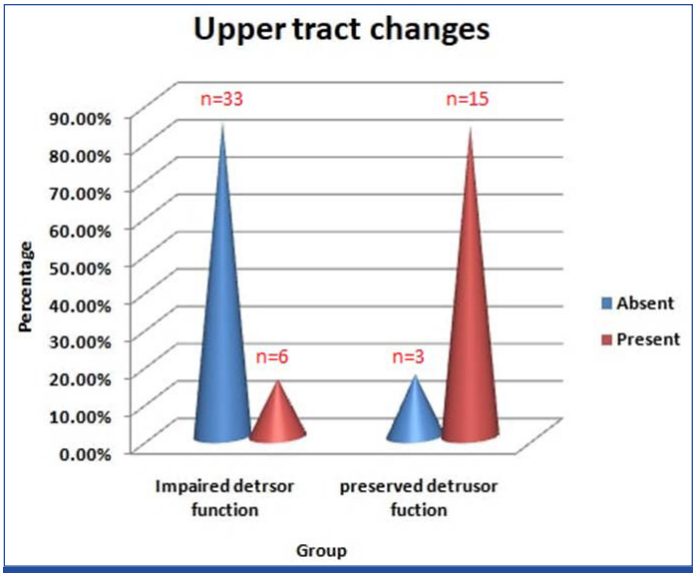
RESULTS

A total of 60 patients who fulfilled inclusion criteria were initially selected for this study. Out of these patients, three patients were lost to follow-up therefore, the present study included 57 patients. The mean age of preserved detrusor function group was 56.17 years (Range: 53.75 to 58.25 years) and the impaired detrusor function group mean age was 67.08 years (Range: 65 to 68 years) as shown in [Table/Fig-1]. In this study out of 18 patients of preserved detrusor function group, 15 (83.3%) patients had upper tract changes present and in these patients mean Pdet at filling cystometry on 5th day of UDS was 46.4 cm H_2O (Range: 44-49 cm H_2O) and out of 39 patients of impaired detrusor function group only 6 (15.4%) patients had upper tract changes and 33 patients had normal upper tract as shown in [Table/Fig-2].

In impaired detrusor function group (n=39), mean Pdet at filling cystometry on 5th day of UDS was 12.64 cm H_2O (Range: 10-15 cm H_2O) which gradually decreases to became 6.74 cm H_2O (Range: 5-8 cm H_2O). In this group on 5th day of UDS, mean Qmax (Peak Flow Rate) was 3.36 mL/sec (Range: 2-5 mL/sec) which gradually increases to became 5.77 mL/sec (Range: 5-7mL/sec). Mean Pdet at Qmax (detrusor pressure at peak flow rate) was 15.13 cm H_2O (Range: 13-18 cm H_2O) also gradually increases to became 47.49 cm H_2O (Range: 48-53 cm H_2O) as shown in [Table/Fig-3].

Group	N	Mean age (years)	Median (IQR)	t-value	df	p-value*
Preserved detrusor function	18	56.17	57 (53.75-58.25)	-9.365	55	<0.001
Impaired detrusor function	39	67.08	66 (65-68)			
Group	**N**	**Mean PVR (mL) at initial catheterization**	**Median (IQR)**	**t-value**	**df**	**p-value***
Preserved detrusor function	18	1077.78	1100 (1000-1200)	-2.773	55	0.008
Impaired detrusor function	39	1220.51	1300 (1000-1400)			
Group	**N**	**Mean Pdet at filling cystometry (Cm H_2O) 5th day**	**Median (IQR)**	**t-value**	**df**	**p-value***
Preserved detrusor function	18	43.72	45 (40-49)	19.181	55	<0.001
Impaired detrusor function	39	12.64	12 (10-15)			
Group	**N**	**Mean Qmax at voiding cystometry (mL/sec) 5th day**	**Median (IQR)**	**t-value**	**df**	**p-value***
Preserved detrusor function	18	6.94	7 (6-8)	12.055	55	<0.001
Impaired detrusor function	39	3.36	3 (2-5)			
Group	**N**	**Mean Pdet at Qmax (Cm H_2O) 5th day**	**Median (IQR)**	**t-value**	**df**	**p-value***
Preserved detrusor function	18	44.89	45 (40-48.5)	24.275	55	<0.001
Impaired detrusor function	39	15.13	15 (13-18)			

[Table/Fig-1]: Division of two groups on the basis of Age, PVR, Pdet at filling and voiding cystometry, and Qmax.
*p-value <0.05 was considered statistically significant; Pdet: Detrusor pressure; PVR: Post void residue urine volume; Qmax: peak flow rate; t-student's paired t-test; df: Degrees of freedom value; IQR: Interquartile range; N: Number of patients



[Table/Fig-2]: Bar diagram showing the percentage of patients in groups with upper tract changes.

Time	Mean Pdet at filling cystometry (Cm H_2O)	Median (IQR)	Min	Max	p-value*	Mean changes	Mean changes (%)	p-value*
Day 5	12.64	12 (10-15)	5	25				
Day 14	11.77	10 (10-15)	5	20	<0.001	-0.9	-6.88%	0.0035
Day 30	9.31	10 (6-10)	5	20		-3.3	-26.34%	<0.001
6th week	6.74	6 (5-8)	3	10		-5.9	-46.68%	<0.001
Time	**Mean Qmax at voiding cysto-metry**	**Median (IQR)**	**Min**	**Max**	**p-value***	**Mean changes**	**Mean changes (%)**	**p-value***
Day 5	3.36	3 (2-5)	2	5				
Day 14	3.92	4 (3-5)	2	5	<0.001	0.56	16.7%	0.0014
Day 30	4.67	5 (4-5)	2	7		1.31	39.0%	<0.001
6th week	5.77	6 (5-7)	2	8		2.41	71.7%	<0.001
Time	**Mean Pdet at Qmax (Cm H_2O)**	**Median (IQR)**	**Min**	**Max**	**p-value***	**Mean changes**	**Mean changes (%)**	**p-value***
Day 5	15.13	15 (13-18)	7	25				
Day 14	19.23	20 (15-23)	10	28	<0.001	4.1	27.1%	<0.0001
Day 30	26.13	28 (25-30)	8	30		11	72.7%	<0.001
6th week	47.49	50 (48-53)	10	57		32.36	213.9%	<0.001

[Table/Fig-3]: UDS findings in impaired detrusor function group done at day 5, day 14, day 30 and 6th week.
*p-value <0.05 was considered statistically significant; Pdet: Detrusor pressure; Qmax: Peak flow rate; Pdet Qmax: Detrusor pressure at peak flow rate; IQR: interquartile range

In the impaired detrusor function group out of 39 patients, all (n=39) had Pdet at Qmax ≤30 cm H_2O on UDS, done at 5th day, 14th day, and 30th day. In this group (n=36), 92.30% patients had Pdet at Qmax >30 cm H_2O on UDS done at 6th week indicating detrusor muscle regains their contractile ability and only 3 (7.7%) patients had Pdet at Qmax >30 cm H_2O which shows it remained underactive (p-value<0.001) as shown in [Table/Fig-4].

Impaired detrusor function group	Pdet at Qmax (cm H_2O)		p-value*
	≤30	>30	
Day 5	15.13 (13-18)	0	-
Day 14	19.23 (15-23)	0	-
Day 30	26.13 (25-30)	0	-
6th week	n=3 (7.7%) 13.11 (10-15)	n=36 (92.30%) 48.9 (48-53)	<0.001

[Table/Fig-4]: Patients with Pdet at Qmax >30 cm H_2O on UDS in impaired detrusor function group.
*p-value <0.05 was considered statistically significant; Pdet at Qmax: Detrusor pressure at peak flow rate; N: Number of patients; UDS: Urodynamic study

DISCUSSION

Standard criteria, including the duration and volume of post-void residual urine,are necessary for diagnosing chronic urinary retention(CUR) [1-3]. Researchers often define CUR as PVR greater than 300 mL [4,5]. Before definitive prostate surgery, there is catheter drainage advised for detrusor impairment correction in CUR patients. No literature clearly says that, in how many CUR patients detrusor impairment occurs and what is the minimum time required for improvement of impaired detrusor function. In the present study out of total 57 patients with chronic urinary retention, 39 patients had impaired detrusor function, and the minimum time required to regain detrusor function to the near normal range was 6 weeks.

A retrospective study was done by Paul HA et al., in which, they divided patients with chronic retention of urine into two main groups normal or high-pressure bladder filling (Pdet ≥25 cm H_2O) and low-pressure bladder filling (Pdet <25 cm H_2O). In all the patients with low and high-pressure filling, the mean pressure increases 11 cm H_2O (range 0-25) and 82 cm H_2O (Range: 40-148) respectively; mean bladder capacities 960 mL (470-3000) and 825 mL (380-3500) and mean residual urine volumes 755 mL (320-2550) and 715 mL (310-3200). Pressure-flow analysis of micturition showed that all patients had outlet obstruction. After prostatectomy, the patients with high-pressure filling achieved good bladder emptying by normal detrusor contraction. The poor results in the patients with low-pressure filling were due to inadequate detrusor contraction, and voiding was accomplished by abdominal straining [6]. The drawbacks of their study, they did TURP in all patients, and data was collected retrospectively. Compare to their study, in the present study, we divided CUR patients in preserved detrusor function group (pdet at Qmax >30 cm H_2O) and the Impaired detrusor function group (pdet at Qmax ≤30 cm H_2O). In the present study, preserved detrusor function group had a mean PVR of 1077.78 mL, the mean Pdet at filling phase was 43.72 cm H_2O, and 83.3% of patients had upper tract changes, whereas, the impaired detrusor function group had a mean PVR of 1220.51 mL, mean Pdet at filling phase 12.64 cm H_2O, and in this group, only 15.4% patients shows upper tract changes.

Another prospective randomised study done by Ghalayini et al., showed the usefulness of clean intermittent self-catheterisation (CISC) in ensuring the recovery of bladder function in men with CUR. In their study of the 41 patients, 17 (mean age 67 years, range 52–84) were randomised to immediate TURP and 24 (mean age 69 years, range 55–85) to CISC. In both groups, significant improvement in quality of life and international prostate symptom score at six months was seen (p-value<0.001). In the CISC group, there was a significant improvement in voiding and end-filling pressures, indicating recovery of bladder function (p-value <0.001 for each). Of the 41 men, nine (22%) with voiding pressures of <45 cm H_2O had no significant improvement in symptoms or urodynamic variables. Detrusor overactivity was found in 17 (41%) patients, of whom six had upper tract dilatation which resolved after treatment [10]. As compared to their study, in our study, there was significant improvement in detrusor contractility (p-value <0.001) on UDS done at 6th week in impaired detrusor function group which revealed that initial catheterisation helps to recover bladder function.

Retrospective study done by Pal M et al., concluded that initial catheter drainage of urine is an effective mode of temporary management in patients with chronic urinary retention secondary to BPH. They graded bladder function into improved (Pet at Qmax> 40 cm H_2O), mild improvement (Pdet at Qmax 20-40 cm H_2O) and no improvement (Pdet at Qmax <20 cm H_2O) [11]. Drawback of their study was they did not mention for how many period initial catheterisation helps to improve bladder function. As compared to their study, in the present study out of 39 patients, 36 (92.30%) patients showed significant bladder function improvement [mean Pdet at Q max 48.9 cm H_2O, range of 48-53 cm H_2O (p-value <0.001)] at 6th week after initial catheterisation. If TURP will done before 6th week after initial catheterisation as definitive treatment in patients with CUR due to BPH , patients symptoms will not improve as detrusor muscle incapable to contract.

Djavan B et al., showed that patients with acute urinary retention, aged ≥80 years with a retention volume of >1500 mL, no evidence of instability and maximal detrusor pressure of <28 cm H_2O are at high-risk of treatment failure. He suggested that the detrusor may recover in patients younger than 80 years after surgery, suggesting that prostatectomy should still be performed in this group even if a preoperative urodynamic study suggests an unfavorable outcome [12]. The drawback of their study is that they did not include chronic urinary retention patients.

Monoski MA et al., evaluated the utility of preoperative urodynamics, as a predictor of surgical outcome in catheterized men and found that Impaired Detrusor Contractility (IDC) and Detrusor Overactivity (DO) helped to predict the outcome. Even though almost all men improved their voiding function and quality of life after surgery, those patients without DO or IDC had the most improvement. This was particularly evident one month postoperatively, when considering the IPSS for patients with and without DO and the IPSS, Qmax, and PVR in patients with and without IDC. However, despite the increased risk of re-operation in this group, most men (63%) gained significant benefit. Therefore, preoperative IDC is not a contraindication to performing surgery [13].

Temporary catheter drainage in CUR due to BPH has a significant beneficial effect in patients with bladder outlet obstruction (BOO) and should be part of initial management [11,12]. Age of presentation, duration of BOO, and amount of urine drained at presentation have a clinically significant influence on detrusor recovery in patients undergoing catheter drainage. Thus, the management protocol should be individualized to have a favorable outcome [13,14].

In the present study, we conclude that, chronic urinary retention due to BPH can impair detrusor function, and the minimum duration required to regain the functional properties of detrusor muscle in these patients after initial catheterisation was 6 weeks. Patients having upper tract changes due to chronic urinary retention with BPH , mainly have high detrusor pressure at filling cystometry (Pdet at filling cystometry >40 cm H_2O) on UDS. UDS can differentiate the patients, who get more benefits after prostate operation in these patients. Patients of extreme ages need extra caution. So far, we have searched, but no single study of serial UDS examination in chronic urinary retention patients due to prostatomegaly is available.

Limitation(s)

Limitations of this study are small sample size, shorter duration of the serial urodynamic study, unable to conclude on detrusor function recovery in patients, which remains underactive for up to six weeks.

CONCLUSION(S)

Patients of chronic urinary retention due to BPH may have impaired detrusor function. Upper tract changes mainly occur in chronic urinary retention patients. Minimum time required to regain the contractile ability of detrusor muscle to the near normal range is six weeks in impaired detrusor function patients. One should wait till six weeks or beyond for TURP after initial catheterisation in these patients because the early operation will not help to improve symptoms.

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