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Partha Paul Chowdhury
Registrar, Department of Urology, Mymensingh Medical College Hospital, Mymensingh, Dhaka, Bangladesh

Md. Fazlul Haque Siddique
Associate Professor, Department of Urology, Mymensingh Medical College, Mymensingh, Dhaka, Bangladesh

Md. Ibrahim Ali
Resident Surgeon, Department of Urology, Mymensingh Medical College Hospital, Mymensingh, Dhaka, Bangladesh

Md. Saidur Rahaman
Registrar, Department of Urology, Mymensingh Medical College Hospital, Mymensingh, Dhaka, Bangladesh

Noashad Alam
Assistant Registrar, Department of Urology, Mymensingh Medical College Hospital, Mymensingh, Dhaka, Bangladesh

Shubha Roy
Medical Officer, Department of Urology, Dhaka Medical College Hospital, Dhaka, Dhaka, Bangladesh

Mahmud Hasan Tanim
Assistant Registrar, Department of Urology, Mymensingh Medical College Hospital, Mymensingh, Dhaka, Bangladesh

Corresponding Author:
Partha Paul Chowdhury
Registrar, Department of Urology, Mymensingh Medical College Hospital, Mymensingh, Dhaka, Bangladesh

Intravesical prostatic protrusion as a predictor of outcome of transurethral resection of prostate for benign enlargement of prostate

Partha Paul Chowdhury, Md. Fazlul Haque Siddique, Md. Ibrahim Ali, Md. Saidur Rahaman, Noashad Alam, Shubha Roy, Mahmud Hasan Tanim

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Abstract
Transurethral resection of the prostate (TURP) is considered standard surgical therapy for benign enlargement of prostate (BEP). Transabdominal ultrasound measurement of intravesical prostatic protrusion (IPP) is a noninvasive method of assessing the severity of symptoms in patients with bladder outlet obstruction (BOO) due to prostatic enlargement. To evaluate the outcome of transurethral resection of prostate in a patient with benign enlargement of prostate with intravesical prostatic protrusion. This quasi-experimental study was conducted from January, 2021 to December, 2021 in department of urology, Dhaka Medical College Hospital, Dhaka. A total of seventy-eight patients (age 50-70 years) admitted for TURP due to BEP with IPP were purposively selected for the study. Patients were divided into two groups according to their IPP grade: group-I includes IPP of ≥ 5mm (significant group) and group-II includes IPP of < 5mm (non- Significant group). Lower Urinary Tract Symptoms (LUTS) severity were scored by the International Prostate Symptom Score (IPSS). Postoperatively, changes in IPSS, IPSS-v, IPSS-s, Quality of life (QoL) score, maximum urinary flow rate (Q max), and post void residual (PVR) at one month and three months after the operations were recorded in a predesigned data collection sheet. The mean ages of the patients were 61.9±4.5 and 61.5±5.6 years in group I and group II respectively. Preoperatively, there was significant statistical difference between the groups regarding IPSS, IPSS-v, IPSS-s, QoL score ($p< 0.001$), Q max ($p = 0.008$), and PVR ($p = 0.026$). After three months of operation (TURP), mean score of the IPSS, IPSS-v, IPSS-s, Qol and PVR were significantly lower and mean score of Q max was significantly higher in group I compared to that of group II ($p< 0.05$). The mean changes in IPSS, IPSS-v, IPSS-s, Qol, Q max and PVR were also significantly greater in group I compared to group II ($p< 0.05$). In this study, patients with IPP ≥ 5 mm experienced greater symptom improvement following TURP compared with patients with IPP < 5 mm.

Keywords: Transurethral resection of prostate, post void residual urine, maximum urinary flow rate, international prostate symptom score, benign enlargement of prostate, intravesical prostatic protrusion

Introduction
Benign Enlargement of Prostate (BEP) is a common cause of Bladder Outlet Obstruction (BOO) in elderly men (Lee *et al*., 2017) [17]. Histologically, there is epithelial and stromal cell hyperplasia in the transition zone in association with increased smooth muscle tone in prostate and bladder neck can cause BOO (Kadihasannoglu *et al*., 2019) [13]. The prevalence of histologic Benign Prostatic Hyperplasia (BPH) in autopsy studies rises from approximately 20% in men aged 41–50 years, to 50% in men aged 51–60 years, and up to 90% in men older than 80 years (Washington and Shinohara. 2020). But the relationship between prostate size & BOO remains controversial (Lee *et al*., 2017) [17]. Obstruction and symptoms do not depend entirely on prostate's size (Hossain *et al*., 2012) [11]. There is a strong correlation of Intravesical Prostatic Protrusion (IPP) with Benign prostatic obstruction (BPO), 21% of the prostate with Grade-1 (defined by a IPP of equal or less than 5 mm) were obstructed, while for Grade-3 (defined by a IPP of more than 10 mm) 94% were obstructed on pressure flow study. So, progression of BEP depends not only on the size but also the shape of the prostate adenoma which causes obstruction. Thus the relationship between prostate volume (PV) and IPP is important (Wang *et al*., 2015) [19].

Previous studies have demonstrated that the hyperplasia location affects the symptom severity. Moreover, hyperplasia of the lateral and median lobes of the prostate may lead to prostatic protrusion into the bladder. Intravesical prostatic protrusion (IPP) is an anatomical configuration, which can affect voiding and cause BOO. This can be established using ultrasonography (Kadihasanoglu *et al*., 2019) [13]. Intravesical Prostatic Protrusion (IPP) is a morphological change which lead to a protrusion of enlarged prostatic tissue into the bladder. Chia *et al*. (2003) [1] suggested 1 that this protrusion of prostate causes a ball-valve‖ type of obstruction that disrupts the funnelling effect of the bladder neck results in dyskinetic movement of the bladder during voiding (Rieken *et al*., 2017). IPP is a useful noninvasive method for estimating the outcome of a trial without catheter (TWOC) in men with acute urinary retention (AUR) (Lee *et al*., 2012) [18].

Intravesical Prostatic Protrusion (IPP) cannot be accurately diagnosed by traditional digital rectal examination (DRE) and non-invasive studies (Gandhi *et al*., 2018) [7]. Several studies have previously demonstrated that ultrasonographic measurement of IPP is able to detect BOO in BEP patients quickly and non-invasively (Hossain *et al*., 2012) [11]. Thus, IPP can be measured non-invasively by transabdominal ultrasonography by measuring the vertical distance from the tip of the protruding prostate to the base of the bladder at the base of the prostate gland (Shin *et al*., 2013). Current guidelines from International scientific committee and the American Urological Association (AUA) on the evaluation and management of BEP recommend the use of uroflowmetry to evaluate BPH patients considered as candidates for surgical therapy. So, the noninvasive parameters are used to measure the severity of BOO by analysing correlations from clinical history, symptoms, transabdominal ultrasonography and uroflowmetry (Huang *et al*., 2012) [12]. Initial evaluation of patients presented with Lower urinary tract symptoms (LUTS) due to BEP includes a medical history, physical examination by utilizing the International Prostate Symptom Score (IPSS), measurement of post-void residual (PVR) & uroflowmetry, but recent data suggest that these studies correlate mostly to lower urinary tract functional status rather than mechanical obstruction. Current studies reported the stratification of IPP to predict BOO. In recent years, there has been an interest in the practical application of IPP in context of risk stratification, in patients with BPO. (Kuo *et al*., 2016) [16]

The treatment of BEP includes watchful waiting, medical therapy, conventional surgical therapy and minimally invasive therapy. Although photoselective vaporization of the prostate with a potassium titanyl phosphate laser and Holmium laser enucleation of the prostate (HOLEP) have recently become established as surgical treatment options to treat BEP, still Trans Urethral Resection of Prostate (TURP) is considered as the standard surgical therapy for BEP. So, accurate prediction of surgical outcome is important for making plan for surgical therapy (Lee *et al*., 2012) [18].

The study is designed to evaluate the outcome of TURP in a patient with BEP with varying severity of IPP. Accurate prediction of surgical outcomes is important when making plans for surgical therapy. IPP is an independent risk factor in predicting the severity of BOO & can help in clinical decision making at initial evaluation of BEP patients. If the postoperative improvement in symptoms could be predicted before surgery, it would be very helpful for making plans for surgical therapy. So, both surgeons & patients can be benefited from this study. Surgeons can expect better post-operative outcomes in term of changes in IPSS, IPSS-v, IPSS-s and QoL in patients with significant IPP & counsel the patient about better outcome of TURP. Also, patients with significant IPP can make their decision about TURP as a better option.

Materials and Methods

This quasi-experimental study was conducted in the Department of Urology, Dhaka Medical College Hospital from January 2021 to December 2021. The study population included patients admitted for Transurethral Resection of the Prostate (TURP) due to Benign Enlargement of the Prostate (BEP) with Intravesical Prostatic Protrusion (IPP) who had failed medical therapy. Inclusion criteria comprised patients aged 50-70 years with LUTS due to BEP and IPP, an International Prostate Symptom Score (IPSS) > 7, and a prostate volume between 40-80 ml. Patients with a history of per-urethral surgery, refractory or chronic retention, or diabetes mellitus were excluded. A purposive sampling technique was employed. Independent variables included age, prostate volume, and IPP measurement, while dependent variables encompassed IPSS (total, voiding sub-score, storage sub-score, and quality of life score), post-void residual urine (PVR), and maximum urinary flow rate (Q max). The IPSS, consisting of seven symptom questions and one quality-of-life question, was used for symptom assessment. Uroflowmetry estimated the Q max, with values < 15 ml/s considered abnormal. PVR was measured via transabdominal ultrasound. All patients underwent a comprehensive clinical evaluation, including history-taking, physical examination, and laboratory investigations such as urine R/M/E, culture sensitivity, complete blood count, random blood sugar, and serum creatinine. Ultrasonography of the kidney, ureter, bladder, and prostate assessed prostate size, echo-texture, capsular integrity, IPP measurement, and PVR. Q max was recorded via uroflowmetry. Patients diagnosed with bladder outlet obstruction (BOO) due to BEP with IPP and meeting the inclusion criteria were selected for the study after informed consent. Patients were categorized into two groups based on IPP grade measured by transabdominal ultrasonography: Group I (IPP ≥ 5mm, significant group) and Group II (IPP < 5mm, non-significant group). Preoperative data were collected for age, prostate volume, IPP, IPSS, IPSS sub-scores, QoL score, Q max, and PVR. TURP was performed using a standard technique. Postoperative follow-ups at one and three months recorded changes in IPSS, sub-scores, QoL score, Q max, and PVR. Data collection tools included consent forms, data collection sheets, investigation reports, and follow-up sheets. Data analysis was conducted using SPSS, with quantitative data presented as mean±SD and analyzed using independent sample t-tests, ANOVA, and Bonferroni tests. Qualitative data were presented as frequency and percentage and analyzed using chi-square tests. A p-value < 0.05 was considered statistically significant.

Ethical approval was obtained from the Research Review Committee and the Ethical Review Committee of DMCH. Patient data were kept confidential, and informed consent was secured from participants or their legal representatives.

Results

Table 1: Comparison of patients by age (n=78)

Age group (in years)	Group I (n=39) n (%)	Group II (n=39) n (%)	p value
51-60	16 (41%)	18 (46.2%)	0.648a
61-70	23 (59%)	21 (53.8%)	
Mean±SD	61.9±4.5	61.5±5.6	0.722b
Range	51-67	54-69	

a = chi-square test and
b = Independent sample t test

Table 2: Comparison of patients by prostate volume (PV) (n=78)

Prostate volume (PV) (in ml)	Group I (n=39) n (%)	Group II (n=39) n (%)	p value
40-49	16 (41%)	23 (59%)	0.189a
50-59	14 (35.9%)	12 (30.8%)	
60-69	9 (23%)	4 (10.3%)	
Mean±SD	53.0±7.9	50.0±7.8	0.100b
Range	42-68.5	40-68	

a = chi-square test and
b = Independent sample t test

Table 3: Comparison of patients by Intravesical Prostatic Protrusion (IPP) (n=78)

Criteria	Group I (n=39) Range	Group II (n=39) Range	p value
IPP (Mean±SD)	7.8±1.8	3.2±1.1	< 0.001
	5.6-11.6	1.2-4.8	

Table 4: Comparison of patients by mean score of the International Prostate Symptom Score (IPSS) at baseline (n=78)

Criteria	Group I (n=39) mean± SD Range	Group II (n=39) mean± SD Range	p value
IPSS	21.9±5.91 4-30	14.1±2.8 10-19	< 0.001
IPSS-v	12.9±3.3 9-17	8.2±2.0 6-10	< 0.001
IPSS-s	8.9±2.7 6-11	5.9±0.9 5-7	< 0.001
QoL	4.0±1.0 3-5	3.0±0.5 2-4	<0.001

p value reached from independent sample t test

Table 5: Comparison of patients by mean score of maximum urinary flow rate (Q max) and post-void residual (PVR) at baseline (n=78)

Criteria	Group I (n= 39) Mean± SD Range	Group II (n= 39) Mean± SD Range	p value
Q max (ml/s)	8.6±0.5 8.0-9.9	8.9±0.5 8.1-9.9	0.008
PVR (ml)	114.5±6.3 100-125	98.1±8.5 85-110	0.026

p value reached from independent sample t test

Table 6: Comparison of patients by mean score of the International Prostate Symptom Score (IPSS) after one month (n= 78)

Criteria	Group I (n= 39) Mean± SD Range	Group 2 (n= 39) Mean± S Range	p value
IPSS	14.6±3.8 10-18	11.3±3.3 8-15	< 0.001
IPSS-v	8.8±2.5 6-11	7.2±2.8 4-10	0.009
IPSS-s	5.8±1.4 4-7	4.2±1.1 3-6	< 0.001
QoL	3.0±0.5 1-4	2.0±0.5 1-3	< 0.001

p value reached from independent sample t test.

Table 7: Comparison of patients by mean score of maximum urinary flow rate (Q max) and post-void residual (PVR) after one month (n= 78)

Criteria	Group I (n= 39) Mean± SD Range	Group II (n= 39) Mean± SD Range	p value
Q max (ml/s)	17.7±2.21 5-21	16.4±3.1 12-20	0.03
PVR (ml)	48.4±3.7 40-55	37.3±4.8 30-45	< 0.001

p value reached from independent sample t test.

Table 8: Comparison of patients by mean score of the International Prostate Symptom Score (IPSS) after three months:

Criteria	Group I	Group II	p value
IPSS	8.1±2.1 5-11	9.5±3.1 6-13	0.025
IPSS-v	5.4±1.6 3-7	6.3±2.2 3-9	0.04

IPSS-s	2.7±0.8 1-4	3.1±0.9 2-5	0.04
QoL	2.0±0.5 1-2	1.0±0.5 0-2	<0.001

p value reached from independent sample t test

Table 9: Comparison of patients by mean score of maximum urinary flow rate (Q max) and post-void residual (PVR) after three months (n=78)

Criteria	Group I (n=39) Mean± SD Range	Group II (n=39) mean± SD Range	p value
Q max (ml/s)	19.4±1.7 17-22	18.4±1.5 16-20	0.0074
PVR (ml)	24.2±2.4 20-30	22.6±3.1 18-26	0.01

p value reached from independent sample t test.

Table 10: Comparison of patients by post-operative changes of mean score of the International Prostate Symptom Score (IPSS) from baseline in group I (n= 39)

Criteria	Before TURP (Baseline) (n=39) Mean± SD Range	One month after TURP (n=39) Mean ±SD Range	Three months after TURP (n=39) Mean± SD Range	p value
IPSS	21.9±5.9 14-30	14.6±3.8 10-18	8.1±2.1 5-11	<.001
IPSS-v	12.9±3.3 9-17	8.8±2.5 6-11	5.4±1.6 3-7	<.001
IPSS-s	8.9±2.7 6-11	5.8±1.4 4-7	2.7±0.8 1-4	<.001
QoL	4.0±1.0 3-5	2.0±0.5 1-3	1.0±0.5 0-2	<.001
Bonferroni test				
	IPSS	IPSS-v	IPSS-s	QoL
	p value	p value	p value	p value
Before TURP vs 1 month after TURP	< 0.001	< 0.001	< 0.001	< 0.001
Before TURP vs 3 months after TURP	< 0.001	< 0.001	< 0.001	< 0.001
1 month vs 3 months after TURP	< 0.001	< 0.001	< 0.001	< 0.001

p value reached from ANOVA test and Bonferroni test

Table 11: Comparison of patients by post-operative changes of mean score of the International Prostate Symptom Score (IPSS) from baseline in group II (n= 39)

Criteria	Before TURP (Baseline) (n=39) Mean± SD Range	One month after TURP (n=39) Mean± SD Range	Three months after TURP (n=39) Mean± SD Range	p value
IPSS	14.1±2.8 10-19	11.3±3.3 8-15	9.5±3.1 6-13	<0.001
IPSS-v	8.2±2.0 6-10	7.2±1.8 4-10	6.3±2.2 3-9	0.002
IPSS-s	5.9±0.9 5-7	4.2±1.1 3-6	3.1±0.9 2-5	<0.001
QoL	3.0±0.5 2-4	2.0±0.5 0-2	1.0±0.5 1-3	<0.001
Bonferroni test				
	IPSS	IPSS-v	IPSS-s	QoL
	p value	p value	p value	p value
Before TURP vs 1 month after TURP	< 0.001	< 0.001	< 0.001	< 0.001
Before TURP vs 3 months after TURP	< 0.001	< 0.001	< 0.001	< 0.001
1 month vs 3 months after TURP	< 0.001	< 0.001	< 0.001	< 0.001

p value reached from ANOVA test and Bonferroni test

Table 12: Comparison of patients by post-operative changes of mean score of the maximum urinary flow rate (Q max) and post void residual (PVR) from baseline in group I (n= 39)

Criteria	Before TURP (Baseline) (n=39) Mean± SD Range	One month after TURP (n=39) Mean± SD Range	Three months after TURP (n=39) Mean± SD Range	p value
Q max (ml/s)	8.6±0.5 8.0-9.9	17.7±2.2 15-21	19.4±1.7 17-22	<0.001
PVR (ml)	114.5±6.3 100-125	48.4±3.7 40-55	24.2±2.4 20-30	<0.001
Bonferroni test				
	Q max p value		**PVR p value**	
Before TURP vs 1 month after TURP	< 0.001		< 0.001	
Before TURP vs 3 months after TURP	< 0.001		< 0.001	
1 month vs 3 months after TURP	< 0.001		< 0.001	

p value reached from ANOVA test and Bonferroni test

Table 13: Comparison of patients by post-operative changes of mean score of the maximum urinary flow rate (Q max) and post void residual (PVR) from baseline in group II (n= 39)

Criteria	Before TURP (Baseline) (n=39) Mean± SD Range	One month after TURP (n=39) Mean± SD Range	Three months after TURP (n=39) Mean± SD Range	p value
Q max (ml/s)	8.9±0.5 8.1-9.9	16.4±3.1 12-20	18.4±1.5 16-20	<0.001
PVR (ml)	98.1±8.5 85-110	37.3±4.8 30-45	22.6±3.1 18-26	<0.001
Bonferroni test				
	Q max p value		**PVR p value**	
Before TURP vs 1 month after TURP	< 0.001		< 0.001	
Before TURP vs 3 months after TURP	< 0.001		< 0.001	
1 month vs 3 months after TURP	0.0005		< 0.001	

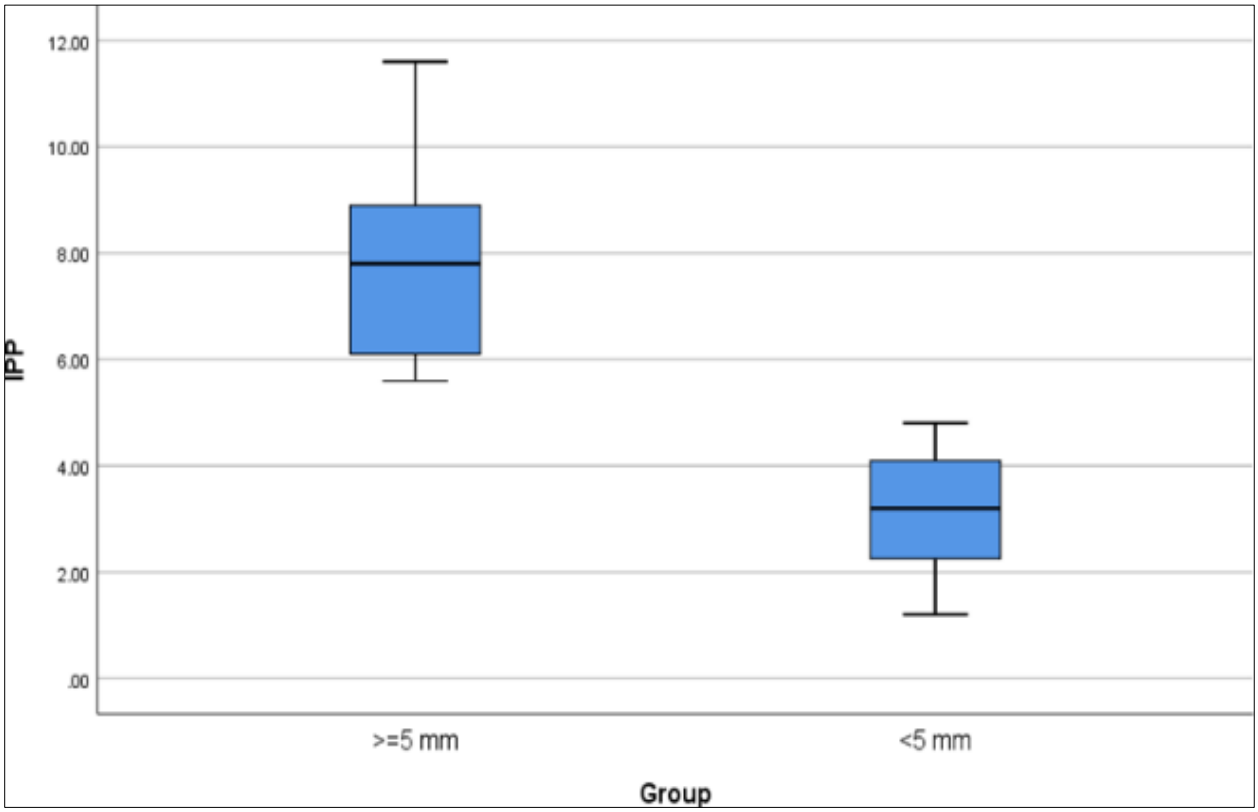

Fig 1: Comparison of patients by their Intravesical prostatic protrusion (IPP) grading.

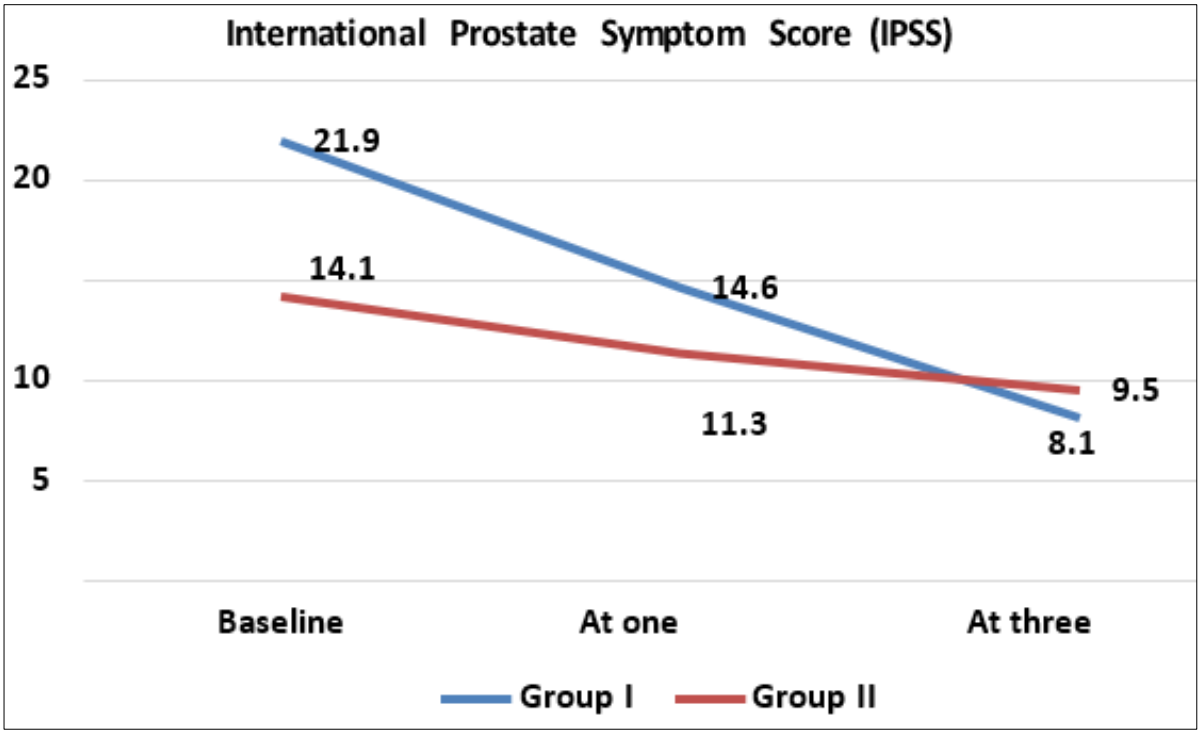

Fig 2: Shows that at baseline, the mean IPSS score of Group I was 21.9 which decreased to 14.6 at one month. Finally it reduced to 8.1. On the other hand, at baseline, the mean IPSS score of Group II was 14.1 which decreased to 11.3 at one month. Finally it reduced to 9.5.

A total of 78 patients who were diagnosed as a case of bladder outlet obstruction (BOO) due to benign enlargement of prostate (BEP) with presence of intravesical prostatic protrusion (IPP) were enrolled in this study. Transurethral resection of prostate (TURP) was done in all patients of group I and Group II. Data regarding IPSS, IPSS-v, IPSS-s, QoL, Q max and PVR were collected both preoperatively and postoperatively after 1 and 3 months. Findings derived from data analysis are presented below. The summarized findings from data analysis presented in the form of tables and figures. In this table, both the groups were categorized according to age difference in 3 decade where maximum age was 67 years and 69 years for group I and group II respectively. And minimum age of group I and group II were 51 years and 54 years respectively. Age group 61-60 years were containing 23 (59%) and 21 (53.8%) people in group I and group II respectively. The mean age of the patients was 61.9±4.5 and 61.5±5.6 years in Group I and Group II respectively (table I). There was no statistically significant difference regarding age between the two groups ($p > 0.05$). Among the 39 patients in group I, 16 (41%) had PV from 40-49 ml, 14 (35.9%) had PV from 50-59 ml, while 9 (23%) had PV from 60-69 ml. On the other hand, in group II, 23 (59%) had PV from 40-49 ml, 12 (30.8%) had PV from 50-59 ml while 4 (10.3%) had PV from 60-69 ml. The mean prostate volume (PV) of the patients were 53.0±7.9 and 50.0±7.8 ml in Group I and Group II respectively (table II). There was no statistically significant difference regarding prostate volume between the two groups ($p > 0.05$). The mean IPP in group I and group II were 7.8±1.8 and 3.2±1.1 respectively. The mean IPP in group I was significantly higher than group II ($p< 0.001$). At baseline, the mean score of the IPSS, IPSS-v, IPSS-s and Quality of life (Qol) were significantly higher in group I compared to group II ($p< 0.001$) (table IV) At baseline, the mean score of the Q max was significantly lower in group I ($p=0.008$) compared to group II while the mean score of the PVR was significantly higher in group I compared to group II ($p=0.026$) (table V). After one month, the mean score of the IPSS was significantly higher in group I ($p<0.001$) compared to group II. The mean score of the IPSS-v, IPSS-s and Quality of life (Qol) score were also significantly higher in group I compared to group II ($p=0.009$, $p<0.001$ and $p<0.001$ respectively) (table VI) After one month, the mean score of the Q max was significantly higher in group I ($p = 0.03$) compared to group II. The mean score of the PVR was significantly lower in group I compared to group II ($p <0.001$) (table VII). After three month, the mean score of the IPSS, IPSS-v and IPSS-s were significantly lower in group I compared to group II ($p = 0.025$, $p = 0.04$ and $p = 0.04$ respectively). The mean score of the Quality of life was also significantly lower in group I compared to group II ($p = <0.001$) (table VIII). Fig. 2 shows that at baseline, the mean IPSS score of Group I was 21.9 which decreased to 14.6 at one month. Finally, it reduced to 8.1. On the other hand, at baseline, the mean IPSS score of Group II was 14.1 which decreased to 11.3 at one month. Finally, it reduced to 9.5. After three months, mean score of maximum urinary flow rate (Q max) was significantly higher ($p = 0.0074$) and mean score of PVR was significantly lower ($p = 0.01$), in Group I compared to Group II (table IX). Post-operative changes of mean score of International Prostate Symptom Score (IPSS) and Quality of life due to urinary symptoms was significantly lower in group I ($p< 0.001$). (table XII). Post-operative changes of mean score of International Prostate Symptom Score (IPSS) and Quality of life due to urinary symptoms was significantly lower in group II ($p< 0.05$) (table XV) Post-operative changes of maximum urinary flow rate (Q max) were significantly higher and post void residual (PVR) was significantly lower in group I ($p< 0.001$) (table XVIII). Post-operative changes of maximum urinary flow rate (Q max) were higher and post void residual (PVR) in group II was lower which were statistically significant ($p< 0.05$) (table XXI).

Discussion

Clinical benign prostatic hyperplasia is one of the most common diseases in ageing men and the most common cause of lower urinary tract symptoms (LUTS). (Lim, 2017). The measurement of intravesical prostatic protrusion (IPP) is a noninvasive procedure which can be used as a useful predictor for clinical progression in men with benign prostatic hyperplasia (BPH) (Chia *et al*., 2003; Nose *et al*., 2005; Keqin *et al*., 2007; Lee *et al*., 2010b) [1, 20]. The present study aimed to identify how the outcome of TURP in a patient with BEP may be influenced by varying severity of IPP.

The most frequent condition among elderly men is benign prostate hyperplasia (BPH). According to reports, BPH affects 15% to 60% of males over the age of 40, and its prevalence rises dramatically with age (Wang *et al*., 2015b) [19]. Patients in both groups were more than sixty years age which was consistent with the study of Hossain *et al*. (2012) [11] where the mean age of the patients was found 64.3 years. Other studies also support this finding (Lee *et al*., 2010a; Shin *et al*., 2013; Cumpanas *et al*., 2013) [19, 3]. The mean prostate volume (PV) of the patients were 53.0±7.9 and 50.0±7.8 ml in Group I and Group II respectively. Hossain *et al*. (2012) [11] found the mean PV of the non-obstructed group were 33.17±10.50 ml and those of obstructed group were 44.03±14.32 ml. As the present study purposively included patients with PV from 40-80 ml, the mean score was higher than that of the study of Hossain *et al*. (2012) [11]. After TURP, the mean changes in IPSS, IPSS-v, IPSS-s, and QoL score of the significant IPP group were greater than those of the group with no significant IPP ($p < 0.001$, $p < 0.001$, $p = 0.004$, and $p = 0.030$, respectively). Changes in Qmax and PVR did not differ significantly between the two groups (Lee *et al*., 2012) [18]. In present study, three months after TURP, the mean changes in IPSS, IPSS-v, IPSS-s, QoL score and Qmax were significantly greater and PVR was significantly lower in significant IPP group than that of non-significant group ($p = 0.025$, $p = 0.049$, $p= 0.04$, $p = 0.03$, $p = 0.0074$, $p = 0.01$ respectively).

In general, TURP has been shown to significantly increase Q max and decrease in PVR, as well as the IPSS and QoL (Horasanli *et al*., 2008) [8]. In the present study, at baseline, significant difference was observed regarding mean score of maximum urinary flow rate (Q max) and post-void residual (PVR) between two groups. After three months of TURP, mean score of Q max significantly increased and PVR was significantly decreased in Group I compared to Group II. Moreover, before TURP, there was also significant statistical difference regarding mean score of the International Prostate Symptom Score (IPSS) between two groups. The mean IPSS score of Group I was 21.9 which decreased to 14.6 at one month. Finally it reduced to 8.1. On the other hand, the mean IPSS score of Group II was 14.1 which decreased to 11.3 at one month. Finally it reduced to 9.5. After three months, mean score of the International Prostate Symptom Score (IPSS) also significantly lower in Group I compared to Group II. The mean changes in IPSS was also significantly greater in Group I compared to Group II. This findings correlate with the retrospective study of Lee *et al*. (2012) [18]. They found a close connection between significant IPP and improvement in the IPSS and IPSS-s. TURP in significant IPP group (≥5 mm) resulted in a reduction of IPSS, IPSS-v, IPSS-s, and QoL scores on average, showing statistical differences with the group with insignificant IPP (<5mm).

Lee *et al*. (2010)a [19] also suggested that a symptomatic patient with significant IPP, would have significant bladder outlet obstruction and would benefit from TURP or more aggressive medical therapy. In contrast, a similar patient with non-significant IPP would require additional evaluation with pressure-flow studies or flexible cystoscopy to establish a diagnosis before considering invasive intervention. The Korean study of Shin *et al*. (2013) reported that IPP can predict BOO, compared with Q max, PVR, and prostate volume, for BPH/LUTS patients, and may have diagnostic predictive value similar to that of pressure-flow studies. They suggest that the degree of IPP can be a guideline for further treatment in patients with BPH/LUTS.

Lee *et al*. (2010) [20] b suggested that a higher IPP grade is associated with a higher risk of clinical progression in BPE. Keqin *et al*. (2007) [14] found that the greater the protrusion, the more severe was the detrusor impairment, possibly as a result of the increased detrusor pressure caused by the IPP. Due to the ball-valve mechanism, impairment of detrusor function was more severe in the significant IPP group than in the not significant IPP. They suggested that significant IPP patients might be benefited from early surgical intervention.

Tan and Foo (2003) b found that patients with an IPP of ≤5 mm benefited from nonsurgical procedure, but that patients with an IPP of 10 mm or more required a more definitive surgical procedure such as transurethral resection. Moreover, the prospective study of Cumpanas *et al*. (2013) [3] reported that men with a significant IPP seem to be more frequently poor responders to medical treatment among patients with LUTS due to BEP.

In present study, the mean changes of IPSS, IPSS-v, IPSS-s, QoL, and PVR were also significantly decreased and the mean changes of Q max was significantly increased in between same groups of both the significant (group-I) and non-significant IPP group (group-II), 1 and 3 months after TURP ($p< 0.05$).

So, it would be extremely useful in planning surgical therapy if the postoperative improvement in symptoms could be anticipated before to surgery (Lee *et al*., 2012) [18].

Conclusion

Finding of the study has showed, IPSS, IPSS-v, IPSS-s, QoL and PVR were significantly lower ($p = 0.025$, $p = 0.04$, $p = 0.04$, $p = <0.001$ and $p = 0.01$) and Q max was significantly higher ($p = 0.0074$), after TURP in group I (Significant IPP group ≥5 mm) than that of group II (Non-significant IPP group <5 mm).

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