Original Article

Study of correlation of urodynamic profile with symptom scoring and ultrasonographic parameters in patients with benign prostatic hyperplasia

Ankur Garg[1], Shweta Bansal[2], Sudipta Saha[3], Ajay Kumar[3]

[1]Department of General Surgery, VMMC and Safdarjung Hospital, Departments of [2]Anaesthesia and [3]General Surgery, Lady Hardinge Medical College, New Delhi, India

Abstract

Context: Urodynamic study (UDS) and ultrasonography (USG) both are established investigations to assess the patients of benign prostatic hyperplasia (BPH). It is known that the prostate mass (PM) and post-void residual urine volume (PVR) are not significantly related to the patients' symptoms and degree of obstruction; however, the relation between the UDS, USG and patient's International Prostate Symptom Scoring (IPSS) has not been defined. **Aims:** To correlate the urodynamic parameters with IPSS, PM and PVR in patients with lower urinary tract symptoms (LUTS) suggestive of BPH. **Settings and Design:** An observational study carried out as a thesis project. **Methods and Materials:** Thirty male patients aged more than 40 years with LUTS suggestive of BPH were selected and underwent USG, UDS and IPSS. In UDS, the parameters studied were the maximum flow rate (Q_{max}), detrusor pressure (P_{det}) and bladder compliance (BC). PM and PVR were studied in the USG. **Statistical Analysis Used:** IBM Statistical Package for the Social Sciences (SPSS) software version 16 (SPSS Inc., Chicago, USA). Pearson's correlation and two-sided significance levels were determined. **Results:** 1. Significant negative correlation between Q_{max} and PVR_{USG} ($r = -0.404$, $P = 0.027$); PM_{USG} ($r = -0.655$, $P = <0.001$) and IPSS ($r = -0.563$, $P = 0.001$). 2. Significant positive correlation between P_{det} and PVR_{USG} ($r = 0.535$, $P = 0.002$); PM_{USG} ($r = 0.719$, $P = <0.001$) and IPSS ($r = 0.649$, $P = <0.001$). 3. Significant negative correlation between BC and PVR_{USG} ($r = -0.490$, $P = 0.006$); PM_{USG} ($r = -0.654$, $P = <0.001$) and IPSS ($r = -0.667$, $P = <0.001$). **Conclusions:** UDS has a significant correlation with IPSS and USG findings and urodynamic parameters give a more specific diagnosis in BPH patients when it is combined with USG and IPSS.

Keywords: Benign prostatic hyperplasia (BPH), detrusor pressure (P_{det}) and bladder compliance (BC), International Prostate Symptom Scoring (IPSS), lower urinary tract symptoms (LUTS), maximum flow rate (Q_{max}), post-void residual urine volume (PVR), prostate mass (PM), ultrasonography (USG), urodynamic study (UDS)

Introduction

Benign prostatic hyperplasia (BPH), identified as the most common clinical condition in older men throughout the world, is the non-malignant growth of the prostate gland.[1] BPH is not life-threatening but causes bothering symptoms, impacting the quality of life.[2]

To describe the BPH symptoms, various symptom scores have been developed and to quantify the objective parameters, there is an established role of ultrasonography (USG) and pressure-flow studies, i.e. urodynamic studies (UDS).

Our study aims to correlate the urodynamic parameters with symptom scoring(IPSS) and USG parameters in patients with LUTS suggestive of BPH.

Subjects and Methods

This study was conducted as a thesis project. Thirty male patients above 40 years of age with LUTS suggestive of BPH were selected. Patients with previous urinary tract surgery, previous

Address for correspondence: Dr. Shweta Bansal, A-2/131, Ground Floor, Paschim Vihar, New Delhi - 110 063, India.
E-mail: dr.bansalshweta.07@gmail.com

Received: 26-08-2019 **Revised:** 11-12-2019
Accepted: 16-12-2019 **Published:** 28-01-2020

Access this article online

Quick Response Code:

Website: www.jfmpc.com

DOI: 10.4103/jfmpc.jfmpc_698_19

How to cite this article: Garg A, Bansal S, Saha S, Kumar A. Study of correlation of urodynamic profile with symptom scoring and ultrasonographic parameters in patients with benign prostatic hyperplasia. J Family Med Prim Care 2020;9:215-20.

prostate or bladder surgery, bladder stones, chronic urinary tract infection (UTI) and prostatic carcinoma were excluded from the study. Approval from ethics committee has been obtained as the research was done as a thesis project for M.S. degree by Dr. Ankur Garg in October 2011.

The absence of any clinical or microbiological evidence of UTI and avoidance of any urinary tract instrumentation at least one week prior to surgery were the pre-requisites to be met before the study.

All the selected patients underwent UDS, USG and International Prostate Symptom Scoring (IPSS).

In UDS, each of the patients was explained about the procedure and placed comfortably on the urodynamic chair in privacy. A thorough cleaning and proper draping of the parts were done. After performing uroflowmetry using uroflowmeter [shown in Figure 1], the UDS was conducted by inserting a catheter—8 Fr double-lumen catheter with a side hole 5 cm from the tip [shown in Figure 2]—through the urethra using lignocaine 2% jelly following all aseptic precautions. The rectal catheter [Figure 3] was placed per rectally using lignocaine 2% jelly following all aseptic precautions. The patient was then asked to sit over the uroflowmeter device [workstation shown in Figure 4] and the urethral and rectal catheters were connected to the pressure transducers. The urinary bladder was filled with saline using an infusion pump with a filling rate kept at 50 ml/min. The patient was asked to cough intermittently to ascertain the position of the catheters during the study. These fluid-filled catheters transmitted the intra-vesical and intra-abdominal pressures to the transducers. The patient was asked to withhold voiding throughout the storage phase and to disclose sensations of desire and urgency as and when felt by him. At the point of urgency, patient was asked to void (voiding phase). Using the Phoenix plus V3 (Albyn-Medical, UK) software in the UDS, the parameters calculated were the maximum flow rate (Q_{max}), detrusor pressure (P_{det}) and bladder compliance (BC). Prostate mass (PM_{USG}) and post-void residual urine volume (PVR_{USG}) were assessed using USG.

Figure 1: Uroflowmeter with a sensor

IPSS consists of eight questions ranging from incomplete emptying, frequency, intermittency, urgency, weak urinary stream, hesitancy, nocturia to the impact of above symptoms on the quality of the remaining life.[3]

Correlation between parameters assessed with UDS and USG and IPSS was performed using statistical analysis. For statistical analysis of the data, Statistical Package for the Social Sciences (SPSS) software version 16 (SPSS Inc., Chicago, USA) was used. Pearson's correlation and two-sided significance levels were determined. Where appropriate, Bland–Altman plots were performed using the regression approach for non-uniform differences with the 95% limits of agreement.

Results

In our study, the mean age of the patients included was 55.23 years (Range 41–72 years) [Table 1].

We analysed the correlation of UDS parameters with USG parameters and IPSS.

The correlation coefficient (r) had values −1 to +1. In which, 0 meant no correlation, >0 to +1 was a positive correlation and −1 to <0 was negative correlation.

Correlation of maximum flow rate (Q_{max}) in UDS with USG parameters and IPSS

The mean Q_{max} of the patients included was 10.57 ml/sec. (Range 5–20 ml/sec.).

We found a moderate negative correlation between Q_{max} and PVR_{USG} ($r = -0.404$, $P = 0.027$), PM_{USG} ($r = -0.655$, $P = <0.001$) and IPSS ($r = -0.563$, $P = 0.001$) as depicted in Graphs 1–3.

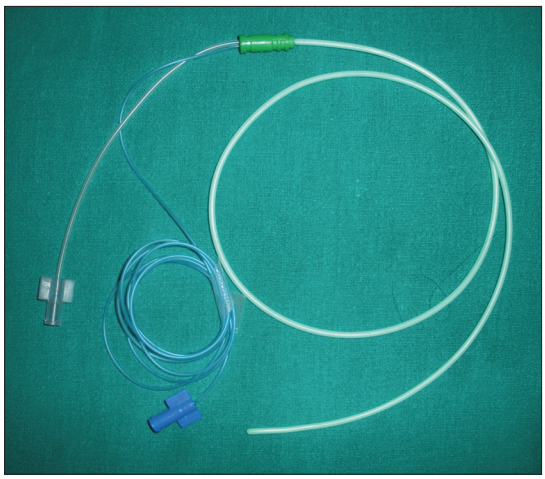


Figure 2: An 8 Fr dual lumen intra-vesical catheter (Used for both pressure measurement [blue channel] and bladder filling [transparent channel])

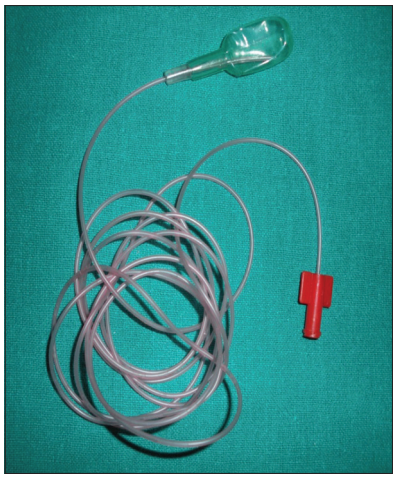


Figure 3: A rectal catheter with a measuring balloon

Figure 4: Urodynamic workstation—comprising of transducers and pump for bladder filling

Table 1: Age of patients in the study

Age Groups	Frequency	%
41-50	15	50
51-60	5	16.7
61-70	5	16.7
71-80	5	16.7
Total	30	100

Correlation of detrusor pressure (P_{det}) in UDS with USG parameters and IPSS

The mean P_{det} of the patients included was 63.60 cmH_2O (Range 25–145 cmH_2O.).

We found a significant positive correlation between P_{det} and PVR_{USG} ($r = 0.535$, $P = 0.002$), PM_{USG} ($r = 0.719$, $P = <0.001$) and IPSS ($r = 0.649$, $P = <0.001$) as depicted in Graphs 4–6.

Correlation of bladder compliance (BC) in UDS with USG parameters and IPSS

The mean BC of the patients included was 27.20 ml/cmH_2O. (Range 4–45 ml/cmH_2O.).

We found a significant negative correlation between BC and PVR_{USG} ($r = -0.490$, $P = 0.006$), PM_{USG} ($r = -0.654$, $P = <0.001$) and IPSS ($r = -0.667$, $P = <0.001$) as depicted in Graphs 7–9, respectively.

Discussion

The prostate continues to grow with the age of men. By the age of 60 years, BPH can be identified histologically in about 50% of men and the incidence increases by up to 90% by the age of 90 years.[4,5]

To describe and quantify the BPH symptoms, various symptom scores have been developed, such as the IPSS, clinical prostate score and Danish prostate symptom score (DAN-PSS-1). To quantify the objective parameters of BPH, there is an established role of USG and pressure-flow studies, i.e., UDS. In USG, one can measure the PM and PVR easily, whereas pressure-flow studies give an account of objective parameters, such as urinary flow rate, PVR and P_{det} at Q_{max}.

The relation between prostate size, symptoms severity and urodynamic measurements of the severity of bladder outlet obstruction (BOO) is complex.[6,7]

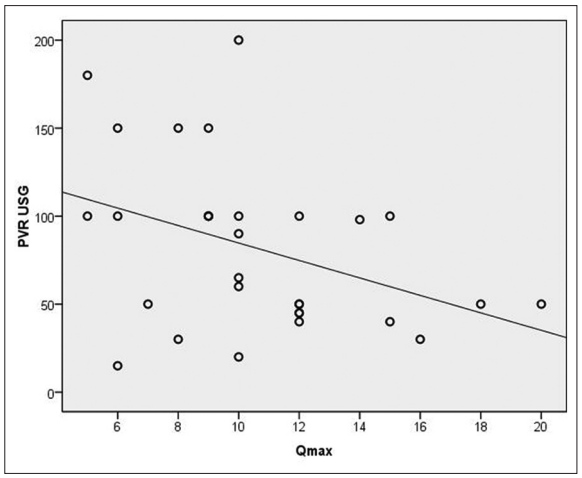
Despite the lack of evidence in the literature that there is any significant correlation between LUTS and BOO, symptom severity and measurement of flow rate are the commonly used criteria for selection of treatment modality in patients with BPH. Emberton *et al.* (1995) also found more than half of the United Kingdom (UK) urologists rely on symptomatology when selecting patients for prostatic surgery.[8]

Urodynamic investigations with pressure and flow analysis are used as the gold standard for the quantification of the degree of obstruction in elderly men.[9]

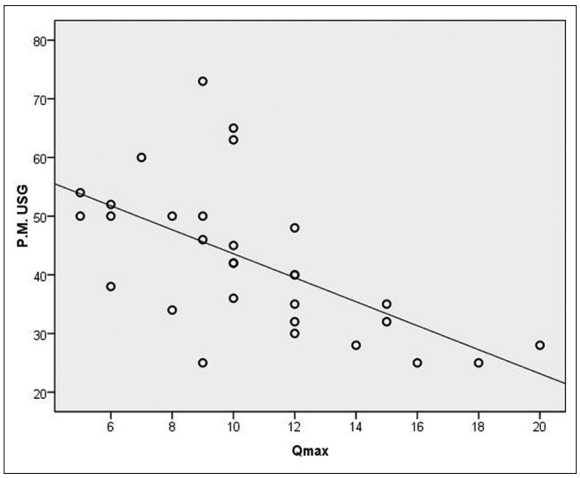
Uroflowmetry should be regarded as a basic clinical urodynamic test.[10] In the past, various studies have established the correlation between the USG parameters and symptom scoring in elderly males with BPH. However, no study has shown the correlation of the urodynamic profile with USG parameters and IPSS in patients of BPH.

In our study, we found a moderate negative correlation between Q_{max} and PVR_{USG} ($r = -0.404$, $P = 0.027$), PM_{USG} ($r = -0.655$, $P = <0.001$) and IPSS ($r = -0.563$, $P = 0.001$), i.e. when Q_{max} decreased, indicating some obstruction, other parameters showed an increase in their values. This, in turn, supports the diagnosis of obstruction and worsening of BPH patients' symptoms.

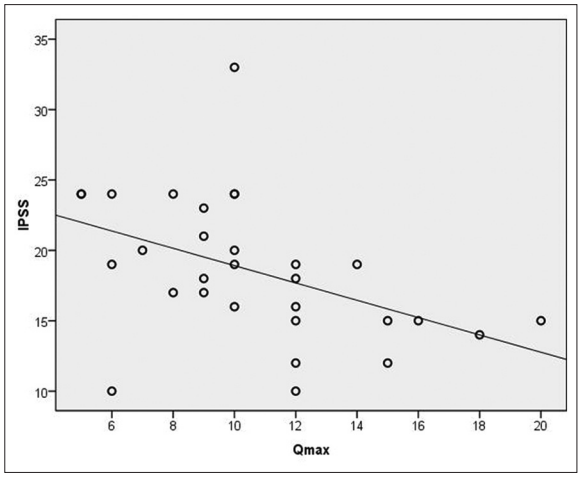
In the past, Q_{max} has been correlated with different parameters in various studies. However, there is a slight variation in their results when compared to our study. In his study, Bosch (1995),[11] found



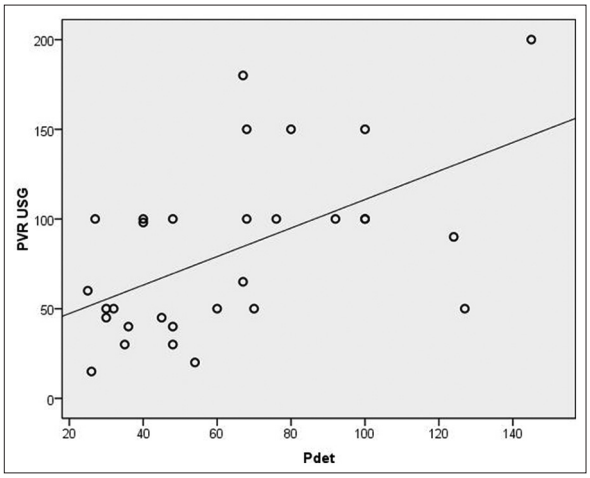
Graph 1: Correlation between Q_{max} and PVR_{USG}



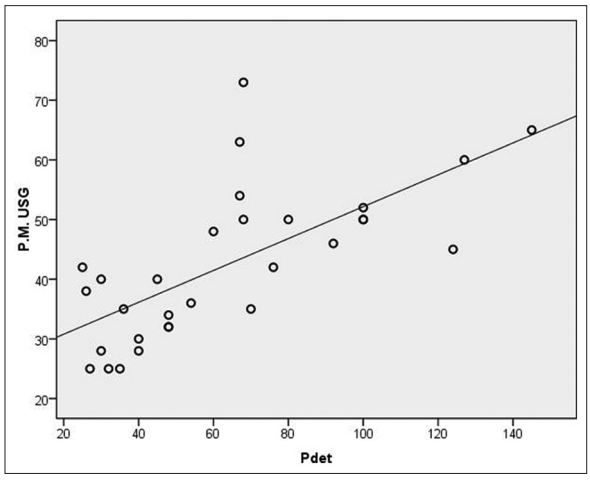
Graph 2: Correlation between Q_{max} and PM_{USG}



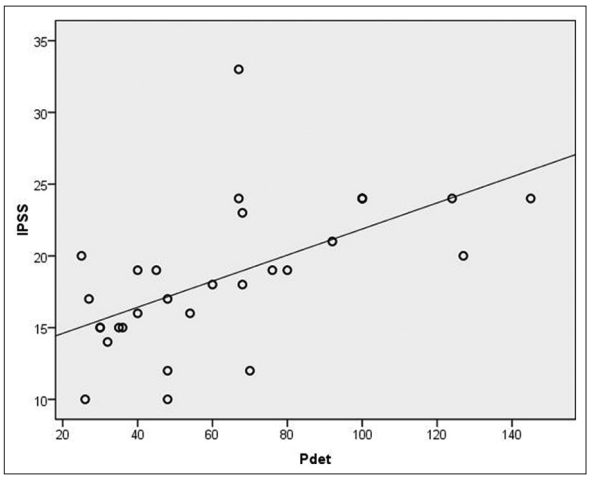
Graph 3: Correlation between Q_{max} and IPSS



Graph 4: Correlation between P_{det} and PVR_{USG}

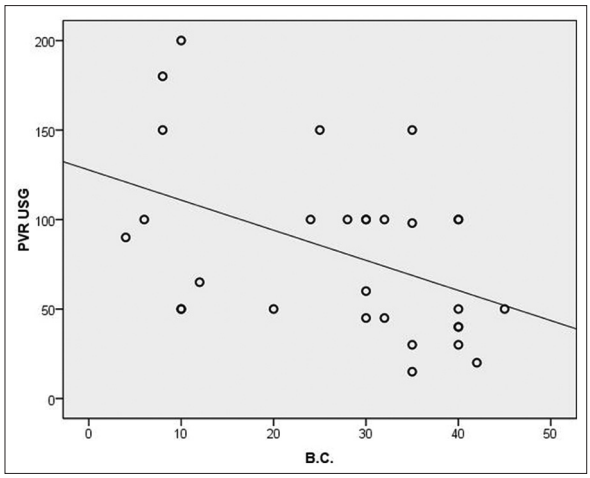


Graph 5: Correlation between P_{det} and PM_{USG}

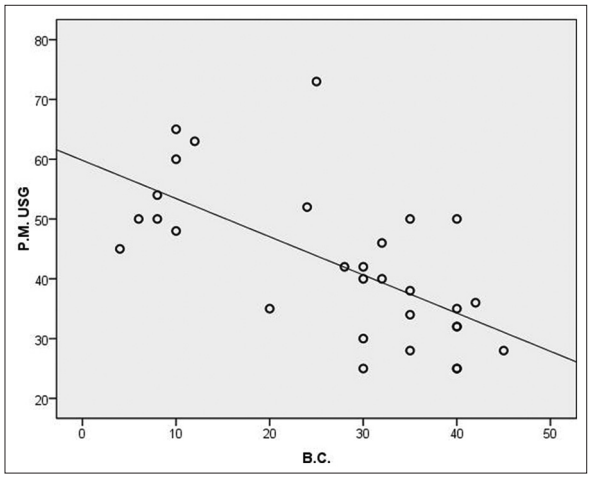


Graph 6: Correlation between P_{det} and IPSS

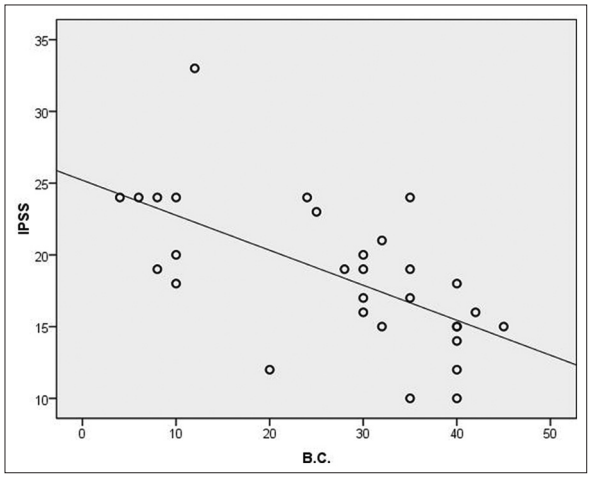
a weak negative correlation between Q_{max} and IPSS. He attributed this to the theoretical possibility of measurement problems or poor test–retest reliability of peak flow rate. Barry (1993) also conducted a similar study in 198 outpatients and found a weak correlation between symptom score (American Urological Association [AUA]) and peak flow rate. He blamed the unreliability in the measurement of physiological/anatomical parameters for the same. He also proposed that these parameters may be measuring different pathophysiological phenomena.[6] In a recent study done by Oranusi *et al.*,[12] published in 2017, where they collected prospective



Graph 7: Correlation between BC and PVR_{USG}



Graph 8: Correlation between BC and PM_{USG}



Graph 9: Correlation between BC and IPSS

data from 51 patients, the correlation between IPSS and Q_{max} was found to be negative and statistically significant.

In our study, we found a significant positive correlation between P_{det} and PVR_{USG} (r = 0.535, P = 0.002), PM_{USG} (r = 0.719, P = <0.001) and IPSS (r = 0.649, P = <0.001), i.e., P_{det} increases in proportion to the degree of obstruction and symptom severity in BPH patients.

In indexed literature, very few studies have correlated P_{det} with other parameters in BPH patients. Aganovic *et al.* studied the correlation between detrusor contractility duration (DCD) and IPSS.[13] He found no significant correlation between DCD and IPSS, prostate volume and PVR.

We found a significant negative correlation between BC and PVR_{USG} (r = −0.490, P = 0.006), PM_{USG} (r = −0.654, P = <0.001), IPSS (r = −0.667, P = <0.001), i.e. with an increase in PVR and PM, there is a decrease in BC. Also, we found that with the increase in BC, IPSS falls; hence, BPH patients felt better whereas their condition worsened with a decrease in BC. Abnormally poor compliance is often an artefact of the unnaturally high filling rates that are used during cystometry (excluding ambulatory urodynamic).

Conclusion and Recommendations

From the study, we conclude that:

1. UDS has a significant correlation with IPSS and USG findings, and the urodynamic parameters give a more specific diagnosis in BOO patients when used in combination with USG and IPSS, rather than when each of them is used alone.
2. In combination, UDS along with USG and IPSS help to differentiate between obstruction because of prostate and various other causes of LUTS, such as bladder neck dysfunction, spastic urethral sphincter and poor relaxation of the urethral sphincter, urethral stricture or pseudodyssynergia.

We recommend:

1. UDS should be done routinely in the work-up of patients with BPH, as it provides objective documentation of BOO because of various causes and guides about the degree of obstruction.
2. UDS in combination with USG and IPSS could help increase the specificity of diagnosis of BPH at primary health care level.
3. USG, IPSS scoring and UDS should be done before starting any intervention, such as medical, surgical and lifestyle modification, in BPH patients and at regular intervals to assess long-term improvement of BPH symptoms.
4. A long-term study with a large number of patients should be conducted to further consolidate the correlation between the USG, IPSS and UDS.

Financial support and sponsorship

Thesis Project done by Dr. Ankur Garg in the Department of Surgery, Lady Hardinge Medical College.

Conflicts of interest

There are no conflicts of interest.

References

1. Napalkov P, Maisonneuve P, Boyle P. Worldwide patterns of prevalence and mortality from benign prostatic hyperplasia. Urology 1995;46:41-6.
2. De la Rosette JJ, Alivizatos G, Madersbacher S, Perachino M, Thomas D, Desgrandchamps F, *et al.* Guidelines on benign prostatic hyperplasia. Eur Urol 2001;40:256-63.
3. Eckhardt MD, van Venrooij GE, Boon TA. Symptoms and quality of life versus age, prostate volume, and urodynamic parameters in 565 strictly selected men with lower urinary tract symptoms suggestive of benign prostatic hyperplasia. Urology 2001;57:695-700.
4. Berry SJ, Coffey DS, Walsh PC, Ewing LL. The development of human benign prostatic hyperplasia with age. J Urol 1984;132:474.
5. Arrighi HM, Guess HA, Metter EJ, Fozard JL. Symptoms and signs of prostatism as risk factors for prostatectomy. Prostate 1990;16:253-61.
6. Barry MJ, Cockett ATK, Holtgrewe HL, McConnell JD, Sihelnik SA, Winfield HN. Relationship of symptoms of prostatism to commonly used physiological and anatomical measures of the severity of benign prostatic hyperplasia. J Urol 1993;150:351-8.
7. Yalla SV, Sullivan MP, Lecamwasam HS, DuBeau CE, Vickers MA, Cravalho EG. Correlation of American urological association symptom index with obstructive and nonobstructive prostatism. J Urol 1995;153: 674-80.
8. Emberton M, Neal D, Black N, Harrison M, Fordham M, McBrien MP, *et al.* The National Prostatectomy Audit: The clinical management of patients during hospital admission. Br J Urology 1995;75:301-16.
9. Abrams PH, Griffiths DJ. The assessment of prostatic obstruction from urodynamic measurements and from residual urine. Br J Urol 1979;51:129-34.
10. Ozawa H, Igarashi T, Uematsu K, Watanabe T, Kumon H. The future of urodynamics: Non-invasive ultrasound videourodynamics. Int J Urol 2010;17:241-9.
11. Bosch JL, Hop WC, Kirkels WJ, Schröder FH. The International prostate symptom score in a community-based sample of men between 55 and 74 years of age: Prevalence and correlation of symptoms with age, prostate volume, flow rate and residual urine volume. Br J Urol 1995;75:622-30.
12. Oranusi CK, Nwofor AE, Mbonu O. Correlation between international prostate symptom score and uroflowmetry in patients with benign prostatic hyperplasia. Niger J Clin Pract 2017;20:454-8.
13. Aganović D, Prcić A. Detrusor contraction duration and strength in the patients with benign prostatic enlargement. Bosn J Basic Med Sci 2004;4:29-33.