

Voiding Dysfunction

Correlation of Male Overactive Bladder with Intravesical Prostatic Protrusion

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Purpose: Male overactive bladder (OAB) may be caused by prostatic pathologies such as bladder outlet obstruction (BOO). Intravesical prostatic protrusion (IPP) has been found to correlate with BOO and acute urinary retention. We investigated the interrelation between male OAB symptoms and IPP for estimating anatomical changes to the prostate.

Materials and Methods: We assessed 179 consecutive men aged >40 years who presented with lower urinary tract symptoms. The initial evaluation included International Prostate Symptom Score (IPSS) and quality of life assessments, transrectal ultrasonography (TRUS), uroflowmetry, and postvoid residual urine volume. The degree of IPP was determined by the distance from the tip of the protrusion to the circumference of the bladder at the base of the prostate gland. Patients with IPP <0.5 cm were defined as group A (n=114), and patients having 0.5 cm ≤ IPP < 1 cm were defined as group B (n=38). The others were defined as group C (n=27).

Results: A total of 51 patients complained of urgency in group A, 38 patients in group B, and 27 patients in group C. Likewise, 14 patients had a history of acute urinary retention in group A, 8 patients in group B, and 16 patients in group C. IPP grade had a statistically significant relation with both OAB and a history of acute urinary retention.

Conclusions: The results of our study have shown that male OAB is correlated with IPP. However, larger scale studies are needed to confirm these results.

Key Words: Overactive bladder; Prostatic hyperplasia; Ultrasonography

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INTRODUCTION

Benign prostatic hyperplasia (BPH) is found in over half of 60-year-old men and in almost all of 80-year-old men, who develop bladder outlet obstruction and lower urinary tract symptoms [1]. Overactive bladder (OAB) is currently defined by the International Continence Society (ICS) as urgency, with or without urgency urinary incontinence, usually with frequency and nocturia, and in case of the presence of bladder outlet obstruction due to prostatic hyperplasia, 50% to 75% of cases are accompanied by OAB [2-4]. In addition, it has been reported that the higher the age and the more severe the lower tract obstruction, the higher the prevalence of OAB due to BPH [5,6]. Voiding

symptoms are the most common in bladder outlet obstruction due to BPH; however, the most troublesome symptom for the patients is OAB caused by instability of the detrusor [7].

Recently, studies on the correlation between the degree of intravesical prostatic protrusion (IPP) and bladder outlet obstruction have been actively conducted, and correlations of IPP with the storage symptom subscale of the International Prostate Symptom Score (IPSS) have been reported domestically [8]; however, the studies on the direct correlations between the degree of IPP and OAB have not been sufficient. Therefore, this study analyzed the correlations between IPP measured by transrectal ultrasonography (TRUS) and the symptoms of OAB.

MATERIALS AND METHODS

We performed IPSS, TRUS (model Accuvix XQ, Medison), uroflowmetry (model Urolynx1000, Mediwatch), residual urine test by ultrasonography, and serum prostate-specific antigen (PSA) test for 208 patients over 40 years old who had visited the hospital from January 2007 to May 2010 owing to lower urinary tract symptoms. We also performed a retrospective study with 179 patients, excluding 23 patients who had diagnosed urinary tract infection, prostatic malignancy, ureteral or bladder stones, urethral stricture, or neurogenic bladder and 6 patients who had had a history of urogenital surgery. OAB was defined as patients who complained of symptoms with 2 points or more for the 4th questionnaire related to urgency on the IPSS, which was performed for all subjects. IPP was measured as the shortest distance connecting the protruded end of the prostate into the bladder based on the bladder neck in the sagittal plane, which reflects the maximum longitudinal length of the prostate as suggested by Nose et al [9]. The patients were classified into 3 types according to grades by the degree of protrusion: < 5 mm, 5-10 mm, and > 10 mm. Among 179 patients, 115 patients were grade I (group A), 38 patients were grade II (group B), and 27 patients were grade III (group C) in IPP. IPP was measured by transrectal ultrasonography, and the volume of the prostate and the volume of the prostatic transitional zone were measured by transrectal ultrasonography. The correlations of IPP grade with the volume of the prostate and the volume of the prostatic transitional zone and the correlations between IPP grade and OAB or acute urinary retention were analyzed. The

statistical significance was tested for maximum flow rate and voided volume by uroflowmetry and residual urine volume by ultrasonography. The statistical analysis was conducted by using SPSS ver. 12.0 (SPSS Inc., Chicago, IL, USA), and the one-way ANOVA test and multiple linear analysis were used to analyze the relationship of the factors. Statistical significance was defined as a p-value less than 0.05.

RESULTS

The average age of the 179 patients was 70.1±7.5 years, and the mean IPSS, prostate volume, and prostate transitional zone volume were 20.7±6.7, 53.9±33.0, and 32.0±24.4, respectively. IPP was measured by using TRUS according to the method suggested by Nose et al [9]. The patients were classified according to IPP severity as group A (n=114) with IPP < 5 mm, group B (n=38) with IPP of 5-10 mm, and group C (n=27) with IPP ≥ 10 mm. The average age, mean IPSS, mean prostate volume, and mean transitional zone volume of group A were 69.4±6.4, 21.2±6.7, 41.2±18.3, and 22.9±13.2, respectively. In group B, the average age, mean IPSS, mean prostate volume, and mean transitional zone volume were 71.8±9.3, 18.5±7.0, 57.0±31.6, and 32.7±22.1, respectively. In group C, the average age, mean IPSS, mean prostate volume, and mean transitional zone volume were 70.4±8.7, 21.8±5.5, 102.8±36.9, and 68.9±29.1, respectively (Table 1).

In the one-way ANOVA, IPP grade showed a statistically significant ($p < 0.05$) effect on prostate volume, transitional zone volume, PSA, and residual urine volume but not

TABLE 1. Baseline demographics

	Overall (n=179)	Group A (n=114)	Group B (n=38)	Group C (n=27)
Age (yr)	70.1±7.5	69.4±6.4	71.8±9.3	70.4±8.7
Prostate volume (g)	53.9±33.0	41.2±18.3	57.0±31.6	102.8±36.9
Transitional zone volume (g)	32.0±24.4	22.9±13.2	32.7±22.1	68.9±29.1
IPSS	20.7±6.7	21.2±6.7	18.5±7.0	21.8±5.5
IPSS (QoL)	4.1±1.1	4.1±1.1	4.0±1.4	4.4±0.5

IPSS: International Prostate Symptom Score, QoL: quality of life

TABLE 2. The correlation of PSA, prostate volume, prostatic transitional zone volume, VV, RV, Qmax, IPSS, and QoL with IPP grade

	Group A (n=114), median (range)	Group B (n=38), median (range)	Group C (n=27), median (range)	p-value
PSA (ng/ml)	3.1 (0.01-49.1)	3.0 (0.1-19.4)	7.9 (0.3-22.1)	< 0.01
Prostate volume (g)	41 (10.1-140.2)	57 (16-152)	102 (25-297)	< 0.01
Transitional zone volume (g)	23 (5-89.6)	32 (8-85)	69 (8-157)	< 0.01
VV (ml)	165 (0-700)	171 (51-489)	149 (72-489)	0.69
RV (ml)	44 (0-680)	57 (0-313)	78 (0-277)	0.03
Qmax (ml/s)	9.2 (0-42.7)	9.6 (3.6-40.1)	8.8 (2.2-40.1)	0.85
IPSS	21.2 (4-35)	18.5 (5-32)	21.7 (11-33)	0.06
IPSS (QoL)	4.1 (0-6)	4.0 (1-6)	4.4 (3-6)	0.38

PSA: prostate-specific antigen, VV: voided volume, RV: residual volume, Qmax: maximum flow rate, IPSS: International Prostate Symptom Score, QoL: quality of life, IPP: intravesical prostatic protrusion

TABLE 3. Multiple linear regression analysis of the various factors affecting OAB

Variable	Beta	p-value
PSA (ng/ml)	-0.1	0.890
Prostate volume (g)	-0.3	0.914
Transitional zone volume (g)	0.03	0.916
VV (ml)	-0.2	0.859
RV (ml)	0.0	0.733
Qmax (ml/s)	-0.1	0.542
IPSS	0.2	0.056
IPSS (QoL)	0.1	0.380
IPP	0.2	0.013

OAB: overactive bladder, PSA: prostate-specific antigen, VV: voided volume, RV: residual volume, Qmax: maximum flow rate, IPSS: International Prostate Symptom Score, QoL: quality of life, IPP: intravesical prostatic protrusion

on voided volume, maximum flow rate, or IPSS (Table 2).

Concerning the classifications by each IPP grade, 45% (51/114) of group A complained of urgency, 74% (28/38) of group B, and 70% (19/27) of group C. Likewise, 12% (14/114) of group A had a history of acute urinary retention, 21% (8/38) of group B, and 59% (16/27) of group C. By multiple linear regression analysis, IPP grade was statistically significantly related to both OAB ($p=0.01$) (Table 3) and a history of acute urinary retention ($p < 0.01$) (Table 4).

DISCUSSION

OAB symptoms are the most troublesome among the lower urinary tract symptoms, referring to cases showing urgency as one of the storage symptoms [10]. Detrusor hyperactivity is the most common cause of OAB symptoms and is often correlated with bladder outlet obstruction and BPH [11-14]. However, there is an argument that OAB symptoms and detrusor hyperactivity are not related to bladder outlet obstruction, but to aging [15]. This is supported by the EPIC study, which was a population-based cross-sectional survey of adults 18 years of age or older in five countries (Canada, Germany, Italy, Sweden, and the UK). The results of that study showed no sexual difference in the prevalence of OAB but that the prevalence in both males and females increased with age.

Since Nose et al suggested the clinical implication of IPP [9], there have been many studies related to IPP and lower urinary tract symptoms. Kim et al reported the correlations of prostate volume, serum PSA value, and IPSS according to IPP severity measured by abdominal ultrasonography [16]. In addition, Keqin et al reported the correlation of IPP with bladder outlet obstruction by classifying 206 patients with IPP of > 10 mm and < 10 mm [17]. Doo and Uh reported the correlation of IPP with acute urinary retention in 157 patients [18], and Ku et al reported the correlation of IPP with bladder outlet obstruction in 260 patients by measuring the prostatic urethral angle [19]. Lee et al analyzed the correlation of IPP with the storage symp-

TABLE 4. Multiple linear regression analysis of the various factors affecting AUR

Variable	Beta	p-value
PSA (ng/ml)	-0.1	0.099
Prostate volume (g)	0.2	0.367
Transitional zone volume (g)	-0.2	0.459
VV (ml)	-0.2	0.054
RV (ml)	1.7	0.093
Qmax (ml/s)	0.1	0.230
IPSS (symptom score)	0.2	0.057
IPSS (QoL)	0.0	0.763
IPP	0.4	< 0.01

AUR: acute urinary retention, PSA: prostate-specific antigen, VV: voided volume, RV: residual volume, Qmax: maximum flow rate, IPSS: International Prostate Symptom Score, QoL: quality of life, IPP: intravesical prostatic protrusion

tom score of the IPSS, referring to the fact that the storage symptom score was underestimated compared with the score for urination symptoms, and reported a high correlation between IPP and the storage symptom score [8]. Moreover, our study reported the statistically significant relation between IPP and OAB, highlighting the correlation of IPP with the questionnaires related to urgency among the questionnaires on storage scores in the IPSS.

Since the studies of IPP began, IPP was initially measured mainly by abdominal ultrasonography. However, this method can be used only in cases of bladder filling to about 100 to 200 cc, reflecting the difficulty of IP measurement and the lower reliability in cases of an empty bladder. In the present study, we tried to enhance the accuracy of the results for IPP by using transrectal ultrasonography to follow the recent trend and to minimize the tester's error by performing ultrasonography by single tester. In the present study, we reported not only the correlations of IPP with acute urinary retention, prostate volume, PSA, IPSS, and quality of life as shown in previous studies, but also the statistically significant relation between IPP and OAB symptoms.

Further larger scale studies of the statistical significance of IPP severity in relation to the symptom severity of OAB would be helpful to generate more accurate results. Furthermore, the correlations between detrusor overactivity and IPP severity should be tested by use of urodynamic study.

CONCLUSIONS

The results of this study suggest that IPP, which reflects anatomical changes in the prostate, may be related to male OAB symptoms. We should actively consider this variable in the treatment of male OAB.

Conflicts of Interest

The authors have nothing to disclose.

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