KJU
Korean Journal of Urology

www.kjurology.org
DOI:10.4111/kju.2010.51.5.344

Voiding Dysfunction

Effects of Obesity on Prostate Volume and Lower Urinary Tract Symptoms in Korean Men

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Purpose: We investigated the effects of obesity on prostate volume (PV) and lower urinary tract symptoms (LUTS) in Korean men.

Materials and Methods: From December 2007 to 2009, a total of 10,383 ostensibly healthy Korean men aged ≥50 years visited our health promotion center for a routine check-up. Among them, 872 men who wanted a prostate evaluation were enrolled in this study. All men underwent detailed clinical evaluations with the International Prostate Symptom Score (IPSS) questionnaire. Anthropometric measurements, including height, weight, and waist and hip circumferences, were determined. A blood sample was obtained for serum prostate-specific antigen (PSA) measurement. Thereafter, a digital rectal examination and transrectal ultrasound were performed.

Results: In total, 465 men with moderate to severe LUTS (IPSS≥8 points) were included in this prospective study. The participants' mean age was 57.2 years. Multivariate analysis demonstrated that only waist circumference was a significant factor in predicting PV besides age and serum PSA. The univariate analysis showed no statistically significant relations between any of the obesity-related parameters and LUTS. The PV was also not correlated with LUTS.

Conclusions: Central obesity is the more important predictor of PV than overall obesity. There are no significant relations between obesity-related parameters and LUTS.

Key Words: *Abdominal obesity; Prostate; Prostatic hyperplasia*

Article History:
received 18 February, 2010
accepted 13 April, 2010

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INTRODUCTION

Lower urinary tract symptoms (LUTS), often the result of benign prostatic hyperplasia (BPH), are common among older men and have a negative impact on their quality of life [1]. Multiple studies have reported that obese men have a larger prostate volume (PV) than do nonobese men [2-6], and recently some studies have revealed that a relationship exists between obesity and LUTS [2,4,7,8]. The suggested pathophysiology was hyperinsulinemia [9-11], caused by tissue insulin resistance, which stimulates the autonomic nervous system, particularly the sympathetic nervous system [12]. The overactivity of the sympathetic nervous system results in bladder outlet obstruction and LUTS.

The Korean National Health and Nutrition Surveys reported an increase in the prevalence of obesity from 1995 to 2001 [13]. The prevalence of clinical BPH was reported to be from 10.6% to 31% in men over 50 years of age, with an age-related increase seen in South Korea [14,15]. However, there are insufficient data on the effect of obesity on LUTS in Korean men. Therefore, in this cross-sectional study, we investigated the effects of obesity on PV and LUTS in Korean men.

MATERIALS AND METHODS

From December 2007 to 2009, a total of 10,383 ostensibly healthy Korean men aged ≥50 years visited our health promotion center for a routine check-up. Among them, 872 men who wanted a prostate evaluation were enrolled in this study.

All men underwent detailed clinical evaluations with the International Prostate Symptom Score (IPSS) questionnaire. Anthropometric measurements, including height, weight, and waist and hip circumferences, were determined. A blood sample was obtained for serum prostate-specific antigen (PSA) measurement (AxSYM, Abbott

Laboratories, Abbott Park, IL, USA). Thereafter, a digital rectal examination (DRE) and transrectal ultrasound was performed. Body mass index (BMI) was calculated as the weight divided by square of the height, and waist-to-hip ratio (WHR) was determined as the waist circumference divided by the hip circumference.

The exclusion criteria of this study were mild LUTS (IPSS <8); the use of medications affecting prostate growth, such as antiandrogens and 5-α-reductase inhibitors; a high serum PSA level of >4.0 ng/ml; abnormal findings on the DRE; pyuria (white blood cells >5 on urinalysis), the presence of neurogenic bladder dysfunction; confirmed prostate cancer; acute or chronic urinary retention status; acute or chronic prostatitis within the previous 3 months; a history of recurrent urinary tract infection or bladder stones; and previous surgical intervention related to BPH.

Univariate analysis by Pearson's correlation coefficient was used to test the linearity of the relationships among the variables. Multiple linear regression analysis was used to test the linear effect of variables in predicting PV. All statistical analysis was performed by using commercially available software (SPSS, version 14.0 KO, Chicago, IL, USA). A p-value of <0.05 was considered statistically significant.

RESULTS

In total, 465 men with LUTS (IPSS ≥ 8 points) and aged $\geq$ 50 years were included in this prospective study. The participants' mean age was 57.2 years (Table 1).

The univariate analysis showed that the PV was positively correlated with all obesity-related parameters: BMI, waist circumference, and WHR (Table 2). However, multiple linear regression analysis demonstrated that, among the obesity-related parameters, only waist circumference was a significant factor in predicting PV (Table 3).

We then examined the correlation between obesity parameters and LUTS represented by IPSS. The univariate analysis showed that there were no statistically significant relationships between obesity-related parameters and

TABLE 1. Characteristics of the study population

Characteristics	Mean±SD
Age (years)	57.2±5.6
BMI (kg/m^2)	24.64±2.64
WC (cm)	83.6±7.1
WHR	0.90±0.05
IPSS	13.8±5.1
Voiding	8.9±3.9
Storage	4.9±2.5
PV (ml)	26.6±8.6
PSA (ng/ml)	1.50±0.70

BMI: body mass index, WC: waist circumference, WHR: waist to hip ratio, IPSS: International Prostate Symptom Score, PV: prostate volume, PSA: prostate-specific antigen

TABLE 3. Multiple linear regression analysis to determine independent predictors of PV

Variables	Coefficient	p-value	VIF
Age	0.153	0.001	1.011
BMI	0.027	0.696	2.338
WC	0.183	0.008	2.342
PSA	0.142	0.002	1.007

PV: prostate volume, VIF: variation inflation factor, BMI: body mass index, WC: waist circumference, PSA: prostate-specific antigen

TABLE 2. Univariate correlation analysis between various parameters

Variables		PV	PSA	Storage	Voiding	IPSS	WHR	WC	BMI
Age	r	0.150	0.135	0.230	0.071	0.164	0.077	0.019	0.047
	p	0.001	0.003	<0.001	0.131	<0.001	0.101	0.691	0.316
BMI	r	0.164	0.042	0.020	0.030	0.033	0.497	0.754	
	p	<0.001	0.371	0.660	0.520	0.480	<0.001	<0.001	
WC	r	0.217	0.070	0.016	0.043	0.041	0.802		
	p	<0.001	0.135	0.726	0.350	0.377	<0.001		
WHR	r	0.174	0.058	0.061	0.010	0.037			
	p	<0.001	0.212	0.194	0.835	0.431			
IPSS	r	0.027	0.033	0.673	0.884				
	p	0.560	0.485	<0.001	<0.001				
Voiding	r	0.012	0.022	0.251					
	p	0.801	0.633	<0.001					
Storage	r	0.076	0.033						
	p	0.106	0.487						
PSA	r	0.151							
	p	0.001							

PV: prostate volume, PSA: prostate-specific antigen, IPSS: International Prostate Symptom Score, WHR: waist to hip ratio, WC: waist circumference, BMI: body mass index, r: correlation coefficient, p: as determined by Pearson's correlation coefficient

LUTS (Table 2). Voiding and storage symptoms also revealed no correlation with any obesity-related parameters. PV was not correlated with any type of LUTS.

DISCUSSION

LUTS comprise a spectrum of voiding and storage symptoms, which in men are generally considered a sign of clinically significant BPH [16]. A review of the available data appears to support a strong independent relationship between obesity and BPH or LUTS.

Over the past two decades, many different groups have investigated the influence of obesity on the development of BPH and LUTS with conflicting results [1,17-22]. Most of these groups have concluded that overall obesity, abdominal obesity, and/or WHR can increase the risk of BPH and LUTS, at least to some degree.

The Veterans Administration Normative Aging Study reported that increased BMI was a significant predictor of a clinical diagnosis of BPH [17]. Rohrmann et al examined the association between obesity and LUTS in the National Health and Nutrition Examination Survey (NHANES) III cohort [1]. They found that an increase in BMI after age 25 was positively associated with LUTS. They also noted that men with a larger waist circumference (>102 cm) were more likely to have LUTS than were men with a smaller waist circumference. Kristal et al examined several modifiable lifestyle factors related to the development of symptomatic BPH in 5,600 men enrolled in the placebo arm of the Prostate Cancer Prevention Trial who were followed for 7 years [18]. They reported significant increases in symptomatic BPH (IPSS >14), with abdominal obesity as measured by WHR. Laven et al examined a cohort of 27,858 Swedish men and found that low birth weight and abdominal obesity, but not BMI, were associated with an increased risk of LUTS [19]. Together, these results suggested that weight gain and central adiposity in adulthood were associated with a higher prevalence of LUTS.

However, these results may not be universally applicable. Joseph et al looked at modifiable risk factors for LUTS specifically in black men and found no greater risk with increasing BMI [10]. Gupta et al followed 1206 Vietnam veterans from the Air Force Health Study for an average period of 15 years and showed no increased risk of BPH or LUTS in men with metabolic syndrome compared with that in men without it [3].

To our knowledge, only three studies have assessed the relationship between obesity and LUTS in Korean men [20-22], and all were done in a cross-sectional manner. One was a community-based study performed in 348 elderly men whose age was over 65 years, in which no relationship between obesity and LUTS was shown [20]. The second study also showed that there was no association between metabolic syndrome and voiding dysfunction in men older than in their 60 s [21]. The third study by Lee et al involving 602 patients (aged ≥ 40 years) with BPH or LUTS who were attending a urology clinic, provided evidence that central obesity is the predictor of LUTS correlated with BPH [22]. That study reported that Korean men with a waist circumference of >90 cm experienced a 1.36-fold increased risk of severe LUTS compared with those with a waist circumference of ≤ 90 cm. They also observed that storage symptoms, such as nocturia and urgency, increased with increasing PV in men with a waist circumference of >90 cm [22].

Our study of 465 men recruited through the health promotion center showed that PV was positively correlated with central obesity, as represented by waist circumference, but not with BMI, which represented overall obesity. There was no significant relationship between obesity-related parameters and LUTS. Our study might have been affected by selection bias due to the heterogeneous eligibility of the study population. This may be why our study population showed a relatively small PV (mean: 26.6 ml) compared with the PV values reported in the three studies mentioned above [20-22].

Recent studies concerning the pathophysiology of BPH have suggested that in addition to the conventional risk factors, such as age, family history, and androgen activity, newly identified risk factors, such as diet and obesity, may have a major role in the development of BPH [23]. However, most of theses studies were performed in Western persons. We think it may be difficult to directly adopt the results of those studies to Korean persons, because differences in the incidence of BPH, LUTS, and obesity exist among different ethnic groups. Moreover, obesity defined by the Adult Treatment Panel III is much more rigid for Western men (>102 cm of waist circumference) than for Orientals (>90 cm of waist circumference).

We need another large, longitudinal, prospective, community-based study to fully reveal the relationship between obesity and BPH or LUTS in Korean men.

CONCLUSIONS

Our data showed that PV was positively correlated with central obesity, as represented by waist circumference, but not with BMI, which represented overall obesity. There was no significant relationship between obesity-related parameters and LUTS.

Conflicts of Interest

The authors have nothing to disclose.

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