Kaohsiung Journal of Medical Sciences (2015) 31, 194—198

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: http://www.kjms-online.com

ORIGINAL ARTICLE

# Association between prostatic resistive index and cardiovascular risk factors in patients with benign prostatic hyperplasia

**Mehmet Murat Baykam [a], Binhan Kagan Aktas [a,*], Suleyman Bulut [a], Cuneyt Ozden [a], Tagmac Deren [b], Suleyman Tagci [a], Cevdet Serkan Gokkaya [a], Ali Memis [a]**

[a] *Urology Clinic, Numune Training and Research Hospital, Ankara, Turkey*
[b] *Radiology Clinic, Numune Training and Research Hospital, Ankara, Turkey*

Received 2 September 2014; accepted 5 December 2014
Available online 20 January 2015

**KEYWORDS**
Benign prostatic hyperplasia;
Cardiovascular system;
Doppler ultrasonography;
Metabolic X syndrome;
Regional blood flows

**Abstract** We evaluated the relationship between prostatic resistive index (RI) and cardiovascular system (CVS) risk factors in patients with benign prostatic hyperplasia. The study included 120 patients who were attending our outpatient clinic with lower urinary tract symptoms related to benign prostatic hyperplasia. The clinical, laboratory, anthropometric data, and CVS risk factors (hypertension, diabetes mellitus, metabolic syndrome, history of CVS events, and smoking) of the patients were evaluated regarding the association between prostate RI level by regression analyses. The prostatic RI levels of the patients were measured using power Doppler imaging. In univariate regression analysis, there were statistically significant relationships between prostatic RI levels and the patients' age, International Prostate Symptom Score, hip circumference, fasting blood glucose, prostate specific antigen, triglycerides, high-density lipoprotein cholesterol, low-density lipoprotein cholesterol, total prostate volume, uroflowmetric maximal flow rate, and all investigated CVS risk factors ($p < 0.05$). The prostatic RI levels were found to be associated with fasting blood glucose and total prostate volume, and also with CVS risk factors including only metabolic syndrome and cigarette smoking in the multivariate regression analysis. Our results showed that prostatic RI level is significantly related to metabolic syndrome and smoking among the investigated CVS risk factors.


Conflicts of interest: All authors declare no conflicts of interest.

* Corresponding author. Numune Egitim ve Arastirma Hastanesi, Uroloji Klinigi, Ulku Mahallesi, Talatpasa Boulevard, Number 5, Ankara 06100, Turkey.
*E-mail address:* kaanaktas73@hotmail.com (B.K. Aktas).

http://dx.doi.org/10.1016/j.kjms.2014.12.008

## Introduction

Benign prostatic hyperplasia (BPH) is histologically defined as a nonmalignant, unregulated overgrowth of the prostate gland. Secondary to an enlarged prostate, BPH may be clinically associated with lower urinary tract symptoms (LUTS) [1]. LUTS in the aging man is primarily caused by BPH. Up to 90% of men in their 70s have some LUTS suggestive of BPH (LUTS/BPH), and their health-related quality of life is impaired because of these discomfiting symptoms [2]. LUTS/BPH may less commonly progress to serious morbidities including acute urinary retention, a need for surgery, urinary incontinence, or a recurrent urinary tract infection [3]. Age and genetics play important roles in the etiologies of BPH and LUTS. And, in addition to them, unhealthy diets, a sedentary lifestyle, inflammation, and some major cardiovascular system (CVS) risk factors including hypertension (HT), noninsulin-dependent diabetes mellitus (DM), obesity, smoking, dyslipidemia, and metabolic syndrome (MetS) were reported to be novel modifiable risk factors in the development of BPH in recent studies [4–8].

Transrectal ultrasonography is one of the classical methods used in the evaluation of BPH patients. The use of transrectal probes in color and power Doppler imaging (PDI) gives detailed information about intraprostatic vascularity [9]. It has been reported that the development of LUTS/BPH causes an increase in both vascular resistance and prostatic resistive index (RI), and prostatic RI is correlated with the symptom score and urine flow rate in LUTS/BPH patients [10,11]. In this study, with an attempt to provide etiologic information and find new preventions, we evaluated the relationship between the prostatic RI levels and CVS risk factors in patients with LUTS/BPH.

## Methods

### Patients

A total of 120 consecutive BPH patients aged 50 years or older and exhibiting LUTS at our urology outpatient clinic in a tertiary care teaching hospital between January 2013 and March 2014 were prospectively included in this study. Patients with a history of prostatic malignancy, prostatic surgery, bladder neck or urethral stricture, and previous LUTS therapy, and those with neurologic diseases affecting the lower urinary tract were not included in the study. The patients were fully informed about the study design, and informed consent was obtained from all participating patients.

Initially, a detailed medical history was taken from each patient. CVS risk factors including smoking status, presence of DM, HT, or a history of CVS events (coronary heart disease or myocardial infarction) were recorded. The urologic evaluation included a digital rectal examination, International Prostatic Symptom Score (IPSS), urinalysis, maximum flow rate ($Q_{max}$) on uroflowmetry, and postvoid residual urine volume. Anthropometric measurements including weight, height, hip circumference (HC), and waist circumference (WC) were taken for each patient by the same observer (S.T.), using the same methods and instruments for all the patients, and body mass index values were calculated by dividing weight in kilograms by height in meters squared. WC and HC were measured respectively by using a nonelastic constant tension tape at the midpoint of the lowest rib and iliac crest at the end of exhalation, and around the widest portion of the buttocks with the participant standing. Their blood pressure was measured using a Braun BP6200 Exactfit 5 Automatic Blood Pressure Monitor (Kaz Inc., Braun GmbH, Kronberg, Germany). The blood samples were drawn from the overnight-fasting participants, and the serum levels of fasting blood glucose (FBG), triglyceride (TG), high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C), and prostate-specific antigen (PSA) were recorded. The criteria proposed for the clinical diagnosis of MetS were provided by the report of the National Cholesterol Education Program's Third Adult Treatment Panel III, any three of the five following factors: abdominal obesity (WC $>$102 cm), HT (blood pressure $>$130/85 mmHg or taking antihypertensive medication), hyperglycemia (FBG $>$110 mg/dL), hypertriglyceridemia (serum TG $>$150 mg/dL), and reduced levels of HDL-C ($<$40 mg/dL) [12].

### Measurement of prostatic RIs

The prostatic RIs were measured by a radiologist (T.D.) using PDI. The ultrasound examination consisted of a transrectal ultrasonography and PDI using a GE Logiq E9 (General Electric Healthcare Systems, Chalfont St Giles, UK) with a 9-MHz endocavitary probe while the patient was lying on top of an examination table in a left lateral decubitus position. The patients were asked to empty their urinary bladder to prevent intraprostatic vasculature from the compression. The total prostate volume ($V_p$) and transitional zone volumes ($V_{tz}$) were calculated using the ellipsoid formula, and then recorded. The blood flow from the three capsular arteries on the largest transverse section of the prostate was measured, and then a spectral waveform analyses was performed. When the pulsatile waveforms of a given Doppler spectrum became stable, the RIs [(maximum velocity − minimum velocity)/maximum velocity] were measured from each of the three blood flow samples using the onboard software, and the mean value was calculated and then recorded.

### Statistical analysis

All statistical analyses were performed using SPSS, version 18 (SPSS Inc., Chicago, IL, USA). The descriptive statistics were presented as mean ± SD, and statistical analyses were performed using Pearson's correlation and linear regression tests. A $p$ value $<$ 0.05 was considered significant. Additionally, we conducted a *post hoc* power analysis with the G*Power 3.0.10 software program (Heinrich-Heine University, Düsseldorf, Germany) to identify the power achieved [13].

## Results

The mean values of patient characteristics are shown in Table 1. Of the total 120 patients, 60 (50.0%) were hypertensive, 49 (40.8%) were diabetic, 58 (48.3%) had MetS, 55