Is Type-2 Diabetes Mellitus Associated With Overactive Bladder Symptoms in Men With Lower Urinary Tract Symptoms?

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OBJECTIVE To elucidate the relationship between type-2 diabetes mellitus (DM) and overactive bladder symptoms in men with lower urinary tract symptoms (LUTS), after adjusting for the impact of age and prostate volume.

MATERIALS AND METHODS Data were obtained from a prospectively maintained database of 905 first-visit patients with LUTS and benign prostatic hyperplasia. After excluding those with comorbidities that may affect urinary symptom, we selected 139 patients with type-2 DM and 139 nondiabetic controls matched by propensity scoring for age and prostate volume.

RESULTS There were no differences in voided volume and maximal flow rate between the 2 groups, whereas residual urine volume was significantly higher in DM patients than controls (29.34 ± 26.99 mL vs 22.45 ± 23.25 mL; $P = .028$). The total International Prostatic Symptom Score was significantly higher in DM patients than controls (17.80 ± 7.60 vs 15.88 ± 7.05; $P = .031$). Storage (7.45 ± 3.21 vs 6.58 ± 3.11; $P = .024$) and postmicturition (2.57 ± 1.49 vs 2.19 ± 1.59; $P = .045$) symptom scores were higher in DM patients than controls, whereas the groups had similar voiding symptom scores ($P = .104$). Among storage symptoms, DM patients had higher frequency ($P = .010$) and nocturia ($P = .003$) scores but similar urgency scores. The Overactive Bladder Symptom Score was also significantly higher in DM patients; this difference was due to a higher nocturia (but not urgency) score.

CONCLUSION DM patients with LUTS and benign prostatic hyperplasia had greater storage and postmicturition symptoms than age and prostate volume—matched controls. The disparity in storage symptoms was mainly because of frequency and nocturia rather than urgency. UROLOGY 84: 670–674, 2014. © 2014 Elsevier Inc.

Type-2 diabetes mellitus (DM) and lower urinary tract symptoms (LUTS) suggestive of benign prostatic hyperplasia (BPH) are common disorders in elderly men. It is well known that DM can affect urinary function.[1-3] Voiding dysfunction has been estimated to occur in as many as 45% of patients with DM.[4]

In a recent cross-sectional evaluation of 2 population-based cohorts, Sarma et al[5] observed that after adjusting for age, men with diabetes were 1.42 times more likely to report moderate to severe LUTS than their nondiabetic counterparts. Michel et al[1] found that men with BPH and DM had a significantly lower maximum urinary flow rate than men without DM.

Classically, diabetic cystopathy is characterized by impaired bladder sensation, increased bladder capacity, and decreased detrusor contractility.[6,7] Additionally, several studies have shown that prostatic growth is associated with DM, as a component of the metabolic syndrome.[8,9] Accordingly, DM can produce LUTS as a consequence of bladder dysfunction, prostatic enlargement, or both.

Several recent studies have shown that DM may cause overactive bladder (OAB) symptoms,[10,11] and Daneshgari et al[12] suggested that early-stage bladder dysfunction

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associated with DM is characterized by an overactive and compensated bladder in an experimental study, whereas late-stage DM-related dysfunction is characterized by an acontractile and decompensated bladder. However, controversy remains whether DM actually causes detrusor overactivity.[13,14]

In the present study, we evaluated the impact of type-2 DM on LUTS in elderly men. As aging and bladder outlet obstruction due to BPH are known to be important causal factors of OAB in elderly men, we used propensity score matching to more clearly elucidate the relationship between DM and LUTS, after adjusting for age and prostate volume.

MATERIALS AND METHODS

Patient Cohort

This is a retrospective analysis of a prospectively maintained database for first-visit men with LUTS between April 2010 and June 2012. During this period, 905 patients were registered in the database. A detailed medical history was obtained for each, and patients with the following comorbidities were excluded: type-1 DM, prostate or bladder carcinoma, history of lower urinary tract surgery, or any evidence of urinary tract infection and neurologic disease that could affect voiding function. Of the remaining patients, 139 with type-2 DM were selected (designated as the diabetic group). To adjust for the effects of patient age and prostate volume, we used propensity score matching for age and prostate volume to select 139 patients without DM for the control group.

International Prostate Symptom Score (IPSS), quality of life, and Overactive Bladder Symptom Score (OABSS) questionnaires were completed by all patients.[15] Transrectal ultrasonography (ProSound Alpha 5 SV, Hitachi-Aloka Medical, Ltd., Tokyo, Japan) was performed, and prostate volume was determined from length, height, and width measurements of the total prostate, using the ellipsoid formula (length × width × height × 0.52) for the transverse and axial sections. Uroflowmetric measurements were performed in the standing position using Bluetooth uroflowmetry (Urodyn+, Mediwatch UK, Ltd., Ruby, United Kingdom). Maximal flow measurements when voided volume was <125 mL were discarded, and uroflowmetric measurements were repeated. Postvoid residual urine volume was measured using a bladder scanner (BioCon-500, MCube Technology Co., Ltd., Seoul, Korea).

Good Clinical Practice Protocols

The study was performed in accordance with applicable laws and regulations, good clinical practices, and ethical principles as described in the Declaration of Helsinki. Our institutional review board approved this study protocol (approval number: 4-2013-0466).

Statistical Analyses

The data are presented as mean ± standard deviation, except where otherwise indicated. Propensity score matching was performed to elucidate the characteristics of urinary symptoms in DM patients. Propensity scores were used to match patients based on the range of each characteristic. Propensity scores were calculated for each patient using a multivariate logistic regression model based on the following covariates: age and prostate volume. The control group was selected in a 1:1 ratio with respect to the diabetic group. All statistical analyses were performed using R statistical software (R, version 3.0.2, R Foundation for Statistical Computing, Vienna, Austria; http://www.r-project.org) and its MatchIt package for propensity score matching. Variables in the 2 groups were compared using the Student or Welch 2-sample *t* test and the chi square test. A *P* value <.05 was considered statistically significant, and all statistical tests were 2-sided.

Table 1. Patient characteristics

Characteristic	Mean ± Standard Deviation
Number of patients	278
Age (y)	65.33 ± 9.05
Prostate volume (mL)	35.11 ± 15.41
Transitional zone volume (mL)	17.29 ± 11.37
Prostate-specific antigen level (ng/mL)	2.03 ± 2.36
Voided volume (mL)	252.50 ± 147.79
Postvoid residual (mL)	25.85 ± 25.35
Peak urine flow rate (mL/s)	13.24 ± 6.58
IPSS	
Total score	16.83 ± 7.37
Voiding symptoms	7.50 ± 4.02
Storage symptoms	7.01 ± 3.18
Postmicturition symptoms	2.38 ± 1.55
Quality of life	3.76 ± 1.14
OABSS	
Total score	5.07 ± 3.27
Daytime frequency	0.56 ± 0.55
Nocturia	1.92 ± 0.94
Urgency	1.77 ± 1.56
Urge incontinence	0.82 ± 1.35

IPSS, International Prostate Symptom Score; OABSS, Overactive Bladder Symptom Score.

RESULTS

A total of 278 men were included in this study. Their mean age was 65.33 ± 9.05 years. The total IPSS and OABSS scores were 16.83 ± 7.37 and 5.07 ± 3.27, respectively. The total prostate volume was 35.11 ± 15.41 mL, maximum flow rate was 13.24 ± 6.58 mL/s, and residual urine volume was 25.85 ± 25.35 mL (Table 1). There were no differences in age, prostate volume, transitional zone volume, prostate-specific antigen level, voided volume, and maximum flow rate between the diabetic and control groups, whereas residual urine volume was significantly higher in the diabetic group than in the control group (29.34 ± 26.99 mL vs 22.45 ± 23.25 mL; *P* = .028; Table 2).

The total IPSS was significantly higher in the diabetic group than in the control group (17.80 ± 7.60 vs 15.88 ± 7.05; *P* = .031). For the IPSS subscores, the diabetic group exhibited a higher storage symptom score (7.45 ± 3.21 vs 6.58 ± 3.11; *P* = .024) and postmicturition symptom score (2.57 ± 1.49 vs 2.19 ± 1.59; *P* = .045) than the control group. However, the voiding symptom score did not differ between the 2 groups (*P* = .104). Among the storage symptoms, the diabetic group had a significantly higher frequency score (*P* = .010) and