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Original Article

Prostate volume and prostate-specific antigen in men with Parkinson's disease are not different compared to age-matched control group: A prospective, case-controlled multicenter study

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ABSTRACT

Purpose: Patients with Parkinson's disease (PD) suffer from gait disturbance as well as lower urinary tract symptoms (LUTS). There have been no reports that evaluated the prostate volume (PV) and prostate-specific antigen (PSA) of patients with PD. In this study, we prospectively evaluated PV and PSA in men with PD.

Methods: From May 2009 to January 2012, 60 PD patients and 60 age-matched non-PD patients with LUTS enrolled at three centers in Korea. All participants (PD as well as non-PD patients) had LUTS at presentation. We measured the PV using a transrectal ultrasonography and checked the serum PSA level in patients with PD and their non-PD counterparts, who served as the age-matched control group, and then compared the data of both groups. Patients with abnormal digital rectal examination results and/or serum PSA levels >4.0 ng/mL underwent prostate biopsy.

Results: The mean patient age was 71.37 ± 7.36 years and 70.85 ± 6.31 years for PD and non-PD patients ($P = 0.651$), respectively. There were no significant statistical differences between the two groups in terms of total PV (28.56 ± 14.59 in PD vs. 29.21 ± 10.41 in non-PD, $P = 0.727$), transition zone PV (12.72 ± 8.76 vs. 12.73 ± 6.68, $P = 0.993$), and total serum PSA (1.88 ± 2.80 vs. 2.01 ± 2.02, $P = 0.759$). In the PD group, seven patients had PSA levels >4.0 ng/mL (range, 4.12–11.18 ng/mL). Among these patients, prostate cancer (PC) was detected in two patients. In the non-PD group, PSA levels >4.0 ng/mL were detected in nine patients (range, 4.16–8.28 ng/mL). Among these patients, PC was detected in three patients. The PC occurrence rate was similar in both groups.

Conclusions: Our data show that a neurologic lesion causing PD does not affect PV and PSA. As both groups have a similar PC occurrence rate, it is clear that prostate evaluation is necessary for PD as well as non-PD patients.

1. Introduction

Parkinson's disease (PD) is a movement disorder associated with loss of dopaminergic neurons in the substantia nigra pars compacta (SNC) and the development of Lewy bodies.[1] The most striking finding of bladder dysfunction in PD patients is neurogenic detrusor overactivity.[2–4] This can be easily explained because dopaminergic mechanisms are thought to play a central role in normal micturition control, and dysfunction of these may lead to detrusor overactivity.[5]

A study showed that aging has a correlation with the growth of the prostate, which is also closely linked to serum prostate-specific antigen (PSA) levels.[6,7] Although it is not clearly explicated how to regulate the development of prostate, neural pathways as well as

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hormonal influences can be considered a key factor to explain the growth of the prostate gland.[8]

It has been revealed through animal experiments that the autonomic nervous system is highly influential on the growth and function of the prostate. According to the study of Zermann et al.,[9] central neurons play an important role in the control of the prostate gland. However, the effects of central nervous system injuries as PD on prostatic growth and function are less well examined.

As the population is aging, the burden of neurological disorders is increasing but access to care is limited. In particular, a considerable number of patients with PD suffer from gait disturbance as well as lower urinary tract symptoms (LUTS). There are no reports that have evaluated the prostate activity of patients with PD. Therefore, we prospectively evaluated the prostate volume (PV) and PSA level in men with PD.

2. Methods

2.1. Patients

From May 2009 to January 2012, 60 PD patients and 60 age-matched non-PD patients were enrolled at three centers in Korea (Chonbuk National University, Jeonju, South Korea; Wonkwang University Hospital, Iksan, South Korea; and Presbyterian Medical Center, Jeonju, South Korea). All of the enrolled patients visited the urology department of these institutions to undergo prostate evaluation for the relevant LUTS. Patients were excluded from the analysis if they had a history of, or had undergone treatment for, acute or chronic prostatitis in the past 3 months; had received a diagnosis of prostate cancer (PC); had undergone prostate surgery or radiation treatment; had received 5α-reductase inhibitors; or had signs or symptoms compatible with a current urinary infection.

2.2. Methods

All patients underwent a general and urological standard evaluation, including a digital rectal examination (DRE), transrectal ultrasound (TRUS) evaluation of prostate size, and a test of PSA level. In PD patients, age, cause of PD, and duration were recorded. Blood samples were obtained before the patients were examined by a physician.

In this procedure, an experienced urologist performed TRUS and DRE. A 7.0-MHz transducer (TRUS; B&K Medical, Herlev, Denmark) was used for scanning. Total PV and transition zone (TZ) PV were measured. Patients with abnormal DRE results and/or serum PSA levels >4.0 ng/mL underwent prostate biopsy.

2.3. Statistical analysis

Comparisons of data for serum PSA levels and PV parameters were made using the *t* test. Serum PSA levels and PV parameters were correlated with age and duration of PD using the Spearman correlation coefficient. The statistical software package SPSS 15.0 (SPSS Inc., Chicago, IL, USA) was used for all statistical analyses. A *P* value <0.05 was considered significant.

3. Results

A total of 120 patients were enrolled. Table 1 illustrates the characteristics of the PD patients. The mean time between PD and examination was 5.86 years (Table 1). The mean serum PSA level and total PV increased with age in PD patients as well as in the control group (Table 2). The mean age of patients was 71.37 ± 7.36 years for the PD group and 70.85 ± 6.31 years in for the non-PD group ($P = 0.651$). There were no significant statistical differences between two groups in terms of total PV (28.56 ± 14.59 in PD patients vs. 29.21 ± 10.41 in non-PD patients, $P = 0.727$), TZ PV (12.72 ± 8.76 vs. 12.73 ± 6.68, $P = 0.993$), and total serum PSA (1.88 ± 2.80 vs. 2.01 ± 2.02, $P = 0.759$; Table 3). Age at the time of the study enrollment was correlated with serum PSA level and PV parameters in both groups, but disease duration in the PD group did not correlate with serum PSA level and PV parameters (Table 4). In the PD group, PSA levels >4.0 ng/mL was detected in seven patients (range, 4.12–11.18 ng/mL). Among these patients, PC was detected in two patients by prostate biopsy, with PSA levels of 5.51 ng/mL and 11.18 ng/mL. In the non-PD group, PSA levels >4.0 ng/mL were detected in nine patients (range, 4.16–8.28 ng/mL). Among these patients, PC was detected in three patients by prostate biopsy, with PSA levels of 4.16 ng/mL, 6.01 ng/mL, and 8.28 ng/mL. The PC occurrence rate was similar in both groups.

Table 1
Characteristics of PD patients.

Age group (y)	Mean age (y)	PD patients (*n*)	Time since PD (y)
51–60	56.39 ± 2.53	5	4.86 ± 2.16
61–70	67.85 ± 1.78	23	6.75 ± 3.95
71–80	74.94 ± 2.53	28	5.27 ± 3.14
>80	85.28 ± 5.21	4	6.16 ± 4.23
All	71.37 ± 7.36	60	5.86 ± 5.58

PD, Parkinson's disease.

4. Discussion

There is increasing recognition that the nonmotor symptoms of PD are the most troublesome as the disease advances, and prominent among these are LUTS.[10,11] http://www.sciencedirect.com/science/article/pii/S0022534709000718 LUTS have a great impact on quality of life, early institutionalization, and health economics. http://www.sciencedirect.com/science/article/pii/S0022534709000718 In patients with PD, the most prevalent LUTS is nocturia and the most common urodynamic finding is detrusor overactivity, usually with complete bladder emptying. In PD, widespread degeneration of dopaminergic and nondopaminergic areas involved in lower urinary tract function is prominent, including locus coeruleus, cerebellar Purkinje cells, dorsal motor nucleus of the vagus, intermediolateral cell column (preganglionic neurons innervating the internal sphincter and the bladder), and Onuf's nucleus (neurons innervating the external sphincter).[12] http://www.sciencedirect.com/science/article/pii/S0022534709000718 In PD, neurodegeneration in the nigrostriatal dopamine system removes the tonic inhibitory control over the pontine micturition center, resulting in decreased bladder capacity and detrusor overactivity. http://www.sciencedirect.com/science/article/pii/S0022534709000718 Neurogenic detrusor overactivity in PD is easily explained, because dopaminergic mechanisms are thought to play a central role in normal micturition control and dysfunction of these may lead to detrusor overactivity. Dopaminergic neurons have both inhibitory and stimulatory effects on micturition acting via D1 and D2 receptors, respectively. Such neurons are of particular abundance in the SNC and the ventral tegmental area of the midbrain.[13] The most widely accepted theory is that the basal ganglia inhibit the micturition reflex in the "normal" situation via D1 receptors, and that cell depletion in the SNC in PD results in the loss of this D1-mediated inhibition and, consequently, detrusor overactivity. http://www.sciencedirect.com/science/article/pii/S0022534709000718 Although impaired relaxation or bradykinesia of the urethral sphincter has been suggested to result in voiding dysfunction, http://www.sciencedirect.

Table 2
Serum PSA values and total PV of PD patients and age-matched control group.

Age group (y)	PD patients (*n*)	Serum PSA (ng/mL)	Total PV (mL)	Control group (*n*)	Serum PSA (ng/mL)	Total PV (mL)
51–60	5	0.48 ± 0.70	23.32 ± 9.13	3	0.51 ± 0.67	21.41 ± 11.23
61–70	23	1.35 ± 1.22	25.35 ± 7.25	26	1.54 ± 0.96	23.48 ± 7.55
71–80	28	2.45 ± 1.98	31.27 ± 10.31	27	2.53 ± 1.05	34.40 ± 11.24
>80	4	2.48 ± 2.26	34.56 ± 12.23	4	2.65 ± 1.17	37.21 ± 11.45

PD, Parkinson's disease; PSA, prostate-specific antigen; PV, prostate volume.

Table 3
Comparison of PV and PSA in PD patients and control group.

	PD patients	Control group	*P*
No.	60	60	
Age (y)	71.37 ± 7.36	70.85 ± 6.31	0.651
Total PV (mL)	28.56 ± 14.59	29.21 ± 10.41	0.727
TZ PV (mL)	12.72 ± 8.76	12.73 ± 6.68	0.993
Serum PSA (ng/mL)	1.88 ± 2.80	2.01 ± 2.02	0.759

PD, Parkinson's disease; PV, prostate volume; PSA, prostate-specific antigen; TZ, transition zone.

Table 4
Correlation of age, duration of PD and PV, PSA in PD patients.[a)]

	Age (y)	Duration of PD (mo)
Total PV (mL)	0.031	0.057
TZ PV (mL)	0.165	0.153
Serum PSA (ng/mL)	0.028	0.039

PD, Parkinson's disease; PSA, prostate-specific antigen; PV, prostate volume; TZ, transition zone.
[a)] All correlation coefficients were not statistically significant.

com/science/article/pii/S0022534709000718 urodynamic studies have shown that bladder outlet obstruction is not common in PD.[14] http://www.sciencedirect.com/science/article/pii/S0022534709000718.

Nevertheless, voiding symptoms in male patients with PD may be caused by coincident benign prostate enlargement. In our study, there are no differences in the PV parameters and serum PSA level in PD patients compared with those of non-PD patients (the control group). Considering the correlation between the function of prostate and autonomic nerves, it can be assumed that patients with spinal cord injury, whose innervation of the prostate has been impaired, may have a difference in the size of prostate and the level of PSA compared to healthy men.[8,15,16] However, our data show that a neurologic lesion causing PD does not affect PV and PSA as spinal cord injury. PC was detected in two patients in the PD group and in three patients in the non-PD group. The PC occurrence rate was similar in both groups. Base on our data, neurologic lesion causing PD does not affect PC occurrence.

In our study, patients with PD have the usual PV and PSA as non-PD patients. Moreover, the PC occurrence rate was similar in both groups. In conclusion, prostate evaluation is necessary in men with PD as well as in non-PD patients.

Conflicts of interest

No potential conflict of interest relevant to this article was reported.

References

1. Clarke C. *Parkinson's Disease in Practice*. 2nd ed. London: Royal Society of Medicine Press Ltd; 2006.
2. Araki I, Kitahara M, Oida T, Kuno S. Voiding dysfunction and Parkinson's disease: urodynamic abnormalities and urinary symptoms. J Urol 2000;164:1640–1643.
3. Blackett H, Walker R, Wood B. Urinary dysfunction in Parkinson's disease: a review. Parkinsonism Relat Disord 2009;15:81–87.
4. McVary KT, McKenna KE, Lee C. Prostate innervation. Prostate 1998;8:2–13.
5. Seki S, Igawa Y, Kaidoh K, et al. Role of dopamine D1 and D2 receptors in the micturition reflex in conscious rats. Neurourol Urodyn 2001;20:105–113.
6. Berry SJ, Coffey DS, Walsh PC, Ewing LL. The development of human benign prostatic hyperplasia with age. J Urol 1984;132:474–479.
7. Stenman UH. Prostate-specific antigen, clinical use and staging: an overview. Br J Urol 1997;79:53–60.
8. Pannek J, Berges RR, Cubick G, Meindl R, Senge T. Prostate size and PSA serum levels in male patients with spinal cord injury. Urology 2003;62:845–848.
9. Zermann DH, Ishigooka M, Doggweiler R, Schubert J, Schmidt RA. Central nervous system neurons labeled following the injection of pseudorabies virus into the rat prostate gland. Prostate 2000;44:240–247.
10. Chaudhuri KR, Healy DG, Schapira AH. Non-motor symptoms of Parkinson's disease: diagnosis and management. Lancet Neurol 2006;5:235–245.
11. Sakakibara R, Shinotoh H, Uchiyama T, et al. Questionnaire based assessment of pelvic organ dysfunction in Parkinson's disease. Auton Neurosci 2001;92:76–85.
12. Wenning GK, Geser F, Stampfer-Kountchev M, Tison F. Multiple system atrophy: an update. Mov Disord 2003;18:34–42.
13. Fowler CJ, Griffiths D, de Groat WC. The neural control of micturition. Nat Rev Neurosci 2008;9:453–466.
14. Christmas TJ, Kempster PA, Chapple CR, et al. Role of subcutaneous apomorphine in parkinsonian voiding dysfunction. Lancet 1988;2:1451–1453.
15. Shim HB, Jung TY, Lee JK, Ku JH. Prostate activity and prostate cancer in spinal cord injury. Prostate Cancer Prostatic Dis 2006;9:115–120.
16. Shim HB, Kim YD, Jung TY, Lee JK, Ku JH. Prostate-specific antigen and prostate volume in Korean men with spinal cord injury: a case-control study. Spinal Cord 2008;46:11–15.