

Is there a difference between Parkinson disease patients and a control group in terms of urinary symptoms and quality of life?

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Background/aim: The aim of this study is to research whether urinary symptoms and disruption of quality of life observed in Parkinson disease patients are different than those of their healthy peers. Additionally, whether these complaints were affected by characteristics such as age at onset of Parkinson disease, sex, disease duration, and severity was investigated.

Materials and methods: This study comprised a total of 79 individuals, 39 Parkinson patients and a control group of 40 individuals. Parkinson diagnosis was provided by a neurology expert according to the UK Parkinson's Disease Society Brain Bank Criteria. All patients were evaluated by a urologist with the International Prostate Symptom Score (IPSS) and an overactive bladder (OAB) questionnaire.

Results: Compared with the control group, the Parkinson patient group had statistically significantly higher rates of urological complaints ($P < 0.001$), irritative symptoms ($P < 0.001$), voiding symptoms ($P < 0.001$), OAB score ($P < 0.001$), IPSS total score ($P = 0.007$), and treatment requirements ($P < 0.001$).

Conclusion: Urologic complaints were observed more frequently in the Parkinson patient group compared to the control group. Another important result of this study is that in the Parkinson patient group there was no difference found between urologic complaints in terms of sex.

Key words: Parkinson disease, bladder dysfunction, lower urinary tract symptoms

1. Introduction

Parkinson disease (PD) is a chronic progressive disease (1). Parkinson patients frequently have nonmotor disorders such as constipation, sexual dysfunction, and lower urinary tract symptoms, in addition to motor disorders (2). Nonmotor disorders frequently observed in PD patients include bladder dysfunctions like urgency and frequent urination (3). The brain pathology causing bladder dysfunction includes dopamine changes in the basal ganglia-frontal circuit that normally suppresses the urination reflex (1). Animal studies have shown a correlation between dopaminergic degeneration in the brain and overactive bladder (4).

The incidence of urinary complaints observed with PD is reported as 93% (1,5). Among the most commonly reported complaints are irritative bladder symptoms like urgency, leaking, and frequent urination. Bladder dysfunction increases related to the severity of PD (5). Some studies have not found this correlation (1). Though

PD patients generally respond very well to dopaminergic medications, urological complaints generally do not respond to medication treatment (6). Anticholinergic medications frequently used for urinary complaints may disrupt cognitive functions in older patients and it should be remembered that they may cause serious results (7).

The aim of this study is to investigate whether there is a difference between urinary complaints observed with PD and disruption of quality of life caused by these complaints in patients and healthy individuals. An additional aim was to identify whether urinary complaints observed with PD are affected by characteristics like sex, age, disease duration, and severity.

2. Materials and methods

This study was completed at the Ordu University Hospital with cooperation between the urology and neurology clinics. This study included 39 patients applying to the neurology clinic between January 2013 and June 2014 with

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a diagnosis of PD and a control group of 40 people (chosen from patients' relatives) for a total of 79 individuals. Patients who could complete the survey forms themselves, or with the help of family, were included in the study.

PD diagnosis was provided by a neurology expert based on the UK Parkinson's Disease Society Brain Bank Criteria. The severity of disease was identified using the Unified Parkinson's Disease Rating Scale (UPDRS) and Hoehn and Yahr scale (H & Y) (8,9). The study received local ethics committee permission (number 2014/4). Urological evaluation of individuals in the study, including history, physical examination, and urine and blood tests, was completed in the urology clinic. Urological complaints were determined using the International Prostate Symptom Score (IPSS) and overactive bladder (OAB) questionnaire forms (10).

The IPSS questionnaire form comprises 7 questions about urological complaints and one question about quality of life. For each question, the patient is given a score between 0 and 5 points and these scores are added to obtain a total score. The total score varies from 0 to 35. According to the total score, urinary complaints are classified as mild (0–7), moderate (8–19), and severe (20–

35). Quality of life (QoL) is evaluated by the last question and severity of disruption of QoL is determined according to points from 0 to 5 (no disruption to severe) (11).

3. Results

3.1. Sex difference and age

In the patient group 29 (74.4%) were male and 10 (25.6%) female, while in the control group 27 (67.5%) were male and 13 (32.5%) female. In the patient group, there were no differences identified between the sexes in terms of irritative ($P = 0.095$) and voiding ($P = 0.94$) complaints, incontinence ($P = 0.45$), urgency ($P = 0.21$), nocturia ($P = 0.95$), and treatment requirements due to urological complaints ($P = 0.75$) (Table 1).

The comparison of female and male patients in the PD group is shown in Table 2. The mean age of PD patients was 69.7 ± 7.4 years, and the mean age was 67.9 ± 7.7 years in the control group. In terms of age and sex, there was no statistical difference identified between the PD and control group ($P = 0.284$ and $P = 0.777$, respectively). There were higher rates of urologic symptoms, irritative (storage) complaints, voiding complaints, overactive bladder score,

Table 1. Comparison of LUTS between female patients and male patients with PD.

	Males (n = 29)	Females (n = 10)	P-value
Age (years), mean \pm SD	68.90 \pm 7.451	72.40 \pm 7.027	0.10
Age at onset of disease, years	63.83 \pm 8.477	66.30 \pm 7.973	0.22
Duration of PD, years	5.10 \pm 3.735	6.10 \pm 2.885	0.29
Mean levodopa dosage (mg/day)	422.4 \pm 252.1	657.5 \pm 371.3	0.05
Stage of disease			
1 (H & Y stage), n (%)	10 (34.4)	3 (30)	
2 (H & Y stage), n (%)	10 (34.4)	4 (40)	0.36
3 (H & Y stage), n (%)	9 (31.2)	2 (20)	
4 (H & Y stage), n (%)	0 (0)	1 (10)	
UPDRS			
UPDRS total	23.5 \pm 14.8	23.8 \pm 9.7	0.58
UPDRS cognitive	1.72 \pm 1.16	2.7 \pm 1.33	0.04
UPDRS motor sections	17.6 \pm 15.08	15 \pm 6.81	0.93
UPDRS activities of daily living	7.37 \pm 7.83	6.5 \pm 2.59	0.36
Urologic symptoms, n (%)			
Irritative symptoms, n (%)	20 (68)	7 (70)	0.95
Voiding, n (%)	17 (58.6)	6 (60)	0.94
Nocturia, n (%)	20 (68.9)	7 (70)	0.95
Treatment needs, n (%)	19 (65.5)	6 (60)	0.75
IPSS total	9.9 \pm 6.108	8.80 \pm 6.143	0.53
QoL	2.34 \pm 1.58	2.1 \pm 1.59	0.76

Table 2. Comparison of LUTS between Parkinson patients and control group.

LUTS	PD (n = 39)	Controls (n = 40)	P-value
Age, years			
Sex, n (%)	69.79 ± 7.4	67.95 ± 7.7	0.284
Female	10 (25.6)	13 (32.5)	0.777
Male	29 (74.4)	27 (67.5)	0.777
Urologic symptoms, n (%)	27 (69.2)	3 (7.5)	<0.001
Irritative symptoms, n (%)	23 (59)	1 (2.5)	<0.001
Voiding symptoms, n (%)	11 (28.2)	2 (5)	0.005
Overactive bladder, n (%)	20 (51.3)	2 (5)	<0.001
Urge incontinence, n (%)	16 (41)	3 (7.5)	<0.001
Incontinence, n (%)	7 (17.9)	0 (0)	0.005
Nocturia, n (%)	27 (69.2)	25 (62.5)	0.450
Treatment needs, n (%)	25 (64.1)	4 (10)	<0.001
IPSS total	9.62 ± 6.05	5.18 ± 3.61	0.007
QoL	2.28 ± 1.57	1.05 ± 1.19	0.014

urge incontinence, incontinence, and treatment needs among PD patients compared to controls (Table 2).

3.2. Comparison of PD and control groups

When total IPSS scores and QoL scores were compared between the groups, they were significantly higher in the PD patient group compared to the control group ($P = 0.007$ and $P = 0.014$, respectively). When IPSS subscores were examined, the scores for question 2 (feeling of need to urinate within 2 h of urination) ($P = 0.03$) and question 4 (urgency) ($P = 0.08$) were observed to be significantly higher in the PD group. In terms of other IPSS questions, there were no differences observed ($P > 0.05$). In the PD patient group, irritative symptoms ($P < 0.001$), voiding symptoms ($P = 0.005$), OAB score ($P < 0.001$), urgency ($P < 0.001$), leaking ($P = 0.005$), and treatment requirements due to urological complaints ($P < 0.001$) were found to be significantly high compared to the control group.

3.3. Duration and severity

The duration of PD varied from 1 year to 15 years, with a mean of 5.36 ± 3.52 years and median of 3 years. No association between the duration of disease and total IPSS score ($r = 0.072$; $P = 0.663$), QoL ($r = -0.090$; $P = 0.586$), irritative symptoms ($r = 0.189$; $P = 0.250$), and voiding symptoms ($r = 0.091$; $P = 0.580$) was observed. The UPDRS total scores varied from 8 to 60 with a mean of 25.58 ± 113.58 . There was no correlation found between total UPDRS points and total IPSS score ($r = 0.101$; $P = 0.539$), QoL ($r = 0.078$; $P = 0.528$), and irritative symptoms ($r = 0.269$; $P = 0.098$). There was no correlation between total IPSS score ($r = 0.008$; $P = 0.963$), QoL ($r = -0.194$; $P = 0.236$), and irritative symptoms ($r = 0.002$; $P = 0.990$) and UPDRS motor points. There was no correlation found

between UPDRS cognitive score and total IPSS score ($r = 0.073$; $P = 0.658$) and QoL ($r = 0.226$; $P = 0.167$); however there was a correlation found with irritative symptoms ($r = 0.447$; $P = 0.004$) (Table 3).

3.4. Age at onset of disease

The age at onset of PD varied from 44 to 78 years and the mean age at onset of PD was identified as 64.46 ± 8.31 years. There was no correlation found between disease onset age and total IPSS score ($r = 0.121$; $P = 0.464$), QoL ($r = 0.185$; $P = 0.260$), irritative symptoms ($r = 0.130$; $P = 0.431$), and voiding symptoms ($r = -0.116$; $P = 0.923$) (Table 4).

3.5. Disease stage (H & Y stage)

The distribution of PD patients according to stage is as follows: 13 patients (33.3%) in stage 1, 14 (35.9%) in stage 2, 11 (28.2%) in stage 3, and 1 (2.6%) in stage 4. The majority of patients were in the early stages of the disease. There was no correlation found between disease stage and total IPSS score ($r = 0.187$; $P = 0.253$), QoL score ($r = 0.078$; $P = 0.637$), and irritative symptoms ($r = 0.363$; $P = 0.023$).

4. Discussion

In our study lower urinary system symptoms (LUTS) were identified more frequently in the PD patient group compared to the control group. The IPSS total and QoL scores showing severity of urological complaints were observed to be higher in the PD group. The most common urinary complaints in the PD group were irritative bladder symptoms and these were identified significantly more frequently compared to the control group. There was a positive correlation identified between stage and severity of PD and overactive bladder complaints.

Table 3. Demographics and PD characteristic features of the patients.

	PD (n = 39)
Mean age, years (min–max)	69.79 ± 7.41 (53–82)
Sex, n (%) male	29 (4.4)
female	10 (25.6)
Age at onset of disease, years (min–max)	64.46 ± 8.31 (44–78)
Duration of PD, years (min–max)	5.36 ± 3.52 (1–15)
Stage of disease	
1 (H.Y.S.), n (%)	13 (33.3)
2 (H.Y.S.), n (%)	14 (35.9)
3 (H.Y.S.), n (%)	11 (28.2)
4 (H.Y.S.), n (%)	1 (2.6)
UPDRS (min–max)	
UPDRS total	23.58 ± 13.58 (8–60)
UPDRS cognitive	1.97 ± 1.26 (0–5)
UPDRS motor sections	16.97 ± 13.41 (3–78)
UPDRS activities of daily living	7.15 ± 6.85 (0–28)

UPDRS: Unified Parkinson’s Disease Rating Scale, H.Y.S: Hoehn and Yahr scale.

IPSS scores are important to see the severity, progression, and effect of treatment for urological complaints. A 3-point reduction in IPSS score shows that treatment is effective (11). The IPSS is mainly used to evaluate obstructive complaints. In our study it was used in both sexes to determine the effect of obstructive symptoms in neurological disease. In the PD patient group there was no difference identified between the sexes in terms of IPSS total scores (P = 0.605). Expected to increase linked to prostate disease in elderly male patients, voiding (obstructive) complaints were found to be similar in women. A study reported that this may be caused by bradykinetic external sphincter and somatic pelvic muscle dysfunction developing linked to neurological disease (12). Though this questionnaire is not validated for women, we

used a single form for both sexes. The definition of OAB includes complaints such as frequent urination, urgency, and/or leaking. To assess OAB an 8-question OAB questionnaire form was used. As OAB complaints may be common symptoms in many diseases, it is necessary to exclude causes such as underlying infection and bladder tumors (13).

Though the IPSS form is generally used to assess obstructive complaints caused by prostate hypertrophy in men, in PD patients there was no difference in total IPSS scores identified between the sexes. In a study comparing total irritative and obstructive common urinary scores between the sexes in PD by Campos-Sousa et al., they reported no differences between the sexes (14). Similarly, in our study, there were no differences identified between

Table 4. The correlation of nonmotor functions and clinical features in the Parkinson group.

(r / P)	IPSS _{total}	QoL	IEFF	Voiding symptoms	Irritative symptoms
Age	0.163 / 0.320	0.165 / 0.314	-0.249 / 0.184	-0.059 / 0.719	0.0232 / 0.155
Disease duration	0.072 / 0.663	-0.090 / 0.586	-0.034 / 0.859	0.091 / 0.580	0.189 / 0.250
Age at onset	0.121 / 0.464	0.185 / 0.260	-0.213 / 0.258	-0.016 / 0.923	0.130 / 0.431
H&Y stage	0.187 / 0.253	0.078 / 0.637	0.001 / 0.998	0.072 / 0.664	0.363 / 0.023
UPDRS total	0.101 / 0.539	0.104 / 0.528	0.044 / 0.816	0.180 / 0.272	0.269 / 0.098
UPDRS motor	0.008 / 0.963	-0.194 / 0.236	0.027 / 0.887	0.019 / 0.906	0.002 / 0.990
UPDRS cognitive	0.073 / 0.658	0.226 / 0.167	0.091 / 0.631	0.204 / 0.214	0.447 / 0.004
UPDRS activities of daily living	0.073 / 0.658	0.226 / 0.167	0.091 / 0.631	0.204 / 0.214	0.447 / 0.004

the sexes in PD patients in terms of irritative ($P = 0.95$) and voiding ($P = 0.94$) symptoms. Additionally, there was no difference identified between the sexes in terms of total IPSS scores and QoL scores ($P = 0.76$). The reason for this may be that our study excluded patients receiving medication treatment for prostate disease or who had undergone prostate surgery. Our results are in accordance with the results of many studies, including those by Araki et al. and Lemack et al. (14–16). The lack of differences identified between women and elderly men, who are expected to have more urological complaints linked to prostate growth, is reported to be due to the contribution of neurological changes occurring in PD to urinary complaints (17,18). In our study the effect of PD is clearly visible when compared with the control group ($P < 0.001$). As reported in the literature, this suggests a relationship between dopaminergic degeneration and LUTS (19). It is reported to be difficult to determine the degree of the effect of this damage on urological complaints (1).

Myers et al. reported a correlation between disease onset age and irritative complaints in PD patients (20). This result is supported by urodynamic studies showing irritative complaints completed by Araki et al. (21). However, there are studies reporting contradictory results, including one by Sammour et al. (22). That study reported that there was no relationship between voiding dysfunction and disease onset age ($P = 0.960$). Our results are in accordance with those of Sammour et al., showing no correlation between disease onset age and irritative and voiding complaints ($P > 0.05$).

In our study we did not find any correlation between age and urological symptoms in the PD group ($P > 0.05$). These results are in accordance with a study by Gray et al. that reported that urological complaints were related to age; however, age did not affect urological complaints (23).

In our study there was no correlation identified between disease duration and irritative and voiding symptoms. Our study results comply with the study by Compos-Sousa et al., who reported no relationship between disease duration and urinary symptoms (14). As reported by Diamond et al. the reason for there being no relationship between disease duration and urinary symptoms may be that each patient has a different age at onset (24).

The severity of disease was assessed using H & Y staging and UPDRS scales. Our findings show that as disease stage and progression increase, the severity and frequency of urologic complaints increase. Disease progression is related more to OAB symptoms like urgency and leaking. A study using urodynamic methods reported that urinary complaints increased with progression of PD, in accordance with the results of our study (16). Additionally, we identified a positive correlation between UPDRS cognitive and UPDRS daily life scores with irritative

complaints ($P = 0.004$). These results are in accordance with the results of studies by many researchers like Araki and Kuno and Sammour et al. (16,22). The researchers reported that severity of urinary complaints increased with disease progression. It was also reported that UPDRS score is associated with erection and lubrication (25).

Comparing the PD and control groups, urinary complaints were identified significantly more frequently in the PD patient group. The most frequently encountered urinary complaints in the PD patient group were OAB complaints like urgency, frequent urination, and leaking ($P < 0.001$). After irritative symptoms, the most frequently observed complaints in the PD group were voiding complaints and this rate was 59%, while in the control group this rate was 2.5% ($P < 0.001$). While the incidence of urological complaints in the PD group was 69.2%, this rate was 7.5% in the control group and these results are in accordance with rates reported in the literature (27%–75%) (13,15). The reason for such a broad interval of incidence rates in the literature may be due to patient selection criteria in urology and neurology clinics. Due to difficulty in understanding the questionnaire form, and due to the chronic nature of PD, patients are in close contact with doctors and may have had help from doctors in filling in the form (15,26). The IPSS total score and QoL in the PD group were negatively affected compared to the control group. These patients felt they required more treatment to resolve their urologic complaints ($P < 0.001$). Many studies comply with our results, reporting that urological complaints disrupt the QoL of patients (16,27). There was no difference identified between the groups in terms of nocturia (nighttime urination frequency > 1) ($P = 0.450$).

The reason for increased urological complaints in PD patients has been broadly examined in the literature and studies have reported the role of the dopaminergic system in neurogenic control of the bladder. Symptoms such as urgency, frequent urination, and nocturia, suggesting an OAB due to reduction in dopaminergic functions of the nigrostriatal area, are more commonly encountered in PD (28). Additionally, studies have reported that the severity of urinary dysfunction in PD is related to the scale of dopamine degeneration, stage of disease, and neurological deficit (29). A study by Winge et al. identified a correlation between urological complaints and reduction in total counts of dopaminergic neurons and caudate degeneration (30). The results of the study reported that reduced cortical stimulation from the basal ganglia is a significant cause of urinary symptoms in PD disease. The same study found the dopaminergic medications used for treatment had no effect on resolving or reducing urological complaints.

The limitations of our study are linked to the low number of patients. Another limitation is that advanced assessments such as uroflowmetry, urodynamics, and

cystoscopy were not performed for detailed evaluation of patient. Another deficient point of the study is that for patients requiring treatment results after treatment are not known.

In conclusion, in our study, urological complaints were observed more frequently in PD patients compared to the control group. The most commonly observed symptoms were irritative urination symptoms such as urgency and leaking, immediately followed by voiding symptoms. An interesting point of the study is that no difference was found

between women and men, though voiding complaints are expected to be more common in men due to prostate disease. The majority of PD patients believe that urological complaints are a result of the neurological disease and think they must live with it and do not share their complaints with doctors. As a result, PD patients should be routinely questioned about urological symptoms and necessary precautions should be taken. This is important both to improve the QoL of patients and to prevent serious problems that may develop in the future.

References

1. Sakakibara R, Tateno F, Nagao T, Yamamoto T, Uchiyama T, Yamanishi T, Yano M, Kishi M, Tsuyusaki Y, Aiba Y. Bladder function of patients with Parkinson's disease. *Int J Urol* 2014; 21: 638-646.
2. Sakakibara R, Uchiyama T, Yamanishi T, Shirai K, Hattori T. Bladder and bowel dysfunction in Parkinson's disease. *J Neural Transm* 2008; 115: 443-460.
3. Winge K, Skau AM, Stimpel H, Nielsen KK, Werdelin L. Prevalence of bladder dysfunction in Parkinson's disease. *NeuroUrol Urodyn* 2006; 25: 116-122.
4. Yoshimura N, Mizuta E, Kuno S, Sasa M, Yoshida O. The dopamine D1 receptor agonist SKF 38393 suppresses detrusor hyperreflexia in the monkey with parkinsonism induced by 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine (MPTP). *Neuropharmacology* 1993; 32: 315-321.
5. Winge K, Nielsen KK. Bladder dysfunction in advanced Parkinson's disease. *NeuroUrol Urodyn* 2012; 31: 1279-1283.
6. Uchiyama T, Sakakibara R, Hattori T, Yamanishi T. Short-term effect of a single levodopa dose on micturition disturbance in Parkinson's disease patients with the wearing-off phenomenon. *Mov Disord* 2003; 18: 573-578.
7. Sakakibara R, Tateno F, Kishi M, Tsuyuzaki Y, Uchiyama T, Yamamoto T. Pathophysiology of bladder dysfunction in Parkinson's disease. *Neurobiol Dis* 2012; 46: 565-571.
8. Fahn S, Elton RL. Unified Parkinson's Disease Rating Scale. In: Fahn S, Marsden CD, Goldstejn M, Calne DB, editors. *Recent Developments in Parkinson's Disease*. Florham Park, NJ, USA: Macmillan Healthcare Information; 1987. pp. 153-163.
9. Hoehn MM, Yahr MD. Parkinsonism: onset, progression and mortality. *Neurology* 1967; 17: 427-442.
10. McVary KT, Roehrborn CG, Avins AL, Barry MJ, Bruskewitz RC, Donnell RF, Foster HE Jr, Gonzalez CM, Kaplan SA, Penson DF et al. Update on AUA guideline on the management of benign prostatic hyperplasia. *J Urol* 2011; 185: 1793-1803.
11. Chapple CR, Roehrborn CG, McVary K, Ilo D, Hennekes C, Viktrup L. Effect of tadalafil on male lower urinary tract symptoms: an integrated analysis of storage and voiding international prostate symptom subscores from four randomised controlled trials. *Eur Urol* 2015; 67: 114-122.
12. Galloway NT. Urethral sphincter abnormalities in Parkinsonism. *Br J Urol* 1983; 55: 691-693.
13. Abrams P, Cardozo L, Fall M, Griffiths D, Rosier P, Ulmsten U, van Kerrebroeck P, Victor A, Wein A. The standardisation of terminology of lower urinary tract function: report from the Standardisation Sub-committee of the International Continence Society. *Am J Obstet Gynecol* 2002; 187: 116-126.
14. Campos-Sousa RN, Quagliato E, da Silva BB, de Carvalho RM Jr, Ribeiro SC, de Carvalho DF. Urinary symptoms in Parkinson's disease: prevalence and associated factors. *Arq Neuropsiquiatr* 2003; 61: 359-363.
15. Lemack GE, Dewey RB Jr, Roehrborn CG, O'Suilleabhain PE, Zimmern PE. Questionnaire-based assessment of bladder dysfunction in patients with mild to moderate Parkinson's disease. *Urology* 2000; 56: 250-254.
16. Araki I, Kuno S. Assessment of voiding dysfunction in Parkinson's disease by the international prostate symptom score. *J Neurol Neurosurg Psychiatry* 2000; 68: 429-433.
17. Reggio E, de Bessa J Jr, Junqueira RG, Timm O Jr, Sette MJ, Sansana V, Gomes CM. Correlation between lower urinary tract symptoms and erectile dysfunction in men presenting for prostate cancer screening. *Int J Impot Res* 2007; 19: 492-495.
18. Pavlakis AJ, Siroky MB, Goldstein I, Krane RJ. Neurourologic findings in Parkinson's disease. *J Urol* 1983; 129: 80-83.
19. Sakakibara R, Shinotoh H, Uchiyama T, Sakuma M, Kashiwado M, Yoshiyama M, Hattori T. Questionnaire-based assessment of pelvic organ dysfunction in Parkinson's disease. *Auton Neurosci* 2001; 92: 76-85.
20. Myers DL, Arya LA, Friedman JH. Is urinary incontinence different in women with Parkinson's disease? *Int Urogynecol J Pelvic Floor Dysfunct* 1999; 10: 188-191.
21. 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.
22. Sasmour ZM, Gomes CM, Barbosa ER, Lopes RI, Sallem FS, Trigo-Rocha FE, Bruschini H, Srougi M. Voiding dysfunction in patients with Parkinson's disease: impact of neurological impairment and clinical parameters. *NeuroUrol Urodyn* 2009; 28: 510-515.

23. Gray R, Stern G, Malone-Lee J. Lower urinary tract dysfunction in Parkinson's disease: changes relate to age and not disease. *Age Ageing* 1995; 24: 499-504.
24. Diamond SG, Markham CH, Hoehn MM, McDowell FH, Muentner MD. Effect of age at onset on progression and mortality in Parkinson's disease. *Neurology* 1989; 39: 1187-1190.
25. Ozcan T, Benli E, Demir EY, Ozer F, Kaya Y, Haytan CE. The relation of sexual dysfunction to depression and anxiety in patients with Parkinson's disease. *Acta Neuropsychiatr* 2015; 27: 33-37.
26. Benli E, Keleş İ, Ceylan C, Geçit İ, Ateş C. The level of the understandability of the IPSS form by the patients in different regions of Turkey. *Turkiye Klinikleri J Urology* 2012; 3: 36-40 (in Turkish with English abstract).
27. Winge K, Skau AM, Stimpel H, Nielsen KK, Werdelin L. Prevalence of bladder dysfunction in Parkinson's disease. *Neurourol Urodyn* 2006; 2: 116-122.
28. Abrams P, Cardozo L, Fall M, Griffiths D, Rosier P, Ulmsten U, Van Kerrebroeck P, Victor A, Wein A; Standardisation Sub-Committee of the International Continence Society. The standardisation of terminology in lower urinary tract function: report from the standardisation sub-committee of the International Continence Society. *Urology* 2003; 61: 37-49.
29. Iacovelli E, Gilio F, Meco G, Fattapposta F, Vanacore N, Brusa L, Giacomelli E, Gabriele M, Rubino A, Locuratolo N et al. Bladder symptoms assessed with overactive bladder questionnaire in Parkinson's disease. *Mov Disord* 2010; 25: 1203-1209.
30. Winge K, Friberg L, Werdelin L, Nielsen KK, Stimpel H. Relationship between nigrostriatal dopaminergic degeneration, urinary symptoms, and bladder control in Parkinson's disease. *Eur J Neurol* 2005; 12: 842-850.