Lower Urinary Tract Symptoms in Men With Parkinson Disease

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ABSTRACT

Purpose: The aim of this study was to examine the prevalence, presentation, and predictors of lower urinary tract symptoms (LUTS) in men with idiopathic Parkinson disease (PD). **Methods:** Guided by the Theory of Unpleasant Symptoms, this retrospective exploratory study used data abstracted from admission clinical records of 271 male patients with idiopathic PD enrolled in a movement disorders clinic at a large metropolitan Veterans Affairs Medical Center in the eastern region of the United States. Data from the admission questionnaire, Unified Parkinson's Disease Rating Scale, and Mini Mental State Examination were abstracted by trained research assistants. Interrater reliability for the abstraction process was 0.99 in a randomly selected 10% sample of records. Descriptive statistics were used to determine the prevalence of LUTS. Logistic regression was used to determine LUTS risk factors and predictors. **Results:** At least one LUTS was reported by 40.2% of participants. Incontinence was the most prevalent symptom, affecting almost 25% of participants, followed by nocturia (14.8%) and frequency (13.7%). Of the 10 identified risk factors for LUTS, four significant predictors were discovered: number of non-PD medications ($p < .05$), PD duration ($p < .05$), number of comorbidities ($p < .05$), and history of a hernia diagnosis ($p < .05$). **Conclusions:** Assessment for LUTS should be a component of every evaluation of a patient with PD. Our findings offer a preliminary profile of the male PD patient with LUTS, which is an important step toward effective screening, detection, and access to care and treatment. Next steps in research include further work to identify predictors of LUTS in both male and female PD populations, explore patient perspectives, begin trials of interventions for LUTS in the PD population, and analyze the economic impact.

Keywords: lower urinary tract symptoms, men's health, nonmotor symptoms, Parkinson disease

Parkinson disease (PD) is a progressive, disabling neurological disorder with a global prevalence of between 4.1 and 4.6 million that is expected to double over the next 2 decades (Dorsey et al., 2007). The PD involves degeneration of the substantia nigra and is primarily characterized by motor symptoms such as bradykinesia, rigidity, and resting tremor (Defreitas et al., 2003). Autonomic nonmotor symptoms, including constipation, orthostatic hypotension, and urinary dysfunction, are also common. Patients with PD, as well as their lay caregivers and healthcare providers, frequently need to evaluate and manage issues of function and disability, including those related to lower urinary tract symptoms (LUTS).

Early in the 19th century, James Parkinson (1817) noted the presence of urinary incontinence (UI) in a case report on the ''shaking palsy.'' Today, estimates of the prevalence of UI and other LUTS, such as nocturia, urinary urgency, and urinary frequency, vary in studies of adults with idiopathic PD. Moreover, the pathophysiology, risk factors, and optimal treatment of LUTS in patients with PD are poorly understood. This retrospective

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exploratory study examined the prevalence, presentation, and predictors of LUTS in men with idiopathic PD who received care at a movement disorders clinic in a large metropolitan Veterans Affairs Medical Center.

Background/Literature Review

Estimates of the prevalence of LUTS in patients with PD vary. Although as many as 71% of patients with PD have reported experiencing LUTS, recent studies using validated questionnaires and excluding subjects with multisystem atrophy report lower prevalence rates of 27%–39% (Blackett, Walker, & Wood, 2009; Sammour et al., 2009; Winge & Fowler, 2006). Evidence also suggests that the prevalence of LUTS is a function of PD severity rather than PD duration (Araki & Kuno, 2000; Coelho, Ferreira, Rosa, & Sampaio, 2008; Winge, Werdelin, Nielsen, & Stimpel, 2004).

In patients with PD, LUTS are attributed to lesions of the basal ganglia, which interfere with normal inhibition of voiding by the pontine micturition center. Reduction in nigrostriatal dopamine (specifically, diminished or absent D1 receptor stimulation) leads to partial or total disconnection of the micturition reflex from voluntary control and, in turn, uninhibited bladder contractions in the presence of negligible volumes of urine (Blackett et al., 2009; Gray, Stern, & Malone-Lee, 1995; Katz & Greenstein, 1989; Ransmayr et al., 2008; Singer, 2005; Singer, Weiner, & Sanchez-Ramos, 1992; Siroky, 2003). This is generally referred to as detrusor hyperreflexia or detrusor overactivity (DH/DO), the most common urodynamic pattern in patients with PD (Chancellor & Blaivas, 1991; Katz & Greenstein, 1989; Fitzmaurice et al., 1985; Ragab & Mohammed, 2011; Siroky, 2003). Symptoms reported by patients with PD and DH/DO include urinary urgency and frequency, nocturia, and urge UI (Araki & Kuno, 2000; Blackett et al., 2009; Ragab & Mohammed, 2011; Ransmayr et al., 2008; Sakakibara et al., 2001a; Stacy, 1999).

Although less common than DH/DO, additional lower urinary tract pathology in patients with PD includes detrusor weakness, uninhibited external sphincter relaxation (Sakakibara, Hattori, Uchiyama, & Yamanishi, 2001b), diminished bladder capacity (Defreitas et al., 2003; Gray et al., 1995), poor voluntary sphincter control (Staskin, Vardi, & Siroky, 1988), and poor control of pelvic floor muscles (Stacy, 1999). Symptoms associated with these findings include incomplete bladder emptying (Singer et al., 1992), retarded initiation of voiding, a weak urinary stream (Sakakibara et al., 2001a), and UI (Sakakibara et al., 2001b).

A number of factors external to the lower urinary tract may also contribute to LUTS in patients with PD.

> Both lower urinary tract (LUT) pathology and factors such as postural instability, freezing episodes, and dyskinesia that are extrinsic to it contribute to lower urinary tract symptoms (LUTS) in individuals with Parkinson disease.

Motor disturbances, including postural instability, festination, freezing episodes, and dyskinesia (Stacy, 1999), can prevent or delay access to a toilet and lead to UI (Giladi et al., 2000). Likewise, several studies document a relationship between functional decline and the development of LUTS in patients with PD (Araki & Kuno, 2000; Sakakibara et al., 2001a).

Prior studies suggest that constipation, anticholinergic medications, edema, and dementia are also risk factors for LUTS in patients with PD. Constipation, found in 44%–69% of patients with PD (Sakakibara et al., 2001a; Singer et al., 1992; Stacy, 1999), can lead to fecal impaction and fecal incontinence and may thus be a risk factor for the development of LUTS (Newman & Wein, 2009; Sakakibara et al., 2001a). Anticholinergic therapy, a commonly used drug treatment for overactive bladder with or without UI, may aggravate incomplete bladder emptying and urinary frequency associated with DH (Stacy, 1999). In fact, a more recent review suggests that healthcare providers of patients with PD should carefully consider the risks and benefits of using anticholinergic drugs to treat LUTS and collaborate with urology as needed (Blackett et al., 2009). Moreover, some of the common PD drug therapies, such as carbidopa/levodopa, have been found to affect bladder function by worsening urinary urgency and DH/DO while improving urinary hesitancy and detrusor contractility (Brusa et al., 2007; Uchiyama, Sakakibara, Hattori, & Yamanishi, 2003). In edematous patients, fluid reequilibration during recumbency may precipitate nocturnal urinary frequency (Stacy, 1999). Finally, dementia, which occurs over time in up to 80% of patients with PD (Aarsland, Andersen, Larsen, Lolk, & Kragh-Sorensen, 2003), can lead to a functional type of UI resulting from loss of the cognitive skills to recognize and respond to the need to void. In the late stages of dementia, patients can also experience involuntary neurogenic bladder contractions and symptoms of LUTS (Newman & Wein, 2009).

Quality of life for patients with PD is negatively affected by both motor and nonmotor symptoms, including LUTS (Araki & Kuno, 2000; Blackett et al., 2009; Rahman, Griffin, Quinn, & Jahanshahi, 2008; Sammour et al., 2009; Winge & Fowler, 2006). Despite some research on the prevalence, pathophysiology, etiologies, impact, and treatment of LUTS in patients with PD, more is clearly needed. Neuroscience nurses and rehabilitation specialists are in key positions to evaluate and manage LUTS in patients with PD. The study reported here aims to provide additional important knowledge and ultimately contribute to improved care for men with PD who also experience LUTS.

Methods

Design

The Theory of Unpleasant Symptoms (Lenz, Pugh, Milligan, Gift, & Suppe, 1997; Lenz, Suppe, Gift, Pugh, & Milligan, 1995) provided conceptual orientation for this retrospective exploratory study. The theory posits that physiological, psychological, and situational factors interact to influence the symptom experience. Thus, we examined (1) the prevalence of LUTS; (2) physiological, psychological, and situational factors hypothesized to influence the LUTS experience; and (3) predictors of LUTS.

Included in our definition of LUTS were incontinence, frequency, nocturia, urgency, hesitancy, dribbling, and retention. Physiological factors were somatic contributors to the expression of LUTS, including number of comorbid diagnoses; number of medications, categorized as number of prescribed anti-Parkinson agents, and number of all other drugs; PD duration (number of years since diagnosis); PD severity; and functional status. Psychological factors were indicators of mental state, affective response to illness, and degree of uncertainty about the possible meaning of LUTS, including cognitive status, diagnosis of major depression, and diagnosis of anxiety. Situational factors were demographic characteristics that might affect the experience and reporting of LUTS, including age, race, years of education, marital status, and employment status.

Sample

We sampled admission clinical records of all patients enrolled in the Parkinson's Disease Research Education and Clinical Center (PADRECC) at a large Veterans Affairs Medical Center in the eastern region of the United States during July 2003 ($N = 392$). Included were all records that listed the diagnosis of idiopathic PD. Excluded were records of female ($n = 4$) and deceased patients ($n = 14$) because they differed demographically from the overwhelming majority of male living patients. Also excluded were records that listed the diagnoses of secondary PD, atypical PD, progressive supranuclear palsy, and multisystem atrophy ($n = 103$). These degenerative neurological conditions share some common features with idiopathic PD but differ fundamentally in their pathophysiology, progression, and clinical presentation. Thus, our final sample included 271 records.

Measures

The admission clinical record consisted of data from the PADRECC Admission Questionnaire, Unified Parkinson's Disease Rating Scale (UPDRS; Fahn, Elton, & Members of the UPDRS Development Committee, 1987), and Mini Mental State Examination (MMSE; Folstein, Folstein, & McHugh, 1975). The PADRECC Admission Questionnaire is a comprehensive health history that elicits information about demographic characteristics; PD history; current medications; history of medical–surgical, mental health, cognitive, and sleep problems; family history of neuropsychiatric and psychosocial problems; and self-appraisal of current mobility, functional status, pain/discomfort, anxiety/depression, and overall health. The questionnaire was completed voluntarily by the patient and/or caregiver before the initial visit to the PADRECC and reviewed by clinicians during the visit. Data about LUTS, number of comorbid diagnoses, number of antiparkinson agents, number of non-PD medications, PD duration, diagnosis of major depression, diagnosis of anxiety, and demographic characteristics were obtained from the PADRECC Admission Questionnaire.

The UPDRS is a 42-item structured observational scale that was designed for universal use by clinicians and researchers in the interest of standardized measurement of PD severity (Fahn et al., 1987). The scale was used by the clinician to evaluate each patient's functional status and PD severity during their initial visit to the PADRECC. The UPDRS contains six subscales that measure (1) mentation, behavior, and mood; (2) activities of daily living; (3) motor function; (4) complications of therapy; and global evaluations of both (5) disease stage and (6) activities of daily living. In the first three subscales, patients are rated on a 5-point scale (0–4) on each item with higher scores reflecting greater severity. In the fourth subscale, patients rate the presence, absence, and extent of dyskinesias, clinical fluctuations, and other common complications of PD therapy on scales ranging from either 0–4 or 0–1, also in the direction of greater severity as scores increase. The fifth subscale is a modified version of the

Hoehn and Yahr Staging Scale (Hoehn & Yahr, 1967), which the clinician uses to stage the disease on a scale ranging from 0 (*no signs of disease*) to 5 (*wheelchair bound or bedridden unless aided*). The Schwab and England Activities of Daily Living Scale (Schwab & England, 1969) is incorporated in the UPDRS as the sixth subscale, which is the clinician's global evaluation of the patient's functional ability, ranging from 0% (bedridden and without vegetative functions) to 100% (completely independent). The UPDRS can be completed in 15–20 minutes on most patients, and its reliability and validity have been supported in both initial and subsequent testing (Fahn et al., 1987; Martinez et al., 1994). Scores on the modified Hoehn and Yahr Staging Scale (subscale 5) and Schwab and England Activities of Daily Living Scale (subscale 6) were used in this study as indicators of PD severity and functional status, respectively. An updated version of the UPDRS, which adds the evaluation of nonmotor symptoms, was developed and published by the Movement Disorder Society subsequent to the completion of this study (Goetz et al., 2008).

The MMSE, a 30-item screen for cognitive impairment, is the most commonly used test to assess serial cognitive change (Folstein et al., 1975). Items sample important cognitive functions, including orientation (10 points), registration (3 points), attention and calculation (5 points), recall (3 points), and language (9 points). Scores greater than or equal to 25 points (out of 30) indicate normal cognitive function. Below this, scores can indicate severe (≤9 points), moderate (10–20 points), or mild (21–24 points) cognitive impairment (Mungas, 1991). The MMSE can be completed in 10 minutes in most patients, and its reliability and validity are well documented (Zahinoor, Rajji, & Shulman, 2010). In the PADRECC, the MMSE was used by the clinician to evaluate each patient's cognitive status during their initial visit. MMSE scores were used in this study as the indicator of cognitive status.

Procedure

Data were abstracted from each eligible record by trained research assistants, scanned onto an EXCEL spreadsheet, and imported into the SAS (SAS Institute, 2008) software package for analysis. Interrater reliability was 0.99 in a randomly selected 10% sample of records. Missing values comprised less than 10% of the data for all variables except PD duration, with 14% of values missing, and were not replaced.

Descriptive statistics were obtained for the total sample. Next, continuous variables were dichotomized to reflect clinically meaningful risk factors for LUTS. Logistic regression was then employed to test for statistically significant associations between having LUTS and the hypothesized physiological, psychological, and situational risk factors. Finally, a multivariable prediction model was developed from the set of statistically significant hypothesized risk factors for LUTS. Estimates of the Cox and Snell r^2, Nagelkerke (Max rescaled) r^2,

TABLE 1. Descriptive Characteristics of Sample[a]

Variable	*M* ± *SD*	Range	*n* (%)
Age[b]	72.1 ± 8.9	48–92	
Race:[b] White			238 (88.1)
Marital status:[c] Married			211 (81.5)
Employment:[d] Not working			225 (91.8)
Education (years)[e]	13.7 ± 3.6	4–30	
Cognitive status (MMSE score)[f,g]	26.4 ± 4.0	9–30	
Major depression diagnosis			53 (19.6)
Anxiety diagnosis			22 (8.1)
Total comorbidities	3.6 ± 2.1	0–11	
Total anti-Parkinson agents	1.9 ± 1.2	0–6	
Total other medications	5.2 ± 3.3	0–16	
PD duration (years)[h]	7.1 ± 6.3	0–43	
PD severity (Hoehn and Yahr score)[i,j]	2.5 ± 0.8	0–5	
Functional status (Schwab and England score)[k,l]	73.1 ± 20.6	10–100	

Note. MMSE = Mini Mental Status Examination; PD = Parkinson disease; SD = standard deviation.
[a]*N* = 271. [b]*N* = 270. [c]*N* = 259. [d]*N* = 245. [e]*N* = 265. [f]*N* = 255. [g]Total score = 0–30. [h]*N* = 232. [i]*N* = 267. [j]Total score = 0–5. [k]*N* = 262. [l]Total score = 10–100.

and the ROC (area under the curve) were derived to assess the predictive value of the multivariable model. The closer each of these statistics gets to 1, the stronger the predictive value of the logistic regression model.

Results

Descriptive characteristics of the sample are presented in Table 1. Participants were predominantly older, White, married, not employed, and educated at the high school level or beyond and had MMSE scores that reflected intact cognition. Almost 20% carried a diagnosis of major depression, whereas anxiety diagnoses were about half as common. On average, participants had more than three comorbid diagnoses, took one to two antiparkinson agents in addition to five other medications, and had been diagnosed with PD for 7 years, although disease durations of up to 43 years were found. The distribution of Hoehn and Yahr scores for PD severity indicates the predominance of mild bilateral disease with some impairment of balance among participants. Schwab and England scores for functional status suggest that participants were generally independent, albeit slow, in most activities of daily living. Comorbidities that affected more than 15% of the sample are presented in Table 2.

The prevalence of LUTS is presented in Table 3. At least one LUTS was reported by 40.2% of participants. Incontinence was the most prevalent symptom, affecting almost 25% of participants, followed by nocturia (14.8%) and frequency (13.7%). In contrast, urgency, hesitancy, dribbling, and retention were reported by less than 5% of participants. It should be noted that these may be conservative estimates of the actual prevalence of LUTS in this sample because, at the time of the study, LUTS were documented and explored only when triggered by a specific complaint from the patient.

TABLE 2. Prevalent Comorbid Diagnoses[a]

Diagnosis	*n* (%)
Hypertension	113 (41.7)
Prostate disease	98 (36.2)
Heart disease	86 (31.7)
Hyperlipidemia	65 (24.0)
Hernia	55 (20.3)
Major depression	53 (19.6)
Cancer	49 (18.1)
Constipation	44 (16.2)
Diabetes	42 (15.5)
Dementia	41 (15.1)

[a]*N* = 271.

TABLE 3. Prevalence of LUTS[a]

Diagnosis	*N* (%)
Any lower urinary tract symptom	109 (40.2)
Incontinence	64 (23.6)
Nocturia	40 (14.8)
Frequency	37 (13.7)
Urgency	10 (3.7)
Hesitancy	4 (1.5)
Dribbling	4 (1.5)
Retention	3 (1.1)

[a]*N* = 271. LUTS = lower urinary tract symptoms.

Differences in hypothesized risk factors for LUTS are described in Table 4. Participants with LUTS were significantly older and less likely to be employed than those without LUTS. In addition, participants with LUTS were more likely to experience some degree of cognitive impairment, carry more than three comorbid diagnoses, and report intake of more than five other (non-PD) medications compared with those without LUTS. Moreover, significantly greater proportions of participants with LUTS carried the diagnosis of PD for more than 10 years and had Hoehn and Yahr symptom severity scores of greater than 2, the point at which bilateral disease is present and PD begins to interfere with balance. Likewise, significantly greater proportions of participants with LUTS had Schwab and England functional status scores of less than 80, the point at which complete independence in performance of activities of daily living is lost. Differences in the prevalence of comorbid diagnoses in men with and without LUTS are shown in Table 5. Men with comorbid diagnoses of hernia and dementia were disproportionately affected by LUTS compared with their counterparts without these comorbidities.

Of the 10 identified risk factors for LUTS, four significant predictors were discovered: number of other (non-PD) medications, PD duration, number of comorbidities, and history of a hernia diagnosis (see Table 6). Specifically, participants who took more than five non-PD medications were twice as likely to have LUTS. Furthermore, participants with a PD diagnosis of more than 10 years of duration were 2.25 times more likely to have LUTS, whereas those with more than three additional comorbid diagnoses or history of a hernia diagnosis were respectively 2.08 and 2.14 times more likely to have LUTS. This multivariable prediction model achieved 73.5% concordance (i.e., agreement) with the observed LUTS responses and an

TABLE 4. Differences in Hypothesized Risk Factors for LUTS in Men With and Without LUTS

Variable	LUTS: Yes, *n* (%)	LUTS: No, *n* (%)	χ
Age, years			
<65	11 (22.0)	39 (78.0)	13.28***
≥65	97 (44.1)	123 (55.9)	
Race			
White	92 (38.7)	146 (61.3)	2.45
Non-White	17 (53.1)	15 (46.9)	
Education, years			
≤12	55 (40.2)	82 (59.9)	0.08
>12	50 (39.1)	78 (60.1)	
Marital status			
Married	79 (37.4)	132 (62.6)	3.43
Not married	25 (52.1)	23 (47.9)	
Employment			
Working	3 (15.0)	17 (85.0)	6.60*
Not working	96 (42.7)	129 (57.3)	
Cognitive status (MMSE score)			
<25	34 (58.6)	24 (41.4)	6.27*
≥25	68 (34.5)	129 (65.5)	
Major depression diagnosis			
Yes	27 (50.9)	26 (49.1)	3.10
No	82 (37.6)	136 (62.4)	
Anxiety diagnosis			
Yes	6 (27.3)	16 (72.7)	1.75
No	103 (41.4)	146 (58.6)	
Total comorbidities			
≤3	42 (29.2)	102 (70.8)	9.04**
>3	67 (52.8)	60 (47.2)	
Total anti-Parkinson agents			
≤2	77 (40.3)	114 (59.7)	0.78
>2	32 (40.0)	48 (60.0)	
Total other medications			
≤5	53 (34.4)	101 (65.6)	7.49**
>5	56 (47.9)	61 (52.1)	
PD duration, years			
≥10	63 (35.6)	114 (64.4)	5.15*
>10	29 (52.7)	26 (47.3)	
PD severity (Hoehn and Yahr score)			
≤2 (balance not impaired)	38 (31.1)	84 (68.9)	8.07**
>2 (balance impaired)	70 (48.3)	75 (51.7)	
Functional status (Schwab and England score)			
<80 (not completely independent)	52 (52.0)	48 (48.0)	24.69***
≥80 (completely independent)	54 (33.3)	108 (66.7)	

Note. LUTS = lower urinary tract symptoms; MMSE = Mini Mental Status Examination; PD = Parkinson disease.
*$p < .05$, two tailed. **$p < .01$, two tailed. ***$p < .001$, two tailed.

TABLE 5. Differences in Prevalent Comorbid Diagnoses in Men With and Without LUTS

Variable		LUTS: Yes, *n* (%)	LUTS: No, *n* (%)	χ
Hypertension	Yes	48 (42.5)	65 (57.5)	0.41
	No	61 (38.6)	97 (61.4)	
Prostate disease	Yes	44 (44.9)	54 (55.1)	1.40
	No	65 (37.6)	108 (62.4)	
Heart disease	Yes	36 (41.9)	50 (58.1)	1.41
	No	73 (39.5)	112 (60.5)	
Hyperlipidemia	Yes	23 (35.4)	42 (64.6)	0.83
	No	86 (41.7)	120 (58.3)	
Hernia	Yes	30 (54.5)	25 (45.5)	5.89*
	No	79 (36.6)	137 (63.4)	
Major depression	Yes	27 (50.9)	26 (49.1)	3.10
	No	82 (37.6)	136 (62.4)	
Cancer	Yes	88 (39.6)	134 (60.4)	0.17
	No	21 (42.9)	28 (57.1)	
Constipation	Yes	22.(50.0)	22 (50.0)	2.09
	No	87 (38.3)	140 (61.7)	
Diabetes	Yes	19 (45.2)	23 (54.8)	0.52
	No	90 (39.3)	139 (60.7)	
Dementia	Yes	28 (68.3)	13 (31.7)	15.83**
	No	81 (35.2)	149 (64.8)	

Note. LUTS = lower urinary tract symptoms.
*$p < .05$, two tailed. **$p < .001$, two tailed.

area under the curve (ROC) value of 0.74 (95% confidence interval [0.67, 0.81], $p < .0001$). The ROC value represents the model's ability to accurately predict LUTS status. ROC values range from 0.5 to 1.0, where 0.5 corresponds to the model randomly predicting LUTS status and 1.0 corresponds to perfect prediction. Thus, the value of 0.74 is significantly better than the random chance level (0.5) of accurately predicting LUTS status. Cox and Snell r^2 (.17) and Nagelkerke r^2 (.23) estimates of the model's explanatory contribution to the total variance in LUTS status were, however, modest.

Discussion

The LUTS were reported by 40.2 % of our sample, which exceeds the rates of 27%–39% reported in the most recent prevalence studies (Blackett et al., 2009; Sammour et al., 2009; Winge & Fowler, 2006). The literature suggests that patients with PD experience mostly urgency, frequency, nocturia, and urge UI and, to a lesser extent, retention, hesitancy, and a weak urinary stream. The high prevalence of UI (25%) in our sample is surprising given the relatively mild degrees of PD severity and functional impairment observed. Also surprising is the low rate of urgency reported (3.7%). UI, nocturia, and frequency were, however, the most prevalent LUTS, which is consistent with published reports, as is the low prevalence of retention, hesitancy, and dribbling in this sample.

On the basis of published studies and reviews, risk factors for LUTS in patients with PD include motor disturbances, PD severity, functional decline, fecal incontinence, PD medications, constipation, edema, and dementia. In our study, we chose to conceptualize risk factors more holistically by adopting the Theory of Unpleasant Symptoms as a framework. Thus, in addition to the aforementioned risk factors from published studies and reviews, we hypothesized the following additional physiological, psychological, and situational factors that might increase the risk for LUTS in men with PD: number of comorbidities, number of non-PD medications, and PD duration (physiological); major depression and anxiety diagnoses (psychological); and age, race, years of education, marital status, and employment status (situational). Our findings support the utility of the Theory of Unpleasant Symptoms as a model for comprehending the broad range of risk factors that might precipitate LUTS in men with PD. We found physiological, psychological, and situational differences between

TABLE 6. Predictors of LUTS

Variable	B	*SE*	*OR*	95% CI
Age	0.34	0.49	1.40	[0.54, 3.65]
Employment	−0.58	0.72	0.56	[0.14, 2.27]
Cognitive status (MMSE score)	−0.28	0.44	0.75	[0.31, 1.80]
Total comorbidities	0.73*	0.33	2.08	[1.09, 3.96]
Total other medications	0.69*	0.33	2.00	[1.06, 3.79]
PD duration	0.81*	0.38	2.25	[1.06, 4.79]
PD severity (Hoehn and Yahr score)	0.46	0.34	1.59	[0.81, 3.12]
Functional status (Schwab and England score)	−0.02	0.38	0.98	[0.47, 2.05]
Hernia diagnosis	0.76*	0.38	2.14	[1.01, 4.54]
Dementia diagnosis	0.92	0.49	2.50	[0.96, 6.51]

Note. *OR* = odds ratio; CI = confidence interval; LUTS = lower urinary tract symptoms; MMSE = Mini mental Status Examination; PD = Parkinson disease. The reference category is having no LUTS. Model: $\chi^2 = 37.92$, $p < .001$. Cox and Snell $r^2 = .17$. Nagelkerke r^2 (Max rescaled r^2) = .23. ROC statistic (area under the curve) = 74.2%.
*$p < .05$, two tailed.

men with and without LUTS. Physiologically, number of comorbidities, number of non-PD medications, PD duration, PD severity, functional impairment, and history of a hernia diagnosis were all proportionately greater in men with LUTS. Psychologically, dementia was proportionately greater in men with LUTS, as were the situational risk factors of advanced age and lack of employment.

Our findings confirm previous studies suggesting that PD severity (Araki & Kuno, 2000; Coelho et al., 2008; Winge et al., 2004), functional decline (Araki & Kuno, 2000; Sakakibara et al., 2001a), and dementia (Newman & Wein, 2009; Stacy, 1999) are risks for the development of LUTS in this population. We did not analyze differences in specific motor disturbances or intake of specific PD medications among men with and without LUTS, although we did find that the number of PD medications taken by men with and without LUTS did not differ significantly. In contrast to published reports, constipation was not supported as a risk factor for LUTS in our study, although the low prevalence rate in our sample (16%) suggests that it may have been underreported. Likewise, edema and fecal incontinence were not supported as risk factors for LUTS in our study, but their low prevalence rates in our sample (7% and 1%, respectively) warrant cautious interpretation of this finding.

The model generated for predicting LUTS represents an important addition to the evidence base concerning men with PD. The four factors in the model (total comorbidities, total non-PD medications, PD duration, and history of a hernia diagnosis) all represent physiological risks for LUTS. With the exception of having a hernia diagnosis, all of the most prevalent comorbid diagnoses among participants in our study (see Table 2) present obvious risks for development of LUTS related to their pathophysiological effects and/or pharmacological treatment. We attribute the predictive power of having a hernia diagnosis to the likelihood that it represents one or more obvious risk factors for LUTS that were either not measured or not measured well. For example, obesity and constipation are common correlates of hernia and LUTS (Amid, Graham, Selwyn, & Glaser, 2005; Lukacz et al., 2011). In our study, obesity was not measured, and constipation was self-reported and not defined. We also failed to measure history of smoking (i.e., smoker's cough), which is associated with development of both hernia and LUTS and is prevalent in both active duty and retired military personnel (Fiegelman, 1994; Teachman, 2011). The predictive power of PD duration corresponds to the conventional view that LUTS are related to the extent of dopamine depletion and become more troublesome as PD progresses (Fowler, 2007), although findings from an earlier study by Defreitas and colleagues (2003) challenge this assumption.

Several limitations of this study must be considered. First, the study was retrospective. Thus, there was no opportunity to go beyond the available data, which limited the inclusion of some additional risk factors and the usefulness of others, particularly those that were self-reported and/or poorly defined. Second, the sample had limited diversity and may not reflect the true male PD population. Minorities and those in low-income areas often experience limited access to care and are often underrepresented in epidemiological surveys of PD, particularly those relying on medical records (Harris, Koehoorn, & Teschke, 2011; Muangpaisan, Mathews, Hori, & Seidel, 2011). In fact, a recent Canadian study

by Lix and colleagues (2010) documented greater burden of PD in low-income areas. In contrast, greater prevalence of PD among men is well documented (Harris et al., 2011). Fourth, because our data on LUTS were self-reported and volunteered by patients without a specific prompt from the provider, underreporting is a distinct possibility. Finally, the model's predictive contribution to the total variance in LUTS status was modest at best, which prompts consideration of additional variables as well as testing with a larger sample.

Implications

Annual assessment of nonmotor symptoms, including LUTS, has been designated by the American Academy of Neurology as 1 of 10 indicators of quality healthcare for patients with PD (Chen et al., 2010). Moreover, an updated version of the UPDRS, which adds the evaluation of LUTS and other nonmotor symptoms, is now available (Goetz et al., 2008). On the basis of the high prevalence of LUTS, and particularly UI, found in this study, LUTS should be a standing part of every nursing evaluation of a patient with PD and not simply explored in response to a patient's complaint. Beyond this, our findings offer a preliminary profile of the male patient with PD and LUTS, which is an important step toward effective screening, detection, and access to care and treatment.

Lifestyle changes and behavioral therapies, including fluid management, nonpharmacological strategies for addressing lower extremity edema, scheduled toileting, and bladder retraining, have been successful in managing LUTS in patients without PD and should certainly be considered by the neuroscience nurse for the initial treatment of LUTS in patients with PD. Pharmacological therapies for LUTS, particularly the use of anticholinergic medications for urgency and frequency, should be used with caution in patients with PD in light of their potential to exacerbate risks for impaired mental status, falls, and constipation (Lieberman, 2004). However, if behavioral approaches are exhausted, the risk–benefit ratio of pharmacological therapies to relieve LUTS should be evaluated by the interdisciplinary team and discussed with the patient and family.

Next steps in research include further work to identify predictors of LUTS in both male and female PD populations. Perspectives of patients with PD and their caregivers should also be explored to gain an understanding of common beliefs and behaviors related to LUTS as well as the impact of LUTS on quality of life. Beyond this, trials of interventions for LUTS in the PD population are long overdue. Conservative interventions, including lifestyle changes and behavioral therapies, have not been examined specifically in patients with PD experiencing LUTS and represent an obvious opportunity to provide relief and improve quality of life (Wagg, 2011; Wood, Neumiller, Setter, & Dobbins, 2011). Similarly, the efficacy and safety of standard pharmacological therapies for overactive bladder have not been examined in patients with PD and are worthy of investigation. Finally, future research should assess the economic costs of LUTS in patients with PD, particularly expenses related to providing care for incontinence.

The underassessment and undertreatment of LUTS in patients with PD represents a significant burden to patients and families. This study underscores the need for neuroscience nurses to incorporate LUTS in their assessment of all patients with PD in the interest of early detection, treatment, and support of a lifestyle that maximizes dignity and independence.

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