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Correlation Between the Overactive Bladder Questionnaire (OAB-q) and Urodynamic Data of Parkinson Disease Patients Affected by Neurogenic Detrusor Overactivity During Antimuscarinic Treatment

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Abstract

Introduction:

Parkinson disease (PD) patients present urinary symptoms during the course of the disease, very often suggestive of overactive bladder and sustained by neurogenic detrusor overactivity. These symptoms cause a severe lowering of quality of life determining social withdrawal and they need to be early diagnosed to restore social interaction and prevent urinary tract complications. Today overactive bladder diagnosis is easier, thanks to the availability of new investigative tools, particularly voiding questionnaires. The aim of the present study was to evaluate the reliability of the Overactive Bladder screener (OAB screener/ OAB-questionnaire), a new voiding questionnaire specifically developed for the overactive bladder diagnosis in PD subjects suffering from overactive bladder symptoms. Clinical data obtained by the questionnaire were compared with urodynamic outcomes, at basal conditions and after antimuscarinic treatment, to better explorate the questionnaire reliability.

Materials and Methods:

Forty PD patients have been enrolled in the protocol, and submitted to the OAB screener, voiding diary and urodynamic investigation before and after antimuscarinic treatment. OABscore and urodynamic parameters were statistically analyzed and compared.

Results:

The OAB-q well correlated with voiding diary and urodynamic data of Parkinson subjects either at baseline or after the antimuscarinic treatment. The study suggests that this clinical tool might be used for neurogenic overactive bladder diagnosis and that it seems to be a useful outcome measure for treatments of neurogenic OAB. Key Words: overactive bladder, OAB-q, PD, urodynamic

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veractive bladder (OAB) is a prevalent and disabling condition characterized by urinary urgency, urinary frequency with or without urinary incontinence.¹ Epidemiological studies show that OAB is associated with severe worsening of quality of life (OoL) because of a strong limitation of daily activities with consequent social withdrawal of sufferers.² Current therapeutic choices still present a considerable rate of failure. This fact is partly related to the high variability of clinical response in different groups of patients (pts) and partly secondary to the significant occurrence of side effects determined by antimuscarinics (drugs of first choice to treat OAB)^{3,4}

OAB may present as a sensorial disorder or may be the consequence of detrusor overactivity (DO), which is an alteration of bladder function characterized by the occurrence of involuntary detrusor contractions during the filling phase.¹ According to the International Consultation on Incontinence (ICI) guidelines,⁵ DO is an instrumental diagnosis which is achieved by the urodynamic investigation, whereas OAB diagnosis

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July - August 2006

221

and treatments are based on symptom assessment.

OAB symptoms of pts affected by neurogenic diseases are very frequently sustained by urodynamic DO ("neurogenic" DO).⁶ In these subjects, DO is the upshot of lesions involving nervous micturition centers and loops; these lesions lower micturition reflex control and are responsible for symptoms which are usually more severe if compared with those secondary to non-neurogenic causes.^{1,6}

Patients with PD frequently present lower urinary tract symptoms, often typical of OAB and associated with a neurogenic DO urodynamic finding.^{7,8} In this group of subjects, the risk of developing urinary symptoms is correlated to the age of neurogenic history or disease severity, and it may have a dramatic impact on QoL.⁷ Neurogenic voiding dysfunction can lead to severe damage of the upper and lower urinary tract; for this reason, this condition needs early diagnosis and treatment.⁹ The growing scientific interest regarding OAB and its significant socioeconomic impact has recently strongly prompted intense research in this field.¹⁰ Consequently, much more is known about the OAB pathogenetic mechanisms, and new therapeutic chances are under investigation.11,12

The development of new clinical tools for OAB assessment is aimed to allow easier diagnosis and guarantee a better follow-up, by using standardized methods, particularly voiding questionnaires.^{13–17} A new voiding questionnaire, named overactive bladder screener (OAB questionnaire), has been specifically developed to better individuate, stratify, and monitor OAB pts.^{18,19} Although this questionnaire has been already used in different recent studies, no data are still available about its use in neurogenic subjects.²⁰

The aim of the present study was to evaluate the reliability of the OAB-q in evaluating OAB symptoms secondary to DO in a PD pts cohort. To better exploration in this aspect, after the symptomatic assessment (OAB-q and voiding diary), pts have been submitted to urodynamic investigation at basal conditions, and during a therapeutic protocol with antimuscarinics to find out if the OAB-q scores are reliable with voiding diary and predictable of urodynamic parameters either at diagnosis or during treatment.

METHODS

Screening Phase

The screening phase of the study involved 53 subjects (42 males, 11 females) aged from 48 to 70, all with PD diagnosis. All the pts had an idiopathic PD, evaluated using Unified Parkinson Disease Rating Scale, and Hoehn and Yahr rating scale for PD.

Patients were evaluated by physical examination, urine analysis, bladder ultrasound, and 3 days voiding diary. Symptom assessment was performed by the 8 bladder symptoms items of the OAB-q^{4,5} (Table 1, www.overactivebladder.com) and voiding diary (Table 2).

DO presence was assessed by urodynamic investigation. Significant OAB-q score (\geq 8) (indicative of OAB diagnosis), 8 micturitions a day combined with at least 3 episodes of urinary urgency a day recorded in the voiding diary, and DO evidence during urodynamic test were considered inclusion criteria.

Urodynamic was assessed following the report of the "Good Urodynamic Practice,"⁶ with a preliminary free flowmetry with post-voiding residue evaluation performed by Bladder Scan [Bladder Scan BVM 6500; Diagnostic Ultrasound http://my.scanpoint.com]. A test-retest urodynamic assessment (cystometry and pressure-flow study associated with pelvic needle electromyography [www.oxinst.com]) was executed (20 min apart) in each pt with a Dantec Duet Medtronic instrument (www.medtronic. com).

All the pts were not on dopaminergic therapy during urodynamic. As reported by Literature, the effects of dopaminergic treatment

TABLE 1. Inserire in Bibliografia: Inizio Modulo

Answering the following questions will help you find out if you have the symptoms of overactive bladder.

	Yes	No
Do you urinate more than 8 times in a 24-hour period?	•	•
Do you frequently get up 2 or more times during the night to go to the bathroom?	•	•
Do you have uncontrollable urges to urinate that sometimes result in wetting accidents?	•	•
Do you frequently limit your fluid intake when you are away from home so that you won't have to worry about finding a bathroom?	•	•
When you are in a new place, do you make sure you know where the bathroom is?	•	•
Do you avoid places if you think there won't be a bathroom nearby?	•	•
Do you frequently have strong, sudden urges to urinate?	•	•
Do you go to the bathroom so often that it interferes with the things you want to do?	•	•
Do you use pads to protect your clothes from wetting?	•	•
Fine modulo		

Comment: The OAB questionnaire.

on bladder control and urodynamic parameters are unpredictable in the individual patient, though some patients experience worsening changes.^{21,22}

Enrolment Phase

Forty pts were considered eligible for the study. The following subjects were excluded: 3 male pts with maximum flow < 12 mL/sec at the free flowmetry and/or with a post-voiding residue \geq 100 mL, because they could not receive the antimuscarinics for severe risk of acute urinary retention; 3 male pts with severe bladder outlet obstruction at the urodynamic test; 1 male and 2 females without DO at cystometric evaluation; 2 females with severe genital prolepses and prevalence of stress incontinence symptoms at the voiding diary and no significant score at the OAB-q; 2 males were excluded because of clinical findings indicative of Multiple Systemic Atrophy (MSA) diagnosis; and MSA subjects often present different urodynamic findings compared with PD ones and also develops lower clinical response to antimuscarinics.²³

Patients Baseline Characteristics

Enrolment started in October 2004 and was concluded in January 2005. Forty subjects,

TABLE 2. The volding Diary						
Time	Amount Voided (mL)	Leak Volume (mL)	Activity During Leak	Was There an Urge?	Fluid Intake (mL)	

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223

33 males (median age 58 yrs) and 7 females (median age 56 yrs) aged from 49 to 68 years were included in the therapeutic protocol. None of the pts reported previous antimuscarinic treatment. All the pts were on dopaminergic treatment (Table 3).

The neurological disease was diagnosed 6 years before in 24/40 pts; the others were diagnosed in 2000 (6/40), 2001 (3/40), 2002 (3/40), and 2003 (4/40). History showed the following comorbidities: blood hypertension (17/40), chronic gastritis (11/40), dislipidemy (10/40), constipation (9/40), recent history (maximum of 12 months) of Type 2 diabetes mellitus with no-insulinic therapy (8/40), chronic heart failure (4/40). Twenty-nine out of 40 pts reported occupational extradomestic activities, whereas the remaining pts stopped their job after the PD diagnosis. Thirty-four pts were married (27 males, 7 females). Twenty-seven pts (22 males, 5 females) reported satisfying sexual activity.

Therapeutic Protocol

Patients enrolled in the study after the urodynamic assessment were treated by tolterodine 4 mg Extended Release in a night-time regimen, as recently proposed by Mattiasson in 2004.⁹ Reevaluation was performed after 90 days by means of OAB-q, 3-days voiding diary, free flowmetry with postvoiding residue evaluation, and urodynamic test with pelvic needle electromyography.

RESULTS

Adverse Events and Drop-out pts Rate

Thirty-two out of forty (80%) pts concluded the protocol and 8/40 (20%) abandoned it because of the following events: 2/40 (5%) constipation; 3/40 (7.5%) dizziness/headache; 3/40 (7.5%) no clinical improvement. Dry mouth was the most frequent side effect reported by pts (11/32 = 34.3%) and defined moderate by 9 (28%) and severe by 2 (6.2%). No severe adverse events was reported.

Clinical Results

Data obtaqined by OAB sreener, voiding diaries, and urodynamics were analyzed by Student *t* test, and values were expressed as mean and spreading with \pm SD. Before and after-treatment data are reported in Tables 4 and 5.

Symptom Scores

Patients found the self-administered compilation of OAB-q easy. The analysis of OAB-q data highlighted urinary urgency as the most important item; the questionnaire showed that more than 70% of subjects suffered from nocturnal micturition episodes; 64% of pts reported that urinary symptoms interfered with their daily activities.

After treatment, 24/32 pts had a negative OAB-q score (75%) with a significant reduction of urinary urgency rate (46%) and of nocturnal micturition episodes. Urinary incontinence was reported by 7/32 (21.8%) pts.

Statistical analysis showed, from baseline to 90 days of antimuscarinic treatment, significant improvements (P < 0.001) in all OAB-q parameters.

The OAB-q subscales showed significant changes (P < 0.05) of urgency episodes (\geq 3), micturitions (\geq 3) and daily incontinence episodes (\geq 1). Improvements in OAB-q scales were associated and well correlated with voiding diaries and urodynamic changes observed during the therapy.

Voiding Diary

Three-days voiding diary showed, at baseline, a significant increase of the micturition episodes. Urinary urge incontinence was reported by 16/40 (40%) pts and 13 (32.5%) of them reported pad usage (mean 3 pads/d). Mean micturition interval resulted of 129 \pm 29 minutes with a mean voiding volume of 98 \pm 38 mL. The mean number of incontinence episodes reported was 4 \pm 2.3 a day. After treatment, diary evaluations showed a significant decrease of daily micturition and of urinary urgency episodes. 25 pts decreased their number of micturitions to <8 a day.

 TABLE 3.							
Demographic Data							
Sex (No. pts)	Male (33)	Female (7)					
Age, median (years)	58 (49–68)	56 (49–68)					
Civil status	27 married	All married					
Comorbidities	Blood hypertension (13/33), chronic gastritis (9/33), dislipidemy (10/33), constipation (4/33) Type 2 diabetes mellitus (6/33), chronic heart failure (4/33)	Blood hypertension (4/7), chronic gastritis (2/7), constipation (3/7), Type 2 diabetes mellitus (2/7)					
Occupational	Working: 28	Working: 1					
status	Not working: 5	Not working: 6					
Sexual	Satisfied: 22	Satisfied: 5					
activity	Not satisfied: 11	Not satisfied: 2					

Micturition interval increased gaining a mean value of 211 ± 41 minute, with a consequent improvement of mean voiding volumes to 229 ± 22 mL. Mean number of urinary incontinence episodes decreased significantly to 2.4 ± 1.2 a day (Table 4).

Flowmetry and Urodynamic Data

At base line, free flowmetry maximum flows ranged from 13.8 and 18.6 mL/sec. Postvoiding residue ranged from 58 to 100 mL (Table 5). Cystometry showed early evidence of first desire to void in most of the patients and a consequent reduced cystometric capacity with a mean value of 227 \pm 20 mL. Mean first desire to void was assessed at 120 \pm 27 mL. All pts presented DO, well correlated to OAB-q score. DO occurred from a mean volume of 77 \pm 19 mL with a maximum amplitude of 59 \pm 17 cm H₂O. Nineteen pts had urinary leakage DO correlated with a mean detrusor leak point pressure of 63 ± 8 cm H₂O. Pressure-flow study showed a moderate increase of micturition pressures (mean detrusorial pressure at opening 48 ± 8 cm H₂O, mean detrusorial pressure at maximum flow 62 ± 4 cm H₂O) associated with moderate reduction of flow indexes (mean maximum flow 13.0 \pm 3.4 mL/sec). After antimuscarinic treatment protocol, maximum flow ranged from 13.3 to 18.1 mL/sec and did not show significant modifications compared with baseline data. Post-voiding residue was similar to baseline assessment ranging from 79 to 99 mL. DO disappeared in 2/32 pts (6.2%). The other

TABLE 4. Voiding Diary					
Parameter	Before Treatment	After Treatment	Р		
Mean micturition interval (minutes)	129 (±29)	211 (±41)	0.05		
Mean daily micturition episodes	12.1 (±1.8)	6.8 (±0.4)	0.05		
Mean voiding volume	179 (±38) mL	271 (±22) mL	0.05		
Pts with urinary leakage	16/40 (40%)	6/40 (15%)	-		
Mean number of incontinence episodes	4 (±2.3)	2.1 (±0.8)	0.024		

Comment: During antimuscarinic treatment, a statistically significant change of micturition interval time was observed; consequently the number of micturitions and the mean volume of each micturition improved. A significant reduction of pts reporting urinary incontinence and of the mean number of urinary incontinence episodes in the remaining pts was also observed. P value was obteined by Student t test.

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TABLE 5.					
Before Treatment	After Treatment	Р			
77 ± 19	148 ± 27	0.01			
120 ± 27	153 ± 34	0.024			
176 ± 13	263 ± 31	0.05			
227 ± 20	339 ± 47	0.05			
59 ± 17	46 ± 12	NS			
40/40 (100%)	38/40 (95%)	-			
78 ± 21	78 ± 42	n.s			
14.8-18.6	13.9–18.3	NS			
16.3-21.6	15.9-21.1	NS			
62 ± 6	63 ± 8	NS			
22 ± 4	21 ± 6	NS			
	Before Treatment 77 ± 19 120 ± 27 176 ± 13 227 ± 20 59 ± 17 $40/40 \ (100\%)$ 78 ± 21 $14.8-18.6$ $16.3-21.6$ 62 ± 6 22 ± 4	Before TreatmentAfter Treatment 77 ± 19 148 ± 27 120 ± 27 153 ± 34 176 ± 13 263 ± 31 227 ± 20 339 ± 47 59 ± 17 46 ± 12 $40/40 (100\%)$ $38/40 (95\%)$ 78 ± 21 78 ± 42 $14.8-18.6$ $13.9-18.3$ $16.3-21.6$ $15.9-21.1$ 62 ± 6 63 ± 8 22 ± 4 21 ± 6			

Comment: During the antimuscarinic treatment, the volume of first desire to void and the volume of detrusor involuntary contractions (DIC), both increased and consequently the cystometric capacity improved. Furthermore, the cystometric volume of leakege occurring in pts presenting urinary incontinence improved. Disappearance of DO has been observed in 2 pts. No changes have been observed regarding maximum flow indexes (both males and females), detrusorial pressures during maximum flow rate (Pdet Max Flow) and post-voiding residue, showing that antimuscarinic treatment did not affect micturition parameters. No significant modification of detrusor involuntary contractions amplitude was recorded. P value was obteined by Student t test.

30 pts observed an increase of volume of first and strong desire to void, and the consequent increase of cystometric capacity (mean value 339 \pm 47 mL). In these pts, the volume of first detrusor involuntary contraction significantly increased from 77 \pm 19 mL to 148 \pm 27 mL, with a maximum amplitude of 46 \pm 12 cm H₂O.

Seven out of thirty-two (21.8%) pts did not show any significant urodynamic improvment and 8/32 (25%) still presented urinary leakage secondary to DO (mean detrusor leak point pressure 60 ± 4.3 cm H₂O). The mean cystometric volume at urinary leakage was 263 ± 31 mL, presenting a significant increase if compared with baseline assessment. Pressure-flow analysis showed mean detrusorial pressure at opening of 49 ± 5 cm H₂0 and of 62 ± 6 cm H₂O at maximum flow, associated with mean maximum flow indexes of 13.7 ± 4.4 mL.

DISCUSSION

Neurogenic DO is a frequent urodynamic finding in PD pts and it is responsible for OAB symptoms. This condition needs early diagnosis and treatment to improve

QoL of pts and save them from any possible complications secondary to vesico-sphincteric dysfunction (bladder decompensation, vesico-ureteral reflux, urinary infections, urinary retention, and chronic renal failure). OAB diagnosis is based on clinical symptom assessment,²⁴ which has been performed in the past by different, nonspecific, voiding questionnaires.^{25–29} The recent introduction of the OAB-q allows a specific symptom assessment of OAB syndrome and it enables a better evaluation of its impact on QoL.^{18,30} This questionnaire is characterized by 8 items assessing the amount of "bother" the pts associated with OAB symptoms. Questions are of easy comprehension, the test execution needs few minutes. A score ≥ 8 is suggestive for OAB diagnosis. The usefulness and reliability of this questionnaire has been clearly showed by literature in different recent studies.^{18,31} Consequently, the questionnaire has been translated and is available for clinical use in more than 14 countries with different languages.¹³ Several studies show its reliability for OAB symptoms also compared with other questionnaires which have been used until today.18,25-31 Particularly, LS et al examined test-retest reliability

CLINICAL

of 4 patients and reported outcome measures for patients with overactive bladder: OAB-q, Patient Perception of Bladder Condition (PPBC), Urgency Questionnaire (UQ), and Primary OAB Symptom Questionnaire (POSQ).²⁹ Patients were scheduled for two visits 2 weeks apart and completed all questionnaires at both visits. A total of 47 patients enrolled, with 46 completing both visits, 35 were classified stable. Statistically significant correlations were present between visits 1 and 2 for all subscales of the OAB-q, UQ, and POSQ.

No significant differences between visit 1 and 2 were noted, except for the OAB-q symptom bother scale (change of 5.8 points on a 100-point scale). The multi-item subscales of the OAB-q and the UQ demonstrated good internal consistency across both visits. Test-retest reliability of the Patient Perception of Bladder Condition was weaker than the other three measures, but still acceptable for use as a global, single-item outcome measure. The OAB-q, POSQ, and UQ demonstrated good test-retest reliability, with intraclass correlations equivalent or superior to those previously reported for 7-day micturition diaries. Findings suggest that the 4 measures examined in this study demonstrate the necessary reproducibility for use as outcome measures for OAB treatments.

The need of using OAB-q in a wider population has been expressed by the 2004 ICI report³² to perform better and larger epidemiological investigation on OAB, and to extend the use of a specific clinical tool for OAB condition. In fact, epidemiological data today available about OAB incidence and prevalence come from studies performed with different nonspecific questionnaires and consequently they result hard to compare.¹⁰

PD pts frequently develop OAB symptoms after some years from the neurological exordium; these symptoms are sustained by DO frequently associated with dysfunctional behavior of the pelvic floor during micturition.³³ Stocchi et al urodynamically studied 30 PD pts, observing that 36.6% of them had

normal micturition findings with normal bladder sensitivity, whereas most pts had bladder hyperreflexia or impaired control of the perineal muscle function (incomplete pelvic floor relaxation).³³ These data were compared with those obtained from MSA subjects, showing that MSA pts may present urodynamic alterations earlier, before an advanced stage of the disease, combined with an altered pelvic floor ElectroMyoGraphy, which is not compromised in PD pts. These data have been confirmed by Araki³⁴ and also by Sakakibara³⁵ in a videourodynamic and neurophysiologic study, who reported that the findings of postmicturition residual >100 mL, detrusor external sphincter dyssynergia, open bladder neck at the beginning of bladder filling, and neurogenic sphincter motor unit potentials are highly suggestive of MSA. The different pattern of urodynamic, video-urodynamic, and neurophysiological evaluations between MSA and the PD subjects justifies the need to distinguish these two categories also during clinical studies. For these evidences, the 2 patients suspected of MSA diagnosis were excluded from this protocol and only idiopathic PD was included.

Considering the high prevalence of OAB in pts suffering from PD, the validation of specific questionnaires for OAB symptoms in this group of pts may contribute to early diagnose OAB (suggestive for DO), and limit the use of invasive and more expensive investigation tools (such as urodynamic).

No studies have been performed in PD pts to evaluate OAB symptoms by means of OAB-q, and no studies compared the OAB-q scores with urodynamic data in PD subjects. Comparing the urodynamic data of PD with the OAB-q scores appeared a good method of investigation to understand if the OAB-q score modifications correlated with functional bladder changes, which in this study have been intentionally determined by the administration of antimuscarinic treatment.

This study confirms the occurrence of DO, and consequent OAB symptoms in PD pts already reported in Literature.36-38 PD pts usually do not present severe bladder symptoms; the population enrolled in this protocol

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July - August 2006

227

is not representative to a larger PD population cause the inclusion criteria (OAB-q, DO evidence at DO, and significant changes at the voiding diary) conditioned the enrolment of pts with severe symptoms, which allows a better exploration of OAB-q reliability.

The OAB-q indicated urinary urgency as the most frequent symptom reported by all subjects in this study, followed by urinary frequency, nocturia and urinary incontinence with pad usage. All the pts enrolled in the study presented at baseline an OAB-q score suggestive for OAB. Furthermore, the questionnaire resulted strongly correlated with voiding diary and urodynamic data.

The OAB-q was also reliable in the evaluation of the therapeutic outcomes: pts presenting cystometric improvements contextually had OAB-q score reduction. This data confirms the already known good correlation of this questionnaire with symptoms of OAB in pts treated with antimuscarinics and demonstrate that it may be used in different group of subjects, included PD pts.

Efficacy and safety of antimuscarinics in PD was not the main objective of this investigation.

However, the clinical and urodynamic data suggest that antimuscarinic therapy may induce significant changes of urodynamic parameters in PD subjects with consequent clinical improvement, although randomized study on larger population may prove the real efficacy of this treatment in this kind of pts. In fact neurogenic pts may present extreme variability of clinical response to antimuscarinic treatment.

Furthermore, antimuscarinics present some side effects secondary to the ubiquitary disribution of muscarinic receptors, as drymouth and constipation, but also cognitive impairment (central effect) may occurr. In our cohort of pts we record moderate, not severe side effects. None of the patients presented any central adverse events. It must be highlighted, however, the short time of treatment.

Various antimuscarinics are today available for OAB symptoms treatment. In the past years, the most frequently anticholinergic drug used was oxybutinin, an antimuscarinic and antispasmodic drug, whereas most recently (in 1997 the first use in healthy human volunteers), tolterodine has been used. This is an uroselective, potent, competitive muscarinic receptor antagonist particularly developed for the treatment of OAB, which has demonstrated a better tolerability profile and a higher efficacy.^{39,40} Of recent introduction, darifenacin, an antagonist at muscarinic cholinergic M1, M3, and M5 receptors, which showed to be significantly superior to placebo in reducing the numbers of micturitions, incontinence, and urgency episodes, urge severity, and increasing the warning time and volume per micturition.⁴¹ Similar results in treating symptoms secondary to detrusor hyperactivity are reported by using solifenacin, another antagonist at muscarinic cholinergic M1, M2, and M3 receptors.⁴² Trospium chloride, a quaternary amine, has been also shown to be effective in relieving OAB symptoms.43

The extreme variability of clinical response to antimuscarinics treatment shows that our knowledge of DO pathophysiology is not completely understood, and that further investigations are needed to better understand it and find out better and safe therapeutic strategies.

Recently, some experimental data suggest new future possible treatments of PD (such as the subthalamic nucleus stimulation⁴⁴) and some Authors report also somewhat favorable effects on DO obtained by these procedures, but these are little data coming from pilot studies and they need further randomized investigation on wider populations to be confirmed.

CONCLUSIONS

PD pts frequently present during the course of the disease lower urinary track symptoms (LUTS), and symptoms of OAB are the most frequently reported and are often sustained by neurogenic DO. This condition causes a severe deterioration of QoL and can lead to severe damages of urinary tract function,

228

Palleschi et al

Volume 29, Number 4 July - August 2006

> thus to need early and easy diagnosis and treatment. The OAB-q, a voiding questionnaire specifically developed for OAB diagnosis, seemed to be reliable in reporting voiding symptoms of PD pts and their changes during treatment protocol.

> Basing on these data, this study suggests that OAB-q may be used for the OAB secondary to PD and that its use may be extended to other neurogenic conditions. Therefore, the OAB-q seems to be a useful outcome measure for treatments of OAB also in neurogenic pts.

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