SHORT REPORT

Lower urinary tract function in dementia of Lewy body type

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Objective: Dementia of Lewy body (DLB) type is the second commonest degenerative cause of dementia and autonomic dysfunction has been recognised in DLB. Lower urinary tract (LUT) function in DLB has not been fully delineated. We investigated LUT function in DLB by evaluating clinical and urodynamic data.

Methods: We examined 11 patients (eight men, three women; age range 65–81; disease duration 2–14 years) with probable DLB. Urodynamic studies consisted of: measurement of postvoid residual in all patients, uroflowmetry in five, and electromyography (EMG) cystometry in seven.

Results: All patients had symptoms of LUT: urinary incontinence (urgency type/functional type due to dementia and immobility/both urgency and stress type in 7/2/1 patients, respectively); night-time frequency; urgency; and daytime frequency and voiding difficulty. Seven had postvoid residuals, and three had residual urine volume >100 ml. Decreased urinary flow was seen in all five and detrusor overactivity in 5/7 patients who underwent flowmetry and EMG cystometry, respectively. Low compliance detrusor (storage phase, n=2; with bethanechol supersensitivity), an underactive detrusor (n=4), an acontractile detrusor (n=1), and detrusor–sphincter dyssynergia (voiding phase) (n=1) were also seen; 2/3 patients who underwent motor unit potential analysis had neurogenic changes.

Conclusion: LUT dysfunction is a common feature in DLB, not only due to dementia and immobility, but also to central and peripheral types of somato-autonomic dysfunction.

METHODS

This was a retrospective study in which we reviewed the records according to published criteria³ of 11 patients (eight men and three women; mean age 74.2 years) with probable DLB who were admitted to our department in the past four years (table 1). The mean score on the Mini Mental State Examination (MMSE) was 14.2. Although one patient (case 10) scored 27 on the MMSE, his cognitive decline fluctuated and was of a magnitude to interfere with normal social functions. None of the patients had magnetic resonance imaging abnormalities suggestive of multiple system atrophy (MSA). The head-up tilt test⁹ showed orthostatic hypotension in 7/9 patients studied. The mean supine plasma noradrenaline level⁹ was 128.5 pg/ml (range 47–210; normal >100). One patient had Horner's syndrome. Three men had erectile dysfunction. No abnormalities were seen on the electrocardiograms or chest x rays, or in the blood chemistries, including blood sugar and urinalysis. Parkinsonism preceded DLB in 6/11 patients, autonomic failure preceded in three (all three were initially diagnosed as PAF), dementia preceded in one, and dementia and parkinsonism occurred at the same time in one patient.

Urodynamic studies consisted of uroflowmetry, measurement of postvoid residuals (PVRs), electromyography (EMG) cystometry and pressure-flow analysis. EMG cystometry was performed after inserting a double lumen 8 Fr transurethral catheter, a rectal catheter, and a concentric needle electrode into the external anal sphincter muscle.^{10 11} The bethanechol test was performed according to the method described by Lapides *et al.*¹² None of the men had apparent prostatic hypertrophy on ultrasound echography. Neurogenic change on the sphincter EMG was evaluated according to the criteria of Palace *et al.*¹³ The study was approved by the ethical committee at our institute.

RESULTS

All patients had symptoms of lower urinary tract (LUT) dysfunction (table 2). Ten patients had urinary incontinence: the urgency type was the commonest (n = 7), followed by the functional type due to dementia and immobility (n = 2), and both the urgency and stress type (n = 1). Night-time urinary frequency (more than twice) was noted in nine patients, followed by the sensation of urgency in eight, daytime urinary frequency (more than eight times) in six, and voiding difficulty in six. None was in a state of urinary retention. In the 10 patients with urinary incontinence, urinary incontinence occurred at almost the same time as autonomic failure in five. Urinary incontinence and autonomic failure appeared before the onset of parkinsonism (<3 years) in three patients (cases 1, 5, and 6; initial diagnosis, PAF) and after the onset of parkinsonism (>3 years) in two. In the other five patients, urinary incontinence occurred together

Abbreviations: DLB, dementia of Lewy body type; EMG, electromyography; LUT, lower urinary tract; MMSE, Mini Mental State Examination; MSA, multiple system atrophy; PAF, pure autonomic failure; PVR, postvoid residual

Dementia of Lewy body (DLB) type is the second commonest degenerative cause of dementia.^{1 2} The name DLB is derived from the pathology of the disorder, in which there is widespread appearance of Lewy bodies in the cerebral cortex and in the basal ganglia.^{1 2} Lewy bodies are the pathological hallmark of Parkinson's disease, but in this disease Lewy bodies appear almost exclusively in the substantia nigra. Thus, the clinical features of DLB are characterised by various combinations of dementia and parkinsonism, and visual hallucination and fluctuation of cognition are common. Other features supportive of the diagnosis include postural syncope,³ which has been seen in 28% of pathology proved cases⁴ and may precede dementia and parkinsonism.^{5 6} Postural syncope is a core symptom of pure autonomic failure (PAF),⁷ in which Lewy bodies appear in the autonomic nervous system and occasionally in the basal ganglia as well.⁸ Until now, to our knowledge, no urodynamic data have been available on DLB. Therefore we collected detailed micturitional histories and conducted urodynamic studies to study lower urinary tract function in DLB.

Table 1 Details of patients in the present study

				Dementia			Parkinsonism		Imaging	Autonomic function		
				MMSE score (N>24)	Visual hallucination	Fluctuating cognition	Mobility	Dose of levodopa (mg/day)	SPECT hypoperfusion	Postural syncope	HUT BP fall (mm Hg) (N<20)	MIBG cardiac scintigraphy
Patient	Age (years)	Sex	Duration and course (years)									
1	65	M	14 (AF,inco>PD>DM,ret)	12	+	+	Wheel chair	200	TPO	+	72.8	NP
2	68	M	4 (PD>DM,inco)	17	—	+	With aid	500	PO	—	14.7	NP
3	70	M	7 (PD>DM,inco)	4	+	+	With aid	300	TPO	—	N	DNV
4	74	F	6 (DM>PD,inco)	7	+	+	Wheel chair	200	TPO	—	NP	NP
5	74	M	13 (AF,inco>PD>DM)	22	+	+	With aid	300	NP	+	60.0	NP
6	74	M	8 (AF,inco>PD>DM,ret)	20	+	+	Without aid	—	Diffuse	+	38.3	NP
7	76	M	2 (DM=PD,inco)	7	+	+	With aid	300	TP	—	15.4	DNV
8	78	F	5 (PD>DM)	13	+	±	With aid	300	FPO	—	N	NP
9	78	F	6 (PD>DM>inco)	6	+	+	Wheel chair	400	PO	—	NP	NP
10	78	M	3 (PD>AF,inco,DM)	27	+	+	With aid	400	TPO	—	24.3	DNV
11	81	M	4 (PD>AF,inco>DM)	21	+	+	With aid	300	NP	+	51.5	NP

AF, autonomic failure; BP, blood pressure; DM, dementia; DNV, denervation; F, frontal; inco, urinary incontinence; MIBG, metaiodobenzylguanidine; MMSE, Mini Mental State Examination; N, normal; NP, not performed; O, occipital; P, parietal; PD, parkinsonism; ret, urinary retention; SPECT, single photon emission computed tomography; T, temporal.
HUT, head-up tilt test (60 degrees, 10 minutes).

with or after the onset of dementia. Two patients with functional incontinence belonged to this group. Decreased urinary flow was noted in all five patients studied. PVR was measured in all patients. In patients who did not undergo EMG cystometry or flowmetry, we measured the PVR soon after they had voided, with the help of staff nurses. Seven patients had PVR of more than 30 ml (mean 119 ml). PVR of more than 100 ml was found in three patients. EMG cystometry was performed in seven patients after obtaining informed consent from the patients and their families. Storage phase abnormalities were: decreased first sensation (n=4); decreased bladder capacity (n=2); detrusor overactivity (n=5); and a low compliance detrusor (n=2). Voiding phase abnormalities were: equivocal obstruction (n=3); grade 3 outlet obstruction (n=1); underactive (weak) detrusor (n=4); acontractile detrusor (n=1); detrusor-sphincter dyssynergia (n=1). Denervation supersensitivity of the detrusor was noted in both patients studied. Neurogenic changes in the sphincter motor unit potentials were noted in two of three patients studied.

DISCUSSION

The present study revealed that all 11 DLB patients had LUT symptoms, indicating the frequent occurrence of LUT dysfunction in DLB. The commonest LUT symptom was urinary incontinence in 10/11 patients (91%), including the

urgency type in seven, the functional type due to dementia and immobility in two, and both the urgency and stress type in one patient. Many studies have shown that the severity of immobility and dementia are positively correlated with functional incontinence.¹⁴ Parkinsonian gait disorder may be an early and prominent feature in DLB, and may lead to functional incontinence and frequent falls, whereas it is very uncommon in the early stage of Alzheimer's disease.¹⁵ Nevertheless, urgency incontinence was the commonest symptom in our patients with DLB. In addition, among the 10 patients with urinary incontinence, urinary incontinence preceded both parkinsonism and dementia in three. These findings suggest that urinary incontinence in DLB is not simply a result of immobility or dementia, but possibly of neurogenic detrusor dysfunction.¹⁶ del-Ser *et al*¹⁵ also found that urinary incontinence usually preceded severe mental failure in DLB, and that the onset of urinary incontinence was significantly earlier in DLB than in Alzheimer's disease. PVR of more than 100 ml was found in 27% of patients. Since we examined a small number of patients, we cannot simply compare the LUT function in DLB with that in autonomic failure with Parkinson's disease (AFPD, PD), PAF, or MSA. However, based on our previous data,^{9, 11, 17-19} the severity of storage dysfunction seems to be MSA=DLB>AFPD=PAF=PD (although functional incontinence significantly overlaps in DLB); whereas severity of voiding dysfunction

Table 2 Lower urinary tract function in dementia of Lewy body type

Patient	Lower urinary tract symptom			Flowmetry		EMG cystometry				Denervation				Sphincter EMG	
	Night-time frequency (N<1)	Daytime frequency (N<7)	Urinary incontinence	Voiding difficulty	Poor flow	PVR (ml) (N<30)	Storage phase		DO	LC	Voiding phase*		Bethanechol test	Average duration (ms) (N<10 ms)	% of MUP>10 ms (N<20%)
							FS (ml)	BC (ml)			Grade of obstruction	Detrusor power			
1	2	8	Urge/stress	+	NP	210	90	210	—	+	No flow	A	DNV	N	N
2	3	8	Urge	+	+	40	80	85	+	—	2	W	NP	NP	
3	Unable to tell		Functional	?	NP	12	NP				NP		NP	NP	
4	5	10	Urge	+	+	100	130	130	+	—	0	W	NP	NP	
5	3	10	Urge	—	NP	14	NP				NP		NP	NP	
6	3	—	Urge	+	NP	320	160	260	—	+	NP		DNV	NP	
7	5	8	Urge	+	+	70	210	440	+	—	1	N	NP	N	40
8	3	—	—	—	NP	35	NP				NP		NP	NP	
9	Unable to tell		Functional	?	NP	0	NP				NP		NP	NP	
10	2	—	Urge	—	+	3	80	205	+	—	3	W	NP	10.48	40
11	6	12	Urge	+	+	60	80	320	+	—	1	W	NP	NP	

*Schafer's nomogram.

Obstruction scale: 0, normal; 1-2, equivocal; 3-6, obstruction.

Detrusor power scale: ST, strong; N, normal; W, weak; VW, very weak; A, acontractile detrusor.

BC, bladder capacity (200<N<600); FS, first sensation (100<N<300); dur, duration (N<10.0).

DNV, denervation; DO, detrusor overactivity; EMG, electromyography; LC, low compliance; MUP, motor unit potentials; N, normal; NP, not performed; PVR, postvoid residual.

Table 3 Comparison of lower urinary tract function in DLB, AFDP, PAF, PD and MSA (see text)

Disease	LUT symptoms	Urinary incontinence (storage dysfunction)	PVR >100 ml (voiding dysfunction)	No. of patients	Reference	Detrusor overactivity (central type)	Low compliance (preGGL type)	Bethanechol supersensitivity (denervation) (postGGL type)	Neurogenic change of sphincter MUPs (denervation) (Onuf's nucleus)	No. of patients	Reference
MSA	96%	63%	52%	121	9	56%	31%	19%	93%	121	9, 11
DLB	100%	91%	27%	11	–	71%	29%	2/2	2/3	7	–
AFDP	100%	43%	29%	7	19	86%	14%	1/3	4/4	7	19
PAF	100%	33%	33%	6	17	67%	33%	2/3	¼	6	17
PD	53–70%	25–28%	0%	115	18	81%	0%	Not performed	5%	21	11

AFDP, autonomic failure with Parkinson's disease; DLB, dementia of Lewy body type; GGL, ganglion; LUT, lower urinary tract; MSA, multiple system atrophy; MUP, motor unit potential; PAF, pure autonomic failure; PD, Parkinson's disease; PVR, post-void residual.

seems to be MSA >> DLB = AFDP = PAF >> PD (table 3). In particular, a large PVR is a prominent feature in MSA whereas it is uncommon in Lewy body diseases.

Although urodynamic studies are the gold standard for examining LUT function, few detailed studies have been conducted in cognitively impaired older subjects because of methodological (reliability) and ethical (feasibility and benefit) issues. To ensure the accuracy of the urodynamic results, we performed the tests by encouraging and communicating with the patients, particularly when assessing bladder capacity. Sphincter EMG recording is controversial, since it is considered moderately invasive and uncomfortable, although it may facilitate the collection of important data when there are large PVRs. In the present study, EMG cystometry revealed detrusor overactivity in 71% of patients studied. The spino-bulbo-spinal micturition reflex is under tonic (mainly inhibitory) influence of the anteromedial frontal cortex, central cholinergic pathways,²⁰ and the nigrostriatal dopaminergic system.^{21–22} All these regions are known to be involved in this disorder^{1–2} and may contribute to the occurrence of detrusor overactivity in DLB. Occurrence of detrusor overactivity has been reported in 40% of Alzheimer's disease patients.²³ Thus, occurrence of detrusor overactivity seems to be higher in DLB than in Alzheimer's disease. In our study, 29% of patients (n = 2) with DLB undergoing EMG cystometry had a low compliance detrusor, indicating a preganglionic lesion of the pelvic nerves.¹⁶ The bethanechol test showed that both these patients had denervation supersensitivity of the detrusor, indicating a postganglionic lesion of the pelvic nerves.¹² These findings are in accordance with the pathological reports of neuronal cell loss and Lewy bodies in the intermediolateral columns of the spinal cord and in the autonomic ganglia,²⁴ and the results of physiological studies⁴ and metaiodobenzylguanidine (MIBG) cardiac scintigraphy suggesting postganglionic abnormalities in DLB. Analysis of the motor unit potentials of the external sphincter revealed neurogenic findings in two of three patients studied. This finding suggests the involvement of the sacral Onuf's nucleus, or its fibres to the external sphincter, in DLB.¹³ From these results, the sites responsible for LUT dysfunction in DLB seem to be both the central and peripheral nervous systems regulating the LUT.

The prevalence of the neurogenic sphincter EMG seems to be MSA >> DLB = AFDP = PAF >> PD (table 3). However, these assumptions require confirmation in a larger study. Care of LUT dysfunction in patients with DLB may require clean, intermittent self-catheterisation for the large PVR. Anticholinergic agents for urge urinary incontinence and α -adrenergic blocking agents for PVR should be used cautiously, since anticholinergic agents may worsen cognitive function²⁵ and α -blockers may worsen postural hypotension in these patients. Behavioural therapy (prompted voiding with physical assistance) can be used to manage functional incontinence in many patients with DLB.

In conclusion, LUT dysfunction is a common feature in DLB, due to central and peripheral types of abnormality.

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