

CHAPTER 8

PARKINSONIAN DISORDERS AND PURE AUTONOMIC FAILURE

INTRODUCTION

Disorders of bladder, bowel and sexual function are common problems in Parkinson's disease (PD), multiple system atrophy (MSA) and pure autonomic failure (PAF). Although the pathology of PD and MSA is quite different and distinct, the differential diagnosis of the conditions in life, particularly in the early stages, may be difficult and the presence of autonomic failure, as indicated by postural hypotension, may assist in the differential diagnosis. Figure 1 shows the major clinical features of these various disorders and the relationship between them [1]. However, it should be noted that the pathophysiological cause of postural hypotension does not necessarily also cause bladder, bowel and sexual dysfunction in these diseases and pelvic organ disorders may occur without postural hypotension.

In patients with PD, pelvic organ dysfunction usually occurs late in the course of the disease and is not associated with postural hypotension. MSA is commonly misdiagnosed as PD, but pelvic organ dysfunction usually occurs early in the course of the disease, before the onset of symptoms of hypotension and it is often the prominent complaints of bladder and sexual dysfunction which raise the suspicion of the correct diagnosis. Although the commonest presentation of MSA is as a parkinsonian syndrome (striatonigral degeneration: SND) (Case 1), cerebellar syndrome (olivopontocerebellar atrophy: OPCA) and autonomic disorder (Shy-Drager syndrome) (Case 2) may also occur. PAF is a sporadic disorder characterized by widespread autonomic failure without other neurological features. It usually occurs in older age and has a less rapidly progressive course than MSA.

In all these disorders, complaints of bladder, bowel and sexual dysfunction may add considerably to the patients' disabilities. The neurologist needs to be aware of the possible

diagnostic significance of such symptoms as well as the various treatments available for the conditions.

DISORDERS OF MICTURITION

MSA. Much of the attention to autonomic failure in MSA has focussed on postural hypotension which is considered to be a marker for autonomic involvement [2]. Urinary dysfunction has attracted less attention, despite the fact that both of the two original patients with Shy-Drager type had urinary frequency, incontinence and urinary retention. A recent study has shown that over 90% of all three variants of MSA patients had urinary symptoms, whereas only 43% had symptoms of

KEYPOINTS:

- Although the pathology of PD and MSA is quite different and distinct, the differential diagnosis of the conditions in life, particularly in the early stages, may be difficult and the presence of autonomic failure, as indicated by postural hypotension, may assist in the differential diagnosis.
- Much of the attention to autonomic failure in MSA has focussed on postural hypotension which is considered to be a marker for autonomic involvement. Urinary dysfunction has attracted less attention.

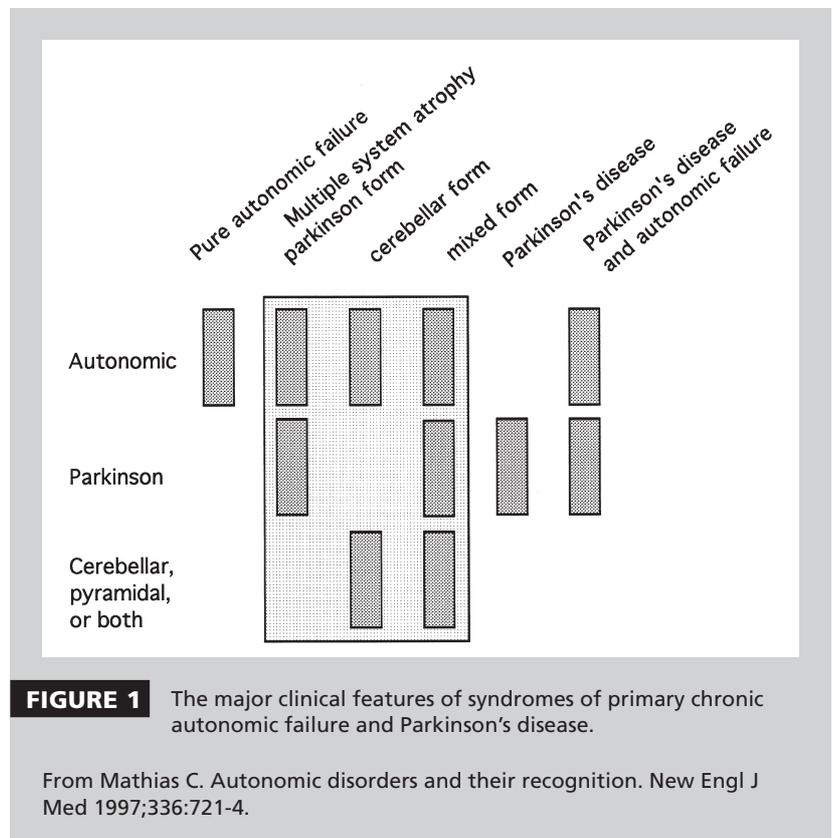


FIGURE 1 The major clinical features of syndromes of primary chronic autonomic failure and Parkinson's disease.

From Mathias C. Autonomic disorders and their recognition. *New Engl J Med* 1997;336:721-4.

NEUROLOGIC BLADDER, BOWEL AND SEXUAL DYSFUNCTION

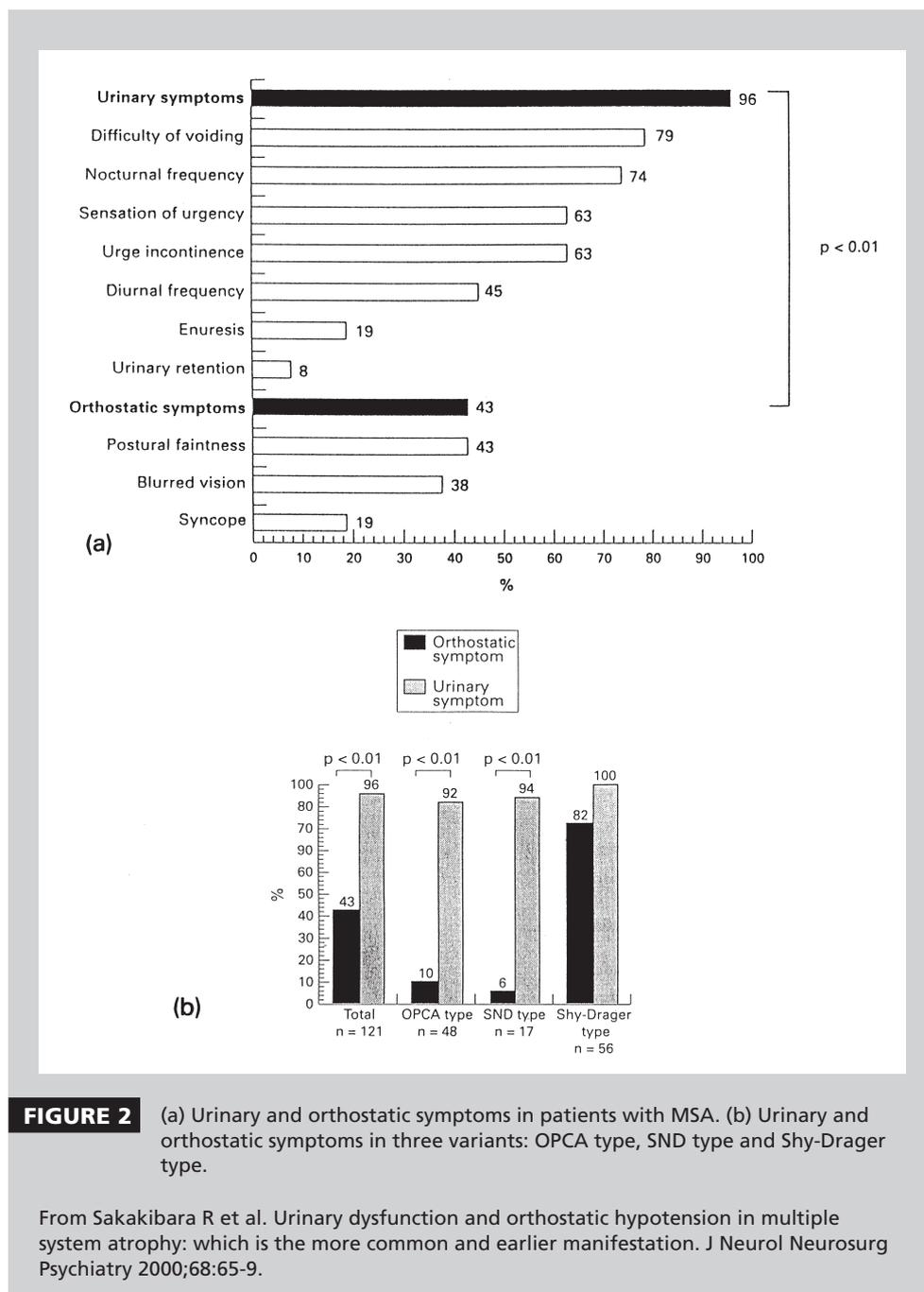


FIGURE 2 (a) Urinary and orthostatic symptoms in patients with MSA. (b) Urinary and orthostatic symptoms in three variants: OPCA type, SND type and Shy-Drager type.

From Sakakibara R et al. Urinary dysfunction and orthostatic hypotension in multiple system atrophy: which is the more common and earlier manifestation. *J Neurol Neurosurg Psychiatry* 2000;68:65-9.

KEYPOINTS:

- The sites of neurological involvement responsible for the urinary dysfunction in MSA are probably both central and peripheral.

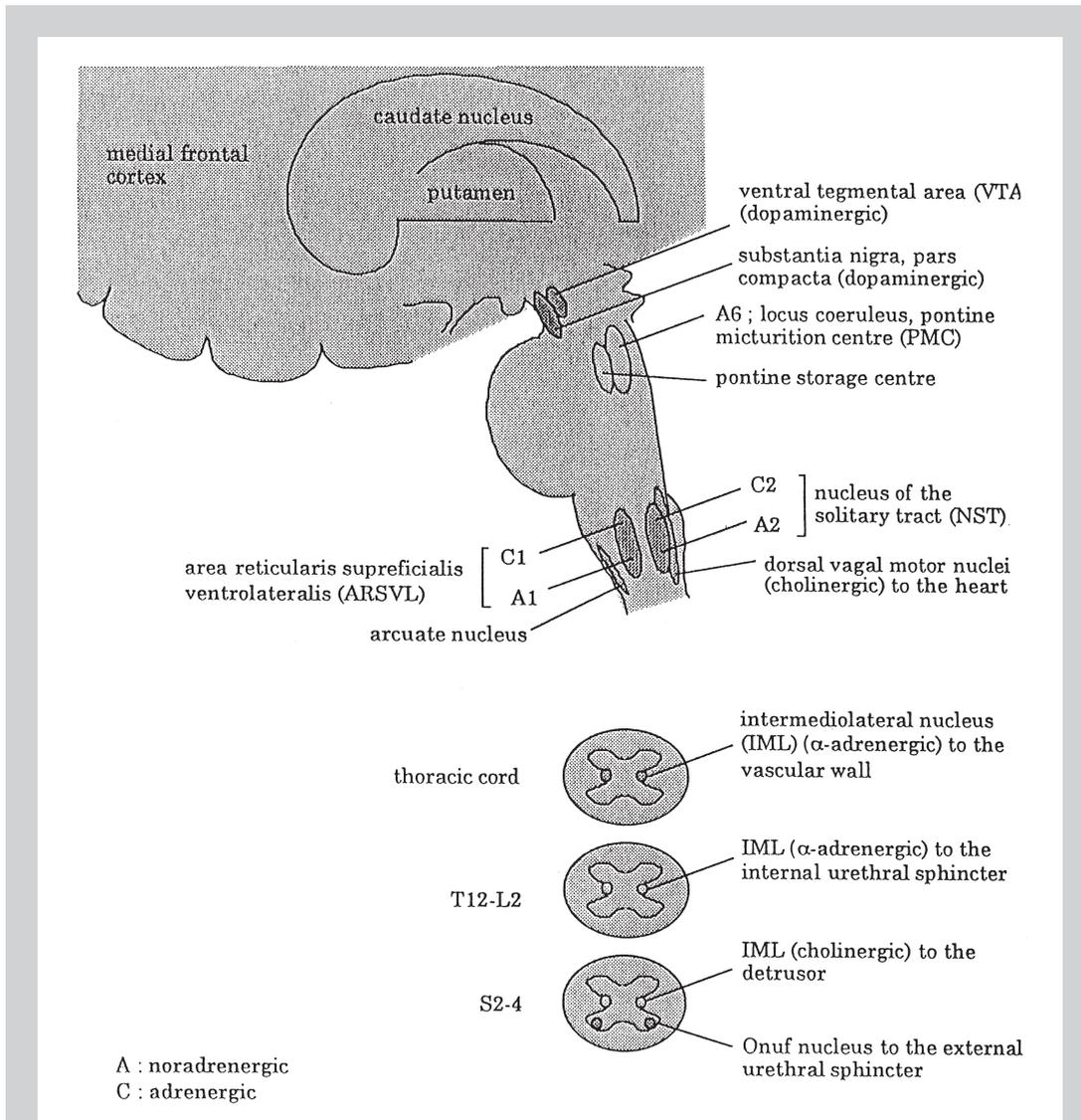
orthostatic hypotension [3] (Figure 2). In some patients, urinary symptoms were the sole presenting complaints (Case 3) and these included difficulty in voiding (79%), nocturnal urinary frequency of more than twice (74%), sensation of urgency (63%), urge incontinence (63%), daytime frequency of more than eight times (45%), nocturnal enuresis (19%) and urinary retention (8%) (see Figure 2). Disorders of

micturition are more common and occur earlier than orthostatic hypotension in MSA.

The urodynamic features of these 128 patients with MSA were also analyzed [3]. Fifty-two percent had a raised post-micturition residual volume of more than 100 ml. Detrusor hyperreflexia was demonstrated in 56%, reduced compliance in 31%, and detrusor atonia in 5%. Sphincter EMG showed detrusor-sphincter dyssynergia in 45% and changes due to chronic reinnervation were found in 74% of the patients, in keeping with other reports [4,5]. A subcutaneous injection of Bethanechol (2.5 mg) showed abnormal increment of detrusor pressure > 15 mm H₂O after 30 minutes in 19%, suggesting cholinergic denervation supersensitivity. The balance of pathophysiology may change during the course of the disease so that whereas early on symptoms due to detrusor hyperreflexia are prominent, as the disease progresses symptoms may change to those due to incomplete bladder emptying with low compliance and atonic bladder [3].

The sites of neurological involvement responsible for the urinary dysfunction in MSA are probably both central and peripheral and have been illustrated in Figure 3. These include neuronal degeneration and glial cytoplasmic inclusions (GCIs) in the pontine micturition center (PMC), the putamen, the substantia nigra, sacral intermediolateral (IML) and Onuf's nuclei, and possibly some involvement of the frontal cortex and postganglionic cholinergic fibers.

Changes of chronic reinnervation on EMG of the anal or urethral sphincter have been used as a test to recognize MSA (Figure 4) [6]. These changes reflect the selective degeneration of the Onuf's nucleus, the group of



KEYPOINTS:

- Because PAF is a much less common disorder than MSA, the precise incidence of bladder dysfunction in PAF is uncertain.

FIGURE 3 Schematic presentation of the central neural structures as for urinary and cardiovascular dysfunction in MSA. Commonly affected sites critical for urinary function include the basal ganglia, the pontine micturition centre, the lumbosacral spinal cord (IML) and Onuf's nucleus. Commonly affected sites critical for cardiovascular function include catecholamine-containing medullary nuclei and the thoracic spinal cord (IML nuclei).

sacral anterior horn cells. Because in PD the anterior horn cells of Onuf's nucleus are not affected, sphincter EMG has been proposed as a means of distinguishing between PD and MSA, although there is disagreement about this [7]. In some patients with MSA, the degeneration of Onuf's nucleus may lead to sphincter weakness, thus causing stress incontinence with low urethral closure pressure.

PAF. Because PAF is a much less common disorder than MSA, the precise incidence of

bladder dysfunction in PAF is uncertain. A recent study investigated micturition function of six patients who met the criteria of clinical findings and autonomic function tests without abnormal brain magnetic resonance imaging (MRI) [8]. All patients had urinary symptoms (see Table 1). Only one patient had urinary symptoms at the onset of disease, whereas in the others, bladder symptoms appeared following the onset of erectile dysfunction (ED) or orthostatic faintness. Two of six patients

NEUROLOGIC BLADDER, BOWEL AND SEXUAL DYSFUNCTION

CASE 1

History: A 60-year-old man complained of a short-step, festinating gait with postural tremor and rigidity in both hands. Two years earlier, he had been diagnosed with Parkinson's disease and was commenced on 300 mg of L-Dopa/carbidopa without benefit. He also had urinary urge incontinence and voiding difficulty with postmicturition residuals of 320 ml.

Examination: Neurological examination revealed evidence of a parkinsonian syndrome without evidence of laterality or resting tremor. The patient was unable to perform tandem gait and on turning, his footing was wide-based, suggestive of gait ataxia.

Cystometry with simultaneous sphincter EMG revealed a poorly compliant bladder on filling and detrusor areflexia with detrusor-sphincter dyssynergia (DSD) on voiding. Analysis of the external sphincter EMG showed neurogenic motor unit potentials (MUP) with mean duration over 10 ms.

Management: For his urinary dysfunction, the patient was taught to perform clean, intermittent self-catheterization (CISC).

Comment: This patient did not demonstrate either resting tremor or laterality and this was suggestive of atypical Parkinson's disease. Detrusor areflexia, DSD and a neurogenic sphincter were all demonstrated on investigation. Neuro-urological assessment can help to distinguish patients with MSA from those with Parkinson's disease, the former being the diagnosis in this case.

KEYPOINTS:

- Urinary dysfunction usually occurs together with a higher Hoehn-Yahr grade.

who had had symptoms for more than 10 years had raised postmicturition residuals. Urodynamic findings showed low compliance bladder in two and denervation supersensitivity of the detrusor in two, indicating pre- and post-

ganglionic pelvic nerve lesions, respectively. These findings are in keeping with pathological reports of neuronal cell loss in the IML columns of the spinal cord, Lewy bodies in the IML cells and in the bladder wall in patients dying of PAF [9].

Urinary dysfunction in PAF appears to be as common, but less severe, than that in MSA (Case 4).

PD. Patients with PD often have bladder symptoms: one survey reported the frequency of urinary dysfunction to be 57% of 97 patients [10] (Figure 5). Similar figures for prevalence, ranging from 40 to 70% have been found in other studies [5,11]. Urinary dysfunction usually occurs together with a higher Hoehn-Yahr grade [12] and is related to striatal presynaptic dopamine depletion shown by in vivo SPECT study, suggesting urinary dysfunction in PD may reflect pathology of the disease.

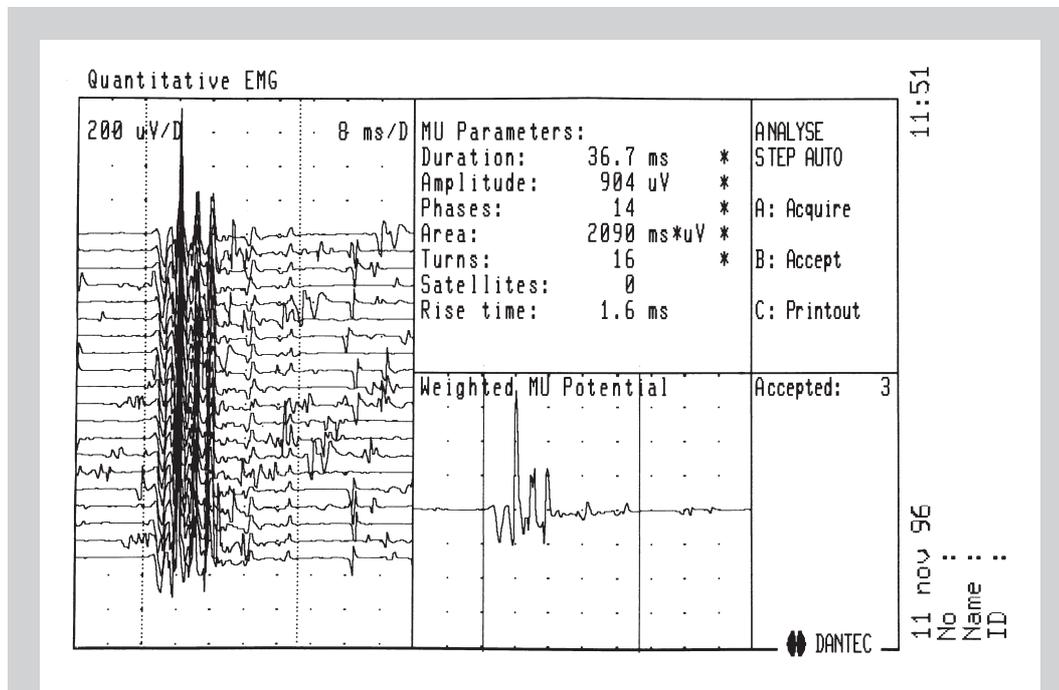


FIGURE 4

An example of a motor unit recorded from the anal sphincter of a patient with MSA, using a concentric needle electrode. Extreme changes of chronic reinnervation are seen in this highly polyphasic unit of prolonged duration (36.7 ms).

TABLE 1 Urinary dysfunction in six patients with PAF

	Y.I.	F.A.	H.S.	I.M.	S.M.	S.T.
Age at onset (years), sex	59, male	64, female	66, male	64, male	56, male	46, male
Initial symptoms	Impotence syncope	Orthostatic faintness	Orthostatic and constipation	Voiding difficulty	Impotence	Orthostatic faintness
Duration (years)	4	4	6	9	10	18
Appearance of minimum rigidity (years after onset)	-	3	6	-	10	16
Autonomic signs and symptoms						
Orthostatic syncope	+	+	+	+	+	+
Horner's syndrome	-	-	+	-	-	-
Laryngeal stridor	-	-	-	-	-	-
Perspiratory abnormality	+	+	+	+	-	+
Erectile dysfunction	+	+	?	?	+	+
Constipation	+	+	+	+	+	+
Micturitional symptoms						
Nocturnal frequency	+	+	+	+	+	+
Diurnal frequency	-	-	-	-	+	-
Urgency	-	+	+	+	+	+
Incontinence	Stress	-	Urge	-	-	-
Hesitancy/prolongation	+	+	+	+	-	+

From Sakakibara R et al. Micturitional disturbance in pure autonomic failure. *Neurology* 2000;54:499-501.

The common urinary symptoms in PD are urgency, frequency and sometimes, urge incontinence. Urodynamic study shows detrusor hyperreflexia in 45-93% of the symptomatic patients as a cause of filling disorder

[5,9,10]. Sphincter EMG rarely shows denervation which, in contrast, is the common finding in MSA.

Some authors have suggested that an impaired relaxation, or bradykinesia, of the external urethral sphincter can result in voiding dysfunction due to bladder outlet obstruction. However, this phenomenon is not common and large postmicturition residuals are rare in PD. Nevertheless, there are still some patients whose main abnormality is hypocontractile detrusor.

The responsible sites for the detrusor hyperreflexia seem to be the nigrostriatal lesions in PD. Experimental studies showed that electrical stimulation of the basal ganglia inhibits micturition reflex in the cat [13], probably by activating striatal GABAergic neurons which descend to the locus ceruleus (PMC). Bladder hyperreflexia occurs in MPTP (1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine)-induced parkinsonian animals. There is experimental evidence that D1 receptors have an inhibitory and D2 a facilitatory effect on the micturition reflex [14]. Therefore, it seems likely that bladder hyperactivity in PD is associated with a reduction in the central dopamine D1 receptors.

KEYPOINTS:

- The responsible sites for the detrusor hyperreflexia seems to be the nigrostriatal lesions in PD.

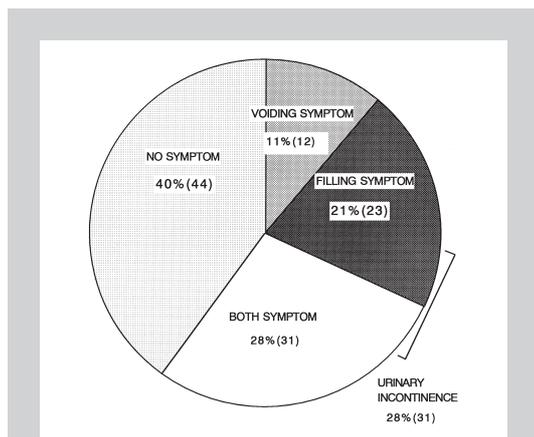


FIGURE 5 Urinary dysfunction in Parkinson's disease.

From Hattori T et al. Voiding dysfunction in Parkinson's disease. *Jpn J Psychiatry Neurol* 1992;46:181-6.

NEUROLOGIC BLADDER, BOWEL AND SEXUAL DYSFUNCTION

CASE 2

History: A 58-year-old man had a new onset of frequent fainting episodes that tended to occur after standing from a sitting position and on walking up stairs. In addition, he noticed dizziness that occurred after urination at night and about half an hour after a meal. He also described erectile dysfunction (ED), frequent urination (three voids per night) and urinary urgency for 2 years preceding the onset of faintness. He had recently begun to have slight slurring of speech.

Examination: Neurological examination showed a mild ataxic dysarthria, incoordination of the limbs and mild rigidity of the hands and the neck. He had a somewhat ataxic, short-stepping gait. Deep tendon reflexes were preserved. On standing, his blood pressure fell from 130/80 to 82/60 mm Hg without an increase in heart rate.

Management: His postural and postprandial hypotension were treated with an indirect sympathomimetic drug. His postvoid residual urine volume was insignificant and so he was commenced on an anticholinergic. Treatment with sildenafil citrate was contraindicated because of his postural hypotension.

Comment: This patient was considered to have the Shy-Drager type of MSA, because the autonomic failure (postural hypotension, urinary dysfunction and ED) preceded cerebellar and extrapyramidal involvement. Other common autonomic abnormalities in MSA are respiratory (vocal cord paresis, sleep apnea syndrome), gastrointestinal (constipation) and perspiratory (hypohidrosis) involvement. Postprandial hypotension and exercise-induced hypotension are also features in patients with MSA.

Treatment. The approach to treatment of urinary dysfunction is no different to that of other neurological causes of these symptoms and is discussed in Chapter 2.

Clinical studies examining the effect of dopaminergic agonists on bladder behavior in

patients with PD have produced conflicting results. Using L-Dopa, apomorphine, pergolide (D1/D2 agonists) or bromocriptine (D2 agonist) some reports showed lessening of detrusor hyperreflexia, whereas others showed improvement of voiding difficulty. Whereas peripherally acting drugs, such as anticholinergic agents, lessen detrusor contractility, dopaminergic agonists may modulate both filling and voiding functions by acting on the specific central pathways.

There is a particular problem with the use of α -blockers in an attempt to improve bladder emptying in patients with MSA, since these can exacerbate postural hypotension.

CASE 3

History: A 62-year-old man was referred because of gait difficulty that had become apparent 6 months earlier. Five years previously, he had undergone a transurethral resection of the prostate for symptoms of voiding dysfunction and urinary urge incontinence. However, the operation had failed to decrease his postmicturition residuals and he was taught to perform CISC.

Examination: On admission, he had a parkinsonian syndrome with marked ataxia and exaggerated deep tendon reflexes. Extensor plantar reflexes were noted bilaterally. He was also found to have a postural systolic pressure fall of 46 mm Hg (126/86 lying to 80/55 mm Hg on standing), which was only associated with a mild headache in the nuchal area.

Management: He was prescribed 300 mg of L-Dopa/carbidopa with minimal improvement. His urinary urge incontinence was treated with 20 mg of propiverine hydrochloride, an anticholinergic drug. He still required CISC for his high postmicturition residuals.

Comment: Male patients with MSA sometimes undergo prostate surgery prior to referral to neurologists because MSA can present with isolated genitourinary symptoms initially. In such cases, urinary urgency and frequency can be treated with anticholinergic medications and high postmicturition residuals can be treated with CISC.

DISORDERS OF DEFECATION

MSA. Duration of patients' symptoms of anorectal dysfunction is shorter in those with MSA than in patients with PD, and constipation appears to be increasingly common with advancing disease [15]. Several mechanisms may cause constipation in MSA, including reduced small and large bowel motility and chronic rectal impaction leading to decreased colorectal sensation or paradoxical contraction of the puborectal muscle during attempts at defecation — a phenomenon similar to detrusor-urethral sphincter dyssynergia and suggestive of supranuclear pudendal dysfunction.

Although much less common than constipation, fecal incontinence may also occur in

MSA, which does not appear to be correlated with the occurrence of urinary incontinence. Low resting anal pressure and reduced maximal contraction pressure may account for fecal incontinence for liquid stools sometimes induced by laxative treatment. Anorectal manometric variables did not differentiate patients with MSA from those with PD [15].

PD. In his classic monograph, James Parkinson described the bowel dysfunction of shaking palsy: "the bowels which all along had torpid, now in most cases, demand stimulating medicines of very considerable power: the expulsion of the feces from the rectum sometimes requiring mechanical aid."

Constipation occurs in 29-77% of PD patients compared to 10-13% of age-matched controls. Difficulty in defecation occurs in 67-94% of PD compared to 28% of a control group [16].

Colonography has shown megacolon in selected PD patients with severe fecal impaction (intestinal pseudo-obstruction) and in PD, rectal transit times are prolonged, indicating reduction of rectal contractility. Immunostaining of biopsied colonic musculature and the submucosa showed a reduction of dopamine-containing neurons and there has also been a report showing Lewy bodies in the myenteric plexus of the colon [17]. These findings suggest that not only central, but also peripheral dopamine dysfunction in the colon account for the prolonged transit time and constipation in PD.

Rectoanal manometry has shown reduced resting and defecating pressures [15]. These probably reflect dysfunction of the internal

anal sphincter innervated by lumbosacral sympathetic nerve. Other possible causes include over extension injury of the myenteric plexus due to severe fecal impaction, and an adverse effect of anticholinergic agents in PD.

Defecography and anal sphincter EMG showed paradoxical contraction of the puborectal muscle in PD as a cause of rectal constipation [18] (Figure 6).

Treatment. The treatment of constipation and fecal incontinence is discussed in Chapter 3.

The prokinetic agent cisapride improves both symptoms and accelerates colonic transit time in patients with PD and constipation. Psyllium has been shown to increase stool frequency and weight, but did not increase colonic transit or anorectal function in PD patients with confirmed constipation. A diet rich in insoluble fiber produced a significant improvement in constipation, as indicated by an increase in stool frequency and an improvement in stool consistency [19].

Pelvic floor relaxation problems and paradoxical puborectalis contraction may respond to dopaminergic drugs; however, some patients may still experience evacuation difficulties. A study using rectal manometry and defecography showed that apomorphine (a D1/D2 agonist) improved defecatory dysfunction in PD [20]. The effect was not antagonized by domperidone, a peripheral type dopamine blocker that does not penetrate the blood-brain barrier, but two of five patients showed marked hypotension on defecation. Although not described in detail, L-Dopa and other dopamine agonists are also reported to

KEYPOINTS:

- Several mechanisms may cause constipation in MSA, including reduced small and large bowel motility and chronic rectal impaction leading to decreased colorectal sensation or paradoxical contraction of the puborectal muscle during attempts at defecation.
- In his classic monograph, James Parkinson described the bowel dysfunction of shaking palsy: "the bowels which all along had torpid, now in most cases, demand stimulating medicines of very considerable power: the expulsion of the feces from the rectum sometimes requiring mechanical aid."

CASE 4

History: A 71-year-old man had a 10-year history of headache, dizziness and occasional syncope on standing, which was gradually worsening. He had also noticed decreased sweating and experienced considerable discomfort during the summer time. In addition, he had nocturia and symptoms of voiding dysfunction, but had a normal size prostate. He had no gait difficulty or speech disturbance at all.

Examination: Neurological examination did not reveal cerebellar ataxia, parkinsonism or pyramidal signs and deep tendon reflexes were preserved. However, the head-up tilt test revealed marked postural hypotension, with a blood pressure fall (from 140/80 lying to 75/50 mm Hg standing) accompanied by dizziness.

Management: Cystometry revealed detrusor areflexia with a large postmicturition residual. The patient was commenced on CISC with good symptomatic benefit.

Comment: This elderly patient has long-standing, widespread autonomic failure with bladder involvement, but lacks any other neurological abnormality, so he was therefore diagnosed as having pure autonomic failure (PAF).

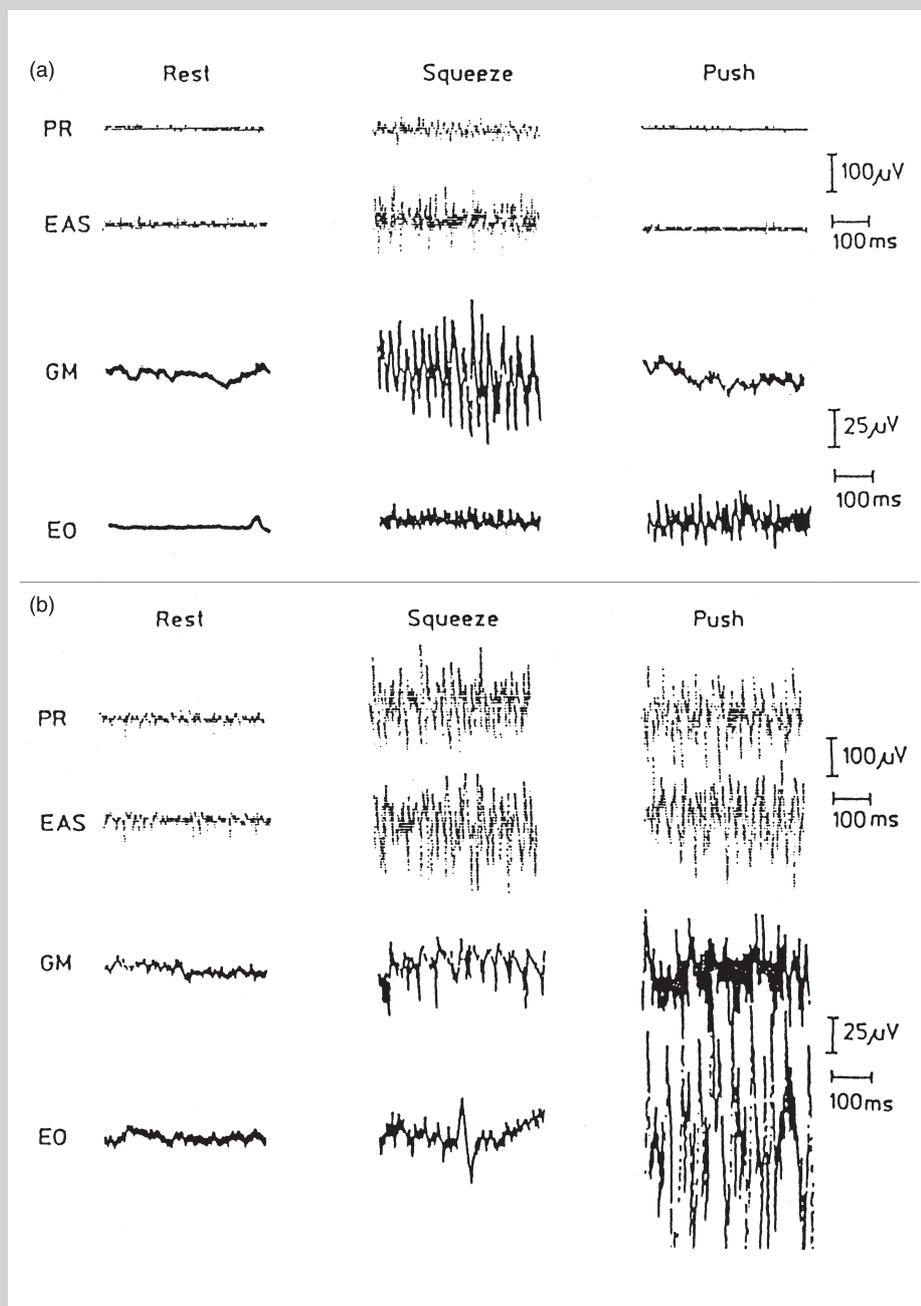


FIGURE 6 Paradoxical anal sphincter muscle contraction. (a) Control patient. EMG recordings from puborectalis (PR), external anal sphincter (EAS), gluteus maximus (GM) and external oblique (EO) muscles at rest, during voluntary sphincter contraction (squeeze) and during simulated defecation straining (push). A normal pattern of sphincter muscle inhibition is seen during straining. (b) Parkinson's disease with constipation. Paradoxical sphincter muscle contraction and gluteal recruitment during straining.

From Mathers S et al. Constipation and paradoxical puborectalis contractions in anismus and Parkinson's disease: a dystonic phenomenon? *J Neurol, Neurosurg Psychiatry* 1988;51:1503-7.

be effective on defecatory dysfunction in PD, particularly in the early stage. Dopamine may modulate defecatory function via central neural pathways.

SEXUAL DYSFUNCTION AND ED IN MEN

MSA. A well-documented feature of MSA is that the first symptom in men is often ED. This usually predates the onset of any other neurological symptoms by several years [4] and is quite separate from the development of postural hypotension. Preserved erectile dysfunction is a clinical feature strongly against a diagnosis of MSA. It is not known why ED should be such an early and constant feature in MSA.

PD. Estimates of the prevalence of erectile dysfunction in patients with PD show that it is a significant problem, affecting 60% of a group of men compared with an age-matched healthy group without PD in whom the prevalence was 37%. In the same study, ED preceded the onset of PD in 17%, although the author concludes "the five cases ... may actually represent cases of MSA", whereas in another study, ED was found to affect men with PD only some years after the neurological disease had been established [21].

A survey of young patients with PD (mean age 49.6 years) and their partners revealed a high level of dysfunction, with most severely affected couples being those in which the patient was male. ED and premature ejaculation was a complaint in a significant proportion. In general terms, however, sexual dysfunction appeared to be multifactorial with no simple single cause identified [22].

Treatment. The treatment of ED is discussed in Chapter 4.

Special care must be taken to recognize autonomic failure causing postural hypotension in men with parkinsonism and MSA since it has been shown in a small number of patients with this combination that sildenafil exacerbated the hypotension.

Apomorphine has been used by men with PD to improve sexual function [23]. Bromocriptine (a D2 receptor agonist) decreases serum level of prolactin, which is shown to improve erectile dysfunction with hyperprolactinemia. Dopamine agonists may also cause hypersexuality, although the frequency with which this occurs has not been well documented.

KEYPOINTS:

- A well-documented feature of MSA is that the first symptom in men is often ED.

CASE-ORIENTED MULTIPLE CHOICE QUESTIONS

- ▶ A 52-year-old man with a resting tremor and rigidity of the right hand was diagnosed as having Parkinson's disease. Ten years after the onset of symptoms, he gradually developed urinary urgency with frequency and nocturia.

What is the most likely cause of his bladder symptoms?

- A. Detrusor hyperreflexia.
- B. A poorly compliant bladder.
- C. An atonic bladder.
- D. Stress urinary incontinence.
- E. Detrusor instability secondary to prostatic obstruction.

The answer is A. Detrusor hyperreflexia is common in Parkinson's disease because bladder function is affected by input from supra-nuclear areas, including the nigrostriatal dopaminergic system. The nigrostriatal neurons probably influence the pontine micturition center (PMC) via GABAergic inhibitory mechanism.

- ▶ A 60-year-old man was referred with a short-step, festinating gait, rigidity of both hands and a postural tremor. He also had urge urinary incontinence and symptoms of voiding dysfunction with postmicturition residuals of 320 ml. He was thought to have a Parkinsonian syndrome by the referring clinician. Cystometry revealed a poorly compliant bladder, with detrusor areflexia and detrusor-sphincter dyssynergia (DSD). External sphincter EMG showed neurogenic motor unit potentials.

Which is the correct diagnosis?

- A. Parkinson's disease.
- B. Multiple system atrophy.
- C. Multiple cerebral infarction.
- D. Benign prostatic obstruction with detrusor instability and Parkinson's disease.
- E. Detrusor areflexia and Parkinson's disease.

The answer is B. This constellation of symptoms is not typical of Parkinson's disease, particularly because a resting tremor and evidence of laterality are absent. Urodynamic studies revealed detrusor areflexia with DSD, and the sphincter EMG showed neurogenic motor unit potentials. All of these are the features of MSA, not of Parkinson's disease.

Multiple choice questions
continued ▶

NEUROLOGIC BLADDER, BOWEL AND SEXUAL DYSFUNCTION

Multiple choice questions
continued

- A 58-year-old man presented with frequent fainting episodes that tended to occur when standing from the sitting position and also when walking up stairs. He also complained of faintness after urination and after meals. Over the preceding 2 years he had worsening genitourinary problems with erectile dysfunction, urinary urgency and nocturia. A year after presentation, he developed an abnormal gait and a mild speech disturbance. Examination demonstrated a mild gait ataxia and rigidity of the hands with preserved deep tendon reflex. On standing, his blood pressure fell from 130/80 to 82/60 mm Hg without an increase in the heart rate.

Which is the patient's diagnosis?

- A. Autonomic failure with multiple system atrophy.
- B. Autonomic failure with Parkinson's disease.
- C. Pure autonomic failure.
- D. Diabetic autonomic neuropathy.
- E. Amyloidosis.

The answer is A. All the above disorders can present with widespread autonomic failure; however, this patient was diagnosed with MSA, because of the cerebellar and extrapyramidal involvement and preserved deep tendon reflexes. Other typical presenting features are vocal cord paresis, sleep apnea syndrome, constipation and hypohidrosis.

- A 42-year-old nulliparous woman had a 2-year history of intractable urinary frequency and incontinence. The incontinence occurred when coughing, washing her hands and carrying a heavy load. She also had a shuffling gait and difficulty speaking. Examination demonstrated mild parkinsonism, limb ataxia, exaggerated deep tendon reflexes and postural hypotension. On ultrasonography of the bladder, there was no postmicturition residual urine. The urethral pressure profile showed low maximum urethral closure pressure (UP_{max}) and Valsalva straining with 150 ml in the bladder demonstrated leakage at a low abdominal leak point pressure.

Which type of urinary incontinence is most likely in this patient?

- A. Urge incontinence (secondary to detrusor instability).
- B. Genuine stress incontinence.
- C. Overflow incontinence.
- D. Neurogenic incontinence (secondary to detrusor hyperreflexia).
- E. Mixed incontinence.

The answer is B. Despite the fact that she is nulliparous, the incontinence occurred during conditions where intra-abdominal pressure rises. A low abdominal leak point pressure (on cystometry) combined with a low maximum urethral closure pressure (on urethral pressure profilometry) indicate that there is an intrinsic weakness in the external sphincter. In relation to the co-existing neurological symptoms and signs, the patient was diagnosed with MSA.

- A 71-year-old man had a 10-year history of headache, dizziness and occasional syncope on standing. He also had nocturnal urinary frequency and decreased sweating. On examination, the gait was normal and deep tendon reflexes and speech normal. There was no evidence of cerebellar ataxia, parkinsonism or pyramidal signs. However, the head-up tilt test revealed marked postural hypotension.

What is the diagnosis of this patient?

- A. Autonomic failure with multiple system atrophy.
- B. Autonomic failure with Parkinson's disease.
- C. Pure autonomic failure.
- D. Diabetic autonomic neuropathy.

The answer is C. This patient has widespread autonomic failure, but he has no other neurological abnormality.

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This study found no statistical difference between the sphincter motor units of patients with MSA and PD and in particular did not find the highly prolonged motor units other studies have reported.
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NEUROLOGIC BLADDER, BOWEL AND SEXUAL DYSFUNCTION

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