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Title (type in CAPITAL LETTERS, leave one blank line before the text) CORRELATION BETWEEN MICTURITION SYMPTOMS, URODYNAMIC FINDINGS AND CRANIAL AND SPINAL MAGNETIC RESONANCE IMAGING FINDINGS IN MULTIPLE SCLEROSIS
Aims of Study Because multiple sclerosis (MS) can affect any level of the central nervous system (CNS), urinary problems are common among MS patients and can differ from patient to patient. Approximately 10% - 20% of patients with MS have primary progressive MS (PPMS). The aim of the present study was to investigate the relationship between voiding dysfunction and clinical parameters and to study the correlation between micturition disturbances and both cranial and spinal MRI examination including volumetric parameters.
Methods 25 consecutive patients with PPMS (13 males and 12 females, mean age 50.9 ±10 years) were recruited to the study. Mean duration of MS was 12 years (range 3-36). Voiding complaints were asked, patients underwent full urodynamic investigation conforming to the standards of ICS, and MRI examination. From the cranial MRI examination the volumes of T1- and T2-weighted plaques, total intracranial volume and relative brain atrophy were defined. From the spinal MRI examination the number of the cervical and thoracic plaques, the total spinal volume and relative spinal atrophy were defined. Diffuse T2-weighted lesions were calculated from both cranial and spinal cord MRI images. The diffuse lesions were put in the classes by the location of the lesion: frontal, temporal, parietal, occipital, basilar pons, mesencephalon, vermis, hemisphere cerebelli, cervical spinal cord and thoracic spinal cord. For statistical analysis correlations were calculated as Spearman's rank correlation coefficient and Mann-Whitney test was used to compare the differences between groups.
Results All the patients had some micturition complaints, urgency (84%), urge incontinence (76%), frequency (56%), nocturia (40%) and stress incontinence (32%) being the most common ones. There was no difference between the genders. Only 3 patients had normal finding in urodynamic investigation. Detrusor hyperreflexia was more common among men than women.

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Urodynamic finding	Whole Group		Men		Women		P
	No.	%	No.	%	No.	%	
Detrusor hyperreflexia	15	60	11	85	4	33	0.030
Hypotonic detrusor	4	16	1	8	3	25	0.470
Detrusor with normal activity	6	24	1	8	5	42	0.152
Detrusor sphincter dyssynergia	17	68	8	62	9	75	0.755
Obstruction	15	60	10	77	5	42	0.089

Frequency and urge incontinence had no association with the MRI parameters. The association was, however, found between urgency and the total spinal CSF (cerebrospinal fluid) volume ($p=0.025$). The total spinal CSF volume was larger in patients with nocturia ($p=0.019$) and they also had more relative spinal atrophy ($p=0.01$). The patients with stress incontinence had more diffuse brain lesions in parietal lobes ($p=0.009$).

There was a weak association between detrusor hyperreflexia and volume of the T2-weighted plaque volume ($p=0.036$). Hypotonic detrusor was associated with the total brain volume ($p=0.019$) and number of thoracic plaques ($p=0.019$). A significant correlation was found between detrusor sphincter dyssynergia (DSD) and the T2-weighted plaque volume ($p=0.009$) and a weak association between DSD and the number of spinal plaques ($p=0.034$).

Conclusions

Voiding symptoms were very common among MS patients and did not correlate with urodynamic findings. Spinal MRI correlated better with voiding symptoms and urodynamic findings than cranial MRI. Especially spinal atrophy was of importance in micturition disturbances. However, based on MRI examination it is not possible to characterize the quality or severity of micturition dysfunction. Therefore, urodynamic investigation is needed before making decision of treatment.