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The association between spasticity and urinary incontinence and impact on quality of life in patients v

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Abstract: Background and objectives: Based on the literature, up to 80% of multiple sclerosis patients develop spasticity, urinary problems occur up to 90%. Spasticity and bladder dysfunction most likely represent different manifestations of the same underlying pathology, i.e. damage to the descending tracts in the spinal cord. **The aim** of the study was to evaluate the links between the spasticity and bladder dysfunction and quality of life in patients with multiple sclerosis. **Materials and Methods**: a cross-sectional study was performed at Lithuanian University of Health Sciences, Department of Neurology from January 15, 2017 to March 15 2018. Inclusion criteria: 18 to 65 years old; multiple sclerosis diagnosis confirmed by updated McDonald Diagnostic Criteria (2017). Spasticity was evaluated using the MAS scale. Urination disorders assessed by OABSS scale and obstructive symptom questionnaire. Quality of life assessed with SF-Qualiveen scale. The analysis was performed with SPSS statistical package**. Results**: Men and women with increased spasticity had a higher EDSS score. Women with spasticity were older, men had longer disease duration. Patient with higher spasticity had more intense bladder dysfunction. Patients with spasticity were associated with greater incidence of urinary incontinence with retention. Patients with spasticity had higher urinary tract infection rate and lower glomerular filtration. Patients with spasticity had more obstructive urinary tract symptoms. Patients with higher spasticity had a lower quality of life**. Conclusions**: The relationship between spasticity and investigated objects support the hypothesis that spasticity is associated with an increase in the external urethral tone that leads to urinary retention and its related complications.

Keywords: Multiple sclerosis; spasticity; urinary incontinence.

Introduction

Multiple sclerosis (MS) is an inflammatory autoimmune neurodegenerative disease of the central nervous system (CNS), which has onset in young adults [1,2,3,4]. MS is the most common severely disabling neurological condition. One of the major determinants of functional disability is spasticity [5,6,7,8]. Spasticity with MS usually occurs with movement disorders, pain, sleep disorders, muscle spasms [9]. Also, patients with MS with spasticity are more likely to develop urinary incontinence [10]. Some research suggests that these two symptoms may be related and affect each other's development. More detailed research is necessary to examine the interactions and relationship of these symptoms. There are just a few studies on the association between spasticity and other symptoms of multiple sclerosis [10, 11, 12,]. Studies that investigate the association of spasticity with urination disorders and their complications (urinary tract infections, renal insufficiency) have not been performed. In Lithuania, there is no scientific research that would examine spasticity and urinary problems and their relations to MS. Therefore, it would be important to identify the links between these factors, because it can affect the diagnostics and treatment of spasticity, urinary incontinence and their complications.

Materials and Methods

Participants and Ethical Considerations

The study was performed at the Lithuanian Health Sciences University Hospital Kaunas Clinics Neurology Department from January 15, 2017 to March 15 2018. The type of research is observational analytical cross-sectional study. To the study were included patients, aged from 18 to 65 years; diagnosed with MS, confirmed by updated McDonald's criteria (2017) [13]. Patients with chronic urinary system diseases such as non-neurogenic urinary tract disorders (benign prostatic hyperplasia, other bladder and urethra diseases that could cause obstruction) were excluded from the study. The informed consent form was signed by each patient before the study. The study was approved by the Ethics Committee of Biomedical Research of the Lithuanian University of Health Sciences No. BEC-LSMU(R)-2b.

Study Procedures

In the study an anonymous questionnaire was used. The composite questionnaire consisted of 2 parts: demographic data (age, gender) and clinical data (disease course, duration of the symptoms, disability status) and the findings of all paraclinical tests were collected for all patients. Disability was measured using the Kurtzke Expanded Disability Status Scale (EDSS). The patients were followed up prospectively. In the study, all available patients' medical documentation were reviewed. The glomerular filtration rate was calculated using the Cockcroft-Gault formula.

Spasticity Evaluation - A Modified Ashworth Scale was used. This scale evaluates the resistance of passive joint movement. The passive movement is performed in 1 second (number '21' is said in mind) and repeated three times. Muscle tension is evaluated in scores from 0 to 4: 0 - no muscle tone increase; 1 - slight increase in muscle tone in rapid movement, absent or maintains minimal resistance at the end of the movement, in flexion-extension; 1+ - slight increase in muscle tone, rapid movement, with minimum resistance in less than half a of movement; 2 - Significant increase in muscle tone during full motion, but the limb moves easily; 3 - Significant increase in muscle tone, difficult to perform passive movement; 4 - the damaged part of the body is rigid in flexion-extension.

Urinary incontinence assessment. For the evaluation of the neurogenic hyperactive urinary bladder symptoms, its intensity and frequency we used the "Overactive Bladder Symptom Score" (OABSS) [14]. This scale is published in the foreign scientific literature and is used as one of the most convenient and accurate tool for assessing the severity of the symptoms of the overactive bladder. Patients were asked to indicate their urinary system in the past week;

the final result was the sum of four questions. The Obstructive Urinary Symptom Questionnaire was used to evaluate the severity of detrusor-sphincter dyssynergia. Questions: "Do you have urinary retention?"; "Is it hard to start urinating?"; "Do you have a feeling that you have not completely emptied your bladder?"; "Are you suffering from inconstant, intermittent, weak urinary flow?"; "Do you ever use abdominal compressions to trigger urinary reflex?". The Likert scale of 5 points (1 - never, 2 - rarely, 3 - sometimes, 4 - often, 5 - always) was chosen for the assessment of the questionnaire questions. The severity of the obstruction was assessed using the sum of five points. The higher the number of scores, the greater the bladder obstruction [15,16].

Life quality assessment was evaluated using the SF-Qualiveen scale. The scale consists of four pairs of questions. They are used to evaluate 4 aspects: anxiety, fear, feelings and limitations. The Likert scale of 5 points (1 - never, 2 - rarely, 3 - sometimes, 4 - often, 5 - always) was chosen for the assessment of the questionnaire questions. The final score was the sum of points of the 8 questions [14].

Statistics

Statistical analysis was performed using SPSS 24.0 statistical package. The dependence of quantitative data of the normal distribution assessed by histograms and the Shapiro-Wilk test. The Student T-test was used to compare the average of the two independent populations. The chi ($\chi 2$) criterion was used to compare qualitative data. The mean of quantitative data between several independent populations was compared using ANOVA. The data is given displaying the mean values with standard deviation, median or percentage. When the variables did not meet the condition of normal distribution, a nonparametric statistical hypothesis verification method Mann-Whitney U (for the variable between two groups) was used. The correlation between the symptoms is determined by the correlation coefficients of Spearman and Kendall. The difference was considered statistically significant when $p < 0.05$.

Results

Demographic and clinical characteristics of patients with multiple sclerosis and their interactions. The demographic characteristics of patients with MS are presented in Table 1. The study involved 63 patients (42 women and 21 men) with relapsing-remitting (RR) (93.73%) and secondary progressive (SP) (7.27%) forms of MS. Two of these patients were not included in the study because they were diagnosed with benign prostatic hyperplasia. The spasticity was observed in 57.38% of patients with MS. Urinary incontinence was present in 83.60% of patients with MS. The specific treatment for urinary incontinence was prescribed for 51.40% of patients. The progression of the disease, duration, EDSS, the incidence of spasticity, intensity, type of urination disorder between women and men did not differ.

Gender Demographical and clinical characteristics	Female	Male	p value
Age, years ± SD	47.80±13.82	48.11±13.85	n.s
Course of disease	90.20% RR 9.80% SP	100% RR 0% SP	n.s
EDSS ± SD	4.39±1.56	4.85±1.41	n.s
Duration of disease ± SD	11.40±7	9.95±7.32	n.s
Spasticity	59.50%	52.60%	n.s
Severity of spasticity (sum of score in 4 joints)	2±2.48	1.90±2.97	n.s
Urination disorders			
- Urinary incontinence	19.50%	38.90%	n.s
- Urinary incontinence/retention	65.90%	38.90%	n.s
- No urination disorders	14.60%	22.20%	n.s

[1] MS – multiple sclerosis; SD – standard deviation, RR – relapsing–remitting; SP – secondary progressive; n.s. – not statistically significant

Table 1. Distribution of demographic and clinical characteristics of patients with MS in terms of gender.

The relationship between the demographic and clinical characteristics with spasticity in patients with multiple sclerosis.

Women and men who had spasticity also had a higher functional disability (p=0.001; p=0.04). Women who were diagnosed with spasticity were older than women who did not have spasticity (p=0.01). Men who had spasticity, the duration of the disease was longer than those who did not have spasticity (p=0.021). The data is shown in Table 2.

Demographical and clinical characteristics	Group with spasticity (N=35)		Group without spasticity- (N=26)		p value
	Female N=25	Male, N=10	Female, N=17	Male, N=9	
Gender, %	71.48	28.60	65.40	34.60	n.s.
Age, years ± SD	53.63±10.58*	51.20± 12.41**	39.06± 13.75 *	44.67± 15.27**	*p=0.01 **n.s
EDSS ± SD	5.22±1.16*	5.50±0.97**	3.09±1.19*	4.13±1.53**	*p=0.001 **p=0.04
Duration of disease ± SD	12.84±0.39*	13.50±8.30**	9.29±6.13*	6±3.16**	*n.s **p=0.021

MS – multiple sclerosis; SD – standard deviation, n.s. – not statistically significant.

Table 2. Comparison of demographic and clinical characteristics of patients with multiple sclerosis with spasticity and patients without spasticity by gender.

The relationship between spasticity and the severity and intensity of urinary incontinence.

Patients with multiple sclerosis and higher spasticity had more severe urination disorders (p=0.01; r=0.325) (figure 1).

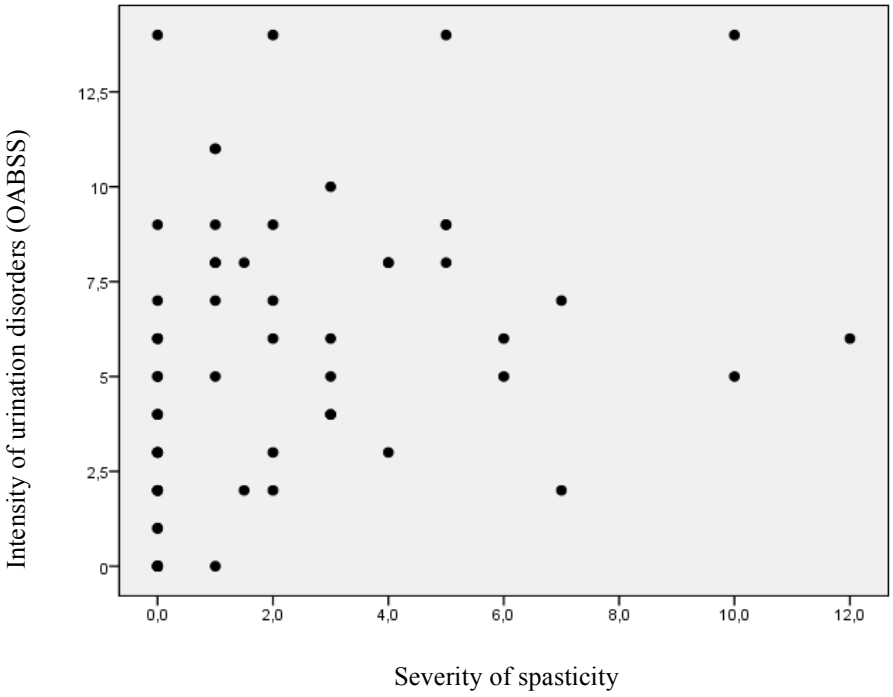

Figure 1. Association between severity of spasticity and intensity of urination disorders.

In patients with MS and spasticity, incontinence and retention symptoms were more commonly observed than in patients with no spasticity (p=0.003) (figure 2).

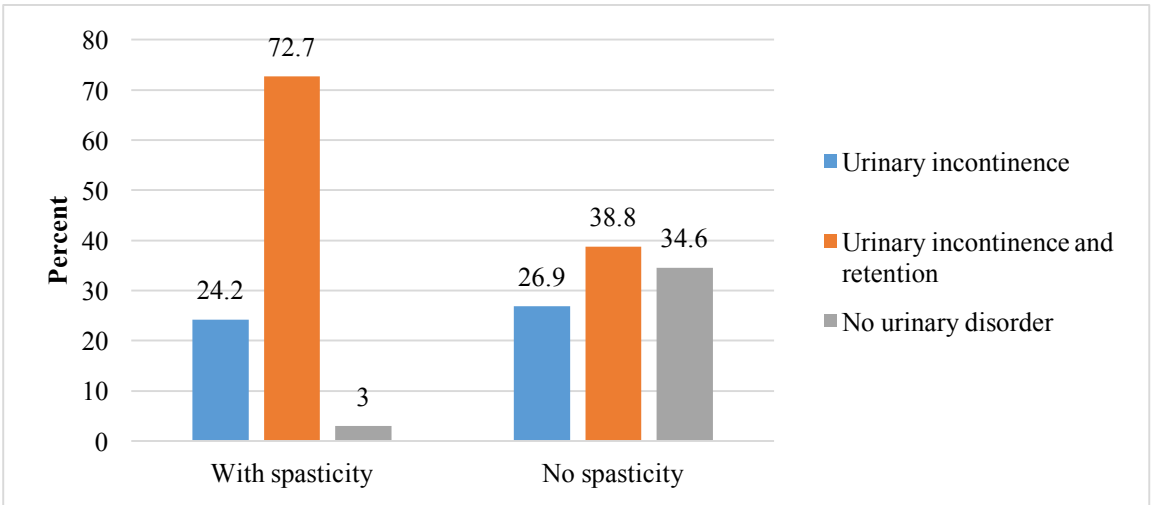

Figure 2. Association between spasticity and different types of urination disorders.

Association between spasticity and urinary tract infections.

Urinary tract infections (UTI) were more common in patients with spasticity than those with no spasticity (34.30% and 11.50%, respectively) (p=0.038) (figure 3).

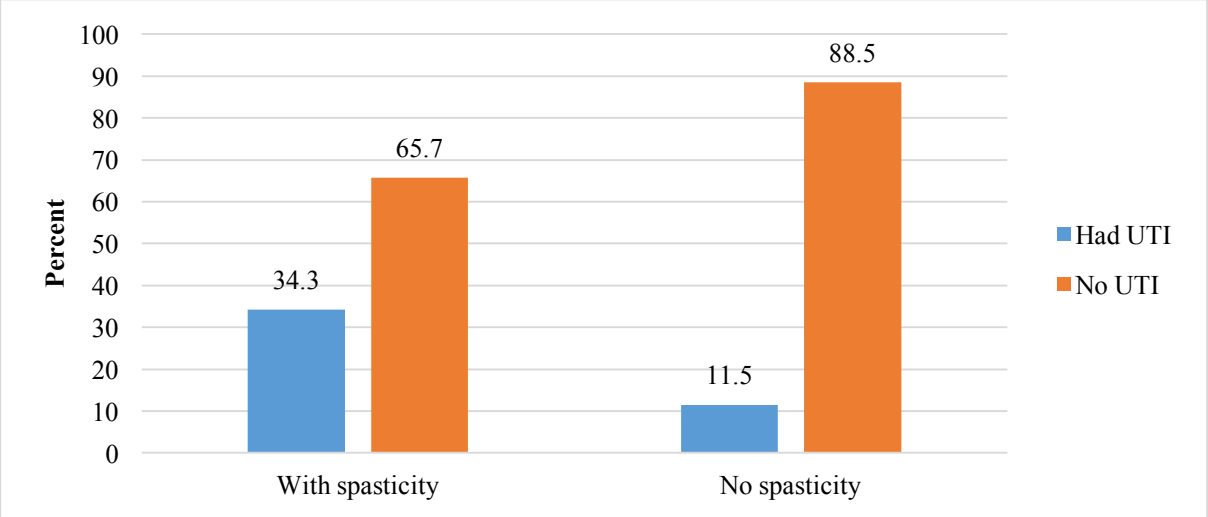

Figure 3. Association of spasticity and urinary tract infections (UTI).

The association between spasticity and glomerular filtration rate.

In patients with MS and spasticity, the mean glomerular filtration rate was lower than patients with no spasticity (77.17±16.8 ml/min/1.73m^2 and 94.38ml/min/1.73 m^2; p=0.001) (figure 4).

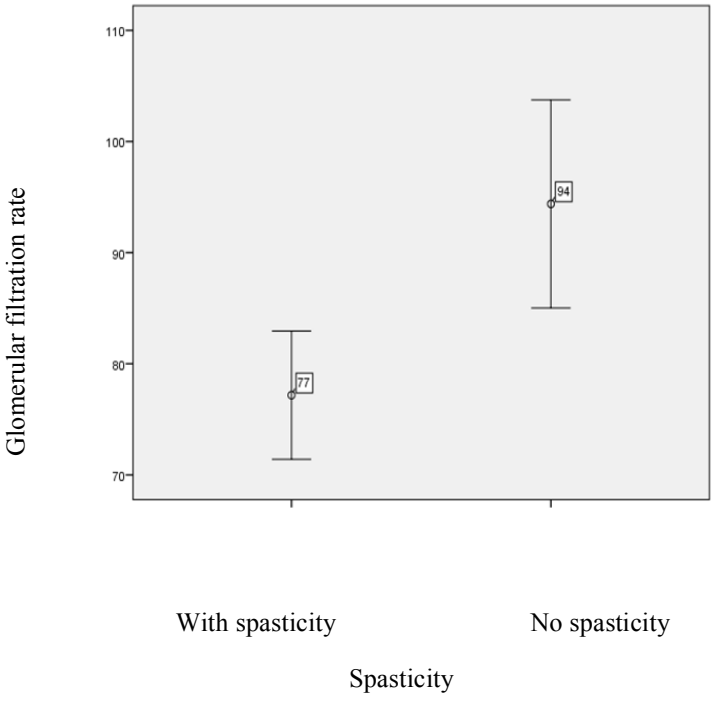

Figure 4. Association between spasticity and glomerular filtration rate.

Association of spasticity with obstructive urinary symptoms.

Obstructive urinary symptoms were more severe in patients with MS and spasticity (12.60±5.29 and 9.27±4.12, respectively) (p=0.017) (figure 5).

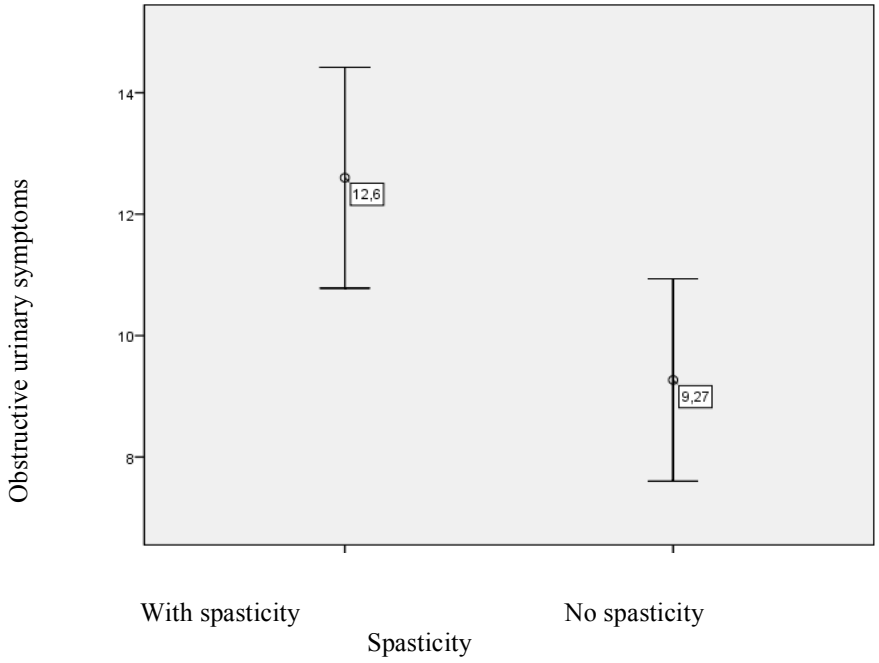

Figure 5. Association of spasticity with obstructive urinary symptoms.

The relationship between spasticity and quality of life of patients with urination disorders.

Patients with multiple sclerosis and higher intensity spasticity had a lower quality of life (p=0.005; r=0.355) (figure 6).

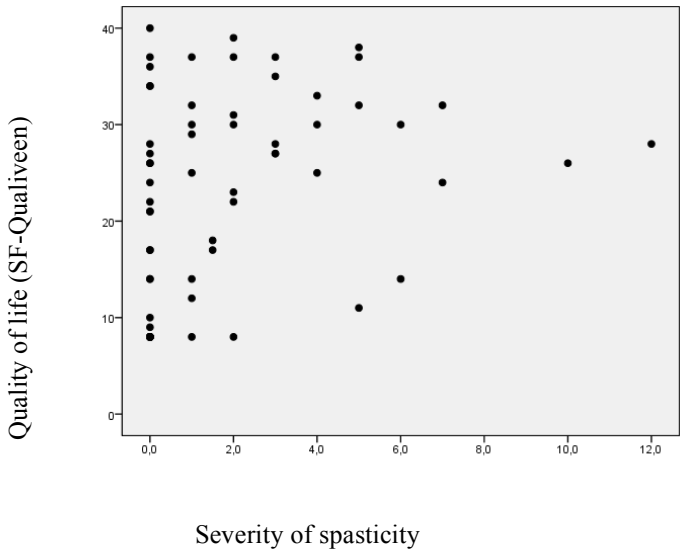

Figure 6. The relationship between spasticity and quality of life of patients with urination disorders.

Discussion

In Lithuania, a study which analyses the relationship between spasticity and urinary incontinence in patients with MS was made for the first time, therefore the results of this study could be significant and useful in clinical practice on the treatment of spasticity, urination disorders and complications prevention. The group of research subjects consisted of 61 patients with MS, but larger groups of patients would help to collect more accurate data on the relationship between spasticity and urination disorders.

The relationship was established between spasticity and urinary incontinence and urinary retention symptoms, the severity of urinary incontinence, obstructive urinary symptoms, urinary tract infections incidence, and poorer renal function substantiates the hypothesis in the literature that spasticity is associated with an increase in the external urethral sphincter tone that causes urinary retention, obstruction and its complications. Furthermore, some study says that voiding symptoms are less prevalent in the older age of female patients with MS population than in male patients with MS [17]. However, in our study, spasticity was associated with other clinical data (greater disability of men and women, longer duration of men's disease) and demographic factors (older women's age), and these factors could have had an effect on the outcomes: the older age group of the patients in the spasticity group could have worse kidney function.

In our study, spasticity was determined in more than half of the subjects, and literature sources provide similar data [5,18]. Like in other authors' studies, spasticity was found most often in the lower extremities, but can also be detected in the upper extremities. Urine incontinence with urinary retention was the most common type of urinary disorder. According to the author's data, especially this type of disorder indicates detrusor-sphincter dyssynergia (DSD), which in clinical trials is up to two thirds of patients with MS [16,19]. In our study, patients experienced either a combination of urinary incontinence or urinary incontinence and retention symptoms; isolated urinary retention has not been observed. These results coincide with literature data that detrusor hyperreflexia develops primarily in patients with MS, and DSD develops later. Diagnosis of obstructive symptoms, which also indicates urinary retention and possible DSD, was higher in patients with spasticity in the group. These results coincide with the clinical studies that examined the relationship between spasticity and urination disorders after spinal cord injury [11, 12]. The obtained data support the hypothesis that the spasticity of patients with MS, may affect not only the skeletal muscles, but also the muscle of the external urethral sphincter, this is a pathophysiological DSD link. Patients can not voluntarily relax the external urethral sphincter which causes symptoms of obstructive urinary due to urination disorders. The obstruction increases the volume of residual urine and forms a vesicoureteral reflux. With a reversible urinary flow, the risk of urinary tract infection is increased [15]. Our study also identified the relationship between spasticity and (urinary tract infections) UTI incidence - patients with diagnosed spasticity were more likely to have UTI. Further studies are needed to analyze the direct effect of UTI on spasticity, since it is believed that the afferent stimulation of the inflammatory bladder could increase spasticity. This would explain why spasticity may be increased in patients with UTI [20]. Damage to kidney parenchyma is suspected due to vesicoureteral reflux and frequent UTI and eventually develops chronic renal failure [16]. Our results showed that spasticity was associated with poorer renal function. The fact that due to the spastic external urethral sphincter, the subclinical kidney function insufficiency is also present in other clinical studies [19,21]. It has also been found that the higher degree of spasticity in the limbs was related to the more severe of urination disorders. The fact that the higher the spasticity was, the more severe the urination disorders, other sources of literature have found it too [16]. Also, in literature it is said that there is link between urination disorders and severity of disability [22,23].

It was found that the higher the spasticity in the limbs, the lower the quality of life of patients with urination disorders. The obtained correlation shows that spasticity, by affecting urination disorders, affects the quality of life of patients with MS [24]. Patients are worried about possible exacerbations of urination disorders, poor smell of urine, and feeling of embarrassment due to urination disorders, unable to get out of the home without thinking about the next urination. According to the research data, even 83.6% patients had urinary disorder. Only half of them were prescribed specific drugs for the treatment of urination disorders. Perhaps it's uncomfortable for the patient to focus on these symptoms and they are not always taken into consideration. Doctors often do not measure the type of urinary disorder. In MS the detrusor's hyperactivity and urinary incontinence develops primarily, urinary retention (detrusor-sphincter dyssynergia) develops in the course of the illness. In that case urination disorders should be re-evaluated during disease course. Based on our study, spasticity could be one of the factors that causes the development of external sphincter hypertonia and urinary retention in the patients with MS. Thus, the early diagnosis of obstructive urinary symptoms would allow us to think about the use of antispasmodics, since very often patients are only treated with antimuscarinic drugs that are only suitable for urinary incontinence also for overactive bladder, antimuscarinics are the first option, and more recently, beta-3-receptor agonists have become available and can be useful either as an add-on or stand-alone treatment [25].

Conclusions

Men and women with spasticity were more likely to have more severe functional disability. Women who were diagnosed with spasticity were older age. In men who experienced spasticity, the duration of the disease was longer. Patients with multiple sclerosis and higher spasticity had more severe urination disorders. Patients who had spasticity were more likely to experience urinary incontinence and urinary retention symptoms. Patients with spasticity were more likely to have urinary tract infections during the course of the disease and had a lower glomerular filtration rate. Patients with spasticity were more likely to have more severe obstructive urinary symptoms. Patients with multiple sclerosis and higher spasticity had a poorer quality of life.

Author Contributions

The individual contributions of the authors to the manuscript are equal.

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Conflicts of Interest

The authors declare no conflict of interest.

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