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Bladder Rehabilitation Follow-up Study in Multiple Sclerosis Patients

Multipl Skleroz Hastalarında Mesane Rehabilitasyonu Takip Çalışması

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ABSTRACT Objective: This study aimed to compare the results of the initial and follow-up urodynamic tests in multiple sclerosis (MS) patients, evaluate the effectiveness of the recommended medical and non-medical treatment methods, and assess the patients' compliance with the treatment. **Material and Methods:** Twenty-four patients with MS were included in the study. The urodynamic analyses of the patients were conducted retrospectively using their laboratory outcomes. **Results:** While only 8.3% of patients required medical treatment for neurogenic bladder before the initial urodynamic examination, all patients were recommended medical treatment after the examination. There was an increase in maximum cystometric capacity, a decrease in detrusor pressure at maximum cystometric capacity, and a decrease in maximum detrusor pressure at the follow-up urodynamic examination compared to the initial one, all exhibiting a significant difference ($p=0.044$, $p=0.049$, and $p<0.001$, respectively). The follow-up urodynamic examination results revealed a statistically significant decrease in the storage problem and preserved sensation of bladder fullnes, whereas it exhibited a statistically significant increase in the emptying problem ($p<0.001$, $p<0.001$, and $p=0.004$, respectively). **Conclusion:** Based on the initial urodynamics results, we concluded that the management of neurogenic bladder dysfunction in MS patients was inadequate, and that there were improvements in the follow-up urodynamics with the recommended medical and non-medical treatment methods. Due to the progressive nature of MS, the urinary system of the patients diagnosed with the disease should be evaluated periodically and their treatment should be rearranged when necessary.

Keywords: Multiple sclerosis; lower urinary tract dysfunction; follow-up urodynamics

ÖZET Amaç: Bu çalışmada, multipl skleroz (MS) hastalarında, ilk ürodinami ve takip ürodinami sonuçlarının karşılaştırılması, önerilen medikal ve nonmedikal tedavi yöntemlerinin etkinliğini ve hastaların tedaviye uyumunun değerlendirilmesi amaçlandı. **Gereç ve Yöntemler:** Çalışmaya 24 MS hastası dâhil edildi. Hastaların ürodinamik analizleri laboratuvar sonuçları kullanılarak retrospektif olarak yapıldı. **Bulgular:** İlk ürodinamik inceleme öncesi hastaların sadece %8,3'ü nörojenik mesane için medikal tedavi kullanırken, ilk ürodinamik inceleme sonrası hastaların tamamına nörojenik mesaneye yönelik medikal tedavi önerildi. Kontrol ürodinami incelemesinde ilk ürodinami incelemesine göre maksimum sistometrik kapasitede artış, maksimum sistometrik kapasitedeki detrüsör basıncında azalma ve maksimum detrüsör basınçtaki azalmada istatistiksel olarak anlamlı farklılık tespit edildi (sırasıyla $p=0,044$, $p=0,049$ ve $p<0,001$). Kontrol ürodinamik incelemede, hastaların depolama sorunu ve korunmuş doluluk duyusunda istatistiksel olarak anlamlı azalma saptanırken, boşaltma sorununda istatistiksel olarak anlamlı artış tespit edildi (sırasıyla $p<0,001$, $p<0,001$ ve $p=0,004$). **Sonuç:** İlk ürodinami sonuçlarına göre MS hastalarında nörojenik mesane disfonksiyonu yönetiminin yetersiz olduğu, önerilen medikal ve nonmedikal tedavi yöntemleri ile takip ürodinamilerde düzelmelerin olduğu belirlenmiştir. MS hastalığının ilerleyici özelliğinden dolayı hastalar üriner sistem açısından belirli aralıklarla değerlendirilmeli ve gerekirse tedavileri yeniden düzenlenmelidir.

Anahtar Kelimeler: Multipl skleroz; alt üriner sistem disfonksiyonu; takip ürodinami

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Multiple sclerosis (MS) is an autoimmune, inflammatory, and progressive disease characterized by demyelinated plaques in the central nervous system. Although MS rarely affects the urinary system at the early stage, it affects the lower urinary tract (LUT) over time and may also cause damage to the upper urinary system since it is a progressive neuro-demyelinating disease.[1-5] LUT symptoms (LUTS) are the first observed symptoms in 3-10% of MS patients, and 75-96% of the patients have been reported to develop LUTS eight to 10 years after diagnosis.[1-3,6] Urodynamic tests have revealed abnormal findings in 52% of MS patients who had no urologic complaints, while this rate has been reported as 98% in patients with urologic complaints.[7] Although lower urinary system dysfunction is rarely a life-threatening condition, it impacts the quality of life and may cause damage to the upper urinary tract as it progresses.[1,8,9] Researchers recommended a detailed history and physical examination, and if necessary urodynamic tests, to evaluate the urinary system in MS patients.[10,11] A urodynamic experts study group stated that while urodynamics is an important diagnostic tool in evaluating the urinary system for MS patients and useful for evaluating LUT dysfunction (LUTD) in high-risk patients, studies with a high level of evidence are required to support urodynamics follow-up protocol in the long term.[11] Since MS is a progressive neuro-demyelinating disease, the urinary system of the patients diagnosed with the disease should be evaluated as early as possible, their appropriate treatment should be planned, and they should be followed up at regular intervals. Thus, urinary system complications that may develop in these patients can be prevented and their quality of life can be improved.

Researchers have reported neurogenic bladder characteristics and recommended treatment methods in MS patients based on urodynamic examinations.[12-14] However, studies in which the follow-up urodynamics of these patients are evaluated after a certain period by administering medical and non-medical treatment according to the results of the initial urodynamic examination are limited.[2,15,16] Studies on follow-up urodynamics mostly evaluated the effectiveness of neuromodulation.[17-20]

In the current study, we retrospectively analyzed the initial and follow-up urodynamic test results of the patients who were admitted to our inpatient rehabilitation program with the diagnosis of MS and treated based on the outcomes of their initial urodynamics. We also aimed to evaluate the effectiveness of the recommended medical and non-medical treatment methods and the compliance of the patients to the treatment.

MATERIAL AND METHODS

The retrospective study included 24 adult patients who were admitted to the inpatient rehabilitation program in our hospital between 2010 and 2020 with the diagnosis of MS and were referred to the urodynamics unit of the hospital with the diagnosis of neurogenic bladder. The approval for the study was obtained from the Ankara City Hospital 1 No. Clinical Research Ethics Committee (date: July 2, 2020, decision no: E1-20-887). The study was conducted in accordance with the principles of the Declaration of Helsinki.

The mean age of the patients, age at the time of MS diagnosis, gender, duration of the disease (time from diagnosis to the initial and follow-up urodynamic examinations), and the time between the initial and follow-up urodynamic tests were recorded.

The cystometry-uroflowmetry results of the patients included in the study were evaluated retrospectively using the urodynamics unit records. The urodynamic examinations were performed by the same physician (ME, second author) according to the International Continence Society.[21] The bladder was completely emptied before the examination. The urodynamic examinations were performed with the Libra+ urodynamic measuring device (MMS; Enschede; the Netherlands) while the patients were in the supine position. While infusing saline fluid into the bladder with a pump connected to one lumen of the 8-Fr double-lumen, a transurethral catheter was placed in the bladder of the patients, and intravesical pressure was measured through the other lumen connected to a transducer. Continuous abdominal pressure was measured using a 7-Fr catheter inserted into

the rectum. Detrusor pressure was calculated by subtracting abdominal pressure from vesical pressure ($P_{det}=P_{ves}-P_{abd}$). The electromyography activity of the pelvic floor muscles was recorded using superficial electrodes placed in the perianal region. Filling cystometry and flow pressure during voiding tests were performed. The bladder was filled with sterile saline at room temperature at a filling rate of 50 mL/min, using the continuous filling technique. Before the study, the patients were informed about the components of bladder filling sensation (first bladder filling sensation, first desire to void, and strong desire to void) and were asked to report their bladder filling sensations throughout the examination. The urodynamic examination was terminated in cases where the patient reported a strong need to void, a significant leakage developed, the intravesical pressure reached 40 cm H_2O, or blood pressure changes (systolic blood pressure going above 140 mmHg or a 20-40 mmHg increase in systolic blood pressure of adults compared to values obtained prior to the examination) were observed. The detrusor type during filling cystometry was classified as overactive, normoactive, or underactive; detrusor compliance as hypocompliant or normocompliant, and the bladder filling sensation as preserved, partially preserved, or absent.[22] Based on the guidelines of the European Association of Urology, bladder compliance ≥20 mL/cm H_2O was considered "normal" and <20 ml/cm H_2O "hypocompliance".[23] The lowest limit for normal bladder capacity was accepted as 300 mL. If the maximum cystometric capacity measured during the filling phase was below the expected bladder capacity, it was considered a storage problem. If the residual urine amount measured by the catheter or suprapubic ultrasonography at the end of the voiding phase was ≥50 mL, it was considered a voiding problem.[22]

Before the urodynamic tests, the medical treatments the patients received for neurogenic bladder were classified as anticholinergics, alpha-blockers, or both anticholinergics and alpha-blockers, and their voiding methods as spontaneous voiding, catheter-free voiding (the Valsalva maneuver, trigger voiding, anal sphincter stretching), intermittent catheterization, or indwelling catheter.

Maximum cystometric capacity (mL) and detrusor pressure at maximum cystometric capacity (cm H_2O) were investigated as the filling phase parameters and maximum detrusor pressure (cm H_2O), maximum flow rate (mL/sec), detrusor pressure during maximum urinary flow (cm H_2O), voided urine volume (mL), and post-void residual urine amount (mL) as the voiding phase parameters. The recommended medical treatments for neurogenic bladder based on urodynamics results and urinary emptying methods were evaluated.

STATISTICAL ANALYSIS

The study data were analyzed using the SPSS for Windows v.21.0 software (SPSS Inc., Chicago, IL, USA). The descriptive statistics are presented as mean±standard deviation, frequency distribution, and percentage. The t-test was used for the subgroup comparisons of the measured parameters. The Wilcoxon signed-rank test, chi-square test, and/or Fisher's exact test were used to compare the categorical parameters. A p value of <0.05 was considered statistically significant.

RESULTS

Fifteen female patients and nine male patients with a mean age of 37.6±8.0 years were included in the study. The mean age of the patients at the diagnosis of MS was 28.8±8.6 years, the mean duration of disease was 8.9±5.2 years, and the time between the two urodynamic tests was 13.2±15.2 months (Table 1).

Before the initial urodynamic examination, 83.3% of the patients used spontaneous or catheter-free voiding as the bladder emptying method, 4.2% used intermittent catheterization, while only 8.3% used anticholinergics for neurogenic bladder. Fol-

TABLE 1: Demographic and follow-up data of the patients.

Parameters	
Mean age (years)	37.6±8.1 (24-54)
Age at the time of diagnosis (years)	28.8±8.6 (18-49)
Gender, female/male	15 (62.5) / 9 (37.5)
Duration of disease (years)	8.9±5.2 (2-19)
Time between the two urodynamic tests (months)	13.2±15.2 (1-53)

The data are shown as mean±standard deviation, (range) or n (%).

lowing the initial urodynamic examination, 66.6% of the patients were recommended spontaneous or catheter-free voiding and 16.6% intermittent catheterization. We also found that all patients were started medical treatment for neurogenic bladder. After the follow-up urodynamic examination, 58.8% of the patients were recommended spontaneous or catheter-free voiding and 37.5% intermittent catheterization, while 95.8% were started drugs for neurogenic bladder. The voiding methods and medical treatment results before and after the initial and follow-up urodynamic examinations are given in Table 2.

There was an increase in maximum cystometric capacity (from 252 mL to 322 mL), a decrease in detrusor pressure at maximum cystometric capacity (from 31 cm H_2O to 23 cm H_2O), and a decrease in maximum detrusor pressure (53 cm H_2O to 45 cm H_2O) in the patients' follow-up urodynamics results, all exhibiting a statistically significant difference ($p=0.044$, $p=0.049$ and $p<0.001$, respectively). The follow-up urodynamics results also revealed a statistically significant decrease in the patients' storage problem (from 79.2% to 66.7%; $p<0.001$) and preserved sensation of bladder fullness (from 62.5% to 50.0%; $p<0.001$), whereas it exhibited a statistically significant increase in the emptying problem (79.2% to 91.2%; $p=0.004$). Detrusor activity, compliance, voided urine volume, post-void residual urine vol-

TABLE 2: Urinary emptying methods of the patients and medications taken by them.

	Initial urodynamics		Follow-up urodynamics	
	Before	After	Before	After
Emptying method				
Spontaneous voiding	14 (58.3)	14 (58.3)	12 (50)	12 (50)
Catheter-free voiding	6 (25)	2 (8.3)	5 (20.8)	2 (8.3)
Intermittent catheterization	1 (4.2)	4 (16.7)	5 (20.8)	9 (37.5)
Indwelling catheter	3 (12.5)	4 (16.7)	2 (8.3)	1 (4.2)
Medical treatment	2 (8.3)	24 (100)	20 (83.3)	23 (95.8)
Anticholinergics	2 (8.3)	20 (83.3)	17 (70.8)	19 (79.2)
Alpha-blockers	0 (0)	17 (70.8)	11 (45.8)	15 (62.5)
Combination of anticholinergics and alpha-blockers	0 (0)	13 (54.2)	7 (29.1)	12 (50)

The data are shown as n (%).

TABLE 3: Initial and follow-up cystometry-uroflowmetry examination results (n=24).

Variables	Initial urodynamics	Follow-up urodynamics	p value
Maximum cystometric capacity (mL)	252±226 (21-826)	322±177 (77-675)	0.044
Maximum detrusor pressure (cm H_2O)	54±16 (17-76)	45±13 (16-63)	<0.001
Detrusor pressure at maximum cystometric capacity (cm H_2O)	31±18 (4-66)	23±13 (1-52)	0.049
Maximum flow rate (mL/sec)	9±8 (0-27)	10±9 (0-39)	0.3
Detrusor pressure during maximum urinary flow (cm H_2O)	55±26 (0-98)	54±33 (0-109)	0.8
Voided volume (mL)	121±165 (0-583)	181±190 (0-675)	0.06
Post-voiding residual urine (mL)	131±177 (0-815)	141±130 (0-460)	0.8
Detrusor compliance (mL/cm H_2O)	11±10 (2-41)	15±11 (2-46)	0.1
Detrusor hypocompliance	22 (91.7)	16 (66.7)	0.059
Storage dysfunction	19 (79.2)	16 (66.7)	<0.001
Emptying dysfunction	19 (79.2)	22 (91.7)	0.005
Storage and emptying dysfunction	14 (58.3)	14 (58.3)	*
Bladder-filling sensation			
Preserved	15 (62.5)	12 (50)	<0.001
Partially preserved	9 (37.5)	12 (50)	
Detrusor activity			
Detrusor overactivity	19 (79.2)	19 (79.2)	*
Detrusor underactivity	5 (20.8)	5 (20.8)	

The data are shown as mean±standard deviation, (range) or n (%). Bold p values denote statistical significance.

ume, maximum flow rate, and the detrusor pressure during maximum urinary flow were similar between the initial and follow-up test outcomes. The comparison of the urodynamic parameters after the initial and follow-up urodynamic examinations is given in Table 3.

DISCUSSION

In our study, the follow-up urodynamics results of the patients who were given neurogenic bladder treatment after the initial urodynamic examinations were evaluated. The compliance of the patients to the treatment and the changes in the response to neurogenic bladder treatment were investigated. Based on the follow-up urodynamics results, we detected an increase in maximum cystometric capacity and emptying problem and a decrease in detrusor pressure at maximum cystometric capacity, storage problem, and preserved sensation of bladder fullness. In addition, we found out that all patients were given medical treatment after the initial urodynamics and that the compliance of the patients to medical treatment was high.

In a study on 121 MS patients, which did not include patients using indwelling catheters, Domurath et al. reported that 84 patients emptied their bladder spontaneously, 11 by straining, six by reflex voiding and intermittent catheterization, and four by intermittent catheterization, while total incontinence developed in three patients.[24] The remaining 13 patients used various combinations of bladder emptying methods (spontaneous emptying, straining, and reflex). In another urodynamics study, the authors recounted spontaneous voiding in 95 (77.9%) of 122 MS patients and intermittent catheterization in 27 (22.1%).[13] In other urodynamic studies, the researchers reported that MS patients needed catheterization; 12.8%-26% of the patients used a catheter at some point in their lives, with intermittent catheterization being the most common emptying method (64.7% and 81.2%).[25,26] We found that 83.3% of the patients in our study preferred spontaneous or catheter-free voiding as the bladder emptying method. After the initial urodynamic examination, spontaneous voiding and catheter-free voiding were recommended for 66.6% of the patients, intermittent catheterization for 16.7%, and indwelling catheter for 16.7%. Before the follow-up urodynamics, we concluded that the patients followed the recommended bladder emptying method. However, after the follow-up urodynamics, spontaneous or catheter-free voiding was recommended to 58.3% of the patients, intermittent catheterization to 37.5%, and indwelling catheter to 4.2%. According to these data, the rates of both spontaneous voiding and indwelling catheter use decreased, while the rate of intermittent catheter use increased after the treatment. We can assume that the rate of using indwelling catheters has decreased because patients benefited from medical and non-medical treatment methods. However, we believe that the decrease in the spontaneous voiding rate of the patients and the high rate of intermittent catheterization may be related to the progression of the disease and the change in neurogenic bladder characteristics over time.

El Helou et al. performed urodynamic examinations on 25 MS patients and concluded that 68% of the patients did not receive treatment for neurogenic bladder prior to the examination.[8] After the urodynamic examinations, the researchers administered anticholinergics to 33% of the patients, alpha-blockers to 8%, and both anticholinergics and alpha-blockers to 25%. In addition, the authors stated that the patients' adherence to treatment was 87% in their six-month follow-up. In another study, according to the initial and follow-up urodynamic findings of 161 MS patients, only medical treatment (20% anticholinergics, 19% alpha-blockers, 4% beta-3 agonist) was initiated in 43% of the patients for LUTD.[2] Medical treatment with intermittent catheterization was recommended to 24% of the patients, while botulinum toxin injection with intermittent catheterization was recommended to 9%. Akkoç et al. reported that the anticholinergics use rate in MS patients was 27.5%.[27] In a review, the researchers stated that the success rate of alpha-blocker drugs in the medical treatment of LUTD in MS patients varied between 50% and 96%.[28] Only 8.3% of the patients included in the current study were receiving anticholinergics treatment for neurogenic bladder. After the initial urodynamic examination, medical treatment was started for all patients. We found out that 83.3% continued with their

treatment. After the follow-up urodynamic examination, 95.8% of the patients were recommended to continue their medical treatment. After the initial and control urodynamics, the patients were mostly recommended anticholinergics (83.3% and 79.2%, respectively), followed by alpha-blockers (70.8% and 62.5%, respectively), and combined use of anticholinergics and alpha-blockers (54.2% and 50%, respectively).

The medical treatment of LUTD varies according to the storage problem (detrusor overactivity) or voiding dysfunction (detrusor sphincter dyssynergia - detrusor hypoactivity) detected in the patients. Antimuscarinics are often the first choice drugs for patients with detrusor overactivity. Anticholinergics, on the other hand, can reduce muscle spasms and bladder pressure by acting on the detrusor muscle, and relieve symptoms during the urine storage period. In patients with detrusor sphincter dyssynergia, alpha-blockers can reduce the resistance to urinary flow and facilitate urination by reducing dynamic obstruction by relaxing the bladder neck.

Wang et al. detected abnormal urodynamic findings in 85 (67.5%) of 126 MS patients, with detrusor overactivity as the most common problem.[16] After more than 50% of the 161 MS patients whom they had examined exhibited changes in urological symptoms, Abello et al. reexamined the patients' urodynamics over the years and stated that detrusor sphincter dyssynergia and detrusor overactivity were the most observed symptoms.[2] In a systemic review, 53% of the 1,524 MS patients had detrusor overactivity.[29] In another study, where bladder sensation in 100 MS patients was evaluated, 21 had an increase in bladder sensation without detrusor overactivity.[14] In our study, detrusor overactivity was prevalent in 79.2% and detrusor hypoactivity in 20.8% of the patients who underwent initial and follow-up urodynamic examinations. While there was no change in the detrusor activity in patients after medical and non-medical treatment, we found a decrease in normal bladder filling sensation. Although there was a significant improvement in dysfunctions due to detrusor overactivity (bladder capacity, maximum detrusor pressure), it is not surprising that there was no change in detrusor activity, that is, the LUTD type remained constant. We believe that the slight but significant decrease in the frequency of normal bladder filling sensation may be due to the progression of the disease during the period between the two examinations. Some patients with normal filling sensation at the initial examination passed to the partially preserved sensation category at the follow-up examination. None of the patients had complete loss of bladder filling sensation. Since bladder filling sensation is a subjective assessment based on the patient's report, this finding should be supported by new studies.

It has been reported that MS patients have storage-related symptoms more than voiding-related symptoms.[30,31] Akkoç et al. observed bladder emptying problems in 13.3% and 16.2% of MS patients in whom they objectively evaluated voiding problems using ultrasound and catheter.[27] In our study, we objectively evaluated the storage and voiding problems. After the follow-up urodynamics of the patients, there was a decrease in the patients' storage problem (from 79.2% to 66.7%) but an increase in their emptying problem (from 79.2% to 91.7%). The combination of storage and voiding dysfunction was detected in 58.3% of the patients after both initial and follow-up urodynamics.

While the maximum cystometric capacity and the amount of voided urine were decreased in the follow-up urodynamic examinations after initiation of drugs for neurogenic bladder in MS patients, urodynamic examinations revealed an increase in maximum cystometric capacity and voided urine volume and a decrease in the amount of residual urine at the follow-up after neuromodulation techniques were applied.[2,17-20] While a significant increase in maximum cystometric capacity was found during the follow-up urodynamic examinations of the patients who were given medical treatment after the initial urodynamic examination in our study, there was a significant increase in the voided urine volume. The increase in the maximum cystometric capacity of the patients was due to the effect of anticholinergic drugs. Anticholinergics can increase bladder capacity by reducing detrusor muscle spasms. After the initial urodynamics, our patients were started alpha-blockers to help void. However, we found out that the patients did not comply with the treatment after the

initial examination and the alpha-blocker use rate decreased significantly from 70.8% to 45.8%. We believe that the regular use of anticholinergics caused the improvement in the storage problem, whereas the worsening in the emptying problem was due to the irregular use of alpha-blockers in addition to disease progression.

In a study where 22 MS patients were evaluated and bladder compliance was considered abnormal when it was less than 20 mL/cm H_2O, a significant decrease in bladder compliance (from 80 mL/cm H_2O to 12 mL/cm H_2O) was noted in 5 patients after the follow-up urodynamics.[15] A significant increase in bladder compliance was observed in 126 MS patients who were given medical treatment for neurogenic bladder and whose control urodynamics were performed after an average of 14.3 days.[16] While El Helou et al. reported a decrease in bladder compliance in 20% of 25 MS patients who underwent urodynamic examination, Onal et al. found a decrease in bladder compliance in 9% of 249 MS patients.[8,32] In a systemic review, the frequency of hypocompliance in MS patients was reported to vary between 7% and 10%.[30] In our study, hypocompliance was prevalent in 22 (91.7%) of the patients at the initial urodynamics, while 6 patients showed an improvement at the follow-up examinations, bringing the rate of hypocompliance down to 66.6%. We believe that the higher prevalence of compliance in our study was because the cut-off values (12.5-15 mL/cm H_2O) set for hypocompliance in other studies were lower than the cut-off value we had set (20 mL/cm H_2O). In addition, considering that our patients were severe patients who required rehabilitation and MS is a progressive neuro-demyelinating disease, we believe that the loss of elasticity in the detrusor muscle and the development of partial fibrosis contributed to the increase in the prevalence of hypocompliance. The decrease in the prevalence of hypocompliance at the follow-up urodynamics was due to the effectiveness of the anticholinergics treatment we started on the patients.

A significant decrease in maximum detrusor pressure (from 48.8 cm H_2O to 35.8 cm H_2O) and a significant increase in maximum flow rate (from 11.6 mL/sec to 13.2 mL/sec) were noted at the third month follow-up urodynamics of 19 MS patients who had undergone posterior tibial nerve stimulation.[18] Researchers similarly reported an increase in maximum flow rate (from 15 mL/sec to 25 mL/sec) in another study.[19] Wang et al. also found a significant increase in the maximum flow rate after treatment.[16] Abello et al. found that the maximum flow rate in MS patients before and after treatment for neurogenic bladder was similar.[2] While there was an average decrease of 27.8 cm H_2O decrease in the maximum detrusor pressure at the sixth week follow-up urodynamics of MS patients who were administered botulinum toxin, this decrease was 0.5 cm H_2O on average in the group that did not receive botulinum toxin.[33] In our study, we found a significant decrease in the maximum detrusor pressure (from 54 cm H_2O to 45 cm H_2O) after treatment. On the other hand, there was an increase (from 9 mL/sec to 10 mL/sec) in the maximum flow rate, alas an insignificant one.

The most important limitation of our study was its retrospective design. In addition, we could not evaluate the subtype of the MS disease, lesion sites, and urinary system problems in detail, and their effects on quality of life. We also could not find out when the symptoms had started and which symptoms were prominent. Finally, it was not possible to find out the treatments the patients received for the primary disease.

CONCLUSION

In conclusion, neurogenic bladder findings were prevalent in the majority of MS patients as a result of the urodynamic examination. The urodynamic examinations also revealed an overactive detrusor in most of the patients. The initial urodynamic examination findings suggested that the patients did not void with the appropriate method and did not receive medical treatment for neurogenic bladder. As these patients are taken into a rehabilitation program, the urinary system should be evaluated and urodynamic examinations should be performed in high-risk patients. The upper and LUTs should be protected by determining the appropriate bladder emptying method and starting medical treatment for urinary dysfunction, while the quality of life should be increased by reducing the symptoms. Since MS is a

progressive neuro-demyelinating disease and the findings may progress over time, patients should be evaluated in terms of the urinary system at regular intervals and their treatment should be rearranged, if necessary.

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Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

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