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# Urodynamic Abnormalities in Patients with Relapsing Remitting Multiple Sclerosis

**Alaaeldin Sedky Bekhit[1*], Mohammed Saber-Khalaf[2]**

[1]Department of Neuropsychiatry, Sohag University, Sohag, Egypt
[2]Department of Urology, Sohag University, Sohag, Egypt
Email: *alaaeldin_sedky@yahoo.com

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## Abstract

**Background:** Multiple sclerosis (MS) is a disease with wide variability in clinical presentation. Bladder dysfunctions are very common in MS patients. Early detection of bladder abnormalities is important to improve the outcome in MS patients. **Objectives:** The aim of this study is to evaluate the urodynamic detected bladder dysfunctions in relapsing remitting MS patients with mild or without lower urinary tract symptoms. **Methods:** This is a prospective study for 32 patients with relapsing remitting Multiple Sclerosis from January 2017 to June 2018. We included patients with mild or without lower urinary tract symptoms (LUTS) who had mild to moderate disability. Urodynamic studies were performed for all patients. **Results:** Urodynamic abnormalities were detected in 22 patients (68.75%). Detrusor overactivity (DO) was present alone in 8 patients (25%); DO combined with detrusor external sphincter dyssynergia in 8 patients (25%); DO with low compliant bladder and impaired contractility in another 4 patients (13%) while DO with low complaint bladder in 2 patients (6%). Bladder dysfunction was correlated to high disability score; longer duration of illness; frequent relapses and the presence of LUTS. **Conclusion:** Urodynamic abnormalities were found in 68.75% of our patients. This highlights the importance of urodynamic studies in the early evaluation of relapsing remitting Multiple Sclerosis.

## Keywords

Urodynamic, Bladder Dysfunction, Multiple Sclerosis

## 1. Introduction

Multiple sclerosis (MS) is a chronic immune-mediated inflammatory disease of the central nervous system. It affects mostly young adults with frequency 3 - 4 times more in females than males. The exact etiology of MS is still unknown

with possible genetic and environmental influences [1] [2].

MS is a disease with a wide variability in clinical presentation. The course can be intermittent or chronic. The presentation can start by visual disturbances; weakness of extremities; gait problems; fecal and/or urinary manifestations. Bladder dysfunctions are very common in MS patients with incidence ranging from 50% to 97%. The demyelinated plaques in the brain or in the spinal cord can disrupt the transmission of signals between the brain and the urinary system [3].

Normal bladder function is mandatory for preservation of kidney function; prevention of infection; personal independence; self-confidence and overall quality of life. Untreated bladder issues can cause worsening of other MS symptoms, such as weakness and spasticity. Also, repeated bladder or urinary tract infections (UTI); renal stones and/or upper urinary tract deterioration can compromise the overall health [4] [5]. Moreover, several studies found an increased risk of exacerbations around the time of UTI and that infection-related relapses were associated with more sustained neurological deficits that can worsen the quality of life [4] [5].

The evaluation of bladder function is by bladder diary; abdominal ultrasonography with determination of post-void residual urine volume and urodynamic study (UDS). UDS is used to characterize the nature of bladder dysfunction and to predict the risk factors for possible upper urinary tract deterioration. In addition, UDS is essential for proper therapeutic planning. The discrepancy between the symptoms and the objective signs detected by UDS raises the need to put this evaluation method as a mandatory initial investigation in MS patients [6] [7].

Unfortunately, UDS are not routinely requested for early evaluation in patients with MS, because UDS do not belong to a neurologist's field of diagnosis; most patients tend to keep silent about their urinary symptoms and finally it is difficult to perform urodynamic examination in all MS patients especially those with no lower urinary tract symptoms (LUTS) [8]. This delay in the bladder evaluation may lead to inefficient management.

Few studies have investigated the relationship between subjective urinary complaints and urodynamic parameters in MS patients with different results [6] [9] [10]. The aim of this study is to evaluate the urodynamic detected bladder dysfunction in relapsing remitting MS patients with mild or without LUTS.

## 2. Patients and Methods

### 2.1. Patients

This is a prospective study for 32 patients with definite diagnosis of relapsing remitting MS using the 2010 Revisions to the McDonald Criteria [11]. All patients were referred to the neurology department, Sohag University Hospital from January 2017 to June 2018. We included patients with mild or without LUTS who had mild to moderate disability (Expanded Disability Status scale (EDSS) less than 6.5). We defined the severity of LUTS using international pros-

tate symptom score for male patients, if it was less than 7, it was considered mild. Regarding female patients, we used overactive bladder questionnaire short form (OAB-SF). We used the severity domain which is 6 questions with scores range from 6 to 36. Mild LUTS was defined by score less than 12. Exclusion criteria were defined as follows: patients with progressive MS; patients with relapse at the time of investigation; patients with urinary incontinence; catheterized patients; severe disability with EDSS more than 6.5 and/or lack of ability to communicate.

### 2.2. Patients' Evaluation

Patients who met the criteria were recruited to the urodynamic unit, Sohag University Hospital for assessment of their bladder function. The examination included dip stick urinalysis to exclude infection at the time of examination. Urodynamic measurement was done according to international continence society standard (It was done in sitting position with filling the bladder by 6 or 7 French double lumen pressure catheters with 37˚C physiological saline, the filling rate was 10 to 20 ml/min) and was performed by same physician and the same nurse [12].

Evaluated parameters were: Cystometric capacity, presence of detrusor overactivity with or without external sphincter dyssynergia (DESD), bladder compliance, detrusor underactivity and post-void residual urine volume.

### 2.3. Statistical Analysis

Data was analyzed using SPSS version 24. Quantitative data was represented as mean, standard deviation, median and range. Data was analyzed using Mann-Whitney test. Qualitative data was presented as number and percentage and compared using either Chi-square test or fisher exact test. P value was considered significant if it was less than 0.05.

## 3. Results

### 3.1. Baseline Data

Our study included 32 patients with relapsing remitting Multiple sclerosis (MS), 75% of them were females. The mean age was 32 ± 4.8 years with median age 33 (22 - 39) years. LUTS were reported in 37.5% of our patients and were irritative symptoms (increased frequency and urgency) (**Table 1**).

Regarding the neurological data, the median age of onset of MS was 28 (17 - 36) years and the median duration of symptoms was 3 (1 - 9) years. Our patients had mild to moderate disability with median EDSS score 4.5 (1 - 6). Physical activity was preserved in 75% of our patients while 25% had an assisted mobility (**Table 2**).

### 3.2. Clinical Data

On urodynamic evaluation, 10 (31.25%) patients were free and 22 patients (68.75%)

Table 1. Baseline sociodemographic data.

| Variable | Patients (N = 32) |
|---|---|
| **Age/years** | |
| Mean ± SD | 32 ± 4.8 |
| Median (range) | 33 (22 - 39) |
| **Gender** | |
| Man | 8 (25%) |
| Women | 24 (75%) |
| **Associated disease** | |
| Non | 28 (87.5%) |
| Diabetic | 4 (12.50%) |
| **Bladder symptoms** | |
| Yes | 12 (37.5%) |
| No | 20 (62.5%) |

Table 2. Clinical criteria of MS patients (EDSS = Expanded disability status scale).

| Variable | Patients (N = 32) |
|---|---|
| **Age of onset/years** | |
| Mean ± SD | 27.3 ± 5.6 |
| Median (range) | 28 (17 - 36) |
| **Time between onset and diagnosis/months** | |
| Mean ± SD | 13 ± 12 |
| Median (range) | 10.5 (1 - 36) |
| **Duration of illness/years** | |
| Mean ± SD | 4 ± 2.6 |
| Median (range) | 3 (1 - 9) |
| **Total number of attacks** | |
| Mean ± SD | 3 ± 1.5 |
| Median (range) | 3 (1 - 6) |
| **EDSS score** | |
| Mean ± SD | 4.2 ± 1.5 |
| Median (range) | 4.5 (1 - 6) |
| **Physical activity** | |
| Ambulant | 24 (75%) |
| Assisted | 8 (25%) |

had urodynamic abnormalities. Detrusor overactivity (DO) was present alone in 8 patients (25%); DO combined with detrusor external sphincter dyssynergia in 8 patients (25%); DO with low compliant bladder and impaired contractility in another 4 patients (13%) while DO with low complaint bladder in 2 patients (6%).

The median cystometric capacity of our patients was 350 (200 - 400) ml. The most frequent urodynamic abnormalities were detrusor overactivity in 22 patients (68.75%) followed by low compliant bladder in 14 patients (34.7%). DESD was found in 25%. The median post-void residual urine was 50 (20 - 150) ml (Table 3).

Detrusor overactivity was linked to higher disability score (EDSS), longer duration of illness and frequent number of attacks. These factors were statistically significant (Table 4).

Table 3. Urodynamic abnormalities in MS patients (DESD = Detrusor external sphincter dyssynergia; DUA = Detrusor underactivity; PVR = Post void residual urine).

| Variable | Patients (N = 32) |
|---|---|
| **Cystometric capacity/ml** | |
| Mean ± SD | 325 ± 64.8 |
| Median (range) | 350 (200 - 400) |
| **Detrusor overactivity/number and percentage** | |
| Yes | 22 (68.75%) |
| No | 10 (31.25%) |
| **DESD/number and percentage** | |
| Yes | 8 (25%) |
| No | 24 (75%) |
| **Low compliance/number and percentage** | |
| Yes | 14 (34.75%) |
| No | 18 (56.25%) |
| **PVR/ml** | |
| Mean ± SD | 62 ± 39 |
| Median (range) | 50 (20 - 150) |
| **Detrusor underactivity/number and percentage** | |
| Yes | 4 (12.5%) |
| No | 28 (87.5%) |

Table 4. Predictive factors of detrusor overactivity (DO).

| Variable | DO present | DO absent | P value |
|---|---|---|---|
| **Gender** | | | |
| Male | 6 | 2 | 1 |
| Female | 16 | 8 | |
| **Age/years** | | | |
| Mean ± SD | 33 ± 4 | 29.6 ± 5.2 | 0.07 |
| Median (range) | 33 (26 - 39) | 29 (33 - 35) | |
| **Age of onset/years** | | | |
| Mean ± SD | 27.4 ± 6 | 27 ± 5 | 1 |
| Median (range) | 29 (17 - 63) | 27 (20 - 33) | |
| **Duration of illness/years** | | | |
| Mean ± SD | 5 ± 2.8 | 2.4 ± 0.5 | 0.01 |
| Median (range) | 5 (1 - 9) | 2 (2 - 3) | |
| **Time between attacks/months** | | | |
| Mean ± SD | 15.3 ± 13 | 8.4 ± 9.3 | 0.15 |
| Median (range) | 12 (1 - 36) | 4 (1 - 24) | |
| **EDSS** | | | |
| Mean ± SD | 5 ± 1 | 2.6 ± 1 | 0.0001 |
| Median (range) | 5 (3 - 6) | 3 (1 - 4) | |
| **Number of attacks** | | | |
| Mean ± SD | 3.5 ± 1.6 | 2.2 ± 0.4 | 0.01 |
| Median (range) | 3 (1 - 6) | 2 (2 - 3) | |

All urodynamic abnormalities were more common in patients with LUTS, and this was highly statistically significant (Table 5).

## 4. Discussion

The bladder, urethra and external sphincter act as a functional unit for lower

Table 5. Association between urodynamic abnormalities and LUTS (DO = Detrusor overactivity; DESD = Detrusor external sphincter dyssynergia; DUA = Detrusor underactivity).

| Variable | LUTS present | LUTS absent | P value |
|---|---|---|---|
| **Detrusor overactivity** | | | |
| Yes | 12 | 10 | 0.004 |
| No | 0 | 10 | |
| **DESD** | | | |
| Yes | 8 | 0 | <0.0001 |
| No | 4 | 20 | |
| **Low compliant bladder** | | | |
| Yes | 12 | 2 | <0.0001 |
| No | 0 | 18 | |
| **DUA** | | | |
| Yes | 4 | 0 | 0.01 |
| No | 8 | 20 | |

urinary tract. Their basic function is to store the urine with low intravesical pressure and to evacuate it voluntary if the conditions are suitable. This function depends on the intact communication between the sacral spinal micturition center and higher brain centers. Interruption of this communication leads to bladder dysfunction which in turn can carry a possible risk on the upper urinary tract and the patient's quality of life [3].

Our study included a homogenous group of relapsing remitting MS patients. Female to male ratio was 3:1 and this was comparable to other studies that reported predominance of MS in females [3] [13]. In literature, urodynamic abnormalities in MS patients were linked to more severe LUTS and MS types other than relapsing remitting [8]. Thus, we choose this group of patients (relapsing remitting MS without or with mild LUTS) to study their bladder function.

LUTS were reported in 37.5% of our patients, which is far less than reported in the literature. However, this may be caused by removing patients with incontinence; progressive MS and moderate to severe LUTS from our study. In other studies, more than 50% of relapsing remitting MS suffered from moderate to severe LUTS which was more than LUTS reported in progressive MS [14] [15]. This can be attributed to more adaptation to the symptoms in progressive MS and more cognitive impairment [16].

The incidence of urodynamic abnormalities in our study was 68.75%which was less than reported in literature. This can be explained by the fact that 62.5% of our patients had no LUTS. However, the most common reported abnormality was DO with or without DESD. This was consistent with other studies [8] [14] [17]. This can be explained by the modern concept of neural control of the bladder which depends on afferent and efferent reflexes between the sacral micturition center and the pontine micturition center. Interruption of these reflexes and pathways by spinal cord lesions in MS leads to detrusor overactivity with or with coordinated sphincter, which depends on the level of the lesion [3] [18].

The frequency of DESD in our study was 25%. The reported frequency of

DESD in MS patients ranges from 18% to 66% [19]. DESD is associated with risk to the upper urinary tract due to incomplete bladder emptying with possible reflux. This highlights the importance of the early detection of this abnormality to avoid possible complications [20].

We studied the risk factors of urodynamic abnormalities in our patients and found that the presence of LUTS; higher EDSS score; longer duration of illness and the numbers of attacks were statistically significant risk factors. The higher EDSS score was reported in another study as a risk factor [18]. This could be explained by damage to the pontine tegmentum and the spinal cord which induces bladder overactivity by reducing the parasympathetic inhibition that normally allows the bladder to fill. The severity of LUTS and dependency onwheel chair were reported as risk factors in another study [8].

Gender was not found to be a risk factor for urodynamic abnormalities and this was in accordance with literature. However, female gender was associated with more urinary tract symptoms [21].

UDS is essential for proper study of the bladder function and for the therapeutic planning. It helps us to detect the risk factors for upper urinary tract deterioration. Some authors reported poor correlation between symptoms and objective bladder dysfunction [6] [7]. Therefore, UDS are recommended as routine tests for the evaluation of bladder dysfunction or function in patients with relapsing remitting MS [22].

Our study was limited by the small sample size. The prospective nature of the study and homogenous patients' group could be considered as advantages. To our knowledge, this was the first study that examined the bladder function in MS patients with mild or without LUTS.

## 5. Conclusion

Urodynamic abnormalities were found in 68.75% of our relapsing remitting MS patients with mild to moderate disability and mild LUTS. The presence of LUTS; higher EDSS score; longer duration of MS and frequent attacks could be considered as risk factors for bladder dysfunction. This highlights the importance of UDS in early evaluation of relapsing remitting MS.

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Not applicable.

## Authorship Statement

Both authors contributed equally in study design, collecting data, data analysis and preparing the draft. The first author did statistical analysis of the data and prepared the final version for publication.

## Conflicts of Interest

There is no conflict of interest to declare.

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