

## UROFLOWMETRY AND ULTRASOUND MEASUREMENT OF RESIDUAL URINE IN EARLY PARKINSON'S DISEASE

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### ABSTRACT

Urovesical dysautonomic symptoms are present in 27-97% of the patients with Parkinson's disease (PD) depending on patients' selection criteria and methods used. The micturitional disturbances are typical of patients with more severe PD. The authors studied the urovesical function in 23 PD patients aged 41-60 years and without subjective micturitional complaints by uroflowmetry and ultrasound measurement of residual urine. Urovesical disturbances were established in 30,4% of the patients. The average results for Max Flow Rate (MFR) were  $21,85 \pm 5,49$  ml/sec and for residual urine  $27,83 \pm 25,58$  ml. The most influencing factor was the severity of the disease measured by the UPDRS. Our results were important additions to the existing information on the urovesical function in PD. Dysautonomic micturitional disturbances were found even in patients without subjective complaints in the early stages of the disease. Their degree correlated most closely to the severity of PD. The necessity of specialized examinations of dysautonomic urovesical symptoms imposes the presence of a tailor-made patient approach for their early detection and adequate treatment.

**Key words:** Parkinson disease, uroflowmetry, ultrasound, urovesical disturbances, early diagnosis

### INTRODUCTION

Parkinson's disease (PD) is a multiple system disease affecting the extrapyramidal and the autonomic nervous systems (ANS) as well. The urovesical disturbances are among the most frequent dysautonomic symptoms. Recent studies of PD showed their presence in 27-97% of the patients. This different percentage depends on patients' selection criteria and methods used. The most frequent symptoms are nocturia, frequency, and urgency. Some patients demonstrate urinary retention, post voiding residual urine, hesitancy and weak stream. Significant urinary incontinence is not common. It is more frequent in females and manifests like stress-incontinence. At the same time rigidity and bradykinesia can provoke the so-called 'pseudo-incontinence' due to the slowed movements and the difficulties reaching the toilet (2,4,11).

Uroflowmetry is a noninvasive method for establishing disturbances in the evacuatory phase of the micturitional cycle in PD. The most important parameters interpreted are maximal flow rate (MFR), volume of evacuated urine and uroflow pattern. The micturitional disturbances are typical of patients with more severe PD. There are a few studies in

early PD because the movement disorders precede the urovesical ones in 90% of the cases (6).

The purpose of our paper was to study the urovesical functions in early-PD patients without subjective micturitional complaints by means of uroflowmetry and ultrasound measurement of residual urine.

### MATERIAL AND METHODS

Uroflowmetry and ultrasound measurements of residual urine were performed in 23 PD patients (13 males and 10 females) aged 41-60 ( $53,96 \pm 4,78$ ) years with disease duration of 1-3 ( $2,17 \pm 0,78$ ) years. All the persons were at Hoehn-Yahr stage I without subjective complaints suggestive of urovesical dysfunction. Sixteen patients have right-sided movement disorders and seven have left-sided ones. PD was diagnosed in the I<sup>st</sup> Clinic of Neurology of St. Marina University Hospital of Varna according to the criteria of the Bulgarian consensus for diagnostics and treatment of PD and of the UK PD Society Brain Bank. Informed consent was obtained from all the participants in the study. None of them reported subjective micturitional complaints or other ANS disturbances. Patients with mechanical obstruction or other urologic or gynecologic diseases were not included. Intake of food or drugs influencing ANS was discontinued 24h before the examination.

Uroflowmetry and ultrasound measurements of residual urine were performed in the Clinic of Urology of St. Anna University Hospital of Varna according to standard proce-

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dures using Medtronic Urolynx 1000 and Siemens Sonoline SL 100 apparatuses. The parameters assessed were the voiding time, the volume of urine evacuated, MFR and the volume of residual urine. The widely accepted normal values were respected: minimal volume of evacuated urine >100 ml, MFR >19,9 ml/sec and maximal volume of residual urine <51 ml (3,5,9). The results obtained were analyzed by One Sample *t*-test, Pearson's correlation analysis, One-Way ANOVA and rang analysis (8).

## RESULTS AND DISCUSSION

MFR values are between 8,8-33,6 ml/sec (21,85 ±5,49) (95%, CI 19,5-24,2). After applying rang analysis the values 8,8 and 33,6 ml/sec are not excluded ( $p>0,1$ :  $r_{\max}=2,18$ ;  $r_{\min}=2,43$ ;  $K=21$ ).

Urinary flow rate depends on detrusor contraction and urethral resistance. Uroflowmetry is applied to evaluate detrusor dysfunction and subvesical obstruction. Such disturbances are comparatively often due to central level neurological lesions (1,5).

The analysis using One Sample *t*-test shows statistically significant difference ( $p<0,01$ ) between the average MFR and the accepted normal value. We have to bear in mind that normal values may vary for one and the same patient dependent on the volume of voided urine, especially for values over 200ml (5,6).

According to MFR results, the patients are divided into two groups. Pathological values between 8,8-18,7 ml/sec (16,26 ±3,4) are established in 30,4%. Most authors find a MFR decrease in 45-63% of PD patients (7,10). Our results differ most likely due to the fact that all patients of ours are in early stage (HY I) while other studies include patients from all stages. In the remaining 16 patients MFR values are normal varying between 20,7-33,6 ml/sec (24,3 ±4,31) (Table 1).

The volume of residual urine is between 0-100ml (27,83 ±25,58). Abnormal results are found out in 13% of our patients. The analysis using One Sample *t*-test showed a statistically significant difference ( $p<0,01$ ) for all examined between the average volume of residual urine and the accepted normal value (50ml). These results for the patients with normal MFR are 0-50 ml (18,75 ±17,08). For those with pathological results the values are 0-100 ml (48,57 ±30,78). Most of them have bigger quantities of residual urine (Table 1).

It is well known that the volume of residual urine is an indirect index for bladder contractility. That is why its measurement is an important addition to the evaluation of micturitional disturbances. According to literature data, 16% of PD patients have considerable volume of residual urine. These results are from patients in all stages of severity. Little attention is paid, however, to patients at stage I (6,7,10).

The analysis of the relationship between MFR values and residual urine shows a statistically significant difference ( $p<0,01$ ) that is strongly negative (Pearson's coefficient

$r=-0,605$ ), i. e. the volume of residual urine decreases with increasing MFR.

Total score of UPDRS in all patients is 9-15 points (11,61 ±20,01). The score of part III of the same scale is 4-6 points (4,7 ±0,77). In patients with normal MFR the total score is 9-13 points (10,69 ±1,3) and that of part III is 4-5 points (4,38 ±0,5). In the rest patients the points are 10-15 (13,71 ±1,79) and 4-6 (5,43 ±0,79), respectively (Table 1).

Table 1. Values of patients with normal and pathological MFR according to UPDRS and residual urine

Index	Patients with normal MFR	Patients with pathological MFR
MFR	20.7-33.6ml/sec (24.3ml/sec ±4.31 ml/sec)	8.8-18.7ml/sec (16.26 ml/sec ±3.4ml/sec)
UPDRS total	9-13 points (10,69 $\pm$ 1,3 points)	10-15 points (13,71 $\pm$ 1,79 points)
UPDRS part III	4-5 points (4,38 $\pm$ 0,5 points)	4-6 points (5,43 $\pm$ 0,79 points)
Residual urine	0-50ml (18,7 ml ±17,08 ml)	0-100ml (48,5 ml ±30,78ml)

The predominating opinion is that the percentage of urovesical disturbances increases with the increase of severity and duration of PD and that these disturbances are not an initial symptom. They appear most frequently in advanced disease and duration of at least 3 years. In 90% of the cases the extrapyramidal symptoms precede the urological (6). Other authors consider that the frequency of symptoms correlate to the disease severity but neither to duration, nor to gender (4,10). We evaluate disease severity by means of UPDRS total score and part III score. There was a statistically significant ( $p<0,01$ ), moderate to strong negative correlation ( $r=-0,550$ ) between MFR and UPDRS total score for all patients. There was a statistically significant ( $p<0,01$ ), moderate to strong negative correlation ( $r=-0,424$ ) for the part III score, too. That means worsening of urovesical function with decrease of MFR closely associated with the higher score, i.e. increase of severity. Our results are in discrepancy with some other data indicating loss of correlation between the cardinal motor symptoms and severity and the urovesical disturbances (5). The disease duration of the patients is 2,17 ±0,78 years and there is no any statistically significant correlation to the values of MFR as this is in accordance to the literature.

Age is another factor which is not of significant importance for MFR results as shown by correlation analysis. Some authors accept the role of age as an important factor for the appearance of urovesical disturbances (3,5,9). This discrepancy is, probably, due to different selection criteria. The upper age limit for our patients is 60 years and over this age the autonomic functions worsen even in healthy persons (9). By means of ANOVA no statistically significant differ-

ences between the symptomatic side or the dominating motor symptom and MFR were established.

The urovesical symptoms in PD are due to the main pathological process because basal ganglia inhibit the micturition centre and the dopaminergic deficit reduces detrusor inhibition (4,6). Higher percentage of disturbances is found in patients with dominating rigidity and bradykinesia (3). Despite these observations the analysis of our results showed no any significant correlation between MFR and the dominating motor symptom.

Based on the analysis of our results we could conclude that even at I Hoehn-Yahr stage there are urovesical disturbances in 39,4% of the patients despite the absent subjective complaints. These disturbances could be established by means of laboratory examinations only (2,7,11). The severity of PD evaluated by UPDRS is the factor correlating mostly with MFR decrease. Abnormal amount of residual urine is found in 13%. Its volume is inversely proportional to the MFR value, i.e. higher MFR (normal urovesical function) is associated with smaller volume of residual urine. Factors not influencing our results are gender, age, disease duration, dominating motor symptom and symptomatic side. Our data differ slightly from those in the literature due, most probably, to the fact that the examined patients are at early stage, with short duration and at age under 60 years. It is possible that with disease progressing and duration advancing the above mentioned factors take their place in the pathogenesis of the urovesical disturbances in PD.

## CONCLUSION

These results are important additions to the existing information about the urovesical function in PD. Dysautonomic micturitional disturbances are found even in patients without subjective complaints in the early stages of the disease. Their degree correlates most closely to the severity of PD. The necessity of specialized examinations of dysautonomic urovesical symptoms impose the presence of a tailor-made

patient approach for their early detection and adequate treatment.

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