

Urodynamic characteristics of lower urinary tract of patients with idiopathic overactive bladder

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Abstract

Aims: The aims of this study were to determine the frequency and clinical significance of individual urodynamic signs, which revealed on the basis of the results of comprehensive urodynamic examination of patients with the idiopathic overactive bladder (IOAB), to produce definitions of these features, and to describe any necessary remedial action.

Materials and Methods: To identify the most common features and artifacts, we conducted a combined urodynamic examination of 137 patients with IOAB (105 women and 32 men). Age, comorbidities, and urodynamic parameters were analyzed to determine the association between bladder sensation and contractility.

Results: It was found that most patients suffer from the same type of bladder function impairment, often related to the decrease in the average effective capacity of the bladder, frequent urination, urgency urination, and urgent urinary incontinence events. Imperative nature of urination in patients with IOAB leads to the reduction maximum cystometric capacity in 75.9% of patients, increased bladder sensitivity threshold in 70.8%, detrusor overactivity in 35.8%, change in bladder compliance in 43.1%, and urethral instability in 24.8% of patients.

Conclusions: Decreased ability of the bladder to accumulate and hold the urine under the normal or low intravesical pressure and frequent association of bladder instability with signs of obstructive urination are major peculiarities of the impaired urodynamics of the lower urinary tract in patients with IOAB.

Keywords: Lower urinary tract, overactive bladder, urinary incontinence, urodynamics

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INTRODUCTION

Overactive bladder (OAB) is a severe urination disorder, found in at least 17% of the population at the age of 40+ years, accounting for 56% of women and 44% of men.^[1] At the age of more than 65 years, the incidence of symptoms increases up to 30%, and at the age of more than 70 years, the incidence of symptoms increases up to 40%. OAB is a descriptive term, which indicates

the complex of symptoms, in case of which the patient suffers from quite strong urinary urgency, with or without the presence of urgent urinary incontinence (UUI), which usually comes with frequent urination and nocturia, while there are no obvious pathological changes in the bladder or in the unique chemical composition of urine.^[1,2] Increased frequency of urination means the complaints of patients to frequent urge during the day, and the nocturia means

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the complaints of patients of the need to wake up at night more than once to void the bladder. Frequent urination and nocturia can be without UUI.^[2,3] As a rule, such patients have sleep disturbances and suffer from depressive and anxiety disorders.

Diagnostics of disorders of the lower urinary tract (LUT) in patients with idiopathic overactive bladder (IOAB) consists of a collection of complaints, history, neurological and urological examinations, as well as additional examination techniques, among which the urodynamic examination plays a special role. When conducting only the symptomatic evaluation of urination disorders, in most cases, an urologist is unable to set the precise diagnosis due to the fact that many symptoms are subjective and nonspecific to a particular disease area. In this case, the target of the urodynamic examination is to evaluate the LUT state and make a further examination and treatment plan for the patient. We believe that the indications for the urodynamic examination are lack of effect of empirically allocated therapy, planned surgical treatment (e.g. in case of stress urinary incontinence), and associated neurological diseases.^[4]

The aims of this study are to determine the frequency and clinical significance of individual urodynamic signs, revealed on the basis of the results of comprehensive urodynamic examination of patients with the IOAB, to produce definitions of these features, and to describe any necessary remedial action.

MATERIALS AND METHODS

We conducted a combined urodynamic examination of 137 patients with IOAB (105 women and 32 men). The examination was carried out on Delphis KT Urodynamic Unit (Laborie, Canada) in accordance with the recommendations of the Standardization Committee of the International Continence Society.^[5] The examination consisted of several stages: uroflowmetry (UFM), filling cystometry, urethral profilometry, pressure-flow study, and pelvic floor electromyography (EMG).

All patients underwent urology, gynecology, and neurological examinations to exclude somatic diseases, which can cause the complex of OAB symptoms. Furthermore, the rate of voiding diary in all patients was registered in an orderly manner by keeping the voiding diary for 3 days at home. The voiding diary was started to be filled in upon the patient’s all-day activity up to the next day. During this process, the patients recorded the bedtime, which enabled to subsequently count the

number of urinations, urinary urgency, and UUI events during the day. All patients were instructed in detail as to the correct fill in a diary. The patients were recommended not to change their ordinary daily schedule and drinking water schedule.

The study of bioelectrical activity of pelvic floor muscular system by EMG and sphincter muscles of pelvic organs was performed on two-channel computer EMG.

RESULTS

When analyzing the voiding diary in patients with IOAB, it can be noted that despite the variety of clinical manifestations, most of the patients suffer the same type of bladder function impairment, often related to overactivity [Figure 1]. These include the reduced average voided volume, frequent urination, presence of urgency urination, and UUI events. It should be noted that, in our opinion, the recording of voiding diary plays a significant role in the evaluation of voiding dysfunction. This is the only objective noninstrumental method of determining the ability of the bladder to accumulate and hold the urine, which is a repeated noninstrumental cystometry, providing insight into the state of the threshold of the bladder reflex excitability. A comprehensive urodynamic examination complements the clinical examination. The data obtained must be compared with the clinical symptoms; the use of bare figures will lead to a diagnostic error for sure. The diagnostics of any kind of voiding dysfunction in the majority of patients can be conducted without using the invasive methods of urodynamic examination. Only in some cases, determining a diagnosis in patients with complex voiding dysfunction (e.g. in case of a

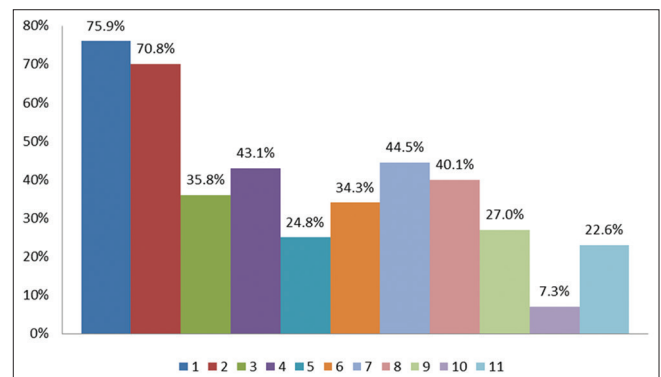


Figure 1: Frequency of urodynamic symptoms in patients with IOAB: 1 – Reduction of maximum cystometric capacity; 2 – Bladder oversensitivity; 3 – Detrusor overactivity; 4 – Change in bladder compliance; 5 – Urethra instability; 6 – Bladder outlet obstruction; 7 – Sphincter failure; 8 – Reduction of functional length of the urethra; 9 – Pain during the urodynamic examination; 10 – Detrusor sphincter dyssynergia; 11 – Urinary incontinence during the examination

combination of UUI and obstructive urination) requires a comprehensive urodynamic examination.

During the examination of the bladder function in the phase of accumulation by the method of retrograde cystometry, we observed the following changes: reduced maximum cystometric capacity in 104 (75.9%) patients, reduced bladder sensation in 97 (70.8%) patients, and change in bladder compliance in 59 (43.1%) patients. In 49 (35.8%) patients, the core sign of dysfunction was inhibited detrusor activity during the whole period of bladder filling as a result of spontaneous detrusor contraction. Its number during one filling phase of cystometry could vary from 1 to 12. If the minimum-by-force reduction increased the intravesical pressure up to 15 cm water column, the maximum-by-force reduction increased the intravesical pressure up to 45 cm water column, i.e., up to the values of voiding pressure.

Values of the cystometry measurement do not reflect the real anatomic bladder capacity, but this urodynamic value was, as a rule, higher than the voided volume, which is recorded by the patients in their diaries. 22 (16.0%) patients showed normal values of cystometry measurement in our study. At the same time, we think that the removal of these patients from the group of patients, receiving treatment for IOAB, is not necessary.

When comparing the data of cystometry measurement with the clinical data, we should note the dissociation of sensitivity and reflexive ability threshold, i.e., the urination urgency, bladder pain, and feeling of bladder fullness occurred at low intravesical pressure. Oversensitivity and hypererethism of the bladder against the background of normotension were probably related to the oversensitivity of the mucous membrane of the urethra and triangle of the bladder to insertion of even the minimum volume of fluid. Thus, the dissociation of sensitivity and reflexive ability threshold of the detrusor is typical for IOAB.

The function of sphincter muscle is usually similarly affected. According to the results of urethral profilometry, the maximum urethral pressure in 61 (44.5%) patients with IOAB did not exceed 30 cm water column, which evidenced the presence of urethral sphincter failure. The shortening of the functional length of the urethra was recorded in 55 (40.1%) patients. The fluctuations in maximal intraurethral pressure were recorded in 34 (24.8%) patients in a static position of the sensor for 5–10 min with the amplitude of 15–20 cm water column, which was defined by us as the urethral instability.

According to the results of the UFM, we found three possible variants for emptying the bladder: 56 (40.1%) patients – normal urination, 34 (24.8%) patients – rapid urination, and 47 (34.3%) patients – obstructive urination. In addition, 24 (17.5%) patients suffered from stuttering urination.

According to the results of retrograde cystometry, most of the patients with IOAB suffer from the increased detrusor tone just before urination. Therefore, there is very good reason to suppose “rapid” urination (subject to a proportional increase of tone of the effective urethral diameter). However, the latter is found only in 47 (34.3%) patients. Its absence in rest of patients is perhaps associated with the nonproportional opening of the sphincter. In some cases (under minimum partial sphincter incontinence during urination act), normal urination is observed, but in other cases, there is obstructive urination.

Examination of the bladder functions during the phase of evacuation by UFM and EMG methods of the anal sphincter confirmed the relationship of obstructive urination with incomplete relief of the urethra from the influences of the sphincter: In these cases, the bladder is evacuated against the background of its quite high electrical activity. It was urodynamically expressed in the recording of “bursts” of contractive activity of the striated sphincter of the urethra and pelvic floor muscles, which obstruct the flow of urine or even completely stop it.

During the detailed evaluation of the nature of urination using the “pressure flow” examination, the results of the patients with signs of obstructive urination and instability of the urethra have shown that during the urination, the pressure in the urethra does not fall, which probably lies behind the infravesical obstruction. Spontaneous drops and buildups of detrusor pressure during the urination act were recorded in patients with signs of detrusor overactivity (DO), which also could lie behind the combination of pollakiuria, urge incontinence, and obstructive urination.

According to the results of the cystostomy measurement and sphincter EMG, we can say about the coordination of detrusor function and bladder sphincter. EMG found no symptoms of muscle dysfunction of perineum and sphincter muscle in 17.8% of patients with IOAB. During the filling phase of cystometry, these patients showed increased EMG activity of LUT sphincters with maximum expressivity of EMG signals at the time of the occurrence of the first urgency of urination. During the evacuation phase, with random detrusor contraction, there

was laxation of the periurethral striated muscles, which was reflected on the curves of sphincter EMG by the disappearance of electric signals. EMG, conducted on two feedback channels with the determination of the dynamics of the intravesical pressure level, allowed to establish that in 35 (25.5%) patients with IOAB, the bladder sphincter and anal hole are in different action state, i.e., there were significant differences in the levels of electrical activity of these sphincters.

DISCUSSION

Analyzing the data, obtained during the recording of voiding diary, it can be noted that the patients with normal reflex excitability of bladder and partial hyporeflexia suffered from more rapid urination. The effective bladder capacity was not significantly changed. We explain this by the fact that urination very closely relates to the sensitivity of bladder. The sensitivity of bladder determines the nature of the reflex reactions. That is why bladder sensitivity mainly affects the frequency of urination. The bladder oversensitivity of these patients may, in particular, be the cause of the urgency urination and UUI. The assumption about the normal reflex activity of the bladder is confirmed by the recording of urination rates, which include normal or large portions.

Characterizing generally the features and artifacts of the impaired urodynamics of LUT in case of IOAB, it may be concluded that the main problem is the decreased ability of the bladder to accumulate and hold the urine under normal or low intravesical pressure, which is the main reason for bladder instability. It defines the sudden, compelling urge to evacuate the bladder immediately after the urge. The second peculiarity is the frequent combination of bladder instability with the signs of obstructive urination. The latter is most often caused by a primary obstruction of the neck of the urinary bladder. Thus, the above clinical states can be caused by different, sometimes paradoxical, combinations of urodynamic symptoms, which are to be absolutely considered during the examination of these patients.

Analyzing a large number of options of urodynamic findings, it is necessary to pay attention to the following fact. According to voiding diary, each patient shows quite a wide range of fluctuations of the effective bladder capacity. At first glance, these data do not correspond to the data of the cystometry measurement, which, in fact, determines the necessity of urodynamic examinations for verification of LUT dysfunction. However, the average voided volume is reduced; therefore, we can conclude that in most cases, patients with IOAB, regardless of its forms, seek to evacuate the bladder upon the occurrence of first

urge, which is imperative in nature (or not waiting for occurrence of imperative urge), and significantly less likely to “demonstrate” urination according to the actual state of the reflex excitability of the bladder. In our opinion, the expressed bladder oversensitivity in most patients and peculiarities of the mental control determine the clinical manifestations of IOAB.

CONCLUSIONS

1. According to the results of the examination conducted, it is found that most patients with IOAB suffer the same types of impairments of the storage function of the bladder, often associated with a decrease in the average effective capacity of the bladder, frequent urination, presence of urgency urination, and UUI events
2. Urgency nature of urination in patients with IOAB due to overactivity and oversensitivity of the bladder depending on the expressiveness of the impairment of the integrative function of LUT leads to the reduction of the maximum cystometric capacity in 75.9% of patients, reduction of the bladder sensitivity threshold in 70.8% of patients, DO in 35.8% of patients, the reduction of compliance in 43.1% of patients, and urethra instability in 24.8% of patients
3. Decreased ability of the bladder to accumulate and hold the urine under the normal or low intravesical pressure and frequent association of bladder instability with signs of obstructive urination are major peculiarities of the impaired urodynamics of LUT in patients with IOAB.

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Conflicts of interest

There are no conflicts of interest.

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