ROLE OF UROFLOWMETRY IN A CLINICAL STUDY OF PATIENTS WITH CHRONIC PROSTATITIS

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Annotation. *We studied 154 patients with chronic prostatitis aged 20-70 years (mean age 48.9 years). The control group consisted of 66 patients aged 20-70 years (mean age 48.7 years) without urinary tract pathology. All patients underwent uroflowmetry using a Potok-K uroflowmeter and an ultrasound examination of the bladder and prostate with determination of post-void residual volume and prostate volume. During uroflowmetry, the average volumetric urine flow rate, maximum volumetric urine flow rate, urine flow acceleration, flow time, time to maximum flow and voiding waiting time were determined, and nomograms of the maximum and average volumetric flow rate were used and a qualitative assessment of uroflowgrams was performed. A normal type of uroflogram was detected in 42.9% of patients with chronic prostatitis, intermittent in 12.3%, superflow in 9.1%, preobstructive in 9.1%, obstructive in 13.6%, and interrupted in 13% patients.*

For patients of a younger age, intermittent and superflow types of uroflograms are characteristic, which may indicate detrusor sphincter dysinergy and hyperactivity of the bladder. In older patients, obstructive and obstructively interrupted uroflowgram types are more often observed. In patients with chronic prostatitis, the earliest indicator of urodynamic disturbance is a decrease in urine flow acceleration. Marked changes in uroflowgrams were noted in 26.6% of patients with obstructive and obstructively interrupted type of voiding. These patients are shown the appointment of alpha-1-blockers that improve the function of the detrusor and the neck of the bladder. The proposed pharmacurodynamic test with a single dose of silodosin allows you to develop indications for the appointment of alpha-1-blockers.

Key words: *uroflowmetry, chronic prostatitis, urodynamics of the lower urinary tract.*

Chronic prostatitis is one of the most common urological diseases, often accompanied by the manifestation of dysuric symptoms, pain in the genitourinary system and is often associated with sexual dysfunction [1]. The frequency of chronic prostatitis among the male population is 5-8%, among men 20-50 years old – up to 10%, older than 50 years old – 9-16% [2-4], in Ukraine among men 20-60 years old – about 19% [5]. Approximately 50-60% of men with chronic prostatitis experience lower urinary tract symptoms [6].

An impressive layer of publications on the diagnosis and treatment of chronic prostatitis, unfortunately, contains few works on the urodynamics of the lower urinary tract. An objective assessment of urodynamic disorders in chronic prostatitis is an

important factor in the development of therapeutic tactics. At the same time, the need to use uroflowmetry as a non-invasive method for assessing urodynamics of the lower urinary tract with prostatitis has not yet been sufficiently argued.

The purpose of the study was to clarify the significance of uroflowmetry data in the examination of patients with chronic prostatitis.

Materials and methods. 154 patients with chronic prostatitis type III A (19 patients) and III B (135 patients) aged 20 to 70 years (mean age 48.9 years) were studied. Disease duration varied from 1 year to 6 years. The control group consisted of 66 patients without pathology of the urinary tract, aged from 21 years to 70 years with an average age of 48.7 years similar to the age of patients with chronic prostatitis. All patients underwent examination, including digital rectal examination, microscopy of prostate secretion, urethral scraping by PCR, bacteriological examination of prostate and urine secretion, urinalysis, ultrasound with determination of post-void residual volume (PVR) and prostate volume (PV), as well as uroflowmetry.

Studies of urine flow during urination were performed using a Flow-K uroflowmeter (Ukraine, developer A.E. Kvyatkovsky). Uroflowmetry results were evaluated by the following parameters: voided volume (ml), average volumetric urine flow rate Qav (normal 10-20 ml/s), maximum volumetric urine flow rate Qmax (normal 15-30 ml / s), urine flow acceleration UFA (about 5 ml/s^2), flow time TQ (normal <20 s), time to maximum flow Tmax (normal 4-12 s), voiding waiting time Twait (normal 1-5 s) [7]. Using the Liverpool Nomograms, the average and maximum volumetric flow rates corresponded automatically to the age norm regardless of the volume of urine excreted. Considering that the graphical type of curves is of no small importance in the interpretation of uroflograms, a qualitative assessment of uroflograms was carried out.

Studies of the prostate gland, bladder, determination of prostate volume and PVR were performed using a HONDA HS-2000 ultrasound machine. Statistical data processing was carried out in Excel; Student's test was used to compare statistical data.

Results and discussions. As a result of the analysis of the obtained uroflograms in patients with chronic prostatitis, the following types of curves were distinguished: “normal”, “superflow type” uroflograms (with high flow rate, rapid achievement of the maximum flow rate and flow time), “intermittent type” uroflograms (with alternating significant increase and decrease in flow rate), "obstructive type" uroflograms (with a significant decrease in flow rate parameters, values of speed indicators for nomogram below the line of the 25% distribution of normal indicators), uroflowgrams of the “preobstructive type” (with a slight decrease in velocity indicators and a slight deviation from the norm on the nomograms), “uroflowgrams of the obstructively interrupted type” (with a significant decrease in the velocity of urine flow and interruption of voiding) (tab. 1).

In chronic prostatitis, the normal type of uroflowgrams reflecting normal urination was found in 42.9% of cases, deviations from the norm were observed more often - in 57.1% of cases.

Of the uroflowgrams with deviations from the norm, uroflowgrams with signs of dynamic infravesical obstruction of various degrees of severity (preobstructive,

obstructive, obstructively interrupted type) were most often found – more than a third of uroflowgrams (35.7%). Of all cases with a deviation from the normal type of uroflowgram, they amounted to 62.5%.

Table 1

Frequency of various types of uroflowgrams in patients with chronic prostatitis

Types of uroflowgrams	Number of patients	Frequency	The average age of patients (age limits), years
Normal	66	42,9 %	42,8 (20-70)
Superflow	14	9,1 %	31,2 (22-55)
Intermittent	19	12,3 %	46,9 (27-70)
Preobstructive	14	9,1 %	52,5 (27-70)
Obstructive	21	13,6 %	54,3 (30-70)
Obstructively interrupted	20	13 %	57,4 (25-70)

In a quarter of cases (25.3%), uroflowgrams with an unstable flow and sharp fluctuations in the volumetric flow rate (intermittent and obstructively interrupted types) were observed, which of all cases with deviations from the norm was 44.3%. The irregular nature of intermittent uroflowgrams is inherent in disorders such as detrusor sphincter dysinergy and dysfunction of the bladder neck. With the obstructively interrupted type of uroflowgram, apparently, there is a combination of mismatch between the detrusor and the sphincter apparatus of the urethra, as well as dynamic infravesical obstruction due to inflammation and venous stasis in the prostate.

Rarely, there was a rapid type of uroflowgram (9.1%), moreover, in patients of a younger age, which reflects their tendency to hyperactivity of the bladder.

The data on the prostate volume and PVR obtained as a result of ultrasound examination of patients with chronic prostatitis are presented in table. 2.

Table 2

Voided volume, prostate volume and PVR in patients with chronic prostatitis, M ± m

Types of uroflowgrams	Voided volume (ml)	Prostate volume (cm3)	PVR (ml)
Normal	235,5±10,3	16,95±0,68	8,79±0,88
Superflow	221,6±21,8	15,53±1,55	8,14±1,49
Intermittent	252,3±18,2	16,42±1,13	9,64±1,36
Preobstructive	212,6±23,8	18,59±1,58	15,96±2,87
Obstructive	243±20,1	17,57±1,02	29,02±4,82
Obstructively interrupted	207,9±22,5	21,20±1,26	27,30±7,48

The average values of prostate volume and PVR in patients of the first four types of uroflowgrams were within normal limits. In patients with chronic prostatitis with obstructive urination, the average prostate volume did not statistically differ from that in patients with a normal type uroflowgram, but PVR was 3 times large on average ($p < 0.01$). We conditionally divided this group of patients with chronic prostatitis into two subgroups: patients with PVR ≤ 30 ml and patients with PVR > 30 ml. It turned out that in patients with PVR > 30 ml the average prostate volume was 1.35 times greater ($p < 0.01$), and the average PVR was 3.88 times greater ($p < 0.001$) compared with the first subgroup. A slight increase in prostate volume in the second subgroup is explained by swelling of the prostate gland, flattening of the median groove, which was detected by palpation. The average age of patients in the first subgroup was 51.9 years, the second – 58.1 years. An increase in PVR in the second subgroup can be associated both with stagnation in the prostate gland and with an age-related decrease in the compensatory capabilities of the detrusor.

Uroflowmetric indicators of patients in the control group, as well as patients with chronic prostatitis, depending on the type of uroflowgram are presented in table. 3.

Table 3

Uroflowmetric indicators of urine flow in the control group and patients with chronic prostatitis, M ± m

Types of uroflowgrams	Qav (ml/s)	Qmax (ml/s)	UFA (ml/s^2)	TQ (s)	Tmax (s)	Twait (s)
Normal (control group)	17,47±0,67	30,24±1,08	4,97±0,40	14,45±0,49	7,43±0,37	4,90±0,48
All types of uroflowgrams (prostatitis)	12,49±0,53	22,55±0,85	3,02±0,22	23,84±1,27	11,81±0,70	9,95±1,74
Normal	14,66±0,53	25,17±0,91	3,37±0,21	17,00±0,94	8,83±0,67	5,22±0,70
Superflow	11,36±0,84	23,89±2,10	2,04±0,20	23,43±1,91	13,02±1,15	12,55±2,83
Intermittent	25,88±1,14	41,25±1,83	8,68±0,64	8,45±0,62	5,12±0,47	10,17±2,59
Preobstructive	8,41±0,57	16,21±1,92	1,93±0,54	24,67±1,48	10,6±1,13	13,58±8,95
Obstructive	5,47±0,44	12,30±0,99	1,36±0,35	48,67±4,57	17,22±2,89	6,84±1,88
Obstructively interrupted	7,25±0,74	14,70±1,55	1,36±0,54	30,95±2,95	20,35±2,40	22,11±10,07

If we do not differentiate the results of uroflowmetry in chronic prostatitis depending on the types of uroflowgrams, then all quantitative indicators, with the exception of the urine flow acceleration, which was reduced, on average corresponded to the generally accepted norm. At the same time, in comparison with the control group, the indicators of the volumetric flow rate were lower, and the time indicators were higher. The urine flow acceleration was reduced by 1.6 times compared with the control group, Qmax – by 1.3 times.

In the group of patients with chronic prostatitis with a normal type of uroflowgram, the average quantitative values of the uroflowmetry parameters did not go beyond the generally accepted norm, and on the Qmax and Qav nomograms exceeded the 50th percentile. The only indicator whose average value was lower was UFA. However, when comparing the uroflowmetry parameters of this group of patients with chronic prostatitis with a control group of men, similar in quantitative, age composition and average voided volume, all speed indicators were significantly lower ($p < 0.05$). The flow time was significantly greater ($p < 0.05$) than in the control group, Tmax and Twait did not differ significantly ($p > 0.05$).

In patients with chronic prostatitis with intermittent type of uroflogram, the flow rate of urine during urination underwent significant fluctuations, and uroflograms were intermittent. These manifestations are associated with the alternation of episodes of uncontrolled contraction and relaxation of the urethral sphincter during urination. The frequency and amplitude of the fluctuations in the volumetric flow rate had a wide spectrum of patterns – from slow-wave to "staccato". The urine flow acceleration in these patients on average was significantly lower compared with the group of patients with the normal type of curve ($p < 0.01$), other indicators of velocity were within normal limits, although slightly reduced compared with the control group. Flow time increased by more than 2 times ($p < 0.01$). At the same time, the average values of TQ and Tmax only slightly exceeded the indicators of the generally accepted norm.

Patients with a superflow type of uroflogram had a significant increase in urine flow rate, especially UFA, and a decrease in TQ and Tmax relative to the control group and the group of patients with a normal curve type ($p < 0.05$), which indicated detrusor hyperactivity. It is necessary to pay attention to the fact that the average age of patients in this group was less than in other groups, and averaged 31.2 ± 2.5 years. In patients with a superflow and frequent urination, a mirabegron beta-3-adrenergic agonist, which has a relaxing effect on the detrusor, can have a good effect.

In the group of patients in which uroflograms corresponded to unexpressed obstruction, Qmax and Qav were on average slightly lower than the generally accepted norm and significantly lower than in the control group ($p < 0.01$), the rate of urine flow acceleration was most reduced (on average 2.6 times). Often the dome of the curve was shifted to the right, which may indicate a slow opening of the neck of the bladder. TQ and Tmax were increased. Increased by 2.8 times was the voiding waiting time.

Thus, unexpressed changes in the flow of urine in chronic prostatitis in young people were more often manifested by an intermittent and superflow type of urination, in men older than 50 years – the appearance of signs of preobstructive type, which may be associated with age-related changes in the genitourinary system.

In the group of patients with obstructive urination, urine flow rates with uroflowmetry were reduced by 2 or more times, especially UFA (2.5 times on average), and TQ and Tmax were increased compared to the group with the normal type of uroflowgram ($p < 0,01$).

In patients with chronic prostatitis with an obstructively interrupted type of uroflowgram, uroflowmetry indicators were almost at the same level as in the group

of patients with obstructive type of uroflowgram. There was a significant decrease in all velocity indicators and an increase in all time indicators compared with the group of patients with the normal type of uroflowgram ($p < 0.05$), regardless of the number of PVR. The indicators of uroflowmetry in the subgroup of patients with PVR > 30 ml did not differ significantly from the subgroup of patients with PVR ≤ 30 ml, with the exception of UFA, which was significantly lower by 1.79 times, and Twait, which was the largest among all groups of patients (41.71 ± 24.76 s). An increase in the voiding waiting time in patients with chronic prostatitis may be associated with difficulty opening the neck of the bladder due to dynamic infravesical obstruction. An obstructively interrupted uroflowgram type was more often detected in patients with chronic prostatitis older than 50 years old, and was observed both in patients with an increased amount of residual urine and in patients with a small amount of residual urine. The quantitative parameters of uroflowmetry were independent of PVR, and PVR was not associated with PV.

The use of alpha-blockers for the treatment of patients with chronic prostatitis, along with the appointment of antibacterial, non-steroidal anti-inflammatory and other drugs, can significantly improve urination [8, 9]. Alpha-adrenergic blockers, in addition to affecting the smooth muscles of the prostate and the internal sphincter of the urethra, being vasoactive substances, improve hemomicrocirculation in the prostate gland, impaired in chronic prostatitis. Their use is most relevant for the treatment of patients with obstructive and obstructively interrupted uroflowgram type. However, it can also be used to treat patients with manifestations of detrusor-sphincter dysinergy: with an obstructively intermittent and intermittent type of uroflowgram. The solution to the question of the appropriateness of the appointment of alpha-1-blockers is greatly simplified, thanks to the pharmacurodynamic test with silodosin, proposed by A.E. Kvyatkovsky [10]. Pharmacourodynamic test consists in uroflowmetry with determination of the maximum and average volumetric urine flow rate before taking and 2.5-3 hours after taking 8 mg of silodosin. Given the increase in the maximum and average volumetric urine flow rate by 25-30%, drug therapy with silodosin is prescribed, in the absence of changes or a slight increase in the maximum and average volumetric urine flow rate, treatment with alpha-1-blocker is considered inappropriate. In this case, further examination is necessary in order to identify the organic cause of obstruction. Pharmacourodynamic test is a highly informative method for predicting the expected result of treatment with silodosin. According to our, together with a team of authors, data [7], the use of alpha-1-adrenergic blocking agents in the complex treatment of chronic bacterial prostatitis gives good results: an improvement in lower urinary tract urodynamics was noted in 96% of patients.

Conclusions. Considering that more than half of patients with chronic prostatitis of type III A and III B have urination disorders (57.1%), uroflowmetry is important for their objectification.

The normal type of uroflowgram was detected in 42.9% of patients with chronic prostatitis. Unexpressed changes in the parameters of uroflowgrams (in patients with intermittent, superflow and preobstructive type of uroflowgrams) were detected in

30.5% of patients, pronounced changes in the parameters and nature of uroflowgrams (in patients with obstructive and obstructively interrupted type of uroflowgrams) – in 26.6% of patients.

Intermittent and rapid types of uroflowgrams, indicating detrusor sphincter dysinergy and hyperactivity of the bladder, are more often observed in patients of a younger age, obstructive and obstructively interrupted types, reflecting dynamic infravesical obstruction, in older patients.

The importance of the urine flow acceleration indicator for the early detection of urodynamic disorders in patients with chronic prostatitis is indicated by its primary decrease in patients with uroflowgram type, identified by other indicators and nomograms as normal, as well as its significant decrease in patients with preobstructive urination.

Quantitative indicators of uroflowmetry in chronic prostatitis are not directly dependent on the prostate volume and the post-void residual volume.

Patients with obstructive and obstructively interrupted uroflowgrams, which make up about a quarter of all patients with chronic prostatitis, are indicated for the use of alpha-1-blockers. The proposed pharmacurodynamic test with a single dose of silodosin allows you to develop indications for the appointment of alpha-1-blockers.

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