

ORIGINAL ARTICLE

EVALUATION OF EFFICACY OF EXTRACORPOREAL SHOCK WAVE THERAPY IN COMPLEX TREATMENT OF PATIENTS WITH CHRONIC NON-BACTERIAL PROSTATITIS / CHRONIC PELVIC PAIN SYNDROME

DOI: 10.36740/WLek202108110

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ABSTRACT

The aim: Study of hemodynamics of the prostate and evaluation of the effectiveness of extracorporeal shock wave therapy (ESWT) in the complex treatment of patients with chronic prostatitis with non-inflammatory chronic pelvic pain syndrome (NCPPS), (NIH III B).

Materials and methods: There were 63 patients with NCPPS aged 29 to 45 years, with a disease duration of more than 3 years and low efficacy of treatment against the background of standard therapy. All patients received standard therapy according to the clinical protocol. The main group (33 men – group II), against the background of standard therapy, received a course of ESWT, followed by a comparative assessment of clinical results regarding to the group of patients (30 men – group I) who received only standard therapy after the course, and after 3 and 6 months after treatment.

Results: According to the results of transrectal ultrasonography in Doppler mode, a marked decrease in volumetric blood flow in the prostate gland of patients was observed. The use of ESWT against the background of standard treatment contributed to a longer and more stable clinical effect, with a significant improvement in hemodynamic parameters in the prostate unlike the results in the group of patients receiving only standard therapy.

Conclusions: Significant disorders of prostate hemodynamics were found in patients with NCPPS. Use on the background of standard treatment of ESWT in these patients is pathogenetically justified with a lasting and stable clinical effect.

KEY WORDS: hemodynamics of the prostate, dopplerography, quality of life

Wiad Lek. 2021;74(8):1834-1838

INTRODUCTION

Chronic prostatitis (CP) is the most common urological disease among men of working age, and its characteristic symptoms in 8,2% negatively affect their quality of life [1]. The incidence of prostatitis in Ukraine is about 19% of the male population aged 20 to 60 years [2]. Mostly these patients do not have an infection in the secretion of the prostate, semen and urine. This form of CP, according to the classification of the National Institutes of Health (NID), is defined as chronic non-bacterial prostatitis, or chronic pelvic pain syndrome (CPPS / category III) [3].

Among the congenital anatomical pathogenetic causes of CP / CPPS there is a feature of the blood supply of the prostate gland, when the arterioles end not in the glandular tissue, but in the connective tissue between the acini. Therefore, edema of the prostate, against the background of the inflammatory process leads to compression of these arterioles with the occurrence of its ischemia. In addition, the anatomical and physiological feature is a dense fibrous capsule of the prostate. As a result of edema of parenchyma, intraprostatic pressure increases with impaired microcirculation. According to the results of tran-

srectal color duplex mapping of the prostate, Kogan M. with co-authors, indicated a significant decrease in peak systolic arterial blood flow rate and a significant increase in the resistance index of arteries in the prostate of patients with non-inflammatory form of CP / CPPS compared with data from healthy volunteers. The direct correlation of pain intensity and peak systolic velocity of arterial blood flow in the prostate gland was proved, which was confirmed pathohistologically in the studies of Lytvynets Ye.A., Halo O. Ye. [4,5].

In the absence of clear ideas about the etiology and pathogenesis of CPPS, the treatment of patients is empirical and symptomatic. Traditional therapy is not always effective enough and is usually non-durable.

THE AIM

Study of prostate hemodynamics and evaluation of the effectiveness of extracorporeal shock wave therapy (ESWT) in the complex treatment of patients with chronic prostatitis with non-inflammatory chronic pelvic pain syndrome (NCPPS), (NIH III B).

MATERIALS AND METHODS

In the period of 2019, there were 63 patients under observation, aged 37.4 ± 8.1 years with chronic non-bacterial prostatitis, with non-inflammatory chronic pelvic pain syndrome (NCPPS) / (CP / CPPS- (NIH IIIB)), with a long recurrent course of the disease ($5,4 \pm 2,3$ years), which was difficult to treat with traditional therapy. Patients gave written information consent to the processing of the received data on the basis of confidential information processing. During the diagnostic examination – compliance with the ethical principles of medical research with human participation in accordance with the Helsinki Declaration of the World Medical Association. The diagnosis of chronic non-bacterial prostatitis with non-inflammatory chronic pelvic pain syndrome (NCPPS) / CP / CPPS / (NIH III B) was set on the basis of the following criteria: the presence of periodic / persistent pain (discomfort) over the bosom, in perineum, scrotum, sacrum during a long time, with or without urination disorders; the presence of leukocytes in the amount of <10 in sight in microscopic examination of the secretion of the prostate or urine after massage of the prostate (VB3) and semen; negative results of microbiological studies of prostate or urine secretion after prostate massage (VB3) and semen; negative PCR results in the diagnosis of urethral secretion.

Hemodynamics of the prostate was evaluated using TRUS with Doppler with a sensor of 5-10 MHz, on the device GE LOGIQ P9 / P7, with the determination of qualitative and quantitative indicators.

The obtained data on the state of blood flow in the patients' prostate were compared with the corresponding data

in the group of 25 practically healthy men. Patients were also surveyed according to the International Symptom Assessment System using the Chronic Prostatitis Symptom Index (NIH-CPSI, 1999).

Criteria for inclusion in the study: the presence of NCPPS (NIH IIIB); the patient's ability to cooperate adequately and motivated in the research process; the absence of the following factors: when performing TRUS hyperplasia of the prostate, age increasing of total PSA level, undergoing surgery on the lower urinary tract or pelvic injuries, severe neurological and / or endocrine changes, various manifestations of perineal skin diseases, coagulation disorders.

Patients were randomly divided into two groups. The first group, 30 patients, received standard therapy for a month – antibiotics, nonsteroidal anti-inflammatory drugs, alpha-blockers, muscle relaxants. The second group, 33 patients, against background of standard therapy underwent a course of ESWT, which was held twice a week for a month according to the standard method with the setting of the shock wave source at three typical points on the perineum. The total number of pulses is 3000 (1000 pulses per point). The Gentle^{Pro} radial shock wave therapy device from Zimmer AestheticDivision was used in the following mode: frequency – 10 Hz; pressure -1,5-2 bar; pulse energy 90-120 mJ.

Assessment of the dynamics of symptoms, data of blood flow in the prostate was done immediately after the course and 3 and 6 months after treatment in both groups of patients.

Table I. Assessment of the dynamics of the severity of subjective manifestations of the disease in patients with NCPPS before and after treatment on the NIH-CPSI scale ($M \pm m$)

Indicator	group	before treatment	after treatment	after 3 months	after 6 months
Pain or discomfort	I	14,71±2,04	10,21±1,16 p=0,013	9,28±0,97 p=0,016	11,69±1,27 p=0,024
	II	14,48±1,93	7,03±1,12 p=0,023	6,13±0,92 p=0,018	6,45±0,94 p=0,018
Violations of urination	I	3,84±0,86	2,25±0,86 p=0,019	2,43±0,16 p=0,032	3,56±0,82 p=0,178
	II	3,97±0,83	1,97±0,23 p=0,012	2,39±0,13 p=0,034	3,21±0,11 p=0,132
The impact of the disease on everyday life	I	4,12±0,84	2,67±0,44 p=0,027	2,26±0,11 p=0,024	2,97±0,54 p=0,033
	II	4,07±0,39	1,95±0,19 p=0,018	1,42±0,11 p=0,021	1,55±0,14 p=0,016
Quality of life	I	4,31±0,65	2,79±0,52 p=0,023	2,37±0,24 p=0,038	3,11±0,51 p=0,042
	II	4,33±0,96	2,07±0,21 p=0,012	1,52±0,15 p=0,008	1,64±0,17 p=0,009
Total score NIH-CPSI	I	26,98±4,39	17,92±2,98 p=0,032	16,34±1,48 p=0,028	21,33±3,14 p=0,043
	II	26,85±4,41	13,02±2,61 p=0,018	11,46±1,31 p=0,016	12,85±1,36 p=0,015

Notes:

p - reliability of differences before and after treatment;

Table II. Indicators of prostate hemodynamics according to TRUS with Doppler in patients with NCPPS before and after treatment (M ± m)

Indicator (control group)	group	before treatment	after treatment	after 3 months	after 6 months
Peak systolic velocity cm / s (12,58±0,37)	I	7,41±0,34 p ¹ =0,022	8,52±0,27 p=0,078	8,89±0,44 p=0,082	8,12±0,36 p=0,080
	II	6,98±0,21 p ¹ =0,018	10,92±0,47 p=0,012	11,69±0,32 p=0,024	11,35±0,44 p=0,010
Diastolic velocity cm / s (3,96±0,22)	I	2,33±0,15 p ¹ =0,028	2,78±0,12	2,64±0,19	2,46±0,14
	II	2,16±0,18 p ¹ =0,028	3,28±0,22 p=0,022	3,55±0,34 p=0,018	3,46±0,18 p=0,024
The average linear velocity cm / s (7,37±0,24)	I	5,32±0,12 p ¹ =0,032	6,41±0,23 p=0,082	6,32±0,42 p=0,078	5,84±0,22 p=0,12
	II	5,48±0,13 p ¹ =0,026	6,99±0,47 p=0,025	7,31±0,55 p=0,019	7,18±0,12 p=0,020
Pulsation index conv.un. (0,92±0,04)	I	1,34±0,05 p ¹ =0,012	1,14±0,02 p=0,082	1,18±0,05 p=0,094	1,26±0,05 p=0,121
	II	1,28±0,05 p ¹ =0,011	0,98±0,02 p=0,006	0,94±0,02 p=0,004	0,96±0,03 p=0,007
Index of resistance conv.un. (0,54±0,02)	I	0,82±0,02 p ¹ =0,009	0,74±0,01 p=0,062	0,71±0,02 p=0,059	0,78±0,01 p=0,072
	II	0,78±0,02 p ¹ =0,008	0,65±0,02 p=0,003	0,61±0,02 p=0,005	0,62±0,02 p=0,004
The diameter of the vessels, cm (0,062±0,005)	I	0,044±0,008 p ¹ =0,006	0,048±0,007 p=0,052	0,052±0,008 p=0,056	0,046±0,008 p=0,052
	II	0,046±0,007 p ¹ =0,007	0,058±0,008 p=0,004	0,062±0,007 p=0,006	0,058±0,007 p=0,004
Density of the vascular plexus, vessels / cm ² (1,89±0,014)	I	0,78±0,02 p ¹ =0,008	0,86±0,02 p=0,058	0,82±0,02 p=0,062	0,79±0,01 p=0,061
	II	0,79±0,02 p ¹ =0,008	1,14±0,12 p=0,004	1,23±0,11 p=0,003	1,18±0,12 p=0,008
Total relative improvement,%	I		14,1%	14,4%	5,9%
	II		32,4%	45,1%	39,2%
Volumetric blood flow l / min. (0,06±0,01)	I	0,01±0,001 p ¹ <0,001	0,014±0,001 p=0,058	0,016±0,001 p=0,056	0,012±0,001 p=0,052
	II	0,008±0,001 p ¹ <0,001	0,034±0,004 p=0,004	0,038±0,004 p=0,006	0,036±0,002 p=0,004

Notes:

p - the probability of differences before and after treatment, after 3 months and 6 months

p¹ - the probability of differences in the groups before treatment with indicators in the control group

Statistical processing of the obtained data was done using Microsoft Excel, Statistika-10.0, "MedCalc" (v.17.6). The U-Mann-Whitney U Test was used to establish the statistical significance of the difference between average indicators.

RESULTS

The initial questionnaire data in both groups of patients certainly did not differ. Namely, before treatment, when surveying in patients of group I, the average total score on the NIH-CPSI scale was 26,98 ± 4,39 and in group II – 26,85 ± 4,4.

In patients with NCPPS, during dopplerography, there was a depletion of the vascular pattern with a decrease in vascular diameter and vascular plexus density more than twice, with a marked decrease in volumetric blood flow in the prostate. There was also a significant decrease in peak systolic, diastolic and average linear velocity, with an increase in pulsation index and resistance index. Violation of hemodynamics led to tissue hypoxia of the prostate, which was manifested by pain.

The results of the dynamics of the severity of symptoms and their impact on quality of life after treatment are presented in table I.

When surveying patients of group I who received basic therapy, the score on NIH-CPSI after treatment was 17,92 ±

2,98, which is 33,6% lower than before treatment, after 3 months – $16,34 \pm 1,48$, which is 39,4% lower than before treatment and after 6 months – $21,33 \pm 3,14$ (20.9%), with a tendency to symptoms return. The obtained data indicate the return of clinical manifestations over time after the standard course of treatment of patients with NCPPS.

After treatment in patients of group II, who underwent ESWT against background of standard therapy, the total score for NIH-CPSI was $13,02 \pm 2,61$, which is 51,5% lower than before treatment, after 3 months – $11,46 \pm 1,31$, which is 57,3% lower than before treatment, and after 6 months – $12,85 \pm 1,36$, which is 52,1% lower than before treatment with a stable clinical effect, except for urination disorders, where the indicators, as in group I, approached the indicators before treatment, without a certain static difference.

Characteristics of the state of blood flow in the prostate before and after treatment are presented in table II.

In patients who underwent a course of ESWT against background of standard therapy, hemodynamic parameters in the prostate changed significantly. There was a significant increase in peak linear velocities of blood flow in the vessels, with an increase in vascular diameter and vascular plexus density, with a significant decrease in the pulsation index and the resistance index. The overall relative improvement in prostate vascularization after treatment was 32,4%, after 3 and 6 months, 45,1% and 39,2%, respectively, with an increase in volumetric blood flow of more than four times. However, in the group of patients who received only basic therapy, the hemodynamic parameters in the prostate after treatment changed slightly and remained at the same level after 3 months after treatment. And 6 months after treatment, these indexes returned almost to baseline. The total relative improvement in prostate hemodynamics in this group of patients after treatment was 14,1%, and after 3 and 6 months, 14,4% and 5,9%, respectively. No side effects were reported with the use of ESWT.

Therefore, the obtained results indicate that the use of ESWT in the complex treatment of patients with NCPPS provides stimulation of microcirculation in the prostate gland, and thus contributes to a lasting and stable clinical effect.

DISCUSSION

There is no universal successful therapy for NCPPS today, because drug treatment in a large number of cases does not allow to achieve a positive long-term clinical result.

A number of scientists point out to the high efficiency and safety of shock wave therapy in the treatment of patients with CPPS, namely: Zimmermann R. et al. showed a significant reduction in pain and improvement in urination (although without a certain difference), which improved the quality of life of patients after ESWT. These studies also demonstrated that ESWT is non-traumatic to the prostate [6,7]. Al. Edwan G. M. et al. confirmed the safety and efficacy of ESWT in cases of resistance to any other treatment for CPPS, with a stable clinical effect after 6 and 12 months after treatment [8].

In a study by G. L. Fojecki et al. by selecting scientific papers from medical web resources, there were identified

three studies of CPPS involving 200 men, who had a positive dynamics of pain reduction on the NIH-CPSI scale [9].

Pajovic B. et al. indicate that the use of ESWT against the background of standard therapy is significantly more effective in reducing pain on the NIH-CPSI scale and improving urination, in contrast to the results in patients receiving only standard treatment (α -blocker, anti-inflammatory agent and muscle relaxant) [10]. Zhang ZX et al. in their study noted a low percentage (4%) of recurrence of clinical manifestations in patients 3 months after the course of ESWT against the background of standard therapy, in contrast to the group of patients receiving standard therapy (50%) [11]. The data obtained by Guu S. J. et al. indicate a stable clinical effect in patients 3 months after the course of ESWT, who are resistant to traditional treatment (antibiotics, α -blockers, anti-inflammatory drugs), noting such mechanisms of low-dose ESWT as induction of neovascularization, decreased muscle tone, nerve interruption impulse [12]. It should be noted that only in one of these studies (Al. Edwan G.) was conducted an assessment of long-term results of the effectiveness of ESWT, namely after 12 months, in contrast to others in which the results were evaluated up to 3 months. We obtained significant statistically certain results 6 months after treatment on a total score on the NIH-CPSI scale, except for improved urination, which indicates the usefulness of long-term use of α -blockers.

The results of our study for the first time showed a positive statistically significant dynamics of blood flow in the prostate after ESWT with the saving of the total improvement in hemodynamics in the prostate after 6 months by 39,2%. Our data pathogenetically substantiate the use of ESWT in the complex treatment of patients with NCPPS (NIH IIIB), and the use of TRUS with Doppler mapping allows to monitor the parameters of hemodynamics in the prostate to assess the effectiveness of treatment. Wang H.J. et al. confirm that low levels of shock wave energy enhance the expression of vascular endothelial growth factor, endothelial nitric oxide synthase [13]. ESWT is recommended by the European Association of Urologists as a physiotherapeutic component in the complex therapy of NCPPS. However, today there are no common standards for such therapy (applicator localization, frequency of procedures, optimal interval between procedures, duration of therapy, shock-wave modes), which is partly due to both small groups of patients who participated in the study and the number of published data. Therefore, in the future it is necessary to observe the effectiveness of ESWT in the treatment of large groups of patients with NCPPS, with the assessment of long-term results.

CONCLUSIONS

According to prostate dopplerography data in patients with NCPPS revealed significant hemodynamic disorders that correlate with clinical manifestations. According to the data obtained, it is possible to hypothesize that chronic ischemic prostate disease as the cause of the non-inflammatory form of chronic non-bacterial prostatitis.

The use of extracorporeal shock wave therapy against the background of standard therapy helps to improve hemodynamic parameters in the prostate in patients with NCPPS, while maintaining a long and stable clinical effect.

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The presented work was executed within the complex research work of the Department of Urology «Clinical and pathogenetic characteristics of pathological conditions of the urinary system and male genitals and justification of effective treatment methods» (state registration № 0113U007797).

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Conflict of interest:

The Authors declare no conflict of interest.

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Received: 07.07.2020

Accepted: 02.06.2021

A – Work concept and design, **B** – Data collection and analysis, **C** – Responsibility for statistical analysis, **D** – Writing the article, **E** – Critical review, **F** – Final approval of the article