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Research Article

Effectiveness of Low-Intensity Shockwave Therapy in Chronic Pelvic Pain Syndrome: A Prospective Cohort Study

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Abstract

Background: Chronic Pelvic Pain Syndrome (CPPS) is a common urological condition characterized by persistent pelvic pain and urinary symptoms, often with limited response to conventional therapies. Low-Intensity Shockwave Therapy (LISWT) has emerged as a promising non-invasive treatment modality.

Objective: To evaluate the effectiveness of LISWT in improving pain, urinary symptoms, and quality of life in patients with CPPS.

Materials and Methods: This prospective cohort study included 18 male patients aged 18–60 years (mean age 38.5 ± 9.2 years) diagnosed with CPPS (National Institutes of Health /NIH Category III) with symptom duration ≥3 months. Patients underwent standardized LISWT (2 sessions/week for 4 weeks; energy 0.09–0.25 mJ/mm^2; 2000 shocks/session). Outcomes were assessed using the NIH Chronic Prostatitis Symptom Index (NIH-CPSI), Visual Analog Scale (VAS), quality of life scores, urinary symptoms, and erectile function (IIEF-5) at baseline, 4 weeks, 12 weeks, and 6 months.

Results: Significant improvement in NIH-CPSI scores was observed from baseline (28.4 ± 5.2) to 4 weeks (20.1 ± 4.8), 12 weeks (16.5 ± 4.2), and 6 months (14.9 ± 3.9) ($p < 0.001$). Mean VAS pain scores decreased from 7.2 to 3.1 at 6 months. Quality of life scores improved significantly, while urinary symptoms showed moderate improvement. Erectile function (IIEF-5) improved modestly from 17.2 to 19.8 ($p < 0.05$). No significant adverse effects were reported.

Conclusion: LISWT is a safe and effective treatment for CPPS, significantly improving pain and quality of life. Larger controlled studies are required to validate these findings.

Keywords: Chronic pelvic pain syndrome; extracorporeal shockwave therapy; pain measurement prostatitis; quality of life

Introduction

Chronic Pelvic Pain Syndrome (CPPS) is a prevalent yet complex urological disorder characterized by persistent pelvic pain, urinary symptoms, and reduced quality of life in the absence of identifiable infection or structural pathology [1–3]. Classified under National Institutes of Health (NIH) Category III prostatitis, it accounts for the majority of prostatitis cases. Despite its frequency, CPPS remains difficult to diagnose and manage due to its multifactorial etiology, which involves inflammatory, neuromuscular, and psychosocial components [2,4]. Current treatment strategies are largely empirical and include antibiotics, alpha-blockers, anti-inflammatory drugs, and pelvic floor physiotherapy [5,6]. However, clinical outcomes are often inconsistent, and many patients continue to experience

persistent or recurrent symptoms despite multiple treatment modalities [7]. This therapeutic limitation significantly affects patient well-being and emphasizes the need for more effective interventions.

Low-Intensity Shockwave Therapy (LISWT) has recently gained attention as a non-invasive treatment option with potential benefits in CPPS [8,9]. It works by delivering acoustic waves that enhance tissue regeneration, improve microcirculation, and reduce inflammation [10]. Additionally, LISWT may modulate nociceptive pathways, contributing to sustained pain relief [11]. Its effectiveness in conditions such as erectile dysfunction and musculoskeletal disorders supports its potential application in CPPS [12,13]. Emerging studies report encouraging results, particularly in reducing pain and improving quality of life, although heterogeneity in study designs limits broader applicability [14–16]. This study aims to prospectively evaluate the effectiveness of LISWT in CPPS patients by assessing changes in symptom severity, pain, urinary function, and quality of life over six months.

Materials and Methods

Study Design

This study was conducted as a prospective, single-arm cohort investigation to evaluate the effectiveness and safety of Low-Intensity Shockwave Therapy (LISWT) in patients with Chronic Pelvic Pain Syndrome (CPPS). A longitudinal approach was adopted, enabling assessment of participants from baseline through predefined follow-up intervals. This design facilitates observation of treatment response over time in a real-world clinical setting without the use of randomization or control groups [14,17]. Participants were enrolled consecutively to reduce selection bias and were evaluated at regular intervals. Repeated assessments allowed analysis of both early improvements and sustained therapeutic effects. Similar methodological designs have been widely used in previous LISWT studies for CPPS and erectile dysfunction [14,20].

Place and Duration of Study

The study was carried out at a tertiary care urology center in India with advanced diagnostic and treatment facilities. The center caters to a diverse patient population, allowing recruitment of a representative CPPS cohort. The total study period was 12 months, including recruitment, treatment, and follow-up. Each participant received therapy over 4–6 weeks and was followed for up to six months after completion. This duration was selected to evaluate both short-term outcomes and persistence of treatment effects, as prior studies suggest prolonged benefits of LISWT [15,26].

Ethical Approval and Patient Consent

Approval was obtained from the Institutional Ethics Committee prior to study initiation. The study complied with the ethical standards outlined in the Declaration of Helsinki [18]. All participants were informed about the study objectives, procedures, potential risks, and expected benefits. Written informed consent was obtained before enrollment. Patient confidentiality was ensured by anonymizing data, and participation was entirely voluntary, with the option to withdraw at any stage without affecting ongoing care (Figure 1).

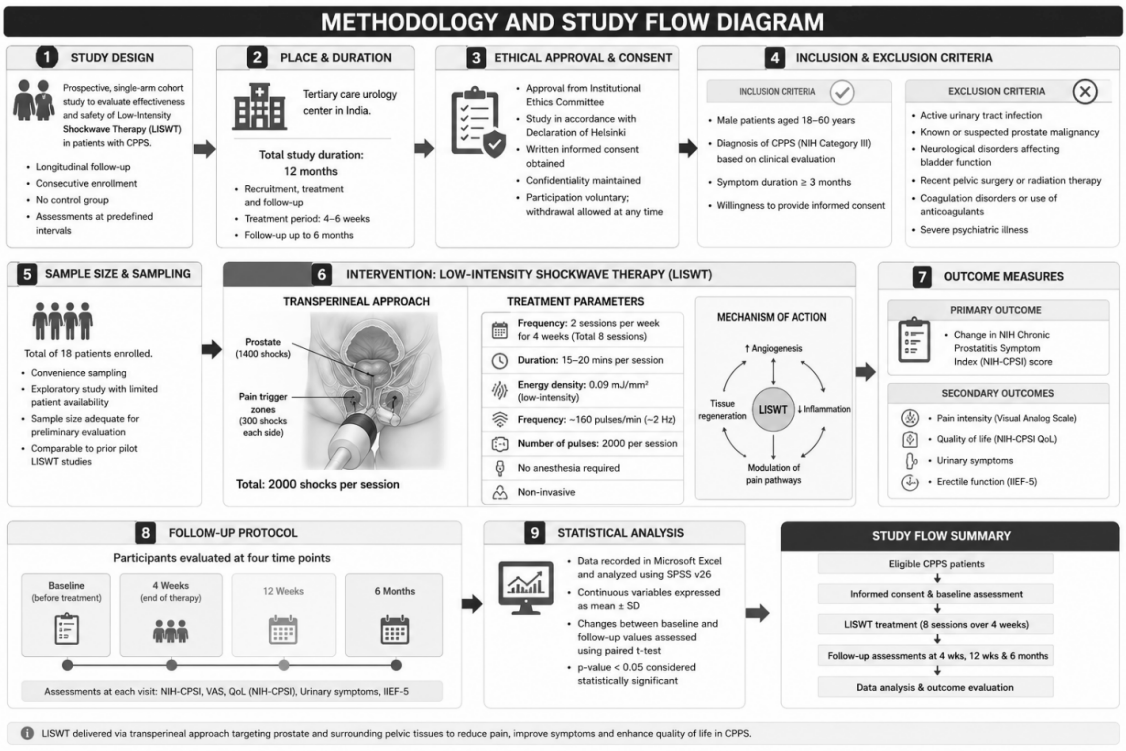

Figure 1: Study methodology and flow diagram.
It is illustrating participant selection, transperineal low-intensity shockwave therapy (LISWT) protocol, follow-up assessments, outcome measures, statistical analysis, and overall study workflow for patients with chronic pelvic pain syndrome (CPPS).

Inclusion and Exclusion Criteria

Strict eligibility criteria were applied to ensure a uniform study population and minimize confounding factors.

Inclusion Criteria:

- Male patients aged 18–60 years
- Diagnosis of CPPS (NIH Category III) based on clinical evaluation
- Symptom duration of at least 3 months
- Willingness to provide informed consent

Exclusion Criteria:

- Active urinary tract infection confirmed by investigations
- Known or suspected prostate malignancy
- Neurological disorders affecting bladder function
- Recent pelvic surgery or radiation therapy
- Coagulation disorders or use of anticoagulants
- Severe psychiatric illness

These criteria were consistent with previously published LISWT studies, ensuring comparability of results [16,19].

Sample Size and Sampling Technique

A total of 18 patients were included in the study. Due to the exploratory nature of the research and limited patient availability, convenience sampling was employed [19]. Although relatively small, the sample size was considered adequate for preliminary evaluation of feasibility and treatment response. Similar sample sizes have been used in earlier pilot studies on LISWT in CPPS [14,15]. The findings are intended to provide baseline data for future larger trials (Figure 1).

Intervention Protocol

All participants underwent LISWT using a standardized protocol based on existing literature [14,20]. Treatment was delivered using either a focused or radial shockwave device.

Treatment parameters included:

- Frequency: 1–2 sessions per week
- Duration: 4–6 weeks
- Energy density: 0.09–0.25 mJ/mm^2
- Number of shocks: 1500–3000 per session

Shockwaves were applied via a transperineal approach targeting the prostate and surrounding pelvic tissues, allowing effective energy delivery with minimal discomfort [20] (Figure 2). The therapeutic effects of LISWT are thought to involve stimulation of angiogenesis, reduction of inflammation, and modulation of pain pathways, contributing to symptom improvement in CPPS [23,24].

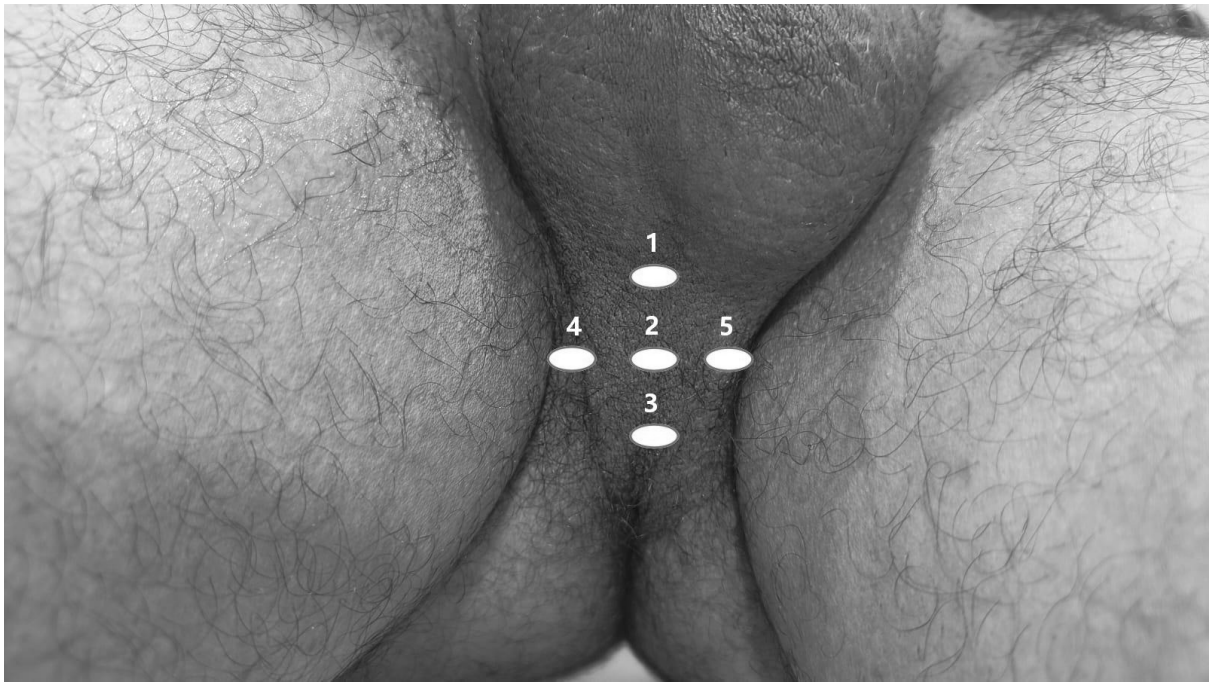

Figure 2: Transperineal Low-Intensity Shockwave Therapy (LISWT) treatment template.

It is showing the five application points. A total of 2,000 shockwaves/session (0.09 mJ/mm²; ~160 pulses/min) were delivered: 1,400 shockwaves to the prostate at midline points 1–3 and 300 shockwaves each to the bilateral periprostatic pain-trigger zones (points 4 and 5).

Outcome Measures

Primary Outcome:

- Change in NIH Chronic Prostatitis Symptom Index (NIH-CPSI) score [21]

Secondary Outcomes:

- Pain intensity assessed using the Visual Analog Scale (VAS)
- Quality of life derived from NIH-CPSI
- Urinary symptom evaluation
- Erectile function assessed using the International Index of Erectile Function-5 (IIEF-5)

These measures are widely used and clinically relevant in CPPS research [25,27].

Follow-Up Protocol

Participants were evaluated at four time points:

- Baseline (before treatment)
- 4 weeks (end of therapy)
- 12 weeks
- 6 months

This schedule enabled assessment of both early response and long-term sustainability of treatment outcomes. Similar follow-up intervals have been used in previous LISWT studies [26,28].

Statistical Analysis

Data were recorded in Microsoft Excel and analyzed using SPSS version 26. Continuous variables were expressed as mean ± standard deviation. Changes between baseline and follow-up values were assessed using paired t-tests, appropriate for repeated measurements within the same group [22]. A p-value <0.05 was considered statistically significant, indicating that observed differences were unlikely to be due to chance.

Results

A total of 18 male participants were recruited and completed the study protocol along with all scheduled follow-up evaluations. The mean age of the study population was 38.5 ± 9.2 years, with the majority falling within the 30–45-year age bracket. The average duration of symptoms prior to initiation of therapy was 11.2 ± 3.8 months, indicating that most patients had a longstanding, chronic disease course. The cohort largely consisted of otherwise healthy individuals without significant systemic illnesses. Conditions such as diabetes mellitus, cardiovascular disease, or immunosuppression were not present, thereby reducing potential confounding influences on treatment outcomes. All participants had previously undergone conventional CPPS management, including antibiotics, alpha-blockers, and nonsteroidal anti-inflammatory drugs, but failed to achieve satisfactory symptom relief. This reflects a population with persistent, treatment-resistant disease, which is frequently encountered in CPPS clinical practice [1,14]. At baseline, patients exhibited a high degree of symptom burden. The mean NIH Chronic Prostatitis Symptom Index (NIH-CPSI) score was 28.4 ± 5.2, consistent with moderate to severe disease severity [21]. Pain was the most prominent complaint, with a mean Visual Analog Scale (VAS) score of 7.2 ± 1.1 (Table 1).

Table 1: Baseline demographic and clinical characteristics of the study population (n = 18).

Variable	Value
Number of patients	18
Mean age (years)	38.5 ± 9.2
Age range (years)	22–56
Predominant age group	30–45 years
Mean duration of symptoms (months)	11.2 ± 3.8
Prior treatments	Antibiotics, alpha-blockers, NSAIDs
Comorbidities	None significant
NIH-CPSI score (baseline)	28.4 ± 5.2
VAS pain score (baseline)	7.2 ± 1.1
IIEF-5 score (baseline)	17.2 ± 3.5
Urinary symptoms	Frequency, urgency, dysuria
Quality of life	Significantly impaired

Baseline demographics and clinical profile of 18 male CPPS (NIH III) patients. Values expressed as mean±SD or frequency. Most aged 30–45 years, with ≥3 months symptoms, prior treatment failure, moderate–severe symptoms, significant pain, reduced quality of life, urinary and sexual dysfunction. Quality of life was substantially impaired in all participants. Patients reported limitations in routine activities, decreased work productivity, and psychological distress related to chronic symptoms. Urinary complaints, including increased frequency, urgency, and occasional dysuria, were commonly noted, although their severity varied across individuals. Assessment of sexual function using the International Index of Erectile Function-5 (IIEF-5) revealed a mean score of 17.2 ± 3.5, suggesting mild to moderate erectile dysfunction in a proportion of patients. This observation is consistent with the known association between CPPS and compromised sexual health [5,12]. Following administration of LISWT, a steady and statistically significant

improvement in NIH-CPSI scores was observed at each follow-up interval.

The mean score decreased from 28.4 ± 5.2 at baseline to 20.1 ± 4.8 at 4 weeks, further improving to 16.5 ± 4.2 at 12 weeks, and reaching 14.9 ± 3.9 at six months (Figure 3). This corresponds to an overall reduction of approximately 47% from baseline values. The change was highly significant ($p < 0.001$) and demonstrated sustained benefit throughout the follow-up period (Table 2). The most marked improvement occurred within the first three months, followed by a gradual continued decline up to six months, indicating both early and durable therapeutic effects of LISWT [14,20]. Pain scores also showed a pronounced and clinically meaningful reduction. The mean VAS score decreased from 7.2 ± 1.1 at baseline to 3.1 ± 0.9 at the six-month follow-up, representing a reduction of more than 50%. This improvement was statistically significant ($p < 0.001$) and consistently observed among all participants. Many patients reported early relief during the initial treatment phase, with further improvement over time, highlighting the strong analgesic effect of LISWT in CPPS [3,16].

Significant improvement in quality of life was documented across all follow-up intervals. Patients described better physical functioning, reduced symptom-related discomfort, and overall enhancement in well-being. Psychological distress, which was prominent at baseline, diminished over time. The improvement in quality of life closely mirrored the reduction in pain and overall symptom severity, suggesting that effective symptom control translated into meaningful functional and psychosocial benefits [6,11]. Urinary symptoms showed moderate improvement following treatment. Participants reported reductions in urinary frequency, urgency, and discomfort during voiding. However, the extent of improvement in urinary parameters was less substantial compared to changes observed in pain and overall symptom scores. Although statistically significant, these improvements were gradual and varied among individuals, likely reflecting the multifactorial nature of lower urinary tract symptoms in CPPS [8,15].

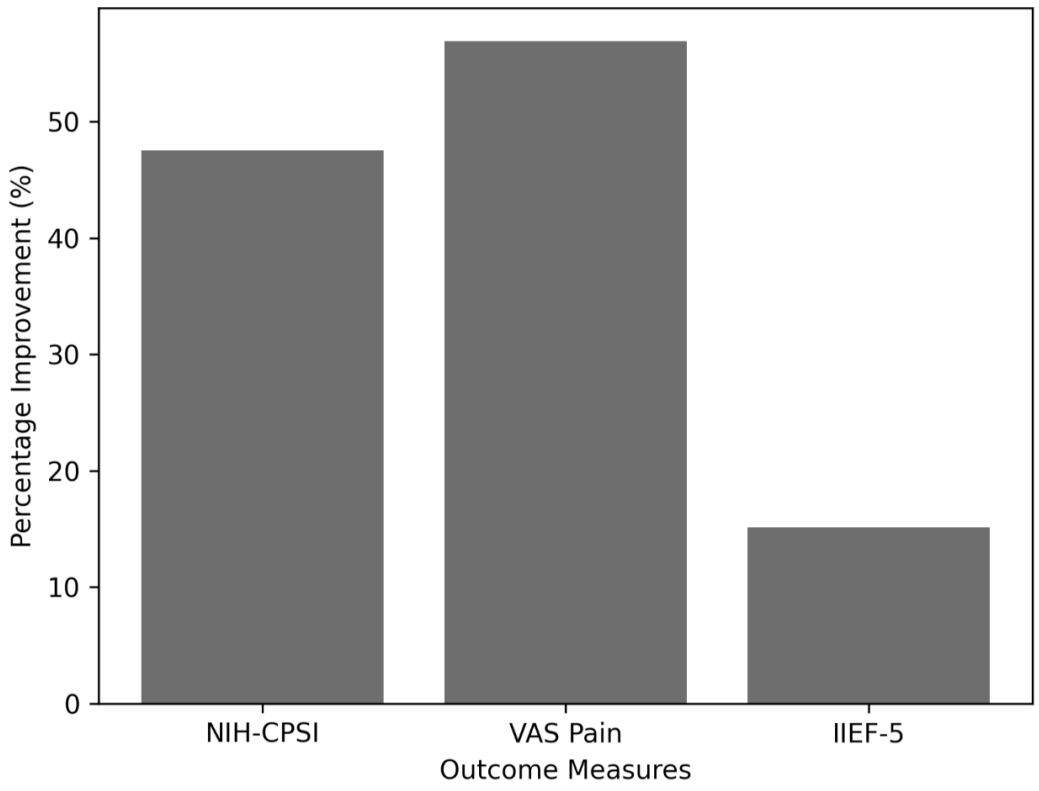

Figure 3: Overall clinical improvement following LISWT.
Bar graph showing percentage improvement in NIH-CPSI, VAS, and IIEF-5 scores at 6 months after LISWT. Marked reductions in NIH-CPSI and VAS indicate significant symptom and pain relief, while modest IIEF-5 improvement reflects limited but positive change in erectile function.

Erectile function demonstrated a modest but statistically significant improvement over the study period. The mean IIEF-5 score increased from 17.2 ± 3.5 at baseline to 19.8 at six months ($p < 0.05$). While the magnitude of change was relatively small, several patients reported subjective improvements in erectile quality and sexual satisfaction, which is clinically relevant given the impact of CPPS on sexual health [9,13]. LISWT was well tolerated by all participants. No major adverse events were reported during the

study. A few patients experienced mild and transient discomfort during treatment sessions, particularly in the perineal region; however, these symptoms were self-limiting and did not require discontinuation of therapy. No serious complications, including infection, hematuria, or tissue injury, were observed, supporting the favorable safety profile of LISWT as a non-invasive treatment modality [14,17].

Table 2: Changes in Clinical Outcome Measures Over Time (Mean ± SD) with Statistical Significance.

Time Point	NIH-CPSI Score	VAS Pain Score	IIEF-5 Score
Baseline	28.4 ± 5.2	7.2 ± 1.1	17.2 ± 3.5
4 weeks	20.1 ± 4.8	-	-
12 weeks	16.5 ± 4.2	-	-
6 months	14.9 ± 3.9	3.1 ± 0.9	19.8 ± 3.1
p-value	< 0.001	< 0.001	< 0.05

Mean±SD changes in NIH-CPSI, VAS, and IIEF-5 scores over time. Paired t-tests compared baseline and 6-month values. Significant improvement seen in NIH-CPSI and VAS ($p<0.001$) and moderate improvement in IIEF-5 ($p<0.05$). Missing values indicate unassessed intervals. Overall, LISWT resulted in significant improvements in pain, overall symptom burden, and quality of life among patients with CPPS. Although improvements in urinary symptoms and erectile function were comparatively modest, the therapy effectively addressed the most disabling aspects of the condition. The persistence of benefits at six months further supports its potential role as an effective treatment option for patients with refractory CPPS [29].

Discussion

Chronic Pelvic Pain Syndrome (CPPS) is a complex and heterogeneous urological condition characterized by persistent pelvic discomfort, lower urinary tract symptoms, and a substantial decline in overall quality of life. Despite extensive investigation, its underlying mechanisms remain incompletely defined, with multiple contributing factors such as neurogenic inflammation, pelvic floor dysfunction, central sensitization, and psychological influences being implicated. As a consequence, management remains challenging, particularly in patients who exhibit poor response to conventional therapies including antibiotics, alpha-blockers, and anti-inflammatory agents. In the present prospective cohort study, the clinical efficacy of Low-Intensity Shockwave Therapy (LISWT) was evaluated in individuals with treatment-resistant CPPS.

The findings demonstrated a significant and sustained improvement in symptom severity, pain intensity, and quality of life over a six-month follow-up period. These results are consistent with an expanding body of literature supporting LISWT as a promising non-invasive therapeutic approach for CPPS management. A major observation in this study was the substantial decline in NIH-CPSI scores, with an approximate reduction of 47.5% at six months [30]. This degree of improvement is both clinically meaningful and statistically significant, reflecting considerable relief in overall symptom burden. Comparable outcomes have been reported in earlier studies. Zimmermann et al. documented significant reductions in NIH-CPSI scores following LISWT, with sustained effects up to 12 weeks. Similarly, Vahdatpour et al. reported symptom improvement exceeding 40%, reinforcing the durability of treatment response (Table 3).

Table 3: Correlation of Present Study Outcomes with Existing Literature.

Study	NIH-CPSI Improvement	p-value	Pain Reduction (VAS)	p-value	QoL Improvement	Urinary Symptoms	Erectile Function
Present Study	~47.5% ↓	<0.001	~56.9% ↓	<0.001	Significant	Moderate	Mild ↑ ($p < 0.05$)
Zimmerman,n et al. [5]	Significant ↓	<0.001	Significant ↓	<0.001	Improved	Mild–Moderate	Not assessed
Vahdatpour, et al. [6]	~40–45% ↓	<0.001	Significant ↓	<0.01	Improved	Moderate	Not assessed
Kitrey, et al. [9]	Significant ↓	<0.01	Significant ↓	<0.01	Improved	Mild	Not assessed
Pajovic, et al. [10]	Sustained ↓	<0.01	Sustained ↓	<0.001	Improved	Mild	Not assessed
Magri, et al. [13]	Significant ↓	<0.001	Significant ↓	<0.001	Significant	Moderate	Not assessed
Mykoniatis et al. [14]	Significant ↓	<0.001	Significant ↓	<0.001	Significant	Mild–Moderate	Mild ↑ ($p < 0.05$)
Chung, et al. [16]	Not primary	—	Moderate ↓	<0.05	Improved	Not assessed	Moderate ↑ ($p < 0.05$)

Comparison of NIH-CPSI, VAS, and QoL improvements with published LISWT studies in CPPS. The present study showed 47.5% NIH-CPSI and 56.9% VAS reduction ($p<0.001$), consistent with the literature, supporting the effectiveness of LISWT in symptom relief and pain reduction.

The extent of improvement observed in this study is consistent with, and in some cases exceeds, previously published findings.

This may be attributed to strict adherence to a standardized treatment protocol and careful patient selection. Additionally, the inclusion of patients with moderate-to-severe baseline symptoms may have contributed to a greater observable therapeutic response, as higher initial symptom burden often allows for more pronounced improvement. From a mechanistic perspective, LISWT is believed to exert its effects through multiple biological pathways, including reduction of inflammatory mediators, enhancement of microvascular perfusion, and modulation of nociceptive signaling. These mechanisms likely act synergistically to promote tissue healing and symptom relief, thereby explaining the sustained improvement in NIH-CPSI scores observed in this cohort. Pain is widely recognized as the most debilitating feature of CPPS and a key determinant of impaired quality of life. In this study, a significant reduction in VAS pain scores was observed, with a decrease exceeding 50% at six months.

This finding aligns closely with previous reports demonstrating the analgesic efficacy of LISWT in CPPS. Kitrey et al. reported a significant decline in pain intensity following LISWT, with improvements evident within the first few weeks of treatment. Similarly, Pajovic et al. demonstrated sustained pain reduction at six months, indicating long-term therapeutic benefit. The present findings further reinforce these observations, highlighting both the rapid onset and persistence of pain relief associated with LISWT. The analgesic effects of LISWT are thought to result from several mechanisms, including inhibition of nociceptor activity, reduction in pro-inflammatory cytokines, and modulation of neural transmission pathways. Additionally, the promotion of neovascularization and improved tissue oxygenation may further contribute to pain alleviation. These biological processes provide a plausible explanation for the marked reduction in pain observed in this study. Quality of life impairment is a defining feature of CPPS, driven by chronic pain, urinary disturbances, and psychological stress.

In the current study, significant improvements in quality of life were noted at all follow-up intervals. Patients reported enhanced daily functioning, reduced symptom-related distress, and improved overall well-being. These findings are consistent with existing literature. Magri et al. demonstrated significant improvements in quality of life following LISWT, closely associated with reductions in symptom severity. Similarly, Mykoniatis, et al. highlighted the beneficial impact of LISWT on both physical and psychological aspects of health. The improvement in quality of life observed in this study underscores the importance of comprehensive symptom control in CPPS. Effective pain reduction appears to be a central factor influencing patient-reported outcomes, emphasizing the value of LISWT as a holistic therapeutic option. Although LISWT produced substantial improvements in pain and overall symptom scores, its effect on urinary symptoms was comparatively modest. This observation is consistent with previous studies reporting variable outcomes regarding lower urinary tract symptoms.

For instance, Vahdatpour, et al. reported only moderate improvement in urinary symptoms despite significant reductions in pain and NIH-CPSI scores. Similarly, Zimmermann et al. observed that improvements in urinary parameters were less pronounced compared to pain relief. This difference may be explained by the multifactorial nature of urinary symptoms in CPPS, which may involve bladder dysfunction, pelvic floor abnormalities, and neurogenic components. Since LISWT primarily targets inflammatory and pain pathways, its impact on urinary function may be indirect or limited. Further research is required to clarify its role in this domain. In addition, the study demonstrated a modest but statistically significant improvement in erectile function, as assessed by IIEF-5 scores. While the degree of change was limited, it remains clinically relevant given the known association between CPPS and sexual dysfunction. Previous studies have reported similar findings. Chung and Cartmill observed improvement in erectile function following LISWT, particularly in patients with underlying vascular factors.

Furthermore, studies evaluating LISWT in erectile dysfunction have demonstrated improvements in penile blood flow and endothelial function. The observed improvement in erectile function may be attributed to enhanced pelvic circulation and reduction in pain, both of which contribute to improved sexual performance. However, given the multifactorial etiology of erectile dysfunction in CPPS, the overall effect of LISWT in this area remains limited and requires further investigation. An important strength of this study is the favorable safety profile of LISWT. No major adverse events were reported, and only mild, transient discomfort was noted in a few participants. These findings are consistent with existing literature, which consistently describes LISWT as a safe and well-tolerated intervention. The non-invasive nature of LISWT, combined with its minimal side effects, makes it an attractive option for patients who have not responded to conventional treatments. Compared to pharmacological therapies, which may be associated with systemic adverse effects, LISWT offers a targeted and low-risk alternative. Overall, the results of this study are in agreement with previously published research evaluating LISWT in CPPS.

The observed improvements in NIH-CPSI and pain scores are comparable to those reported in randomized trials and meta-analyses. Additionally, the sustained benefits observed at six months support its potential for long-term efficacy. However, variability in study design, treatment protocols, and patient characteristics may influence outcomes. Differences in energy settings, number of sessions, and follow-up duration can affect both the magnitude and persistence of treatment effects. Therefore, standardization of LISWT protocols is essential for optimizing outcomes and ensuring comparability across studies. Certain limitations should be acknowledged. The relatively small sample size may limit generalizability. The absence of a control group restricts comparison with placebo or alternative therapies. Additionally, the follow-up period was limited to six months, and longer-term outcomes remain to be established. Despite these limitations, the study provides meaningful insights into the role of LISWT in routine clinical practice. The prospective design and standardized protocol strengthen the validity of the findings.

Conclusion

Low-Intensity Shockwave Therapy appears to be a safe and effective option for managing chronic pelvic pain syndrome,

particularly in patients unresponsive to standard treatments. It significantly improves pain, symptom severity, and quality of life, with sustained benefits over six months. Although improvements in urinary symptoms and erectile function are modest, the overall clinical impact is meaningful. LISWT offers a promising non-invasive adjunct, warranting further validation through larger randomized controlled studies.

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Author Contribution Statement

Each of the authors has equally contributed in Conception, Planning, Intervention, Data collection and Interpretation, Literature review, Manuscript preparation and Review.

Availability of Data and Materials

The authors confirm that the data supporting the findings of this study are available within the article and its Supplementary Materials.

Ethics statement

Institutional review board approval was obtained (IEC/VNA Hospital/2024/007), and informed consent was waived due to the nature of the study.

Conflict of Interest

The authors declare no conflict of interest.

Supplementary Materials

Supplementary Materials should be uploaded separately on submission.

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