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ORIGINAL PAPER

Chronic prostatitis as possible risk factor for Peyronie's disease: Psychological, sexual and prostatitis-like symptoms in patients with PD

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Summary ***Objective: This study aims to investigate a possible relationship between chronic prostatitis (CP) and Peyronie's disease (PD) and to characterize the psychological profile of patients suffering from PD, with or without concomitant CP.***
Methods: We included 539 patients with PD, of which 200 were found to have underlying CP. As a comparator population, we selected 2201 patients without PD, referring to our tertiary care clinic. In this population, we detected 384 subjects with CP. All 539 PD patients underwent photographic documentation of the penile deformation, and dynamic penile eco-color Doppler with plaque and volume measurements and answered the following questionnaires: the Generalized Anxiety Disorder-7, the Patient Health Questionnaire-9, the Visual Analog Scale for penile pain measurements, the International Index of Erectile Function (IIEF), and the NIH-Chronic Prostatitis Symptom Index.
Results: The overall prevalence of chronic prostatitis in PD patients was 37.1% compared to a prevalence of 17.4% in the non-PD control population (OR = 2.79 and p < 0.0001). The severity of CP symptom total scores (NIH-CPSI) correlated significantly with the severity of erectile dysfunction (p < 0.0001). Significant anxiety was present in 89.2% of PD patients and it is more prevalent in PD patients with CP than in PD patients without CP (93.0% vs. 87.0%, respectively; p = 0.0434). Significant depression was detected in 57.1% of PD patients and it is more prevalent in PD patients with CP than in PD patients without CP (64.0% vs. 53.09%, respectively; p = 0.0173).
Conclusion: Chronic prostatitis (CP) and Peyronie's disease (PD) are frequently associated. Our results demonstrate the strong impact of chronic prostatitis on the mental status of PD patients. Anxiety and depression were significantly more pronounced in PD patients with CP than in PD patients without CP.

KEY WORDS: Chronic prostatitis; Peyronie's disease; Risk factors.

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INTRODUCTION

Prostatitis is a pathological condition that is often observed in patients with *Peyronie's disease* (PD).
This clinical association is often present in specialist outpatient practice and is also described in the literature (1-5). With this study, we set out to ascertain whether there are common factors between the two pathologies that could justify this relationship.

Inflammatory features common to two pathologies: PD and CP

In both diseases, there is a chronic inflammatory process in which pro-inflammatory cytokines and *oxygen* and *nitrogen reactive species* (ROS/RNS) play an important role (6-10). Furthermore, there are studies in the literature that have confirmed the therapeutic efficacy of the use of antioxidant substances in both diseases (10-15). We also know that pro-inflammatory cytokines, *Tumor Necrosis Factor* (TNF), and interleukin 1 and 6 (IL-1 and IL-6) are present at high levels in the inflammatory process of PD and *chronic prostatitis* (CP) (6, 7).
In both diseases, as well as in other chronic inflammatory diseases, the circulating levels of cytokines are increased; therefore, these can act systemically in other organs, including the nervous system (16-19). It has been ascertained that pro-inflammatory cytokines can determine various effects at this level and particularly by reducing serotonin levels. This mechanism, as is known, is also strongly involved in the development of depression. Pro-inflammatory cytokines are also capable of causing an additional pro-depression effect as they cause changes in glucocorticoid function via the hypothalamic-pituitary-adrenal axis (20). Cytokines are also capable of having effects on the amygdala and hippocampus, which are areas widely involved in stress and anxiety (21, 22). Thanks to this knowledge from the literature, we can better understand the causes of anxious-depressive symptoms in patients with PD and CP.
Pro-inflammatory cytokines are also involved in neurogenic inflammation causing pelvic pain in patients with prostatitis/*chronic pelvic pain syndrome* (CPPS) (22). Pelvic pain in CP is therefore the consequence of neurogenic inflammation in the nervous system (central and peripheral).
An important signaling molecule implicated in neurogenic inflammation is *Nerve Growth Factor neurotrophin* (NGF). Neurotrophins are proteins that determine the survival, development, and function of neurons. NGF is a signaling molecule that is produced in the case of neuronal suffering, which in our case is caused by inflammation. NGF appears to be induced by IL-10, a cytokine that possesses anti-inflammatory activity by inhibiting the synthesis of pro-inflammatory cytokines (23-25).
Several studies have demonstrated that NGF together with some cytokines (IL-6 and IL-10) that regulate inflamma-

tion can play a role in the pain of patients with CPPS; furthermore, NGF directly correlates with pain severity (23-25). We also know that IL-10 is a known inducer of NGF and a suppressor of IL-6 and IL-8 expression (23, 25). The association of increased levels of NGF in other inflammatory states (inflammatory bowel disease and arthritis) has also been demonstrated (25).
Although no studies exist in the literature, it is likely that NGF also plays a role in PD and associated erectile dysfunction, since some studies demonstrate a protective role of this neurotrophin on erectile function (26-28). *Kalisch et al.*, in one of their studies, demonstrated that the NGF neurotrophin increases NOS activity expression (in all three of its isoforms: nNOS, eNOS, and iNOS) and *nitric oxide* (NO) production, the principal mediator of penile erection (29).
In an experimental study on diabetic rats, the induction of IgC (anti-NGF) was detected with related erectile dysfunction caused by a decrease in the tissue level of NGF (neutralizing effect of anti-NGF) (26). It is in fact known that in patients with diabetes mellitus, the incidence of erectile dysfunction is significantly higher than in the general male population. In another experimental study on diabetic rats with erectile dysfunction, the presence of high concentrations of NGF was found in the penis, and the authors hypothesized that the significant presence of NGF, in the presence of erectile nerves that are severely damaged by diabetes, would not be sufficient to compensate for the reproductive needs of nerve fibers (27). Another study found elevated concentrations of NGF in urine in patients with type 2 diabetes mellitus and associated erectile dysfunction (28).
Considering that several pro-inflammatory biological factors and other signaling molecules are present in CP, it may be hypothesized that CP could represent a risk factor for PD.
The present study aimed at studying the relationship between a history of CP and PD. The psychological impact of PD, in the presence or absence of concomitant CP, was also investigated in depth.

Psychological consequences of PD and CP

The penile deformation present in patients with PD inevitably determines a significant impact on the psychic sphere of these patients, their *quality of life* (QoL), and their psycho-social relationships. In fact, these patients show depressive symptoms in about 48% of cases (30). In these patients, bowing can frequently lead to a loss of personal body image, lower self-esteem, and a lower ability to achieve satisfactory sexual intercourse; furthermore, sexual performance anxiety with secondary psychogenic erectile dysfunction is often present (31). Other possible consequences are as follows: the tendency to lose confidence in their sexual abilities; decreased sex drive or even sexual aversion; concern about further sexual trauma; and curtailing or canceling appointments with prospective sexual partners (32-34). Although there is no specific incidence of anxiety symptoms in PD in the literature, some studies report the presence of "*emotional difficulties*" and "*distress*" in about 80-81% of cases (34, 35). In our recent study, we found that moderate-to-severe anxiety was present in 89.4% of PD patients (36).
Chronic prostatitis such as PD is characterized by a strong component of frustration with related anxious-depressive symptoms (21). Depression and catastrophizing about pain are often present; in this regard, some authors believe that depression and catastrophism represent a strong factor in the development, prolongation, and perpetuation of prostatic symptoms and, particularly, chronic pelvic pain (37, 38). Patients who have more pain tend to amplify it and have more catastrophic thoughts, resulting in a poorer physical QoL and a tendency towards depression (39). In their recent study, Bai et al. found a higher incidence of depression, anxiety, somatization disorder, and obsessive-compulsive behavior in patients with ED associated with CP/CPPS (40).
The literature is quite scarce regarding the incidence of anxiety and depression in patients with CP/CPSS; however, in the few studies analyzed, the incidence of anxiety symptoms in patients with CP/CPPS was found in about 60-90% of cases (41, 42), while with respect to the incidence of depressive symptoms, these were found to be present in approximately 27-90% of cases in patients with CP/CPPS (42-44).
This study aims to investigate a possible relationship between CP and PD and to characterize the psychological profile of patients suffering from PD, with or without concomitant CP.
In the ***Supplementary Materials*** we published an "*Addendum*"" as a deeper insight into the two diseases CP and PD.

Patients and methods

Study design

We performed a retrospective analysis of the clinical database of a single andrology clinic. From the database, we considered two separate cohorts of patients observed between January 2013 and January 2023. In this study, one cohort included 539 patients diagnosed with PD. As a comparator population, we considered a cohort of 2201 urological patients referred to our clinic for any disease but not PD. Among our cohorts of patients, we identified patients with a diagnosis of long-standing CP (*CP, Category II chronic bacterial prostatitis or Category III chronic prostatitis/chronic pelvic pain syndrome, NIH criteria*).
All data were obtained from patient records. This retrospective observational study was conducted in compliance with the principles contained in the Declaration of Helsinki ; all study subjects were contacted and provided informed consent for the study. Sensitive data were anonymized to warrant patients' privacy according to *Legislative Decree 10 August 2018*, n. 101, published in the *Official Gazette of the Italian Republic, General Series*, issue 205, 09/04/2018.

Inclusion criteria

The inclusion criteria for both groups were as follows: age between 18 and 75 years and availability of data that report the results of thorough clinical history examination (comprising all diseases, including prostatitis).
The diagnosis of PD was made as follows: performing penile palpation for all PD patients and by a (i) photo-

graphic documentation of the penile deformation (according to *Kelâmi*) with a goniometric measurement of the angulation and evaluation with respect to the possible presence of the multiplanarity of the curvature (29) and a (ii) dynamic penile eco-color Doppler ultrasound with plaque measurements and volume calculation (in the three dimensions) using an ellipsoid formula (volume = 0.524 x width x length x thickness) (45, 46).

Exclusion criteria

The exclusion criteria were as follows:

– for both groups, PD patients and non-PD patients an age under 18 years and over 75 years;
– for the comparison control cohort (2201 non-PD patients) a diagnosis of PD, without excluding all other associated diseases including a possible erectile dysfunction.

Clinical data

Patients with PD were asked to complete of the following questionnaires: (i) the *Visual Analog Scale* (VAS) for penile pain measurement, (ii) the *International Index of Erectile Function* (IIEF), (iii) the *NIH-Chronic Prostatitis Symptom Index* (NIH-CPSI), (iv) the *Generalized Anxiety Disorder-7* (GAD-7, focusing on anxiety), and (v) the *Patient Health Questionnaire-9* (PHQ-9, focusing on depression) (47-51).

The VAS score range varies from 0 (no pain) to 10 (most intolerable pain) (48).

The IIEF score interpretation is as follows: severe ED = from 0 to 10; moderate ED = from 11 to 16; mild-to-moderate ED = from 17 to 21; mild ED = from 22 to 25; no ED, from 26 to 30 (49).

The GAD-7 score interpretation is as follows: minimal anxiety = 0-4; mild anxiety = 5-9; moderate anxiety = 10-14; and severe anxiety = 15-21 (50). We considered the presence of significant anxiety when GAD-7 score > 9.

The PHQ-9 score interpretation is as follows: minimal depression = 0-4; mild depression = 5-9; moderate depression = 10-14; moderately severe depression = 15-19; and severe depression = 20-27 (51). We considered significant depression when PHQ-9 score > 9.

NIH-CPSI is assessed in 3 domains with the following severity levels: pain (from 0 to 21), urinary symptoms (from 0 to 10), and impact on QoL (from 0 to 12) (47).

Chronic prostatitis was diagnosed in patients with prostatitis-like symptoms according to the following examinations: clinical history, thorough physical examination, including the digital rectal exam, prostate ultrasound, and microbiological assessment (pre- and post-massage urine and sperm cultures).

Study endpoints

The primary endpoint of the study was the association between a diagnosis of CP and the occurrence of PD in a patient population referring to a single tertiary care andrology center.

The secondary endpoints are as follows:

– The impact of prostatitis on the psychological status of patients and, particularly, on anxiety, which was assessed with the GAD-7 test, and depression which was assessed with the PHQ-9 test;
– The impact of prostatitis on the presence and severity of erectile dysfunction;
– The impact of prostatitis on the presence and severity of penile pain;
– The impact of prostatitis on the severity of penile curvature;
– The impact of prostatitis on the PD plaque volume;
– The impact of prostatitis on the multiplanarity of penile curvature;
– The impact of prostatitis on plaque multifocality;
– The impact of prostatitis on plaque calcification.

Statistical analysis

The central tendency and dispersion data for continuous or interval variables were expressed as means and *standard deviations* (SDs) or medians and *interquartile ranges* (IQRs), respectively.

Intergroup unpaired comparisons for continuous or interval variables were performed using a 2-tailed t-test (heteroscedastic) or a 2-tailed Mann–Whitney–Wilcoxon (rank-sum) test, respectively.

Differences between proportions in unpaired groups were analyzed by both a Z-test and Pearson's chi-square test.

Correlations between questionnaire scores were analyzed by non-parametric tests (Spearman's rho and Kendall's tau). Analyses were performed in the "R" environment for statistical computing.

We planned a post hoc analysis of the statistical power achieved for the crude odds ratio calculation using the G*Power 3.1 software (52).

A 5% threshold for the alpha error was used to define statistical significance (significant p-value < 0.05).

Results

A Table (***Supplementary Materials***) summarizes the clinical characteristics of the two groups (PD patients and non-PD control population) and the relative statistical study. Cases and controls did not differ in age, and most associated pathologies. However, for some associated diseases such as diabetes mellitus, erectile dysfunction, hypertension, *benign prostatic hyperplasia* (BPH), and CP, there was a statistically significant difference between the two groups.

Prevalence of CP in PD patients

From our general patient database, we extracted a cohort of 539 PD patients, with a mean age of 49.68 years (± 12.16 SD), that met our inclusion criteria. Within this cohort, 200 patients (37.1%) were diagnosed with CP. The median total score of the NIH-CPSI test in this cohort was 9 (IQR = 10). The cohort of urological patients without PD meeting our inclusion criteria consisted of 2201 subjects, with a mean age of 50.53 years (± 12.04 SD), of which 384 (17.4%) were diagnosed with CP. The statistical comparison between the mean age of the two patient cohorts (unpaired t test) was not significant (p value = 0.1088).

The difference between the proportions of CP patients in the two cohorts is statistically significant (p < 0.0002, two-tailed Z-test: p < 0.0001 and two-tailed chi-square test; chi-square = 98.6). We generated a contingency

table comparing the presence/absence of a history of prostatitis in patients diagnosed or not with PD.
The resulting significant crude odds ratio (OR) for prostatitis was 2.79 (95% CI, 2.27 to 3.43, p < 0.0001) (see Table 1). The post hoc analysis showed an achieved power equal to 0.99 for the magnitude of effect (odds ratio) and 95% CI.

Assessment of prostatitis symptoms (NIH-CPSI test) in PD patients with or without PC

Median NIH-CPSI scores were significantly higher in PD patients with CP (n = 200) (median NIH-CPSI = 9, IQR = 10) compared to PD patients without CP (n = 339) (median NIH-CPSI = 2, IQR=2; P = < 0.0001, two-tailed Mann-Whitney-Wilcoxon test).

Psychological profiling of PD patients with or without CP

All included PD patients completed the Generalized Anxiety Disorder-7 questionnaire. Median anxiety scores of GAD-7 in patients with or without CP were identical and not significantly different at the statistical level (CP = 14, IQR = 7; no-CP = 14, IQR = 7, p = 0.21, two-tailed Mann-Whitney-Wilcoxon test).
However, the severity of total CP symptom scores assessed with the NIH-CPSI test correlated positively and significantly with GAD-7 anxiety scores (Spearman's rho, 0.21, p = 0.0031; Kendall's tau, 0.163, p = 0.018).
PHQ-9 depression scores were significantly higher in CP patients (median = 14; IQR = 4) compared to patients without CP (median = 12.5; IQR = 4, p = 0.0017, two-tailed Mann-Whitney-Wilcoxon test).
However, the severity of total CP symptom scores assessed with the NIH-CPSI test did not significantly correlate with PHQ-9 depression scores (Spearman's rho, 0.072, p = 0.309; Kendall's tau, 0.054, p = 0.28).
Table 2 summarizes data of GAD-7, PHQ-9, NIH-CPSI, and IIEF in PD patients with and without prostatitis.

Erectile dysfunction in PD patients with or without CP

We evaluated the median scores of the IIEF test in PD patients with erectile dysfunction with or without prostatitis. In these patients, erectile dysfunction developed concomitantly with PD.
Median IIEF scores were not significantly different in PD patients with (median IIEF = 23, IQR = 4.5) or without CP (median IIEF = 23, IQR = 5; P = 0.98, two-tailed Mann-Whitney-Wilcoxon test). However, the severity of total CP symptom scores assessed with the NIH-CPSI test correlated significantly and inversely with IIEF scores (Spearman's rho, -0.9, p < 0.0001; Kendall's tau, -0.77, p < 0.0001).

Penile pain assessments in PD patients with or without CP

We evaluated the median VAS scores in PD patients with penile pain with or without prostatitis.
Median VAS scores were not significantly different in patients with (median VAS = 2, IQR = 5) or without CP (median VAS = 1, IQR = 4; p = 0.784, two-tailed Mann-Whitney-Wilcoxon test) (see Table 2).

Severity of the penile curve and fibrotic plaque in PD patients with or without CP

Patients with prostatitis showed a less pronounced penile curve (29 ± 34 degrees) compared with patients without CP (34 ± 21 degrees, p = 0.0066, two-tailed t-test).
No significant differences were found between the mean volumes of fibrotic plaques in PD patients with (809.6 ± 563.9 mm^3) or without CP (mean = 908.4 ± 618.6 mm^3; p = 0.063, two-tailed t-test).

Characteristics of PD in patients with or without CP

Table 3 summarizes the findings relative to plaque calcification and plurifocal lesions and relative to curve complexity (multiplanar curve deformity). No significant differences were found in any of the considered findings between patients with or without CP.

Psychological profile (anxiety and depression) of PD patients

The results showing the psychological profile (anxiety and depression) of PD

Table 1.
Prevalence of CP in PD patients compared to the non-PD control population.

	Cohort of patients with Peyronie's disease (PD)	Non-PD control population	Statistical analysis odds ratio (OR) - P value
Chronic prostatitis (CP)	200	384	-
No chronic prostatitis (CP)	339	1817	-
TOTAL	539	2201	-
Prevalence of CP (%)	37.1	17.4	OR = 2.79 - P < 0.0001

Table 2.
Summary of data of GAD-7, PHQ-9, NIH-CPSI, IIEF and VAS in PD patients with and without chronic prostatitis.

Questionnaire score	PD patients with prostatitis (CP) (n cases = 200) Median score	PD patients without prostatitis (CP) (n cases = 339) Median score	Mann-Whitney test P value
NIH-CPSI	9	2	**< 0.0001**
IIEF	23	23	0.98
GAD-7	14	14	0.21
PHQ-9	14	12.5	**0.0017**
VAS	2	1	0.784

NIH-CPSI = National Institutes of Health Chronic Prostatitis Symptom Index is assessed in 3 domains with the following severity levels: pain (from 0 to 21), urinary symptoms (from 0 to 10), and impact on quality of life (QoL) (from 0 to 12) (47).
IIEF = International Index of Erectile Function (IIEF) questionnaire, score range = 0-30. Interpretation: severe erectile dyisfunction (ED) = from 0 to 10; moderate ED = from 11 to 16; mild-to-moderate ED = from 17 to 21; mild ED = from 22 to 25; no ED, from 26 to 30 (49).
GAD-7 = Generalized Anxiety Disorder-7 questionnaire, score range = 0-21. Interpretation: 0-4, minimal anxiety; 5-9, mild anxiety; 10-14, moderate anxiety; 15-21, severe anxiety. "Significant anxiety" (moderate-to-severe anxiety) when GAD-7 score > 9 (50).
PHQ-9 = Patient Health Questionnaire-9, score range = 0-27.
Interpretation: 1-4, minimal depression; 5-9, mild depression; 10-14, moderate depression; 15-19, moderately severe depression; 20-27, severe depression. "significant depression" (moderate to severe depression) when PHQ-9 score > 9 (51).
VAS = Visual Analog Scale questionnaire for pain measurement. Score range = 0-10. Interpretation: 1-5, mild-moderate pain; 6-7, severe pain; 8-10, very severe pain (48).

Table 3.
Summary of findings related to plaque calcification and multifocal lesions and curve complexity (multiplanar curve deformity).

	Prostatitis (n = 200)	No Prostatitis (n = 339)	P, Fisher's exact test	P, Pearson's chi-square
No. of patients with a complex (multiplanar) curve	62 (31%)	105 (31%)	0.99	0.99
Number of patients with multifocal plaque	46 (23%)	58 (17%)	0.11	0.094
Number of patients with calcifications	61 (30.5%)	81 (24%)	0.105	0.092

Table 4.
Psychological profile of 539 patients with Peyronie's disease.

Psychological questionnaire	Mental state	N. cases	Prevalence (%)	Mean test score
GAD-7	Minimal anxiety	6	1.1	2.5
	Mild anxiety	52	9.6	6.7
	Moderate anxiety	269	49.9	13.06
	Severe anxiety	212	39.3	19.7
	"Significant anxiety"	481	89.2	15.9
	TOTAL	539	-	14.9
PHQ-9	Minimal depression	62	11.5	3.3
	Mild depression	169	31.3	7.08
	Moderate depression	194	35.9	12.1
	Moderately severe depression	89	16.5	16.6
	Severe depression	25	4.6	21.64
	"Significant depression"	308	57.1	14.19
	TOTAL	539	-	10.7

GAD-7 = Generalized Anxiety Disorder-7 questionnaire, score range = 0-21.
Interpretation: 0-4, minimal anxiety; 5-9, mild anxiety; 10-14, moderate anxiety; 15-21, severe anxiety.
"Significant anxiety" (moderate-to-severe anxiety) when GAD-7 score > 9 (50).
PHQ-9 = Patient Health Questionnaire-9, score range = 0-27.
Interpretation: 1-4, minimal depression; 5-9, mild depression; 10-14, moderate depression; 15-19, moderately severe depression; 20-27, severe depression.
"Significant depression" (moderate to severe depression) when PHQ-9 score > 9 (51).

Table 5.
Psychological profile of PD patients with or without chronic prostatitis (PC).

Psychological questionnaire	Mental state	PD patients with CP N. cases out 200 cases Prevalence (%)	PD patients without CP N. cases out 339 cases Prevalence (%)	Statistical analysis P-value (χ2 test)
GAD-7	"Significant anxiety"	186 (93.0)	295 (87.0)	**0.0434**
	Severe anxiety	87 (43.5)	125 (36.8)	0.1526
PHQ-9	"Significant depression"	128 (64.0)	180 (53.09)	**0.0173**
	Severe depression	13 (6.5)	25 (7.3)	0.8344

CP = Chronic prostatitis.
GAD-7 = Generalized Anxiety Disorder-7 questionnaire, score range = 0-21.
Interpretation: 0-4, minimal anxiety; 5-9, mild anxiety; 10-14, moderate anxiety; 15-21, severe anxiety.
"Significant anxiety" (moderate-to-severe anxiety) when GAD-7 score > 9 (50).
PHQ-9 = Patient Health Questionnaire-9, score range = 0-27.
Interpretation: 1-4, minimal depression; 5-9, mild depression; 10-14, moderate depression; 15-19, moderately severe depression; 20-27, severe depression.
"Significant depression" (moderate to severe depression) when PHQ-9 score > 9 (51).

patients are illustrated in Table 4. Notably, "*significant anxiety*" is more prevalent in PD patients showing the concomitant presence of CP
compared to patients with PD alone (93.0% *vs*. 89.2%, respectively). We also found that severe anxiety is more prevalent in PD patients showing the concomitant presence of CP compared to patients with PD alone (43.5% *vs*. 39.3%, respectively) (see Table 5). It should be also noted that "significant depression" is more prevalent in PD patients showing the concomitant presence of CP compared to patients with PD alone (64.0% *vs*. 57.1%, respectively). We also found that severe depression is more prevalent in PD patients showing the concomitant presence of CP compared to patients with PD alone (6.5% *vs*. 4.6%, respectively) (see Table 5).

Discussion

The scientific literature is rich in studies that have demonstrated the presence of numerous risk factors able to favor the onset of PD. These studies include the following risk factors: penile trauma, erectile dysfunction, congenital penile curvature, *Dupuytren's* disease, diabetes mellitus, dyslipidemia, obesity, hypertension, smoking, alcohol consumption, rheumatoid arthritis, psoriasis, and psoriatic arthritis (36, 53-58).
This is the first study that specifically investigates the association between PD and CP.
Our results show that the overall prevalence of CP in patients with PD was significantly higher (37.1%) compared to the prevalence in a non-PD control population (17.4%). Our data suggest that CP and PD are frequently associated.
Another study on this topic identified PD as a risk factor for prostatitis (3).
In our study, median IIEF scores were not significantly different in PD patients with or without CP although the severity of CP symptom total scores (NIH-CPSI) correlated significantly with the severity of erectile dysfunction ($p < 0.0001$).
Some studies published in the literature have already argued or demonstrated the correlation between prostatic symptoms and erectile dysfunction (59-65).
In our study, median VAS scores were not significantly different in PD patients with or without CP.
Furthermore, the presence of CP in patients with PD does not affect the following: severity of penile curvature, complexity of penile curvature (multiplanarity), penile plaque volume, plaque plurifocality, and plaque calcification presence.
In their study, *Smith and colleagues* reported that 81% of PD patients suffered from "*emotional difficulties*" (35). Our results revealed that "significant anxiety" was present in 89.2% of PD patients.
Furthermore, our study found that "*significant anxiety*" is more prevalent in PD patients showing the concomitant

presence of CP compared to PD alone (93% *vs*. 89.2%, respectively). We also found that severe anxiety is more prevalent in PD patients showing the concomitant presence of CP compared to PD alone (43.5% *vs*. 39.3%, respectively). Our findings show that prostatitis symptomatology affects PD patients' anxiety status; in fact, the severity of total CP symptom scores, assessed with the NIH-CPSI test, correlates positively and significantly with GAD-7 anxiety scores ($p < 0.05$). These results demonstrate the strong impact of CP on the anxiety state of PD patients.

Nelson and coworkers, in their study about depression in men with PD, demonstrated that 48% of patients show clinically meaningful depression (30). In our study "*significant depression*" was reported in a higher fraction of patients (57.1%). Furthermore, our study found that "*significant depression*" is more prevalent in PD patients showing the concomitant presence of CP compared to PD alone (64.0% *vs*. 57.1%, respectively). We also found that severe depression is more prevalent in PD patients showing the concomitant presence of CP compared to PD alone (6.5% *vs*. 4.6%, respectively).

Overall, our results demonstrate the strong impact of PD and CP on the mental status of patients.

Conclusions

Chronic prostatitis (CP) and PD are frequently associated. Although the present study has the limitations of a retrospective analysis performed on a patient database, the size of the odds ratio (= 2.79), and its statistical significance ($p < 0.0001$) support the relative certitude of our results. Patients with PD and CP showed a significantly higher prevalence of more severe depression and anxiety.

In urological and andrological clinical practice, the involvement of psychologists is desirable in order to provide the patient with psychological support treatment and to mitigate the psychological impact of these two physically and psychologically devastating diseases (PD and CP). Our study suggests that patients with PD and/or CP should always be studied by administering specific psychological questionnaires because depressive and anxious symptoms may be unknown or at least underestimated in terms of severity and prevalence. Further studies are needed not only to confirm CP as a risk factor for PD but also to further investigate the psychological effects of CP and PD.

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