

REHABILITATION SECTION

Original Research Article

PTSD and Pain: Exploring the Impact of Posttraumatic Cognitions in Veterans Seeking Treatment for PTSD

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Abstract

Objective. Previous research has demonstrated a significant relationship between posttraumatic stress disorder (PTSD) and pain. While several models attempt to explain this relationship, significant questions remain regarding factors that may play a role in this interaction. The purpose of this study was to determine whether posttraumatic cognitions mediate the relationship between PTSD and pain.

Design. The sample comprised 136 veterans who presented to the VA Ann Arbor Health Care System seeking evaluation and treatment in the PTSD clinic. Participants completed the Clinician-Administered PTSD Scale, the Posttraumatic Cognitions Inventory, and Brief Pain Inventory-Short Form, along with other assessments as part of their evaluation.

Results. This study showed that the majority of patients (86.8%) reported some problems with pain. Further, the findings indicate that there is a significant relationship between PTSD severity and pain severity. Posttraumatic cognitions were not related to the level of pain experienced, but they were related to pain interference in this population.

Conclusions. In particular, negative cognitions regarding the self were associated with the level of pain-related interference, and partially mediated the relationship between PTSD and pain. The clinical implications of these findings are discussed.

Key Words. PTSD; Pain; Veterans; Cognitions; Mutual Maintenance

Introduction

Posttraumatic stress disorder (PTSD) and pain are both considerable problems within the veteran population and are significant concerns for service members returning from the recent conflicts in Afghanistan and Iraq. Initial reports suggest that between 11% and 22% of Operation Enduring Freedom and Operation Iraqi Freedom veterans meet the criteria for PTSD [1–4]. Further, between 42% and 47% of returning veterans report some pain at their initial screening in a veterans health administration (VHA) facility, with 50–60% of those cases reporting pain levels above the VHA's cutoff for clinically significant pain [5,6]. These findings mirror reports from previous eras of service, for example, [3,7], as well as data from the civilian population [8–10]. Thus, pain and PTSD are common and costly problems in our military and our society. With a growing number of returning veterans and aging veterans from other eras, better understanding of these conditions and their potential interrelationships is critical to maximize effective care for both concerns.

Comorbid PTSD and Pain

A substantial research base indicates a high rate of comorbidity between PTSD and pain (see [11–13] for thorough reviews of existing research). Patients experiencing chronic pain report higher rates of PTSD than the general population [14–16], and PTSD symptoms are correlated with the intensity and disability associated with this

pain [17–21]. Similarly, several studies have demonstrated that prevalence rates of pain-related conditions are higher in people with PTSD than those without PTSD and those with other anxiety disorder [17,22,23].

Veteran samples show similar associations between pain and PTSD. In a study looking at rates of pain in Vietnam veterans receiving treatment for PTSD, it was found that 80% of participants reported suffering from chronic pain, and the majority of those participants described pain in more than one area of their body [24]. More recently, among a sample of veterans from all eras, 66% of PTSD patients sampled had a chronic pain diagnosis in their medical record [25]. Further, in a study of veterans entering a pain management program, nearly half (49%) met the criteria for PTSD [26]. This pattern has also been replicated in female veterans, with results showing that female veterans who met criteria for PTSD reporting greater levels of pain-related interference, bodily pain, and greater frequency of headaches and migraines compared with those without PTSD [27].

Based on these studies, research has shifted toward understanding the potential mechanisms that may explain this relationship. Many of these theories rest on an idea that common factors may predispose a person to develop and/or maintain PTSD and pain disorders. One such theory is the mutual maintenance theory [28]. This theory proposes that shared cognitive, behavioral, and affective features of each of these disorders maintain and potentially increase the symptoms of the other. Lending some empirical support to this hypothesis, a longitudinal study of patients who had suffered a traumatic injury demonstrated that early pain and PTSD scores not only predicted later pain and PTSD scores, but they also predicted and were mediated by each other at follow-up time points [29]. In other words, the results indicated that pain symptoms appeared to be involved in the development and maintenance of PTSD symptoms, and vice versa.

Cognitive Factors in Pain and PTSD

Cognitive behavioral theories of pain [30] suggest that a person's interpretation and beliefs, as well as their response to pain, impact the level of intensity and disability experienced. In particular, catastrophizing can play a role in the experience and maintenance of pain. Previous research indicates that patients with pain-related conditions who catastrophized more often tended to report greater intensity of pain and report higher levels of pain-related disability [31–34]. Additionally, specific beliefs and a person's perception of their ability to manage pain are associated with the impact and experience of pain. These data suggest that beliefs about self-efficacy or the ability to manage pain are negatively related to pain intensity and disability [31,35,36], while negative cognitions regarding such things as the permanence of pain, or pain-related fears (e.g., fear of reinjury), are related to increased disability [37–39].

With regard to PTSD, cognitive theories suggest that the development and maintenance of symptoms are related to the way a person processes and interprets the traumatic event [40–42]. Negative appraisals and interpretations about the causes and consequences of the traumatic event sustain high levels of anxiety by fostering an increased perception of current and future threat. In particular, negative cognitions about the world (e.g., perception of the world as dangerous) and self (e.g., beliefs about competence and self-blame) heighten the sense of threat and maintain symptoms [41,42]. The relationship between negative cognitions and PTSD symptoms has received substantial empirical support, with data demonstrating that negative posttraumatic attributions are related to symptom severity and diagnosis in both prospective and retrospective studies (e.g., [43–46]). Additionally, negative cognitions about the self have been shown to be the most strongly related to PTSD symptoms [44–46], with increases in these cognitions corresponding to an increase in symptoms over time [46] and reductions being significantly related to symptom improvement over the course of treatment [44]. Additionally, reductions in PTSD symptoms with effective treatment are associated with decreases in reported health problems, including in participants with pain-related difficulties [47].

Current Study

Taken together, certain cognitions or cognitive styles are linked to PTSD and pain. However, to date, no studies have examined whether similar cognitions contribute to both of these disorders. The purpose of the current study is to explore whether negative posttraumatic cognitions associated with PTSD are related to pain in veterans seeking treatment for PTSD, and to see if these cognitions mediate the relationship between PTSD and pain.

Method

Participants

One hundred thirty-six veterans who presented to the VA Ann Arbor Health Care System PTSD Clinic for evaluation completed the measures used in the current study. The sample was mostly male (93.3%) and primarily Caucasian (85.5%). The majority of participants (102) reported serving in a combat zone, with the largest percentage indicating that their service was during the Vietnam era (51.2%). See Table 1 for full descriptive statistics for this sample.

Measures

All veterans completed measures as part of standard evaluations, including several self-reports and clinical interview measures for PTSD and comorbid conditions. The following measures were used in the analyses:

Brief Pain Inventory-Short Form (BPI)

The BPI is a widely used self-report questionnaire that assesses various dimensions of pain. In particular, the

Table 1 Sample characteristics (N = 136)

Variable	Mean (SD) or N (%)*
Pain measures	
Report pain problem	118 (86.8%)
Worse pain	6.01 (2.68)
Least pain	3.79 (2.48)
Average pain	5.05 (2.42)
Current pain	4.69 (2.90)
PTSD symptoms and cognitions	
CAPS	69.13 (18.20)
PTCI total	140.24 (40.72)
Demographics	
Age	51.49 (14.50)
Gender (male)	125 (93.3%)
Race	
	Caucasian
	112 (85.5%)
	African American
	10 (7.6%)
	Hispanic
	5 (3.8%)
	Other
	4 (3.1%)
Service connected for physical condition	55 (43.7%)
Service connected for psychiatric condition	11 (8.7%)
Served in a war zone	102 (78.5%)
Service era	
	Vietnam
	65 (51.2%)
	OEF or OIF
	29 (22.3%)
Military sexual trauma	11 (8.6%)
Comorbid mental health disorders	
Major depression (current)	44 (33.1%)
Bipolar disorder [†]	5 (3.8%)
Alcohol abuse or dependence	25 (18.8%)
Drug abuse or dependence	9 (6.8%)
Generalized anxiety disorder	16 (12%)
Panic disorder [‡] (current)	12 (8.9%)
Social phobia	10 (7.6%)
Obsessive compulsive disorder	4 (3.0%)

* All percentages are valid percents where the missing data has been removed.

[†] Includes bipolar I and bipolar II diagnoses.

[‡] Includes panic disorder with and without agoraphobia.

Pain was measured using the Brief Pain Inventory-Short Form. Comorbid mental health diagnoses were assessed using the Mini International Neuropsychiatric Interview.

CAPS = Clinician-Administered PTSD Scale; OEF = Operation Enduring Freedom; OIF = Operation Iraqi Freedom; PTCI = Posttraumatic Cognitions Inventory; PTSD = posttraumatic stress disorder.

measure is designed to capture the intensity of pain experienced, as well as the level of interference related to the pain. Research on the factor structure of this instrument supports these two factors [48], and suggests that the interference dimension can be broken down into mood interference (e.g., mood or relationship interference) and activity interference (e.g., interference with walking, working) [49,50]. Data on internal consistency suggest that the measure has good reliability, with alpha values ranging between 0.80 and 0.92 for the items in the scale [48]. Test-retest values varied across items, but ranged between 0.83 and 0.93 when administered daily over the course of a week [51].

Clinician-Administered PTSD Scale (CAPS)

The CAPS [52] is a 30-item semi-structured interview that assesses the frequency and intensity of the PTSD symptoms identified in the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition, Text Revision (DSM-IV-TR). CAPS has strong test-retest reliability (between 0.90 and 0.98 [53]), high internal consistency (alpha of 0.94 for total score [53]), and good convergent and discriminant validity [54]. The clinic from which these data were derived utilized a total of 4 rule while administering the CAPS (total for frequency and intensity must equal at least 4 during the past month, with both frequency and intensity being

greater than 0, to be considered fully present or at a diagnostic level).

Mini International Neuropsychological Interview (MINI)

The MINI [55] is a structured interview designed to assess Axis I diagnoses. The version of the MINI utilized in this study was based on DSM-IV criteria and was used to identify comorbid conditions within the sample. MINI is psychometrically sound with strong inter-rater reliability (kappa values ranging from 0.88 to 1.0) and good test-retest reliability for the diagnoses (ranging from 0.76 to 0.93 [56]).

Posttraumatic Cognitions Inventory (PTCI)

The PTCI is a 36-item self-report questionnaire that evaluates trauma-related cognitions and contains three subscales: negative cognitions about self, negative cognitions about the world, and self-blame [57]. PTCI has demonstrated good reliability and test-retest reliabilities (0.80–0.85). It has good internal consistencies ranging from 0.86 to 0.97, and strong correlations with other measures of posttraumatic cognitions [57].

Data Analytic Strategy

Pearson product bivariate correlations were conducted in order to demonstrate a relationship between the primary pain and PTSD measures. Additionally, based on the model proposed by Baron and Kenny [58], regression analyses were run to explore if posttraumatic cognitions mediate the relationship between PTSD and pain.

Results

Descriptive Statistics

Prior to conducting any of the primary analyses, we examined descriptive statistics for the key variables. Results demonstrated that the average score on the CAPS was 69.13 (SD = 18.20), indicating that majority of participants were above standard cutoffs for PTSD diagnosis. The average score on the PTCI was 140.24 (SD = 40.72), demonstrating that there was a significant range in terms of responses on this measure. Finally, results showed that the majority of participants (86.8%) reported some problems with pain.

Bivariate Relationships among Pain, PTSD, and Cognitions

In order to establish the presence of a relationship between the main variables of interest, correlations were run examining how scores on the CAPS and PTCI related to items on the BPI (see Table 2). Results demonstrate that total CAPS score is significantly positively related to the reported intensity of pain (worst pain, $r = 0.21$, $P < 0.05$; least pain $r = 0.25$, $P < 0.05$; average pain, $r = 0.19$, $P < 0.05$; current pain $r = 0.20$, $P < 0.05$) and some areas of pain interference (walking interference, $r = 0.20$, $P < 0.05$; sleep interference $r = 0.20$, $P < 0.05$; enjoyment interference $r = 0.18$, $P < 0.05$; average interference $r = 0.18$, $P < 0.05$). Similarly, the CAPS intrusive and avoidant subscales were both significantly related to three of the four items related to pain intensity, but only avoidance was significantly related to any of the interference items.

Table 2 Pearson product bivariate correlations for pain and PTSD variables

	CAPS				Total PTCI	Negative Cognitions of Self	Negative Cognitions of World	Self-Blame
	Total	Intrusions	Avoidance	Hyperarousal				
Worse pain	0.21*	0.18*	0.22**	0.11	0.01	0.04	-0.02	-0.08
Least pain	0.25**	0.21*	0.22*	0.19*	0.04	0.08	0.00	-0.14
Average pain	0.19*	0.18*	0.13	0.16	0.00	0.00	0.02	-0.07
Current pain	0.20*	0.13	0.23**	0.10	-0.02	0.02	-0.01	-0.14
General interference	0.13	0.09	0.14	0.08	0.17	0.21*	0.08	0.00
Mood interference	0.17	0.12	0.15	0.15	0.20*	0.23**	0.14	0.03
Walking interference	0.20*	0.17	0.19*	0.13	0.13	0.15	0.09	0.01
Work interference	0.17	0.14	0.18*	0.06	0.14	0.18*	0.06	-0.01
Relationship interference	0.08	0.07	0.07	0.06	0.22*	0.24**	0.13	0.09
Sleep interference	0.20*	0.16	0.19*	0.12	0.18*	0.20*	0.10	0.05
Enjoyment interference	0.18*	0.14	0.19*	0.10	0.22*	0.26**	0.06	0.08
Average interference	0.18*	0.14	0.18*	0.11	0.21*	0.24**	0.10	0.04

* $P < 0.05$; ** $P < 0.01$.

CAPS-Total: Total score from the Clinician-Administered PTSD Scale. Intrusion, avoidance, and hyperarousal are the subscale scores on the CAPS corresponding to symptom clusters in the DSM-IV-TR. Pain and interference scores from items on the Brief Pain Inventory-Short Form.

CAPS = Clinician-Administered PTSD Scale; PTCI = Posttraumatic Cognitions Inventory; PTSD = posttraumatic stress disorder.

Posttraumatic Cognitions in Comorbid PTSD Pain

Table 3 Pearson product bivariate correlations for PTSD symptoms and cognitions

	Total PTCI	Negative Cognitions of Self	Negative Cognitions of World	Self-Blame
CAPS total	0.31**	0.29**	0.28**	0.15
Intrusion	0.16	0.13	0.16	0.17
Avoidance	0.32**	0.33**	0.27**	0.13
Hyperarousal	0.25**	0.24**	0.28**	0.06

* $P < 0.05$; ** $P < 0.01$.

CAPS-Total: Total score from the Clinician-Administered PTSD Scale. Intrusion, avoidance, and hyperarousal are the subscale scores on the CAPS corresponding to symptom clusters in the DSM-IV-TR.

CAPS = Clinician-Administered PTSD Scale; PTCI = Posttraumatic Cognitions Inventory; PTSD = posttraumatic stress disorder.

With regard to the PTCI, no significant relationships were found between the total score or subscales of this measure and pain intensity. However, there were significant positive relationships between the PTCI and pain interference items. Specifically, the total PTCI was significantly related to mood interference ($r = 0.20$, $P < 0.05$), relationship interference ($r = 0.22$, $P < 0.05$), sleep interference ($r = 0.18$, $P < 0.05$), enjoyment interference ($r = 0.22$, $P < 0.05$), and average ($r = 0.21$, $P < 0.05$). The negative cognitions of self subscale of the PTCI was significantly related to general interference ($r = 0.21$, $P < 0.05$), mood interference ($r = 0.23$, $P < 0.05$), work interference

($r = 0.18$, $P < 0.05$), relationship interference ($r = 0.24$, $P < 0.05$), sleep interference ($r = 0.20$, $P < 0.05$), enjoyment interference ($r = 0.26$, $P < 0.05$), and average ($r = 0.21$, $P < 0.05$). The remaining two subscales of the PTCI were not significantly related to any of the items on the BPI.

In addition to exploring the relationship between the trauma measures and pain, correlations between the CAPS and the PTCI were also obtained (see Table 3). Results from this analysis indicate that the CAPS total score was significantly positively related to the PTCI total ($r = 0.31$, $P < 0.01$), the negative cognitions of self subscale ($r = 0.29$, $P < 0.01$), and the negative cognitions of the world subscale ($r = 0.28$, $P < 0.01$). The avoidance and hyperarousal subscales were also significantly related to the total PTCI, the negative cognitions of self subscale, and the negative cognitions of the world subscale. The intrusion subscale of the CAPS and the self-blame subscale of the PTCI were not significantly related to the total score or any of the subscales on the CAPS.

Mediation Analyses

In order to examine if posttraumatic cognitions mediate the relationship between PTSD symptoms and pain, several regressions were run in accordance with the mediation model proposed by Baron and Kenny [58]. Based on the relationships identified in the correlations, analyses explored whether the total PTCI score or the negative cognitions of self subscale mediated the relationship between the CAPS total score and the average level of interference from pain (see Table 4 for regressions

Table 4 Mediation analysis relationship between CAPS total and average pain interference, mediated by PTCI total (N = 133)

Regression Analysis 1: CAPS Total Predicting Average Pain Interference

	SE	B	adjR ²	F	ΔR ²	ΔF
CAPS total	0.01	0.03	0.03	4.49*	~	~

Regression Analysis 2: CAPS Total Predicting Total PTCI

	SE	B	adjR ²	F	ΔR ²	ΔF
CAPS total	0.18	0.68	0.09	13.79**	~	~

Regression Analysis 3: PTCI and CAPS Total predicting Average Pain Interference

	SE	B	adjR ²	F	ΔR ²	ΔF
Step 1			0.04	5.76*	~	~
Total PTCI	0.01	0.01				
Step 2			0.04	3.96*	0.02	2.11
Total PTCI	0.01	0.01				
CAPS total	0.01	0.02				

* $P < 0.05$; ** $P < 0.01$.

CAPS = Clinician-Administered PTSD Scale; PTCI = Posttraumatic Cognitions Inventory.

Table 5 Mediation analysis relationship between CAPS total and average pain interference, mediated by negative cognitions of self on the PTCI (N = 133)

Regression Analysis 1: CAPS Total Predicting Average Pain Interference

	SE	B	adjR ²	F	ΔR ²	ΔF
CAPS total	0.01	0.03	0.03	4.49*	~	~

Regression Analysis 2: CAPS Total Predicting Negative Cognitions of Self

	SE	B	adjR ²	F	ΔR ²	ΔF
CAPS total	0.01	0.02	0.08	12.59**	~	~

Regression Analysis 3: Average Pain Interference Predicted by Negative Cognitions of Self and CAPS Total

	SE	B	adjR ²	F	ΔR ²	ΔF
Step 1						
Negative cognitions of self	0.19	0.52	0.05	7.74**	~	~
Step 2						
Negative cognitions of self	0.20	0.44*	0.06	4.86**	0.01	1.92
CAPS total	0.01	0.02				

* $P < 0.05$; ** $P < 0.01$.

CAPS = Clinician-Administered PTSD Scale; PTCI = Posttraumatic Cognitions Inventory.

including total PTCI, and Table 5 for regressions with the negative cognitions of self subscale).

Under both models, an initial regression was run to examine whether CAPS total score was a significant predictor of average pain interference. Results show that CAPS total score is significantly associated with average pain interference and accounted for 3% ($r = 0.18$) of the variance. Next, a regression was run to examine whether CAPS total score was significantly related to the potential mediating variable. In the case of the total PTCI score, the findings show that the CAPS total score is significantly associated with PTCI and accounted for 9% ($r = 0.31$) of the variance. CAPS total was also significantly associated with negative cognitions of self subscale, explaining 8% ($r = 0.29$) of the variance.

Finally, a regression was run in which the potential mediating variable was initially entered as a predictor of average pain interference, and was then entered along with the CAPS total score to see if this reduced the proportion of the variance accounted for by the CAPS. Results with the total PTCI demonstrate that PTCI significantly predicts average pain interference and accounts for 4% ($r = 0.21$) of the variance when entered alone. When the CAPS total score is also entered, the model remains significant, but still accounts for only 4% ($r = 0.24$) of the variance in pain interference. However, the CAPS total score only explains 2% of the variance when entered with PTCI total, and the CAPS is no longer a significant predictor, suggesting partial mediation.

In the regressions examining negative cognitions of self subscale, negative cognitions about the self was a signifi-

cant predictor and accounted for 5% ($r = 0.24$) of the variance in average pain interference when it was entered alone. When the CAPS total score was added to the model, 6% ($r = 0.26$) was accounted for, but only 1% of the variance was attributed to the CAPS, and the CAPS was no longer significant, indicating that negative cognitions about the self partially mediated this relationship.

Discussion

The primary purpose of this article was to explore whether cognitions thought to be related to maintenance of PTSD mediate the relationship between PTSD and pain. In accordance with previous research, the results from this study replicate the significant co-occurrence of PTSD and pain, with the vast majority of veterans presenting for treatment in the PTSD clinic reporting that pain is a significant problem for them. Further, the findings indicate that there is a significant relationship between the level of PTSD symptoms and the level of pain reported. However, contrary to initial predictions, posttraumatic cognitions were not related to the level of pain experienced in this population; but were shown to be related to certain areas of pain interference. In particular, a person's negative beliefs about him/herself were associated with the level of pain-related impairment, as this subscale was significantly related to all but one type of interference (walking) measured on the BPI. This is commensurate with previous literature suggesting that negative cognitions regarding the self are most strongly related to symptomatology [44–46]. In previous studies, however, these cognitions were also linked to PTSD symptoms. The fact that this subscale was the most consistently related to pain disability in this

study lends some support for the idea that similar cognitive styles or beliefs may underlie both of these disorders.

Analyses were conducted to determine whether posttraumatic cognitions, and specifically negative cognitions regarding the self, mediated the relationship between PTSD symptoms and pain-related disability/interference. CAPS total scores did predict both the total PTCI and negative cognitions of self subscale scores. Further, total PTSD symptoms explained a small, but significant amount of average pain interference. However, once posttraumatic cognitions were entered into the equation, total PTSD scores were no longer significant. This was true whether the total PTCI was used, or only the negative cognitions of self subscales were entered. These findings suggest that certain types of posttraumatic beliefs or cognitions partially mediated the relationship between PTSD and pain-related impairment in this sample.

The findings of this study add to our growing understanding of the relationship between PTSD and pain, and provide critical information about potential targets for treatment of either condition. Specifically, as negative posttraumatic cognitions regarding the self contribute to increased avoidance, they also contribute to increased interference from pain. This suggests that the sense of inability to handle emotional distress may be generalized to an inability to handle physical distress. As such, among comorbid patients, therapies addressing posttraumatic cognitions (e.g., prolonged exposure and cognitive processing therapy) may provide additional benefit beyond PTSD symptom reduction. Additional research among this comorbid population is warranted.

While our results are promising and consistent with previous research, study limitations must be taken into account. Specifically, our results are based on self-report data. While this is a valid way to assess subjective experience, it is uncertain how these ratings relate to objective levels of impairment or disability. Further, given the specific nature of this sample (veterans seeking help for PTSD through the VHA), it is unclear if these results will generalize to other populations or samples. Future research in this area is needed to provide more insight into the stability and generalizability of these findings.

Finally, it is important to note that this study focused exclusively on trauma-related cognitions, and did not explore the impact of maladaptive cognitions more generally. Additional research is needed to determine if these specific cognitions account for a unique portion of the relationship between PTSD and pain. Further, while there were several significant findings reported, the relationships found were modest in size. As such, the clinical significance or impact of these findings is unclear at this time.

Of note, while correlations between PTSD symptoms and pain were modest, findings were consistent with previous studies. For instance, correlations between PTSD symptoms and average pain levels found in this study were consistent with those reported by Liedl et al.

[29]. In that study, correlations between individual symptoms clusters and average pain ranged from 0.08 to 0.19 at baseline, which is commensurate with our correlations that ranged between 0.13 and 0.18. With regard to regression analyses, correlations from this study are slightly lower, but comparable with those reported in a study looking at intrusive symptoms of PTSD and pain in Vietnam veterans [24]. Method variance may also account for the differences in strength of relationship. The current study utilized a structured interview to assess for PTSD symptoms and a self-report measure to assess for pain, while many of the previous studies relied on self-report measures to assess for both. Thus, assessment method variance may contribute to the strength of relationship, such that a clinician's view of symptoms and a participant's report may differ.

In conclusion, the current study explored the comorbidity of PTSD and pain through examination of the impact of posttraumatic cognitions on pain. Negative PTSD-related beliefs about the self partially mediated the relationship between PTSD and pain interference. Future replication and additional research among patients with PTSD and pain is warranted.

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Porter et al.

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Posttraumatic Cognitions in Comorbid PTSD Pain

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