



ORIGINAL ARTICLE

Pain and Post-Traumatic Stress Disorder Symptoms During Inpatient Rehabilitation Among Operation Enduring Freedom/Operation Iraqi Freedom Veterans With Spinal Cord Injury

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Abstract

Objective: To examine the frequency of post-traumatic stress disorder (PTSD) symptoms and pain, and how PTSD symptoms were associated with pain severity ratings and the longitudinal course of pain during inpatient rehabilitation for spinal cord injury (SCI) among veterans of the Operation Enduring Freedom/Operation Iraqi Freedom (OEF/OIF) conflicts.

Design: Longitudinal analysis of data gathered from electronic medical records.

Setting: SCI specialty care centers within the Department of Veterans Affairs.

Participants: Veterans of the OEF/OIF conflicts (N=87) who received inpatient rehabilitation for SCI and disorders at Department of Veterans Affairs SCI centers between May 2003 and October 2009.

Interventions: Not applicable.

Main Outcome Measure(s): PTSD screening at start of rehabilitation and pain numeric rating scale measurements completed throughout rehabilitation. Cut-scores were used to categorize participants into 1 of 4 groups on the basis of scores at the start of rehabilitation: Pain and PTSD, Pain Alone, PTSD Alone, Neither Condition.

Results: Comorbid pain and PTSD symptoms were more common than either condition alone, and nearly as common as not having either condition. Participants with pain at the start of rehabilitation (Pain and PTSD, Pain-Alone groups) showed declines in pain ratings over the course of rehabilitation. In contrast, participants in the PTSD-Alone group showed increasing pain over the course of rehabilitation.

Conclusions: Pain and PTSD symptoms may be more likely to manifest as comorbidities than as isolated conditions during inpatient rehabilitation. Assessment routines and care plans should be prepared with comorbidities as a foremost concern. It is advisable to screen for pain and PTSD at multiple time points during inpatient rehabilitation to detect new or emerging concerns.

Archives of Physical Medicine and Rehabilitation 2013;94:80-5

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Supported by the Department of Veterans Affairs, Veterans Health Administration, Health Services Research and Development Service (grant no. IIR 07-188-3) and Spinal Cord Injury Quality Enhancement Research Initiative (grant no. QLP 42-002).

This article presents the views of the authors; it does not necessarily represent the views or policies of the Department of Veterans Affairs or the Health Services Research and Development Service.

No commercial party having a direct financial interest in the results of the research supporting this article has or will confer a benefit on the authors or on any organization with which the authors are associated.

Elevated risk for post-traumatic stress disorder (PTSD) is to be expected after traumatic spinal cord injury (SCI) for the simple fact that such injuries frequently expose a person to extreme physical injury and threat of death. Research on the prevalence of PTSD after SCI supports this position. Radnitz et al¹ have found that rates of current and lifetime PTSD among persons with SCI are comparable to rates in other traumatized groups, for example,

12% and 29% for current and lifetime prevalence, respectively. Other investigators have found similar, elevated rates of PTSD both during or shortly after rehabilitation for SCI,²⁻⁴ and even decades after initial injuries heal and rehabilitation is complete.^{5,6}

Research has linked PTSD to the experience of pain, particularly among military veterans. For example, Shipherd et al⁷ found that among a sample of veterans with PTSD, 66% also had a chronic pain diagnosis. A high rate of comorbid pain and PTSD has been documented in a number of other studies focusing on veterans of Operation Enduring Freedom/Operation Iraqi Freedom (OEF/OIF). Three studies of veterans of OEF/OIF being treated at polytrauma rehabilitation centers⁸⁻¹⁰ found high rates of pain (81%–97%) and PTSD (68%–78%). High comorbidity rates are consistent with parallel, general observations that physical and psychological issues experienced by veterans of OEF/OIF are more likely to occur in clusters than in isolation.¹⁰ Not only does the co-occurrence of PTSD and pain appear to be common but the conditions appear to have additive negative effects on functioning and distress as well.¹¹⁻¹⁴

Pain is a serious and common concern after SCI,¹⁵⁻¹⁷ so it is reasonable to hypothesize that persons with SCI are at risk for co-occurring pain and PTSD, and the associated deleterious outcomes that are found in other populations. However, such hypotheses have not been tested; little is known about the extent to which pain and PTSD overlap after SCI, or what pain and PTSD overlap might mean in terms of the severity and temporal course of pain. This study focused on co-occurring PTSD symptoms and pain among OEF/OIF veterans who sustained SCI during active military service. Specific study goals were to examine how PTSD symptoms were associated with acute pain severity ratings and the longitudinal course of pain during inpatient rehabilitation for SCI.

Methods

Study design

This was a retrospective longitudinal analysis of data gathered from electronic medical records of veterans of OEF/OIF with SCI who completed rehabilitation in the Department of Veterans Affairs (VA) Spinal Cord Injury and Disorders (SCI/D) System of Care between March 2003 and October 2009. The VA SCI/D System of Care consists of an integrated network of care based on a hub and spokes model. Comprehensive interdisciplinary specialty and primary care is located at 24 designated SCI centers (hubs). Locally accessible primary care is provided at other VA facilities (spokes) by SCI-trained primary care teams. All study procedures were approved and overseen by the authors' human subjects research institutional review boards.

List of abbreviations:

OEF/OIF	Operation Enduring Freedom/Operation Iraqi Freedom
PC-PTSD	primary care post-traumatic stress disorder screen
PTSD	post-traumatic stress disorder
SCI	spinal cord injury
SCI/D	spinal cord injury and disorders
VA	Department of Veterans Affairs

Participants

Military personnel returning from the OEF/OIF conflicts who were transferred from a military treatment facility to a VA SCI center between May 2003 and October 2009 were identified from electronic records maintained by VA SCI/D services. This search identified 140 veterans from the OEF/OIF conflicts who received inpatient rehabilitation for SCI/D during that time period. Fifty-three patients were excluded because they were missing a baseline pain assessment and/or PTSD screening, for a final sample of 87 patients (62%).

Data collection and measures

Trained chart reviewers examined the electronic patient medical records for demographic characteristics (age at injury, sex, marital status, and ethnicity), information on SCI and other injuries (level of injury, completeness, etiology of injury, and occurrence of traumatic injuries comorbid to SCI), length of inpatient rehabilitation stay (length of stay), and clinical assessments of PTSD symptoms and pain.

PTSD symptoms

The primary care post-traumatic stress disorder screen (PC-PTSD)¹⁸ was used to identify participants with PTSD symptoms during inpatient rehabilitation. The PC-PTSD consists of 4 questions reflecting major features of PTSD such as hyperarousal, avoidance, numbing, and reexperiencing symptoms. Three questions answered affirmatively indicate a positive screen for PTSD. The PC-PTSD has been shown to be a psychometrically sound, sensitive, and specific screen for PTSD.¹⁸ The PC-PTSD screen was administered as part of routine care within 2 days of admission to inpatient rehabilitation.

Pain

As part of routine clinical care, participants were asked by nursing and other medical staff to rate their current pain intensity at multiple time points during inpatient rehabilitation using the 0 to 10 numerical rating scale, with 0 = "no pain" and 10 = "pain as bad as could be." Numerical pain rating scales of this variety have been shown to have good test-retest reliability and adequate validity in terms of associations with other pain measures and treatments.¹⁹ Participants used the numerical rating scale to rate overall pain intensity. Scores of 4 or higher on the numerical rating scale were considered to indicate clinically significant pain.²⁰

Analyses

Descriptive statistics were used to characterize the population on key study variables. Cut-scores on baseline pain and PTSD symptoms measures were used to categorize participants into 1 of 4 groups: Pain and PTSD, Pain Alone, PTSD Alone, and Neither Condition. The first pain rating measured on the first day of inpatient rehabilitation (baseline pain) was used to determine this grouping (scores of 4 or higher indicating the presence of significant pain). All pain ratings taken over the course of inpatient rehabilitation were averaged to create an overall pain score. Differences between baseline pain and overall pain score were assessed to describe changes in pain scores over time. Two-way analysis of variance was used to compare the 4 study groups on

Table 1 Participant characteristics

Age (y), mean \pm SD	27.2 \pm 6.9
Marital status (%)	
Married	59.3
Single	36.0
Divorced	4.7
Race (%)	
White	68.9
Black	14.9
Other	16.2
Paraplegia/tetraplegia (%)	
Paraplegia	63.5
Tetraplegia	36.5
SCI completeness (%)	
Complete	52.4
Incomplete	47.6
Etiology (%)	
Gunshot wound	33.7
Explosive device	27.9
Motor vehicle accident	24.4
Other	7.0
Fall	7.0
Comorbid injuries, total number, mean \pm SD	2.0 \pm 1.6
Comorbid injuries (%)	
Fractures	71.3
Wound/laceration	29.9
Other injuries	29.9
TBI	20.7
Pneumothorax/hemothorax	16.1
Intraabdominal	10.3
Amputation	5.7
Sensory loss	5.7
Burn	4.6
Bladder/ureter	4.6
Cardiac	2.3

Abbreviation: TBI, traumatic brain injury.

baseline pain and overall pain, with post hoc Scheffe tests conducted when overall analyses of variance were statistically significant. To more specifically examine pain scores over time, each participant's inpatient stay was divided into quarters, and average quarterly pain scores were computed within each quarter. Multiple regression analyses with repeated measures per patient were computed to examine associations between study group and pain over time. In these equations, average quarterly pain was used as the dependent variable in regression analyses, allowing for repeated measures within each participant. Independent variables entered into the equation included PTSD symptoms, baseline pain,

inpatient quarter, and all possible 2-way and 3-way interactions. Bonferroni corrections were applied to address concerns about the number of tests conducted.

Results

Descriptive characteristics and group comparisons

Information on demographics, SCI characteristics, and comorbid injuries is shown in table 1. The sample had 98.9% men with an average age of 27.2 years (SD, 6.9, range 19–58). Participants had 2 traumatic injuries comorbid to SCI, on average. Demographic and SCI characteristics were not associated with pain and PTSD status. The total number of comorbid traumatic injuries was not associated with pain and PTSD status. Prevalence of individual comorbid injuries was not associated with pain and PTSD status.

Table 2 displays pain scores for the sample according to study group. More than two thirds of participants had pain, PTSD symptoms, or both at baseline. More than half (55%) had elevated pain at baseline, and almost half (44%) screened positive for PTSD. Participants in the PTSD and Pain group (n=26, 30%) were nearly equal in representation to those in the Neither Condition group (n=27, 31%). Participants with PTSD and Pain were more common than participants with either condition alone (PTSD Alone, n=12 [14%], and Pain Alone, n=22 [25%]), confirmed by chi-square analysis ($P<.05$). Study groups did not differ on the duration of inpatient rehabilitation. Statistically significant differences on baseline pain scores were observed, of course, because of study grouping methods. However, participants with PTSD Alone did not report higher baseline pain than did participants with Neither Condition, and those with PTSD and Pain did not have higher baseline pain than did those with Pain Alone at baseline. The PTSD-Alone group showed higher levels of overall pain than did other groups; other study groups were not significantly different from each other on overall pain. Both groups with elevated baseline pain (PTSD and Pain, Pain Alone) showed an average decrease of about 3.5 points between baseline and overall pain scores. In contrast, the PTSD-Alone group appeared to show an average increase of about 3.0 points in pain between the baseline and the overall pain scores, while those with Neither Condition only increased about 1.2 points on average. These apparent trends were next examined by regression equation using pain averaged within each quarter of the length of stay.

Pain over time

A statistically significant 3-way interaction ($P<.05$) in the regression equations revealed that change over time in pain scores varied according to study group. Specifically, pain decreased over

Table 2 Characteristics of pain-PTSD groups

Variables	PTSD + Pain (n=26)	PTSD Alone (n=12)	Pain Alone (n=22)	Neither (n=27)
Baseline pain	6.1 \pm 1.5*	1.1 \pm 1.4 [†]	6.0 \pm 1.9*	0.9 \pm 1.1 [†]
Overall pain	2.7 \pm 3.0*	3.5 \pm 2.9 [†]	2.5 \pm 2.6*	2.0 \pm 2.4*
Pain difference	-3.5 \pm 3.4*	3.0 \pm 3.1 [†]	-3.4 \pm 3.3*	1.2 \pm 2.4*
Length of stay (d)	105 \pm 70	142 \pm 110	146 \pm 178	111 \pm 123

NOTES. Pain difference, baseline — overall pain. Overall pain, average of all pain scores during inpatient rehabilitation. Within rows, values with different superscripts (* or [†]) reflect differences between pain-PTSD groups that are statistically significant ($P<.05$). Values with the same superscript are not significantly different. Values are mean \pm SD.

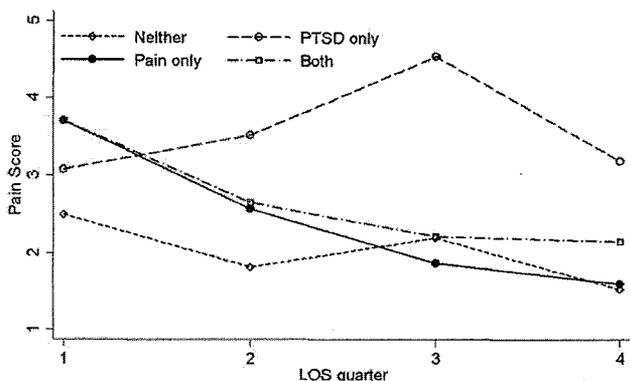


Fig 1 Pain across rehabilitation quarters, according to pain/PTSD status. NOTE. Average quarterly pain scores are shown separately for each study group. Abbreviation: LOS, length of stay.

the first and second quarters of the inpatient stay for participants in the Pain-Along, PTSD and Pain, and Neither Condition groups. In contrast, in the PTSD-Along group, pain was stable in the first 2 quarters of rehabilitation and then increased significantly in the third quarter ($P < .05$). See figure 1.

Discussion

Most knowledge about pain and PTSD after SCI is found within largely independent research literatures that have not addressed possible additive and interactive effects associated with co-occurring conditions. This study was designed to investigate co-occurring pain and PTSD symptoms after SCI to better understand rates of co-occurrence and what co-occurrence might mean to pain ratings and trajectory. On the basis of past findings from non-SCI populations, we expected to find high rates of co-occurrence, with greater pain and worse courses of pain over time being associated with PTSD symptoms. These expectations were partially met. Study findings represent novel information about pain and PTSD after SCI.

Rates of elevated pain, PTSD symptoms, and the co-occurrence of pain and PTSD symptoms were high in this study, reflecting the well-known physical and psychological burdens that can manifest during inpatient rehabilitation for SCI. Over half of the sample was experiencing elevated pain at baseline, a finding consistent with past reports on pain.¹⁵⁻¹⁷ The especially high rate of probable PTSD was more novel. Nearly half (44%) of the participants in this study screened positive for PTSD, which, to our knowledge, is one of the highest rates of probable PTSD reported in the literature for persons with SCI. Other studies have found rates of probable PTSD within 6 months of injury to be less than half the rate in the present study.^{2,4,9} High rates of PTSD symptoms in the present study are consistent with rates found among OEF/OIF veterans receiving care at polytrauma centers.^{3,8,10} The nature of the experiences of OEF/OIF veterans may account for high rates of PTSD symptoms: higher proportions of military personnel have been deployed, deployments have been longer and more frequent, and deployment to combat zones has been more common than during other conflicts.²¹ These findings may also be attributable to standardized, system-wide PTSD screening within the VA.²² It is important to note that while combat exposure is a common explanation for high rates of PTSD,^{23,24} we did not find that veterans with combat-related etiologies were more likely to have PTSD symptoms and/or pain.

An additional notable finding was the high frequency of participants with comorbid pain and PTSD symptoms. This parallels another report of high rates of comorbid psychiatric concerns after SCI.⁶ In the present study, comorbid pain and PTSD symptoms were more common than either condition alone, and nearly as common as not having either condition. Similar high comorbidity rates have been reported from studies of nonveteran samples¹¹ and veterans of OEF/OIF.¹⁰ Recent research has highlighted adverse clinical outcomes associated with comorbid pain and PTSD among OEF/OIF veterans.²⁵

Several cognitive-behavioral theories explaining the etiology and maintenance of co-occurring pain and PTSD have been advanced, each emphasizing the role of cognitive processes.¹¹ More specifically, certain cognitive processing errors and biases are thought to serve as shared vulnerabilities in the development and maintenance of both pain and PTSD. For example, some persons may be more likely to respond with high distress to both traumatic stressors and physical sensations such as pain²⁶ and to create negative expectations and interpretations of pain.²⁷ Activation of these cognitive patterns may then increase pain severity, pain interference, trauma-related distress, and maladaptive coping strategies such as avoidance.

Presence of PTSD symptoms did not appear to be generally associated with higher levels of pain intensity in this study. This contrasts with past findings from other populations, where persons with comorbid pain and PTSD tend to experience more severe manifestations of both conditions.¹²⁻¹⁴ One explanation for these divergent findings may be that participants in the present study were involved in inpatient rehabilitation, where pain and PTSD symptoms were being routinely screened and could be addressed swiftly by the interdisciplinary team at the start of rehabilitation. It is also important to note that the present sample was experiencing acute pain, whereas the past research cited above has focused on persons with chronic pain conditions. Also, the present study focused on PTSD symptoms rather than PTSD diagnoses and results could have more closely mirrored past research if diagnoses had been analyzed.

The finding that participants with PTSD Alone at baseline experienced an increase in pain levels over time was curious, especially considering that the pain levels in this group rose over the cutoff, suggesting the emergence of clinically significant pain. By contrast, those with both pain and PTSD at baseline showed improvements in pain, with pain levels dropping below the cutoff over the course of the study. This finding may be due to possible differences in treatment, such as early interventions for pain among those presenting with both pain and PTSD symptoms at the start of rehabilitation. Alternatively, declining pain scores could reflect pain issues resolving naturally, without intervention, as injuries heal. In contrast, participants with PTSD Alone may have developed pain concerns that were undetected or unaddressed until evident in the latter half of rehabilitation. Although this interpretation is hypothetical in the absence of data, it is consistent with observations that psychological distress can interfere with the detection and treatment of pain.²⁸

Study limitations

The primary design limitations to this study relate to sample selection and measurement strategies. The study focused on persons with acute pain; results may not generalize to populations with chronic pain conditions. The study population was intentionally limited to OEF/OIF veterans with SCI, but this raises

questions of whether or not results generalize to other veteran subgroups: those who do not receive care in the VA or those with more long-standing injuries. It is also unknown whether findings would generalize to nonveteran populations. However, when veterans with SCI have been directly compared with nonveterans with SCI on pain and other psychosocial factors, statistically significant differences have been few and small in magnitude.^{29,30} Key study measures were limited to screening tools for pain and PTSD. Such measures are not designed to capture the complexities of these conditions but rather to trigger additional assessment in clinical settings. Study findings could have differed had, for example, additional pain assessments or PTSD diagnoses been available for analysis. Finally, this study did not collect data that could possibly explain group differences or why changes occurred in pain ratings over time, such as data on pain interventions.

Conclusions

Pain and PTSD are more likely to manifest as comorbidities than as isolated conditions during inpatient rehabilitation for SCI. Therefore, assessment routines and care plans should be prepared with comorbidities as a foremost concern. In terms of assessments, it is advisable to screen for pain and a range of psychological concerns, including PTSD, at multiple time points during inpatient rehabilitation to detect new or emerging concerns. Ideally, assessments should collectively capture the environmental, cognitive, and behavioral factors that may be influencing pain and comorbidities.³¹ Treatment plans should also be tailored to address comorbidities and individual patient characteristics. For example, psychoeducation should address links between disorders, and interventions could be designed to target maladaptive cognitive and behavioral patterns that maintain both conditions.³² Assessment of pain-related environmental, cognitive, and behavioral factors should inform the selection of the most effective treatments for the individual patient.³¹

Keywords

Pain; PTSD; Rehabilitation; Spinal cord injuries; Veterans

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