ACRM
AMERICAN CONGRESS OF REHABILITATION MEDICINE

Archives of Physical Medicine and Rehabilitation

journal homepage: www.archives-pmr.org

Archives of Physical Medicine and Rehabilitation 2014;95:1100-5

ORIGINAL ARTICLE

Comorbidity of Pain and Depression Among Persons With Traumatic Brain Injury

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Abstract

Objective: To assess the prevalence of pain, depression, and comorbid pain and depression among a civilian sample of persons with traumatic brain injury (TBI).

Design: Longitudinal survey design with 1-year follow-up.

Setting: Inpatient rehabilitation and the community.

Participants: Participants (N = 158) admitted to inpatient rehabilitation after moderate to severe TBI.

Interventions: Not applicable.

Main Outcome Measures: Depression was assessed with the Patient Health Questionnaire-9 (PHQ-9); pain was assessed with a numerical rating scale from 0 (no pain) to 10 (worst pain). Participants who reported average pain ≥4 were classified as having pain, and participants with PHQ-9 scores ≥10 were classified as depressed.

Results: Both pain and depression were more prevalent at baseline assessment (pain: 70%; depression: 31%) than at year 1 (pain: 34%; depression: 22%). Comorbid pain and depression declined from 27% at baseline to 18% at year 1. Pain was significantly associated with depression at baseline (relative risk: 2.62, $P = .003$) and at year 1 (relative risk: 7.98, $P < .001$).

Conclusions: Pain and depression are common and frequently co-occur in persons with TBI. Although their frequency declined over the first year after injury, the strength of their association increased. Assessment and treatment of both conditions simultaneously may lead to improved outcomes, both early after TBI and over time.

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Both pain and depression are common among persons who have experienced moderate to severe traumatic brain injury (TBI). Estimated rates of major depressive disorder in the year after TBI range from 26% to 53%,[1-3] which stands in contrast with a 12-month prevalence of 6.7% in the general adult population.[4] Likewise, although prevalence estimates of chronic pain vary depending on how pain is assessed, there is evidence that chronic pain may be more prevalent among persons with history of TBI than the general population. A review of 23 studies examining chronic pain after TBI suggested a point prevalence of 57.8% (95% confidence interval, 55.5−60.2) for chronic headaches when combining civilian and military samples.[5] The same review estimated a prevalence of 51.5% for general chronic pain among civilian (ie, nonmilitary) persons who have experienced TBI. The prevalence of chronic pain is somewhat lower in the general adult population (range, 37%−43%).[6,7] Although persons with a history of moderate to severe TBI appear to bear an increased burden of both depressive symptoms

Supported by the National Institute on Disability and Rehabilitation Research Traumatic Brain Injury Model Systems (grant no. H133A070032) and Department of Defense Congressionally Directed Medical Research Programs (grant no. W81XWH-12-2-0109).

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

0003-9993/14/$36 - see front matter © 2014 by the American Congress of Rehabilitation Medicine
http://dx.doi.org/10.1016/j.apmr.2014.02.001

and chronic pain relative to the general population, there is little research examining the co-occurrence of depression and pain in this population.

Existing literature on depression and pain in the general population and in other neurologic groups (eg, multiple sclerosis[8]) documents significant comorbidity between these conditions.[9,10] This co-occurrence may result because depression and chronic pain interact so as to exacerbate each other.[9] Investigators have proposed a variety of causal mechanisms for this reciprocal relation. A recent review summarized these potential mechanisms, including shared neurotransmitter pathways; mutual impact on cognitive processes (eg, threat appraisal, catastrophizing); and a cycle of behavioral changes, including reduced activity and subsequent increases in pain and depressive symptoms.[10] Some researchers have even suggested that the presence of both pain and depression might be more accurately conceptualized as a depression-pain syndrome rather than the presence of 2 independent disorders.[11] In addition to possible shared etiology, there is also evidence that the co-occurrence of pain and depression is clinically significant. For instance, the extant literature suggests that persons with both chronic pain and depression experience greater disability than persons with only chronic pain or depression.[10,12] Their comorbidity also has implications for treatment: research in other populations has shown that both conditions may reduce treatment responsiveness in the other condition.[10,13-15]

Although evidence exists that both chronic pain and depression are common among persons with history of TBI and that the co-occurrence of pain and depression is clinically important, we are not aware of any studies examining the comorbidity of pain and depression among persons with history of TBI. A recent systematic review of studies investigating pain among persons with TBI reported that low-grade evidence exists for an association between depression and pain in persons with TBI.[16] If it were the case that pain and depression occur relatively independently of each other among persons with TBI, it would follow that pain and depression are separate constructs that can be assessed and treated independently in this population. Conversely, evidence of pain and depression being highly comorbid in persons with TBI would suggest that the interplay of pain and depression is similar to that observed in the general population. Such findings would highlight the importance of further research examining how best to assess and treat both conditions in this population.

To investigate these questions, we examined the co-occurrence of pain and depression in a cohort of participants with moderate to severe TBI both during inpatient rehabilitation and at 1 year postinjury. Given that the first year after TBI is typically an active time of recovery and change in functioning, we were interested in exploring whether and how the frequency of, and association between, pain and depression might change over time. Based on existing literature, our hypotheses were that persons with pain would be more likely to be depressed and persons with depression would be more likely to have pain at both time points.

List of abbreviations:

PHQ-9	**Patient Health Questionnaire-9**
TBI	**traumatic brain injury**
TBIMS	**Traumatic Brain Injury Model Systems**

Methods

Participants

Participants were part of a larger study of individuals enrolled in the University of Washington TBI Model Systems (TBIMS). The TBIMS is a longitudinal study sponsored by the National Institute on Disability and Rehabilitation Research. Inclusion criteria for the TBIMS included (1) diagnosis of TBI by Glasgow Coma Scale[17] score <13 on emergency department admission, >30 minutes of loss of consciousness, >24 hours posttraumatic amnesia, or neuroimaging indicating intracranial abnormality; (2) ≥ 16 years of age; (3) admission to the acute hospital within 72 hours of injury; and (4) receipt of both medical and rehabilitation care within the same system. Over 90% of eligible subjects during this study period consented to enrollment in the TBIMS and completed in-person assessment during inpatient rehabilitation (baseline); over 90% of those enrolled completed assessment by telephone at 1 year postinjury (year 1). In addition to the data collected for the TBIMS, participants were also asked about their pain and mood at baseline and 1 year postinjury. Of the 160 individuals who were consecutively enrolled between August 2004 and June 2007, 158 completed the measures of pain and depression at baseline, and 116 completed them at 1 year postinjury. Of the 42 participants for whom year 1 data were not available, only 15 were lost to follow-up. The remaining 27 participants were unable to complete the specific measures necessary for the current analyses because of time constraints. Data from this study have been previously used to describe sleep and co-occurring psychological conditions after TBI,[18] but the data used for the analyses that follow have not been previously reported. All study procedures for the TBIMS and additional measures were approved by the University of Washington Human Subjects Review Committee, and informed consent was obtained from each participant.

Measures

Pain: 0 to 10 numerical rating scale

Participants were asked to rate their overall pain, acknowledging that they may have pain in multiple locations, using the analog pain scale. Three questions about pain were asked: (1) overall average intensity of pain during the past week; (2) worst pain over the past week, and (3) current pain on a numerical rating scale from 0 (no pain) to 10 (pain as bad as could be). These ratings were averaged to create a characteristic pain score that has been shown to be a valid and reliable measure of pain intensity.[19,20] In the present study, and consistent with research on persons with other types of pain,[21-23] participants with an average score ≥ 4 were considered to have at least moderate pain.

Depression: Patient Health Questionnaire-9

The Patient-Health Questionnaire-9 (PHQ-9) is a commonly used measure of depression in medical populations[24] and has been validated in TBI populations.[25] Consistent with published guidelines, in the present study participants who scored ≥ 10 on the questionnaire were classified as depressed.[25]

Data analysis

Using the cutoffs for pain and depression previously described, descriptive statistics were computed to identify frequencies of pain alone, depression alone, comorbid pain and depression, and neither pain nor depression at both baseline and year 1. A Fisher