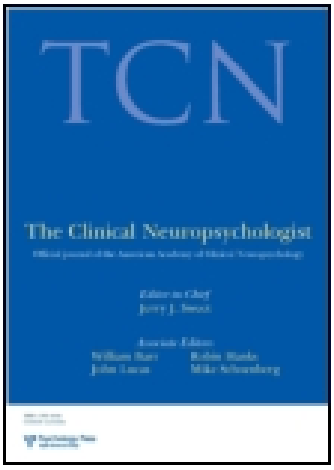

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Incidence of Postconcussion Symptoms in Psychiatric Diagnostic Groups, Mild Traumatic Brain Injury, and Comorbid Conditions

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CE Incidence of Postconcussion Symptoms in Psychiatric Diagnostic Groups, Mild Traumatic Brain Injury, and Comorbid Conditions

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The constellation of physical, cognitive, and emotional symptoms, collectively known as postconcussion syndrome (PCS), is not uniquely associated with concussion, making the etiology of chronic postconcussion symptoms controversial. The current study compared percentages of individuals meeting symptom-based criteria for PCS in a population-based sample of veterans composed of subgroups with various psychiatric diagnoses, a history of mild traumatic brain injury (MTBI), and healthy controls. Participants were identified from 4462 randomly sampled male U.S. Army veterans who served during the Vietnam era. Only 32% of veterans with a history of MTBI met DSM-IV symptom criteria for PCS as compared to 40% of those diagnosed with post-traumatic stress disorder (PTSD), 50% with generalized anxiety disorder (GAD), 57% with major depressive disorder (MDD), and 91% with somatization disorder. Results were consistent with existing literature showing that the PCS symptoms are not unique to concussion, and also provide important base-rate information for neuropsychologists practicing in both clinical and personal injury forensic settings.

Keywords: Head injuries; Psychiatric diagnoses; Veterans' health.

INTRODUCTION

Each year an estimated 1.7 million people sustain a traumatic brain injury (TBI; Faul, Xu, Wald, & Coronado, 2010) with approximately 75% of those TBIs classified as falling in the mild range (Centers for Disease Control, CDC, 2003). There is no doubt that many individuals with mild traumatic brain injury (MTBI) experience cognitive deficits and postconcussive symptoms immediately after injury, with the majority experiencing excellent neurobehavioral recovery. However, there is a significant minority who report distressing symptoms months

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(Alves, Macciocchi, & Barth, 1993; Dikmen, McLean, & Temkin, 1986; Hartlage, Durant-Wilson, & Patch, 2001; Powell, Collin, & Sutton, 1996) or even years post injury (Alexander, 1992; Hartlage et al., 2001; Deb, Lyons, & Koutzoukis, 1999). Common symptom complaints include headaches, balance problems, dizziness, fatigue, depression, anxiety, irritability, and memory and attention difficulties. It is important to note that this constellation of physical, emotional, and cognitive symptom complaints is only one part of the formal diagnostic criteria for postconcussion syndrome (PCS).

Despite the frequency with which MTBI occurs, the incidence, cause, and persistence of symptoms following an uncomplicated MTBI remain controversial in the medical-legal arena. Determining whether MTBI is the cause of post-acute or chronic symptoms is extremely difficult. Even objective findings suggesting either residual neuroimaging or neurocognitive abnormalities would not necessarily mean that subjective symptom complaints were related to a past MTBI. Traditionally, medical causality follows a linear model in which a specific event (infection, injury, etc.) leads to symptoms, which are verified by history, medical examination, and diagnostic tests. A diagnosis is established when findings point to one particular etiological explanation and are inconsistent with alternative etiologies. However, the particular symptom complaints after a MTBI are not exclusive to PCS. Recent studies suggest that PCS complaints after a concussion are more likely due to psychological factors, such as depression, anxiety, or PTSD, rather than a MTBI (Lippa, Pastorek, Benge, & Thornton, 2010; Meares et al., 2011; Ponsford et al., 2012; Wilk et al., 2010).

Increasingly researchers are calling into question the validity of the PCS symptom constellation. To qualify as a syndrome, there must be a set of symptoms or characteristics indicating the existence of a condition present in persons who have the condition and absent in those who do not have it (Larrabee, 2005). In fact, symptoms associated with PCS are not specific or unique to MTBI and are common in other conditions such as chronic pain (Smith-Seemiller, Fow, Kant, & Franzen, 2003), depression (Gunstad & Suhr, 2001; Iverson, 2006), and even healthy community and student samples (Chan, 2001; Garden & Sullivan, 2010; Iverson & Lange, 2003; Vanderploeg, Curtiss, Luis, & Salazar, 2007; Wang, Chan, & Deng, 2006). The non-specificity of PCS symptoms (PCSS) presents a major diagnostic challenge for clinicians.

The challenge for the neuropsychologist (either in a legal setting or clinical setting) is to determine whether these self-reported, non-specific symptoms are more likely than not related to an often remote injury event during which a MTBI possibly occurred. The evidentiary standard in personal injury cases is 51%, meaning that "the trier of fact favors parties having at least 51% of the evidence in their favor" (Greiffenstein & Cohen, 2005, p. 35). As such it would be extremely useful for the expert to be able to say that, based on prevalence studies, it is more or less likely that the reported PCSS are due to the MTBI versus psychiatric disorders and/or chronic pain, when those conditions are present. However, there is no existing literature to show relevant PCSS prevalence across diagnoses within the same overall population-based sample. Although several studies have shown high rates of PCSS in a variety of patient populations as well as healthy control samples, no one has completed a comparative study of PCSS frequency within the same

sample across diagnostic conditions and healthy controls. The current study examined the incidence of satisfying only the symptom-based criteria for PCS in a population-based sample of community dwelling, Vietnam-era U.S. military veterans.

Also examined were the frequencies of reporting two specific PCSS: headaches and dizziness. Recent research has found these two symptoms are most uniquely associated with MTBI. Vanderploeg et al. (2007) and Vanderploeg, Belanger, and Curtiss (2009) reported that individuals with a history of MTBI were more likely than healthy controls to report symptoms of headaches, dizziness, sensitivity to light, sleep problems, double vision, and memory problems. However, only headaches, sleep problems, and memory problems remained significant after demographic, medical, psychiatric, and other injury variables were controlled, although the odds ratio for dizziness remained the largest. Similarly, Hoge et al. (2008) reported that soldiers with MTBI were significantly more likely to report a high number of physical health symptoms. However, after adjustment for PTSD and depression, only headaches remained significantly associated with MTBI, although again, dizziness had the highest odds ratio associated with MTBI.

METHOD

Participants

The data utilized in the current investigation were those of the Vietnam Experience Study (Centers for Disease Control, 1988a, 1988b). These data were collected in the mid-1980s as part of an investigation of the effects of the Vietnam experience on veterans. This nonclinical, population-based sample consisted of 4462 randomly selected, male U.S. Army veterans who entered the military between January 1965 and December 1971 serving during the Vietnam era. Of these participants, 56% served in Vietnam and the remaining participants served in the U.S., Germany, or Korea.

Participants were flown from their city of residence to a city in the southwestern United States for a 3-day comprehensive evaluation involving extensive medical, psychological, and neuropsychological evaluations. All participants provided written informed consent and experimental procedures complied with the code of ethics of the Institutional Review Board. Data from the original study were collected in a research context—a non-clinical and non-medicolegal/compensation setting. Participants were told the nature of the study was to evaluate the effects of the Vietnam experience. Therefore potential secondary gain or other biases were unlikely to have played a role in evaluation results.

The participants ranged in age from 31 to 48 years ($M = 37.8$; $SD = 2.5$), were predominantly non-Hispanic Caucasians (82%) and completed an average of 13 years of formal education ($M = 13.3$; $SD = 2.3$).

Procedures

Details of the data collection and original study methodology have been published elsewhere (Centers for Disease Control, 1988a, 1988b). From the many

variables included in the original study, measures used in the current study included: basic demographic information, a 30-minute structured medical history questionnaire and a structured psychiatric interview, the Diagnostic Interview Schedule (DIS), Version III-A (Robins et al., 1987). Information about a history of TBI was determined from the following two questions: (a) Since your discharge from active duty, have you injured your head? and (b) Did you lose consciousness as a result of the head injury? If participants were unclear if they had lost consciousness, they were asked if they had "blacked out" in the accident. Thus the TBI criteria included a disturbance of consciousness or period of post-traumatic amnesia, not just unconsciousness. Individuals who reported hospitalization after the TBI were excluded from analyses. Therefore the TBI group can most likely be considered a mild TBI sample. Given that the evaluations were conducted approximately 16 years after military discharge, the TBI would, on average, have likely occurred about 8 years prior to the evaluation. Unfortunately no other information was collected regarding when the injury occurred and all data are self-report.

Psychiatric diagnoses were determined via the DIS Version III-A (DIS-III-A), administered by trained examiners under supervision of doctoral level psychologists. The DIS-III-A is a standardized questionnaire used to assess the prevalence of psychiatric disorders in the general population. The instrument consists of modules that are grouped together in diagnostic categories (e.g., anxiety, mood, substance use). Diagnoses on this version of the instrument were made according to DSM-III (American Psychiatric Association, 1980), not DSM-IV, and were generally considered to represent "current" diagnoses. To be classified as having psychiatric diagnoses in the present study, participants had to endorse the pertinent criteria within the last year. Of the 4462 individuals, the following diagnostically unique subgroups were identified: major depressive disorder (MDD) ($n = 58$), generalized anxiety disorder (GAD) ($n = 141$), somatization disorder ($n = 21$), alcohol abuse/dependence ($n = 391$), post-traumatic stress disorder (PTSD) ($n = 130$), MTBI ($n = 154$), and healthy controls ($n = 3001$; i.e., no MTBI and no psychiatric diagnoses). Because of the small sample size those in the somatization disorder group included those who also met criteria for up to one other psychiatric diagnosis (i.e., nine with somatization only, two with comorbid PTSD, seven with comorbid GAD, and three with comorbid alcohol abuse/dependence). Additionally, subgroups with multiple diagnoses were included (see Table 1) for a total number of participants equaling 4422. A total of 40 participants were excluded either because they were hospitalized after the TBI or because not all psychiatric subgroups were included for this study (e.g., drug abuse/dependence and other affective disorders).

PCSS frequencies were captured from the medical history questionnaire administered by physician assistants based on the criteria listed in the Diagnostic and Statistical Manual of Mental Disorders 4th Edition (DSM-IV; American Psychiatric Association, 1994) and the International Statistical Classification of Disease and Related Health Problems 10th Edition (ICD-10; World Health Organization, 1992). Because the objective was to identify PCSS in a non-clinical, non-referred population, many of whom had not experienced a head injury, the following criteria were not included in the PCSS diagnosis: a history of head injury, neuropsychological evidence of cognitive problems, or preoccupation with symptoms. Participants met the DSM-IV criteria for PCSS if three or more of the

Table 1. Frequencies and odds ratios for DSM-IV and ICD-10 Postconcussion Syndrome Symptom Cluster, Headaches & Dizziness

	DSM-IV PCSS		ICD-10 PCSS		Headaches		Dizziness	
Diagnostic conditions (*n*)	%	Odds ratio (CI)	%	Odds ratio (CI)	%	Odds ratio (CI)	%	Odds ratio (CI)
GAD, PTSD, & MTBI (12)	92	71.12 (9.16–552.32)	100	n.a.	67	12.32 (3.69–41.08)	58	12.28 (3.87–38.93)
Depression, GAD, & PTSD (48)	92	71.12 (25.42–198.99)	96	156.75 (37.90–648.33)	71	14.95 (7.96–28.10)	63	14.62 (8.06–26.54)
Depression, GAD, PTSD, & MTBI (11)	91	64.65 (8.25–506.40)	100	n.a.	64	10.78 (3.14–36.97)	55	10.53 (3.19–34.69)
Somatization (21)	91	61.42 (14.25–264.68)	91	64.74 (15.02–279.05)	76	19.70 (7.18–54.07)	81	37.28 (12.47–111.50)
Depression & PTSD (81)	85	37.18 (19.96–69.24)	86	43.37 (22.76–82.63)	64	11.04 (6.93–17.59)	57	11.53 (7.31–18.18)
Depression, PTSD, & MTBI (13)	85	35.56 (7.85–161.01)	100	n.a.	62	9.85 (3.21–30.26)	46	7.52 (2.51–22.52)
GAD & PTSD (87)	83	31.03 (17.62–54.66)	83	32.71 (18.57–57.64)	62	10.08 (6.46–15.73)	54	10.31 (6.65–15.97)
Depression, GAD, & MTBI (25)	80	25.86 (9.65–69.29)	80	27.26 (10.17–73.06)	52	6.67 (3.02–14.72)	50	8.77 (3.91–19.70)
GAD & MTBI (45)	76	19.98 (10.04–39.76)	80	27.26 (13.03–57.04)	53	7.04 (3.88–12.76)	50	8.77 (4.80–16.03)
Depression & GAD (133)	75	19.59 (13.04–29.44)	77	22.42 (14.79–33.99)	51	6.44 (4.52–9.19)	42	6.46 (4.49–9.31)
PTSD & MTBI (32)	75	19.40 (8.65–43.47)	75	20.45 (9.12–45.84)	50	6.16 (3.06–12.41)	41	6.00 (2.94–12.27)
Depression & MTBI (39)	72	16.46 (8.13–33.32)	74	19.76 (9.56–40.88)	49	5.85 (3.10–11.05)	45	7.10 (3.71–13.61)
Depression (58)	57	8.53 (5.02–14.50)	55	8.39 (4.95–14.23)	24	1.96 (1.06–3.61)	19	2.05 (1.05–4.00)
GAD (141)	50	6.37 (4.51–9.01)	41	4.76 (3.35–6.77)	23	1.88 (1.26–2.82)	22	2.47 (1.63–3.75)
PTSD (130)	40	4.31 (2.99–6.22)	39	4.26 (2.94–6.16)	29	2.45 (1.65–3.64)	22	2.41 (1.56–3.72)
MTBI (154)	32	3.02 (2.12–4.30)	27	2.47 (1.70–3.59)	27	2.31 (1.60–3.34)	20	2.14 (1.41–3.24)
Alcohol abuse/dependence (391)	26	2.25 (1.75–2.89)	24	2.19 (1.70–2.82)	14	1.01 (0.74–1.37)	14	1.44 (1.06–1.96)
Control subjects (3001)	13	1.00 (n.a.)	13	1.00 (n.a.)	14	1.00 (n.a.)	10	1.00 (n.a.)

PCSS = Postconcussive syndrome symptoms; GAD = Generalized anxiety disorder; PTSD = Post-traumatic stress disorder; MTBI = Mild traumatic brain injury; Depression = Major depressive disorder; *n* = number of participants; % = Frequencies; CI = confidence intervals; n.a. = not applicable.

following symptoms were endorsed: fatigue; sleep problems; headaches; dizziness; irritability; and either anxiety, depression, or mood lability. The ICD-10 PCSS criteria require three or more of the following: (1) headache, dizziness, malaise, fatigue, or noise intolerance; (2) irritability, depression, anxiety, or emotional lability; (3) subjective concentration, memory, or intellectual difficulties; (4) insomnia. We adopted the Mittenberg and Strauman (2000) PCS classification scheme for the ICD-10 criteria.

Analyses

Frequencies of the PCSS, as well as frequencies of headaches and dizziness, were determined for each subgroup and odds ratios for PCSS, headaches, or dizziness were calculated using the healthy control subgroup for comparison.

RESULTS

Overall findings are presented in Table 1. A total of 32% of veterans with a history of concussion without any comorbid Axis I psychiatric disorder met DSM-IV criteria for PCSS (27% met ICD-10 PCSS criteria), as compared to 40% of those diagnosed with PTSD (39% ICD-10), 50% with GAD (41% ICD-10), 57% with MDD (55%), and 91% with somatization disorder (91% ICD-10). The only diagnostic subgroup that had a lower frequency of PCSS than MTBI was alcohol abuse/dependence (26% DSM-IV; 24% ICD-10).

When examining comorbid diagnostic groups, 75% of those that were diagnosed with comorbid MDD and GAD met DSM-IV criteria for PCSS (77% ICD-10) versus 80% (80% ICD-10) of those with comorbid MDD, GAD, and MTBI. Additionally, 85% of veterans diagnosed with comorbid MDD and PTSD met DSM-IV criteria for PCSS (86% ICD-10), the same frequency whether or not MTBI was comorbid. The two highest multiple diagnostic subgroups that met DSM-IV criteria for PCSS were GAD, PTSD, and MTBI at 92% (100% ICD-10) and MDD, GAD, and PTSD also at 92% (96% ICD-10).

With regard to headaches and dizziness, somatization disorder had the highest percentage at 76% and 81%, respectively, whereas veterans diagnosed with a history of MTBI had some of the lowest frequencies at 27% and 20%, respectively (see Table 1).

DISCUSSION

Although several studies have shown high rates of PCSS in a variety of patient populations as well as healthy control samples, prior to this study no one has completed a comparative analysis of PCSS frequency within the same sample across diagnostic conditions and healthy controls. Like previous studies (Chan, 2001; Garden & Sullivan, 2010; Gunstad & Suhr, 2001; Iverson, 2006; Iverson & Lange, 2003; Smith-Seemiller et al., 2003; Vanderploeg et al., 2007; Wang et al., 2006), current findings again demonstrate that PCSS are not unique to concussion. The symptoms and problems typically conceptualized as comprising PCS are non-specific; they can follow a MTBI, or they can arise from other conditions singly or

in combination. In the current population-based sample those with somatization disorder, MDD, GAD, or PTSD had higher frequencies of PCSS than individuals with a history of concussion. With increasing numbers of psychiatric conditions, the frequency of PCSS increased. With one psychiatric comorbidity, a history of concussion increased the frequency of PCSS. However, with two or more psychiatric comorbidities, a history of concussion added minimally to PCSS frequency. The same pattern of findings was seen with the individual symptoms of headaches and dizziness.

The present findings have a great deal of relevance in medical-legal contexts where there is uncertainty about the causation of reported symptoms. One expert may assert that the presence of PCSS verifies that a suspect MTBI was in fact a MTBI and that the symptoms are the result, even if the claimant has comorbid PTSD and Depression. In contrast, the current findings suggest that it is more likely that the PCSS are secondary to PTSD and Depression, and that the suspect MTBI plays no role in the current symptom presentation.

The experienced clinician who works with this patient population knows that a reasonable perspective for conceptualization is biopsychosocial. In all cases clinicians should carefully study the history and progression of symptoms and problems, and systematically conduct a differential diagnostic assessment examining competing explanations for the symptoms. The current study's findings would be a valuable aid in this process.

From a theoretical perspective the current data can be seen as consistent with the hypothesis that chronic PCS following a concussion may be a form of somatoform disorders (McCrea, 2007) given that 91% of those with somatization disorder met symptom-based criteria for PCSS, a substantially higher frequency than veterans with a remote history of concussion. However, at the same time the finding that a comorbid concussion added to the frequency of PCSS over and above the presence of all single psychiatric conditions suggests that a history of concussion, even in a chronic state, has some additional unique contribution to the presence of PCSS. In all cases the frequency of PCSS with multiple diagnoses, with or without a history of concussion, was less than summative of the unique diagnostic subgroups' frequencies. This finding suggests a possible common mechanism that may reflect PCS (as well as the unique symptoms of headaches, dizziness, and others), being associated with increased levels of stress or distress, mediated through a type of somatoform response.

An important advantage of these data is that the set of variables was obtained in a non-clinical, non-referred, population-based randomly selected sample and without regard to MTBI status. Therefore the data are likely free of MTBI-attributable reporting bias. The data collection situation in the current study is similar to that of clinical practice where details regarding the presence, severity, and time frame of a MTBI typically are entirely self-report.

Several factors may limit the generalizability of this study. The sample was entirely male. Given today's military composition it is possible that the results would be different if groups were assessed on demographic factors alone, i.e., gender and ethnicity. However, it is unlikely to change the overall result that PCSS frequencies are significantly higher among various psychiatric diagnostic groups than in individuals with chronic MTBI. Another limitation was that, because we

relied on archival data that were collected for another purpose, details of injury severity, time post onset, and compensation status related to MBTI are unknown. In addition, all information about MTBI was based on self-report unsubstantiated by other data. Also lacking is any information about additional head injuries prior to or during military service.

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