Depression, anxiety, and stress as predictors of postconcussion-like symptoms in a non-clinical sample

Shannon Edmed, Karen Sullivan

Clinical Neuropsychology Research Group, School of Psychology and Counselling, Queensland University of Technology, Brisbane, Australia
Institute of Health and Biomedical Innovation, Queensland University of Technology, Brisbane, Australia

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ABSTRACT

This study examined the relationship between postconcussion-like symptoms and depressive symptoms, anxiety and stress respectively. Seventy-one university students with a negative concussion history completed the Depression Anxiety Stress Scales (DASS) and the British Columbia Postconcussion Symptom Inventory (BC-PSI). A multiple regression was conducted using the three DASS subscale scores as predictors of postconcussion-like symptoms. Depressive symptoms, anxiety and stress were significantly positively correlated with postconcussion-like symptoms at the bivariate level. When these three factors were examined together 72.9% of variance in BC-PSI total scores was explained overall. Stress and depressive symptoms emerged as significant multivariate predictors explaining 15% and 3% of unique variance, respectively. Anxiety was not a significant multivariate predictor. These results suggest that stress may be a more important predictor of postconcussion-like symptoms than previously identified. Findings are interpreted in light of Iverson (2012) conceptual model of poor outcomes from mild traumatic brain injury.

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1. Introduction

For most individuals, the postconcussion symptoms experienced in the acute stage of a mild traumatic brain injury (mTBI) resolve within a few days to a few months (Schretlen and Shapiro, 2003; Belanger et al., 2005; Belanger and Vanderploeg, 2005). However, some individuals continue to report a set of physical, cognitive, and affective difficulties beyond the typical recovery period (King and Kirwilliam, 2011). This atypical recovery profile is often referred to as Postconcussion Syndrome (PCS; Williams et al., 2010). PCS (or Postconcussive Disorder) is recognised in formal diagnostic systems, such as the Diagnostic and Statistical Manual Fourth Edition (DSM-IV-TR; American Psychiatric Association (APA), 2000) and the World Health Organization's (WHO) International Classification of Diseases (ICD-10; WHO, 1992).

PCS is a disabling condition characterised by symptoms and difficulties that persist beyond one (WHO, 1992) to three months (APA, 2000) of the injury. The symptoms experienced by people with PCS include but are not limited to headaches, dizziness, sensitivity to noise, irritability, and difficulties with memory (WHO, 1992; APA, 2000). Whilst the aetiology of the persistent symptoms that comprise PCS remains uncertain (Prigatano and Gale, 2011), a substantial body of research has now identified that factors independent of brain injury status are associated with ongoing symptomatology.1

The symptoms associated with PCS are not specific or unique to the syndrome. Postconcussion-like symptoms are also reported by people with chronic pain (Iverson and McCracken, 1997; Smith-Seemiller et al., 2003), or people who receiving psychological treatment for other conditions (Fox et al., 1995; Iverson, 2006). Postconcussion-like symptoms are also reported in community and student samples (Chan, 2001; Iverson and Lange, 2003; Wang et al., 2006; Garden and Sullivan, 2010; Edmed and Sullivan, in press). The non-specificity of PCS symptoms presents a major diagnostic challenge for clinicians.

In 2007, Iverson and colleagues (2007) presented a conceptualization of the factors that influence PCS symptom report. This model included both biological and psychological factors. The newer incarnation of this model is described as a “biopsychosocial model” of poor outcomes from mTBI (Iverson, 2012). Both of these models identified a role for depression, anxiety and stress. In the 2007 conceptualisation, depression was identified as a contributing factor in its own right, whereas anxiety and stress were grouped together with ‘somatic preoccupation’ (Iverson

1 The focus of this article is primarily on psychological factors associated with PCS. Readers interested in more information about biological factors associated with PCS are referred to Bigler (2008).
et al., 2007). In the more recent model, depression remains on its own, but anxiety, stress, and worry are grouped together as a factor that influences poor mTBI outcomes (Iverson, 2012).

Of these three factors, the relationship between depression and PCS has been the most extensively researched (e.g., Sawchyn et al., 2000; Trahan et al., 2001). Iverson and colleagues (2007) suggest that depression is not only a challenging differential diagnosis for PCS, but that it may also form the predominant aetiology of PCS for some patients. A considerable body of base-rate research has found that higher levels of depression or depressive symptoms are associated with higher levels of post-concussion-like symptoms (e.g., Suhr and Gunstad, 2002; Iverson and Lange, 2003; Iverson, 2006; Garden and Sullivan, 2010). In one study, Iverson (2006) found that 90% of patients with depression and no history of head injury, met liberal self-report criteria for PCS. However, studies of the the relationship between PCS symptoms and anxiety or stress. Nevertheless those that have been conducted have revealed a positive association between PCS and anxiety or stress. For example, among college students with and without mTBI histories, greater PCS/postconcussion-like symptomatology was reported by those individuals who: (a) reported a greater number of, and being more impacted by, stressful events (as measured by the Daily Stress Inventory; Gouvier et al., 1992), (b) had higher levels of subjective stress (as measured by the Perceived Stress Scale; Machulda et al., 1998), and (c) were exposed to higher levels of experimentally induced acute stress (measured physiologically and subjectively following completion of cognitively demanding tasks; Hanna-Pladdy et al., 2001). Less commonly reported in the literature, but nevertheless present, is the finding that anxiety (as measured by the Beck Anxiety Inventory) and postconcussion-like symptomatology were positively correlated in neurologically normal young adults and people with “recovered” mTBI (Trahan et al., 2001). With a few exceptions, this past research has largely explored these variables (i.e., depression, anxiety, or stress) and their relationship to PCS and postconcussion-like symptoms either in isolation or independently. Studies that have considered these factors together have found that mTBI outcomes are predicted by scores on the Hospital Anxiety and Depression Scale (HADS), the Impact of Events Scale, duration of posttraumatic amnesia, and some neuropsychological measures (King, 1996; King et al., 1999). Specifically, King (1996) found that PCS symptom report at 7–10 days was predicted by intrusive thoughts about a stressful event, and at three months, PCS symptom report was predicted by HADS anxiety. The King et al. (1999) study found that depression as measured by the HADS predicted PCS symptom report at 7–10 days, and HADS anxiety predicted PCS symptom report at six months. However, these studies had an inadequate sample size to generate a reliable regression model (N=50–52, with 7–17 predictors). Furthermore, these studies did not include a control group. Thus, it is difficult to determine if these predictions hold for mTBI samples only or if they might also be demonstrated in a non-clinical sample. Additional research that addresses these concerns and considers the influence of depression anxiety and stress on post concussion-like symptom report is clearly needed.

This exploratory study sought to investigate the relationship between postconcussion-like symptoms and the reporting of symptoms of depression, anxiety, and stress, respectively. To address one of the limitations of past research, this study aimed to have an adequate participant-to-variable ratio. A non-clinical sample was used to determine if relationships demonstrated previously in clinical groups would hold outside of this context.

2. Method

2.1. Participants

The participants were 71 undergraduate students (74.6% female) from Queensland University of Technology. Participants were aged from 17–54 years (M=24.27, S.D.=8.93) and had no history of head injury or neurological impairment. Four participants indicated that they spoke a language other than English at home. These participants were retained in the sample because sufficient English proficiency was assumed on the basis of current student status at an Australian university. Volunteers received course credit or entry into a prize draw for participation.

2.2. Materials

2.2.1. Preexperimental questionnaire

This questionnaire was developed for this study. It was used to obtain demographic data (age, gender, language-spoken-at-home), and to confirm the exclusionary criteria (self-reported history of previous head injury or other neurological impairment). To confirm the exclusionary criteria, we asked yes/no questions such as: “Have you experienced a diagnosis of any mental or intellectual impairment such as a brain injury, seizures, or other neurological problems?”

2.2.2. British Columbia Postconcussion Symptom Inventory

The British Columbia Postconcussion Symptom Inventory (BC-PSI; see Iverson et al., 2007) is a 16-item measure modelled on the ICD-10 diagnostic criteria for PCS. The first 13 items on the inventory use a 6-point Likert scale to measure the frequency of each symptom (not at all, 1–5), and the intensity (not at all–severe problem) of various PCS symptoms experienced over the previous two weeks, including that day. The 13 BC-PSI symptom items are headaches, dizziness/ light-headed, nausea/feeling sick, fatigue, extra sensitive to noises, irritable, feeling sad, nervous or tense, temper problems, poor concentration, memory problems, difficulty reading, and poor sleep. The scale also measures participants’ experience with three additional life problems. However, these questions were not included in the analysis. The “symptom total score”, which was used as the outcome measure in this study, was calculated as per Iverson et al. (2007) by first multiplying the frequency and severity rating to create a “product score”. These product scores were then converted into “item scores” that ranged from 0 to 4, where 0=0–1, 1=1–2, 2=3, 3=4–6, 4=7–12, and 4=15+ . Finally, the item scores were summed to create the symptom total score that ranges from 0 to 52. A total score greater than 15 is considered extremely high for healthy adults (Iverson et al., 2007). The BC-PSI was used because of its comparability to ICD-10 diagnostic criteria, and its sound psychometric properties. The BC-PSI has been shown to have moderate to good convergent validity with other PCS measures (r=0.59–0.77; see Sullivan and Garden, 2011) and good internal consistency in a healthy sample (α=0.82; Iverson et al., 2007). The obtained Cronbach’s alpha for the BC-PSI symptom total score in the current study was α=0.85.

2.2.3. Depression Anxiety Stress Scales

The Depression Anxiety Stress Scale (DASS; Lovibond and Lovibond, 1995a) assesses the experience of 42 negative emotional symptoms over the previous week on a 4-point Likert scale, ranging from 0 (does not apply to me) to 3 (applied to me very much). The DASS was originally developed and normed in Australia but, more recently, it has also been normed or translated for use in other countries, such as in the United Kingdom (Crawford et al., 2009), Malaysia (Hashim et al., 2011), Arabic countries (Taouk et al., 2011), and Spain (Daza et al., 2002). The DASS has three subscales (i.e., depression, sample item: “I felt that I had lost interest in just about everything; anxiety, sample item: “I found myself in situations that made me so anxious I was most relieved when they ended, and; stress, sample item: “I found it difficult to relax”). Each of which has 14 items. Subscales are scored by summing the item scores and can range between 0 and 42, with higher scores reflecting greater severity of emotional symptoms. The DASS has been shown to include good psychometric properties in terms of internal consistency for each of the subscales (α=0.90–0.97; Crawford and Henry, 2003; α=0.88–0.95; Crawford et al., 2011), its factor structure (see Clara et al., 2001), and convergent validity (r=0.65–0.75; Nieuwenhuijsen et al., 2003). The 21-item version of the DASS, which compares favourably to the 42-item version that was used in this study, has also recently been investigated using Rasch model analysis (Shea et al., 2009) and confirmatory factor analysis (Henderson and Crawford, 2005), supporting the unidimensionality of α=0.95. High correlations have been found between the DASS and the Beck Depression and Anxiety Inventories, respectively (r=0.74–0.81; Lovibond and Lovibond, 1995b), and the Hospital Anxiety and Depression Scale (r=0.62–0.66; Crawford and Henry, 2003). Further, the DASS Stress scale has been found to be strongly related to worry as measured by the Penn State Worry Questionnaire (r=0.69; Brown et al., 1997; r=0.64; Sazb, 2011). In the current study, the DASS subscales had very high internal consistency (The Cronbach’s alphas for the depression, anxiety, and stress scales were as follows α=0.95, α=0.85, and α=0.93, respectively).
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