Traumatic brain injury (TBI), including mild TBI (MTBI), increases the risk for developing a variety of psychiatric disorders (Whelan-Goodinson, Ponsford, Johnston et al. 2009; McAllister 2010). This general considered to be related to the vulnerability of brain regions integral to the modulation of mood, affect, and executive function to the effects of trauma (McAllister 2011a). The presence of post injury psychiatric conditions can serve to accentuate or increase the degree of distress associated with lingering symptoms, and successful treatment of comorbid conditions can result in significant reduction of post concussive symptoms. Relatively little is known about the neuropsychiatric sequelae of sports concussion, although a small body of literature is emerging. Much of our knowledge of this topic comes from what we know of the neuropsychiatric aspects of TBI in general, and is briefly reviewed (McAllister 2011b).

**Depression:** Depressive symptoms are a common complication of brain injury (Pagulayan, Hoffman, Temkin et al. 2008). It is important to distinguish between depression as a disorder (Major Depressive Disorder) and symptoms that are consistent with or suggest depression. Many post concussive symptoms such as subjective slowing, irritability, fatigue, and sleep disturbance can be consistent with a depressive syndrome, even when patients may not endorse explicit items such as “depressed mood.” For example Kontos et al. (2012) found significantly elevated depressive symptoms on a depression scale within two weeks of a concussion in college and high school athletes, but the mean score was well below the threshold generally considered consistent with clinically significant depression. Nevertheless they found correlations between depression symptoms and performance on some cognitive tests.

In addition to the effects of a single acute concussion on mood, there may be an effect of repetitive concussions on mood stability, depression, and risk of suicide. McKee et al. (2009; 2013) have reported that these symptoms are typically a prominent part of the clinical picture in their series of chronic traumatic encephalopathy. Kerr et al. (2012), found a relationship between the number of reported concussions and diagnosis of depression in a cohort of retired professional football players. Both Hart et al. (2013); and Strain et al. (2013) have reported correlations between white matter diffusivity metrics (fractional anisotropy) and depression diagnosis and symptoms in retired football players.

**Anxiety:** Few studies have examined anxiety syndromes that occur after mild brain injury (Moore, Terryberry-Spohr, Hope et al. 2006). As with depression there is an overlap between some post concussive symptoms and generalized anxiety disorder (GAD) symptoms. For example many patients endorse complaints of headache, dizziness, blurred vision, irritability, and sensitivity to noise or light after mild brain injury. It is less clear how many patients actually experience anxiety and how many have diagnosable anxiety disorders. Fann et al. (Fann, Katon
et al. 1995) reported that 24% of their sample (the majority of whom had MTBI) evaluated 2–3 years after injury met criteria for GAD.

**Mania:** Mania can occur after MTBI but is a rare phenomenon and has not been reported to my knowledge as a complication of a sports concussion. The phenomenology of mania after TBI may differ somewhat from primary or idiopathic mania in having a higher rate of relapse and a higher percentage of irritable and violent behavior. Quite commonly, patients have both personality changes secondary to their injury and a manic syndrome. The latter can present as a periodic worsening of the irritability and impulsivity characteristic of the former. This periodicity may be mistaken for an integral part of the personality changes and may account for the lower frequency of mania diagnosed in these patients.

**Post Traumatic Stress Disorder (PTSD):** There is an increasing awareness of the relationship between PTSD and brain injury in both civilian and military populations (Stein and McAllister, 2009). It is not uncommon in clinical practice to see patients with a history of mild brain injury who manifest signs and symptoms suggestive of PTSD. These may include sleep disturbance, recurrent nightmares, exaggerated startle responses, daytime flashbacks, and avoidant behaviors such as refusing to drive or leave home. Bryant and Harvey (1999) studied 46 individuals admitted to a hospital after an MTBI (LOC with PTA <24 hours) and 59 survivors of motor vehicle accidents without evidence of TBI 6 months after their accidents and reported that the TBI group with PTSD was significantly more symptomatic than the TBI without PTSD group. This suggests that, as with depression, PTSD can amplify post concussive symptoms after an MTBI and complicate recovery.

**Summary:** In conclusion, sports concussion, as with other forms of mild TBI, is associated with an increase in psychiatric symptoms acutely after injury. Depression and anxiety-like symptoms are common enough to be considered part of the core clinical picture of a concussion. Like other symptom domains, these phenomena recede fairly quickly in the majority of individuals.

In some individuals, the symptoms can progress to a more clear-cut disorder that must be considered part of the differential diagnosis in individuals with persistent post concussive symptoms. Although further research is needed, some initial evidence suggests that repetitive concussions may be associated with increased rates of depressive illness in some cohorts, and the depression may be associated with changes in white matter indices of diffusivity. The effect on mood and non-cognitive behavior of repetitive head impacts in the absence of diagnosed concussion needs further investigation.
References:


