



# PSYCHIATRIC SEQUELAE OF TRAUMATIC BRAIN INJURY

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## ABSTRACT

*Traumatic brain injuries are unfortunately common. Though the large number of Iraq veterans with head injuries focuses our attention on these injuries, they are also seen in our emergency rooms and intensive care units here at home, where they are concentrated in those with substance abuse and psychiatric disorders. In this paper, we first discuss screening for brain injury in the clinical setting, and then review psychiatric disorders commonly seen after traumatic brain injury. Depression and anxiety disorders occur more commonly in those with brain injuries than in the general population and their symptoms can be confused with the symptoms of the brain injury itself. The prevalence of schizophrenia and mania does not seem to increase following traumatic brain injury. Pre-existing substance abuse can be a direct cause of brain injury, through drunk-driving, fights, or falls. The treatment period required by the brain injury represents an opportunity to treat the addiction that caused it.*

## INTRODUCTION

Traumatic brain injuries have always been an important clinical problem. In a prior issue of the journal Drs. Bentz and Purzycki discussed the acute care of concussion in the general hospital.<sup>1</sup> In this article, I will address the long term psychiatric sequelae of traumatic brain injury. In civilian life traumatic brain injuries are commonly seen in motor vehicle accidents, in falls occurring in elders, or in those suffering from substance abuse.

The headlines from the war in Iraq have brought special focus to the entire clinical syndrome of traumatic brain injury, as head injuries are common in that conflict. The importance of identifying and treating not only the acute injury, but also the chronic sequelae of brain trauma became the focus of congressional hearings, news headlines, and concerns throughout the medical community.

The frequent use of improvised explosive devices (IED's) in roadside bombings in Iraq causes traumatic brain injuries either through direct blunt trauma to personnel in vehicles, or via blast waves to infantry soldiers near the explosion. These attacks have been so common that

brain injury has been called the “signature injury” of the Iraq war. In one survey of 2,525 infantry veterans returning from Iraq, 5% suffered a traumatic brain injury with loss of consciousness, and another 10% sustained a head injury with altered mental status.<sup>2</sup>

There has been considerable controversy about the long term consequences of these injuries, particularly within the Veterans Administration health care system. At first, brain injury was under-recognized in returning veterans, eventually leading to the practice of screening returning veterans from Iraq for head injuries. Now, concerns surrounding these injuries focus on recognizing the obvious differences between very mild head injuries and more severe head injuries. Some have questioned whether we are over-identifying brain injuries in returning veterans, and whether the “post-concussive” symptoms are due more to depression or post-traumatic stress disorder than to the brain injuries themselves. These questioners wonder if the incidence of purported sequelae is amplified by opportunities to exploit the Veteran Administration’s compensation system for injury.<sup>3</sup> These questions are valid, but all clinicians would agree that following trauma it is useful to screen individuals for brain injury, and to treat the symptoms that follow. Regardless of the controversy about the true incidence of sequelae in veterans, and the obvious potential and reward for exaggeration of symptoms, many patients have real disabilities.

In civilians, traumatic brain injuries are commonly seen in motor vehicle accidents, in falls occurring in elders, or in those suffering from substance abuse. Screening for brain injuries in these conditions is important, and symptomatic treatment is essential. In this paper, we will review the psychiatric sequelae of brain injury.

The same psychiatric symptoms that are common in the general population are also seen in patients suffering from traumatic brain injuries. Because the symptoms of brain injury and depression or anxiety are similar, it is often difficult to determine which came first. In a sense, the question is muddled, since the identification and treatment of symptoms is the same regardless of the etiology,

and behaviors such as substance abuse may lead to more frequent brain injuries.

Traumatic brain injuries are especially common in the community psychiatry population. In one prospective survey of those with mental illness and substance abuse, 72% had previously suffered a traumatic brain injury.<sup>4</sup> Tragically, substance abuse often leads to drunk-driving or fights, and both commonly lead to brain injuries. In a survey we conducted at the former Elizabethtown (Pennsylvania) Rehabilitation Hospital, slightly more than 40% of those admitted for care of head injuries were suffering from alcohol abuse.<sup>5</sup> Substance abuse is also common in those involved in motor vehicle accidents, and we often see the combination of traumatic brain injury, substance abuse, and psychiatric disorder.

While there can be lasting consequences from severe brain injury, with mild injury many patients recover over time. Recovery is gradual, and most occurs within the two years following the event.<sup>6</sup> Patients younger than age 26 have a better prognosis than middle-aged patients and are more likely to achieve a greater degree of recovery.<sup>7</sup> Patients who are older, or have higher levels of associated anxiety, have a poorer prognosis.

#### SCREENING FOR BRAIN INJURY

When evaluating any new patient, a good clinical screening question is to ask whether a patient has ever had loss of consciousness or been “knocked out.” Since the risk factors for head injury (substance abuse, neurological disorders) are chronic conditions, many patients have had more than one head injury. Though a head injury can lead to problems even without a loss of consciousness, that phenomenon does indicate a more severe event. It is also important to note which event the individual remembers as happening next after the injury. A longer period of posttraumatic amnesia is a poor prognostic sign.<sup>8</sup>

When a patient presents with a head injury, at the very least a brief cognitive screen is essential, since patients with head injuries often “look fine.” Even so, they often do not perform well cognitively. Established cognitive screening instruments such as the mini-mental status exam<sup>9</sup> often under-diagnose mild dementia or mild head injury. The SLUMS (St. Louis University Mental State Examination<sup>10</sup>) does a better job of identifying those with mild head injury or mild dementia, and is used by some clinics of the Veterans Administration as a screening tool. More formal and thorough neuropsychological testing can do a better job of

identifying the exact nature and extent of those deficits, but it is lengthy and can be expensive. Brief screening instruments such as the SLUMS can help to identify those who need further care or testing, as well as those who need more intensive follow up care. Brain imaging with the MRI can be helpful in localizing the brain injury, but a relatively normal CT scan or MRI does not rule out brain injury. Even if a brain “looks fine” on imaging studies, that does not mean it is operating smoothly or efficiently.

#### PSYCHIATRIC DISORDERS FOLLOWING BRAIN INJURY

Psychiatric disorders are more common in patients who have suffered brain injuries. In one survey of 939 patients, 18% of the control group suffered from psychiatric disorders compared to 34% of those with mild head injuries or 49% of those with moderate to severe head injuries. The risk of psychiatric illness is greatest 6–12 months after the head injury, but there continues to be an increased risk of psychiatric disorders even later.

#### Mood and Anxiety Disorders

Of all psychiatric disorders, mood and anxiety disorders increase the most following brain injury. Relapse of pre-existing affective or anxiety disorders is more likely, but de-novo mood and anxiety disorders arise with greater frequency after head injuries than in a comparative sample of the uninjured general population.<sup>11</sup> However, not all psychiatric disorders increase after brain injury. Neither schizophrenia, which is thought to be a neurodevelopmental disorder arising from problems in brain formation or development, nor mania, show an increased prevalence following head injury.<sup>12</sup>

Patients who suffer from depression following a brain injury seem to have a poorer prognosis.<sup>13</sup> While the data are not clear that treatment of depression following brain injury improves long term prognosis, good clinical sense suggests it is important to treat symptoms following injury. Cognitive Behavioural Psychotherapy clearly improves depression in patients following brain injury,<sup>14</sup> but it isn't clear if medications are as effective as they are in patients with depression that is not associated with brain injuries.<sup>15</sup> Still, as in all cases of depression, it makes sense to begin treatment, and to use whatever means seem effective – antidepressant medications, psychotherapy, or both.

#### Post-Traumatic Stress Disorder

Though civilians can obviously suffer traumatic injuries and be subject to post-traumatic stress disorder (PTSD), the syndrome is a particularly frequent problem in returning veterans who experienced brain injuries. In a survey

of 2,525 Iraq veterans, 44% of those who had experienced brain injuries with loss of consciousness suffered from PTSD, compared with 16% of those who had other combat-related injuries.<sup>2</sup> Depression and PTSD symptoms can of course interfere with personal or work performance, and can be disabling by themselves, i.e. without any residual physical disabilities. Those veterans returning from Iraq with brain injuries were more likely than soldiers with other injuries to report poor health, missed workdays, more medical visits, and a higher number of somatic symptoms such as headache. But, after controlling for depression and PTSD in the sample, headache remained the only symptom that separated those with traumatic brain injuries from other returning veterans. It thus seems that symptoms being attributed to head injuries were actually symptoms of depression and PTSD, which are treatable.<sup>2</sup>

The same lesson applies to those individuals with brain injuries seen in community hospitals following motor vehicle accidents or falls. While continued physical suffering may well occur, it is important to screen for depression and anxiety disorders, to treat those problems, and not to assume that the patient is suffering from the irresolvable sequelae of a brain injury. Since a brain injury can cause depression, and depression can lead to poorer cognitive and social performance, the combination of depression and a physical injury can lead to an even worse outcome. Identification and treatment of depression in this group can help in the overall recovery from brain injury.

#### Other Psychiatric Disorders

Patients with brain injuries are also prone to other psychiatric disorders that can affect both short and long term recovery.

*Sleep disorders* of all types occur at very high rates, occurring in 46% of patients who suffered from brain injuries in one survey.<sup>16</sup> Since anxiety can adversely affect sleep, it is not surprising that those with anxiety suffer more sleep problems.<sup>17</sup> Treatment can be problematic. The benzodiazepines raise concerns that they can impair memory – either acutely or over time – and clinicians often try to avoid their use for chronic sleep problems. Instead, sedating antidepressants such as trazodone or mirtazepine are popular in this setting.

*Dementia* can be another long term sequel. “Dementia pugilistica,” chronic traumatic encephalopathy, has been described in boxers following repeated blows in the ring, occurring in about 10%–20% of retired boxers.<sup>18</sup> The same

can occur in war veterans. A forty year follow up of World War II Navy and Marine veterans showed that veterans with moderately severe head injury were 2X as likely, and those with severe head injury were 4.5X as likely to develop Alzheimer’s disease compared with controls.<sup>19</sup>

*Non-specific psychiatric symptoms* that do not fit neatly into established diagnostic categories can also occur following head injury. Aggression can be seen in about one third of patients following traumatic brain injuries,<sup>20</sup> as can other symptoms which may be difficult to identify. Such patients seem not to do well, and are “different” from their old selves. In a survey of patients with head trauma severe enough to require hospitalization, 3% showed social disinhibition (inability to control immediate impulses), and 15% lacked initiative.<sup>21</sup> These symptoms are often related to frontal lobe injuries.

*Alcohol abuse* is one post-traumatic syndrome which can show some improvement following a head injury. While the extent of post-traumatic alcohol abuse is related to its severity prior to the injury, individuals can be surprisingly successful in achieving abstinence from alcohol after a head injury grabs their attention. In one survey, 31% of those who abused alcohol prior to their injury achieved abstinence afterward.<sup>22</sup> Another review of patients who presented to the emergency room intoxicated, showed that drinking decreased immediately after their injury, and then gradually increased over the ensuing months, but even one year later had not approached the same level of consumption as before.<sup>23</sup>

The hospitalization or clinic visit following the injury presents a key opportunity for intervention in substance abuse. Individuals who present to the hospital with a brain injury and substance abuse are in what can be described as a “critical period of insight;” the opportunity to refer them for prompt evaluation and care of their substance abuse should not be lost.

#### CONCLUSIONS

The wars in Iraq and Afghanistan have focused attention on returning veterans with brain injuries, but these injuries are also common in our emergency rooms here. Those with substance abuse or those with substance abuse and psychiatric disorders are especially likely to present with traumatic brain injuries. Following these injuries, anxiety and depression are common, and can lead to poorer clinical outcomes, disturbed sleep, and more disability. Recognition of these injuries and treatment of

the associated symptoms of depression and anxiety can aid in the gradual process of healing. While the psychiatric symptoms following head injury can be severe and disabling, they also often are treatable. Screening for

depression, anxiety disorders, and substance abuse can lead to proper treatment, hopefully decreasing suffering and leading to more complete recovery from these common injuries.

## REFERENCES

1. Bentz JE, Purzycki EJ. Concussion: Not so minor an injury. *J Lanc Gen Hosp.* 2008;3:84-90.
2. Hoge CW, McGurk D, Thomas JL, Cox AL, Engel CC, Cox CA. Mild traumatic brain injury in US soldiers returning from Iraq. *NEJM* 2008;358:453-463.
3. Hoge CW, Goldberg HM, Castro CA. Care of veterans with mild traumatic brain injury-Flawed perspectives. *NEJM* 2009;360:1588-1591.
4. Corrigan JD, Deutschle JJ. The presence and impact of traumatic brain injury among clients in treatment for co-occurring mental illness and substance abuse. *Brain Inj.* 2008;22:223-231.
5. Kettl PA. Prevalence of alcohol abuse in head injury. Proceedings of the 146th Annual Meeting of the American Psychiatric Association, San Francisco, CA, American Psychiatric Association Press, Inc., Washington, DC. 1993.
6. Fleminger S, Ponsford J. Long term outcome after traumatic brain injury. More attention needs to be paid to neuropsychiatric functioning. *BMJ* 2005;331:1419-1420.
7. de la Plata M, Hart T, Hammond FM, Frol AB, Hudak A, Harper CR, O'Neil-Pirozzi TM, Whyte J, Carlile M, Diaz-Arrastia R. Impact of age on long-term recovery from traumatic brain injury. *Arch Phys Med Rehabil.* 2008;89:896-903.
8. Ponsford J, Draper K, Schonberger M. Functional outcome 10 years after traumatic brain injury: its relationship with demographic, injury severity and cognitive and emotional status. *J Int Neuropsychol Soc.* 2008;14:233-242.
9. Folstein MF, Folstein SE, McHugh PR. Mini-mental state: A practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res.* 1975;12:189-198.
10. <http://www.msun.edu/academics/nursing/Clinical%20Forms/SLUMS%20FORM.pdf>
11. Fann JR, Burington F, Leonetti A, Jaffe K, Katon WJ, Thompson RS. Psychiatric illness following traumatic brain injury in an adult health maintenance organization population. *Arch Gen Psychiatry.* 2004;61:53-61.
12. Koponen S, Taiminen T, Portin R, Himanen L, Isoniemi H, Heinonen H, Hinkka S, Tenovuo O. Axis I and II psychiatric disorders after traumatic brain injury: a 30 year follow up study. *Am J Psychiatry.* 2002;159:1315-1321.
13. Rapoport MJ, McCullagh S, Streiner D, Feinstein A. The clinical significance of major depression following mild traumatic brain injury. *Psychosomatics.* 2003;44:31-37.
14. Bradbury CL, Christensen BK, Lau MA, Ruttan LA, Arundine AL, Green RE. The efficacy of cognitive behavior therapy in the treatment of emotional distress after acquired brain injury. *Arch Phys Med Rehab.* 2008;89(suppl):S61-S68.
15. Dinan TG, Mobayed M. Treatment resistance of depression after head injury: a preliminary study of amitriptyline response. *Acta Psychiatr Scand.* 1992;85:292-294.
16. Castriotta RJ, Wilde MC, Lai JM, Altanosov S, Masel BE, Kuna ST. Prevalence and consequences of sleep disorders in traumatic brain injury. *J Clin Sleep Med.* 2007;3:349-356.
17. Rao V, Spior J, Vaishnavi S, Rastogi P, Mielke M, Noll K, Cornwell E, Schretlen D, Makley M. Prevalence and types of sleep disturbances acutely after traumatic brain injury. *Brain Inj.* 2008;22:381-386.
18. Loosemore M, Knowles CH, Whyte BP. Amateur boxing and risk of chronic traumatic brain injury: systematic review of observational studies. *BMJ* 2007;335:809.
19. Plassman BL, Havlik RJ, Steffens DC, Helms MJ, Newman TN, Drosdick D, Phillips C, Gau BA, Welsh-Bohmer KA, Burke JR, Guralnik JM, Breitner, JCS. Documented head injury in early adulthood and risk of Alzheimer's disease and other dementias. *Neurology* 2000;55:1158-1166.
20. Kim E, Lauterback EC, Reeve A, Arciniegas DB, Coburn KL, Mendez MF, Rummans TA, Coffey EC. Neuropsychiatric Complications of Traumatic Brain Injury-A Critical Review of the Literature (A Report by the ANPA Committee on Research). *J Neuropsychiatry Clin Neurosci.* 2007;19:106-127.
21. Deb S, Lyons I, Koutzoukis C. Neurobehavioural symptoms one year after a head injury. *Br J Psychiatry.* 1999;174:360-365.
22. Bombardier CH, Temkin NR, Machamer J, Dikmen SS. The natural history of drinking and alcohol-related problems after traumatic brain injury. *Arch Phys Med Rehabil.* 2003;84:185-91.
23. Dikmen SS, Machamer JE, Donovan DM, Winn HR, Temkin NR: Alcohol use before and after traumatic head injury. *Ann Emerg Med.* 1995;26:167-176.

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