

Effects of day-of-injury alcohol intoxication on neuropsychological outcome in the acute recovery period following traumatic brain injury[☆]

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Abstract

Some researchers have found that day-of-injury alcohol intoxication is associated with worse outcome following traumatic brain injury (TBI). The purpose of this study is to examine the effects of day-of-injury intoxication on the acute neuropsychological outcome from TBI. Participants were 36 patients with TBI (18 sober, 18 intoxicated) matched on injury severity characteristics and demographic variables. A larger group of 146 patients (112 sober, 36 intoxicated) with TBI was also selected for analyses; not matched on injury severity or demographic variables. Patients had no history of pre-injury alcoholism and were assessed within 10 days post-injury on 13 cognitive measures. Unexpectedly, patients who were sober at the time of injury performed lower on many of the cognitive measures compared to those who were intoxicated. In contrast to the research literature, these results suggest that individuals who were intoxicated at the time of injury performed similarly, and in some cases, better than those who were sober at the time of injury.

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1. Introduction

Individuals who sustain a traumatic brain injury (TBI) are frequently intoxicated with alcohol at the time of injury (Brismar, Engstrom, & Rydberg, 1983; Edna, 1982; Kaplan & Corrigan, 1992; Sparadeo, Strauss, & Barth, 1990). The prevalence of positive blood alcohol levels (BAL) in hospital patients presenting to the Emergency Department (ED) with head trauma ranges from 33% to 72% (e.g., Corrigan, 1995; Dikmen, Machamer, Donovan, Winn, & Temkin, 1995; Gurney et al., 1992; Kreutzer, Doherty, Harris, & Zasler, 1990; Rimel & Jane, 1983; Solomon & Malloy, 1992; Sparadeo & Gill, 1989; Sparadeo et al., 1990), with 37–53% having BALs that exceed the legal limit for intoxication (Gurney et al., 1992; Kraus, Morgenstern, Fife, Conroy, & Nourjah, 1989; Rimel, Giordani, Barth, & Jane, 1982). Day-of-injury alcohol intoxication has significant implications for the diagnosis, management, treatment, and recovery

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from TBI. Patients who present to the ED with a positive BAL are more difficult to manage and treat, have a slower acute recovery (Barker et al., 1999; Brismar et al., 1983; Cunningham, Maio, Hill, & Zink, 2002; Gururaj, 2004; Kaplan & Corrigan, 1992; Kraus et al., 1989; Wilde et al., 2004), and consequently place an increased economic burden on the health care system.

The effects of day-of-injury alcohol intoxication on the neuropsychological and neuropathological outcome from TBI have received modest attention in the research literature. Researchers have reported that patients who are intoxicated at the time of TBI have worse cognitive recovery (Bombardier & Thurber, 1998; Kelly, Johnson, Knoller, Drubach, & Winslow, 1997; Sparadeo & Gill, 1989; Tate, Freed, Bombardier, Harter, & Brinkman, 1999; Wilde et al., 2004) and greater atrophic changes in the brain (Barker et al., 1999; Wilde et al., 2004) compared to those who are sober. Specifically, individuals who are intoxicated at the time of injury (a) have worse global cognitive and neurobehavioral status at discharge as measured by the Rancho Los Amigos Scale (Sparadeo & Gill, 1989), (b) show greater trauma induced degenerative changes post-injury as indicated by higher ventricle-to-brain ratio and lower whole brain volume (i.e., grey and white matter) (Barker et al., 1999; Wilde et al., 2004), and (c) perform more poorly on measures of verbal ability, visuospatial ability, immediate and delayed memory, processing speed skills, and executive functioning (Bombardier & Thurber, 1998; Kelly, Johnson, et al., 1997; Tate et al., 1999; Wilde et al., 2004). Although some studies have reported findings that are inconsistent with this premise (Barker et al., 1999; Bigler et al., 1996; Lange, Iverson, & Franzen, 2007b; Vickery et al., 2008), the majority of the research literature in this area provides support for the presence of a deleterious interaction between day-of-injury alcohol intoxication and outcome from TBI.

It has been suggested that worse outcome following day-of-injury alcohol intoxication may be the result of an increased magnitude of brain injury resulting from a variety of negative responses in the brain not present in a person who is sober at the time of injury. Negative responses include, but are not limited to, hemodynamic and respiratory depression, altered homeostasis due to increased blood clotting time, blood–brain barrier impairment, and/or increased risk for developing hematomas (Alexander, Kerr, Yonas, & Marion, 2004; Altura & Altura, 1999; Altura, Memon, Altura, & Cracco, 1995; Barker et al., 1999; Kelly, 1995; Mauter et al., 2001; Sparadeo & Gill, 1989; Wilde et al., 2004; Woolf, Cox, Kelly, McDonald, & Hamill, 1990; Zink & Feustel, 1995; Zink et al., 2001). However, researchers have reported a significant relationship between day-of-injury alcohol intoxication and pre-morbid history of alcohol abuse in TBI samples (Dikmen et al., 1995; Kreutzer et al., 1996; Sparadeo & Gill, 1989), with up to 75% of patients who are intoxicated at the time of injury having a positive history of pre-injury chronic alcoholism (Bombardier, 1995). Regardless of BAL at the time of injury, prevalence rates of chronic alcoholism in all TBI patients range from 25% to 79% (Bogner, Corrigan, Mysiw, Clinchot, & Fugate, 2001; Corrigan, 1995; Corrigan, Bogner, Mysiw, Clinchot, & Fugate, 2001; Kolakowsky-Hayner et al., 1999; Kreutzer et al., 1990; Rimel et al., 1982; Sparadeo & Gill, 1989; Tobis, Puri, & Sheridan, 1982). As such, worse outcome may simply reflect the effects of pre-injury alcohol abuse that is very common in this patient population (e.g., Barker et al., 1999; Bogner et al., 2001; Corrigan et al., 2001; Fein, Fletcher, & Di Scalfani, 1998; Kolakowsky-Hayner et al., 1999; Paraherakis, Charney, & Gill, 2001; Parsons, 1998; Pfefferbaum & Sullivan, 2002; Pfefferbaum et al., 2000).

The influence of pre-injury alcohol abuse on poor outcome following intoxicated TBI cannot be underestimated. Researchers attempting to differentiate the contribution of day-of-injury alcohol intoxication from pre-injury chronic alcohol abuse have found mixed results. Some studies have clearly supported the influence of alcohol intoxication at the time of injury as more influential in determining neuropsychological and neuropathological outcome than pre-injury alcohol abuse history (Brooks et al., 1989; Tate et al., 1999), other studies have found pre-injury alcohol abuse to be more influential than day-of-injury intoxication (Lange et al., 2007b), or have reported that day-of-injury intoxication and pre-injury alcohol abuse are equally important (Wilde et al., 2004) or non-contributory factors (Vickery et al., 2008). Although these studies do not provide us with clear answers regarding the competing influence of these two alcohol variables on outcome from TBI, this research highlights the methodological importance of controlling for the effects of pre-injury alcohol consumption in research examining the effects of day-of-injury alcohol intoxication.

The purpose of this study is to examine the effects of day-of-injury alcohol intoxication on the acute neuropsychological outcome (i.e., within the first 10 days post-injury) from TBI in a sample of patients with no pre-injury alcohol abuse. It is hypothesized that patients who are intoxicated at the time of injury will have worse neuropsychological outcome compared to those who were sober at the time of injury.

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