

## Abstract

**Objective:** This study aimed to examine the effect of drug use on the length of hospitalization, impaired consciousness, levels of motor and cognitive independence in patients with traumatic brain injury. **Method:** A total of 185 patients with traumatic brain injury in the emergency, neurosurgery ward and ICU of Poursina Hospital were selected via purposive sampling. These participants who were within the age group  $37.46 \pm 17.42$  years were divided into two groups, i.e. drug users ( $n = 35$ ) and non-users ( $n = 150$ ). Then, Demographic and Hospital Inventory and Functional Independence Measure were used for data collection purposes. **Results:** The results showed that the two groups of patients with or without drug use were significantly different from each other in terms of length of hospitalization in neurosurgery ward, total duration of hospital stay, and rates of cognitive independence ( $P < .05$ ). However, no significant difference was found between the two groups in terms of motor independence and length of hospitalization in ICU ( $P > .05$ ). The results also showed that drug using patients experience higher states of impaired consciousness compared to the other group ( $P < .01$ ). **Conclusion:** This study indicated the effect of drug use on the increased length of hospitalization, the intensification of impaired consciousness, and disturbance of cognitive independence in traumatic brain injury patients. The clinical implications of this study are discussed.

**Keywords:** Traumatic Brain Injury, Substance Use Disorder, Cognitive and Motor Independence, Impaired Consciousness

# The Impact of Drug Use on the Length of Hospitalization, Impaired Consciousness and Levels of Motor and Cognitive Independence in Patients with Traumatic Brain Injury

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## Introduction

Traumatic brain injury is a major problem in public health that can lead to disability and death (Shukla, Devi & Agrawal, 2011). Overall, 1.9 million people undergo traumatic brain injury each year. It is noteworthy that three quarters of these injuries have been involved with the use of alcohol and illicit drugs at the beginning. A significant number of survivors of traumatic brain injury continue to use drugs and alcohol in spite of undergoing severe consequences, including the risk of re-injury, a sudden attack of illness, aggressive behavior, decreased life satisfaction, change in job status and social role, family stress, feelings of emptiness, boredom, and frustration (cited in DeLambo, Chandras, Homa & Chandras, 2009). However, some studies have shown that 10 to 20 percent of patients with traumatic brain injury have turned to substance abuse problems for the first time after head injury (Corrigan, 1995; Kreutzer, Witol & Marwitz, 1996).

In general, alcohol consumption has been referred to as a barrier to rehabilitation that is correlated with a longer stay in hospital, poor rehabilitation outcomes, reduced life satisfaction, depression, anger, and anxiety (cited in Tate, Forchheimer, Krause, Meade & Bombardier, 2004). Corrigan (1995) reported that the situations involving drug use in traumatic brain injury such as poisoning were associated with acute complications, prolonged hospitalization, and weaker conditions in hospital discharge. Some studies have revealed devastating effects of drug abuse and improper treatment process of people who have a simultaneously history of alcohol and drug use (Heinemann, Mamott & Schnoll, 1990; Young, Rintala, Rossi, Hart & Fuhrer, 1995). In fact, drug use exacerbates the residual effects of traumatic brain injury, such as deficits in coping skills, memory, problem solving, social skills, fatigue and sensitivity to stimulation (Schmidt & Hyndman, 1999). In other words, many people with brain damage are likely to become involved in learning new skills and/or retraining past issues in spite of suffering from problems pertaining to concentration, word finding, problem-solving skills, and thinking are suffering. However, the main challenge is that drug use interferes in ability to think and makes the thinking process harder in patients with brain damage (Corrigan and Lamb-Hart, 2004). It is notable that the findings of previous studies on this issue have not always been consistent and sometimes contradictory or neutral results have been found. Indeed, some studies have reported no difference in terms of cognitive impairment between traumatic brain injury sufferers with and without drug use (Jorge, et al., 2005) and some other studies have even reported this significant difference in favor of patients with drug use and have found the supportive role of drug use in increasing cognitive abilities of these patients (De Guise, et al., 2009; Lang, Iverson & Franzen, 2008). Therefore, what is achieved by this contradiction in research findings is the need for further reflection on this issue in patients with traumatic brain injury. A limited number of studies have used

the latest version of Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5). In addition, alcohol intoxication has been the only criterion in some studies (De Guise, et al., 2009; Lang, et al, 2008) and samples with drug use have not been evaluated. This evidence implies the importance and necessity of the conduct of this study because its results and findings will be the context of future research and will provide a response to unexplored questions in this regard; for example, regarding the potential negative impact of drug use on the effectiveness of rehabilitation efforts. As Bogner, Mysiw, Clinchot & Fugate (2001) emphasized that it is a necessity to conduct an evaluation of the history of drug use in all studies related to post- traumatic outcomes of brain injury. According to the above-mentioned points, the main research question of the present study was formulated as follows: Does drug use affect the length of hospitalization, impaired consciousness, and levels of motor and cognitive independence in patients with traumatic brain injury?

## **Method**

### **Population, sample, and sampling method**

An analytic cross-sectional design was conducted on 185 participants with traumatic brain injury who were selected using purposive method in Poursina Hospital in 2013. In fact, all patients with traumatic brain injury referring to this hospital in 2013 constituted the population of this study. It should be noted that the study was conducted in specific sections of the hospital, including emergency department, neurosurgery, and intensive care section. The criteria for the inclusion of participants in the study were: 12 years of age and above, score below 15 in Glasgow Coma Scale, focal or diffuse brain damage caused by an external mechanical force, lack of vigilance over one minute, 20 minutes of post-traumatic amnesia, and radiographic or computed tomography findings showing traumatic brain injury (such as skull fractures, intracranial hemorrhage or acute cerebral malformations).

In addition the exclusion criteria of the participants from the study were: patients with clinical or radiological findings representing a spinal cord injury, existence of any neurological disease before traumatic brain injury or brain injury with non-traumatic origin (such as brain tumors, stroke, arterial aneurysm and other cerebrovascular accidents) , patients with vegetative state or severe impairment of consciousness being unable to respond to test items, and patients not satisfied for entering the study for any reason. Patients eligible for inclusion into this study were identified by neurosurgery psychiatrists' diagnosis and review of their hospital records within 72 hours after their arrival at the hospital and initial evaluation was then performed on them. Two trained nurses went to different hospital wards to take sampling every day. At the beginning of the evaluation, the reasons for and the process of the research were explained to the

patients with traumatic brain injury or their companions. Indeed, they were given the guarantee that their information would remain confidential and refusal to participate in the study would not influence their treatment process. Finally, the inclusion of patients into the study was accomplished based on the patients of families' informed consent.

Upon the entry of people with traumatic brain injury into the study, demographic information was collected. In the next step, the criteria of Diagnostic and Statistical Manual of Mental Disorders (fifth edition) were used to identify patients with substance use disorder. Accordingly, subjects were divided into two groups of substance users ( $n = 35$ ) and non-users ( $n = 150$ ). The number of 22 participants used opium, 8 participants suffered from alcohol disorder comorbidity. Finally, evaluation was performed through the hospital information records of patients in order to extract some clinical information such as the exact length of stay in the hospital wards (intensive care, emergency and neurosurgery) and neurosurgical examinations until that day.

### **Instrument**

1. Inventory of demographic and hospital information: Through this instrument, information about age, gender, education level, length of stay in ICU, emergency and surgical wards, and length of coma was collected.

2. Functional Independence Measure: Since its construction in more than 20 years ago, this scale is being widely used now (Chumney, et al., 2010). This was a multi-dimensional measure that evaluates such dimensions as self-care, sphincter control, mobility, locomotion, communication, and social cognition. These dimensions are divided into cognitive (5 items) and motor (13 items) subscales.

Each item receives a score in the range of at least 1 (total assistance is required) to 7 (complete independence). All scores are added and the total score ranging from 18 (total dependence) to 126 (complete independence) is obtained (Nichol, et al., 2011). For this scale, desired construct and concurrent validity measures (Linacre, Heinemann, Wright, Granger & Hamilton, 1994) as well as good internal consistency (Cronbach's alpha coefficient of .93 to .95) have been reported (Ravaud, Delcey & Yelnik, 1999).

### **Results**

From the sample group, a total of 171 subjects were male and 14 subjects were female with an age range of 15-85 years and an average age of  $37.46 \pm 17.42$ .

The average education length of the sample group was  $7.31 \pm 4.49$  years which ranged from 0 to 16 years. Descriptive statistics and demographic variables of the study are presented in the table below for separate groups.

**Table 1: Statistics of the demographic variables for separate groups**

<i>Variable</i>	<i>Drug users</i>			<i>Non-users</i>		
	<i>N</i>	<i>Mean</i>	<i>SD</i>	<i>N</i>	<i>Mean</i>	<i>SD</i>
<b>Impairment of consciousness (in hours)</b>	35	99.70	254.61	146	24.65	119.10
<b>Hospitalized in ICU</b>	35	2.70	3.71	150	1.93	3.51
<b>Hospitalized in two wards*</b>	35	6.90	7.70	150	3.62	3.05
<b>Total duration of hospitalization</b>	35	9.60	10.65	150	5.52	2.65
<b>Motor independence</b>	35	55.09	23.99	150	60.09	16.80
<b>Cognitive independence</b>	35	26.63	11.90	150	31.04	7.29

\*Hospitalization in two wards means Hospitalization in to emergency and neurosurgery sections

Multivariate analysis of variance (MANOVA) was used to examine main effects regarding the impact of drug use on length of hospitalization and level of motor and cognitive independence in patients with traumatic brain injury. The results are presented in the table below.

**Table 2: MANOVA results representing the role of drug use in hospital variables and functional independence**

<i>Factor</i>	<i>Variable</i>	<i>Wilks's lambda</i>	<i>F</i>	<i>Df 1</i>	<i>Df 2</i>	<i>Sig.</i>
<b>Drug use</b>	<b>Hospitalization stay</b>	.912	5.860	3	181	.001
	<b>Functional independence</b>	.957	4.130	2	182	.018

As it can be observed in the above table, there is a significant difference between the groups in both variables. Univariate analysis of variance was used to examine difference in patterns as follows.

**Table 3: Univariate analysis of variance examining patterns of difference between groups in clinical and research variables**

<i>Sources of change</i>	<i>Variable</i>	<i>Mean Square</i>	<i>F</i>	<i>Sig.</i>
<b>Group</b>	<b>Hospitalized in ICU</b>	16.97	1.35	.247
	<b>Hospitalized in two wards</b>	299.75	16.12	.0005
	<b>Total duration of hospitalization</b>	472.40	10.04	.002
<b>Group</b>	<b>Motor independence</b>	711.62	2.11	.148
	<b>Cognitive independence</b>	552.26	7.93	.005

As it is observed in the above table, group belonging has led to differences in hospitalization variables in neurosurgery and emergency wards. However, no difference was found in duration of hospitalization in ICU. In addition, the difference in cognitive independence was significant, but no significant difference was found between the groups in motor independence.

On the other hand, independent t test was used to investigate the role of group membership in impairment of consciousness where the results showed the

existence of a significant difference between the groups ( $P < .01$ ;  $t = 2.580$ ). In other words, drug using patients experienced higher states of consciousness impairment compared to non-users.

### **Discussion and Conclusion**

The aim of the present study was to examine the effect of drug use on the length of hospitalization, impairment of consciousness, and motor and cognitive independence in patients with traumatic brain injury. The findings of this study showed that the patients suffering from traumatic brain injury with and without drug use represented no significant difference in terms of the duration of hospitalization in intensive care unit. However, a significant difference was observed between the two groups in terms of length of stay in the emergency and neurosurgery wards as well as total length of hospital stay. This means that drug using patients with traumatic brain injury experienced significantly lengthier stays in emergency and neurosurgery wards as well as various hospital wards compared to the other group. In line with this finding, Guise, et al. (2009) also showed that the duration of hospitalization among alcohol abusers with traumatic brain injury was significantly higher than the state before the incidence of traumatic brain injury. In addition, Rezaei, Salehi, Yousefzadeh, Mousavi & Kazemnejad (2011) also showed that the difference between the two groups of traumatic brain injury sufferers with and without mental disorders was statistically significant with regard to length of stay in ICU and total stay in hospital. However, no significant difference was revealed between the two groups in terms of stay in public sections of hospital. In this regard, one can argue that the combination of traumatic brain injury and substance use can increasingly impose negative effects on brain structure and function and make these people undergo more serious consequences, including the higher possibility of death, continuous side effects and a drop in immune body status, poor status of discharge from hospital or emergency ward, weak progression of the recovery, and slow healing process. Therefore, patients in this situation need more time to gain recovery. Accordingly, it seems natural that the range of hospitalization length in traumatic brain injury patients with drug use to be higher than the patients without drug use. Furthermore, the findings of this study indicated that traumatic brain injury patients with substance use had significantly lower levels of cognitive independence compared to the group without substance use. It was also shown that substance abuse clearly imposes damaging effects on patients' cognitive independence; however, no significant difference was found between the two groups in terms of motor independence. Although the obtained findings seem natural, uncertainty and inconsistency in the findings of previous studies prevents researchers in this area from reaching a reliable and accurate conclusion. In this regard, De Guise, et al. (2009) conducted a study on 60 patients with severe, moderate, and fair traumatic brain injury and indicated that the patients with alcohol intoxication obtained higher scores in cognitive

components and functional independence compared to their sober counterparts. Lange, et al. (2008) compared cognitive functions between traumatic brain injury patients with and without alcohol intoxication. They unexpectedly found that traumatic brain injury patients with alcohol intoxication performed similar to or even outperformed the group without alcohol intoxication in cognitive tasks. Jorge, et al. (2005) compared the data belonging to 158 traumatic brain injury patients with and without alcohol abuse or dependence in terms of cognitive outcomes and found that no significant difference existed between these two groups of patients in terms of brief mental state examination scores for the assessment of cognitive impairment. In contrast, Baguley, et al. (1997) studied P300 wave in the patients associated with negative events. The results showed that drinking too much alcohol or previous traumatic injury that required hospitalization decelerate the brain functioning and impose an increasingly detrimental effect when combined together. This increasing effect meant that the combination of these two variables together (excessive alcohol consumption and previous brain damage) is worse than the presence of any of them alone. It seems discrepancy in the research findings in this area can be explained by the mention of two things. First, there is the possibility that some well-known instruments for the assessment of cognitive deficits are sensitive enough to measure cognitive problems in traumatic brain injury sufferers. For example, measurement of cognitive functions based on a brief examination of the mental state alone cannot be the evidence of the absence of cognitive deficits in patients with traumatic brain injury. Second, although, in this study, patients at the time of admission and 72 hours later were studied, it is likely that some cognitive problems are of a step-by-step developing nature and reemerge within a few months (normally 2 or 3 months) after the incidence of brain injury traumatic. The absence of any significant difference in motor independence between traumatic brain injury patients with and without substance use can also be indicative of the similar problems, such as balance, coordination, walking, and getting between both groups. However, to account for the harmful effects of drug use on cognitive capacities of traumatic brain injury patients with drug use, one can argue that a) After injury, the brain becomes more sensitive to the use of substances such as alcohol and illegal drugs since many past neurons do not exist anymore and, thereby, the effect of illegal substances (drugs and alcohol) will not be analyzed (Corrigan & Lamb-Hart, 2004). b) Thought issues such as concentration or memory problems arise from traumatic brain injury and consumption of alcohol or other illicit drugs exacerbates the issue. c) It is likely that some brain areas, such as frontal cortex in traumatic brain injury patients are influenced by drug use more than other brain areas. This can lead to the occurrence of deficits in the cognitive processes pertaining to self-regulation, mental control, and judgment.

The results of this study revealed that drug use has significant effects on impairment of consciousness among traumatic brain injury patients such that

traumatic brain injury patients with drug use showed significantly higher consciousness impairment compared to the other group. In this regard, Sachdev, Smith & Cathcart (2001) have argued that the duration of impaired consciousness in traumatic brain injury patients with mental disorders is higher than that in the other group. Impaired consciousness in traumatic brain injury patients with drug use may be due to dysfunction and failure of central nervous system and change (at the level of injury) or the devastation of the functions that contribute to consciousness after anesthesia. In other words, some brain cells die due to traumatic brain injury and some other cells become torn apart (disconnected) at the time of brain damage. Moreover, improvement in brain damage means the construction of new bonds between brain cells. Therefore, it seems that drug use interferes in this process and stops the proper implementation of this recovery (Corrigan & Lamb-Hart, 2004). Hence, traumatic brain injury patients with drug use may experience longer periods of consciousness problems. However, more detailed commentaries on this issue require further studies and a larger number of results. In addition, the findings of this study may have potential clinical applications in relation to emergency management and rehabilitation of traumatic brain injury patients with substance use disorder.

Overall, the findings of this study suggested the detrimental effects of drug use on the length of hospitalization (in emergency ward, neurosurgery ward, and total hospital stay), consciousness deficits, and cognitive independence in patients with brain injury. However, no significant difference was observed between the two groups of traumatic brain injury patients with and without substance use in terms of length of hospitalization in ICU and motor independence. The clinical implications of these results can be interrelated with emergency management and rehabilitation of traumatic brain injury patients with substance use.

The present study suffered from some limitations, the most important one of which was the small number of participants with drug use. Thus, in generalization of the results, care and discretion should be exercised. In addition, due to the small sample size of traumatic brain injury patients with drug use, there was not the possibility of evaluating the effect of type of drugs (i.e., opium and alcohol) on clinical problems and motor and cognitive consequences for the groups. Although the use of the latest Diagnostic and Statistical Manual of Mental Disorders Research was considered a major advantage in this research, the challenging point in the study was a lack of relevant studies in which the latest Diagnostic and Statistical Manual of Mental Disorders has been used. Accordingly, many of the studies and research findings used in this study to compare and explain the obtained results have used Diagnostic and Statistical Manual of Mental Disorders criteria to diagnose the patients with substance abuse problems. Accordingly, the diagnosis of substance abuse has been mentioned in the literature review of a large portion of these studies. This

diagnosis along with drug dependence is referred to as a new disorder, named substance use disorder according to the latest version of this manual. This has been also used in the current study. Therefore, it is recommended that the assessment and monitoring of patients be considered in a period of several months (e.g. 3 months after the injury) in addition to the common clinical examinations during the hospitalization period. In this way, preventive measures can be applied and the clinical failures resulting from traumatic brain injury can be managed in a better way.

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