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Research Article

MILD TRAUMATIC BRAIN INJURY WITH CONTUSION: CLINICAL COURSE AND OUTCOME

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ABSTRACT
Traumatic brain injury (TBI) is an important health problem. The most common type of TBI is mild TBI (MTBI) which is defined as a condition with self-limited symptoms although sometimes it could become complicated. Structural brain damage could have a significant effect on recovery after MTBI, but does not explain the outcome. We studied the clinical course of MTBI patients with contusion in computed tomography (CT) imaging. In this perspective study, forty two patients with MTBI who have brain contusion in CT scan who referred to Emergency Department of Hasheminejad Hospital were enrolled. We followed up the patients during the course of hospitalization and for two weeks after discharge for neurological complications. The most common mechanisms of injury were vehicle accident (85.7%) and falling down (9.5%). The mean of hospitalization was 3.07 +1.33days (2-7d). The mean of performing CT scan was 2.23+0.43. Loss of consciousness occurred in 6 patients (14.3%) during hospitalization. None of patients needed neurosurgical intervention because of injury. The neurological complications were seen in 13 patients (31%). Thirty (71.4%) returned to hospital and among 18 of them the CT scan was repeated. Awareness of clinical course of head injury will help us to plan active interventions that may improve outcome. It seems that performing several CT scans could not help with decision making and estimating the prognosis of patients. Contusion alone did not alter the prognosis of patients in short-team follow –up and did not cause neurosurgical interventions.

Keywords: *Contusion, Mild Traumatic Brain Injury, Outcome*

INTRODUCTION
Traumatic Brain Injury (TBI) is defined as the malfunction of the brain due to an external physical force (Haydel *et al.,* 2000). This malfunction can be temporary or permanent, or even occur without structural disorders (Haydel *et al.,* 2000; Zare *et al.,* 2013). The extent of clinical symptoms varies from very mild to severe (without response, coma) (Kraus *et al.,* 1984). Assessment with the Glasgow Coma Score (GCS) creates three categories of TBI: severe TBI (GCS score of 3-8), moderate TBI (GCS score of 9-13), and mild TBI (GCS score of 9-13) (Tiret *et al.,* 2008).
Mild TBI is the most prevalent (approximately 80 percent) brain trauma in the United States; moderate and severe TBIs each comprise approximately10 percent of all TBI incidence (Lescohier and DiScala, 1993; Thurman, 2001). A United States citizen receives TBI every 15 seconds. The annual incidence of TBI in the United States is 1.2-2.0 million people (Thurman, 2001). In the United States alone, TBI is estimated to be the cause of 50,000 deaths and 235,000 hospitalizations annually. More than 80,000 people experience disabilities as a result of TBI annually (Pickett *et al.,* 2001). Approximately 12,000 patients require intensive care (Alexander, 1995). For TBI patients who are between 5-14 years old, it is estimated that 2,685 cases result in death and 37,000 cases are hospitalized annually (Thurman, 2001; Langlois *et al.,* 2006). In addition, the costs associated with TBI are extraordinarily high (Kraus and Nourjah, 1995). The Centers for Disease Control and Prevention (CDC) estimated that 5.3 million United States citizens are suffering from disabilities that result from TBI. These facts present TBI as a serious threat to public health (Thurman, 2001; Cifu *et al.,* 1999). A huge cost is also imposed on the public health system in our country, in addition to the fact that the society loses a great portion of its active members, either temporarily or permanently, due to the disabilities and side effects that result from TBI

(Jajoda *et al.*, 2002; Wilder, 1976). Thus, we decided to investigate ways to prevent the undue costs of hospitalization of TBI patient via avoiding unnecessary diagnostic evaluations (such as CT) and long hospitalization periods.

MATERIALS AND METHODS

After identifying those patients with mild TBI accompanied by brain contusion that were hospitalized in the intensive care unit (ICU) of HashemiNejad Hospital (Mashhad, Iran) from Feb 2014 to Feb 2105, patient data were recorded, including age, gender, the mechanism of trauma, the number of brain CT scan repetitions, hospitalization period, changes in consciousness level, necessity or unnecessity of neurologic surgeries, and frequency and type of neurological side effects. The forms were added to the patients' files and the ICU nurse was asked to check the parts if necessary. Furthermore, an assistant who was on duty every day was in charge of the patients' follow-ups in the ICU for recording the items. Follow-ups were continued by telephone contact after discharge.

The initial prognosis for the patients included neurologic side effects, reduced consciousness, newly emerged neurologic lesions during follow-ups, and that the patients required neurosurgery. The secondary prognosis included that the patients required additional imaging after discharge or readmission to the hospital after discharge.

Subjects were excluded if: the patient died without any apparent reason during the study, had lesions other than contusions in CT scans, or had the involvement of other organs, such as general surgery or orthopedic problems.

The data were analyzed in SPSS 16 statistical software. The quantitative and qualitative data were presented as Mean± SD and frequency, respectively.

RESULTS AND DISCUSSION

Results

Of 42 patients referred to the ICU of HashemiNejad Hospital in the chosen time period, 30 (71.4%) were male and 12 (28.6%) were female.

The average patient age was 33.78±19.56 (Mean ±SD) with a minimum of 4 and maximum of 74 years. Twelve patients (28.6%) were under 20 years old, 24 (57.1%) were between 20 and 60 years old, and 6(14.3%) were over 60 years old. The average length of hospitalization was 3.07±1.33 days, with the minimum of 2 and maximum of 7 days. The average number of CT scan repetitions was 2.23±0.43 times, with a minimum of 2 and a maximum of 3 times. The types of trauma were: 36 cases (85.7%) of vehicle accidents, 4 cases (9.5%) of falls from height, a case (2.4%) of fighting, and a case (2.4%) of injury during work.

Most injuries occurred in the 20- to 60-year-old age group, in which the most prevalent trauma type (87.5%) was vehicle accident, with 21 incidences Thirty total incidences (71.4%) occurred in men and 12 (28.6%) in women.

Six (14.3%) of the42 patients experienced reduced consciousness levels during the hospitalization period, while 36 subjects did not show any reduction in this factor (Table 1).

Table 1: The frequencies of patients' reasons for admission, side effects, and follow-ups

	Yes	**No.**
Reduced consciousness levels	6 (14.3%)	36 (85.7%)
Neurologic side effects		
Brain contusion	13 (31%)	29 (69%)
Readmission to the hospital	2 (4.8%)	40 (95.2%)
Secondary CTscans	30 (71.4%)	12 (28.6%)
Neurosurgery involvement	18 (42.9%)	24 (96%)
	0	42 (100%)

Neurologic side effects were observed in 13 patients (31%), which consisted of a case (2.4%) of muscle strength loss, a case (2.4%) of hearing loss, 2 cases (4.8%) of impaired long-term memory, 5 cases (12%) of impaired short-term memory, a case (2.4%) of seizure, a case (2.4%) of vision loss, 5 cases (12%) of vertigo, and 7 cases (16.8%) of headache; 29 patients did not suffer from neurological disorders. Two patients (4.8%) had evidence of increased brain contusion size, in contrast to the other 40 patients (95.2%) who showed no evidence of such in control CT scans (Table 1).

Thirty patients were readmitted to the hospital after discharge for the following reasons: a case (2.4%) of failure of recovery from loss of muscle strength, a case (2.4%) of walking difficulties, a case (2.4%) of failure of recovery from memory impairment, a case (2.4%) of seizure, 5 cases (12%) of vertigo, and 17 cases (40.8%) of headache.

CT scans were carried out for 18 (42%) patients from all 30 cases of readmission to the hospital, whereas 24 (57.1%) patients did not undergo these sessions; there was no need for neurosurgery in any of cases (Table 1). There was no statistically significant relation between age and the mechanism of development of injury (Student's t-test, P=0.7). There was no significant relation between age and neurologic side effects (Student's t-test, P=0.7).

A significant relation was observed between age and increases in the size of the brain contusion (P=0.004). Age was not related to patient readmission or the requirement for secondary CT scans (Mann-Whitney, P=0.6, P=0.2). Gender was not significantly related to the mechanism of injury, changes in consciousness, neurological side effects, readmission of patients to the hospital, the requirement for a secondary CT scan, or increased brain contusion size (P>0.05). There was no significant relation between changes in consciousness levels, neurologic outcomes, and increased brain contusion size (P=0.002, P=0.01). The presence of neurologic side effects was significantly related to the number of CT scan repetitions (Mann-Whitney, P=0.02). There was no significant correlation between age and the length of hospitalization (P=0.8). There was a significant relation between the length of hospitalization and the requirement for a secondary CT scan (Mann-Whitney, P<0.001).

In addition, there was no significant relation between changes in consciousness levels during illness and readmission to the hospital (P=0.4). None of the patients needed neurosurgery during their hospitalization (Table 5), making analysis of this factor impossible. The Mann-Whitney test demonstrated that there was a significant direct correlation between the length of hospitalization and the number of CT scan repetitions (P<0.001). The number of CT scan repetitions was significantly related to increases in brain contusion size in control CTs (P=0.01). The patients with neurological side effects were hospitalized for significantly longer periods (Mann-Whitney, P=0.001)

The number of CT scan repetitions was significantly related to patient readmission (Mann-Whitney, P=0.02). There was a significant relation between the number of CT scan repetitions and the need for readmission to the hospital for further CT scan examinations (Mann-Whitney, P=0.007).

Furthermore, there was a significant relation between changes in consciousness levels during illness and the need for readmission for CT scans (Chi^2, P=0.04) in a way that 5 out of 6 cases needed readmission for later CT scans.

Discussion

Brain trauma is an important cause of death and disability in society (Ahmadi *et al.*, 2014) that, despite the progression of the medical sciences, is still a major problem in public health systems. The economic and psychological costs of TBI are extremely high; TBI can lead to the loss of individuals, families, and society (Thurman, 2001; Cifu *et al.*, 1999). This demonstrates that the knowledge of epidemiology, supportive actions, and prevention of TBI effectively reduce TBI mortality and side effects (Cifu *et al.*, 1999). In our study, TBI was more prevalent in men and in the 20- to 60-year-old age group. Accidents were the most prevalent causes of trauma in all age groups.

In a study by Thurman D *et al.*, the prevalence of TBI in men was twice as high as women and mostly observed in three age groups:0-4, 15-24, and older than 75 years of age. They also demonstrated that old individuals had higher risks of death and poorer outcomes (Zare *et al.*, 2013). Similarly, in our study, there was a significant relation between age and the size of the contusion.

In a study by Langlois *et al.,* (2006) the primary cause of trauma in youngsters and the elderly were accidents and falling, respectively; however, falling is the greatest source of trauma in the United States.
Kraus *et al.,* (1995) showed that the prevalence of TBI in men was two times higher than that of women, peaking between 15 and 19 years of age.
More than 40 percent of mild TBI incidences occurred as a result of accidents and the average hospitalization period was 2-3 days (Kraus *et al.,* 1995); in our study the mean length of hospitalization was 3.07±1.33 days (with a minimum of 2 and a maximum of 7 days).
CT scan is routinely used to screen patients with mild TBI; it was chosen for our study as a tool for disease detection and determination of injury development.
Despite the fact that more CT scans were performed for the patients with neurological side effects in our study, there was a significant relation between the number of CT scan repetitions and age, neurologic side effects, and readmission to the hospital.
There were no deaths in our study and 30 cases (71.4%) were readmitted to the hospital in the follow-up period; headache and seizure were the most common causes of secondary referral. None of the patients required post-referral surgeries.
In the present study, the outcomes of those patients with longer hospitalization periods were not different from those with shorter hospitalization periods. Knowledge regarding risk factors and the rapid detection of patients with the potential for developing brain injuries can prevent irreversible brain lesions, morbidity, and mortality due to mild TBI and reduce side effects, such as the high costs and potentially harmful effects of radiation and early discharge of patients from urgency units.

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