

# Characteristics of Traumatic Brain Injury among Accident and Falling Down Cases

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**Abstract-** Motor vehicle and falling down are responsible for the most number of traumatic injuries. This study aimed to compare the characteristics of traumatic brain injury among accident and falling down cases. In this analytical cross-sectional study, data were collected from the records of cadavers who died due to accident or falling down and referred to Kahrizak dissection hall, Tehran forensic medicine organization during 2013. A total of 237 subjects (183 (77.2%) accident and 54 (22.8%) falling down) with a mean age of 35.62 (SD=15.75) were evaluated. A number of 213 (89.9%) were male. From accident group, scalp injury was seen in 146 (79.8%), scalp abrasion in 122 (66.7%), scalp laceration in 104 (56.8%), sub skull bruising in 176 (96.3%), skull fracture in 119 (65%), hemorrhage in 166 (90.7%), Subdural hemorrhage (SDH) in 155 (84.7%), Subarachnoid hemorrhage (SAH) in 161 (88%), Epidural hemorrhage (EDH) in 41 (22.4%), contusion in 140 (76.5%), and skull base fracture in 140 (76.5%) of cases. In falling down group scalp injury was seen in 42 (77.8%) cadavers, scalp abrasion in 38 (70.4%), scalp laceration in 30 (55.6%), sub skull bruising in 49 (90.7%), skull fracture in 39 (72.2%), Hemorrhage in 49 (90.7%), SDH in 43 (79.6%), SAH in 47 (87%), EDH in 10 (18.5%), contusion in 33 (61.1%), and skull base fracture in 39 (72.2%) of cases. There was no significant difference between these two groups ( $P$  Value > 0.05). Accident and falling down had no difference in terms of any injury or hemorrhage.

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**Keywords:** Head trauma; Brain injury; Accident; Falling down

## Introduction

The injury is the primary cause of death among persons younger than 45-year-old in the United States and also other developed countries. Traumatic brain injury (TBI) is the major cause of disability, morbidity, and mortality between these populations. High prevalence of all traumatic deaths in the U.S is due to TBI (1). The incidence of TBI is reported to be 200 per 100,000 at risk population per year in developed countries. TBI injury which is presented as an alteration in brain function manifest as confusion, altered level of consciousness, seizure, coma, or focal sensory or motor neurologic deficit following blunt or penetrating trauma to the head (2).

Head injury (HI) is defined as a nonspecific term, which consists of clinically important external injuries to the face, scalp, and calvarium such as lacerations, contusions, abrasions, and fractures. HI could be

associated with TBI (2). The head is the most common site with severe injury (3).

Based on reports of previous studies, motor vehicle and falling down are responsible for the most number of traumatic injuries (4,5); severe intracranial-facial impalement injuries happen due to falls or traffic accidents (6) and TBI is the most common cause of mortality in all traumatic deaths (7). Mortality rate following an accident in our country is unique relative global. Understanding the characteristics of TBI and its mortality due to accident or falling down can be helpful for predicting the outcome of these events, so this study aimed to compare the characteristics of traumatic brain injury among accident and falling down cases.

## Materials and Methods

This study was an analytical cross-sectional study.

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The data for this study were collected retrospectively from the records of cadavers who died due to head trauma and referred to Kahrizak dissection hall, Tehran forensic medicine organization during 2013. The cause of head trauma was an accident or falling down. Recorded data included age, sex, mechanism of trauma, having scalp injury, scalp abrasion, scalp laceration, sub skull bruising and its severity, skull fracture, hemorrhage, subdural hemorrhage (SDH), subarachnoid hemorrhage (SAH), epidural hemorrhage (EDH), contusion and skull base fracture. Data then entered to SPSS v. 16 and were analyzed. Descriptive tests were used to report mean or frequency, and  $\chi^2$  and independent  $t$ -test were used for analytical analysis and comparison of events between two groups of current study.

It should be noted that we respect to all ethical considerations.

## Results

A total of 237 subjects who died due to trauma (accident or falling down) were evaluated in this study. The mean age of these cadavers was 35.62 (SD=15.75), ranged from two to 80 year. The mean age of cadavers in accident group was 36.4 (SD=16.36) and in falling down group was 32.83 (SD=13.23), which was not statistically significant between two groups ( $P=0.1$ ).

Mechanism of trauma in 183 (77.2%) of cases was an accident and in 54 (22.8%) was falling down. A total of 213 (89.9%) were male. From cadavers who had accident, 164 (89.6%) were male and 19 (10.4%) were female while 49 (90.7%) of cadavers with falling down were male and 5 (9.3%) were female.

From accident group, 146 (79.8%) had scalp injury while this injury was not seen in 37 (20.2%) cases. Forty two (77.8%) cadavers in falling down group had scalp injury and 12 (22.2%) had not. There was not any significant association between trauma mechanism and having scalp injury ( $P= 0.7$ ).

We couldn't find any significant relationship between trauma mechanism and scalp abrasion ( $P=0.6$ ); while 122 (66.7%) of cadavers who had accident involved with scalp abrasion; whereas from falling down group, 38 (70.4%) had scalp abrasion.

Scalp laceration was seen in 104 (56.8%) patients of cases in accident group and 30 (55.6%) cases of falling down the group, which was not statistically significant ( $P=0.6$ ).

Sub skull bruising was observed in 176 (96.3%) of cases with accident and 49 (90.7%) of cases with falling down with no significant difference ( $P=0.1$ ).

Sub skull laceration in 54 (30.7%) cadavers who had accident was mild and in 122 (69.3%) cadavers was severe, while in falling down cadavers, 13 (26.5%) had mild sub skull bruising, and 36 (73.5%) had severe sub skull bruising. These differences were not statistically significant ( $P=0.5$ ).

There was not any significant difference between skull fracture and mechanism of trauma ( $P=0.3$ ), while 119 (65%) patients in accident group and 39 (72.2%) patients in falling down group had scalp fracture.

Hemorrhage was seen in 166 (90.7%) of cadavers who had accident and 49 (90.7%) cadavers who had fallen down which difference was not significant ( $P=0.9$ ).

We couldn't find any significant difference between subdural hemorrhage in accident and falling down group ( $P=0.3$ ); while we found SDH in 155 (84.7%) cadavers with accident and 43 (79.6%) cadavers with falling down.

There was no significant difference between SAH and mechanism of trauma ( $P=0.8$ ). SAH was observed in 161 (88%) of cases with accident and 47 (87%) of cases with falling down.

EDH was seen in 41 (22.4%) of cases who had accident and 10 (18.5%) of cases who had fallen down. There was no significant difference between these difference ( $P= 0.5$ ).

We found significant association between trauma mechanism and having contusion ( $P=0.02$ ); while contusion was seen in 140 (76.5%) of cadavers with accident and 33 (61.1%) of cadavers with falling down (Figure 1).

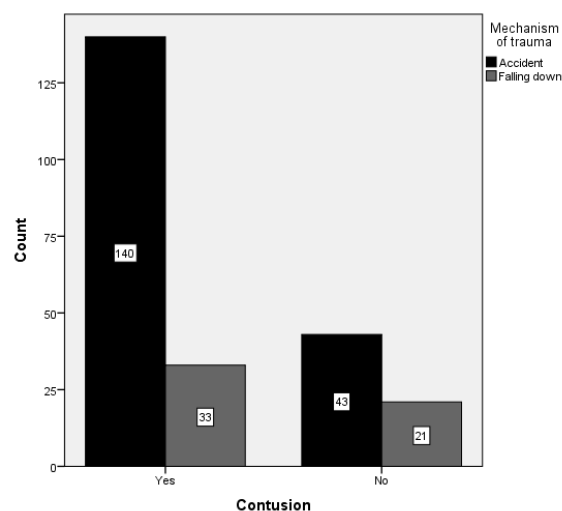


Figure 1. Comparison of contusion between two groups of study

There was not any significant difference between the

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mechanism of trauma and skull base fracture ( $P=0.5$ ). A hundred and forty (76.5%) cases with accident and 39 (72.2%) cases with falling down had skull base fracture.

## Discussion

Trauma is defined as the leading cause of mortality in the first 40 years of life. The traumatic injury could be considered as an etiology of productivity loss, causing more loss of working years than heart disease and cancer combined (8). In developed countries, mechanism of injury is strongly associated with the demographics of patients. Motor vehicles were responsible for half of all TBIs between 1935 and 1974. One-third of TBIs resulted from falls, and 10%, from recreational injuries (4). In Australia, road traffic accidents (40%), sports or recreation (25%), and falls (21%) accounted for the majority of TBIs (9). Traffic accidents (60%) and falls (33%) presented as the main causes of head trauma in France (5).

The male/ female proportion in our population study was 9/1. In a study in china during 1983- 1986 on patients who died due to head trauma, this proportion reported as 7/1 (10); which shows the most numbers of head traumatic death occurred in men. The most number of deaths also were seen in patients with an age of 20–30 year in mentioned study. The mean age of patients in the present study was about 35 years. This prevalence showed that the most number of affected patients are young.

In Adams study in Glasco in a period of four years, 635 cases that died following head trauma were evaluated; EDH was seen in 10% and SDH was seen in 18% of cases in this study (11). In present study hemorrhage was seen in about 91% of cadavers, SDH was observed in more than 3/4 of cadavers in both groups. We also detected SAH in about 88% of cases and EDH in about 20% of cases in both groups.

Based on Knight Forensic Pathology book, frequency of skull fracture in EDH is 85% (12). This rate in Dimaio book is 90- 95% (13). Skull base fracture was seen in about 75% of our cases. Thierauf *et al.*, reported that fracture occur most in falls from a height rather than fall downstairs or ground level fall. Frontal and parietal were introduced as the most common site for lacerations and hematomas (14). In another study combined vault-cranial base fractures were the most common head fractures (15).

We couldn't find any differences between accident group and patients who died by falling down in terms of any injury or hemorrhage in this study. This may show

that severity of injury in these two events is similar and they both equally cause damage in patients.

Based on present results scalp injury and scalp abrasion was seen in more than 2/3 and scalp laceration was seen in more than half of our cases. We detected hemorrhage in about 91% of cadavers. We didn't find any difference between an accident and falling down in terms of any injury or hemorrhage.

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