Journal of Surgery and Trauma 2020; 8(3):108-111.
jsurgery.bums.ac.ir

ORIGINAL ARTICLE

Correlation of fracture depression area and dural tear among patients with depressed skull fracture

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Received: July 20, 2020 ***Revised: October 31, 2020*** ***Accepted: November 14, 2020***

Abstract

Introduction: Depressed skull fracture means to have a fracture that has a depth of more than a bone thickness. Consequently, the force is very small to a blunt object, which is often seen in the frontoparietal region due to the low bone thickness in the area. On the other hand, tearing of the dura matter beneath the depressed fractures has a great value from the prognostic and surgical point of view. This study aimed to investigate the relationship between the area of the depressed fracture and dural tear using computerized tomography scan at admission.

Methods: This cross-sectional study was performed on 40 patients who had been diagnosed with depressed skull fractures atImam Reza Educational Center, Tabriz University of Medical Sciences, Tabriz, Iran,within2016-2017. The level of consciousness, Glasgow Coma Scale, and symptoms on admission were evaluated for each patient. The collected data were analyzed in SPSS software (version 22) using student's t-test and Chi-square test for statistical analysis of parametric and nonparametric variables. A p-value of less than 0.05 was considered significant.

Results: The mean age of the cases was obtained as 34/9±14/32 (18-60) years. The mean depressed fracture area (6/93±5/52) ranged from 0/79-19/63cm² (7.13±5.99) for the patients with dural tear and 6.93±5.66 for the ones with intact dura. The cut-off point for predicting dural tear was determined 6.92 cm² with 84% sensitivity.

Conclusions: It was revealed that there was a significant correlation between the area of fracture depression and dural tear. Furthermore, in patients with dural tear, fracture depression level was considerably higher than that in patients with intact dura.

Key words: Depressed skull fracture, Dural tear, Neurosurgery, Skull fracture

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[DOI: 10.32592/jsurgery.2020.8.3.105]

Introduction

Traumatic brain injury (TBI) is a leading factor of morbidity, mortality, and serious health concerns with potentially adverse consequences for the quality of life (1-2) of patients and their friends and families (3-4). The literature review has shown that about10 million people suffer from a new TBI event worldwide annually(5). It has been revealed that the presence of skull fractures is an important factor in identifying neurological disorders, poor outcomes in patients with TBI, and intracranial lesions, such as hematoma(6-7). Skull fractures are categorized based on pattern (i.e., linear, comminuted, and depressed), anatomic location (i.e., convexity and basal), and skin

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integrity (i.e., open and closed). A High-resolution computed tomography (CT) scan is the most available and reliable diagnostic procedure performed on patients with head trauma for initial evaluation (8-9).

Since assessment of the integrity of dura in depressed skull fracture is essential for TBI patients, this study aimed to determine the association between the area of depressed skull fracture and dural tear in patients with TBI using CT scan as a primary evaluation at admission.

Methods

In this cross-sectional study, after obtaining informed consent from family and guardians, all patients with depressed skull fracture received treatment in a trauma center at the ImamReza Hospital, Tabriz University of Medical Sciences, Tabriz, Iran, within2016-2017wereenteredinto the study. Level of consciousness, Glasgow Coma Scale (GCS), and symptoms were evaluated for each patient on admission. The Glasgow Coma Scale was evaluated by a senior neurosurgeon at admission. Each patient was evaluated under a cranial CT scan, and dural tear or integrity findings were recorded during surgery. Finally, the correlation between the levels of fracture depression area and dural integrity was estimated by comparing imaging and surgical findings. The inclusion criterion was patients aged from18-60 years old with a depressed fracture of skull referring to Imam Reza Hospital within2016-2017. On the other hand, the exclusion criteria were patients aged more than 60and less than 18 years old, suffered from chronic diseases, such as diabetic mellitus, bone deformities, or metastatic cancers, had previous surgery of the skull, a history of brain trauma and injury, hyperthyroidism, hyperparathyroidism, and osteoporosis.

The statistical population of this study consisted of 40 patients, among which 18 (45%) and 22 (55%) patients were diagnosed with dural tears and intact dura, respectively. The collected data were analyzed with respect to the region of fracture in the SPSS software (version 22) using the student's t-test and Chi-square test for statistical analysis of parametric and nonparametric variables. The study was approved by the Ethics Committee of Tabriz University of Medical Sciences with the reference number of "94/1-5/9". A p-value of less than 0.05 was considered significant

Results

The current study included 40 patients out of which 35 (87.5%) were males. The mean age score was estimated at 34/9±14/32 (18-60) years (Table 1). The GCS scores of ≤8 and ≥9were obtained for 7 and 33 patients, respectively (Table 2). The mean depressed fracture area was calculated at 6/93±5/52 (0/79-19/63 cm^2) for all patients. The mean ranges for the patients with dural tear and intact dura were respectively 7.13±5.99 and 6.93±5.66. It was revealed that out of 40 patients, 18 patients had laceration, bleeding, and ecchymosis, 5 cases had laceration and hematoma, 17 subjects were diagnosed with laceration, bleeding, and ecchymosis, and 6 patients with laceration, bleeding, ecchymosis, and hematoma (Table 3).

As is shown in Table 4, the most prevalent symptom was found to be a headache, which was presented in 18 patients. Accordingly, 22(55%) and 18(45%) of patients had intact dura and torn dura, respectively. Table 5 summarizes clinical correlations showing that there was a correlation between the CT scan data and clinical findings. Moreover, it indicates that torn dura had a highly significant relationship with GCS on admission, gender, general symptoms, and fracture area (P<0.001).

The mean levels of area, based on CT findings,

Table 1: Variables of the study

Variable	Number of patients	Percentage (%)
Age group		
Mean age	34.9±14.32 (18-60) years	
Mean age of males	33±10.14 years	
Mean age of females	45±9.67years	
Gender		
Male	35	87.5
Female	5	12.5
Total	40	100

Table 2: Glasgow Coma Scale score at admission

Glasgow Coma Scale score at admission	Frequency of patients
5	3
6	1
7	1
8	2
9	1
10	3
11	1
12	7
13	6
14	2
15	13

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Table 3: Signs and symptoms of the patients at admission

Variable	Numbers of patients (%)
Laceration	18(36)
Hematoma	5(10)
Bleeding	1(2)
Ecchymosis	1(2)
Laceration and hematoma	2(4)
Laceration, bleeding, and ecchymosis	17(34)
Laceration, hematoma, bleeding, and Ecchymosis	6(12)

The numbers show the frequency of patients with these signs.

Table 4: Symptoms of the patients at admission

Variable	Number of patients (%)
Headache	18 (45)
Headache and blurred vision	4 (10)
Headache and vomiting	3 (7.5)
Headache, blurred vision, and vomiting	3 (7.5)
Asymptomatic	12 (30)
Total	40 (100)
Intact dura	22 (55)
Torn dura	18 (45)
Total	40 (100)

The numbers show the frequency of patients with these signs

Table 5: Correlation between clinical findings and computerized tomography findings at admission

City or Town	Glasgow Coma Scale at admission	Gender	General symptoms	Fracture area
Torn dura	<0.001	<0.001	0.001	<0.001
Fracture Area			<0.001	

Numbers show p-value.

were obtained as 6.92 cm^2 in patients with intact dura, and 7.2 cm^2 in patients with dural tear. The cut-off point for predicting dural tear was 6.92 cm^2 with 84% sensitivity and 71%specificity. In this research, it was shown that if the fracture depth was6.92 cm^2 or higher, dural tear probability significantly increased, and further evaluations were needed to be performed.

Discussion

Recent studies have provided evidence that the incidence of traumatic brain injuries is increasing in both developing and developed countries. Regarding this, TBI has become a serious universal problem for humans. The results of this study showed that dural tears were present in 18 (45%) patients and were absent in 22 (55%) of patients. Different studies have documented variable data regarding the incidence of dural tears in depressed skull fractures. For instance, Hossain et al.indicated an incidence of 25% of the dural tear in depressed skull fractures amongTBI patients(10). However, Nayak et al. revealed an incidence of 68.75% for the aforementioned studied domain (11).

The current study reported a significant correlation between high levels of fracture, depression, and dural tear amongTBI patients (12). This evidence demonstrates that dural tear could be a diagnostic factor in patients operated for a depressed skull fracture. Therefore, it has been taken into consideration by operating surgeons that the dural tear should properly be closed either primarily or with the help of dural substitutes. This measure may prevent the risk of serious morbidity and mortality among patients with TBI (6-13).

One of the limitations of this research was related to its small sample size, highlighting the performance of further studies to investigate the relation between the area of depressed fracture and dural tear with a larger population. The other limitations of this study were the incomplete information of patients, their companions, some files.

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Conclusions

Based on our findings, it can be concluded that if the fracture area is 6.92 cm^2 or higher, dural tear likely increases, and further evaluation will be needed to confirm the findings.

Acknowledgments

This research is derived from a dissertation submitted to the Department of Neurosurgery, Tabriz University of Medical Sciences for the fulfillment of the MD degree requirements.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Conflict of Interest

The authors declare that there is no conflict of interest.

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