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Original Article

Assessment of Brain Computed Tomography Indications in Minor Head Trauma

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Abstract:

Background: Minor head trauma is one of the most common reasons of hospital admission and further imaging studies. Brain computed tomography (CT) scan is always a challenge for emergency room physicians. The aim of the present study was to evaluate brain CT scan indications in mild head injured patients presented to Shahid Mohammadi Hospital of Hormozgan University of Medical Sciences.

Method: This cross sectional study was conducted in the emergency department of Hormozgan Province in southern Iran. The studied population was consisted of all patients with minor head trauma who attended to this hospital in 2012. Patients were selected using convenience sampling method. Demographic data and clinical symptoms of participants were acquired. Brain CT scan was performed for all patients and the findings were documented. Data analysis was performed by SPSS using chi square. P-value < 0.05 was considered as statistically significant.

Results: In this study 299 patients were enrolled. The mean age of all patients was 16.06 ± 14.13 years, 184 (61.5%) patients were male and 115 (38.5%) were female. The most common trauma mechanism was traffic accident. Totally 162 (54.2%) patients had vomiting, 35 (11.7%) with history of altered mental status, 18 (6%) with vertigo and 10 (3.3%) with severe headache. The results showed post traumatic amnesia was significantly higher in patients with abnormal CT scans compared to normal CT scans (P = 0.04). There was a significant relationship between epidural hematoma and depressed skull fracture and vomiting.

Conclusion: Our study showed that traffic accident was the most common cause of head injury. These findings were consistent with other studies. Assessment of patients with vomiting and post traumatic amnesia seems to be necessary in emergency department. Future studies are recommended.
Keywords: Craniocerebral Trauma, Amnesia, Vomiting.

Introduction:

Head trauma is a leading cause of mortality and morbidity at any age throughout the world (1). Generally, moderate to severe head injuries can lead to neurological squeal. However, about 10% of permanent disabilities in head injured patients can be attributed to minor head injuries (2). Minor or minimal head injury characterized by amnesia (about 5 minutes), altered or decreased level of consciousness, and Glasgow coma scale (GCS) score of 13 to 15 (3, 4). In spite of high admission rates, patients with minor head injury usually don't need in hospital treatment and could be discharged early after observation in emergency department (5). Nevertheless, some evidences show that a small number of patients with minimal head injury may be complicated with intracranial hemorrhage which may require neurosurgical intervention (6). A fast and available method for early assessment of this group is brain computed tomography (CT) scan (7). Early CT scan can help the diagnosis of intracranial hemorrhage and if accompanies with early surgery, it can promote the prognosis of patients (8). In recent decades, brain CT scan has become one of the most common methods for the evaluation of such patients. Various studies revealed that brain CT scan should be performed for all of the minor head injured patients (9, 10) while some other studies demonstrated that only mild head injured patients with special indications such as vomiting, headache, seizure, deficit in short term memory and alcohol intoxication should undergo CT scan (11, 12). Another study indicated that, if triage of such patients was done by early CT scan, excessive admissions can be prevented when findings are normal (13). Many studies suggested that, early CT scan should be considered as screening imaging, but this screening imaging is expensive, especially in developing countries (11). A study reported that, annually more than $20 million would be saved, with only 10% of brain CT scans which is performed for mild head injured patients (14). In this study we aimed to evaluate the indications of performing brain CT scan in mild head injured patients presented to Shahid Mohammadi Hospital of Hormozgan University of Medical Sciences.

Method:

In this study we prospectively evaluated all of the patients with minor blunt head injury who attended Shahid Mohammadi emergency department (EM) in 2012. Participant selection was performed by convenience sampling method. The study was approved by the ethical committee of Hormozgan University of Medical Sciences. All of the participants or their guardians provided informed consent.

Sociodemographic and trauma characteristics of patients (age, sex, trauma mechanism, interval between trauma to presentation, alcohol and drug consumption) associated symptoms (vertigo, more

than one episode of vomiting, severe headache, post traumatic amnesia, loss of consciousness ≥5 min) and physical examination were collected by a number of emergency specialist.

The CT scan was considered positive If one of the following findings reported in CT scan (fracture line, depressed fracture line, base skull fracture, subdural hematoma (SDH), epidural hematoma (EDH), subarachnoid hemorrhage (SAH), intracranial hemorrhage (ICH) and brain edema).

The patients with GCS of 15 and who were older than 1 year old were enrolled in the study. Exclusion criteria were GCS score of 14 and lower, more than one episode of vomiting, previous history of head trauma, penetrating head trauma, rejection to participate in the study or undergo CT scan and contraindication for CT scan. All patients included in study undergo brain CT scan. Those with normal CT scans were observed for 6 hours and if there was no evidence of associated symptoms, they would be discharged from the hospital and were informed about warning indicators in order to return to the hospital. The patients who had abnormal CT studies were admitted in the neurosurgical ward for better evaluation and treatment. All patients were followed up and visited 1 to 2 weeks after discharge. If patients didn't return to hospital we telephoned them and followed them. Data was entered SPSS v. 21 and analyzed using descriptive statistics (mean, standard deviation, frequency and percent).

Results:

The mean age of all patients was 16.06 ± 14.13 years, 184 (61.5%) patients were male and 115 (38.5%) were female. The majority of patients (N=233, P= 74.6%) were admitted within 6 hours after trauma, 45 (15.1%) patients between 6 to 12 hours and 31 (10.4%) patients after 12 hours. The most common trauma mechanism was traffic accident (N = 142, P = 47.49%), followed by assaults (N = 79, P = 26.4%) (refer to table -1).

Table -1: trauma mechanism among patients with minor head injury

Trauma mechanism	Number (Percent)
Motor vehicle - pedestrian collision	45 (15.1%)
Motor vehicle collision	97 (32.4%)
Falling from height (> 1m)	37 (12.4%)
Falling from height (< 1m)	41 (13.7%)
Assaults	79 (26.4%)
Total	299 (100%)

In this study, 162 (54.2%) patients presented with vomiting, 35 (11.7%) with altered mental status, 18 (6%) with vertigo and 10 (3.3%) with severe headache. Among the participants 7 (2.3%) and 5 (1.7%) gave history of drug and alcohol consumption, respectively.

Among all patients, 62 (20.7%) had abnormal CT scan. Table -2 shows the prevalence of clinical symptoms in patients with positive and negative findings of CT scan.

Table 2: prevalence of clinical symptoms in patients with positive and negative findings on CT scan

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Finding	Total (299)	Abnormal CT Scan (62)	Normal CT Scan (237)	P - Value
Vomiting	162 (54.2%)	29 (46.8%)	133 (56.1%)	NS*
Vertigo	18 (6%)	5 (8.1%)	13 (5.5%)	NS
Severe headache	10 (3.3%)	2 (3.2%)	8 (3.4%)	NS
Amnesia	35 (11.7%)	12 (19.4%)	23 (9.7%)	0.04
Alcohol consumption	5 (1.7%)	0	5 (2.1%)	NS
Drug consumption	7 (2.3%)	2 (3.2%)	5 (2.3%)	NS

* NS: Not Significant

In patients with EDH, vomiting was higher than those without EDH. Also, vomiting in patients with depressed skull fracture was higher than those without it. In table 3, the clinical symptoms of patients with abnormal CT scans are presented.

Table 3: Abnormalities of CT scan in relation to clinical symptoms.

		Vomiting		DLOC		Vertigo		Headache	
		162 (54.2%)	P*	35 (11.7%)	P	18 (6%)	P	10 (3.3%)	P
EDH	Yes (10)	9 (90%)	0.02	3 (30%)	NS*	3 (30 %)	0.001	0	NS
	No (289)	153 (52.9%)		32 (11.1%)		15 (5.2%)		10 (3.5%)	
ICH	Yes (8)	2 (25%)	NS	5 (62.5%)	0.001	0	NS	0	NS
	No (291)	160 (55%)		30 (10.3%)		18 (6.2%)		10 (3.4%)	
Brain edema	Yes (2)	2 (100%)	NS	0	NS	0	NS	1 (50%)	< 0.001
	No (297)	160 (53.9%)		35 (11.8%)		18 (6.1%)		9 (3%)	
SAH	Yes (8)	3 (37.5%)	NS	1 (12.5%)	NS	1 (12.5%)	NS	1 (12.5%)	NS
	No (291)	159 (54.6%)		34 (11.7%)		17 (5.8%)		9 (3.1%)	
SDH	Yes (13)	6 (46.2%)	NS	1 (7.7%)	NS	0	NS	0	NS
	No (286)	156 (54.5%)		34 (11.9%)		18 (6.3%)		10 (3.5%)	

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Skull base Fx	Yes (11)	5 (45.5%)	NS	1 (9.1%)	NS	0	NS	0	NS
	No (288)	157 (54.5%)		34 (11.8%)		18 (6.3%)		10 (3.5%)	
Depressed Fx line	Yes (4)	0	0.02	1 (25%)	NS	1 (25%)	NS	0	NS
	No (295)	162 (54.9%)		34 (11.5%)		17 (5.8%)		10 (3.4%)	
Fx line	Yes (18)	10 (55.6%)	NS	4 (22.2%)	NS	2 (11.1%)	NS	0	NS
	No (281)	152 (54.1%)		31 (11%)		16 (5.7%)		10 (3.6%)	

*P: P –Value

*NS: Not Significant

Conclusion:

The majority of patients with head trauma referred to emergency departments are classified as having minor head injury. Various studies reported different rates of positive CT scans among the minor head injured patients. However, most of these studies have demonstrated that the average rate of positive CT scan findings are estimated to be 10 percent in this population and about 1 percent of these patients need neurosurgical intervention (11, 15, 16).

In this study we evaluated brain CT abnormalities at the presence of symptomatic minor head injured patients. About 20% of participants had positive findings on CT scan. This finding is higher than the results of other studies (1, 17). In the current study, vomiting, vertigo and severe headache had no significant correlation with positive finding on CT scan. This finding is inconsistent with the results of other studies (2, 18).

The results showed that among patients with minor head injury, EDH had significant correlation with vomiting and vertigo. Depressed skull fracture had significant correlation with vomiting. Amnesia was significantly correlated with ICH, and severe headache was significantly correlated with brain edema. The management of patients with minor head injury is varied.

Although the preferred imaging study is mentioned in several studies to be brain CT scan, some authors suggest skull radiography (6). It seems that, magnetic resonance imaging (MRI) is a more sensitive method to diagnosis the subtle lesion compared to skull radiography and brain CT scan, but this method is not available for all population and may not be cost – effective to be used routinely for all patients with minor head injury (19). In this study, we evaluated symptoms which were more frequent among patients with minor head injury and we emphasized less on other symptoms or demographic data which

are considered in other studies such as seizure, trauma above the clavicle, coagulopathy and age above 60 years (14, 20, 21).

A limitation of our study was the evaluation of GCS score among children younger than 3 years old that is not as accurate as adults. Therefore, we applied another scale to determine the mental status of children that was previously used by Reilly and colleagues (22).

Our findings showed that vomiting could be correlated with EDH or depressed skull fracture and severe headache could be associated with brain edema. Therefore, we suggest observing the patients who had vomiting or severe headache in emergency department, even if they have normal finding in physical examination and brain CT scan.

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Conflict of interest: The authors have declared that they have no conflicts of interest.

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