## Original article

# Evaluation Of Ct Scan Results In Patients With Minor Head Trauma Based Its Indications And Final Clinical Results In Patients Referred To Emergency Department Of Namazi Hospital In 2016

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**Abstract:**

**Introduction**: There is much controversy over whether or not to use CT scan in patients with minor traumatic brain injury. The present study was conducted aiming to examine the results of CT scan in minor traumatic brain injury on the basis of the required indications and final clinical results.

**Methods**: A cross sectional study, the present study was conducted in the emergency section of Namazi Hospital, Shiraz, Iran. Patients with traumatic brain injury and Glasgow Coma Scale scores 13 to 15 were included. The clinical and CT scan results of patients were collected, compared and analyzed using SPSS software. P-values less than 0.05 were regarded as significant.

**Findings**: Out of 263 patients, 182 (62.6%) and 81 (30.8%) were male and female, respectively. Also, the mean age of participants was 21.36±21.79. The most prevalent indication in patients was vomiting (56.3%) and the most prevalent unnatural indication was linear skull fracture. The present study reported that there is a significant association between unnatural CT scan results and indications of loss of consciousness level (P<0.01), headache (P=0.01) and post trauma seizure (P=0.04).

**Conclusion:** The present study came to the conclusion that the four indications, namely, consciousness level, headache, post trauma seizure and vomiting can well predict the necessity for using CT scan in patients with minor traumatic brain injury.

**Keywords**: CT scan; Indication; Minor Traumatic Brain Injury.

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## Introduction:

Minor traumatic brain injury is of the most common causes, for which people visit emergency centers such that in United states of America two million traumatic brain injury cases are reported annually, of which 90% is minor traumatic injury (1). Based on Glasgow Coma Scale (GCS), traumatic brain injury is categorized into three minor, mild and major injuries. In patients with minor, mild and major traumatic brain injury, patients' GCS score is 13-15, 9-13, and lower than 8, respectively. (2)

CT scan is the fastest method of diagnosing intracranial hemorrhage to the extent that most patients undergoing natural CT scan no longer needed to be under medical supervision (3). CT scan is being widely and increasingly used as it decisively reports patients' intracranial hemorrhage. Figures show a 200% increase in using advanced traumatic brain injury imaging methods, suggesting lack of a reliable method of identifying life-threatening conditions (4).

Nowadays, most hospitals are equipped with CT scan devices to diagnose types of head injuries like skull fracture or ruptured brain. Also, CT scan is usually employed for patients who do not suffer loss of consciousness level and unnatural neurological conditions, in which the results of CT scan are shown in the form of a large number of natural CT scans in hospitals. Increased unnecessary exposure to rays reflects the issue (5). In the United States, annually a number of 400 thousand requests for CT scan are reported for children with minor traumatic brain injury whose CT scan results are natural (3).

Given the increased degrees of requests for unnecessary CT scan as well as soaring medical costs, it was decided to conduct a cross-sectional study aiming to examine the results of CT scan in patients with minor traumatic brain injury and their required indications as well as to compare them with those of Namazi Hospital at Shiraz.

## Methods:

The present cross-sectional study was carried out in a 6-month time period from May to November 2016. The statistical population was comprised of all the patients suffering from minor traumatic brain injury (with GCS score 13 to 15) visiting emergency section of Namazi Hospital, Shiraz, Iran. All the patients meeting the qualifications for the study were taken into account using census method whereas those who did not undergo CT scan, for any reason, were excluded. After being clinically examined by resident of emergency medicine, patients were transferred to the radiology section where they underwent CT scan by a radiologist, who then interpreted the CT scan results. Patents' information was registered in a pre-prepared checklist incorporating demographic information, trauma mechanisms, GCS scores, CT scan required indications, and results of CT scan.

After the checklists were completed, the collected data was entered into SPSS software version 22, which reported the descriptive statistics. To establish an association between qualitative and quantitative variables, Chi-square and t-test were employed, respectively. Moreover, to determine the degree of correlation between continuous data, Pearson's correlation was

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used. Significance level with confidence interval of 95% was considered as equaling 0.05 and P-values less than this were regarded as statistically significant.

## Findings:

The present study examined a total of 263 patients, of which 182 (69.2%) and 81 (30.8%) were male and female, respectively. Moreover, the patients' mean age was 21.36±21.79. The information regarding patients' age is included in Table 1. With regard to trauma mechanisms, the most common one was accidents incorporating 140 cases (53.2%).

A total of 69 patients (26.2%) had positive CT scan results while the remaining 194 patients (73.8%) enjoyed natural CT scan. In terms of GCS score, a number of 195 (74.15), 33 (12.5%), and 10 patients (3.8%) had scores 15, 14 and 13, respectively. The highest unnatural CT scan was witnessed in patients with GCS score of 14 including 24 patients (72.7%) and then in those with GCS score of 13 including six patients (60%). Nonetheless, only a number of 32 patients (16.4%) with GCS score of 15 had unnatural CT scan.

In the present study, a number of 90 (3.3%), 135 (51.3%), 29 (11%) and 9 (3.3%) patients enjoyed 1, 2, 3, and 4 indications for undergoing CT scan, respectively. 55.6% of patients having 4 indications enjoyed unnatural CT scan followed by patients with 1 (27.9%), 2 (23.7%) and 3 (20.7%) indications.

An examination of indications for undergoing CT scan indicates that the most common indication was patients' vomiting experience with 148 cases (56.3%) followed by progressive headaches with 64 cases (24.3%) and loss of consciousness levels with 58 cases (22.1%). Common indications requiring CT scan are presented in Figure 1. In patients lower than 2 years, vomiting was the most prevalent indication including 17 cases (64.5%) whereas in patients higher than 60 years, the most prevalent indication was progressive headaches with eight cases (40%).

An examination of indications with regard to patients' gender shows that the most prevalent indication in men was vomiting with 100 cases (64.5%) followed by progressive headaches with 42 cases (23.1%). With regard to women, the most common indications for undergoing CT scan were vomiting with 48 cases (59.3%) and progressive headaches with 22 cases (27.2%).

Findings obtained from CT scan revealed that 193 patients (73.4%) enjoyed natural results followed by linear skull fracture with 31 cases (11.8%). CT scan results are similar for both men and women where natural findings and linear skull fracture are among the most common CT scan results.

In patients with natural CT scan results, vomiting was the most common indication with 104 cases (53.9%), followed by progressive headaches with 54 cases (28%). Moreover, in patients with unnatural CT scan results, vomiting with 44 cases (64.7%) and loss of consciousness levels with 29 cases (42.6%) were the most prevalent indications for CT scan, respectively.

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Overall, 58 patients suffered from loss of consciousness levels, out of which a total of 29 patients (50%) had unnatural CT scan results. In this group of patients, the most common CT scan results were base skull fracture and linear skull fracture with eight (13.8%) and seven (12.1%) cases.

In most of the patients with indications of vomiting, progressive headaches, ages higher than 60 or lower than 2 years, skull fracture, multiple trauma, above-clavicle trauma, and post trauma seizure, the most prevalent unnatural CT scan result was linear skull fracture. Another statistically analysed thing in the present study was the percentage of natural or unnatural CT scan results based on either positive or negative indications where the highest percentage of unnatural CT scan results was witnessed in patients suffering from post-trauma seizure. Accordingly, out of 13 patients suffering post trauma seizure, seven patients had unnatural CT scan (53.8%). After seizure, loss of consciousness levels accounted for prediction of 50% of unnatural CT scan. Thus, the highest degree of sensitivity (53.8%) to the need for CT scan belonged to post trauma seizure CI, 95%).

On the other hand, an examination of the percentage of natural CT scan results in patients with negative indications showed that the highest percentage of natural CT scan was reported in patients with no loss of consciousness levels. Accordingly, out of 205 patients with no loss of consciousness levels, 164 patients (particularly 80% with CI 95%) had natural CT scan results. Likewise, of 115 patients showing no vomiting indications, 89 patients (77.4%) enjoyed natural CT scan results.

Seventy seven percent of patients with unnatural CT scan results was positive in at least one of the vomiting and loss of consciousness indications. Considering the three indications, namely, vomiting, loss of consciousness, and higher than 60 years or lower than 2 years of age, 84% of patients was positive in at least one of the indications. When progressive headache was added to the three previous indications, it accounted for 89.8% of positive CT scans. Hence, the sensitivity of the above-mentioned indications was 89.8%.

Similarly, particularity of the four indications, namely, loss of consciousness, vomiting, ages higher than 60 years and lower than 2 years, and progressive headaches equalled 21% whereas the particularity of the two loss of consciousness and vomiting indications was 39%, along with age which decreased by 33%.

On the basis of analyses of the present study, there was a significant association between unnatural CT scan results and presence of indications like loss of consciousness ($P<0.001$), progressive headache ($P=0.01$), and post trauma seizure ($P=0.04$). Other indications were not significantly related to natural and unnatural CT scan results.

In the present study, a significant reverse correlation was reported between the number of indications in patients and their GCS scores ($P=0.001$, $r=0.20$).

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## Discussion:

The question that which one of the patients with traumatic brain injury should undergo CT scan has been around since the advent of the device. Accordingly, the present study was conducted aiming to examine the traumatic brain-injured patients' CT scan results on the basis of their required indications and final clinical results among visitors to emergency section of Namazi Hospital in 2015.

In the present study, the most common trauma mechanism was reported to be accidents. Studies conducted by Satori (6) and Steil (7) confirm this finding but those performed by Quaas (8), Ono (9) and Turedi (10) showed that the most prevalent mechanism was fall trauma. As the number of accidents in Iran is increasingly high, this finding can be generalized in studies conducted in this country.

Results of the present study showed that approximately 53% of unnatural CT scan results belonged to patients with GCS scores 13 or 14. Consistent with results of the present one was those found by Stiell (7) et al where 53% of injuries to brain were reported to occur in patients having GCS scores of 13 and 14. Likewise, in a study performed by Stein et al (11), the largest number of unnatural CT scan results was reported in GCS score of 13.

In the present study, the most prevalent indication was reported in patients with vomiting accounting for 56.3% of patients, followed by progressive headaches (24.3%) and loss of consciousness (22.1%). The study conducted by Saboori et al. (6) reported that the strongest indications were headache, loss of consciousness, and post trauma seizure, which is relatively in line with that of the present one.

In the present study, 26.6% of CT scan results were unnatural which is higher than that of other studies, accounting for the difference in the way the study was conducted. The percentage of unnatural results differs in various studies. For example, in studies conducted by Ono (9), Saboori (6), Haydel (12), Stein (11) and Turedi (10), the percentage of unnatural CT scan results were 4.7%, 6.8%, 6.5%, 17.6%, and 19%, respectively. The same percentage was reported to be 58% in the study carried out by Ahsaee (13), which is due to the examination of inpatients whereas in other studies both inpatients and outpatients were taken into consideration.

In the present study, most of the patients (73.4%) enjoyed natural CT scan while the most prevalent result of unnatural CT scan belonged to linear skull fracture (11.8%) followed by contusion, and skull fracture. In most of the studies, brain injuries are considered as the most prevalent unnatural results of CT scan. According to Hydel (12), Miller (14) and Borczuk (15), the most common CT scan results were contusion and SDH (subdural hemorrhage).

In the present study, it was found that the indications, namely, loss of consciousness levels, progressive headache, and post trauma seizure were significantly associated with patients' unnatural CT scan results. Accordingly, it is safe to say that the three indications are favorable variables for prediction of the need to undergo CT scan in

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patients with minor traumatic brain injury. In studies conducted by Ono (9) and Haydel (12), the results of unnatural CT scan were related to ages higher than 60 years, masculinity, alcohol use, headache, nausea, vomiting, loss of consciousness levels and forgetfulness. As previously shown, so much like other studies, loss of consciousness levels and headache were among the indications associated with CT scan results. On the contrary and unlike Ono's study, with regard to variables in the present study, age, gender, vomiting and forgetfulness were not associated with CT scan results.

## Conclusion:

In the end, the present study came to the conclusion that indications, namely, loss of consciousness, progressive headache, post trauma seizure and vomiting are among the most important predictors of the need for undergoing CT scan. Moreover, it was found that loss of consciousness with high sensitivity and particularity as well as significant association with CT scan results is the most important indication. It is thus recommended that future studies incorporate a wider variety of risk factors, indications and a larger sample size.

The present article was extracted from the thesis written by Amir Hasan Asadi was financially supported by Shiraz University of Medical Sciences.

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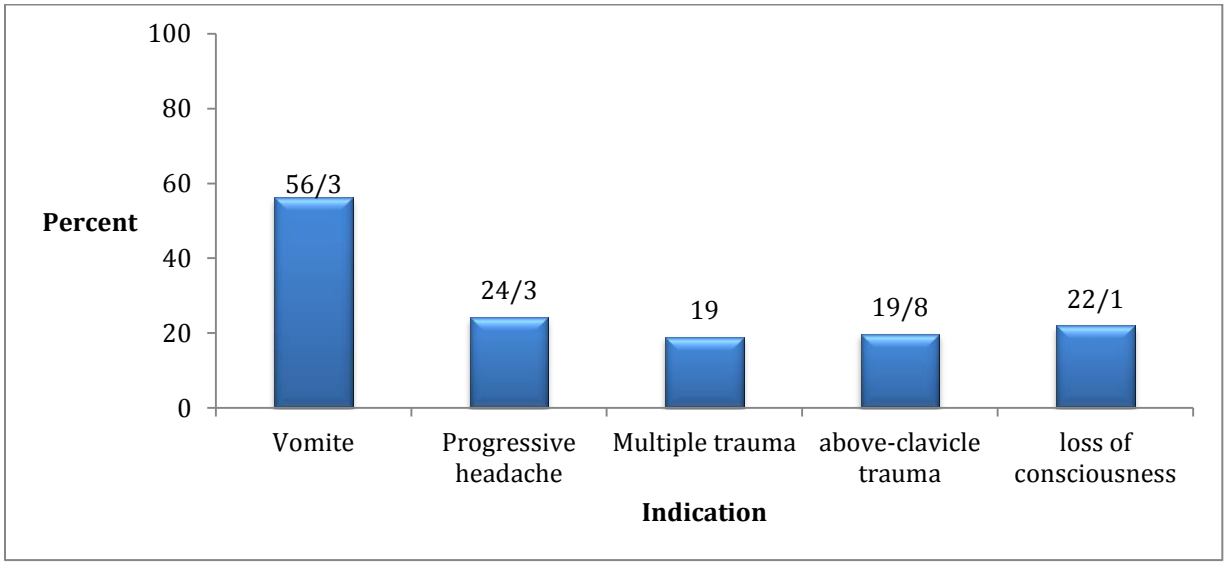
## Tables and Charts:

**Table 1**: The age of patients.

| Sex | Age<br>Mean±SD | Range |
|---|---|---|
| Male | 20.74±21.23 | 1-85 |
| Female | 22.75±23.06 | 1-92 |
| Total | 21.36±21.79 | 1-92 |

**Figure 1**: Common indications requiring CT scan.

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