**Original Article**

# Descriptive Study Of Physical And Imaging Examination Finings Of Head Trauma In Children Under 2 Years Of Old

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**Abstract:**

**Background**: One of the most common pediatric reasons for Emergency Department (ED) referral in childhood is head trauma. Computed tomography (CT) is the standard diagnostic test in the definition of pathologies after head trauma. However, the results of studies related to ionization-induced cancer and the need for sedation during scanning in pediatric have raised concerns about the application of CT, especially in young patients. The present study aims to investigate the compliance of pediatric brain CT scan requests with clinical examinations.

**Methods**: We evaluated minor head trauma children aged below two years old in Namazi hospital, Shiraz, Iran. In this retrospective cross-sectional study, 234 children were evaluated with mild Traumatic brain injury (TBI) from March 2017 to February 2019 brought to the emergency department. 234 patients with a mean age of 12.06±6.84 months were evaluated. Physical examination revealed that a Palpable skull fracture happened in 1 (0.4%), a Parietal scalp hematoma in 16 (6.8%), Occipital scalp hematoma in 11 (4.7%), and temporal scalp hematoma in 7 (3%) patients. Most findings on CT scans were Linear Skull Fracture in 75(32.05%) cases. 90(38.46%) patients had normal CT scans. In patients with positive clinical examination findings, 23.2% of the patients had a positive CT finding; while only 7.3% of the patients with no clinical symptoms had a positive CT finding, indicating a significant difference (P=0.002). A significantly lower age was seen in patients with positive CT scan findings (Mann–Whitney test, P=0.049).

**Conclusion**: To conclude, our study shows that in most cases, a brain CT scan seems to be unnecessary; while physicians should consider all clinical aspects to decide a CT scan request.

**Keywords**: CT scan, emergency medicine, pediatric, traumatic brain injury.

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## Introduction

One of the major factors in increasing nitrate in Trauma is any penetrating or non-penetrating wound or injury that is intentionally or unintentionally caused by external factors such as traffic, poisoning, falls, drowning, etc. (1, 2). Brain trauma (TBI) is defined as a disturbance in the function of the brain following a mechanical force. This dysfunction can be temporary or permanent, or it can cause structural changes in the brain .The clinical spectrum of injury can range from mild (transient confusion) to deep injury (no response and coma). Brain trauma is divided based on the patient's clinical assessment of the level of consciousness with little or no attention to the actual injury that occurred (3). In Iran, different studies have been conducted in connection with head trauma in children in different regions .In a study 7 years old from 2004 to 2010 in Kashan, head trauma is the cause of death of 6.5% of infant deaths under 2 years in 100,000 infants (4). In another study in the following children 10 years in Kermanshah head trauma 31.2% of the amount It accounted for all anatomical injuries (5). Head trauma is one of the major causes of mortality and morbidity in children .In the US annually more than 750000 children and adolescents go to the emergency department with head injuries .Most prevalent in ages 0to It is 4 years (5). Impenetrable brain trauma in children is more likely to cause diffuse injuries than focal injuries .The brain rotates around its center of gravity, leading to diffuse axonal damage and subdural hemorrhage .The applied forces trigger a neurochemical cascade that disrupts the neuronal membrane and stretches the axons (6). Paying attention to the results of the patient's history, physical evaluation and diagnostic imaging distinguish two types of injuries: moderate to severe injuries and mild injuries . In children, it is very large and variable and can show from the very first seconds to the days after the injury. Children are not very aware of the damage and may not be able to describe the symptoms .In infants and young children, neurological symptoms may be subtle. Lethargy, irritability, poor muscle tone, abnormal breathing, and poor nutrition should raise concerns about significant head injury (6). Early and early diagnosis of injured children is essential to reduce mortality and morbidity. is .Computed tomography is a reference standard for diagnosing emergency head and abdominal trauma. The use of CT scans has increased 5-fold over the past two decades (7,8) despite the effectiveness of CT scans in diagnosing brain trauma (9,10), warns that ionizing CT scans can be associated with the progression of subsequent malignancies in patients (11). So far in Namazi Educational and Medical Center, a study on the correctness of CT scan indication in Clinically important traumatic brain injury (ciTBI) in children younger than not done for 2 years. For this reason, in this study the records of pediatric patients smaller than 2 years with minor head trauma referred to the pediatric emergency department of Namazi Hospital in the time interval between 2017 and 2019 have been studied.

## Method

This cross-sectional and retrospective study was performed on medical records of children under 2 years of age who underwent a CT scan with a diagnosis of minor head trauma .Done .The method of data collection was that the researcher referred to the biostatistics department of Namazi hospital, from among the registered files of patients, the file number of patients under 2 years old who referred to the incident department with codesS09) minor head trauma ,(T07) multiple trauma (and W19) falling down (Extracted the registerd. At this point, the number 2136 files were extracted .In this study, in order to monitor our statistical data, we examined

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all the extracted records based on the following conditions (10).

All patients with impression Registered under the title minor head injury by age 2 years from January 2017 to March 2019, who has been referred to the incident department of Shiraz Namazi Hospital, enter the statistical population of the study .Patients with any of the following should be excluded from the study.

By referring to the hospital archives section, among the files extracted from the biostatistics department, according to the entry and exit conditions of the patients' study, the number 234 patients under 2 years of age were eligible for the study 1902 patients were excluded from the study.

Accordingly, and according to the variables mentioned above, the relevant form was designed to collect information. After collecting information based on the designed form, qualitative information as a percentage and quantitative variables as Mean ± SD has been reported .In order to statistically analyze the data from the software, SPSS Edit 23 was used under Windows .To investigate the normal distribution of test data age Kolmogorov-Smirnovtestused .To compare the mean of student t-test or its nonparametric equivalent Mann-Whitney test was used .To compare the frequencies of the test Chi-square And its nonparametric equivalentFisher's exact test was used .Reliability gap in all analyzes %95 and P-value Bilateral less than 0.05 it was considered.

**Results**

After reviewing 2136 cases with codes of multiple trauma, minor head trauma, and falling down, 234 patients under 2 years of age were eligible for the study. The mean age of patients was 12.06±6.84 months. The youngest patient is 1 day old and the oldest patient is 24 months old. The frequency of sex of girls and boys was 47.9% and 52.1%.

**Table 1. characteristics of study participants**

| variable | | Value (n=234) |
|---|---|---|
| age, mean±, months | | 12.06±6.84 |
| sex, n, % | male | 122(52.1%) |
| | female | 112(47.9%) |
| physical exam findings, n, % | Palpable skull fracture | 1 (0.4%) |
| | Parietal scalp hematoma | 16 (6.8%) |
| | Occipital scalp hematoma | 11 (4.7%) |
| | temporal scalp hematoma | 7 (3%) |
| CT scan findings, n, % | Contusion | 19(8.12%) |
| | Intracranial hemorrhage | 1(0.43%) |
| | Basal Skull fracture | 8(3.42%) |
| | Linear Skull Fracture | 75(32.05%) |
| | Subdural hemorrhage | 13(5.56%) |
| | Epidural hemorrhage | 12(5.13%) |
| | Subarachnoid hemorrhage | 5(2.14%) |
| | Depressed Skull Fracture | 11(4.7%) |
| | Normal CT scan | 90(38.46%) |
| Outcome, n, % | Discharged | 65(27.78%) |
| | Admission | 168(71.79%) |
| | Surgery | 1(0.43%) |

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Physical examination revealed that Palpable skull fracture happened in 1 (0.4%), Parietal scalp hematoma in 16 (6.8%), Occipital scalp hematoma in 11 (4.7%), and temporal scalp hematoma in 7 (3%) patients. 199 examinations did not show any abnormality. Most findings on CT scans were Linear Skull Fracture in 75(32.05%) cases. 90(38.46%) patients had normal CT scans, as shown in table 1.

After collecting patients' information, they were divided into positive and negative groups in terms of specific findings in CT scans. In the group with positive clinical examination finding, 23.2% of the patients had a positive CT finding; while only 7.3% of the patients with no clinical symptoms had a positive CT finding, indicating a significant difference (P=0.002). Gender showed no significant relationship with CT scan positive findings (P=0.051) and positive physical exam findings (P=0.532). Comparison of two groups of patients with positive and negative findings in physical exam did not show a significant difference in term of age (Mann–Whitney test, P=0.356). Comparison of two groups of patients with positive and negative CT scan findings showed a significantly lower age in patients with positive CT scan findings (Mann–Whitney test, P=0.049).

**Discussion**

Brain trauma (TBI) is the leading cause of death and disability in children. According to the American Academy of Pediatrics, mild TBI is identified in patients who have normal mental status at the initial examination, who have no abnormal or focal neurological findings, and who have no physical evidence of skull fractures. This definition of mild head injury correlates with a Glasgow Coma Scale (GCS) score of 13 or above (12).

CT scan of the brain, the main choice in imaging for diagnosis TBI and up to 70% of pediatric visits in the emergency department with blunt head trauma are evaluated using CT scans (13, 14). The use of CT scans between different doctors and hospitals could be prodigality (14,15).

Kuppermann et al. in 2009 decide between pediatric patients with head trauma who need a CT scan and patients who do not benefit from it. An algorithm for detecting children at risk ciTBI has developed (15). In a multicenter study, the sensitivity of this algorithm was 100% in children under 2 years and in children above 2 years, 99% reported .How much in pediatric hospitals advises PECARN Used, not well defined (1, 16). The gold standard for TBI diagnosis is a cranial CT scan. Many TBIs detected by CT may not require immediate treatment or any treatment at all. Approximately half of children with minor head injuries have a CT scan, although only about ten percent show evidence of cranial or brain damage. In our study, 174 children (58%) underwent a CT scan, with 54 of them (31%) having abnormal CT results. Furthermore, accidents requiring neurosurgical treatment in children with GCS values of 14–15 are quite rare (17). Only 0.6 percent of children with TBI required neurosurgical intervention, according to Martin et al. (18), while Guzel and coworkers (19) observed a comparable number (1.5 %).

In the study Osmond And others who are in 10 Canadian educational hospitals in children with blunt head trauma Refer to Emergency is done, law CATCH Designed to make the right decision to perform a CT scan .Sensitivity of this criterion 82.2% and its specificity 74.4% has been reported (20). This is while in a study based on modeling of CATCH by Clement and others do It has been concluded that this modeling cannot replace the physician's decision

Our study shows that in most cases, brain CT scan seems to be unnecessary; while physicians should consider all clinical aspects to decide a CT scan request.

**Conclusion:**

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Considering the present study of Guideline PECARN on infants under 2 years of age with trauma as well as other populations in other countries, the susceptibility of sensitivities was acceptable (93/05%) and According to the guideline, the appropriate direction should be taken to determine the direction of the CT scan. Similarly, the rate of adaptation of CT scans in children under 2 years in the Orthopedic Survey Agency is 79/9%, which would be improved by appropriate correction measures.

**Competing interests:** None.

**Authors' contribution:** RS and ZS designed the study. RSMRA and MS collected the medical records and found eligible cases. All authors contributed to drafting and revisions.

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**References**

1. Ballesteros MF, Williams DD, Mack KA, Simon TR, Sleet DA. The epidemiology of unintentional and violence-related injury morbidity and mortality among children and adolescents in the United States. International journal of environmental research and public health. 2018; 15 (4): 616.
2. Centers for Disease Control and Prevention: Web-Based Injury Statistics Query and Reporting System [WISQARS] 2016 [Available from: https://www.cdc.gov/injury/wisqars/index.html.
3. Menon DK, Schwab K, Wright DW, Maas AI. Position statement: definition of traumatic brain injury. Archives of physical medicine and rehabilitation. 2010; 91 (11): 1637- 40..
4. Jalalvandi F, Arasteh P, Safari Faramani R, Esmaeilivand M. Epidemiology of Pediatric Trauma and Its Patterns in Western Iran: A Hospital Based Experience. Glob J Health Sci. 2015; 8 (6): 139-46.
5. Tintinalli JE, Cline DM, Ma OJ, Cydulka RK, Meckler G. Tintinalli's Emergency Medicine Manual 9th Edition: McGraw Hill Professional; 2020.
6. Chang M, Stewart R, Rotondo M, Nathens A. National Trauma Data Bank 2016 Pediatric Annual Report. : 2016. .
7. Rangel-Castilla L, Lara LR, Gopinath S, Swank PR, Valadka A, Robertson C. Cerebral hemodynamic effects of acute hyperoxia and hyperventilation after severe traumatic brain injury. Journal of neurotrauma. 2010; 27 (10): 1853-63. .
8. Robertson CS. Management of cerebral perfusion pressure after traumatic brain injury. Anesthesiology: The Journal of the American Society of Anesthesiologists. 2001; 95 (6): 1513-7. .
9. American Academy of Pediatrics (1999) The management of minor closed head injury in children. Pediatrics 104:1407–15
10. Joyner Jr BL. Does Family Presence in the Trauma Bay Help or Hinder Care? AMA journal of ethics. 2018; 20 (5): 507-12.
11. Vink R, Head VA, Rogers PJ, McINTOSH TK, Faden AI. Mitochondrial metabolism following traumatic brain injury in rats. Journal of neurotrauma. 1990; 7 (1): 21-7. .
12. Lifshitz J, Sullivan PG, Hovda DA, Wieloch T, McIntosh TK. Mitochondrial damage and dysfunction in traumatic brain injury. Mitochondrion. 2004; 4 (5-6): 705-13.
13. Centers for Disease Control and Prevention: Vital Statistics 2008

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[ DOR: 20.1001.1.23222913.2021.10.4.16.6 ]

[Available from: http://www.cdc.gov/nchs/vitalstats.htm .
14. Palchak MJ, Holmes JF, Vance CW et al (2003) A decision rule for identifying children at low risk for brain injuries after blunt head trauma. Ann Emerg Med 42:492–506
15. Güzel A, Hiçdönmez T, Temizöz O, Aksu B, Aylanç H, Karasalihoglu S (2009) Indications for brain computed tomography and hospital admission pediatric patients with minor head injury: how much can we rely upon clinical findings? Pediatr Neurosurg 45:262–70
16. RAGHUPATHI R, GRAHAM DI, McINTOSH TK. Apoptosis after traumatic brain injury. Journal of neurotrauma. 38- 927:) 10 (17; 2000..
17. SMITH DH, CHEN XH, PIERCE JE, WOLF JA, TROJANOWSKI JQ, GRAHAM DI, et al. Progressive atrophy and neuron death for one year following brain trauma in the rat. Journal of neurotrauma. 1997; 14 (10): 715-27. .
18. Papadopoulos MC, Krishna S, Verkman A. Aquaporin water channels and brain edema. The Mount Sinai journal of medicine, New York. 2002; 69 (4): 242-8. .
19. Papadopoulos MC, Verkman AS. Aquaporin-4 and brain edema. Pediatric nephrology. 2007; 22 (6): 778-84. .
20. Engbrecht BW, Baertschiger RM. American pediatric surgical association trauma committee position statement on the use of all-terrain vehicles by children and youth, 2018. Journal of pediatric surgery. 2018; 53 (7): 1444-5. .

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