

**Original article**

**Evaluation the frequency of computerized tomography (CT) scan indication in children under two years old with mild trauma**

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**Abstract:**

**Objective:** Head traumas are prevalent in children with mild severity and without commitment of delayed brain injuries. The aim of present study was to detect the mild head trauma (MHT) children with high risk of brain injuries for avoidance of unnecessary interventions. **Methods:** This cross-sectional study considered 100 children under 2 years old with MHT in Kashani and Alzahra Hospitals between March 2011 and August 2011, Isfahan, Iran. Data was gathered by these project executives including the radiologist reports and the patients past medical history. The patients were divided into normal and abnormal CT scan and reduction of consciousness level, vomiting and the other variables were considered. **Results:** The results were obtained from evaluation of 100 files from the patients with mean age  $18 \pm 7.1$  month. CT scan findings showed that 55 percent of the patients were abnormal and had brain injuries including skull fracture, epidural hemorrhage, skull contusion, and arachnoids hemorrhage. The incidence of repeated vomiting and reduction of consciousness level in patients with non-normal CT scan was more than normal group while this difference was not significantly different. Also according to CT scan findings there was no statistically significant difference between patients with repeated vomiting or reduced consciousness level ( $P > 0.05$ ). **Conclusions:** This study results showed that there is not significantly difference between vomiting incidence, decreased level of consciousness and CT scan results. These criteria were not considered separately as only factors for brain trauma of performing CT scan in MHT patients.

**Key words:** mild head trauma, computerized tomography, children

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**Introduction:**

Head traumas are prevalent in children. Most of the pediatric head trauma are mild and without commitment of delayed brain injuries. However some percent of children with good health first, have been received the post intracranial malignancies<sup>1</sup>. Most of these patients could be discharged after short period of admission and some ones have worst situations and need to brain or nerve surgeries intervention<sup>1-4</sup>. Mild head trauma (MHT) in children under two

years old is described separately due to its complex clinical evaluation, asymptomatic intracranial trauma, intentional possibility and skull fracture due to mild head trauma<sup>5-6</sup>. The aim of evaluation of MHT patients are description of these patients and prevention of worsening and secondary trauma with limitation of unnecessary scanning methods<sup>1</sup>. Computerized tomography (CT) scan is a gold standard test for head trauma children for detection of intracranial injuries<sup>7</sup>. Today 270000 CT scan cases is

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reported in USA<sup>8</sup>. Administering the CT scan in children with MHT is increasing while it has low diagnostic value<sup>2</sup>. In 1995, 15% of admitted children to pediatric emergency ward of Canadian hospitals with mild head trauma, underwent CT scan, however this amount had been increased to 53% in 2005<sup>9-10</sup>. In North America usually 15 to 70 percent of injured children with MHT, referred to emergency wards undergo CT. While 70 to 98 percent of these CT scans are normal showing no brain injuries<sup>11-14</sup>. Brain injuries have been showed only in 4-7% of CT scans of MHT children and then just 5% of them need surgical intervention<sup>9, 15</sup>. Although benefits of CT scan in severe pediatric head trauma is approved but its indication for MHT is already controversial<sup>16</sup>. Some medical experts believed that normal neurologic children are dischargeable without any CT scan<sup>15</sup> and just children with decreased level of consciousness or skull fracture should be candidate for CT<sup>17-18</sup>. In contrast some believe that any usual clinical parameters could not predict traumatic side effects in children and its application suggested for trauma mechanism<sup>6,19</sup>. Dunning et al<sup>20</sup> reported the MHT incidence 55% for children under 5 years old and 28% for those under 2 years old. While in other studies decreased consciousness level was commonly reported<sup>21</sup>. The statistics of intracranial injuries are different as making CT scanning a controversial diagnostic challenge for MHT. Head injury is diagnosed 0.6% in CT scanning of children with mild trauma<sup>22</sup> and 1% in another study<sup>23</sup>.

There is no evidence base medicine for CT of children under 2 years old with MHT and CT usefulness and as increasing CT for these children in our studied hospitals. Also X-ray exposure, high cost of the technique, discomfort of performing and need to send out of patients to different centers are probable problems of CT scanning for these patients. Moreover performing CT scanning for infantile are commitment to non-ignorable future intracranial malignancies, so it must be avoided in unnecessary situations. The purpose of present study was detection of MHT children with high risk of brain injuries for avoidance of unnecessary interventions. The present study considered the frequencies of CT scanning indications in children under two years old with mild head trauma.

### **Materials and Method:**

This cross-sectional study considered 100 children under 2 years old with MHT who were diagnosed or clinically suspected cases referred for CT scan.

These patients were selected from children under two years old who underwent CT scan in the first 6 hours of trauma with consciousness level higher than thirteen in Kashani and Alzahra Hospitals between March 2011 and August 2011, Isfahan, Iran.

If the patients files had not qualified for CT scan with neurologic and convulsion history, their files not included. Clinical history and laboratory data were collected from all patients including age (month), gender, mechanism of head trauma, consciousness level before CT scan, repeated vomiting, decreased level of consciousness, convulsion, craniofacial injury of soft tissue (subgaleal hematoma and lacerations), distant other body parts trauma (e.g. abdomen, extremities and spine) and CT scan findings (Normal CT, simple, dispatched or complex skull fracture, subdural hemorrhage, epidural hemorrhage, intraventricular brain fracture Skull, brain contusion, intracranial hemorrhage, arachnoids hemorrhage and brain tumor). Data gathering was performed by these project executives including the radiologist reports and the patients past medical history. The patients were divided into normal and abnormal CT scan. These two groups were evaluated about reduction of consciousness level, vomiting and the other variables.

### **Statistical analysis**

SPSS for Windows, version 20 was used in all statistical procedures. Data were expressed at mean  $\pm$  SD or as a proportion of sample size. Descriptive statistics and compare means (one sample t-test and Pearson and Spearman tests) were used for age comparison between normal and non normal CT group. P-value less than 0.05 considered significant.

### **Results:**

Among 120 files of patients, 20 files were excluded due to before convulsion history (3 files), incomplete files (12 files) and consciousness level below 13 (6 files). So the results were obtained from evaluation of 100 files. Mean age of the patients was  $18 \pm 7.1$  month that ranged between 1 to 23 weeks. CT scan findings showed that 55 percent of the patients were abnormal and had brain injuries including skull fracture, epidural hemorrhage, skull contusion, and arachnoids hemorrhage (Table 1).

In Table 2 the comparison of age, gender, mechanism of trauma, vomiting and consciousness level between patients with normal and abnormal CT scan is presented. The incidence of repeated vomiting and reduction of consciousness level in patients with

non-normal CT scan was more than normal group while this difference was not significantly different. Also according to CT scan findings there was no statistically significant difference between patients with repeated vomiting or reduced consciousness level ( $P>0.05$ ).

#### **Discussion:**

Recently administration of CT scan for mild head trauma of children has been increased. However, performing CT scan compared to the medical examination has imposed high costs with equal medical management of these patients<sup>24-25</sup>. Using CT scan could be decreased in children with MHT and limited to ones with relevant brain injuries symptoms<sup>26</sup>. According to our results about the children with MHT under two years old, there is no statistical significant difference between patients with normal and abnormal CT scan about vomiting and decreased of consciousness level.

Boys experience head trauma more than girls, although there is not any difference about gender and CT scan explanation results. Besides, falling is the most cause of trauma in studied patients while there is no significant difference about CT scan interpretation and mechanism of trauma in the patients.

Karen et al<sup>27</sup> and Dietrich et al<sup>22</sup> reported the incidence of skull fracture or intracranial trauma 18% and 17% in children with MHT under two years old, respectively. In this study, skull fracture or intracra-

nial trauma incidence was 55%. This difference should be due to difference in inclusion criteria for the patients, as CT scan criteria in previous studies were different with our study. Besides intra skull trauma incidence was 4%<sup>27</sup>, 6%<sup>19</sup>, 0.6%<sup>22</sup>, 1%<sup>23</sup> and 11% in Hahn et al study<sup>28</sup>. Atabaki et al<sup>29</sup> alike our study results did not found any significant difference between vomiting and intra skull trauma for children under two years old. While Palchak et al<sup>30</sup> found significant correlation and expressed vomiting as predictive criteria for performing CT scan in children with mild head trauma. Falmirski et al<sup>31</sup> reported that low level of consciousness in children with MHT is not an enough standalone predictive factor for burn injuries. Also like our study results, Davis and colleagues<sup>15</sup> did not report significant difference between decreased level of consciousness and Intra skull trauma.

The limitations of our study are lack of data of the patients with MHT in studied hospitals who did not performed CT scan. So the evaluation of the exact incidence of intra skull fracture in children under two years old with mild head trauma and the studied criteria between patients with and without CT scan were not possible

This study results demonstrated that there is not significantly difference between vomiting incidence, decreased level of consciousness and CT scan results related to exact incidence of intra skull fracture and burn injuries. These criteria were not considered separately as only factors for burn trauma of per-

**References:**

1. Schutzman SA, Barnes P, Duhaime AC, et al. Evaluation and management of children younger than two years old with apparently minor head trauma: proposed guidelines. *Pediatrics*. 2001;107:983-93. <http://dx.doi.org/10.1542/peds.107.5.983>
2. Osmond MH, Klassen TP, Wells GA, et al. CATCH: a clinical decision rule for the use of computed tomography in children with minor head injury. *CMAJ*. 2010;182:341-8. <http://dx.doi.org/10.1503/cmaj.091421>
3. Connors JM, Ruddy RM, McCall J, et al. Delayed diagnosis in pediatric blunt trauma. *Pediatr Emerg Care*. 2001;17:1-4. <http://dx.doi.org/10.1097/00006565-200102000-00001>
4. Tran T, McGuire T, Malcolm C, et al. Incidence of delayed intracranial hemorrhage in children with an uncomplicated minor head injury [abstract]. *Pediatr Res* 2002; 50:83.
5. Duhaime AC, Alario AJ, Lewander WJ, et al. Head injury in very young children: mechanisms, injury types, and ophthalmologic findings in 100 hospitalized patients younger than 2 years of age. *Pediatrics*. 1992;90:179-85.
6. Keskil IS, Baykaner MK, Ceviker N, Kaymaz M. Assessment of mortality associated with mild head injury in the pediatric age group. *Childs Nerv Syst*. 1995; 11:467-73. <http://dx.doi.org/10.1007/BF00334967>
7. Maguire JL, Boutis K, Uleryk EM, Laupacis A, Parkin PC. Should a head-injured child receive a head CT scan? A systematic review of clinical prediction rules. *Pediatrics*. 2009;124:e145-54. <http://dx.doi.org/10.1542/peds.2009-0075>
8. Mettler FA Jr, Wiest PW, Locken JA, Kelsey CA. CT scanning: patterns of use and dose. *J Radiol Prot*. 2000;20:353-359. <http://dx.doi.org/10.1088/0952-4746/20/4/301>
9. Klassen TP, Reed MH, Stiell IG, et al. Variation in utilization of computed tomography scanning for the investigation of minor head trauma in children: a Canadian experience. *Acad Emerg Med*. 2000;7:739-44. <http://dx.doi.org/10.1111/j.1553-2712.2000.tb02260.x>
10. Osmond MH, Klassen TP, Stiell IG, et al.; CATCH Study Group. The CATCH rule: a clinical decision rule for the use of computed tomography of the head in children with minor head injury [abstract]. *Acad Emerg Med*. 2006;13:S11. <http://dx.doi.org/10.1197/j.aem.2006.03.008>
11. Blackwell CD, Gorelick M, Holmes JF, et al. Pediatric head trauma: changes in use of computed tomography in emergency departments in the United States over time. *Ann Emerg Med*. 2007;49:320-324. <http://dx.doi.org/10.1016/j.annemergmed.2006.09.025>
12. Jagoda AS, Cantrill SV, Wears RL, et al. Clinical policy: neuroimaging and decisionmaking in adult mild traumatic brain injury in the acute setting. *Ann Emerg Med*. 2002;40:231-249. <http://dx.doi.org/10.1067/mem.2002.125782>
13. Taheri PA, Karamanoukian H, Gibbons K, Waldman N, Doerr RJ, Hoover EL. Can patients with minor head injuries be safely discharged home? *Arch Surg*. 1993;128:289-292. <http://dx.doi.org/10.1001/archsurg.1993.01420150043008>
14. Servadei F, Vergoni G, Nasi MT, Staffa G, Donati R, Arista A. Management of low-risk head injuries in an entire area: results of an 18-month survey. *Surg Neurol*. 1993;39:269-275. [http://dx.doi.org/10.1016/0090-3019\(93\)90003-J](http://dx.doi.org/10.1016/0090-3019(93)90003-J)
15. Davis RL, Mullen N, Makela M, et al. Cranial computed tomography scans in children after minimal head injury with loss of consciousness. *Ann Emerg Med* 1994;24:640-5. [http://dx.doi.org/10.1016/S0196-0644\(94\)70273-X](http://dx.doi.org/10.1016/S0196-0644(94)70273-X)
16. Simon B, Letourneau P, Vitorino E, McCall J. Pediatric minor head trauma: indications for computed tomographic scanning revisited. *J Trauma*. 2001;51:231-7. <http://dx.doi.org/10.1097/00005373-200108000-00004>
17. Gómez PA, Lobato RD, Ortega JM, De La Cruz J. Mild head injury: differences in prognosis among patients with a Glasgow Coma Scale score of 13 to 15 and analysis of factors associated with abnormal CT findings. *Br J Neurosurg*. 1996;10:453-60. <http://dx.doi.org/10.1080/02688699647078>
18. Shane SA, Fuchs SM. Skull fractures in infants and predictors of associated intracranial injury. *Pediatr Emerg Care*. 1997;13:198-203. <http://dx.doi.org/10.1097/00006565-199706000-00006>
19. Schunk JE, Rodgerson JD, Woodward GA. The utility of head computed tomographic scanning in pediatric patients with normal neurologic examination in the emergency department. *Pediatr Emerg Care*. 1996; 12:160-165. <http://dx.doi.org/10.1097/00006565-199606000-00004>
20. Dunning J, Daly JP, Malhotra R, et al. The implications of NICE guidelines on the management of children presenting with head injury. *Arch Dis Child*. 2004;89:763-7. <http://dx.doi.org/10.1136/>

- adc.2003.042523
21. Dietrich AM, Bowman MJ, Ginn-Pease ME, Kosnik E, King DR. Pediatric head injuries: can clinical factors reliably predict an abnormality on computed tomography? *Ann Emerg Med.* 1993;22:1535-40. [http://dx.doi.org/10.1016/S0196-0644\(05\)81254-5](http://dx.doi.org/10.1016/S0196-0644(05)81254-5)
  22. Da Dalt L, Marchi AG, Laudizi L, et al. Predictors of intracranial injuries in children after blunt head trauma. *Eur J Pediatr.* 2006;165:142-8. <http://dx.doi.org/10.1007/s00431-005-0019-6>
  23. Dunning J, Daly JP, Lomas JP, Lecky F, Batchelor J, Mackway-Jones K. Derivation of the children's head injury algorithm for the prediction of important clinical events decision rule for head injury in children. *Arch Dis Child.* 2006;91:885-91. <http://dx.doi.org/10.1136/adc.2005.083980>
  24. Afgeijerstam JL, Oredsson S, Britton M. Medical outcome after immediate computed tomography or admission for observation in patients with mild head injury: randomised controlled trial. *BMJ.* 2006;333:465 – 470. <http://dx.doi.org/10.1136/bmj.38918.669317.4F>
  25. Norlund A, Marké LA, AfGeijerstam JL, Oredsson S, Britton M. OCTOPUS Study. Immediate computed tomography or admission for observation after mild head injury: cost comparison in randomised controlled trial. *BMJ.* 2006;333:469–472. <http://dx.doi.org/10.1136/bmj.38918.659120.4F>
  26. Haydel MJ. Clinical decision instruments for CT scanning in minor head injury. *JAMA.* 2005;294:1551–1553. <http://dx.doi.org/10.1001/jama.294.12.1551>
  27. Gruskin KD, Schutzman SA. Head trauma in children younger than 2 years: are there predictors for complications? *Arch PediatrAdolesc Med.* 1999;153:15-20. <http://dx.doi.org/10.1001/archpedi.153.1.15>
  28. Hahn YS, Chyung C, Barthel MJ, Bailes J, Flannery AM, McLone DG. Head injuries in children under 36 months of age. *Childs Nerv Syst.* 1988;4:340.
  29. Atabaki SM, Stiell IG, Bazarian JJ, Sadow KE, Vu TT, Camarca MA, Berns S, Chamberlain JM. A clinical decision rule for cranial computed tomography in minor pediatric head trauma. *Arch PediatrAdolesc Med.* 2008;162:439-45. <http://dx.doi.org/10.1001/archpedi.162.5.439>
  30. Palchak MJ, Holmes JF, Vance CW, et al. A decision rule for identifying children at low risk for brain injuries after blunt head trauma. *Ann Emerg Med.* 2003; 42:492-506. [http://dx.doi.org/10.1067/S0196-0644\(03\)00425-6](http://dx.doi.org/10.1067/S0196-0644(03)00425-6)
  31. Falimirski ME, Gonzalez R, Rodriguez A, Wilberger J. The need for head computed tomography in patients sustaining loss of consciousness after mild head injury. *J Trauma.* 2003;55:1-6. <http://dx.doi.org/10.1097/01.TA.0000071295.67263.A2>
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