Unnecessary Brain CT scan of Traumatic Pediatric Patients; How to Reduce the Numbers?

Mohammad-Taghi Talebian[1], *Shahram Bagheri-Hariri[1]

[1]Department of Emergency Medicine, Faculty of Medicine, Tehran University of Medical Sciences, Tehran, Iran.

Dear Editor-in-Chief,

Considerable numbers of pediatric trauma cases are referred to the emergency department following a traumatic event. The worried parents request for the most sensitive diagnostic test, so emergency physicians order for brain computed tomography (CT) scan (1, 2). The low threshold for decision making regarding the use of brain CT scan results in a huge number of normal imaging. On the other hand, radiation exposure of the child may be accompanied with numerous side effects in the future (3, 4). This calls for the question as to "how to reduce the number of unnecessary brain CT scans of traumatic pediatric patients?"**.** Researchers from all around the world are trying to implement different strategies to reduce the number of unnecessary brain CT scans in the pediatric population. Some surveys have been conducted focusing on better history taking, considering an observation period before decision making, and even measurement of serum biomarker levels. But it seems that implementation of validated clinical prediction rules could be very helpful in this regard. The derivation of clinical prediction rules and conducting related validation studies have been taken into account recently. In such surveys, following a prospective high power cohort study based on the clinical presentation and without any paraclinical testing, the low-risk patients were differentiated from the others. These patients were defined as those who could be omitted from further unnecessary brain CT scan. The National Institute of Clinical Excellence in 2004, the Royal College of Surgeons of England (RCS) in 2005, and the Children's Head Injury Algorithm for the Prediction of Important Clinical Events study group in 2006 formulated their guidelines in this regard so as to reduce the number of unnecessary brain CT scans in pediatric traumatic patients (5-7).

However, the Pediatric Emergency Care Applied Research Network (PECAREN) study was one of the valuable studies which developed and validated two distinct clinical prediction rules for pediatric patients under and above 2 years of age in 2009. Based on the PECAREN study, "normal mental status, no scalp hematoma except frontal, no loss of consciousness or loss of consciousness for less than 5 seconds, non-severe injury mechanism, no palpable skull fracture, and acting normally according to the parents" with a negative predictive value (NPV) of 100% obviate the need for performing brain CT in children younger than 2 years. Also, "normal mental status, no loss of consciousness, no vomiting, non-severe injury mechanism, no signs of basilar skull fracture, and no severe headache" with NPV of 99.95% obviate the need for performing brain CT in children older than 2 years (8). Its validity has also been recently confirmed by Nakhjavan-Shahraki et al. (9). Osmond et al. in 2010 also derived Canadian Assessment of Tomography for Childhood Head Injury (CATCH). Based on CATCH, "failure to reach a score of 15 on the Glasgow coma scale within two hours, suspicion of open skull fracture, worsening headache and irritability" were considered as high-risk factors that have 100% sensitivity for expecting the necessity of further investigation. "Large, boggy scalp hematoma, signs of basal skull fracture, dangerous mechanism of injury" were considered

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Corresponding Author:

Shahram Bagheri-Hariri; Emergency Department, Imam Khomeini Complex Hospital, Keshavarz Blvd, Tehran, Iran. Fax: +982166904848;

Email: hariri.shahram@gmail.com *AND* hariri@sina.tums.ac.ir

as medium-risk factors with 98.1% sensitivity for the prediction of traumatic brain injury by brain CT scan. Apparently, in the absence of these risk factors, the child can be considered as at low risk and does not require brain CT scan (10). More recently, Pediatric Traumatic Brain Injury (PTBI) Prognostic Rule has been proposed in this regard. The related investigators reported that PTBI has a sensitivity of 100% and specificity of 73% in terms of differentiating clinically important traumatic brain injury in pediatric patients with minor head trauma (11). It should be noted that the controversies regarding the most valuable clinical prediction rules are still present, and research on this topic is necessary.

Key Words: Closed Head Injuries, Pediatrics, X-Ray Computed Tomography.

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