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ORIGINAL

Survey of the management of traumatic brain injury in children and the use of clinical decision rules

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Abstract

Traumatic brain injury (TBI) is one of the most frequent reasons for consultation of children in the Emergency Department. The objective of the study was to identify the current practice in the management of mild traumatic brain injury by doctors who have worked in the Emergency Department of a tertiary pediatric center.

Methods: An online survey of 350 doctors who have worked in the emergency department was performed. Variables included demographic characteristics, workplace, availability of TBI management guidelines, and clinical scenarios for patients with mild TBI. Responses were compared to the management defined by Canadian Assessment of Tomography for Childhood Head injury (CATCH), Children's Head injury Algorithm for the prediction of Important Clinical Events (CHALICE) and Pediatric Emergency Care Applied Research Network (PECARN).

Results: 217 responses were obtained. 41% of the respondents were general physicians. 31% of the participants had a clinical experience of fewer than 5 years. Only 41% stated that they have available guidelines for the management of pediatric TBI. There were differences regarding decision-making in relation to observation time and neuroimaging.

Conclusion: Most of pediatric patients with mild TBI are managed by general physicians with work experience of fewer than five years. There were no local guidelines available for the management of mild TBI, and they are also unaware of the existence of clinical decision rules to support the need for neuroimaging.

ENCUESTA DEL MANEJO DEL TRAUMA CRANEOENCEFÁLICO EN LA POBLACIÓN PEDIÁTRICA Y UTILIZACIÓN DE LAS REGLAS DE DECISIÓN CLÍNICA

Resumen

El trauma craneoencefálico (TCE) es uno de los motivos de consulta más frecuentes de los niños a los Servicios de Emergencias (SEM). El objetivo del estudio fue identificar las prácticas en el manejo del TCE en pediatría que se da por parte de médicos que han trabajado en el SEM de un centro pediátrico de tercer nivel de atención.

Métodos: *Se utilizó una encuesta en línea a 350 médicos que hubieran laborado en el SEM. Las variables incluyeron características de los encuestados, sitio de trabajo, disponibilidad de guías para el manejo del TCE y escenarios clínicos de pacientes. Las respuestas fueron comparadas con la conducta definida por las reglas para decisión clínica (RDC)* Canadian Assessment of Tomography for Childhood Head injury *(CATCH),* Children's Head injury Algorithm for the prediction of Important Clinical Events *(CHALICE) y* Pediatric Emergency Care Applied Research Network *(PECARN).*

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Resultados: *Se obtuvieron 217 respuestas. Un 41% de los encuestados eran médicos generales. Un 31% de los participantes tenían experiencia menor a 5 años. Solo un 41% afirmó contar con guías disponibles para el manejo del TCE pediátrico. Existieron diferencias con respecto a la toma de decisiones en relación con el tiempo de observación y la realización de neuroimágenes entre los encuestados y lo propuesto por las RDC citadas.*

Conclusión: *La mayor parte de los pacientes pediátricos con TCE leve son manejados por médicos generales con experiencia laboral menor a los cinco años. La disponibilidad de guías locales para el manejo del TCE leve es limitada. El criterio clínico difiere de las recomendaciones de las RDC para realización de neuroimágenes.*

INTRODUCTION

Traumatic brain injury (TBI) is one of the most common complaints in children presenting to pediatric Emergency Departments (EDs). Most TBIs are classified as mild, defined by a Glasgow Scale (GCS) of 14 or higher; however, despite their clinical classification, they may be associated with severe lesions[1,2].

Clinical decision rules (CDRs) for the management of mild TBI have been developed to facilitate the management of patients and identify those who may need neuroimaging studies as well as observation in the ED. These CDRs are based on variables to determine the likelihood of the presence of a given condition[3].

Validated CDRs for the assessment of mild pediatric TBI include those of the Pediatric Emergency Care Applied Research Network (PECARN)[4], the Canadian Assessment of Tomography for Childhood Head injury (CATCH)[5], and the Children's Head injury algorithm for the prediction of Important Clinical Events (CHALICE)[6]; however, at least eleven other CDRs have been published[3].

Studies comparing these CDRs have concluded that the PECARN CDR is the most sensitive for identifying children with mild TBI with clinically significant intracranial lesions, the CHALICE rule is the most specific, and that the sensitivity of the CATCH rule is close to that of PECARN, but with a specificity that is slightly lower than that of the CHALICE CDR. Clinical judgment also has a low specificity, which could lead to an unnecessary increase in the use of imaging studies[7-9].

In developed countries, surveys have been conducted on the management of mild TBI in pediatric patients by healthcare personnel and have found great variability in the approach to these patients[10-12]. In Latin America, there are no data on the management of TBI in children; therefore, it was decided to conduct a survey of physicians working in the ED of the only third-level pediatric hospital in Costa Rica in order to identify current practices regarding the management of mild TBI.

MATERIALS AND METHODS

A descriptive cross-sectional study was conducted based on an online survey. The survey was completed anonymously by physicians who were working or previously worked in the ED of the National Children's Hospital in Costa Rica (HNN). The hospital is the only third-level hospital in the country with a Pediatric Trauma Unit and around 95,000 annual visits to the ED. The survey included questions about the epidemiological characteristics of the respondents, the place of work, and the availability of guidelines on the management of TBI. Two clinical cases were also included, about which, considering data related to the clinical record, physical examination, and mechanism of trauma, the respondents answered questions on management aspects. Responses were evaluated according to the recommendations of the CDRs (CATCH, CHALICE and PECARN) regarding the use of neuro-imaging.

The following clinical case scenarios were used:

- Case report #1. An 8-month-old boy, while sleeping, fell off the bed onto a wooden floor (estimated height 60cm). His mother reported loss of consciousness of < 5 seconds and at the time of evaluation the child was acting normally. On physical examination, 2 hours later, his GCS was 15 and he had a soft scalp hematoma in the left parietal region but no palpable skull fracture. His vital signs were within normal limits.
- Case report #2. A 12-year-old boy was brought in by ambulance because of TBI while playing soccer (head-to-head contact with another player followed by a fall to the ground impact to head on the right side) one hour prior to arrival. Loss of consciousness for 1 minute, followed by confusion, no vomiting. In the ED: A, B, C: stable. D: Glasgow 14 (E4,V4,M6), repetitive questioning, amnesia, symmetrical and reactive pupils. E: right temporal hard scalp hematoma with abrasion and a 2-cm wound. No other lesions.

STATAIC 16 software (StataCorp College Station, TX 77845, USA. 2016) was used for data analysis. Frequencies and percentages were used for descriptive analysis. Ethical aspects: The study was approved by the HNN Scientific Ethical Committee (CEC-HNN-020-2019).

RESULTS

The survey was sent out to 350 potential participants of whom 217 responded. Table 1 summarizes the results of the epidemiological characteristics of the participants and their work place. Most of the respondents were general practitioners (41% of the total), followed by pediatricians (31%), while the remaining participants were residents or other subspecialists. Of the physicians surveyed, 31% had < 5 years and 20% > 25 years of experience.

Seventy-three percent of the respondents were working in an ED at the moment of the survey; 28% worked in a mixed

TABLE 1. Characteristics of the surveyed physicians and the centers where they work

Professional role	
General practitioner	41%
Pediatrician	31%
Other adult specialties	15%
Residents	7%
Pediatric surgery	6%
Clinical experience	
Less than 5 years	31%
More than or equal to 25 years	20%
10 to 14 years	17%
15 to 19 years	13%
5 to 9 years	13%
20 to 24 years	6%
Type of ED	
Pediatric emergencies	29%
Mixed adult and pediatric emergencies	28%
Other centers	27%
Regional pediatric emergencies	8%
Adult emergencies	8%

adult and pediatric ED and 29% in the ED of the hospital where the survey was conducted. Regarding the availability of neuroimaging, 66% stated a computed tomography (CT) scan is available at their center, while 24% have the possibility of referring the patient to another center. Regarding the observation time, 28% reported a maximum length of stay of 48 hours, 25% of more than 48 hours, and 22% of up to 24 hours. Primary assessment of the patients with mild TBI was by general practitioners in 73%, by pediatricians in 16%, and by a resident in pediatrics or pediatric surgery in 10%.

Availability of local guidelines for the management of TBI in children was reported by 41% of the respondents, of whom approximately 50% indicated that they included mild TBI. On the other hand, 59% reported no guidelines were available.

Regarding the first question about Case #1: How would you manage this patient initially? 41% of the respondents would perform a skull X-ray, while 30% would only observe the patient; on the other hand, 24% of the respondents would request a neuroimaging study upon admission; no response was obtained from the remaining participants. Of the group reporting that they would observe the patient, 10% would observe the patient for < 4 hours, while 72% would observe the patient for > 4 hours.

When the physicians who requested the radiograph were asked how the result of the radiograph would change their approach, 25% were not sure.

When comparing the years of clinical experience, it was found that 33% of the participants who would request an X-ray were physicians with < 5 years of work experience, while 27% of the physicians with a work experience of between 15-19 years would request a CT scan.

Regarding Case #2, when asked about the course of action to follow, 75% of the respondents reported that they would perform an urgent CT scan, while 20% would keep the patient in observation. The remaining percentage would request evaluation by another physician. For the following question, it was indicated that the patient with GCS of 15 had a CT scan without alterations two hours after the trauma; however, the child complained of headache and vomiting on two occasions. For the next step in the management of the patient, 87% responded they would keep the patient in observation in the ED, 9% would admit the patient, and 4% would discharge the patient.

For the following question, it was noted that 8 hours later the child continued with headache and nausea and a GCS of 15. When the physicians were asked about the next step in the management, 43% of the participants responded they would administer analgesia and continue the observation, 20% would discharge the patient with instructions, 17% would consult neurosurgery, 16% would request a CT scan, and 4% would admit the child to the hospital.

DISCUSSION

This study demonstrates the variability in the management of TBI in children. Part of the differences could be attributed to the difference in the availability of resources. Nevertheless, these differences can also be explained by the fact that 59% of respondents reported a lack of local management guidelines and that validated CDRs have not been incorporated into clinical practice. When applying CDRs to the first clinical case, using the CHALICE rule this child would not require a CT scan, with a sensitivity 98% to rule out mortality, need for surgical intervention, and abnormalities on neuroimaging[6]. Application of the PECARN rule would result in an observation period of 4-6 hours from the time of trauma; however, in the case of specific findings, such as a history of consciousness impairment, vomiting, headache, and scalp hematoma without palpable skull fracture, a CT scan could be considered, but with a clear understanding that it may be altered in less than 1%[4]. Finally, if the CATCH rule is applied, the only criterion that would qualify the patient as being at intermediate risk of injury is the soft parietal scalp hematoma; however, the study by Osmond et al. states that intermediate risk patients are those with large soft hematomas, without specifying the size. Therefore, in case 1, the size of the injury would be left to the discretion of the physician[5]. Palchack et al. point out that in children < 2 years of age with soft hematomas there is a higher likelihood of clinically significant injury[13]. Dayan et al. suggest that, if the lesion is an isolated scalp hematoma, a CT scan should not be considered[14].

For clinical case 1, 41% of the respondents would request a skull radiography, a decision that could be motivated by the lack of tomographic resources in the different centers. Chung et al. investigated the ability of pediatric emergency physicians to diagnose fractures on radiography, and reported a sensitivity of 76% with a specificity of 80%[15, 16]. Muñoz et al. conclude that clinical observation can be considered as a valid alternative to radiography in patients with mild TBI[17].

When applying the CDRs to clinical case 2, the CHALICE and PECARN rules agree on the need to perform a CT scan. When applying the CATCH rule, there is a discrepancy as to whether or not to consider the patient as being at intermediate risk, since the only criterion that classifies him as an intermediate-risk patient is that of a high-impact mechanism. In this case, the CDRs coincide with 75% of the respondents who would request a CT scan.

Vomiting has been reported in up to 13% of patients with mild TBI and most of these do not have clinically significant injuries[4]. It has also been found that increased frequency or delayed onset of vomiting is not associated with clinically significant lesions[18]. Headache may occur in up to 46% of children with mild TBI and may slightly increase the likelihood of clinically significant injury[19]. For the next step in the evaluation of the patient eight hours after the trauma, when he only suffered from nausea and mild headache, 43% of the respondents would have kept the patient in observation and only 20% would have discharged the patient with instructions. According to the guidelines of the Canadian Paediatric Society for the management of TBI, the recommendation in this case would be outpatient follow-up with symptomatic treatment[20].

CONCLUSION

Most children with mild TBI are initially managed by general practitioners, most of whom have < 5 years of work experience. Local guidelines for the management of mild TBI are often not available. Clinical criteria differ from CDRs regarding neuroimaging requests. At the national level, EDs need to establish management guidelines for mild TBI that include CDRs, in order to reduce observation times and imaging studies in patients who do not really require them.

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