

Received: 25 November 2020 // Accepted: 07 December 2020 / Published online: 30 December 2020

DOI 10.34689/SH.2020.22.6.007

UDC 616-053.2-073.756.8

THE EVALUATION OF PATIENT WITH CHILDHOOD MINOR HEAD TRAUMA ACCORDING TO CANADIAN ASSESSMENT OF TOMOGRAPHY FOR CHILDHOOD HEAD INJURY (CATCH) RULE

**Suleyman Altun^{1*},
Figen Coşkun²**

¹ Dışkapı Yıldırım Beyazıt Training and Research Hospital,
Emergency Department, Ankara, Turkey;

² Dokuz Eylül University Faculty of Medicine,
Emergency Department, İzmir, Turkey.

Aim: we aimed to test the reliability of Canadian Assessment of Tomography for Childhood Head Injury (CATCH) Rule in children with minor head injury.

Methods: It was performed prospectively on patients admitted due to minor head trauma. Patients were evaluated with CATCH rule and divided into 2 groups. Descriptive values are number and percentage for categorical data, mean \pm standard deviation for age expressed in terms. For categorical data in comparison of groups, Chi-Square and Fisher-Exact test, T test was used on independent samples for continuous data. $p < 0.05$ value was considered statistically significant.

Results: The most common cause of trauma was game and sports injuries. In our study, the CATCH rule has been calculated sensitivity 100%, specificity 48.5%, and negative predictive value was 51.5%.

Conclusion: We found the CATCH rule was very successful in reducing unnecessary CT shots.

Key words: head trauma, childhood, CATCH rule.

Резюме

ОЦЕНКА ПРИМЕНЕНИЯ КОМПЬЮТЕРНОЙ ТОМОГРАФИИ У ПАЦИЕНТОВ ДЕТСКОГО ВОЗРАСТА С МАЛОЙ ТРАВМОЙ ГОЛОВЫ В СООТВЕТСТВИИ С ПРАВИЛАМИ КАНАДСКОЙ ОЦЕНКИ ТОМОГРАФИИ ПРИ ТРАВМЕ ГОЛОВЫ У ДЕТЕЙ

**Сулейман Алтун^{1*},
Фиген Джошкун²**

¹ Учебно-исследовательская больница SB Dışkapı Yıldırım Beyazıt,
Отделение неотложной помощи, г. Анкара, Турция;

² Университет Докуз Эйлул, Медицинский факультет,
Отделение неотложной помощи,
г. Измир, Турция.

Цель: проверить надежность правил канадской оценки томографии для детской травмы головы (CATCH) у детей с легкой травмой головы.

Методы: проспективное исследование пациентов детского возраста, поступивших с легкой травмой головы. Пациентов оценивали в соответствии с правилами CATCH, их разделили на 2 группы. Применяли описательные значения - это число и процент для категориальных данных, среднее \pm стандартное отклонение для возраста, выраженное в терминах. Для категориальных данных при сравнении групп, критериев хи-квадрат и точного критерия Фишера, Т-критерий использовался в независимых выборках для непрерывных данных. Статистически значимым считалось значение $p < 0,05$.

Результаты: Наиболее частой причиной травмы были игровые и спортивные ситуации. В нашем исследовании по правилу CATCH была рассчитана чувствительность 100%, специфичность 48,5%, а прогностическая ценность отрицательного результата составила 51,5%.

Заключение: установлено, что правило CATCH очень эффективно сокращает количество ненужных СТ-исследований.

Ключевые слова: травма головы, детский возраст, правила CATCH.

Түйіндеме

АЗДАҒАН БАС ЖАРАҚАТЫ БАР БАЛАЛАРДЫҢ КОМПЬЮТЕРЛІК ТОМОГРАФИЯСЫН ПАЙДАЛАНА ОТЫРЫП БАЛАЛАРДАҒЫ БАС ЖАРАҚАТЫ КЕЗІНДЕГІ ТОМОГРАФИЯНЫ КАНАДАЛЫҚ БАҒАЛАУ ЕРЕЖЕЛЕРІНЕ СӘЙКЕС БАҒАЛАУ

**Сулейман Алтун ^{1*},
Фиген Джошкун ²**

¹ SB Diskapi Yildirim Beyazit оқыту-зерттеу ауруханасы, Анкара қ., Түркия;

² Догуз Эйлул университеті, Медициналық факультет, Шұғыл көмек бөлімі, Измир қ., Түркия.

Мақсат: Жеңіл бас жарақаты бар балаларда (CATCH) бас жарақатына арналған томографияны канадалық бағалау ережелерінің сенімділігін тексеру.

Әдістер: Жеңіл бас жарақатымен түскен бала жасындағы науқастарды проспективті зерттеу. Науқастарды CATCH ережелеріне сәйкес бағалап, оларды 2 топқа бөлді. Сипаттамалы мағына қолданылды - санатты деректерге ол сан және пайыз, жастың орта стандартты ауытқуы, терминдермен көрсетілген. Топтарды салыстыру кезінде категориялық деректерге, Фишердің нақты критерийі және хи-квадрат критерийіне, Т - критерийі үздіксіз деректер үшін тәуелсіз таңдауларда қолданылған, $p < 0.05$ мәні статистикалық мағынаға ие саналған.

Нәтиже: Жарақаттың ең жиі себебі ойын және спорт жағдайлары болған. CATCH ережелері бойынша біздің есептелінген зерттеуімізде сезімталдық 100%, ерекшелік 48,5%, теріс нәтиженің болжамды құндылығы 51,5% құрады.

Қорытынды: CATCH ережесі керегі жоқ СТ – зерттеулерінің санын өте тиімді қысқартатыны туралы анықталды.

Түйінді сөздер: бас жарақаты, бала жасындағы, CATCH ережесі.

Bibliographic citation:

Altun S., Coşkun F. The evaluation of patient with childhood minor head trauma according to Canadian Assessment of Tomography for Childhood Head Injury (CATCH) Rule // *Nauka i Zdravookhranenie* [Science & Healthcare]. 2020, (Vol.22) 6, pp. 49-53. doi 10.34689/SH.2020.22.6.007

Алтун С., Джошкун Ф. Оценка применения компьютерной томографии у пациентов детского возраста с малой травмой головы в соответствии с правилами канадской оценки томографии при травме головы у детей // *Наука и Здравоохранение*. 2020. 6(Т.22). С. 49-53. doi 10.34689/SH.2020.22.6.007

Алтун С., Джошкун Ф. Аздаған бас жарақаты бар балалардың компьютерлік томографиясын пайдалана отырып балалардағы бас жарақаты кезіндегі томографияны канадалық бағалау ережелеріне сәйкес бағалау // *Ғылым және Денсаулық сақтау*. 2020. 6 (Т.22). Б. 49-53. doi 10.34689/SH.2020.22.6.007

Introduction

Head trauma is one of the most common and important causes of morbidity and mortality in childhood. [1-3]. Usually most of the minor head injuries are managed in emergency rooms [1,4]. From the 1980s CT, which has a privileged place especially in head trauma, its use will have attracted attention all over the world over time, Studies have been started to minimize unnecessary CT shots in the world [4-9]. Patients with minor head trauma have to take a CT scan and / or make a decision to observe risk scores is used [4,10,11]. Patients in the low risk group, with close follow-up CT may not be taken. Medium and high risk patients, it is recommended CT scan and long time observation in the emergency room [4,5,10,12].

In this study, we aimed to test the reliability of Canadian Assessment of Tomography for Childhood Head Injury (CATCH) Rule in children with minor head injury.

Materials and Methods:

This study was conducted between July 15, 2010 - July 15, 2011 at Ministry of Health Ankara Training and Research Hospital Emergency Medicine Clinic. It was performed prospectively on patients admitted due to minor head trauma. Study was worked properly to Helsinki Declaration and Good Clinical Practices Directive. A total of 200 patients with minor head trauma between the ages of 1 and 16 years were included to this study. Patients were evaluated with CATCH rule and divided into 2 groups. 100 patients taken tomography as Group 1, and 100 patients not taken tomography as Group 2 was defined.

Controls were made on the 1st, 7th and 14th days of the patients included in the study. Age and gender of the patients mechanism of trauma, symptoms and signs, whether or not CT was taken, if CT was taken outcomes were recorded in standard forms. The emergencies were

verbally explained to the patients who did not taken CT, before discharge from the emergency room.

Statistical analysis

Statistical evaluation of the data was made with SPSS for Windows 15.0 package program. Descriptive values are number and percentage for categorical data, mean ± standard deviation for age expressed in terms. For categorical data in comparison of groups, Chi-Square and Fisher-Exact test, T test was used on independent samples

for continuous data. p <0.05 value was considered statistically significant.

Results

Of the patients included in the study, 131 (65.5%) were male and 69 (34.5%) were female. Those with CT scanner the mean age was 5.74 ± 4.40 years, it was 5.57 ± 3.54 years for those who did not taken CT. The most common cause of trauma was game and sports injuries (Table 1).

Table 1.

Characteristics of patients.

Variable		Not CT taken	CT taken	p
Gender	Male/female	64/36	67/33	0.655
Age		5,74±4,40	5,57±3,54	0.764
Cause of trauma	Play and sports injulies	46(%)	26(%)	0.000
	Fall from <91 cm	8(%)	0(%)	0.000
	Fall from ≥91 cm	0(%)	46(%)	0.000
	Crash	46(%)	23(%)	0.001
	Fall from bicycle	0(%)	3(%)	0.081
	Pedestrian accident	0(%)	2(%)	0.155
Symptom	Nausea	0	25(%)	
	Vomiting	0	30(%)	
	Progresif headache	0	37(%)	
	Scalp hematoma	24(%)	25(%)	0.869
	Scalp laceration	40(%)	30(%)	0.138
	Fracture sign	0	1(%)	
	Confusion	0	4(%)	

The risk distribution of patients who taken CT was calculated according to CATCH rule. 59 (29.5%) patients in the high risk group, 41 (20.5%) patients were in the medium risk group (Table 2).

Table 2.

The risk distribution of patients CT taken according to CATCH rule.

CATCH rule	Number	%
High risk		
GCS <15 at 2 hours after injury	4	4%
Suspected open or depressed skull fracture	6	6%
History of worsening headache	37	37%
Irritability on exam	12	12%
Medium risk		
Any signs of basal skull fracture	1	1%
Large boggy scalp hematoma	1	1%
Dangerous mechanism of injury	39	39%

Pathological findings were found in 6 (6%) patients in the CT taken group (Table 3). In the group not taken BT there is no finding was found as a result of follow-up. In our study, the CATCH rule has been calculateted sensitivity 100%, specificity 48.5%, and negative predictive value was 51.5%.

Table 3.

Pathological CT findings.

CT outcome	N (%)
Linear fracture	3 (3%)
Depressed skull fracture	1 (1%)
Epidural hematoma	1 (1%)
Cerebral confusion	1 (1%)

Discussion

In our study, sensitivity of the CATCH rule was 100%, specificity 48.5%, negative predictive value was calculated as 51.5%. Osmand et al. had 100% sensitivity 70.2% specificity reported [5]. Kavalcı et al. were reported the sensitivity and specificity of Canadian CT Head Rule (CCHR) that they were 76.4% and 41.7% respectively [8].

In our study, the most common pathology in CT outcomes was isolated linear fracture (3%). Katırcı et al reported that Linear fracture was the most common pathology in the study [3]. Our results are consistent with the literature.

In our study, the average age of the cases was calculated as 5.66 years. It has been reported in the literature that head injuries peak under 5 years of age [10]. Our In our study, the average age was found to be higher. The reason for this is 1 year six children being excluded from the study and the result of increased parental education and awareness It can be shown that trauma measures are more successful.

Head injuries are more common in men than women [5,13,14]. 200 cases participating in our study 131 (65.5%) male and 69 (34.5%) consisted of girls. Boys are more play on the street than girls they may be more exposed to trauma.

Falls and crashes as the most common mechanism of trauma in the literature, motor vehicle accidents were reported subsequently [4,8,15]. Osmond et al. In their study, the most cause of head trauma was falls with a rate of 44.9%, while the second sports injuries were reported with 22.6% [5]. 200 patients included in our study, when trauma mechanisms are examined, the most common reasons are

sports and game injuries (36%), and head collisions (34.5%). It is seen as the cause and it is followed by falls from height (27%). Trauma mechanisms observed in our study are different from the order in the literature. The reason for this is both falling from height and straight taking falls on the ground, we evaluated these patients in the CATCH rule as a fall criteria. In our study, motor vehicle accidents were found to be scarcely. This is because we only get minor head injuries and most motor vehicle accidents cause severe head injuries.

The most common symptom in patients with head trauma is headache. When literature examined, Alexander et al. compared patients with minor and severe traumatic brain injury (TBI) and 87% in patients with minor TBI, 38% in patients with severe TBI they found a headache [16]. Nee et al. in a study, they have done they found vomiting at a rate of 28% in adults and 33% in children in TBI [17]. In our study, we detected the most common symptom in patients was nausea-vomiting, with a rate of 25.5% and progressive headache was the second most common (18.5%). Our headache and vomiting symptoms in our study are similar to those in the literature.

CATCH rule include high indications for CT imaging in head injuries and are evaluated in two groups as medium risk and high risk. In our study, a total of 59 (29.5%) patients had high risk criteria. Most frequent from the high risk group worsening headache (18.5%), the second most common irritability on examination (6%) has been observed. Osmond et al. reported the rate of patients meeting the high risk criteria was reported as 30.2%, they have made most frequently worsened headache with a rate of 16.1%, the second most common irritability took place with a rate of 10.8% [5]. Our study was almost completed with the work of Osmond et al. has the same results. Osmond et al. reported in their 3866 person studies, reported the number of patients who met Canadian rule 81.1%, 50.1% of these patients meet medium risk criteria and dangerous trauma mechanism is the most common 31% in the medium risk group [5]. The results of our study and that of Osmond et al. are parallel. Apart from this study, there has been found no stud conducted in the childhood age group based on Canadian rule. Studies conducted on adults with Canadian criteria have been described, However, the Canadian criteria prepared for adult and childhood age groups are different from each other [4]. This is due to the different rates of trauma mechanisms in the childhood age group, anatomy and the direct and indirect effects of traumas on childhood different effects can be shown.

In our study, pathological findings were detected on CT in 6 (3%) patients. This rate is 6% in the case group undergoing CT. All of these cases are they have been treated with conservative methods. There was no sequelae in any patient. Osmond and et al. detected pathological findings in CT at a rate of 4.1% in their studies, however, they did not include linear fractures in this group. 4.3% in the same study a linear fracture has been reported. Surgical intervention was performed in 0.6% of the patients [5]. In some other studies reported approximately 5% have been abnormal CT findings of minor head trauma patients with GCS 15 who apply to emergency services [18,19]. The rates are similar in our study. In our study, the low number

of patients and not being a primary child trauma center, constituted a limiting factor.

Osmond e al. reported rate of positive disease in patients outside the Canadian criteria is under 1% [5]. In our study, 100 (50%) patients who did not have CT no problem was found. This situation reduces the possibility of abnormal CT. Although not excluded, it is an important indicator of mortality and morbidity. So CT Positive disease rate is 0% in patients who are not taken CT. In this case, the Canadian criteria Patients who did not undergo CT were protected from unnecessary radiation exposure. In addition, unnecessary labor and cost are prevented.

Despite the small number of cases in our study, the results are quite satisfactory. Morbidity and mortality were not encountered in any of our patients.

Conclusion

We found the CATCH rule was very successful in reducing unnecessary CT shots. However, proving the suitability of these criteria for our country and, if necessary, a large number of patients to establish new modified criteria around these criteria and multi-center studies are needed.

Conflict of Interesting: No conflict

Limitation of study: The most limitation of study, it is the low number of cases.

Funding: There is no financial support and sponsorship

Conflict of Interests: The authors declare that they have no conflict of interest.

Contribution of the authors to the study:

Suleyman Altun - literature search, writing a review, developing ideas and concepts;

Figen Coşkun - developing ideas and concepts, methodologically assessing the quality of the articles included, writing a review;

Financing: During this work, there was no funding from outside organizations and medical missions.

References:

1. *Stiell I.G., Lesiuk H., Wells G.A., McKnight R.D., Brison R., Clement C., Eisenhauer M.A., Greenberg G.H., MacPhail I., Reardon M., et al.* The Canadian CT head rule study for patients with minor head injury: rationale, objectives, and methodology for phase I (derivation). *Ann Emerg Med.* 2001;38(2):160–9.
2. *Morton M.J., Korley F.K.* Head computed tomography use in the emergency department for mild traumatic brain injury: integrating evidence into practice for the resident physician. *Ann Emerg Med* 2012;60(3):361-7.
3. *Katırcı Y., Ocak T., Karamercan M.A., Kocaşaban D., Yurdakul M.S., Başpınar İ., Coşkun F.* Compliance with Catch Rules in Administerig Computerized Tomography Scans to Children Admitted to the Emergency Department with Minor Head Trauma. *Acta Medica Mediterranea* 2013; 29: 717-22
4. *Stiell I.G., Wells G.A., Vandemheen K., et al.* The Canadian CT Head Rule for patients with minor head injury. *Lancet* 2001;357:1391.
5. *Osmond M.H., Klassen T.P., Wells G.A., et al.* CATCH: a clinical decision rule for the use of computed tomography in children with minor head injury. *CMAJ.* 2010; 182(4): 341-348.

6. Bouda W., Marghli S., Souissi S., Ksibi H., Methammem M., Haguiga H., Khedher S., Boubaker H., Beltaiief K., Grissa M.H., et al. Prediction value of the Canadian CT head rule and the New Orleans criteria for positive head CT scan and acute neurosurgical procedures in minor head trauma: a multicenter external validation study. *Ann Emerg Med.* 2013; 61(5): 521–7.

7. Gimbel R.W., Pirralo R.G., Lowe S.C., Wright D.W., Zhang L., Woo M.J. et al. Effect of clinical decision rules, patient cost and malpractice information on clinician brain CT image ordering: a randomized controlled trial. *BMC Medical Informatics and Decision Making* 2018; 18: 20. <https://doi.org/10.1186/s12911-018-0602-1>

8. Kavalci C., Aksel G., Salt O., Yilmaz M.S., Demir A., Kavalci G., Akbuga Ozel B., Altinbilek E., Durdu T., Yel C., Durukan P., Isik B. Comparison of the Canadian CT head rule and the new orleans criteria in patients with minor head injury. *World J Emerg Surg.* 2014 Apr 17;9:31. doi: 10.1186/1749-7922-9-31.

9. Melnick E.R., Szlezak C.M., Bentley S.K., Dziura J.D., Kotlyar S., Post L.A. CT overuse for mild traumatic brain injury. *Jt Comm J Qual Patient Saf.* 2012;38:483–9.

10. Haydel M.J., Preston C.A., Mills T.J., et al. Indications for computed tomography in patients with minor head injury. *N Engl J Med* 2000;343:100-43.

11. Sharp A.L., Nagaraj G., Rippberger E.J., Shen E., Swap C.J., Silver M.A., McCormick T., Vinson D.R., Hoffman J.R. Computed tomography use for adults with head injury: describing likely avoidable emergency

department imaging based on the Canadian head CT rule. *Acad Emerg Med.* 2017; 24(1): 22–30.

12. Lindor R.A., Boie E.T., Campbell R.L., Hess E.P., Sadosty A.T. Failure to obtain computed tomography imaging in head trauma: a review of relevant case law. *Acad Emerg Med.* 2015;22:1493–8.

13. Mirzai H., Yağlı N., Tekin I. Epidemiologic and clinical features of cases applying to Celal Bayar University emergency unit with head trauma. *Ulus Travma Acil Cerrahi Derg.* 2005;11(2):146-52.

14. Klassen T.P., Reed M.H., Stiell I.G., 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.

15. Mary L. Thiessen, Dale P. Woolridge. Pediatric Minor Closed Head Injury. *Pediatr Clin N Am* 2006: (53)1-26.

16. Alexander M.P. Mild traumatic brain injury. *Neurology* 1995;45: 1253-60.

17. Nee P.A., Hadfield J.M., Yates D.W., Faragher E.B. Significance of vomiting after head injury *J Neurol Neurosurg Psychiatry* 1999;66:470–473

18. Iverson G.L. Outcome from mild traumatic brain injury. *Curr Opin Psychiatry* 2005;18:301.

19. Syed A.T., Lone N.A, Wani M. Afzal, Bhat A.S. Clinical Management of Patients with Minor Head Injuries. *International Journal of Health Sciences.* 2007;1(1):131-140.

*** Corresponding Author**

Suleyman Altun - Dışkapı Yıldırım Beyazıt Training and Research Hospital, Emergency Department, Ankara/Turkey

E-mail: s.altun.dr@gmail.com

Phone: +905059438999