Article Appraisal

Article: Validation and refinement of a clinical decision rule for the use of Computed Tomography in Children with minor head injury in the ED. CMAJ. July 2018.

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Background and Study Objective(s):

Pediatric Head Injury/Traumatic Brain Injury is a very common presenting complaint in the Emergency Department (ED). Mild Traumatic Brain Injury (TBI) is classified as those presenting with a GCS of 14-15 and compromise > 80% of all head injuries.   With rates of Computed Tomography (CT) increasing in Canadian EDs, multiple Clinical Decision Rules have been developed to help risk stratify these patients. The Canadian Assessment of Tomography for Childhood Head Injury (CATCH) rule was developed from a cohort of 3866 children in 2010 to predict the need for neurosurgical intervention or brain injury on CT after Minor Head Injury and a presenting GCS of 13-15. The aim of this study was to prospectively validate the CATCH rule in a new cohort of pediatric patients with a secondary goal of potential rule refinement to improve its performance.

Study Design:

This was a prospective multicenter cohort study from 9 different pediatric EDs across Canada from 2006-2009. Children (age 0 -16) were eligible for enrolment if they presented with all of the following: 1) Blunt head trauma resulting in witnessed loss of consciousness, amnesia, disorientation, persistent vomiting (> 2 episodes at least 15 min apart), or persistent irritability for children 2 years old or younger; 2) Initial GCS of > 13; and 3) Injury within the last 24 hours. Children were excluded if there was an obvious penetrating skull injury or depressed fracture, a focal neurological deficit, chronic developmental delay, suspected child abuse, if they returned for reassessment of the same head injury, or they

were pregnant.

Patients were assessed by Emergency Physicians or Senior Residents who then completed forms with 15 variables including their interpretation of the CATCH rule. CT scans were ordered based on Physicians clinical judgement and were reviewed by Staff Radiologists. No clinically significant brain injury was classified if the patient received no CT or had a negative CT, received no Neurosurgical intervention, and was asymptomatic on follow up telephone interview at 14 days.

Results:

A total of 4060 patients were included with a mean age of 9.7 years (1 month - 16 years). The overall rate of neurosurgical intervention was 0.6% and rate of brain injury on CT was 4.9%. For the primary outcome of the accuracy of the CATCH rule predicting neurosurgical intervention, it was 91.3% sensitive and 57% specific. For the secondary outcome, the accuracy of the CATCH rule predicting brain injury on CT, it was 97.5% sensitive and 59.6% specific. By adding the additional variable "vomiting > 4 episodes", the sensitivity improved to 100% and 99.5% and specificity to 45.7% and 47.8%, for the primary and secondary outcomes, respectively.

Validity of Results:

This peer-reviewed cohort study outlined a primary aim to prospectively validate the CATCH rule and a secondary aim to refine the rule and improve its performance. The sample size, inclusion and exclusion criteria were appropriate for this study. The baseline characteristics of enrolled patients were similar to missed eligible patients. 434 patients (9.7%) were excluded from the final results as they had inadequate follow-up at 14 days, and could not be reached by telephone despite multiple attempts. However, this is in keeping with other similar studies. Overall, there were no significant concerns with the design, methodology, or statistics of the study.

Generalizability of Results:

This study was conducted across 9 pediatric EDs in Canada which was felt to make the results generalizable to our overall patient population. Specifically the population seen in these EDs reflects commonly seen presentations in our community with ages of patient between 1 month and 16 years with a mean of 9.7 years of age and common mechanisms of injury such as falls, sports, bicycle accidents, and head struck.

The Bottom Line:

The original CATCH rule was only 91% sensitive for predicting the need for neurosurgical intervention. This is too low for a clinically useful rule. With refinement, the authors created a new clinical decision rule (CATCH2) with the addition of the variable "vomiting > 4 episodes" to the original CATCH criteria. The sensitivity of CATCH2 was significantly improved albeit with some decrease in specificity. The improved sensitivity makes the

CATCH2 rule a reasonable clinical decision rule moving forward. With only 8 criteria it is practical and easy to use, however it does have some limitations.

Journal Club attendees agree that the CATCH2 rule is not ready for primetime, it firstly needs to be prospectively validated before widespread use. We also agree that if used alone, it would lead to excessive use of CT in the ED which has inherent risk. CT scans in this study were ordered based on clinical judgement with a rate of ~35%. The original CATCH rule would have had a similar rate, however with the decreased specificity of the CATCH2 rule, it would have had a CT rate of 55%.

A recent prospective study by Babl et al. published in June 2018 in the Annals of Emergency Medicine of ~ 40,000 patients from New Zealand, estimated CT rates based on clinical judgement to be ~9%, significantly lower that the 35% seen in this study. They, however, had much lower rates of clinically significant TBI (~1%) than brain injury on CT seen in this study (4.9%).

Babl et al. also found that clinical practice had very good sensitivity (98.5%) that was similar to PECARN and better than the CATCH and CHALICE rules, but much higher specificity (92.4%) than all of them, for detecting clinically significant TBI. This is in keeping with our groups final position, that no clinical decision rule at this time is as accurate as clinical judgement. These rules play a role in standardizing research and in education, especially to aid in improving clinical judgement for junior learners. However they have a limited role in improving experienced providers ability to detect clinically significant brain injury and may increase the use of CT in pediatric patients presenting with mild TBI in the ED.