PECARN traumatic brain injury algorithm

see https://www.mdcalc.com/pecarn-pediatric-head-injury-trauma-algorithm

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Evidence-based guidelines used to identify children with clinically insignificant traumatic brain injury who do not require Head computed tomography was developed by the Pediatric Emergency Care Applied Research Network (PECARN).

In adult patients with mild traumatic brain injury, elevated serum glucose and white blood cells count (WCC) have been associated with abnormal head CT findings. Currently, glucose or WCC is not considered in pediatric patients. The objective of this study was to determine if elevations in glucose or WCC could be used as additional tools to risk-stratify pediatric trauma patients for intracranial injury (ICI). Data were abstracted from the Maryland Trauma Registry and from electronic medical records for patients at the Johns Hopkins Children's Center from 2017 to 2020. We evaluated 145 encounters that met the inclusion criteria. There were 33 cases of ICI on CT. In addition to higher median glucose and WCC, we found that patients with ICI had a younger median age and were less likely to have other clinically significant injuries than patients without ICI. Following multiple logistic regression analysis, WCC (OR 1.113, 95% CI 1.02 to 1.21), younger age (OR 0.89, 95% CI 0.8 to 0.98), and absence of other injuries (OR 0.41, 95% CI 0.23 to 0.73) were found to be associated with risk of ICI. The area under the curve for our model was 0.79. When used with the PECARN algorithm, our model could help determine which patients may avoid head CT or undergo a shorter observation period [1)]

age <2 years

normal mental status

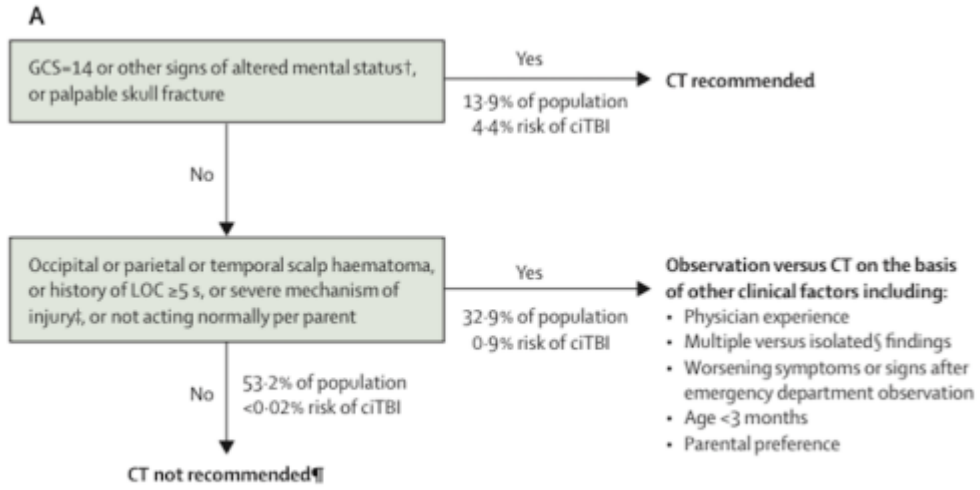
normal behavior per routine caregiver

no loss of consciousness (LOC)

no severe mechanism of injury

no non-frontal scalp hematoma

no evidence of skull fracture



age ≥2 to 18 years

normal mental status

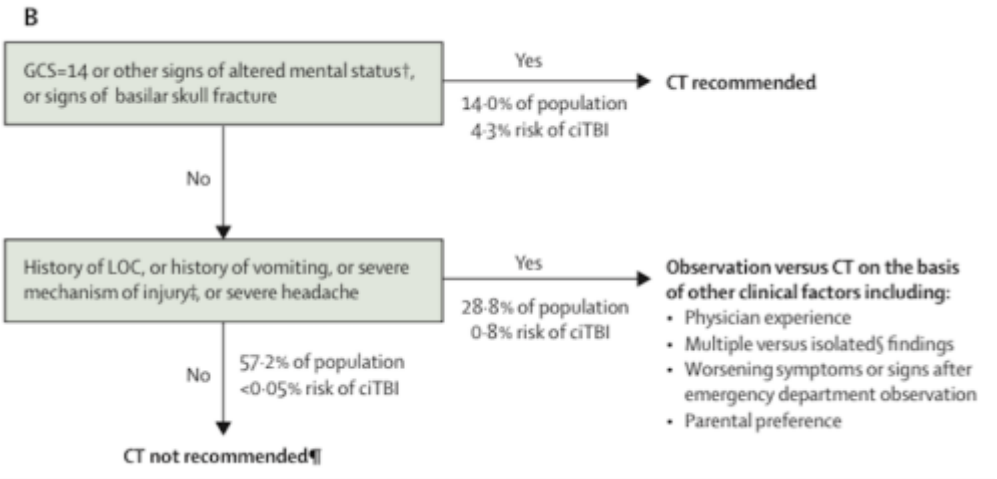
no loss of consciousness (LOC)

no severe mechanism of injury

no vomiting

no severe headache

no signs of basilar skull fracture.



Safety and validity

Transfer and admission were unnecessary and costly in Pediatric Mild Traumatic Brain Injury who met the following criteria: blunt, no concern for Non-accidental trauma, low risk on PECARN assessment, or

intermediate-risk on PECARN with negative imaging or imaging with either isolated, nondisplaced skull fractures without ICH and/or EDH, or SDH <0.3 cm with no midline shift [2].

Gambacorta et al. demonstrated the safety and validity of the PR with 100% sensitivity in both age groups in identifying patients with ciTBI and theoretically in reducing performed CT scans by 29%. Therefore, in patients classified in the low-risk category, it is a duty not to expose the child to ionizing radiation.

What is Known: • CT is the gold standard to identify intracranial pathology in children with head injury but CT imaging of head-injured children expose them to higher carcinogenic risk.

• PECARN Rules support doctors in identifying children with ciTBI in order to reduce exposure to ionizing radiation [3].

Planned ED observation in selected children with minor head trauma is cost-effective for reducing CT use for the PECARN intermediate-risk and high-risk categories [4].

Of 15,163 children, 4,011 (25.5%) were aged <2 years. The frequency of ciTBI was 8.5% (95% CI = 6.0%-11.6%), 0.2% (95% CI = 0.0%-0.6%), and 0.0% (95% CI = 0.0%-0.2%) in the high-, intermediate-, and very-low-risk groups, respectively, for children <2 years and 5.7% (95% CI = 4.4%-7.2%), 0.7% (95% CI = 0.5%-1.0%), and 0.0% (95% CI = 0.0%-0.1%) in older children. The isolated high-risk predictor with the highest risk of ciTBI was “signs of palpable skull fracture” for younger children (11.4%, 95% CI = 5.3%-20.5%) and “signs of basilar skull fracture” in children ≥2 years (11.1%, 95% CI = 3.7%-24.1%). For older children in the intermediate-risk category, the presence of all four predictors had the highest risk of ciTBI (25.0%, 95% CI = 0.6%-80.6%) followed by the combination of “severe mechanism of injury” and “severe headache” (7.7%, 95% CI = 0.2%-36.0%). The very few children <2 years at intermediate risk with ciTBI precluded further analysis The risk estimates of ciTBI for each of the PECARN algorithms risk group were consistent with the original PECARN study. The risk estimates of ciTBI within the high- and intermediate-risk predictors will help further refine clinical judgment and decision making on neuroimaging [5].

PECARN prediction rule has a proper validity in the prediction of ciTBI. Therefore it can be used for screening and identification of high risk children with mild TBI [6].

In external validation, the age-based PECARN TBI prediction rules accurately identified children at very low risk for a clinically significant TBI and can be used to assist CT decision-making for children with minor blunt head trauma [7]

Kuppermann et al. analyzed 42 412 children (derivation and validation populations: 8502 and 2216

younger than 2 years, and 25 283 and 6411 aged 2 years and older). We obtained CT scans on 14 969 (35.3%); ciTBIs occurred in 376 (0.9%), and 60 (0.1%) underwent neurosurgery. In the validation population, the prediction rule for children younger than 2 years (normal mental status, no scalp hematoma except frontal, no loss of consciousness or loss of consciousness for less than 5 s, non-severe injury mechanism, no palpable skull fracture, and acting normally according to the parents) had a negative predictive value for ciTBI of 1176/1176 (100.0%, 95% CI 99.7-100 0) and sensitivity of 25/25 (100%, 86.3-100.0). 167 (24.1%) of 694 CT-imaged patients younger than 2 years were in this low-risk group. The prediction rule for children aged 2 years and older (normal mental status, no loss of consciousness, no vomiting, non-severe injury mechanism, no signs of basilar skull fracture, and no severe headache) had a negative predictive value of 3798/3800 (99.95%, 99.81-99.99) and sensitivity of 61/63 (96.8%, 89.0-99.6). 446 (20.1%) of 2223 CT-imaged patients aged 2 years and older were in this low-risk group. Neither rule missed neurosurgery in validation populations.

These validated prediction rules identified children at very low risk of ciTBIs for whom CT can routinely be obviated [8].

Clinically important traumatic brain injury

see Clinically important traumatic brain injury.

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