

Predicting intracranial traumatic findings on computed tomography in patients with minor head injury: the CHIP prediction rule.

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Abstract

BACKGROUND:

Prediction rules for patients with minor head injury suggest that the use of computed tomography (CT) may be limited to certain patients at risk for intracranial complications. These rules apply only to patients with a history of loss of consciousness, which is frequently absent.

OBJECTIVE:

To develop a prediction rule for the use of CT in patients with minor head injury, regardless of the presence or absence of a history of loss of consciousness.

DESIGN:

Prospective, observational study.

SETTING:

4 university hospitals in the Netherlands that participated in the CT in Head Injury Patients (CHIP) study.

PATIENTS:

Consecutive adult patients with minor head injury (> or =16 years of age) with a Glasgow Coma Scale (GCS) score of 13 to 14 or with a GCS score of 15 and at least 1 risk factor. Exclusion criteria were transfer from another hospital, contraindications for CT, or concurrent injuries precluding a head CT at presentation.

MEASUREMENTS:

Outcomes were any intracranial traumatic CT finding and neurosurgical intervention. The authors performed logistic regression analysis by using variables from existing prediction rules and guidelines, with internal validation by using bootstrapping.

RESULTS:

3181 patients were included (February 2002 to August 2004): 243 (7.6%) had intracranial traumatic CT findings and 17 (0.5%) underwent neurosurgical intervention. A detailed prediction rule was developed

from which a simple rule was derived. Sensitivity of both rules was 100% for neurosurgical interventions, with an associated specificity of 23% to 30%. For intracranial traumatic CT findings, sensitivity and specificity were 94% to 96% and 25% to 32%, respectively. Potential CT reduction by implementing the prediction rule was 23% to 30%. Internal validation showed slight optimism for the model's performance.

LIMITATION:

External validation of the prediction model will be required.

CONCLUSION:

The authors propose the highly sensitive CHIP prediction rule for the selective use of CT in patients with minor head injury with or without loss of consciousness.

*Appendix Table 1. Univariable Analysis of Variables That Were Entered into the Multivariable Logistic Regression Analysis**

Variable	Patients with an Intracranial Traumatic Finding on CT (n = 243)	Odds Ratio (95% CI)	P Value	Nagelkerke R ²
Age, y	48.2	1.2 (1.1–1.3)†	0.000	0.025
Trauma mechanism, n (%)			0.000	0.022
Other	102 (5)	1.0 (reference)		
Pedestrian or cyclist versus vehicle	51 (15)	3.2 (2.2–4.5)		
Fall from any elevation	82 (10)	2.2 (1.6–2.9)		
Ejected from vehicle	8 (12)	2.6 (1.2–5.6)		
Symptoms				
Persistent anterograde amnesia, n (%)	72 (15)	2.7 (2.0–3.6)	0.000	0.028
Vomiting, n (%)	55 (16)	2.7 (2.0–3.7)	0.000	0.023
PTA duration, min	75	1.7 (1.4–2.0)‡	0.000	0.032
Loss of consciousness, n (%)	182 (9)	2.0 (1.5–2.7)	0.000	0.016
Headache, n (%)			0.058	0.004
No	84 (6)	1.0 (reference)		
Diffuse	120 (9)	1.4 (1.1–1.9)		
Localized	39 (7)	1.1 (0.7–1.7)		
Posttraumatic seizure, n (%)	5 (22)	3.4 (1.3–9.3)	0.001	0.003
External evidence of injury, n (%)				
Signs of skull fracture	36 (49)	14 (8.4–22)	0.000	0.070
Contusion of the skull	140 (12)	2.4 (1.8–3.1)	0.000	0.030
Signs of facial fracture	24 (10)	1.3 (0.9–2.1)	0.193	0.001
Contusion of the face	118 (7)	0.8 (0.7–1.1)	0.194	0.001
Neurologic examination				
Mean inverse GCS score upon presentation (15 – GCS score)	0.57	2.3 (1.9–2.7)	0.000	0.048
Neurologic deficit, n (%)	42 (14)	2.1 (1.5–3.1)	0.000	0.012
Change in GCS score at 1 h	–0.04	0.8 (0.7–1.0)	0.009	0.004
Use of anticoagulant therapy, n (%)	13 (16)	2.3 (1.3–4.3)	0.005	0.005
Intoxication, n (%)			0.002	0.002
No	164 (9)	1.0 (reference)		
Mild	18 (6)	0.7 (0.4–1.2)		
Moderate	22 (4)	0.4 (0.3–0.7)		
Severe	39 (9)	1.1 (0.7–1.5)		

* For continuous variables, the mean for patients with an intracranial finding on CT is shown. CT = computed tomography; GCS = Glasgow Coma Scale; PTA = posttraumatic amnesia.

† Per 10 y.

‡ Per 60 min of PTA.