

# A decision rule with 7 clinical criteria identified patients with minor head injury who did not need computed tomography

Haydel MJ, Preston CA, Mills TJ, et al. Indications for computed tomography in patients with minor head injury. *N Engl J Med.* 2000 Jul 13;343:100-5.

**QUESTION**

In patients with minor head injury, can a clinical decision rule using 7 clinical criteria identify those patients who do not need computed tomography (CT) scanning?

**DESIGN**

2 cohort studies, one for derivation and one for validation of the clinical criteria.

**SETTING**

A large, inner-city, level-1 trauma center in New Orleans, Louisiana, United States.

**PATIENTS**

Consecutive patients with minor head injury (loss of consciousness with normal findings on a brief neurologic examination and a score of 15 on the Glasgow Coma Scale) in 2 phases (520 in the derivation set, 909 in the validation set, each with mean age 36 y, 65% men). Inclusion criteria were age  $\geq$  3 years and presentation < 24 hours after injury.

**DESCRIPTION OF PREDICTION GUIDE**

Prognostic clinical criteria recorded before CT scanning in the derivation set were age

and presence of headache, vomiting, drug or alcohol intoxication, short-term antegrade memory deficits, seizure, history of coagulopathy, and physical evidence of trauma above the clavicles. For the validation set, the same criteria, excluding history of coagulopathy, were recorded before CT scanning. Patients were separated into 2 groups: those who had 0 findings and those who had  $\geq$  1 of the 7 findings. All patients had CT scanning.

**MAIN OUTCOME MEASURE**

Abnormal CT scan.

**MAIN RESULTS**

36 (6.9%) patients from the derivation set and 57 patients (6.3%) from the validation set had an abnormal CT scan. All of these patients had  $\geq$  1 of the clinical findings before CT scanning (sensitivity 100%,

specificity 25%) (Table). The absence of all of the 7 findings ruled out an abnormal CT scan for the derivation sample (negative predictive value 100%).

**CONCLUSION**

In patients with minor head injury, the absence of 7 clinical criteria identified patients who did not need computed tomography scanning.

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**Presence of  $\geq$  1 of 7 criteria (antegrade memory deficit, intoxication, trauma, > 60 y of age, seizure, headache, and vomiting) to identify abnormal CT scan results in patients with minor head injury\***

Injury	Sensitivity (95% CI)	Specificity (CI)	+LR	-LR
All injuries	100% (95 to 100)	25% (22 to 28)	1.3	0

\*LRs defined in Glossary and calculated from data in article.

**COMMENTARY**

Although the studies by Haydel and Hoffman and their colleagues use somewhat different methods, they reach remarkably similar conclusions about the initial management of 2 important clinical problems in the ED: minor head injury and suspected (blunt) injury to the neck. In traditional practice, almost all patients with minor head injuries have CT scans, and those with suspected neck injuries have radiography of the cervical spine. The 2 studies show that for both conditions a small but important clinically identifiable subset of patients can have imaging studies safely omitted.

The decision rules in both studies are based on a sufficiently large number of signs, symptoms, and other clinical attributes to guarantee essentially perfect sensitivity at the cost of very low specificity. Thus, the decision rules are typical screening instruments: They are most valuable in the context of high occurrence rates in busy EDs. In such settings, the systematic implementation of the decision rules in these 2 groups of

patients may reduce imaging costs by approximately 20%.

Defensive physicians might argue that no decision rule is perfect. To guard against even the smallest risk for missing an occult intracranial hemorrhage or an unstable cervical fracture, they routinely order imaging procedures on all patients on the basis of the unspoken assertion that the risks and costs of the procedures are less than those of not ordering the tests. The 2 studies allow us to bracket the risks of omission. Taking a somewhat broader view, the quest for total certainty can actually negatively affect the health of a population. Health care budgets, however large, are limited; every additional procedure done implies that some other health care activity must be curtailed (1). The studies allow us to identify patients in whom imaging would provide marginal cost-benefits. Not ordering radiologic procedures for patients identified by the decision rules as low risk, therefore, can improve the overall quality of health care.

*(continued on page 75)*

# Absence of 5 clinical criteria ruled out cervical-spine injury in blunt trauma in the emergency department

Hoffman JR, Mower WR, Wolfson AB, Todd KH, Zucker MI, for the National Emergency X-Radiography Utilization Study Group. *Validity of a set of clinical criteria to rule out injury to the cervical spine in patients with blunt trauma.* N Engl J Med. 2000 Jul 13;343:94-9.

## QUESTION

In patients with blunt trauma to the cervical spine who present to the emergency department (ED), can a set of clinical criteria identify those who need imaging studies?

## DESIGN

A cohort study using data from a previously developed set of clinical criteria.

## SETTING

21 clinical centers in the United States.

## PATIENTS

34 069 patients (mean age 37 y, age range 1 to 101 y, 59% men) with blunt trauma of the cervical spine who presented to the ED. Patients with penetrating trauma and those who received cervical-spine imaging for reasons unrelated to the trauma were excluded.

## DESCRIPTION OF

### PREDICTION GUIDE

The 5 previously validated criteria were tenderness at the posterior midline of the cervical spine; focal neurologic deficit; abnormal level of alertness; evidence of intoxication; and clinically apparent, painful injury that could distract the patient from the pain of cervical-spine injury. Criteria that could not

be assessed were considered to be present. The presence of any one finding indicated cervical-spine injury. All patients received a standard series of 3 radiographic views of the cervical spine unless computed tomography or magnetic resonance imaging of the entire spine was done. Additional imaging could be ordered. Researchers who compiled the 2 sets of findings were blinded to the results of the other.

### MAIN OUTCOME MEASURES

All radiographically confirmed cervical-spine injuries and those that were classified as clinically significant.

### MAIN RESULTS

818 patients (2.4%) had radiologically documented cervical-spine injuries, of which 578 (1.7%) were clinically significant. The sensitivity and specificity for all and clinically

significant cervical-spine injuries are listed in the Table. The sensitivities were high (99%), and the specificities were low (13%).

## CONCLUSION

The absence of all 5 clinical criteria (tenderness at the posterior midline of the cervical spine; focal neurologic deficit; altered level of alertness; evidence of intoxication; and clinically apparent, painful injury that could distract the patient from the pain of cervical-spine injury) ruled out cervical-spine injury in patients who presented to the emergency department with blunt trauma.

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### Absence of 5 clinical criteria to rule out cervical-spine injury in blunt trauma assessed in the emergency department\*

Injury	Sensitivity (95% CI)	Specificity (CI)	+LR	-LR
All injuries	99.0% (98 to 100)	12.9% (2.8 to 13.0)	1.1	0.08
Clinically significant injuries	99.6% (99 to 100)	12.9% (2.8 to 13.0)	1.1	0.03

\*LRs defined in Glossary and calculated from data in article.

## COMMENTARY (continued from page 74)

3 potential applications of these studies immediately come to mind. First, as clinical decision aids, they provide peace of mind for physicians torn between concern for patients and administrative demands for cost saving. Second, as auditing tools, they can identify potential areas in which to economize without sacrificing quality of care. Third, they can serve as a safeguard against unjustified accusations of substandard care.

The rules are only as valid as the individual clinical items on which the decisions are based. Identification may be trivial for such items as age, headache, or vomiting. Some skill, however, may be required to elicit a history of antegrade amnesia, and a fair degree of clinical competence is needed to rule out the presence of minor focal neurologic deficits. Institutions that plan to impose the use of decision rules to reduce the number of unnecessary investigations should ensure that clinical assessments are done at the required level of competence.

Neither of the studies explicitly addresses the role of patients' preferences to have imaging studies. Current concepts of clinical decision making and patient autonomy assert that patient preferences need to be respected (2). Thus, the real challenge for ED physicians will be to convince patients that less is more.

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### References

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