

Clinical decision rules in the emergency department

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Clinical decision (or prediction) rules attempt to reduce the uncertainty of medical decision-making by standardizing the collection and interpretation of clinical data. A decision rule is derived from original research and may be defined as a decision-making tool that incorporates 3 or more variables from the history, physical examination or simple tests.¹ My emergency department colleagues commonly see 2 clinical problems for which there is a strong need for decision rules: whether to order a computed tomography (CT) scan for patients with minor head injury and whether cervical spine radiography is required for alert and stable trauma patients. Two recently published papers²⁻⁴ propose decision rules for these problems. Should they be put into practice?

Use of CT for minor head injuries

Why should physicians worry about head and neck imaging for trauma patients? Each year Canadian emergency physicians treat approximately 47 000 adults with "minor head injury" (i.e., loss of consciousness, amnesia or disorientation associated with a Glasgow Coma Scale [GCS] score of 13–15). In our survey of patients presenting to 7 teaching emergency departments in Canada over a 12-month period,⁵ only 6.2% had a visible brain injury on CT scan, and only 0.5% had an epidural hematoma that required urgent surgery. Among these departments there was a 4-fold variation in the use of CT for patients with minor head injury and a small but important number of intracranial hematomas missed at the first visit.⁵ CT of the head is a high-volume imaging technology that adds significantly to health care costs.

Haydel and colleagues² describe the derivation (phase I, $n = 520$) and validation (phase II, $n = 909$) of a decision rule to identify patients with minor head injury who should undergo CT. This is an important contribution to the literature, but I am concerned that the proposed rule is not reliable, sensitive or specific enough to safely and efficiently guide clinicians in their use of CT for patients with minor head injury. The methodological standards for deriving, validating and implementing clinical decision rules have been well described,^{1,6-10} and clinicians should be aware of some limitations of Haydel's study. Although the predictor variables in the first phase of the study were well standardized, there was no assessment of the interobserver agreement, and some potentially valuable findings were apparently not evaluated (e.g., mechanism of injury, chronic alcohol abuse, signs of basal skull or open skull fracture).

The outcome measure, any acute finding on CT, was well defined but certainly could not be considered a clinically important outcome in terms of patient care. The sample size in the second (validation) phase was relatively large, yet there were far too few clinically important outcomes to measure sensitivity with an acceptably narrow confidence interval (CI); fewer than 6 patients required surgery, meaning the 95% CI was 54%–100%. Finally, the specificity of the rule is so low that 77% of patients presenting with a GCS score of 15 would require CT. This would actually lead to an increase in the use of CT in most Canadian and European sites.

Our research group is currently validating the Canadian CT head rule at 8 tertiary-care hospitals as part of the Canadian CT Head and C-Spine (CCC) Study to develop decision rules for CT head and cervical spine radiography. We derived this rule at 10 Canadian sites using a cohort of 2647 patients with minor head injury, including 229 patients with clinically important CT findings and 42 who required neurological intervention.^{11,12} Twenty-two standardized clinical findings were assessed for interobserver agreement and statistical association with the outcomes. The resultant Canadian CT head rule comprises 5 variables that predict need for neurological intervention with 100% sensitivity (95% CI 92%–100%) and requires a scan for only 32% of patients with a GCS score of 13–15. If this rule is successfully validated, it will allow clinicians worldwide to be selective in the use of CT without jeopardizing the care of patients with minor head injuries. This is similar to the approach that our group took previously in developing and validating the Ottawa ankle rules¹³⁻¹⁵ and the Ottawa knee rule.^{16,17}

Use of cervical spine radiography for trauma patients

Each year physicians in Canadian emergency departments treat approximately 185 000 alert, stable trauma victims who are at risk for cervical spine injury. Only 0.9% of these patients have, however, suffered a cervical spine fracture or dislocation.¹⁸ We have shown that there is large practice variation among Canadian hospitals and physicians in the use of plain radiography and that current use is quite inefficient — more than 98% of cervical spine radiographs ordered in Canadian centres are negative.¹⁸ Cervical spine radiographs are an example of a "little ticket" item, a low-cost procedure that adds to health care costs significantly because they are used so frequently.

Hoffman and colleagues³ prospectively validated the National Emergency X-Radiography Utilization Study (NEXUS) “low-risk” criteria for cervical spine radiography. The decision rule specified that radiography may be omitted if patients exhibited all 5 of the NEXUS criteria: no posterior midline cervical spine tenderness, no evidence of intoxication, normal level of alertness, no focal neurological deficit and no painful distracting injuries. This study, remarkable for its size ($n = 34\ 069$), reported a 99.6% sensitivity for detecting clinically important injuries and 12.9% specificity. Our group has serious concerns about the sensitivity, reliability and potential impact of the NEXUS criteria. In a retrospective application of the NEXUS criteria to our CCC Study cervical spine database of 8933 potential neck injury cases, we found a sensitivity of only 93.2% for clinically important injuries.¹⁹ We also found that 2 of the 5 NEXUS criteria had poor kappa values for interobserver agreement (‘not intoxicated’ $\kappa = 0.23$, ‘absence of distracting painful injuries’ $\kappa = 0.42$). Finally, there is concern that the very low specificity of the NEXUS criteria might actually lead to an increase in the use of cervical spine radiography in Canada. A secondary goal of phase II of the CCC Study is to prospectively evaluate the performance of the NEXUS criteria in multiple sites.

Our research group is currently prospectively validating the accuracy, reliability and acceptability of the Canadian cervical spine (C-spine) rule in a multicentre study which will enroll more than 8000 trauma patients. This rule was derived in a cohort of 8933 alert, stable patients, 148 of whom had clinically important cervical spine injury.²⁰⁻²² Twenty standardized clinical findings were assessed for interobserver agreement and association with clinically important outcomes. The resultant Canadian C-spine rule comprises 3 high-risk and 5 low-risk variables which determine the safety of evaluating range of motion and would have identified important injuries with 100% sensitivity (95% CI 98%–100%). If this rule proves to be accurate and reliable in prospective testing, it will allow emergency physicians to be more selective in their use of cervical spine radiography. The Canadian C-spine rule will improve and standardize patient care by decreasing the current variation in practice among emergency department physicians and should also lead to significant health care savings without jeopardizing quality of care.

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