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Question: Which clinical decision rule, **Nexus or Canadian C-Spine**, is better in evaluating who needs imaging for **cervical spine injuries in blunt trauma**?

More than 13 million patients annually are evaluated for a cervical spine injury in US and Canadian Emergency departments. Physicians have a low threshold in imaging these patients as a delayed diagnosis can lead to severe neurologic disability or death. Less than 3% of patients will be found to have clinically important cervical spine injuries following blunt trauma leading to unnecessary healthcare costs. Additionally, patients will have longer periods of discomfort while wearing a C-collar waiting for their imaging.

Two clinical decision rules have been developed to assist in deciding which patients do not need radiographs: the National Emergency X-Radiography Utilization Study (NEXUS) Low-risk Criteria (Table 1) and the Canadian C-Spine Rule (CCR) [Figure 1]. The NEXUS study was first described in 1992 and has been well-validated with a **sensitivity of 99.6% and a specificity of 12.9%**. As it only involves five criteria and can be applied to all patient populations it is more commonly utilized by physicians in the US. The CCR is more complex requiring the patient to have a GCS of 15, stable, with a focus on mechanism of action and includes a range of motion.

In 2012, Michaleff et al. performed a systematic review evaluating the accuracy of the two rules. An analysis of 15 studies revealed that both rules had a high sensitivity. The majority of the studies were validation studies but indicated that there was one direct comparison study that found that CCR had a higher sensitivity and thus recommended the use of the CCR.

The systematic review referred to a paper published in 2003 in the NEMJ. Stiell et al., who developed the CCR, performed a prospective cohort study in nine Canadian EDs comparing the two decision rules. Primary outcomes were cervical spine injury defined as any fracture, dislocation, or ligamentous instability unless they were “osteophyte avulsion, a transverse process not involving a facet joint, a spinous process not involving lamina, or simple vertebral compression < 25%.” The study enrolled 8,283 patients and 169 were found to have clinically important c-spine injuries. The NEXUS criteria had a lower sensitivity and specificity of **90.7% and 36.8%** while the CCR was **99.4% and 45.1%**. The effect on proportion of patients **needing imaging was 55.9% for CCR and 66.6% for NEXUS**. There are many limitations to this study however. The study was performed in Canada and may not be applicable to the US. Not all of the patients underwent imaging as Canadian physicians do not typically image low-risk patients and thus required utilizing a “proxy outcome assessment tool” which included a phone survey and follow-up imaging if symptomatic. This would not occur in the US. They note that the reliability of physician’s interpretation of the rules favored the CCR but many were not comfortable with testing range of motion and these were considered “indeterminate” (845 patients).

These studies show that the CCR has a higher sensitivity than NEXUS and that it will reduce the number of patients needing imaging. However, a clinical decision rule must also be evaluated on its practicality of use. There is an extremely low threshold for imaging blunt trauma patients, as most physicians are unwilling to miss any clinically important injuries given

the severe disabling consequences or any possibility of litigation. The CCR does not apply to all patient populations, is more complex, and requires evaluating range of motion. Therefore, I believe ED physicians will still utilize NEXUS, if any decision rules.

References:

- Michaleff et al. Accuracy of the Canadian C-spine rule and NEXUS to screen for clinically important cervical spine injury in patients following blunt trauma: a systematic review. *CMAJ*. 184 (16). Nov 6, 2012.
- Stiell et al. The Canadian C-Spine rule versus the NEXUS low risk criteria in patients with trauma. *N Engl J Med*. 349. 2003.

Table 1. The NEXUS Low-Risk Criteria.*

Cervical-spine radiography is indicated for patients with trauma unless they meet all of the following criteria:

- No posterior midline cervical-spine tenderness,†
- No evidence of intoxication,‡
- A normal level of alertness,§
- No focal neurologic deficit,¶ and
- No painful distracting injuries.‖

* Criteria are from Hoffman and colleagues.²⁶

† Midline posterior bony cervical-spine tenderness is present if the patient reports pain on palpation of the posterior midline neck from the nuchal ridge to the prominence of the first thoracic vertebra, or if the patient evinces pain with direct palpation of any cervical spinous process.

‡ Patients should be considered intoxicated if they have either of the following: a recent history provided by the patient or an observer of intoxication or intoxicating ingestion, or evidence of intoxication on physical examination such as an odor of alcohol, slurred speech, ataxia, dysmetria, or other cerebellar findings, or any behavior consistent with intoxication. Patients may also be considered to be intoxicated if tests of bodily secretions are positive for alcohol or drugs that affect the level of alertness.

§ An altered level of alertness can include any of the following: a Glasgow Coma Scale score of 14 or less; disorientation to person, place, time, or events; an inability to remember three objects at five minutes; a delayed or inappropriate response to external stimuli; or other findings.

¶ A focal neurologic deficit is any focal neurologic finding on motor or sensory examination.

‖ No precise definition of a painful distracting injury is possible. This category includes any condition thought by the clinician to be producing pain sufficient to distract the patient from a second (neck) injury. Such injuries may include, but are not limited to, any long-bone fracture; a visceral injury requiring surgical consultation; a large laceration, degloving injury, or crush injury; large burns; or any other injury causing acute functional impairment. Physicians may also classify any injury as distracting if it is thought to have the potential to impair the patient's ability to appreciate other injuries.

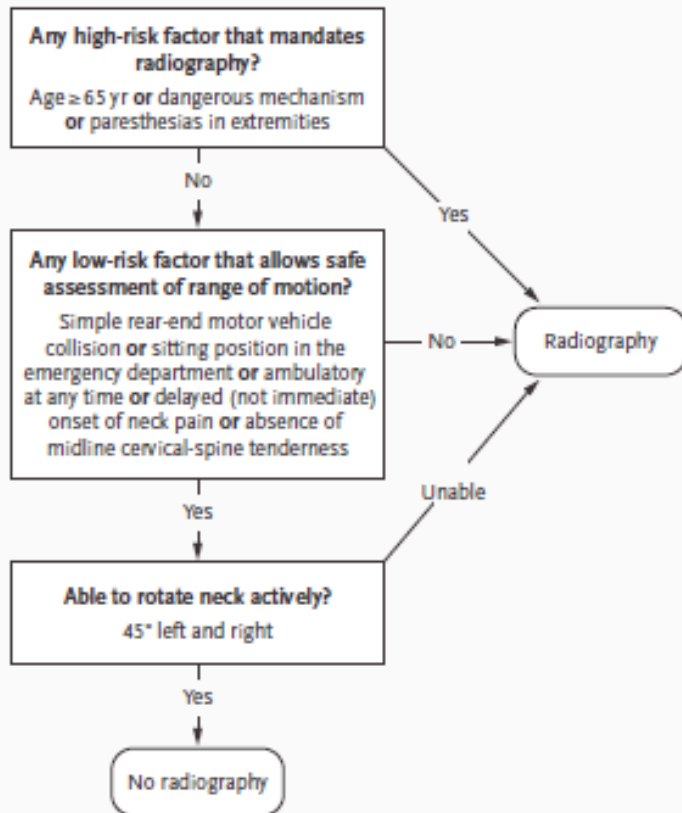


Figure 1. The Canadian C-Spine Rule.

For patients with trauma who are alert (as indicated by a score of 15 on the Glasgow Coma Scale) and in stable condition and in whom cervical-spine injury is a concern, the determination of risk factors guides the use of cervical-spine radiography. A dangerous mechanism is considered to be a fall from an elevation ≥ 3 ft or 5 stairs; an axial load to the head (e.g., diving); a motor vehicle collision at high speed (> 100 km/hr) or with rollover or ejection; a collision involving a motorized recreational vehicle; or a bicycle collision. A simple rear-end motor vehicle collision excludes being pushed into oncoming traffic, being hit by a bus or a large truck, a rollover, and being hit by a high-speed vehicle.

Figures from Stiell et al. The Canadian C-Spine Rule versus the NEXUS Low-Risk Criteria in Patients with Trauma. NEMJ.