Comparison of nexus low risk criteria and Canadian cervical spine rule in blunt neck trauma

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ABSTRACT

Background

The Canadian C-Spine (cervical-spine) Rule (CCR) and the National Emergency X-Radiography Utilization Study (NEXUS) Low-Risk Criteria (NLC) are guidelines for the use of cervical-spine radiography in patients with blunt neck trauma and polytrauma. It is unclear how the two decision rules compare in terms of clinical performance in our setting.

Method

We conducted a prospective observational study in 150 patients in emergency department of IOM TUTH comparing the CCR and NLC as applied to patients with blunt neck trauma and polytrauma. The sensitivity, specificity, and reduction in radiographs were analysed and compared.

Result

Among the 150 patients, the CCR was more sensitive than the NLC (100 % vs. 83.33%) and more specific (47.9 % vs. 42.3%) for injury, and its use would have resulted in lower radiography rates by (46 % vs. 42.33%).Using CCR no potential clinically important cervical spine injuries was missed but using NLC one clinically important cervical spine injury was missed.

Conclusion

For blunt neck trauma and polytrauma patients who are in stable condition, the CCR is superior to the NLC with respect to sensitivity and specificity for cervical-spine injury, and its use would result in reduced rates of radiography. Further studies in larger sample size need to follow rigorous methodologic procedures to ensure that the findings are as free of bias as possible.

Keywords: **CCR (Canadian Cervical Spine Rule), clinically important cervical spine injury, NLC (NEXUS Low Risk Criteria), polytrauma**

Introduction

A clinically important cervical spine injury is defined as any fracture, dislocation or ligamentous instability detectable by diagnostic imaging and requiring surgical or specialist follow-up[1, 2]. These injuries can have disastrous consequences including spinal cord injury and death if the diagnosis is delayed or missed[3]. Despite the low prevalence (< 3%) of clinically important cervical spinal injury following blunt trauma (e.g., motor vehicle collision), accurate diagnosis is imperative for safe, effective management[4]. Currently, uncertainty exists about the optimal diagnostic approach. Some guidelines[5, 6] advocate using screening tools to identify patients with a higher likelihood of clinically important cervical spinal injury; these patients are then sent for imaging to establish the diagnosis. In other more conservative settings, all patients with blunt trauma are sent for imaging. The first approach, involving screening, is arguably preferable because it optimizes resources and time, while reducing unnecessary costs, radiation

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exposure and psychological stress for the patient[7]. For screening to be safe and effective, the screening tools must have high sensitivity, a low negative likelihood ratio and a low rate of false positives. This assures clinicians that a clinically important cervical spine injury is unlikely and reduces the number of referrals for imaging. Clinical decision rules synthesize 3 or more findings from the patient's history, physical examination or simple diagnostic tests to guide diagnostic and treatment decisions[8,9]. Two clinical decision rules, the Canadian C-spine rule and the National Emergency X-Radiography Utilization Study (NEXUS; Box 1)[10],are available to assess the need for imaging in patients with cervical spine injury following blunt trauma. These rules aim to reduce unnecessary imaging by reserving these investigations for patients with a higher likelihood of clinically important cervical spinal injury. Developed independently and validated using large cohorts of patients, these 2 decision rules are recommended in many international guidelines[5,11,12]. However, no consensus exists as to which rule should be endorsed[12]. Therefore, the purpose of our systematic review was to describe the quality of research evaluating the Canadian C-spine rule and NEXUS; describe the diagnostic accuracy of the Canadian C-spine rule and NEXUS; and compare the diagnostic accuracy of the Canadian C-spine rule to that of NEXUS.

Material and methods

A prospective observational study was done for one year from July 2016 to June 2017 in Department of Orthopaedic and Trauma Surgery in Tribhuwan University Teaching Hospital, Kathmandu, Nepal. Total of 150 patients were enrolled for the study. All of the patients visiting with blunt neck trauma and polytrauma at Emergency Department of TUTH were included in the study. Non-trauma patients, GCS Score < 15, unstable vital signs like systolic blood pressure less than 90 mmHg; respiratory rate outside of range 10-24 breaths per minute, patients who have been injured more than 48 hours earlier, intoxicated patients, patients with known vertebral disease, one with previous C-Spine surgery, penetrating neck injury of Gunshot injuries, having simple lacerations were excluded from the study.

All cases with blunt neck trauma and polytrauma cases coming in TUTH emergency were evaluated. Each case was evaluated separately for NEXUS Criteria and Canadian C Spine rule and proforma was filled. X-ray already ordered by ED Physicians was evaluated later for each cases. Comparison was done with X-ray findings.Two weeks telephone follow up done for each case which fall under the category where x-ray need not be done and no x-ray was done in ED by ED physicians and asked whether the neck pain is persisting or subsided. If pain persisted for 2 weeks patients were asked to follow up in ED and x-ray was done.C Spine injuries were ruled out with the help of senior team resident and faculties.

Statistical interpretation of the data was done on SPSS 23.0 for windows. Confidence interval of 95% and P value <0.05 were considered as significant. Patients were considered to have a low probability of cervical-spine injury if they were clinically stable and met all five of the clinical criteria. For patients who will not meet one or more of the criteria's (X-ray need to be done according to the criteria) and who will be reported to have a radio graphically documented cervical-spine injury will be considered to have yielded a true positive result. For patients who meet all five criteria (No x-ray need to be done according to criteria) and who had a radio graphically documented injury, the result was considered false negative. The result was true negative(No X-ray need to be done according to criteria and no injury present) for patients who will meet all the criteria for a low probability of injury and who had no evidence of cervical-spine injury on radiography, whereas it was false positive for those who did not meet all the criteria but who had no injury.(X-ray needs to be done according to criteria but no injury present)

Results

Age of the patient enrolled in the study ranged from 19 to 74 years with mean age being 42.8(+/-13.14) years. The highest incidence of the clinically significant cervical spine injury is found to be in the age group of 31-45 years. The lowest incidence is found to be the age group of >60 yrs. Out of total 150 patients 92 (61.30%) were male and 58 (38.70%) were female.

The most common mode of injury of overall patients presenting in the ER of TUTH is Road Traffic Accident (RTA). A total no of 60 patients out of 150 (40%) sustained injury after RTA followed by fall from height (54 patients i.e. 36%) and other modes of injuries including fall on to head, hit by blunt object, fall from stairs, fall on ground etc. consist of total 36 patients (24%).

Table 1: Clinical characteristics of participants with/without cervical spine injuries and agreement based on NLC and CCR

Clinical characteristics of participants with/without cervical injury and agreement based on Nexus Criteria and Canadian Cervical Spine Rule				
Clinical characteristics	**Cervical Injury Present (n=6)**	**Cervical Injury Absent (n=144)**	**p-value**	**Kappa-value**
Nexus Criteria				
Neurological deficit	2	0	0.000	0.490
Midline cervical tenderness	5	45	0.008	0.115
Alertness Normal	6	104	0.121	0.231
Intoxication	0	21	0.313	0.06
Distracting Injury	1	19	0.806	0.016
Canadian Cervical Spine Criteria				
Age more than 65	0	5	0.642	0.038
Dangerous mechanism	6	60	0.005	0.101
Paresthesia of extremities	2	0	0.000	0.492
Rear end MVC	0	56	0.054	0.078
Sitting position	4	144	0.000	0.4900
Ambulatory at any time	4	144	0.000	0.4900
Delayed onset of neck pain	0	0	-	-
Mid cervical tenderness	5	45	0.008	0.115
Able to move neck	4	68	0.350	0.031

Clinically significant C spine injury in our study detected by both NLC and CCR:

- C4-C5 bilateral facet dislocation with intact neurology.
- C5-C6 unilateral facet dislocation with intact neurology.
- Burst fracture C5 vertebrae with ASIA A neurology.
- C5-C6 bilateral facet dislocation with ASIA A neurology

Clinically significant C spine injury not detected by NLC but detected by CCR:

- Bilateral perched facet C6-C7 with intact neurology

Clinically insignificant C spine injury:

C6 spinous process fracture

Clinical characteristics of participants in accordance to NEXUS Low Risk Criteria and Canadian Cervical Spine Rule

Radiography in accordance to NEXUS Low Risk Criteria and Canadian Cervical Spine Rule

Total X-ray done in 107 patients out of 150 patients (71.33%), both guidelines excluded 43 patients (28.67%) in which X-ray was not done. 88 X-rays were done according to NEXUS criteria and 81 x-rays done according to CCR.

Sensitivity and Specificity of NEXUS Low Risk Criteria and Canadian Cervical Spine Rule

Sensitivity of NLC is found to be 83.33% (95% CI 36.4-99.1) and sensitivity of CCR is 100% (95% CI 51.6-100.0). Specificity of NLC is found to be 42.3 %(95% CI 34.2-50.8) and specificity of CCR is 47.9%(95 % CI 39.5-56.6).

Discussion

Despite the low prevalence (< 3%) of clinically important cervical spinal injury following blunt trauma (e.g., motor vehicle collision), accurate diagnosis is imperative for safe, effective management[13]. Guidelines like NEXUS low Risk Criteria and Canadian Cervical Spine Rule[4,14] advocate using screening tools to identify patients with a higher likelihood of clinically important

(a) (b)

Figure 1: a, b - X-ray cervical spine showing B/L perched facet C6-C7 which was detected using CCR but not detected using NLC. CT scan cervical spine showing B/L perched facet C6-C7

cervical spinal injury; these patients are then sent for imaging to establish the diagnosis. In other more conservative settings, all patients with blunt trauma were sent for imaging. The first approach, involving screening, is arguably preferable because it optimizes resources and time, while reducing unnecessary costs, radiation exposure and psychological stress for the patient[5]. For screening to be safe and effective, the screening tools must have high sensitivity, a low negative likelihood ratio and a low rate of false positives. This assures clinicians that a clinically important cervical spine injury is unlikely and reduces the number of referrals for imaging.

In emergency department of our institute, we practice more conservative approach of screening of cervical spine injury by sending c spine X-ray to all most all patients with blunt neck trauma and poly trauma patients. Thus by means of this study we are trying to decrease the unnecessary x-ray done and discomfort to the patient being immobilised in cervical collar.

Conclusion

The prospective observational study was carried out to study role of NEXUS low risk criteria and Canadian Cervical Spine Rule and compare them in 150 blunt neck trauma and poly trauma patients in our centre. It has been found that NEXUS low risk criteria had sensitivity of 83.33% and specificity of 42.91%.Canadian Cervical Spine Rule had sensitivity of 100% and specificity of 47.91 %. Based on our study we found both clinical guidelines to be highly sensitive that have potential to reduce imaging rates. They both reduce rate of cervical spine radiographs therefore reducing radiation as well as the patient's time and money spent in the hospital. However, lower specificity and significant false positive results indicate that still many people will continue to go unnecessary imaging.

We would conclude that Canadian Cervical Spine Rule have better diagnostic accuracy, and it should be used over NEXUS low risk criteria to assess the need for cervical spine imaging in emergency department in blunt neck trauma and poly trauma patients.

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