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Proper Utilization of the Canadian C-Spine Rule for Mild C-Spine Injury

UNIVERSITY OF SAN DIEGO
Hahn School of Nursing and Health Science
Beyster Institute of Nursing

DOCTOR OF NURSING PRACTICE PORTFOLIO

by

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Abstract

The aim of this evidence-based project was to implement the Canadian C-Spine Rule guideline for low-risk c-spine injury in a urban urgent care in order to reduce unnecessary imaging (cervical X-ray), radiation exposure, and to identify patients requiring ED referral for computed tomography (CT) scans. The use of imaging can help to identify life-threatening neck injuries when clinically appropriate; however, unnecessary imaging without the use of a clinical decision tool is associated with an annual cost of \$6.8 million-\$9.6 million in the United States. Encouraging providers to increase patient engagement and to use other valuable diagnostic tests is part of the solution to over imaging. The literature supports the use of validated clinical-decision guidelines to improve assessment, minimize costs, foster resource utilization, decrease the length of stay in waiting rooms, and reduce unnecessary radiation exposure. The findings suggested significant reduction in unnecessary imaging and identified patients needing ED referral for more advanced imaging. Future projects can focus on the utilization of other clinical guidelines for the management of low-risk patient populations.

Key words: Canadian C-Spine Rule, NEXUS C-Spine, neck injury, neck CT, clinical decision guidelines, clinical decision rules.

Proper Utilization of the Canadian C-Spine Rule for Mild C-Spine Injury

Despite the low prevalence of severe or significant cervical spine (c-spine) injuries, accurate diagnosis is imperative for safe, effective management (Michaleff et al., 2012). The identification and management of neck trauma can be challenging and overwhelming as this anatomical region encloses many vital structures. It poses a diagnostic and therapeutic dilemma in emergency and urgent care settings (Alao & Waseem, 2021).

A c-spine injury can be defined as a fracture, dislocation, or ligament instability that can be detected with diagnostics, such as imaging, and might require specialist intervention (Michaleff et al., 2012). Evaluating a patient for neck trauma begins with the primary survey; decisions about imaging should be based on careful clinical assessment of the patient and knowledge of the injury mechanism (Ibraheem et al., 2018). Caring for patients with neck trauma is of great importance as excessive manipulation and inadequate immobilization of neck-injured patients may cause additional neurological damage and worsen the patient outcomes. Therefore, expedient evaluation, early detection, and proper treatment is critical for favorable outcomes (Ibraheem et al., 2018).

Literature supports clinical-decision-guideline utilization to help providers identify patients at risk of severe c-spine injuries and direct those at risk for imaging (Paykin et al., 2018). Standardization and application of protocols should be encouraged to prevent missed injuries and facilitate patient management in emergency and urgent care facilities by decreasing unnecessary patient radiation exposure and shortening patient wait times. The consistent application of clinical decision rules can potentially reduce annual imaging costs in the United States by \$6.8 million to \$9.6 million and decrease population radiation exposure by 0.8 million mGy to 1.1 million mGy if applied across the United States (Benayoun et al., 2016).

Clinical Guidelines

Two evidence-based guidelines, the Canadian C-Spine Rule and the National Emergency X-Radiography Utilization Study (NEXUS) were considered for selection as the evidence-based guideline for this project. A systematic review comparing the effectiveness and ease of these two clinical decision guidelines determined that the Canadian C-Spine Rule had better diagnostic accuracy than the NEXUS criteria. Michaleff et al. (2012) reported that the Canadian C-Spine Rule had a low rate of false-negative results (0%-0.11%) and imaging rates would be reduced by an average of 42.0% (0.6 %-75.4%) without missing any clinically significant c-spine injury. Stiell et al. (2009) also determined that, for alert and stable patients with trauma to their neck, the Canadian C-Spine Rule had higher sensitivity (99.4 % CCR; 90.7% NLC) and specificity (55.9% CCR; 66.6 % NLC). A systematic review by Moser et al. (2018) examined 679 studies and compared the validity and reliability of clinical decision rules to screen c-spine injuries in alert and stable, low-risk populations and determined that the Canadian C-Spine Rule consistently demonstrated excellent sensitivity (0.90-1.00) and negative predictive values (99%-100%).

The decision was made to implement the Canadian C-Spine Rule for this evidence-based practice (EBP) project due to its superior sensitivity and negative predictive values. Moreover, the extensive inclusion and exclusion criteria facilitated the decision of whether the patient met criteria for imaging. The Canadian C-Spine Rule also added in determining whether the patient was considered high risk based on the Glasgow Coma Scale (GCS), age, and injury mechanism (Figure 1).

Methods

Project Design

This nurse practitioner-led EBP project consisted of a retrospective review of medical records for patients presenting with a c-spine injury. Pre- intervention data were collected for 3 months. As an intervention, physicians and nurse practitioners in a rural urgent care center were educated on the Canadian C-Spine Rule clinical decision guideline as a new protocol for the standard of care in adult patients presenting with c-spine injuries. Post-intervention data were collected for 10 weeks, including the utilization of the guideline, c-spine imaging (X-ray), and ED referral for advanced imaging.

Project Setting

The urgent care center was located in a rural city in Southern California. Institutional Review Board approval was obtained from the University of San Diego (Appendix A). Additionally, the medical director of the facility approved this project with a support letter (Appendix B).

Project Protocol

Electronic medical records were reviewed for patients presenting to the urgent care clinic with a cervical injury. Inclusion criteria were patients 18 years of age and older. Exclusion criteria were patients who did not report a cervical injury as the chief complaint at the time of triage and registration. A medical record review was conducted for 10 weeks utilizing a standardized data collection tool created with the assistance of the University of San Diego's Doctor of Nursing Practice faculty advisor and statistical advisor.

Measurements

All charts were reviewed pre- and postintervention to determine if the patients met criteria for imaging using the Canadian C-Spine Rule. Imaging validation was made by reviewing the provider's documentation. Patients who did not receive imaging were also evaluated to determine if imaging would be indicated. Preintervention data included nine charts and postintervention data were comprised of 12 charts, for a total sample of 21 charts.

Data collection included appropriateness for imaging, type of imaging (X-ray, CT scan, or MRI), date of visit, date of injury onset, chief complaint, sex, type of injury, high or low-risk injury, ability to rotate the neck to 45 degrees, imaging ordered, and emergency department (ED) referral. Medical record review included chief complaint, history of present illness, review of systems, physical examination, medical decision notes, and discharge plan.

Data Analysis

The data analysis for this project was done with Intellectus Statistics (2021). Table 1 provides a summary of statistics for continuous variables; frequencies and percentages for nominal variables.

Findings

The purpose of this EBP project was to determine if the cervical X-rays ordered met criteria for imaging, provider adherence to the guideline, and appropriateness for imaging based on the Canadian C-Spine Rule. A Fisher's exact test was conducted to analyze whether each patient met criteria for imaging (yes/no) and whether a c-spine X-Ray was ordered (yes/no). The results of the Fisher exact test were not statistically significant ($p = 1.000$); providers continued to order cervical imaging at the same rate despite the introduction of this evidence-based guideline (Table 2).

Additional Results

Of the 21 charts reviewed, all patients received cervical X-rays. Additionally, all 21 X-rays were negative for c-spine fracture or any other injury of clinical significance. Despite the implementation of the Canadian C-Spine Rule, 12 orders for imaging were placed for patients presenting with neck complaints. In the postimplementation group, only four patients met criteria for imaging based on the Canadian C-Spine Rule. No significant change in non-criteria imaging was noted (Figure 2).

Limitations

One of the main limitations of this project was the COVID-19 pandemic that created a health crisis affecting the U.S health care delivery system. Due to the high demand for treating COVID -19 patients and stopping the spread of the disease, advisories restricted people's outings and fewer people sought care for problems not related to COVID-19. The number of c-spine X-rays due to trauma in this setting was much lower when compared to previous years. Another limitation during this project was documentation. Providers utilized scribes so the documentation was limited with a lack of details. Lastly, the providers reported difficulty with their patient loads and at sometimes felt overwhelmed due to the constant influx of COVID-19 patients. The workload might have affected their clinical judgement and guideline application.

Potential Cost-Benefit Analysis

The billing department was contacted to determine the cost of c-spine X-rays based in the current procedural terminology codes (CPT codes). The average cost of c-spine X-rays ranged from \$60-\$107. Imaging (c-spine) reimbursement varied by insurance plan. Medicare reimbursed \$ 25.98 for a 2-view c-spine X-ray, Medicaid paid \$25, and private insurance \$50 (Centers for Medicare & Medicaid Services, 2019). However, most patients presenting to this urgent care

were on capitated plans; therefore, no additional income was generated when ordering unnecessary imaging. As there was no incentive for ordering imaging, this urgent care's costs increased when imaging was ordered, particularly when it was not clinically indicated.

The project implementation cost \$50 and had the potential to save thousands. The urgent care reported an average of 150 c-spine X-rays per year pre-COVID-19 pandemic. There is a potential saving of \$2,500 to 5,000 dollars per every 100 X-rays that do not meet criteria for imaging.

Implications for Nursing Practice

The application of the Canadian C-Spine Rule clinical decision guideline can help establish a protocol that facilitates the management of patients presenting with a c-spine injury in urgent cares, walk-in clinics, and EDs. The introduction of this clinical decision guidelines can improve provider documentation supporting the decision to perform patient imaging. Lastly, this clinical tool can help reduce the amount of radiation exposure from unnecessary imaging when clinically appropriate.

Conclusion

A review of the literature provided evidence that the use of clinical decision guidelines improve medical decision making and patient triage, minimize costs, enhance resource utilization, and reduce non-criteria imaging. Encouraging providers to use valuable diagnostic tests that are not restricted to imaging is a part of the solution to the problem of over imaging (Saragiotto et al., 2018). Although this project was limited, establishing a protocol for this patient population was helpful and facilitated patient management. Future projects can focus on the utilization of this and other clinical guidelines for the management of low-risk patient populations.

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Table 1*Frequency Table for Nominal Variables*

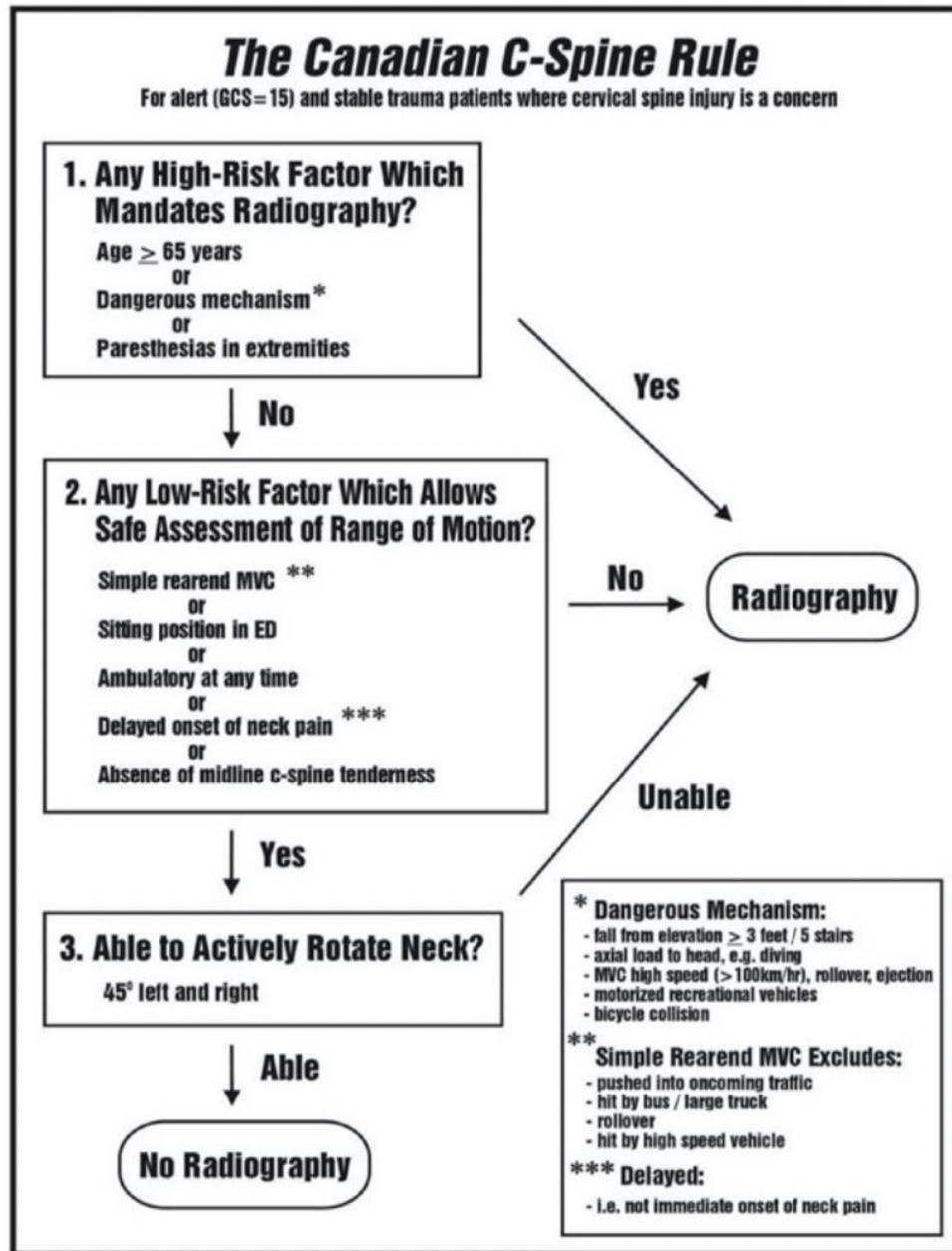
Variable	<i>n</i>	%
Type of Injury		
No Injury	6	33.33
Fall	2	11.11
Fall from bike	1	5.56
Fight kicked/punched	1	5.56
Kicked in neck	1	5.56
MVC	4	22.22
Heavy lifting	1	5.56
Fall from bicycle	1	5.56
Fight	1	5.56
Rotate Neck		
Yes	16	88.89
No	2	11.11
Meet Criteria		
No	10	55.56
Yes	8	44.44
High Risk		
No	11	61.11
Yes	7	38.89
Low Risk		
No	8	44.44
Yes	10	55.56
Refer ED		
No	17	94.44
Yes	1	5.56
X-Ray Ord		
Yes	18	100.00
Sex		
F	8	44.44
M	10	55.56

Table 2*Observed and Expected Frequencies*

Meet Criteria	Group		OR	<i>p</i>
	1	2		
No	6[6.00]	8[8.00]	1.00	1.000
Yes	3[3.00]	4[4.00]		

Figure 1

The Canadian C-Spine Rule Algorithm



Note. From “Canadian C-Spine Rule Study for Alert and Stable Trauma Patients: I. Background and Rationale,” by I. G. Stiell, G. A. Wells, D. McKnight, R. Brison, H. Lesiuk, C. M. Clement, M. A. Eisenhauer, G. H. Greenberg, I. MacPhail, M. Reardon, J. Worthington, R. Verbeek, J. Dreyer, D. Cass, M. Schull, L. Morrison, B. Rowe, B. Hoyrod, G. Bandiera, A. Laupacis, for the Canadian CT Head and C-Spine (CCC) Study Group, 2002. *Canadian Journal of Emergency Medicine*, 4(2), p. 88 (<https://doi.org/10.1017/S1481803500006175>). Copyright 2002 by the Canadian Association of Emergency Physicians.

Figure 2

Non-criteria Pre- and Postimplementation Cervical Spine X-rays

