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Application of the NEXUS low criteria and the Canadian C-Spine rule and results of cervical spine radiography in emergency condition

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INTRODUCTION

- Cervical spine trauma remains a public health issue. [1]
- Fear of failure to identify cervical spine injury has led to *extremely liberal use of radiography* in patients with blunt trauma and remotely possible neck injury.
- Two decision rules have been developed independently to permit more selective ordering of cervical-spine radiography (CSR) and decrease patients' exposure to ionizing radiation and economic losses:
 - **NEXUS**: 1992 (*The National Emergency X-Radiography Utilization Study*) [2]
 - **Canadian Cervical-Spine Rule(CCR)**: 2001 [3]

[1] Chappuis G, Soltermann B. Numbur and cost of claims linked to minor cervical trauma in Europe: results from the comparative study by CEA, AREDOC and CEREDOC. *Eur Spine J*. 2008 Oct;17(10):1350-7. Epub 2008 Aug 15.

[2] Hoffman JR, Schriger DL, Mower W, Luo JS, Zucker M. Low-risk criteria for cervical-spine radiography in blunt trauma: a prospective study. *Ann Emerg Med*. 1992 Dec;21(12):1454-60.

[3] Stiell IG, Wells GA, Vandemheen KL, Clement CM, Lesiuk H, De Maio VJ, et al. The Canadian C-Spine rule for Radiography in alert and stable trauma patients. *JAMA*. 2001 Oct 17;286(15):1841-8.

AIMS OF THE STUDY

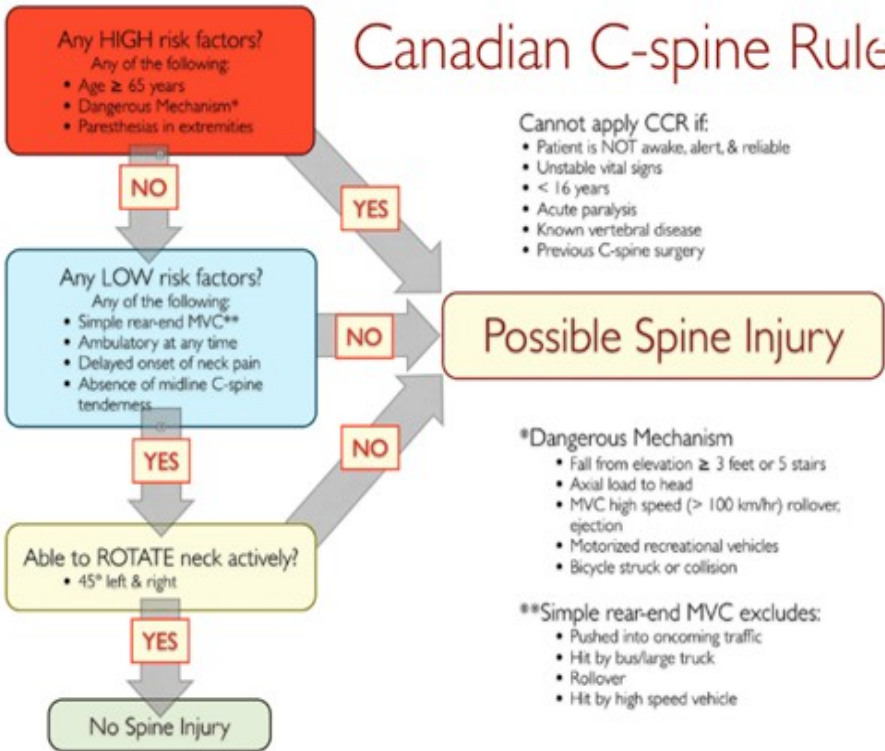
- Evaluate the application of the NEXUS and CCR recommendations.
- Analyze the quality of cervical spine radiography in our emergency department.

METHODS

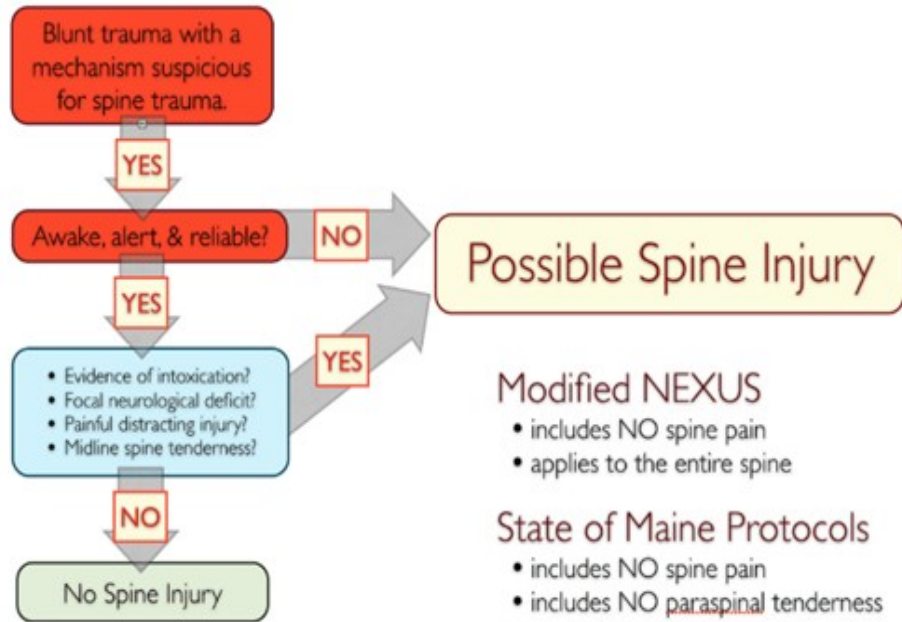
- **Retrospective, Descriptive Study**, 3 Years (2018-2019-2020).
- Emergency Depart / Orthopedic and Trauma Depart.
- Trauma Center Mongi Slim Marsa Hospital, Tunis, Tunisia.
- **Isolated Cervical Spine Trauma, Age \geq 14 Years.**
- Patients with initial Cervical CT Scan were excluded.
- We studied: Epidemiologic, Clinical, Radiological parameters.
- We verified data and application criteria of NEXUS and CCR.

METHODS

Canadian C-spine Rule



NEXUS



RESULTS

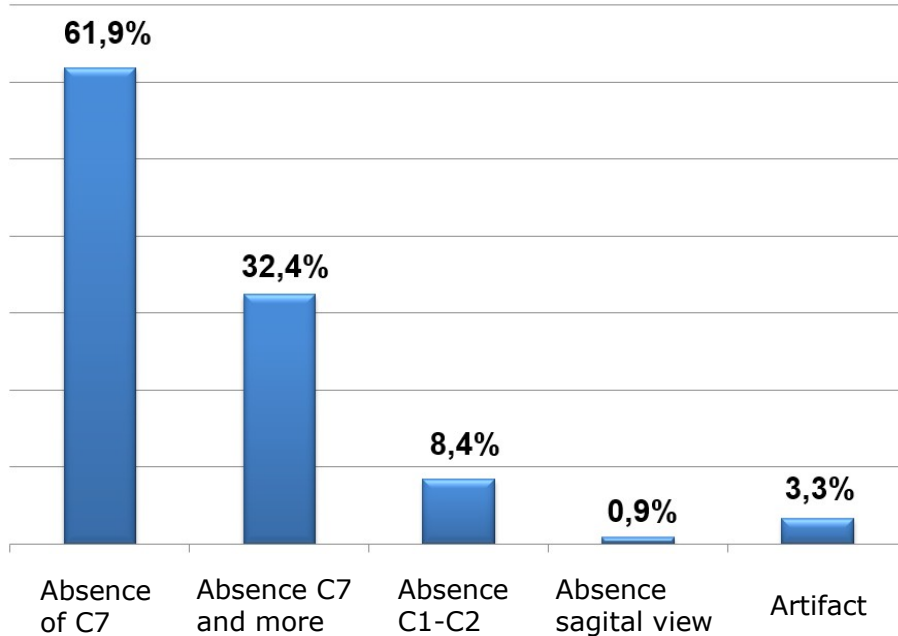
- 213 patients included
- Mean Age = 37 Years / Male Gender = 73.7%.
- High energy mechanism: 46%
- Neck pain: 76.5% / Muscles contracture: 58.7%
- Active mobility wasn't evaluated in 87.3% of cases.
- Neurologic deficit: 4.7%

RESULTS

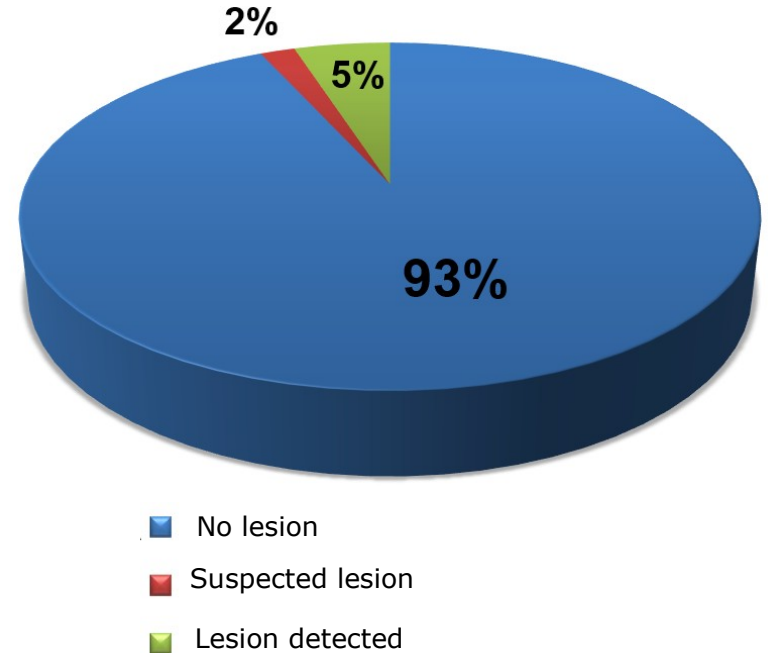
- ***NEXUS rule application: 91.5%***
- ***CCR application: 88.7%***
- **Good Quality X-Rays: 43.2%**

RESULTS

Main causes of poor quality X-Rays



X-Rays Results



RESULTS

- We did not detect any lesion in patients X-Rays in whom the rules have been not respected.
- All patients in whom lesions were detected or suspected in X-Rays, underwent a cervical CT Scan.

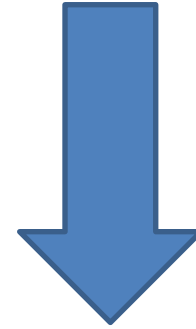
DISCUSSION

Our Study:

- Nexus and CCR *well applied* (>85%)
- Lesions detected : 5%

In the Literature:

- *Less applied:* In the USA (Nexus: 56% / CCR: 10%) [4] : patient insistence, CCR difficult
- *Nexus Vs CCR:* Controversial Canadian Studies [5;6]



Bias !!!
Emergency Conditions
Rules hard to apply ??

[4] S Weiner. *The Actual Application of the NEXUS and Canadian C-Spine Rules by Emergency Physicians. The Internet Journal of Emergency Medicine. 2008 Volume 5 Number 2.*

[5] Stiell IG, Clement C, Mc Knight RD, Brison R, Schull MJ, Rowe BH, et al. *The Canadian C-Spine Rule versus the nexus Low-risk Criteria in patients with trauma. N Engl J Med. 2003 Dec 25;349(26):2510-8.*

[6] Dickinson G, Stiell IG, Schull M, Brison R, Clement CM, Vandemheen KL, et al. *Retrospective application of the NEXUS low -risk application criteria for cervical spine radiography in Canadian emergency departments. Ann Emerg Med. 2004 Apr;43(4):507-14.*

DISCUSSION

CMAJ

RESEARCH

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

Zoe A. Michaleff BAppSc, Chris G. Maher PhD, Arianne P. Verhagen PhD, Trudy Rebbeck PhD, Chung-Wei Christine Lin PhD

Conclusion

Based on studies with modest methodologic quality, we found that both the Canadian C-spine rule and NEXUS were highly sensitive rules that have the potential to reduce imaging rates. However, the lower specificity and false-positive results indicate that many people will continue to undergo unnecessary imaging.



We recommend the application of one of the two rules at least in our emergency rooms.

DISCUSSION

Our Study:

- Low rate of good quality Rx: < 50 %
- C7 non visualized +++



Technical Difficulties: *non-cooperative patient* (pain, unconscious, immobilization) *technicien alone* (traction on the upper limbs, several attempts)

In the Literature:

- Low rate of good quality Rx [7]
- Initial cervical CT Scan [8]
- Lawsuit [9]



↗ **Spending** [10]

↗ **Ionizing Radiations** [11]

[7] Gale SC, Gracias VH, Reilly PM, Schwab CW. The inefficiency of plain radiography to evaluate the cervical spine after blunt trauma. *J Trauma*. 2005 Nov;59(5):1121-5.

[8] Homles JF, Akkinapalli R. Computer Tomography versus plain radiography to screen for cervical spine injury: a meta-analysis. *J Trauma*. 2005;58(5):902-905.

[9] Quigley RS, Akpolat YT, Forrest BD, Wongworawat MD, Cheng WK. Reason for lawsuit in spinal cord injury affects final outcome. *Spine (Phila Pa 1976)* 2015 Jun 1;40(11):851-5.

[10] Blackmore CC, Ramsey SD, Mann FA, Deyo RA. Cervical spine injury screening with CT in trauma patients: a cost-effectiveness analysis. *Radiology*. 1999 Jul;212(1):117-25.

[11] Rybicki F, Nawfel RD, Judy PF, Ledbetter S, Dyson RL, Halt PS, et al. Skin and thyroid dosimetry in cervical spine screening: two methods for evaluation and et comparison between a helical CT and radiographic trauma series. *AJR*. 2002;179(4):933-937.

DISCUSSION

Alternative Solution ??

Comparison of Low-Dose With Standard-Dose Multidetector CT in Cervical Spine Trauma

T.H. Mulkens, P. Marchal, S. Daineffe, R. Salgado, P. Bellinck, B. te Rijdt, B. Kegelaers and J.-L. Termote
American Journal of Neuroradiology September 2007, 28 (8) 1444-1450; DOI: <https://doi.org/10.3174/ajnr.A0608>



CONCLUSION: Low-dose cervical spine MDCT in patients with blunt trauma gives a substantial dose reduction of 61%–71%, compared with standard-dose MDCT, with a small increase in image noise and without difference in subjective image quality evaluation.

CONCLUSION

- **NEXUS and CCR** are **widely used** in our emergency department and seems to be **reliable guidelines** to evaluate patients with possible clinically significant cervical spine injury.
- The high rate of **inadequate CSR** reinforces the debate about its **utility in emergency condition**.
- The **initial Low-Dose Cervical Spine CT Scan** may be a debatable solution.

Disclosure Declaration

none of the authors has any
potential conflict of interest