

# Critical Review Form

## Diagnostic Test

Radiographic Clearance of Blunt Cervical Spine Injury: Plain Radiograph or Computed Tomography Scan? *J Trauma* 2003; 55: 222-227

**Objective:** To test whether CT scan alone is sufficient for the diagnosis and exclusion of cervical vertebral injury (p 222).

**Methods:** Retrospective review of TRACS database from November 2000 through October 2001 of all patients with blunt trauma who received both adequate cervical spine x-rays (CSR) and cervical spine CT (CTC). Inclusion criteria included all patients with neck tenderness, neurological deficits, altered mental status (AMS), or distracting injury. As per the University of Florida trauma protocols all *imaged* patients underwent both CSR and CTC (but not all patients were imaged). All patients discharged with a cervical collar had one-week follow-up (with whom is not described) and the collar was removed if the neck pain had resolved. Unfortunately, no details are provided about the methods of retrospective review.

Guide		Comments
<b>I.</b>	<b>Are the results valid?</b>	
<b>A.</b>	<b>Did clinicians face diagnostic uncertainty?</b>	Yes- they were evaluating whether CTC could be used as the <i>initial</i> screening modality in adult blunt trauma compared to the apparently outdated plain x-ray radiography which has varying degrees success in both adequate study images and a high miss rate of bony injuries (both of which are minimized by CT)
<b>B.</b>	<b>Was there a blind comparison with an independent gold standard applied similarly to the treatment group and to the control group?</b>	No blind comparisons are impossible in a retrospective chart analysis. Patients that passed what sounds like NEXUS criteria (never formally acknowledged) were manually cleared and did not get cervical imaging. Patients that could not be cleared clinically underwent both CTC and CSR imaging where CT imaging was both the Gold standard and the interventional arm being studied for evaluation of bony injuries. According to this study, the Gold standard was CT c-spine + follow up without any routine repeat imaging.
	(Confirmation Bias)	



C.	<p><b>Did the results of the test being evaluated influence the decision to perform the gold standard?</b></p> <p style="text-align: right;">(Ascertainment Bias)</p>	No, all imaged patients had CTS by study design.																
II.	<b>What are the results?</b>																	
A.	<p><b>What likelihood ratios were associated with the range of possible test results?</b></p>	<ul style="list-style-type: none"> <li>• Among 3018 blunt trauma patients, 1,199 had both CRS and CTC</li> <li>• Subjects’ average age 39, average GCS 13, and average ISS 8.4 (see PGY-I answer key for definition of ISS).</li> <li>• Among those with CSR missed injury (41 subjects), the average GCS was 12 and the ISS 15.</li> <li>• Three patients required surgical stabilization (2 subsequently died of associated injuries) and three patients had long-term disability related to a presenting neurological deficit.</li> <li>• For the large majority of patients, “intervention” meant a cervical collar.</li> </ul> <p>The authors did not report a 2x2 table or diagnostic test characteristics (sensitivity, Likelihood Ratio), but using the information reported in the results (pp 223-224) one can construct the following:</p> <table border="1" data-bbox="915 1251 1528 1402" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th>CT +</th> <th>CT -</th> <th>TOTAL</th> </tr> </thead> <tbody> <tr> <td><b>X-ray +</b></td> <td>75</td> <td>0</td> <td>75</td> </tr> <tr> <td><b>X-ray -</b></td> <td>41</td> <td>1083</td> <td>1124</td> </tr> <tr> <td><b>TOTAL</b></td> <td>116</td> <td>1082</td> <td>1199</td> </tr> </tbody> </table> <p>Calculate x-ray diagnostic test characteristics using  <a href="http://araw.mede.uic.edu/cgi-bin/testcalc.pl">http://araw.mede.uic.edu/cgi-bin/testcalc.pl</a></p> <p>Prevalence of injury = 0.097  Sensitivity = 0.65  Specificity = 1.00  LR+ = 9999 (95% CI 87 – 22426)  LR- = 0.35 (95% CI 0.28 – 0.45)</p>		CT +	CT -	TOTAL	<b>X-ray +</b>	75	0	75	<b>X-ray -</b>	41	1083	1124	<b>TOTAL</b>	116	1082	1199
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<b>III.</b>	<b>How can I apply the results to patient care?</b>	
<b>A.</b>	<b>Will the reproducibility of the test result and its interpretation be satisfactory in my clinical setting?</b>	For Barnes-Jewish Hospital, yes. Most Level I trauma centers have easy accessibility to CT and dedicated neuro-radiologists. However, smaller, rural ED's often possess less specialization and/or limited CT access so this study's findings would have limited external validity for many of these community hospitals.
<b>B.</b>	<b>Are the results applicable to the patients in my practice?</b>	Yes. Our Level 1 trauma patients are probably not all that different from level 1 trauma patients in Florida. Note the study demographics, though: sicker and more severely injured patients (not necessarily our vignette patient who is elderly but otherwise has a low ISS score).
<b>C.</b>	<b>Will the results change my management strategy?</b>	Yes. Although a retrospective study with poorly described methods (potential for biased conclusions), the re-affirms that CT is superior in identifying potentially serious bony injuries. <u>The constellation of evidence favors CT as the primary imaging screen for mod-high risk trauma patients requiring spine imaging – bypass plain x-rays.</u>
<b>D.</b>	<b>Will patients be better off as a result of the test?</b>	Yes – if patient important endpoints (surgical intervention, permanent deficit, disability) injuries are not missed. Although specific patient demographics are not presented, of the 41 patients (false negatives) where c-spine injuries were missed on plain x-rays, none were in otherwise compromised patients and, according to the cited EAST criteria (page 225) on 2 of the 41 would have warranted CT imaging. Of the 41, 63% would have required 6-week collar immobilization and 32% would have required some form of surgical intervention.



## Limitations

- 1) Retrospective chart review without any stated methods. Who queried the TRACS database? What search terms were used? Has the TRACS database been demonstrated to be a valid source of trauma registry data?
- 2) The authors failed to use a validated tool such as NEXUS or the Canadian Cervical Spine Rule (see August 2004 Journal Club archives) to risk-stratify these blunt spine trauma patients.
- 3) Poor description of outpatient follow-up (part of the Gold standard). Who conducted the follow-up? Where did it occur?
- 4) Poor description of results – no 2x2 table, specificity, Likelihood ratios, or Confidence Intervals.

## Bottom Line

Poorly reported retrospective review of single-center trauma database suggesting that among moderately injured blunt trauma patients (mean GCS 13, ISS 8.4) cervical spine CT is superior to cervical spine x-ray at ruling in and ruling out injury. Unfortunately, the authors incorporate one of the diagnostic tests (CT) into their Gold standard and fail to report whether patient-important outcomes (death, permanent disability, need for operative stabilization) are more accurately identified by CT than by x-rays. Additionally, they fail to use validated tools like NEXUS to risk-stratify subjects into low-risk subsets not requiring any imaging. Finally, they do not address the cost-effectiveness or efficacy of CT as a first-line diagnostic test for cervical spine vertebral injury in some subset of blunt trauma patients. Nonetheless, the *constellation* of evidence favors CT as the primary imaging screen for mod-high risk trauma patients requiring spine imaging. The new standard of care among this set of trauma patients is to bypass plain x-rays in favor of high resolution CT.