Computed tomography versus plain radiography to screen for cervical spine injury: a meta-analysis
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CRD summary
The review compared plain radiography and computed tomography (CT) for the detection of cervical spine injury following blunt trauma. The review included a small number of studies with significant methodological flaws. The authors' conclusion, that CT is superior to plain radiography, is therefore inadequately supported by the data presented.

Authors' objectives
To compare the performance of computed tomography (CT) and plain radiography in detecting patients with cervical spinal injury following blunt trauma and among patients deemed to require screening radiography.

Searching
MEDLINE was searched from January 1995 to June 2004 for publications in the English language; the search terms were reported. The bibliographies of included studies and four journals were handsearched for additional studies.

Study selection
Study designs of evaluations included in the review
Randomised controlled trials (RCTs) comparing plain radiography and CT, and cohort studies of patients undergoing both plain radiography and CT for the detection of blunt cervical spine injury, were eligible for inclusion.

Specific interventions included in the review
Studies comparing CT and plain radiography for the detection of cervical spine injury were eligible for inclusion. Studies were excluded if the CT scan did not extend from the occiput to the superior aspect of the first thoracic vertebrae, if the distance between cuts on the CT scan was greater than 5 mm, or if the plain radiography series did not include a minimum of anteroposterior view, lateral view or an open mouth odontoid view.

Reference standard test against which the new test was compared
No reference standard was specified by the inclusion criteria. The reference standard used in included studies was either the interpretation of all imaging studies, CT and magnetic resonance imaging, or CT alone.

Participants included in the review
Studies of patients who had experienced blunt trauma to the cervical spine were eligible for inclusion.

Outcomes assessed in the review
No inclusion criteria for the outcome measures were specified. Sensitivity was the only test performance measure presented.

How were decisions on the relevance of primary studies made?
Both authors independently reviewed the retrieved abstracts to determine inclusion or exclusion.

Assessment of study quality
Both authors independently graded the included studies. Level I studies were RCTs. Level II studies were cohort studies of more than 50 representative participants, employing an independent reference standard. Level III studies were cohorts of more than 50 participants, with minimal to moderate selection bias or lacking an independent reference standard. Level IV studies had fewer than 50 participants or severe selection bias. Any disagreements were resolved by consensus.
**Data extraction**
The authors did not state how the data were extracted for the review, or how many reviewers performed the data extraction. Sensitivity values, with 95% confidence intervals (CIs), were presented graphically for each included study.

**Methods of synthesis**
How were the studies combined?
A random-effects model was used to generate pooled estimates of sensitivity, with 95% CIs, for CT and plain radiography.

How were differences between studies investigated?
Heterogeneity was assessed using an unspecified test and considered present where the p-value was less than 0.10. Where heterogeneity was identified, sensitivity analyses were planned.

**Results of the review**
Seven diagnostic cohort studies (n=3,834; 447 with blunt injury) were included in the review.

Five studies were classified as level III and two as level IV.

The pooled sensitivity for plain radiography was 52% (95% CI: 47, 56); there was significant between-study heterogeneity (p=0.07). The pooled sensitivity for CT was 98% (95% CI: 96, 99); no significant between-study heterogeneity was identified.

When only the level III studies were included in the analysis, the pooled sensitivity was 54% (95% CI: 48, 59) for plain radiography and 98% (95% CI: 95, 99) for CT.

No estimates of specificity could be calculated from the available data.

**Authors' conclusions**
CT significantly outperforms plain radiography as a screening test for patients at very high risk of cervical spine injury, and should be the initial screening test for patients with depressed mental status. There was insufficient evidence with respect to less injured, lower risk patients.

**CRD commentary**
The review addressed a clearly stated research question, using appropriately defined inclusion criteria. The electronic searches were limited to a single database and only English language studies were included, giving rise to the possibility that relevant data might have been omitted. No attempt to identify unpublished data was reported and publication bias was not assessed. The methodological quality of the included studies was assessed and considered in the analysis. Appropriate measures were taken to minimise the introduction of error or bias during the selection of studies, however, it was not clear whether similar methods were used during the data extraction. The pooling of heterogeneous data sets, particularly given the clear variations in the reference standard used, is of doubtful value. The available data were insufficient for the calculation of specificity values. Given the limited number of included studies and their significant methodological flaws, the authors' conclusion, that there is 'ample evidence that CT outperforms plain radiography', should be treated with considerable caution.

**Implications of the review for practice and research**
Practice: The authors stated that CT should be the initial screening test in patients at very high risk of cervical spine injury, with significantly depressed mental state.

Research: The authors stated that future studies are required to determine the appropriate method of cervical spine imaging in trauma patients who meet the criteria for imaging, but who are otherwise at low risk.
Bibliographic details

Indexing Status
Subject indexing assigned by NLM

MeSH
Cervical Vertebrae /injuries /radiography; Mass Screening /methods; Sensitivity and Specificity; Spinal Injuries /radiography; Tomography, X-Ray Computed; Wounds, Nonpenetrating /radiography

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Record Status
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.