

Critical Review Form Diagnostic Test

Karul M, Bannas P, Schoennagel BP, Hoffmann A, Wedegaertner U, Adam G, Yamamura J. Fractures of the thoracic spine in patients with minor trauma: comparison of diagnostic accuracy and dose of biplane radiography and MDCT. Eur J Radiol. 2013 Aug;82(8):1273-7.

Objectives: "to investigate the accuracy of biplane radiography in the detection of fractures of the thoracic spine in patients with minor trauma using MDCT [multidetector computed tomography] as the reference and to compare the dose of both techniques." (p. 1274)

Methods: This retrospective, observational study was conducted at the University Medical Center Hamburg-Eppendorf in Hamburg, Germany using patients seen between October 2008 and October 2012. Patients with suspected fracture of the thoracic spine on physical examination (based on the presence of any deformity or step-off on physical examination with low to moderate pain made worse by movement) following "minor trauma" were eligible for enrollment. Patients included in the study had undergone plain "biplane" radiography first, followed by a MDCT scan within 10 days due to "aggravation of their clinical symptoms." Exclusion criteria were abnormal neurologic exam, pregnancy, and follow-up examinations following spinal surgery.

All patients included in the study underwent anteroposterior and lateral plain radiography of the thoracic spine (C7 to L1) on initial presentation, followed by MDCT examination within 10 days using a 256-detector row scanner. All images were interpreted by 2 resident radiologists and then checked by a senior MSK radiologist with 8 years of clinical experience. The radiologists were blinded to the results of MDCT when reviewing the plain films, and the results of MDCT were used as the reference standard.

A total of 107 patients met the inclusion/exclusion criteria, with a mean age of 67 years; 54 patients were male and 53 were female. There were 77 thoracic vertebral fractures identified in 65 (60.7%) patients.

Guide		Comments
I.	Are the results valid?	
A.	Did clinicians face diagnostic uncertainty?	
B.	Was there a blind comparison with an independent gold standard applied similarly to all patients? (Confirmation Bias)	Yes. All patients enrolled underwent MDCT scanning. Plain films were reviewed by resident radiologists and an attending, all of whom were blinded to MDCT results.

		Unfortunately since the authors only enrolled patients who underwent MDCT scanning due to "aggravation of their clinical symptoms," this represents a group of patients at higher-than-normal risk of having an injury (spectrum bias).
C.	Did the results of the test being evaluated influence the decision to perform the gold standard? (Ascertainment Bias)	Not exactly. Only patients who underwent MDCT scanning were included in this study, and this was not determined by the results of initial plain radiography, but rather by worsening of symptoms.
II.	What are the results?	
A.	What likelihood ratios were associated with the range of possible test results?	Using MDCT as the criterion standard, plain radiography had the following test characteristics in assessing for any fracture of the thoracic spine: <ul style="list-style-type: none"> • Sensitivity - 49.2% • Specificity - 54.7% • Positive predictive value - 62.7% • Negative predictive value - 41.1% • LR+ 1.09 • LR- 0.93 Of note, none of the thoracic spine fractures missed on plain radiography were unstable (sensitivity 100%, LR- 0).
III.	How can I apply the results to patient care?	
A.	Will the reproducibility of the test result and its interpretation be satisfactory in my clinical setting?	Uncertain. While plain radiography and CT scan are both common modalities, and are easily performed in most EDs, the accuracy of these studies may vary from site to site or radiologist to radiologist, depending on level of training and experience. The authors provide no measures of interrater reliability within the study.
B.	Are the results applicable to the patients in my practice?	Yes and no. We routinely evaluate and treat patients suffering from blunt trauma in our practice, and routinely perform imaging to evaluate for fracture. This study selected a relatively high-risk population of patients with step-off or deformity of the thoracic spine noted at presentation, and with ongoing pain within the next 10 days. I suspect that patients with findings of step-off or deformity seen in our institution would routinely undergo advanced imaging (CT scan) without relying on plain films, given the high risk of fracture these findings

		confer.
C.	Will the results change my management strategy?	No. Patients with the findings required in this study would immediately undergo advanced imaging (CT scan) to evaluate for fracture, rather than relying on plain films.
D.	Will patients be better off as a result of the test?	No. As stated, the patients in this study should undergo advanced imaging, and plain radiography is not likely to be beneficial given the high risk of fracture. In patients who are low risk (minor trauma with pain and/or midline tenderness without step-off or deformity) plain films may still be beneficial; this study does not address the utility of plain radiography in these patients.

Limitations:

1. This study included only patients with a deformity or step-off on initial examination and persistent symptoms at 10 days. This is clearly a much higher risk patient population than most "minor trauma" seen in our ED ([spectrum bias](#)). Over 60% of patients in this study had a fracture identified.
2. Only patients who eventually underwent CT scanning for persistent pain were included in the study, excluding those lower risk patients who did not receive any advanced imaging.
3. [Likelihood ratios](#)—which provide much more clinically meaningful data than sensitivity, specificity, and negative/positive predictive values—and [confidence intervals](#) were not calculated or provided by the authors.
4. The authors provide no information regarding the nature of the fractures identified (i.e. transverse process, spinous process, vertebral body) other than pointing out that none of the fractures missed on plain radiography were unstable.
5. The authors provide no measures of [interrater reliability](#) within the study.

Bottom Line:

This small, retrospective study looking at a patient population at high-risk for thoracic fracture found that plain radiography performed poorly in terms of ruling in fracture (LR+ 1.09) and ruling out fracture (LR- 0.93). It seems reasonable that in such high-risk patients plain radiography be deferred and advanced imaging be performed. This study did not look at low-risk patients, in whom plain radiography may be a reasonable initial diagnostic approach.