

Critical Review Form

Diagnostic Test

A Prospective Comparison of Supine Chest Radiography and Bedside Ultrasound for the Diagnosis of Traumatic Pneumothorax, *Acad Emerg Med* 2005; 12: 844-849

Objective: “To compare the sensitivity and specificity of bedside ED US with those for supine portable AP chest radiography and CT for the detection of a pneumothorax in trauma patients, and to evaluate whether US can distinguish between small (10% or less), medium (11% to 40%), and large (over 40%) pneumothoraxes.” (p 845)

Methods:

Prospective double-blinded convenience sampling of Medical College of Georgia ED blunt trauma patients presenting from Sept 2003 to May 2004 who received a CT abdomen (not chest) during clinical shifts of five specific EM attendings, each of whom had performed at least 100 trauma US evaluations and ten thoracic US examinations.

A 4- to 2- MHz transducer (same as FAST exam) was placed at four locations on each hemithorax (anterior second intercostal space (ICS) at the mid-clavicular line, fourth ICS at the anterior axillary line, sixth ICS at the mid-axillary line, and sixth ICS at the posterior axillary line). The absence of sliding lung sign ruled in pneumothorax and was confirmed by either a CT abdomen (with lung windows) for a CT-chest or rush of air by inserting a chest tube. Loss of the sliding lung sign at the second ICS defined a small PTX; the mid-axillary line a medium PTX; and the posterior axillary line a large PTX. EM physicians were blinded to the CXR and CT results until data acquisition forms were completed. Radiologists were blinded to the US results.



I.	Are the results valid?	
A.	Did clinicians face diagnostic uncertainty?	Yes, “the US physician was blinded to the chest radiography and CT results until data collection was completed”. (p 846)
B.	Was there a blind comparison with an independent gold standard applied similarly to the treatment group and to the control group? (Confirmation Bias)	Yes, “Radiologists were blinded to US results.” (p 846)
C.	Did the results of the test being evaluated influence the decision to perform the gold standard? (Ascertainment Bias)	Possibly, since CT examination “was obtained at the discretion of the treating physician.” (p 845) However, the authors took substantial effort to minimize bias without irradiating every trauma patient.
II.	What are the results?	



A.	<p>What likelihood ratios were associated with the range of possible test results?</p>	<ul style="list-style-type: none"> 176 patients were enrolled with 43% female. No demographic, injury severity scores, or outcomes, data is provided. Twelve patients had a chest tube placed before CT (all had a rush of air reported). <u>Only 21/176 had a dedicated chest CT.</u> All the rest had CT abdomen with lung windows as the Gold standard. Ultrasound diagnostic test characteristics <table border="1" data-bbox="917 808 1404 924"> <thead> <tr> <th></th> <th>CT+ PTX</th> <th>CT- PTX</th> </tr> </thead> <tbody> <tr> <td>US+ PTX</td> <td>52</td> <td>1</td> </tr> <tr> <td>US- PTX</td> <td>1</td> <td>122</td> </tr> </tbody> </table> <p>Sen 98% Spec 99% Prev 30.1% LR+ 121 (17 – 850) LR- 0.02 (0-0.13)</p> Portable CXR diagnostic test characteristics <table border="1" data-bbox="917 1249 1404 1365"> <thead> <tr> <th></th> <th>CT+ PTX</th> <th>CT- PTX</th> </tr> </thead> <tbody> <tr> <td>CXR+ PTX</td> <td>40</td> <td>0</td> </tr> <tr> <td>CXR- PTX</td> <td>13</td> <td>123</td> </tr> </tbody> </table> <p>Sen 75% Spec 100% Prev 30.1% LR+ ∞ LR- 0.25 (0.16-0.40)</p> US size estimate correlated well with CT ($\kappa=0.79$, 0.6-1.0) with 23 large, 11 medium, and 19 small PTX identified. 		CT+ PTX	CT- PTX	US+ PTX	52	1	US- PTX	1	122		CT+ PTX	CT- PTX	CXR+ PTX	40	0	CXR- PTX	13	123
	CT+ PTX	CT- PTX																		
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CXR- PTX	13	123																		



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, since no inter-rater Kappa reliability assessment was performed and no inexperienced sonographers were included.
B.	Are the results applicable to the patients in my practice?	Uncertain, since no demographic, injury severity score, or outcomes data is provided. Furthermore, recognizing the Knowledge Translation barrier of acceptance, one is uncertain whether trauma surgeons and/or thoracic surgeons untrained in US would accept EM performed US as a surrogate for CXR or CT.
C.	Will the results change my management strategy?	No. I am not as experienced in ultrasound as these investigators, but <u>for similarly trained ultrasonographers</u> , this paper suggests a role for EM US to detect traumatic PTX.
D.	Will patients be better off as a result of the test?	Possibly, if similarly trained EM ultrasonographers can reproducibly identify <i>clinically significant</i> occult (portable supine CXR undetectable) PTX in those not otherwise requiring a CT. Doing so would allow high-risk individuals to receive a chest tube or be closely monitored (serial US?) for expanding PTX and resulting complications. US could thus prevent dangerous hospital transfers or repeat doses of ionizing radiation. Furthermore, portable US equipment can supplant heavier, impractical radiography equipment in war zones or space missions.

Limitations:

- 1. Ultrasound experience of these research physicians limit one's ability to generalize results to most EM physicians who lack similar training.**
- 2. Inclusion of only patients who were to undergo CT at the scanning physicians' discretion leaves open the possibility of selection bias and ascertainment bias.**
- 3. Uncertain whether CT abdomen lung windows included apex to base of lung. If not, may have missed small apical PTX.**
- 4. Authors did not measure comet-tail sign of PTX which may have increased sensitivity.**

Bottom Line:

Single-center ED based study suggesting experienced EM ultrasonographers using an 8-window view can identify occult PTX in blunt trauma patients better than supine portable CXR. Future researchers should ascertain the diagnostic test characteristics of EM-performed US by physicians with less experience and less innate curiosity regarding sonographic imaging while assessing ED length-of-stay and times to definitive therapeutic intervention and disposition decisions.

