Critical Review Form
Diagnostic Test

Ultrasound Diagnosis of Pneumothorax, *Radiol Med* 2006; 111: 516-525

Objective: "**To prospectively evaluate the accuracy of US in the diagnosis of pneumothorax in comparison to CT as the reference standard on a large population of patients at high risk for pneumothorax." (p 517)**

Methods:

Italian study of 184 consecutive patients at a single center who had just undergone a CT-guided percutaneous lung biopsy between March 2002 – January 2005. All US exams were performed by the same sonographer within 15 minutes of the biopsy. Every patient had a CT scan post-biopsy to exclude iatrogenic pneumothorax.

The absence of a lung sliding sign and comet-tail artifacts defined the sonographic presence of PTX. The lung-point sign was used to describe PTX as mild, moderate, or severe. Each patient also underwent a post biopsy supine chest radiograph. All radiographs were interpreted by a radiologist blinded to the results of the CT and US.

Guide		Comments
I.	**Are the results valid?**	
A.	**Did clinicians face diagnostic uncertainty?**	Yes, at the time of the US "the operator was unaware of the post biopsy CT scan" results (p 519)
B.	**Was there a blind comparison with an independent gold standard applied similarly to the treatment group and to the control group? (Confirmation Bias)**	Although not clearly stated, the US results were likely not relayed to the CT-interpreting Radiologist (why would you relay these results to the Radiologist?).
C.	**Did the results of the test being evaluated influence the decision to perform the gold standard? (Ascertainment Bias)**	No – all subjects had the CT performed post-biopsy by protocol. This is the major advantage of this study.
II.	**What are the results?**	

<table>
<tr><td>A.</td><td>What likelihood ratios were associated with the range of possible test results?</td><td>
<table>
<tr><th></th><th>CT+ PTX</th><th>CT- PTX</th></tr>
<tr><td>US+ PTX</td><td>44</td><td>0</td></tr>
<tr><td>US- PTX</td><td>2</td><td>140</td></tr>
</table>
Sen 96%
Spec 100%
Prev 25%
LR+ ∞
LR- 0.04 (0.02-0.18)
<table>
<tr><th></th><th>CT+ PTX</th><th>CT- PTX</th></tr>
<tr><td>pCXR+ PTX</td><td>19</td><td>0 (?)</td></tr>
<tr><td>pCXR- PTX</td><td>27</td><td>94</td></tr>
</table>
Sen 41%
Spec 100%
LR+ ∞
LR- 0.59 (0.46-0.75)

Average time to complete the US was 4 minutes.
US and CT agreed completely regarding PTX severity.

</td></tr>
<tr><td>III.</td><td>How can I apply the results to patient care?</td><td></td></tr>
<tr><td>A.</td><td>Will the reproducibility of the test result and its interpretation be satisfactory in my clinical setting?</td><td>No – this was a formal ultrasonographer, not a multi-tasking EM physician. Furthermore, these simple patients had no confounding injuries or morbidities which trauma patients all too often do.</td></tr>
<tr><td>B.</td><td>Are the results applicable to the patients in my practice?</td><td>No – different patient population than any ED cohort. However, the external validity this study lacks is made up for by the internal validity of the study since every patient had the Gold standard testing performed.</td></tr>
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C.	**Will the results change my management strategy?**	Yes, taken in conjunction with the EM trauma literature on US for occult PTX which lack a uniformly applied Gold standard (CT chest), this paper confirms the diagnostic accuracy of US.
D.	**Will patients be better off as a result of the test?**	Yes, if EM-performed US can reliably identify the sliding lung sign and comet-tail artifacts after brief training sessions and without routine oversight. If, on the other hand, EM-US for occult PTX requires intensive training, frequent updates and a dedicated local sonographer to QA images obtained in order to replicate these results, PTX US will not be eagerly accepted or widely implemented because of specific Pathman's Pipeline leaks: awareness, acceptance, and ability to replicate study protocols.

Limitations

1. **No description of ultrasonographer methods for screening for PTX.**
2. **Dedicated ultrasonographer used, not a distracted under-trained EM physician.**
3. **Post CT biopsy patients differ substantially from complicated multi-trauma patients.**
4. **No 2x2 table is provided and their diagnostic test characteristic descriptions do not add up. Specifically, the authors report 184 subjects but in the first paragraphs of their results section they describe 140 US PTX true-negatives + 44 cases of true-positives (PTX excluded via US) + 2 equivocal (false-negative) cases: 140 + 44 + 2 = 186 which is not 184!**

Bottom Line

A single-center trial in which all "penetrating chest trauma" (CT-guided needle biopsy) patients underwent CT chest (Gold standard for detection of PTX) after a general ultrasonographer performed sonographic evaluation for PTX. The study supports the contention that US is superior to supine CXR to rule out PTX.