Systematic Review Snapshot

TAKE-HOME MESSAGE
Ultrasonography is better than supine radiography for ruling out a pneumothorax in adult patients with traumatic or iatrogenic pneumothoraces.

How Accurate Is Ultrasonography for Excluding Pneumothorax?

EBEM Commentators
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Results

Pooled test characteristics for ultrasonography and radiography for the detection of pneumothoraces.

<table>
<thead>
<tr>
<th>Test</th>
<th>Studies/ Patients</th>
<th>Sensitivity (95% CI), %</th>
<th>Specificity (95% CI), %</th>
<th>Positive Likelihood Ratio</th>
<th>Negative Likelihood Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultrasonography</td>
<td>8/1,048</td>
<td>90.9 (86.5–93.9)</td>
<td>98.2 (97.0–99.0)</td>
<td>50.5</td>
<td>0.09</td>
</tr>
<tr>
<td>Supine/semi erect radiography</td>
<td>7/864</td>
<td>50.2 (43.5–57.0)</td>
<td>99.4 (98.3–99.8)</td>
<td>83.7</td>
<td>0.50</td>
</tr>
</tbody>
</table>

The authors initially identified 570 potential studies but excluded 549 because they were retrospective, editorials, letters, or non-English or because they did not specifically reference ultrasonography or pneumothorax. The remaining 21 studies were reviewed in detail with a standardized data extraction form, resulting in the exclusion of an additional 13, leaving 8 studies for the final analysis. The Quality Assessment of Diagnostic Accuracy Studies results demonstrated good to average quality for all the included studies. Of these, 6 studied traumatic pneumothoraces, whereas 2 studied iatrogenic pneumothoraces. Four studies specifically noted that all ultrasonography was performed by emergency physicians, whereas the other 4 included ultrasonography performed by radiologists, surgeons, or unknown operators. The studies used the absence of both lung sliding and B Lines to diagnose pneumothoraces. Although radiograph position was not an inclusion criterion, 7 studies included only supine radiographs, whereas the last study included both supine and semi erect radiographs.

Ultrasonographic sensitivity ranged from 48.8% to 100%, with specificity from 89.3% to 100%, whereas radiography sensitivity ranged from 20.9% to 75.5%, with specificity from 94.0% to 100%. Subgroup analyses revealed that test characteristics were similar for both traumatic and iatrogenic causes. The wide range observed for ultrasonographic sensitivity is due to one study in which the sensitivity was 48.8%. The other 7 studies showed sensitivities of 86.2% to 98.2%. The review-
ers postulate that this may be due to the transverse ultrasonographic probe orientation used in the outlying study, which is in contrast with the traditional sagittal orientation, in which the ribs and rib shadows provide an anatomic context for reliable identification of the pleural line. Statistical heterogeneity of all the studies was determined by $\chi^2$ test; sensitivity was found to have statistical heterogeneity ($P<.01$), whereas specificity was not ($P=.21$), and thus random- and fixed-effects meta-analyses were performed, respectively.

**Commentary**

Pneumothoraces are common, presenting in 4% to 64% of trauma patients,$^2$ 6% of patients undergoing thoracentesis,$^3$ and 3% of all patients admitted to an ICU.$^4$ CT is often used in cases in which a pneumothorax is suspected despite negative radiograph results because occult pneumothoraces make up 29% to 72% of pneumothoraces in trauma patients.$^1$ Given the poor sensitivity of radiography, as well as the known risk of ionizing radiation associated with CT, ultrasonography may be the preferred imaging modality over both radiography and CT for the detection of pneumothoraces.

This meta-analysis examined the test characteristics of ultrasonography in comparison with supine radiography for the detection of pneumothorax. The sensitivity of ultrasonography was significantly higher than that of radiography, likely because free air travels first to the parasternal regions in a supine patient.$^5$ The specificities of ultrasonography and radiography were not statistically different, and both were high enough that positive findings should be considered diagnostic in both traumatic and iatrogenic pneumothoraces.

Although thoracic ultrasonography is often used during the evaluation of trauma patients, it is not routinely used after central line placement or thoracentesis. Postprocedural sonography of the chest may represent a convenient and immediately available modality for the assessment of potential iatrogenic pneumothoraces, given the increasing use of ultrasonographic guidance for line placement and thoracentesis.

This meta-analysis did not compare ultrasonography with left lateral decubitus or upright chest radiography, which are both more sensitive for pneumothorax than supine radiograph.$^6$

**Editor’s Note:** This is a clinical synopsis, a regular feature of the *Annals’ Systematic Review Snapshot (SRS)* series. The source for this systematic review snapshot is: Alrajhi K, Woo MY, Vaillancourt C. Test characteristics of ultrasonography for the detection of pneumothorax: a systematic review and analysis. *Chest.* 2012;141:703-708.


Michael Brown, MD, MSc, Alan Jones, MD, and David Newman, MD, serve as editors of the SRS series.