Selected article

Abstract

Question: How does dual-section helical computed tomography compare to selective pulmonary arteriography (SPA) in diagnosing pulmonary embolism (PE)?

Design: A prospective cross-sectional study.

Setting: Cardiology and intensive care units of a university teaching hospital in Paris, France.

Patients: Two hundred and four consecutive patients were clinically suspected of having an acute PE. Of these, 158 were enrolled (mean age [and standard deviation (SD)], 58 [14]). Eligibility criteria included a clinical suspicion of acute PE (dyspnea, chest pain, hemoptysis, syncope, risk factors for thromboembolic disease, abnormal findings on chest radiography or electrocardiography, or abnormal arterial blood-gas test results), and the mental ability to give informed consent.

Description of test and diagnostic standard: All patients underwent dual-section helical CT and SPA within 12 hours of each other. Each image was analyzed by 2 blinded radiologists who determined image quality and the presence of PE. A third blinded radiologist was used to settle any differences.

Main outcome measures: Sensitivity, specificity, positive and negative predictive values for PE.

Main results: SPA was considered optimal in 147 (93%), suboptimal in 10 (6%) and inconclusive in 1 (0.6%). Dual-section helical CT findings were considered technically optimal in 140 (89%), suboptimal in 11 (7%) and inconclusive in 6 (4%). SPA demonstrated PE in 62 patients. Table 1 shows the sensitivity, specificity, and positive and negative predictive values of dual-section helical CT (based on SPA as the reference standard).

Conclusions: Dual-section helical CT offers high sensitivity and specificity for the detection of PE and may replace pulmonary arteriography for the direct demonstr-
The techniques of both tests should be well described in the study to allow others to reproduce the results and they are in this paper. In fact, in this study, CT technology going back at least 5 years was used. This provides an advantage in that the scanning technique should be available in most institutions. However, the interpretation of CT performed to diagnose PE requires expert radiologists who may not be available in all institutions capable of performing the CT. In the paper the reported κ value, which measures interobserver variation, was only 0.565 for interpreting CT scans whereas the κ value for interpreting arteriograms was somewhat better at 0.678.

The next important issue to assess is the applicability of the results to our own patient population. Was the patient sample a similar one to what we would see in practice? The study population in the article was primarily an outpatient population of 158 patients. The overall rate of PE in the population was 36%. The results may not be applicable to surgical patients or critically ill, ventilated patients because CT may be less accurate in these patients, who may have underlying atelectasis, pneumonia or low blood flow.

The authors reclassified some of the test results based on clinical findings in the study group. Specifically, they reclassified 2 false-positive CTs as true positives, based on clinical findings suggesting PE despite a

---

**Table 1**

<table>
<thead>
<tr>
<th>Patient group</th>
<th>Sensitivity, % (and no. /total no. of pts)</th>
<th>Specificity, % (and no. /total no. of pts)</th>
<th>Positive value, % (and no. /total no. of pts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disease present</td>
<td>56 (a) / 95 (b)</td>
<td>95 (56/59) / 97 (89/92)</td>
<td></td>
</tr>
<tr>
<td>Disease absent</td>
<td>6 (c) / 89 (d)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**Table 2**

<table>
<thead>
<tr>
<th>Study Data From Which Likelihood Ratios for Pulmonary Embolism Were Calculated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference standard (arteriogram)</td>
</tr>
<tr>
<td>Test results (CT scan)</td>
</tr>
<tr>
<td>Disease present</td>
</tr>
<tr>
<td>Disease absent</td>
</tr>
</tbody>
</table>
negative arteriogram, and they also found 2 CT scans determined to be false negative for PE as being true negative. In these 4 cases the new diagnostic test was therefore found to perform better than the "gold standard." This generates even better sensitivity, specificity, and likelihood ratios for the CT scan. The sensitivity of CT using these calculations goes up to 94% the specificity increases to 96% the likelihood ratio of a positive test goes from 14.3 to 22.3, and the likelihood ratio of a negative test goes from 0.103 to 0.067.

Supporting the use of CT in this patient population is the clinical reality of patient care. Pulmonary angiography requires a specialized suite and experienced radiologists and often is available only in tertiary care centres. It is an invasive procedure, which some critically ill patients may not tolerate. CT scanners capable of matching the results of this study are more widely available and are becoming standard equipment in most community hospitals. The skill of the radiologist will always be important in the interpretation of these studies, but access to experienced radiologists is becoming better with electronic transfer capability of diagnostic images to tertiary care centres where there are radiologists who have the specialized expertise. Another advantage of CT is its ability to diagnose other causes of the symptoms suggestive of PE such as pneumonia, pleural effusion and other forms of interstitial lung disease and pleural disease.

**Conclusions**

This is a good-quality study of a diagnostic test that is now commonly used. It provides evidence for the value of CT in an outpatient population. The results may not be generalizable to the surgical or critically ill patient, who may have atelectasis or low blood flow on positive-pressure ventilation. However, the value of CT in this patient population is its ability to identify these and other problems accurately. CT with up-to-date technology should become the diagnostic test of choice for patients with an abnormal chest radiograph and a suspicion of PE. SPA should be reserved for those in whom CT is inconclusive (i.e., movement artifact) or in whom the accuracy of the test warrants using the "gold standard" test to define the pulmonary vasculature (i.e., chronic distal pulmonary emboli causing pulmonary hypertension).

**Acknowledgement:** The Canadian Association of General Surgeons Evidence Based Reviews in Surgery is supported by unrestricted educational grant from Ethicon Inc., Ethicon Endo-Surgery Inc.

**Reference**