Helical computed tomographic results indicated small-to-moderate changes in the probability of pulmonary embolism

Perrier A, Howarth N, Didier D, et al. **Performance of helical computed tomography in unselected outpatients with suspected pulmonary embolism.** Ann Intern Med. 2001 Jul 17;135:88-97.

QUESTION
In patients with suspected pulmonary embolism (PE), how accurate is helical computed tomography (CT)?

DESIGN
Blinded comparison of helical CT with a validated diagnostic algorithm.

SETTING
Emergency center of the University Hospital of Geneva, Switzerland.

PATIENTS
299 patients > 16 years of age (median age 69 y, 54% women) who presented with clinically suspected PE and a plasma D-dimer level > 500 µg/L. Exclusion criteria were contraindication to CT or anticoagulants (serum creatinine level > 150 µmol/L, allergy to contrast agent, asthma, or pregnancy), treatment with oral anticoagulants on study entry, probable difficulty of follow-up, or expectation of survival < 3 months. Follow-up to 3 months was complete.

DESCRIPTION OF TEST AND DIAGNOSTIC STANDARD
Helical CT was done on pulmonary arteries up to and including the segmental vessels from the level of the aortic arch to the lowest hemidiaphragm. Nonionic contrast material was injected, and a subspecialty-trained chest radiologist scored each vessel for the presence or absence of clot. The diagnostic standard was a recently validated diagnostic algorithm: Patients were considered to have PE if they had a positive pulmonary angiographic result, a high-probability lung scan result, or deep venous thrombosis detected by compression ultrasonography at presentation or 3-month follow-up.

MAIN OUTCOME MEASURES
Sensitivity, specificity, and likelihood ratios for positive, negative, and inconclusive test results.

MAIN RESULTS
The prevalence of PE in the study population was 39%. Interobserver agreement among 3 radiologists was high (κ = 0.82 to 0.90). 12 CT scans were inconclusive. The sensitivity of CT was 70% (95% CI 62 to 78), and the specificity was 91% (CI 86 to 95). The table shows the likelihood ratios for positive, negative, and inconclusive CT results.

CONCLUSION
In patients presenting to the emergency department with suspected pulmonary embolism, a positive helical computed tomographic result indicated a moderate increase in the probability of pulmonary embolism, but a negative result indicated only a small decrease in probability.

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Test characteristics of helical computed tomography (CT) for the diagnosis of pulmonary embolism in the emergency department*

CT test results	Likelihood ratio (95% CI)
Positive	8.3 (5.1 to 13.7)
Negative	0.34 (0.26 to 0.45)
Inconclusive	0.31 (0.08 to 1.21)

*Diagnostic terms defined in Glossary; likelihood ratios and CIs calculated from data in article.

COMMENTARY
The study by Perrier and colleagues is important because it extends our understanding of the ability of helical CT to diagnose or rule out PE. Through careful attention to minimization of selection, workup, and diagnostic-review biases, the authors largely succeeded in overcoming the methodologic flaws that have hampered previous attempts (1, 2).

As with lung scanning (3), helical CT is less accurate than many believe. For example, a patient with a 50% pretest probability of PE and a negative CT result would still have a post-test probability of 25%. A negative CT result is not equivalent to a normal result on a lung scan or an angiogram. Furthermore, when the clinical probability of PE is low, a positive CT result alone may not be sufficient to establish a diagnosis of PE, particularly for isolated segmental abnormalities.

Although the observed likelihood ratios with CT are inferior to those previously shown for lung scanning (3), they were derived from different populations, and comparisons should thus be made with caution. This study cannot provide direct evidence for choosing one diagnostic modality over the other. However, the results provide no support in general for replacing lung scanning with helical CT to diagnose PE.

Three advantages of helical CT deserve mention. First, this study did not consider the value of CTs ability to identify an alternative diagnosis in up to a third of patients with suspected PE (2). Second, as with lung scanning, when the combination of pretest probability and helical CT results yield sufficiently high or low post-test probabilities, the test obviates the need for conventional angiography and its associated higher morbidity. Third, in practice settings in which clinicians can obtain a CT scan more quickly than a lung scan or an angiogram, the use of CT may prevent delays in therapy.

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References
1. **Rathbun SW, Raskob GE, Whitsett TL.** Sensitivity and specificity of helical computed tomography in diagnosis of pulmonary embolism: a systematic review. Ann Intern Med. 2000;132:227-32.
2. **Mullins MD, Becker DM, Hagspiel KD, Philbrick JT.** The role of spiral volumetric computed tomography in the diagnosis of pulmonary embolism. Arch Intern Med. 2000;160:293-8.
3. Value of the ventilation/perfusion scan in acute pulmonary embolism. Results of the Prospective Investigation of Pulmonary Embolism Diagnosis (PIOPED). The PIOPED Investigators. JAMA. 1990;263:2753-9.