Review: Helical CT has better discriminatory power than ventilation–perfusion scan to exclude pulmonary embolism

Hayashino Y, Goto M, Noguchi Y, Fukui T. **Ventilation-perfusion scanning and helical CT in suspected pulmonary embolism: meta-analysis of diagnostic performance.** Radiology. 2005;234:740-8.

Clinical impact ratings: Emergency Med ★★★★★★☆ Hospitalists ★★★★★★☆ Hematol/Thrombo ★★★★★☆☆

QUESTION

How do helical computed tomography (CT) and ventilation–perfusion (V/Q) scan compare in ability to detect acute pulmonary embolism (PE)?

METHODS

Data sources: MEDLINE (1985 to 2003), EMBASE/Excerpta Medica (1985 to 2003), bibliographies of relevant studies, and contact with experts. Articles on helical CT were limited to those published between 1990 and 2003, and articles on V/Q scan were limited to those published between 1985 and 2003.

Study selection and assessment: English-language studies that used helical CT or V/Q scan as a diagnostic test for acute PE and pulmonary angiography as the diagnostic standard; reported true-positive, false-positive, true-negative, and false-negative data in absolute numbers; and had a time interval ≤ 48 hours between the test and the diagnostic standard. Studies were assessed for design, blinding between readers, verification bias, and interpretation bias.

Outcomes: Diagnostic test characteristics and regression coefficients from summary receiver-operating characteristic (ROC) curve analysis.

MAIN RESULTS

12 studies were included. 9 studies (n = 520, mean age range 34 to 63 y based on 8 studies) used helical CT, 5 studies (n = 1269, mean age range 53 to 63 y based on 3 studies) used V/Q scan, and 2 studies used both helical CT and V/Q scan. Test characteristics for helical CT and V/Q scan are in the Table. Summary ROC curve analysis showed that helical CT had greater discriminatory power than V/Q scan when an "intermediate-" or a "high-" probability V/Q scan result was considered positive for PE (regression coefficient 4.14, P = 0.05) but had similar discriminatory power when only a "high-probability" V/Q scan result was considered positive for PE (regression coefficient 0.59, P = 0.46).

CONCLUSION

Helical computed tomography has greater discriminatory power than ventilation–perfusion (V/Q) scan for excluding PE, but the 2 tests have similar discriminatory power in the diagnosis of PE when the V/Q scan is reported as "high probability."

Source of funding: No external funding.

For correspondence: Dr. T. Fukui, St. Luke's International Hospital, Chuo-ku, Tokyo, Japan. E-mail fkts@luke.or.jp.

Test characteristics of helical computed tomography (CT) and ventilation–perfusion (V/Q) scan for detecting acute pulmonary embolism (PE)*

Tests	Number of studies	Weighted sensitivity (95% CI)	Weighted specificity (CI)	+LR	–LR
Helical CT	11	86% (80 to 92)	94% (91 to 96)	14.3	0.15
V/Q scan with "high-probability" cut-off for PE	7	39% (37 to 41)	97% (96 to 98)	13	0.63
V/Q scan with "intermediate-probability" cut-off for PE	7	86% (83 to 88)	46% (44 to 47)	1.6	0.31
V/Q scan with "near normal-to-normal" cut-off for PE	7	98% (97 to 99.5)	4.8% (4.7 to 4.9)	1.03	0.42

*Sensitivity and specificity were weighted using a random-effects model. Diagnostic terms defined in Glossary; LRs calculated using the weighted summary estimates of sensitivity and specificity in the article.

COMMENTARY

You are asked to see a patient with suspected PE who you determine has a moderate pretest probability (24% to 32%) for PE based on a standardized clinical prediction rule (1). Should you order a V/Q scan or helical CT? You know that a V/Q scan provides an indeterminate (or nondiagnostic) result in up to 75% of patients with suspected PE, and helical CT may not be adequate to detect small, subsegmental clots that may be important (2).

Hayashino and colleagues' clever use of a summary ROC curve analysis allows comparison of helical CT with V/Q scan by collapsing V/Q scan results into positive and negative results. The results suggest that, overall, helical CT is more sensitive and better at ruling out PE, irrespective of how the V/Q scan was reported. It is noteworthy, however, that a "near normal-to-normal" V/Q scan has adequate discriminatory power to exclude PE (sensitivity 98%, negative likelihood ratio 0.46) and is a reasonable alternative to rule out PE when helical CT is contraindicated (e.g., patients with impaired renal function). The 2 tests have similar specificities that allow ruling in PE when V/Q is reported as "high probability" for PE. Hayashino and colleagues provided posttest probabilities based on low, medium, and high clinical suspicion, which makes this a practical review. If a patient with a moderate pretest clinical probability of PE has a negative helical CT, the posttest probability is still 5.5%, and is 11.6% with a near normal-to-normal V/Q scan. If the helical CT is positive, the posttest probability is 84%—the same as that of a high-probability V/Q scan.

The authors appropriately discuss the limitations of this process and the fact that all CT data reflected single-slice imaging. Today, most CT scans use 4- to 64-slice imaging, providing greater imaging resolution and the added ability to detect other diseases. We eagerly await the results of the Prospective Investigation of Pulmonary Embolism Diagnosis (PIOPED) II trial, which used multislice CTs and scanning of the pelvic and thigh veins, to see if this mode is useful in patients with moderate clinical suspicion of PE. It seems from this review that both tests are useful when clinical suspicion and test results are concordant.

Scott Kaatz, DO
Jack Buckley, MD
Henry Ford Health System
Detroit, Michigan, USA

References

1. **Wells PS, Ginsberg JS, Anderson DR, et al.** Use of a clinical model for safe management of patients with suspected pulmonary embolism. Ann Intern Med. 1998;129:997-1005.
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.