

Diagnosis

A normal alveolar dead space fraction plus D-dimer assay ruled out suspected pulmonary embolism in the emergency department

Kline JA, Israel EG, Michelson EA, et al. *Diagnostic accuracy of a bedside D-dimer assay and alveolar dead-space measurement for rapid exclusion of pulmonary embolism: a multicenter study.* JAMA 2001 Feb 14;285:761-8.

QUESTION: In patients with suspected pulmonary embolism (PE) who are in the emergency department, can a normal alveolar dead space fraction (ADF) assessment and a negative whole blood agglutination D-dimer assay exclude PE?

Design

Blinded comparison of test results for ADF and D-dimer assay with radionuclide lung scanning (V/Q scan), contrast enhanced computer tomography, and 6 month follow up plus selective use of venous ultrasonography and pulmonary angiography.

Setting

6 urban teaching hospitals in the US.

Patients

380 patients (mean age 50 y, 70% women) with suspected PE. Inclusion criteria were age > 18 years and not being transferred from another facility. Exclusion criteria were signs of circulatory shock, inability to breathe room air and maintain pulse oximetry reading of < 90%, or failure to cooperate with volumetric capnometry and blood collection.

Description of tests and diagnostic standard

ADF was calculated by using a computer algorithm with data from volumetric capnograms recorded for 2 minutes and arterial blood gas results. A test result of < 20% was considered to be normal. D-dimer testing was done at the bedside by using a whole blood agglutination assay (SimpliRED). The diagnostic standard included a V/Q scan or a computed tomogram scan of the chest plus a 6 month follow up. For patients with a non-diagnostic V/Q scan, venous ultrasonography and pulmonary angiography could also be done.

Main outcome measures

Sensitivity and specificity for both ADF and D-dimer assay results.

Main results

64 patients (18%) had PE; these patients were older (56 v 49 y) and less likely to report dizziness (16% v 31%) than were patients without PE. In combination, the ADF

and D-dimer test results had high sensitivity but poor specificity (table). Consequently, negative results from both tests effectively ruled out the diagnosis of PE, even though positive results from both tests did not rule in the diagnosis.

Conclusion

A negative D-dimer test result plus a normal alveolar dead space fraction ruled out pulmonary embolism in symptomatic patients presenting to the emergency department.

COMMENTARY

No single non-invasive test has both high sensitivity and high specificity for PE. Consequently, in addition to an assessment of clinical probability (ie, low, moderate, or high), most patients with suspected PE require either several non-invasive tests or pulmonary angiography to rule in or rule out PE. Kline *et al* evaluate the accuracy of a whole blood D-dimer assay and measurement of ADF for the diagnosis of PE. They confirm that this D-dimer assay has a moderate to high sensitivity for PE, the result is usually normal in the absence of PE, and a normal result is very helpful in ruling out PE.¹ At best, ADF results were moderately predictive of PE. The authors indicate that the addition of ADF measurement to D-dimer testing resulted in a clinically important increase in sensitivity and a decrease in the negative likelihood ratio.

However, this conclusion may not be justified. Firstly, the trade off for detecting 3 cases of PE among the 216 patients with a normal D-dimer test result was that 49 false positive ADF results were obtained. Secondly, even these 3 patients may not have had acute PE; most emboli were diagnosed on the basis of high probability V/Q scans, which are associated with an appreciable proportion of false positive results.² ADF is increased in patients with a high probability scan (ie, ventilated but not perfused lung segments) regardless of whether acute embolism exists. Further studies are required to determine whether and how measurement of ADF should be used as a diagnostic test for PE.

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Alveolar dead space fraction (ADF) and D-dimer assay to rule out pulmonary embolism*

Test	Sensitivity (95% CI)	Specificity (CI)	+LR	-LR
ADF plus D-dimer	98% (92 to 100)	52% (46 to 57)	2.03	0.03
ADF alone	67% (53 to 77)	76% (72 to 81)	2.83	0.43
D-dimer alone	94% (85 to 98)	67% (62 to 72)	2.85	0.09

*Diagnostic terms defined in glossary.