Clinical Diagnosis of Acute Pulmonary Embolism

When Should a V/Q Scan Be Ordered?

If the diagnosis of acute pulmonary embolism is established and appropriate therapy is given, the mortality of acute pulmonary embolism is less than 10 percent. However, most patients who die of pulmonary embolism did not have therapy because the diagnosis of pulmonary embolism was not made. Of the approximately 100,000 to 200,000 patients per year who die of pulmonary embolism, only 10 percent have any form of therapy prior to death. Improving our ability to recognize acute pulmonary embolism would have a much greater impact on decreasing the number of deaths due to pulmonary embolism than would improvements in our current therapy.

The two articles from the PIOPED Study by Stein et al., which appeared in the September 1991 issue of *Chest*, illustrate the difficulties involved in making the clinical diagnosis of acute pulmonary embolism. Ventilation/perfusion scans were performed in 891 patients in whom symptoms, signs, and laboratory findings suggested the diagnosis of acute pulmonary embolism. Pulmonary embolism was documented by pulmonary angiogram or follow-up in only 29 percent. The incidence of a false-positive clinical diagnosis of pulmonary embolism was 71 percent. Because V/Q scans and pulmonary angiograms were performed only when pulmonary embolism was suspected, the rate of false-negative diagnosis of pulmonary embolism was not determined in that study.

Karwinski and Svensen reported the incidence of pulmonary embolism in 21,529 postmortem examinations from 1960 to 1984. The overall incidence of pulmonary embolism in their hospital with a consistent postmortem rate of 75 to 80 percent was 9 percent. In 1,450 cases in which pulmonary embolism was the immediate cause of death, the diagnosis of pulmonary embolism was suspected in only 18.4 percent. In 484 cases in which pulmonary embolism contributed to death, it was diagnosed in only 9.9 percent. The percentage of patients in whom pulmonary embolism was diagnosed prior to death decreased from 19.4 percent in 1960 to 1969 to 10.5 percent in 1980 to 1984. The number of patients dying of pulmonary embolism who had any form of therapy was not reported.

There are very few other common potentially lethal diseases for which our clinical diagnostic accuracy is so poor.

One potential explanation for the poor accuracy in the recognition of pulmonary embolism is the fact that many patients with acute pulmonary embolism have coexistent cardiac or pulmonary disease that may mimic the signs and symptoms of acute pulmonary embolism. In the PIOPED Study, 526 (59 percent) of the 891 patients with clinically suspected pulmonary embolism had coexisting cardiac or pulmonary disease. However, the clinical accuracy of the diagnosis of pulmonary embolism was no better in the patients without coexisting cardiac or pulmonary disease (29 percent) than in those with prior cardiac or pulmonary disease (27 percent). Furthermore, the PIOPED investigators found that the diagnostic accuracy of V/Q scans for acute pulmonary embolism was not affected by the presence of preexisting cardiac or pulmonary diseases.

The principal reason that the clinical recognition of acute pulmonary embolism is so inaccurate is that each of the signs, symptoms, and chest x-ray and ECG findings that are present in acute pulmonary embolism is nonspecific. All of the signs and symptoms seen in patients with acute pulmonary embolism are also present in a variety of other cardiac and pulmonary diseases.

In the PIOPED study of patients without prior cardiac or pulmonary disease, there were no significant differences in symptoms between patients with documented pulmonary embolism and those without documented disease. Furthermore, when the physical findings in those with and without pulmonary embolism were compared, the only significant differences were that rales, a fourth heart sound, and an increased pulmonary component of the second heart sound were somewhat more common in those with pulmonary embolism. Unfortunately, the difference in the incidence of these three physical findings was not sufficient to be of diagnostic value. Analysis of chest x-ray findings gave similar results. Although parenchymal abnormalities, pleural effusion, pleural-based opacities, and decreased pulmonary vascularity were more common in patients with documented pulmonary embolism, the differences were not sufficient to be of diagnostic value. The ECG findings in patients with documented pulmonary embolism are not different from those in patients with suspected pulmonary embolism who have normal pulmonary angiograms.

Given the fact that the symptoms, physical findings, chest x-ray findings, and ECG findings in patients with
pulmonary embolism are nonspecific, when should the clinician suspect pulmonary embolism and order a V/Q scan? I believe that the clinician should suspect pulmonary embolism in patients who have signs, symptoms, and laboratory findings suggesting the presence of one of the three syndromes of acute pulmonary embolism.\textsuperscript{7,8} The pathophysiology of these three syndromes and therefore the resultant signs, symptoms, and laboratory findings are quite different.

Pulmonary infarction or pulmonary hemorrhage occurs in patients with submassive pulmonary embolism who have complete obstruction of a distal branch of the pulmonary circulation.\textsuperscript{9} The classic symptom of pulmonary infarction is pleuritic pain. The most common physical finding is the presence of rales. The chest x-ray film is nearly always abnormal, demonstrating a parenchymal abnormality, pleural effusion, or elevated diaphragm.\textsuperscript{10}

At the other extreme is acute cor pulmonale, caused by obstruction of more than 60 to 75 percent of the pulmonary circulation.\textsuperscript{11} Affected patients are those who present with shock or loss of consciousness.\textsuperscript{12} The chest x-ray film in these patients is usually normal, but the ECG usually shows IRB\textsubscript{3} or the S\textsubscript{1}Q\textsubscript{3} T\textsubscript{3} pattern.\textsuperscript{10}

The pulmonary embolism syndrome most likely to be overlooked is acute, unexplained dyspnea, which occurs in patients with submassive (<60 percent obstruction) who do not develop pulmonary infarction. In these patients, the ECG and chest x-ray findings are usually normal, but the arterial P\textsubscript{O\textsubscript{2}} is nearly always significantly depressed.

In the PIOPED Study,\textsuperscript{3} 91 percent of the 365 patients without prior cardiac or pulmonary disease who were suspected of having acute pulmonary embolism presented with one of these three syndromes. I believe that the accuracy of the clinical diagnosis of pulmonary embolism in this study might have been greater if the signs, symptoms, and laboratory findings had been considered in light of the varying pathophysiological features of these three syndromes.

For example, only 6 percent of patients with pulmonary embolism had ECG evidence suggesting acute cor pulmonale. Were they the same patients who presented with circulatory collapse? Which of the patients with pleuritic pain had chest x-ray abnormalities? Were patients with pleuritic pain who had parenchymal abnormalities, pleural effusion, or pleural-based opacities more likely to have pulmonary embolism than patients with pleuritic pain but a normal chest x-ray film? Of those patients who presented with isolated dyspnea, was the probability of pulmonary embolism greater in those with a low P\textsubscript{O\textsubscript{2}} than in those without a normal or near-normal P\textsubscript{O\textsubscript{2}}?

An analysis of the PIOPED data to determine whether consideration of signs, symptoms, and laboratory findings according to the pathophysiology of these three syndromes would enhance the accuracy of the clinical diagnosis of acute pulmonary embolism would be of great interest.

Given the lack of specificity of signs, symptoms, and x-ray and ECG findings in patients with acute pulmonary embolism, when should the clinician suspect pulmonary embolism and proceed to V/Q lung scanning? I believe that pulmonary embolism should be suspected and a lung scan should be ordered when patients have a combination of signs, symptoms, and laboratory findings that suggest one of the three when they occur in patients with evidence of, or predisposition to, venous thromboembolism.

James E. Dalen, M.D., F.C.C.P.

Tucson

Vice Provost for Medical Affairs and Dean, College of Medicine, University of Arizona.

Reprint requests: Dr. Dalen, Dean, College of Medicine, 1501 North Campbell, Rm 2222, Tucson 85724

REFERENCES


2 Dalen JE, Alpert JS. Natural history of pulmonary embolism. Prog Cardiovasc Dis 1975; 17:259-70


4 Stein PD, Coleman RE, Gottschalk A, Saltzman HA, Terrin ML, Weg JC. Diagnostic utility of ventilation/perfusion lung scans in acute pulmonary embolism is not diminished by pre-existing cardiac or pulmonary disease. Chest 1991; 100:604-60


7 Dalen JE, Dexter L. Pulmonary embolism. JAMA 1969; 207:1505-07


11 McGinn S, White PD. Acute cor pulmonale resulting from pulmonary embolism. JAMA 1935; 104:1473-80