

## **Pulmonary Embolism Diagnosis:**

# **PIOPED STUDY COMPARES LUNG SCANS AND PULMONARY ARTERIOGRAPHY**

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**D**iagnosis of pulmonary embolism could be improved by refining the criteria for diagnosis with ventilation-perfusion scans and combining these lung scan findings with clinical judgment, according to the results of a multicenter trial funded by the National Heart, Lung, and Blood Institute (NHLBI).

The Prospective Investigation in Pulmonary Embolism Diagnosis (PIOPED) study was designed to answer questions about how specific and sensitive ventilation-perfusion scans are and how they compare to the standard technique for diagnosing pulmonary embolism—pulmonary arteriography. The findings showed lung scans, in combination with physician assessment, can be useful for this purpose, but more clearly defined diagnostic criteria are needed to enhance their reliability. Physicians must decide what margin-of-error they will accept before deferring to arteriography.

### **Scans Useful for 'Screening'**

Abass Alavi, MD, chief of the nuclear medicine division of the department of radiology at the Hospital of the University of Pennsylvania, told *Newsline*, "the study identified some

problems with the scan, but it definitely doesn't exclude the scan as a useful test for pulmonary embolism." He added that while the current limitations of lung scans (that certain categories of scan patterns are less specific and more difficult to assess than others) were confirmed by the study, the lung scan "still is a very important test as a screening test. It should be used in most patients who are suspected of having pulmonary embolism" even though "certain patients cannot be diagnosed with a scan and will have to go on to arteriography."

"The most important contribution of the study," said Dr. Alavi, "is that using the accumulated data physicians will be able to refine the criteria for diagnosis of pulmonary embolism." He added that researchers are employing the expansive database generated during the study to develop diagnostic criteria that "reflect more precisely what the probabilities are for pulmonary embolism."

Another important aspect of the PIOPED study is its prospective nature, said Dr. Alavi. Past studies relied on retrospective analyses of angiograms, which, because they included patients selected on the basis of subjective criteria, may have been biased.

This recent study involves "no selection bias whatsoever for enrolling patients in the study," he said, since each patient with an abnormal lung scan was a candidate for pulmonary angiography.

### **Prior Clinical Estimate Improves Reliability**

The results of the study demonstrated that one out of three patients with suspected pulmonary embolism did in fact have the condition, according to Herbert Saltzman, MD, professor of medicine at Duke University Medical Center and chairman of the PIOPED steering committee. He told *Newsline*, "a high probability scan reliably indicated the presence of acute pulmonary embolism . . . in patients who were under clinical suspicion of having pulmonary embolism . . . a less than low probability scan was seldom associated with acute pulmonary embolism" and low and intermediate probability scans were associated with "a significant incidence" of the condition. He added that in cases where there are low and intermediate probability scans, if the degree of clinical suspicion is substantial, arteriography is necessary to make a decision.

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"Prior clinical estimate," said Dr. Saltzman, "did correlate very significantly with final result as determined by arteriography."

Dr. Alavi also noted the significance of clinical judgment by saying, "it's important to combine clinical impression with the scan pattern."

#### **Some Caution Against Overreliance On Clinical Judgment**

Although clinical judgment along with lung scans enhanced predictive ability, that diagnostic combination did not identify all the pulmonary embolisms in the PIOPED study. According to Dr. Saltzman, "there was no scan interpretation category in which pulmonary embolism was never found." In addition lung scans in conjunction with clinical judgment do not always rule out disease when it is absent. "Scans are not reliably specific for the diagnosis of pulmonary embolism," said Dr. Alavi. For these reasons, he added, physicians should be wary of an overreliance on scan results and advocate the use of arteriography when necessary. Clinicians must decide what is an acceptable level of error. Since the serious complications from angiography are not likely, Dr. Alavi said, physicians should "realize the pitfalls of interpretation of the scans" and should seek arteriographic confirmation when the results from lung scans, in combination with other laboratory tests and clinical judgment, are indeterminate.

#### **Over 1,000 Patients Studied**

During the recruitment and testing phase of the study, which began in 1984, over 1,000 patients with suspected pulmonary embolism underwent pulmonary arteriography within 24 hr of the scan. Patients, including those with normal scans or normal subsequent angiograms, were followed up at regular intervals for at least a year. Extensive clinical eval-

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uation, which included laboratory data (in addition to the scans and angiograms), treatment data, and outcome information, was integral throughout the study.

Scans were assigned to one of five categories—high, intermediate, low, and very low probability and normal—based on the number and size of defects observed in scans and chest x-rays (which were taken of all subjects).

The PIOPED study, which was conducted at six centers—the University of Michigan Hospital at Ann Arbor, Henry Ford Hospital, Massachusetts General Hospital, Yale University Hospital, the Hospital of the University of Pennsylvania, and Duke University Medical Center—and was coordinated by the Maryland Medical Research Institute—has the "largest angiography sample in patients with suspected pulmonary embolism in the world" to date, said Dr. Alavi.

Ventilation-perfusion scans have some distinct advantages over arteriography. Unlike arteriography, the lung scan is a non-invasive procedure; it is less expensive, requires less training, and is more easily done and repeated than arteriography.

In addition to improving the criteria for diagnosing pulmonary embolism with ventilation-perfusion scans, researchers are working on other tech-

niques that in concert with lung scans will improve diagnosis. Dr. Alavi told *Newsline*, "new developments in nuclear medicine and other fields combined with lung scans may be all we need to use to handle all these patients non-invasively." These other tests, he added, could "bring specificity to what we see with lung scans."

In a study ancillary to PIOPED, Dr. Alavi studied an imaging technique for clot detection that uses an indium-labeled antifibrin antibody. This study continues independent of PIOPED. Further developments are being made with technetium-labeled antifibrin antibody imaging. Dr. Alavi predicts, "A combination of antifibrin antibody imaging and the lung scan will be excellent and could eventually replace angiography" as well as "simplify the treatment of patients with pulmonary embolism."

The yearly incidence in the US of pulmonary embolism is 650,000. According to Dr. Alavi, there is a 30% chance of death if the condition is left untreated, but an 8% chance if it is detected and treated. He concludes, "the lung scan is a very important tool in the management of these patients and will remain so in the foreseeable future."

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