Clinical Characteristics of Patients with Acute Pulmonary Embolism

Paul D. Stein, MD, Herbert A. Saltzman, MD, and John G. Weg, MD

Among 117 patients with pulmonary embolism (PE) and no prior cardiac or pulmonary disease who participated in the National Heart, Lung, and Blood Institute Prospective Investigation of Pulmonary Embolism Diagnosis (PIOPED) study, combinations of clinical characteristics were identified that were present in nearly all in whom the diagnosis of PE was made.[1] We now assess these as well as additional combinations of characteristics in the entire population of patients with acute PE who participated in PIOPED, irrespective of the presence of prior cardiopulmonary disease.

The eligible population consisted of patients aged ≥18 years in whom acute PE was of diagnostic concern. Symptoms suggestive of PE were required within 24 hours of entry into the study.[2] The PIOPED study consisted of 2 groups. In 1 group, patients who consented to participate in the investigation were obligated to undergo pulmonary angiography if their ventilation/perfusion scans were abnormal. There were 251 patients with acute PE in this arm of the PIOPED study in whom the diagnosis was made by angiography.[2] There was a second group in the PIOPED study which was not described in the PIOPED report. This group included patients who by random sample were not selected for sensitivity and specificity analyses of their ventilation/perfusion scans, and who, therefore, were not obligated by protocol to undergo angiography if their ventilation/perfusion scans were abnormal. Also in this group were patients who refused mandatory angiography and, therefore, refused to participate in the first arm of the study. However, many of these patients underwent diagnostic angiography at the request of their attending physicians. There were 132 patients in this arm of the study who had PE diagnosed by angiography. The present investigation reports the clinical characteristics of acute PE in the 383 patients with acute PE who were in either arm of the PIOPED study. Comparisons were made with 843 patients in whom suspected PE was excluded, either by angiography (677 patients) or follow-up and outcome classification (166 patients). The method of outcome classification has been described.[2]

Chest radiographs were obtained within 24 hours of angiography in all patients. The partial pressure of oxygen in arterial blood (PaO_2), with the patient breathing room air, was measured within 24 hours before the diagnostic pulmonary angiogram in 280 patients with and 624 patients without PE. Detailed methods have been reported.[2]

A chi-square with Yates' correction was used to compare the prevalence and distribution of clinical features. Because of the large number of comparisons made in this analysis, p values tend to exaggerate the statistical significance of observed differences. Comparisons of continuous variables were made with a Student's t test. Data were analyzed at the Henry Ford Heart and Vascular Institute from a tape provided by the PIOPED Data and Coordinating Center. The patients with acute PE were 58 ± 17 years of age (mean ± standard deviation); 204 were men (53%). Patients in whom PE was excluded were 55 ± 18 years of age; 355 (42%) were men. Among the 383 patients with acute PE the most frequent symptoms were dyspnea in 299 (78%), pleuritic pain in 225 (59%) and cough in 166 (43%). The most frequent signs of PE were tachypnea (respiratory rate ≥20 beats/min) in 278 (73%), rales in 210 (55%) and tachycardia (heart rate >100 beats/min) in 115 (30%). The frequency of symptoms and signs in 843 patients with no PE was not significantly different. The most frequent radiographic abnormality was atelectasis or a pulmonary parenchymal abnormality, either or both of which were observed in 263 patients (69%) with and 483 (58%) without PE ($p < 0.001$). A pleural effusion was present in 180 (47%) with and in 327 (39%) without PE ($p < 0.01$). A pleural-based opacity was present in 132 (34%) with and 223 (26%) without PE ($p < 0.01$). An elevated diaphragm was present in 106 (28%) with and in 175 (21%) without PE ($p < 0.01$). The PaO_2 while breathing room air was <80 mm Hg in 226 of 280 (81%) with and 458 of 624 (73%) without PE ($p < 0.05$).

Combinations of signs, symptoms, radiographic features and PaO2 most frequently present in patients with PE are listed in Table I. These combinations of clinical characteristics occurred with nearly the same frequency (within 1%) among patients in whom PE was excluded.

Combinations of signs and symptoms associated with PE in patients with no prior cardiopulmonary disease

From Henry Ford Heart and Vascular Institute, 2799 W. Grand Boulevard, Detroit, Michigan 48202; Duke University, Durham, North Carolina; and the University of Michigan, Ann Arbor, Michigan. This study was supported by contracts NO1-HR-34007, NO1-HR-34008, and NO1-HR-34010 from the National Heart, Lung, and Blood Institute, Bethesda, Maryland. Manuscript received June 10, 1991; revised manuscript received July 19, 1991, and accepted July 20.

TABLE I Combinations of Clinical Findings in Patients with Acute Pulmonary Embolism

	No. of Pts. (%)
Dyspnea or tachypnea*	347/383 (91)
Dyspnea, tachypnea or pleuritic pain	371/383 (97)
Dyspnea, tachypnea, pleuritic pain or DVT	373/383 (97)
Dyspnea, tachypnea, pleuritic pain, or x-ray atelectasis/parenchymal	379/383 (99)
Dyspnea, tachypnea, pleuritic pain, DVT or x-ray atelectasis/parenchymal	381/383 (99)
Dyspnea, tachypnea, pleuritic pain, DVT, x-ray atelectasis/parenchymal or PaO2 <80 mm Hg	280/280 (100)

*Tachypnea = respiratory rate ≥20 beats/min.
DVT = signs of deep venous thrombosis; PaO_2 = partial pressure of oxygen in arterial blood.

were identified among patients who participated in the Urokinase Pulmonary Embolism trial,[3] and this experience was expanded upon in the PIOPED study through the identification of additional useful combinations.[1] Although such combinations are not specific for PE, they are extremely sensitive in identifying the population in whom PE should be considered. In the present study we tested combinations of clinical characteristics among all patients with acute PE, irrespective of prior cardiopulmonary disease. Several combinations were present in almost all patients with acute PE. Dyspnea or tachypnea or pleuritic pain or radiographic evidence of atelectasis or a parenchymal abnormality occurred in 99% of patients. All patients with PE had dyspnea or tachypnea or pleuritic pain or deep venous thrombosis or atelectasis/parenchymal abnormality or a PaO2 <80 mm Hg. These data indicate that among patients in whom PE was identified, only a small percentage did not have a number of important manifestations. These manifestations are not specific for PE, and their presence does not necessarily warrant initiation of an investigation for PE. However, the recognition of these manifestations assists in identifying patients in whom ventilation/perfusion scans or angiography, or both, may be necessary.

1. Stein PD, Terrin ML, Hales CA, Palevsky HI, Saltzman HA, Thompson BT, Weg JG. Clinical, laboratory, roentgenographic and electrocardiographic findings in patients with acute pulmonary embolism and no pre-existing cardiac or pulmonary disease. *Chest* 1991;100:598–603.

2. The PIOPED Investigators. Value of the ventilation/perfusion scan in acute pulmonary embolism: results of the Prospective Investigation of Pulmonary Embolism Diagnosis (PIOPED). *JAMA* 1990;263:2753–2759.

3. Stein PD, Willis PW III, DeMets DL. History and physical examination in acute pulmonary embolism in patients without pre-existing cardiac or pulmonary disease. *Am J Cardiol* 1981;47:218–223.

Lymphoproliferative Disorder Early After Cardiac Transplantation

Debbie Rinde-Hoffman, MD, Guillermo B. Cintron, MD, Jane E. Ferguson, RN, BSN, John C. Toole, MD, and William B. Bugni, MD

In cardiac transplantation, extremely potent immunosuppressive agents are used, which leave the host vulnerable to a variety of infections and malignancies. Among the malignancies, lymphoproliferative disorders are the most common.[1] Most cases of posttransplant lymphoproliferative disorders have been described in patients who have undergone several months of immunosuppression.[2,3] This report describes our experience with patients who developed lymphoproliferative disorder within 3 months of heart transplantation.

Our patient population includes all patients who underwent cardiac transplantation at the University of South Florida/Tampa General Hospital and at St. Joseph's Hospital in Tampa, Florida. As of December 1989, 79 patients had undergone heart transplantation at University of South Florida/Tampa General Hospital and 13 at St. Joseph's Hospital. All patients received immunosuppressive therapy with cyclosporine, azathioprine and prednisone in doses adjusted to the overall clinical condition. In addition, during 1989, "induction" or prophylactic immunosuppressive therapy with OKT3 was initiated within 48 hours of cardiac transplantation. OKT3 was administered by an intravenous infusion of 5 mg/day for 14 consecutive days.

We defined lymphoproliferative disorder as a histologically documented disorder characterized by uncontrolled monoclonal or polyclonal proliferation of B lymphocytes within, or separate from, lymph nodes. Clinical data were obtained from individual medical records.

Table I outlines the salient features in our patients with lymphoproliferative disorder. All patients received OKT3, 3 as part of a prophylactic "induction" protocol and 2 as rescue therapy for acute early cardiac rejection unresponsive to high-dose intravenous corticosteroid therapy. The initial clinical presentation included fever, lymphadenopathy and abnormal liver function tests. In 3 patients the clinical course was one of rapid irreversible multisystem failure and at autopsy all 3 patients with active lymphoprolifera-

From the Division of Cardiology, Department of Internal Medicine, University of South Florida College of Medicine, and the Heart Transplant Program, Tampa General Hospital, Tampa, Florida.

Manuscript received April 17, 1991; revised manuscript received and accepted July 15, 1991.