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Clinical Characteristics of Patients with Acute Pulmonary

Embolism:

Data from PIOPED II

Paul D. Stein, MD^{1,2}, Afzal Beemath, MD¹, Fadi Matta, MD¹, John G. Weg, MD³, Roger D. Yusem, MD⁴, Charles A. Hales, MD⁵, Russell D. Hull, MBBS, MSc⁶, Kenneth V. Leeper Jr., MD⁷, H Dirk Sostman, MD⁸, Victor F. Tapson, MD⁹, John D. Buckley, MD¹⁰, Alexander Gottschalk, MD¹¹, Lawrence R. Goodman, MD¹², Thomas W. Wakefield, MD¹³, and Pamela K. Woodard, MD¹⁴

1Department of Research, St. Joseph Mercy Oakland Hospital, Pontiac, Michigan

2Department of Medicine, Wayne State University, Detroit, Michigan

3Department of Medicine, University of Michigan, Ann Arbor, Michigan

4Department of Medicine, Washington University School of Medicine, St. Louis, Missouri

5Department of Medicine, Massachusetts General Hospital, and Harvard Medical School, Boston, Massachusetts

6Department of Medicine, University of Calgary, Calgary, Alberta, Canada

7Department of Medicine, Emory University, Atlanta, Georgia

8Office of the Dean, Weill Cornell Medical College and Methodist Hospital, Houston, Texas

9Department of Medicine, Duke University, Durham, North Carolina

10Department of Medicine, Henry Ford Hospital, Detroit, Michigan

11Department of Radiology, Michigan State University, East Lansing, Michigan

12Department of Radiology, Medical College of Wisconsin, Milwaukee, Wisconsin

13Department of Surgery, University of Michigan, Ann Arbor, Michigan

14Department of Radiology, Washington University, St. Louis, Missouri

Abstract

BACKGROUND—Selection of patients for diagnostic tests for acute pulmonary embolism requires recognition of the possibility of pulmonary embolism based on the clinical characteristics. Patients in the Prospective Investigation of Pulmonary Embolism Diagnosis II (PIOPED II) had a broad spectrum of severity, which permits an evaluation of the subtle characteristics of mild pulmonary embolism as well as the characteristics of severe pulmonary embolism.

METHODS—Data are from the national collaborative study, PIOPED II.

For replies: Paul D. Stein MD, St. Joseph Mercy Oakland, 44405 Woodward Ave. Pontiac, MI 48341-5023, Tel 248/858-6772, Fax 248/858-6974, E-mail: steinp@trinity-health.org

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RESULTS—There may be dyspnea only on exertion. The onset of dyspnea is usually, but not always, rapid. Orthopnea may occur. In patients with pulmonary embolism in main or lobar pulmonary arteries, dyspnea or tachypnea occurred in 92%, but in only 65% in whom the largest pulmonary embolism was in segmental pulmonary arteries. In general, signs and symptoms were similar in elderly and younger patients, but dyspnea or tachypnea were less frequent in elderly patients with no prior cardiopulmonary disease. Dyspnea may be absent even in patients with circulatory collapse. Patients with a low probability objective clinical assessment sometimes had pulmonary embolism, even in proximal vessels.

CONCLUSION—Symptoms may be mild and generally recognized symptoms may be absent, particularly in patients with pulmonary embolism only in segmental pulmonary branches, but they may be absent even with severe pulmonary embolism. A high or intermediate probability objective clinical assessment may suggest the need for diagnostic studies, but a low probability objective clinical assessment does not exclude the diagnosis. Maintenance of a high level of suspicion is critical.

Keywords

Pulmonary embolism; venous thromboembolism; deep venous thrombosis; clinical diagnosis

Acute pulmonary embolism in patients with severe or fatal pulmonary embolism at autopsy is generally unrecognized antemortem.¹⁻⁴ Advances in the diagnostic methods for acute pulmonary embolism should impact this high rate of underdiagnosis.⁵⁻⁸ However, the successful use of diagnostic pathways requires recognition of patients with possible acute pulmonary embolism based on the clinical characteristics.

The clinical characteristics of patients with acute pulmonary embolism in the first Prospective Investigation of Pulmonary Embolism Diagnosis (PIOPED), an accuracy study of ventilation-perfusion scintigraphy, were described in all enrolled patients⁹, those with no prior cardiopulmonary disease¹⁰, patients according to the presenting syndromes of pulmonary embolism¹¹ and in the elderly.¹² One of the strengths of the data from PIOPED II is that many patients with mild pulmonary embolism were included, which permits identification of subtle clinical characteristics. However, that the clinical characteristics of patients with pulmonary embolism in PIOPED⁹⁻¹², as in PIOPED II and other investigations of patients enrolled in clinical trials^{13,14}, are characteristics of patients whose findings were sufficient to alert attuned physicians to the diagnosis, and characteristics of patients who met the inclusion criteria. Patients who were too ill to participate, or who died suddenly, or were not identified because the clinical findings were mild or atypical, were not included. With these constraints in mind, we describe the clinical characteristics of patients enrolled in PIOPED II.

Patients and Methods

PIOPED II was a prospective multicenter investigation of multidetector CT angiography alone and combined with venous phase imaging of the pelvic and thigh veins for the diagnosis of acute pulmonary embolism.⁵ A composite reference test was used⁵. Patients \geq age 18 years with clinically suspected acute pulmonary embolism were potentially eligible.⁵ Exclusion criteria included an inability to complete tests within 36 hours, critical illness, ventilatory support, shock, recent myocardial infarction, abnormal serum creatinine, allergy to contrast material, pregnancy, treatment with long-term anticoagulants, inferior vena cava filter, and deep venous thrombosis of the upper extremity.

To avoid confusing clinical findings of pulmonary embolism with comorbid conditions, we evaluated patients with no prior cardiopulmonary disease as well as all patients. No prior cardiopulmonary disease was defined as no current asthma, pneumonia, history of chronic

bronchitis, emphysema, chronic obstructive pulmonary disease, current or past history of right or left sided heart failure, lung cancer, or prior pulmonary embolism.

The circulatory collapse syndrome was defined as loss of consciousness or systolic blood pressure ≤ 80 mm Hg. The hemoptysis/pleuritic pain syndrome (previously termed the pulmonary infarction syndrome)¹³ was defined as patients with either hemoptysis or pleuritic pain in the absence of circulatory collapse. The uncomplicated dyspnea syndrome was defined as dyspnea in the absence of hemoptysis, pleuritic pain or circulatory collapse.

Measurements of arterial blood gases were obtained while the patient was breathing room air. The alveolar-arterial (A-a) oxygen difference was calculated as:¹⁵

$$A - a \text{ oxygen difference (mm Hg)} = 150 - 1.25P_a\text{CO}_2 - P_a\text{O}_2$$

where $P_a\text{CO}_2$ = partial pressure of carbon dioxide in arterial blood (mm Hg), and $P_a\text{O}_2$ = partial pressure of oxygen in arterial blood (mm Hg).

Statistical methods

Chi-square was used to compare the prevalence of clinical features in patients with and without pulmonary embolism. Because of the large number of comparisons, p-values are underestimates. Comparisons of continuous variable means were made with two-tailed Student's unpaired t-test.

RESULTS

Acute pulmonary embolism was present in 192 patients among whom 133 (69%) had no prior cardiopulmonary disease. Pulmonary embolism was excluded in 632 patients among whom 366 (58%) had no prior cardiopulmonary disease.

Syndromes of Pulmonary Embolism

The syndrome of hemoptysis or pleuritic pain occurred in 41% of patients with no prior cardiopulmonary disease and in 44% of all patients with pulmonary embolism (Table 1). The uncomplicated dyspnea syndrome occurred in 36% of patients with no prior cardiopulmonary disease and in 36% of all patients with pulmonary embolism. The circulatory collapse syndrome was uncommon, being 8% in patients with no prior cardiopulmonary disease and 8% in all enrolled patients with acute pulmonary embolism. In 19 patients (14%) with pulmonary embolism and no prior cardiopulmonary disease their presentations differed from these syndromes. Tachypnea or tachycardia or a $P_a\text{O}_2 < 80$ mm Hg with signs or symptoms of deep venous thrombosis were the presenting findings in some of these patients (Table 1).

Partial Pressure of Oxygen in Arterial Blood and Alveolar-Arterial Oxygen Difference

The partial pressure of oxygen in arterial blood ($P_a\text{O}_2$) while breathing room air was measured in 74 patients with pulmonary embolism and in 48 patients with pulmonary embolism and no prior cardiopulmonary disease (Table 2). Among all patients with pulmonary embolism, the $P_a\text{O}_2$ while breathing room air was 80 mm Hg or higher in 32% and in those with no prior cardiopulmonary disease it was 80 mm Hg or higher in 38%. The A-a oxygen difference was ≤ 20 mm Hg in 32% of all patients with pulmonary embolism and in 35% of patients with pulmonary embolism and no prior cardiopulmonary disease (Table 2).

Risk Factors for Pulmonary Embolism

Immobilization (bed rest within past month for the most of the day for ≥ 3 consecutive days) was the most frequent risk factor assessed in patients with pulmonary embolism, and surgery

was the usual cause of immobilization (Table 3). One or more of the assessed risk factors were reported in 92% of patients with pulmonary embolism and no prior cardiopulmonary disease. Among all patients with pulmonary embolism, 94% had 1 or more of the assessed risk factors.

Symptoms of Pulmonary Embolism

New dyspnea at rest or on exertion was the most frequent symptom in patients with pulmonary embolism and no prior cardiopulmonary disease (73%)(Table 4). Dyspnea only on exertion was observed in 16% of patients with pulmonary embolism and no prior cardiopulmonary disease and in 16% of all patients with pulmonary embolism (Table 4). Two-pillow orthopnea was often present (Table 4). Among patients with dyspnea who had pulmonary embolism and no prior cardiopulmonary disease, orthopnea occurred in 37 of 97 (38%) and it occurred in 11 of 21 (52%) with dyspnea only on exertion.

The onset of dyspnea was rapid (within seconds or minutes) in 72% of patients with pulmonary embolism and no prior cardiopulmonary disease and in 67% of all patients with pulmonary embolism (Table 5). The onset was within seconds, minutes or hours in 83% of patients with pulmonary embolism and no prior cardiopulmonary disease and in 87% of all patients with pulmonary embolism. In some, however, the onset of dyspnea occurred over days.

Pleuritic chest pain was more frequent than hemoptysis (Table 4). Cough, when present, was usually nonproductive, but purulent sputum and clear sputum were also reported. Hemoptysis may have been pinkish, blood streaked or all blood. Hemoptysis of pure blood occurred in only one patient with pulmonary embolism and no prior cardiopulmonary disease and it was < 1 teaspoonful. Thigh pain and thigh swelling were rarely described in the absence of calf pain or swelling.

Signs of Pulmonary Embolism

Tachypnea was present in somewhat over half of the patients with pulmonary embolism (Table 6). Tachycardia was present in about one-fourth. Clinical evidence of pulmonary hypertension (accentuated pulmonary component of the second sound), right ventricular pressure overload or enlargement (right ventricular lift) or elevated right atrial pressure (jugular venous distension) were shown in 21% of patients with no prior cardiopulmonary disease and 22% of all patients with pulmonary embolism. Lung examination was abnormal in 29% of patients with pulmonary embolism and no prior cardiopulmonary disease and 37% of all patients with pulmonary embolism. Crackles and decreased breath sounds were the most frequent lung findings. Rhonchi and wheezes occurred uncommonly. Signs of deep venous thrombosis (edema, erythema, tenderness, or palpable cord) in the thigh, in the absence of deep venous thrombosis in the calf were rare (Table 6). Among all patients with pulmonary embolism, calf swelling plus pain with palpation of the deep veins occurred in 32%.

Combinations of Signs and Symptoms

Either dyspnea or tachypnea was present in 84% of patients with pulmonary embolism and no prior cardiopulmonary disease and 86% of all patients with pulmonary embolism. Either dyspnea or tachypnea or pleuritic pain were present in 92% of patients with pulmonary embolism and no prior cardiopulmonary disease and is it was also present in 92% of all patients with pulmonary embolism. One or more of these signs and symptoms or signs of deep venous thrombosis were present in 98% of patients with pulmonary embolism and no prior cardiopulmonary disease and in 97% of all patients with pulmonary embolism.

Patients with Circulatory Collapse

Among patients with circulatory collapse with pulmonary embolism and no prior cardiopulmonary disease, dyspnea was present in 9 of 11 (82%), dyspnea or tachypnea was present in 10 of 11 (91%) and dyspnea, or tachypnea or pleuritic pain was also present in 10 of 11 (91%). All 11 patients had dyspnea or tachypnea or pleuritic pain or signs of deep venous thrombosis.

Among all patients with circulatory collapse and pulmonary embolism, dyspnea was present in 13 of 15 (87%), dyspnea or tachypnea was present in 14 of 15 (93%) and dyspnea, or tachypnea or pleuritic pain were also present in 14 of 15 (93%). All 15 patients had dyspnea or tachypnea or pleuritic pain or signs of deep venous thrombosis.

Clinical Characteristics According to Whether Pulmonary Embolism was in Proximal or Segmental Pulmonary Arteries

Among 150 patients with pulmonary embolism in whom images were classifiable, main or lobar (proximal) pulmonary arteries showed pulmonary embolism by CT angiography in 116 (77%). The largest affected branch was segmental in 32 (21%), and subsegmental in 2 (1%). Among all patients with pulmonary embolism in proximal arteries, 94% presented one of the typical syndromes (hemoptysis /pleuritic pain syndrome, uncomplicated dyspnea syndrome or circulatory collapse syndrome), whereas in patients with segmental pulmonary embolism, only 72% had 1 of these presentations. The others with segmental emboli had only calf swelling.

Dyspnea or tachypnea occurred in 92% of all patients with pulmonary embolism in whom the pulmonary embolism was proximal, but in only 65% with segmental pulmonary embolism. Dyspnea or tachypnea or pleuritic pain occurred in 97% of patients with proximal pulmonary embolism and 77% of patients with segmental pulmonary embolism. Dyspnea at rest or during exertion, dyspnea at rest, orthopnea, tachypnea and $P_aCO_2 \leq 35$ mm Hg were more frequent in patients with proximal pulmonary embolism and $P_aCO_2 \geq 40$ mm Hg was less frequent than in patients with segmental pulmonary embolism.

Signs, Symptoms and Combinations According to Age

Most symptoms and all signs occurred with similar frequencies in patients ≥ 70 years old and younger patients (Tables 7-10). In patients with no prior cardiopulmonary disease and among all patients with pulmonary embolism, dyspnea or tachypnea occurred less frequently in elderly patients than in younger patients.

Objective Clinical Assessment in Patients with Pulmonary Embolism

The majority of patients with pulmonary embolism (113 of 176, 64%) had a moderate probability of pulmonary embolism based on the Wells clinical scoring system⁷. The remaining patients with pulmonary embolism were equally divided with a high probability clinical assessment (32 of 176, 18%) and a low probability clinical assessment (31 of 176, 18%). Comparable proportions were found among patients with no prior cardiopulmonary disease, elderly patients, younger patients, and with patients who presented with the various syndromes. Among patients with pulmonary embolism in main or lobar pulmonary arteries in whom an objective clinical assessment was recorded, 16 of 107 (15%) had a low probability objective clinical assessment by the Wells scoring system.⁷

DISCUSSION

The data show a broad range of severity of clinical findings in patients with pulmonary embolism. The syndrome of pleuritic pain or hemoptysis, in the absence of circulatory collapse, was the most frequent mode of presentation in PIOPED occurring in 65% of patients with

pulmonary embolism and no prior cardiopulmonary disease.¹⁰ The present data from PIOPED II showed somewhat fewer patients with pleuritic pain or hemoptysis and more had the uncomplicated dyspnea syndrome. Circulatory collapse was an uncommon mode of presentation in PIOPED¹⁰ and in PIOPED II because of selection criteria. Patients with the hemoptysis or pleuritic pain syndrome have been shown to have less severe pulmonary embolism than patients with uncomplicated dyspnea based on an objective pulmonary angiography scoring system.¹³ Patients with circulatory collapse had the most severe pulmonary embolism based on the angiographic score, but the score was not statistically significantly higher than in patients with uncomplicated dyspnea.¹³ The absence of dyspnea did not exclude pulmonary embolism, even in patients with circulatory collapse.¹¹

Typically, among patients with acute pulmonary embolism, the P_aO_2 is low.¹⁰ However, acute pulmonary embolism cannot be excluded on the basis of a normal P_aO_2 . This was shown in the present study and in PIOPED¹⁰, where 26% of such patients with acute pulmonary embolism and no prior cardiopulmonary disease who had measurements of the P_aO_2 while breathing room air had a $P_aO_2 \geq 80$ mm Hg. Even among patients with submassive or massive acute pulmonary embolism in the Urokinase Pulmonary Embolism Trial, 12% had a P_aO_2 of 80 mm Hg or higher.¹⁶ In patients with pulmonary embolism breathing room air, the A-a oxygen difference closely correlates with the P_aO_2 ¹⁷ and has no greater diagnostic value.

The present data show that patients with pulmonary embolism may have dyspnea only on exertion. Orthopnea was also shown to be symptom of pulmonary embolism. Orthopnea occurred in patients with pulmonary embolism who had dyspnea only on exertion as well as those with dyspnea at rest. Typically, the onset of dyspnea occurred over seconds, minutes or hours, but it is some it occurred over days. Patients with proximal pulmonary embolism (main or lobar pulmonary embolism) compared with those who had only segmental pulmonary artery pulmonary embolism, more often had typical signs, symptoms and blood gases. Patients with pulmonary embolism even in main or lobar pulmonary arteries may have a low probability objective clinical assessment.

In both PIOPED and PIOPED II, pleuritic chest pain was more frequent in patients with pulmonary embolism than hemoptysis.^{9,10} Hemoptysis, when present, occurred only in small amounts. Examination of the lungs was abnormal in a minority (29% with no prior cardiopulmonary disease) of patients with pulmonary embolism.

Signs of deep venous thrombosis in patients with no prior cardiopulmonary disease were more frequent in PIOPED II than in PIOPED (47% vs 11%), as were symptoms of deep venous thrombosis, (44% vs 26%), but in PIOPED II the frequency of signs of deep venous thrombosis (41%) and symptoms of deep venous thrombosis (39%) were similar to those in the Urokinase Pulmonary Embolism Trial.^{10,13}

Dyspnea or tachypnea or pleuritic pain or signs of deep venous thrombosis were seen in the great majority of patients with pulmonary embolism in PIOPED^{9,10} and in the present data from PIOPED II. Conversely, in the absence of dyspnea or tachypnea or pleuritic pain or signs of deep venous thrombosis, pulmonary embolism was infrequently diagnosed.^{9,10}

The diagnosis of pulmonary embolism among elderly patients has been thought to be particularly difficult because the expected signs and symptoms may be absent or ignored.¹⁸⁻²⁰ This did not seem to be the case in the experience of PIOPED¹² or in the present experience of PIOPED II, although among patients with pulmonary embolism and no prior cardiopulmonary disease, dyspnea or tachypnea were present in fewer patients than among younger patients. In the absence of dyspnea or tachypnea among elderly patients in PIOPED, unexplained radiographic abnormalities were important diagnostic clues.¹² When the

diagnosis of pulmonary embolism is uncertain, CT angiography can be performed with the same sensitivity and specificity in elderly patients as in younger patients²¹, although renal failure was a problem among elderly patients who underwent conventional angiography.¹²

In conclusion, symptoms may be mild and generally recognized symptoms may be absent in patients with the largest pulmonary embolism in segmental pulmonary branches, but typical symptoms may be absent even in patients with large emboli. A high or intermediate probability objective clinical assessment may suggest the need for diagnostic studies, but a low probability objective clinical assessment was sometimes present, even in patients with proximal pulmonary embolism. Maintenance of a high level of suspicion is critical for the identification of patients in whom diagnostic tests may be necessary.

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Table 1**Syndromes of Acute Pulmonary Embolism**

	PE No Prior CPD N=133 n (%)	No PE No Prior CPD N=366 n (%)	PE All Patients N=192 n (%)	No PE All Patients N=632 n (%)
Hemoptysis or pleuritic pain	55 (41)	196 (54) [#]	84 (44)	357 (56) ^{##}
Uncomplicated dyspnea	48 (36)	93 (25) [#]	70 (36)	163 (26) ^{##}
Circulatory collapse	11 (8)	21 (6)	15 (8)	33 (5)
Different presentation	19 (14) [*]	56 (15)	23 (12) ⁺	79 (13)

CPD=cardiopulmonary disease, PE=pulmonary embolism.

* Tachypnea or tachycardia and signs or symptoms of DVT in 3; P_aO₂ <80 mmHg and signs or symptoms of DVT in 1.

⁺ Tachypnea or tachycardia and signs or symptoms of DVT in 8; P_aO₂ <80 mmHg and signs or symptoms of DVT in 1.

[#] P < .025

^{##} P < .01

Table 2
Arterial Blood Gases and Alveolar-Arterial Oxygen Difference While Breathing Room Air

	PE No Prior CPD N=48 n (%)	No PE No Prior CPD N=88 n (%)	PE All Patients N=74 n (%)	No PE All Patients N=186 n (%)
P_aO₂ (mm Hg)				
<49	1 (2)	2 (2)	4 (5)	17 (9)
50-59	6 (13)	12 (14)	12 (16)	32 (17)
60-69	15 (31)	14 (16) [#]	20 (27)	35 (19)
70-79	8 (17)	13 (15)	14 (19)	32 (17)
>80	18 (38)	47 (53)	24 (32)	70 (38)
P_aCO₂ (mm Hg)				
≤35	30 (63)	39 (44) [#]	42 (57)	65 (35) ^{**}
36-39	12 (25)	17 (19)	18 (24)	39 (21)
≥40	6 (13)	32 (36)	14 (19)	82 (44) [^]
PH (units)				
<7.35	0 (0)	7 (8) [#]	0 (0)	13 (7) [*]
7.35-7.45	29 (60)	60 (68)	41 (55)	131 (70) [*]
>7.45	19 (40)	21 (24)	33 (45)	42 (23) [^]
A-a O₂ difference (mm Hg)				
<20	17 (35)	44 (50)	24 (32)	70 (38)
21-30	4 (8)	10 (11)	5 (7)	32 (17) [#]
31-40	11 (23)	13 (15)	18 (24)	30 (16)
41-50	9 (19)	13 (15)	14 (19)	32 (17)
51-60	5 (10)	6 (7)	10 (14)	17 (9)
≥61	2 (4)	2 (2)	3 (4)	5 (3)

CPD=cardiopulmonary disease, PE=pulmonary embolism.

[#] P < .05

^{*} P < .025

^{**} P < .01

[^] P < .001

Table 3

Risk Factors

	PE No Prior CPD N=131-133 n (%)	No PE No Prior CPD N=361-366 n (%)	PE All Patients N=185-192 n (%)	No PE All Patients N=588-632 n (%)
Age	56±16	47 ± 16 [^]	57±17	50 ± 17 [^]
Sex (female)	82 (62)	225 (61)	112 (58)	394 (62)
Immobilization [*]	27 (20)	60 (16)	48 (25)	121 (19)
Travel > 4 hr in last month	19 (14)	74 (20)	23 (12)	105 (17)
Surgery (≤ 3 mos)	30 (23) [#]	53 (14) ^{^^^^}	41 (21) ^{##}	83 (13) ^{^^}
Malignancy (excluding lung cancer) ^{**}	29(22)	44 (12) ^{^^^}	37 (19)	82 (13) ^{^^^^}
Thrombophlebitis, ever	11(8)	10 (3) ^{^^^}	19 (10)	27 (4) ^{^^^}
Trauma (≤ 3 mos)	14(11)	27 (7)	16 (8)	49 (8)
Lower extremities and pelvis				
Other	4 (3)	14 (4)	5 (3)	21 (3)
Smoke (ever)	55 (42)	156 (43)	90 (47)	321 (51)
<1 pack/day	29 (22)	74 (20)	43 (22)	122 (19)
1-2 packs/day	20 (15)	62 (17)	37 (19)	152 (24)
> 2 packs/day	0 (0)	5 (1)	1 (1)	19 (3)
Central venous instrumentation (≤3 mos)	12 (9)	17 (5)	22 (12)	35 (6) ^{^^^}
Stroke, paresis or paralysis	4 (3)	10 (3)	7 (4)	17 (3)
Prior pulmonary embolism	-	-	7 (4)	19 (3)
Heart failure	-	-	10 (5)	60 (10)
COPD	-	-	10 (5)	58 (9)
Lung cancer	-	-	5(3)	8 (1)

CPD=cardiopulmonary disease, PE=pulmonary embolism, COPD= Chronic obstructive pulmonary disease

^{*} Bed rest within past month for the most of the day for ≥ 3 consecutive days

^{**} Actively treated in last 3 months

[#] Among patients with PE and no prior CPD who had surgery as a risk factor (n=30), the prevalence of heart, abdominal, pelvic, hip/knee-open, hip/knee-replacement, and neurosurgery ranged from 3 to 5.

^{##} Among all patients with PE who had surgery as a risk factor (n=41), 9 had abdominal surgery and heart, pelvic, hip/knee-open, hip/knee-replacement, and neurosurgery ranged from 3 to 5.

[^] P < .0001

^{^^} P < .001

^{^^^} P < .01

^{^^^^} P < .05

Table 4**Symptoms of Pulmonary Embolism**

	PE No Prior CPD N= 127-133 n (%)	No PE No Prior CPD N= 361-366 n (%)	PE All Patients N= 184-191 n (%)	No PE All Patients N= 622-632 n (%)
Dyspnea				
Dyspnea (rest or exertion)	97 (73)	248 (68)	151 (79)	459 (73)
Dyspnea (at rest) [#]	73 (55)	167 (46)	117 (61)	338 (54)
Dyspnea (exertion only) [#]	21 (16)	73 (20)	31 (16)	111 (18)
Orthopnea (>2-pillow)	37 (28)	88 (24)	69 (36)	220 (35)
Pleuritic pain	58 (44)	207 (57) [^]	89 (47)	376 (59) [^]
Chest pain (not pleuritic)	25 (19)	80 (22)	33 (17)	130 (21)
Cough	45 (34)	103 (28)	82 (43)	248 (39)
Wheezing	27 (21)	66 (18)	58 (31)	193 (31)
Calf or thigh swelling	52 (41)	62 (17) ^{^^}	72 (39)	126 (20) ^{^^}
Calf and thigh swelling	9 (7)	14 (4)	15 (8)	35 (6)
Calf or thigh pain	56 (44)	83 (23) ^{^^}	78 (42)	156 (25) ^{^^}
Calf and thigh pain	22 (17)	24 (7) ^{^^}	30 (16)	61 (10) ^{^^^}

CPD=cardiopulmonary disease, PE=pulmonary embolism.

[#] Information not available in some

* Hemoptysis, PE, No CPD: 2= slightly pinkish, 4= blood-streaked, 1=all blood (<1 teaspoonful)

** Hemoptysis, No PE, No CPD: 1= slightly pink, 2= streaked, 7= all blood (1 pt too little to quantify, 1 pt <teaspoonful, 4 pts 1 teaspoonful to ½ cup, 1 pt >½ cup)

⁺ Hemoptysis, PE, all patients: 3= slightly pinkish, 6= blood-streaked, 2= all blood (<teaspoonful)

⁺⁺ Hemoptysis, No PE, all patients: 7= slightly pinkish, 9= blood streaked, 9= all blood (1 pt too little to quantify, 3 pts <teaspoonful, 4 pts 1 teaspoonful to ½ cup, 1 pt >½ cup)

[^] P < .01

^{^^} P < .001

^{^^^} P < .025

Table 5**Rate of Onset of Dyspnea**

	Patients with Dyspnea and PE No Prior CPD N=92 n (%)	Patients with Dyspnea and No PE No Prior CPD N=242 n (%)	All Patients with Dyspnea and PE N=143 n (%)	All Patients with Dyspnea and No PE N=450 n (%)
Seconds	42 (46)	109 (45)	59 (41)	206 (46)
Minutes	24 (26)	69 (29)	37 (26)	117 (26)
Hours	10 (11)	35 (14)	20 (14)	70 (16)
Days	16 (17)	29 (12)	27 (19)	57 (13)

CPD=cardiopulmonary disease, DVT=deep vein thrombosis, PE=pulmonary embolism.

All differences not significant

Table 6

Signs of Pulmonary Embolism

	PE No Prior CPD N=128-132 n (%)	No PE No Prior CPD N=350-365 n (%)	PE All Patients N=184-191 n (%)	No PE All Patients N=602-629 n (%)
General				
Tachypnea ($\geq 20/\text{min}$)	71 (54)	155 (43) [#]	108 (57)	296 (47) [^]
Tachycardia ($> 100/\text{min}$)	32 (24)	52 (14) [^]	49 (26)	98 (16) [^]
Diaphoresis	3 (2)	27 (7) ^{##}	8 (4)	40 (6)
Cyanosis	0 (0)	1 (0.003)	1 (1)	1 (0)
Temperature $\geq 38.5^{\circ}\text{C}$ ($>101.3^{\circ}\text{F}$)	1 (1)	12 (3)	3 (2)	14 (2)
Cardiac examination (abnormal)	28 (21)	39 (11) [^]	42 (22)	72 (12) ^{^^}
Increased P2 ⁺	15 (15)	14 (5) ^{^^^}	22 (15)	27 (5) ^{^^}
Right ventricular lift ⁺⁺	4 (4)	6 (2)	8 (5)	9 (2) [#]
Jugular venous distension	18 (14)	27 (8) ^{##}	25 (13)	50 (8) ^{##}
Lung examination (abnormal)	38 (29)	94 (26)	70 (37)	227 (36)
Rales (crackles)	23 (18)	52 (14)	40 (21)	112 (18)
Wheezes	2 (2)	12 (3)	6 (3)	54 (9) [#]
Rhonchi	2 (2)	8 (2)	9 (5)	32 (5)
Decreased breath sounds	22 (17)	42 (12)	40 (21)	109 (17)
Pleural friction rub	0 (0)	3 (1)	2/ (1)	5 (1)
DVT signs [†]				
Calf or thigh	62 (47) [*]	77 (21) ^{^^}	90 (47)	146 (23) ^{^^}
Calf and thigh	18 (14)	16 (4) ^{^^}	23 (12)	30 (5) ^{^^}

CPD=cardiopulmonary disease, PE=pulmonary embolism, P2 = pulmonary component of second sound, DVT = deep venous thrombosis

* Number of patients with PE and no CPD who had 1 or more signs of DVT: edema = 55, erythema = 5, tenderness = 32, palpable cord = 2

⁺ Data in 103 patients with PE and no CPD, 293 with No PE No CPD, 145 with PE all patients, 512 No PE all patients

⁺⁺ Data in 110 patients with PE and no CPD, 301 with No PE No CPD, 155 with PE all patients, 529 No PE all patients

[^] P < .01

^{^^} P < .001

^{^^^} P < .0001

[#] P < .025

^{##} P < .05

[†] Edema, erythema, tenderness, or palpable cord

Table 7

Symptoms in Patients with PE and No Pre-Existing Cardiac or Pulmonary Disease According to Age

	≥70 Yrs N=33-35 n (%)	< 70 Yrs N=93-98 N (%)
Dyspnea		
Dyspnea (rest or exertion)	23 (66)	74(76)
Dyspnea (at rest) [#]	17 (49)	56 (58)
Dyspnea (exertion only) [#]	5 (14)	16(16)
Orthopnea (≥2-pillow)	8 (23)	29(30)
Pleuritic pain	12 (35)	45(46)
Chest pain (not pleuritic)	6 (18)	20(20)
Cough	10 (29)	35(36)
Wheezing	3 (9)	24(24)
Calf or thigh swelling	9 (26)	43(44)
Calf or thigh pain	9 (26)	46(47) *

All other differences between age groups are not significant

[#] Information not available in some

* P< 0.05 Age > 70 vs <70 yrs.

Table 8
Symptoms in All Patients with Pulmonary Embolism According to Age

	≥70 Yrs N= 53-55 n (%)	< 70 Yrs N= 130-137 n (%)
Dyspnea		
Dyspnea (rest or exertion)	41 (75)	110 (80)
Dyspnea (at rest) [#]	33 (60)	84 (61)
Dyspnea (exertion only) [#]	7 (13)	24 (18)
Orthopnea (≥2-pillow)	17 (31)	52 (39)
Pleuritic pain	18 (33)	71 (52) ⁺
Chest pain (not pleuritic)	7 (13)	26 (19)
Cough	24 (44)	58 (43)
Wheezing	13 (25)	45 (33)
Calf or thigh swelling	14 (26)	61 (46) ⁺
Calf or thigh pain ⁺	15 (28)	62 (46)

All other differences between age groups are not significant

[#] Information not available in some

⁺ P < .025 Age > 70 vs <70 yrs.

Table 9
Signs in Patients with PE and No Pre-Existing Cardiac or Pulmonary Disease According to Age

	≥70 N=33-35 n (%)	< 70 N=91-98 n (%)
General		
Tachypnea (≥ 20min)	16 (47)	55 (57)
Tachycardia (> 100min)	8 (23)	24 (25)
Diaphoresis	1 (3)	2 (2)
Cyanosis	0 (0)	0 (0)
Temperature >38.5° C (>101.3° F)	0 (0)	3 (1)
Cardiac examination (any)	8 (23)	20 (21)
Increased P2 ⁺	3 (12)	12 (16)
Right ventricular lift ⁺⁺	0 (0)	4 (5)
Jugular venous distension	7 (20)	11 (12)
Lung examination (any)	15 (43)	23 (23) [#]
Rales (crackles)	9 (26)	14 (15)
Wheezes	1 (3)	1 (1)
Rhonchi	0 (0)	2 (2)
Decreased breath sounds	8 (23)	14 (15)
Pleural friction rub	0 (0)	0 (0)

All other differences between age groups are not significant

⁺ Data in 26 patients > 70 yrs, 77 patients < 70 yrs

⁺⁺ Data in 30 patients > 70 yrs, 80 patients < 70 yrs

[#] P < .05 Age > 70 vs <70 yrs.

Table 10**Signs in All Patients with Pulmonary Embolism**

	≥70 Yrs N=52-55 n (%)	< 70 Yrs N=130-137 n (%)
General		
Tachypnea (≥ 20min)	28 (51)	80 (59)
Tachycardia (> 100min)	11 (21)	38 (28)
Diaphoresis	1 (2)	7 (5)
Cyanosis	0 (0)	1 (1)
Temperature >38.5°C (>101.3°F)	0 (0)	3 ()
Cardiac examination (any)	12 (22)	32 (2)
Increased P2 ⁺	3 (7)	19 (18)
Right ventricular lift ⁺⁺	2 (4)	6 (5)
Jugular venous distension	10 (19)	15 (11)
Lung examination (any)	25 (45)	44 (32)
Rales (crackles)	14 (26)	36 (27)
Wheezes	2 (4)	4 (3)
Rhonchi	3 (6)	6 (4)
Decreased breath sounds	16 (29)	24 (18)
Pleural friction rub	1 (2)	1 (1)

All differences between age groups not significant

⁺ Data in 42 patients > 70 yrs, 103 patients < 70 yrs

⁺⁺ Data in 45 patients > 70 yrs, 110 patients < 70 yrs