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Prognostic Value of Symptoms and Signs in Geriatric Acute Pulmonary Embolism—An Analytical Study

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Abstract

Objective The aim of this study was to evaluate the relationship between symptoms and short-term mortality in geriatric patients presenting to the emergency department with acute pulmonary embolism.

Materials and Methods This retrospective cohort study was conducted to evaluate the data of geriatric patients admitted to the emergency department between September 01, 2022, and March 01, 2023. The study population comprised patients who presented with acute pulmonary embolism signs and symptoms. Demographic data, vital parameters, and symptoms were noted.

Results Of the 176 patients included in the final analysis, 55 (31.2%) were female. The median of age was 76 (25th–75th percentile: 72–82.5) years. The most common symptoms were dyspnea (61.9%), fatigue (27.2%), and syncope (23.8%). There was no statistically significant difference between the survivor and nonsurvivor groups in terms of symptoms (*p*-values for dyspnea, syncope, chest pain, back pain, hemoptysis, extremity pain, and fatigue: 0.804, 0.765, 0.154, 0.543, 0.675, 0.342, and 0.943, respectively) (chi-squared test).

Conclusion In patients presenting to the emergency department with acute pulmonary embolism, clinicians should not prioritize based on symptoms but should evaluate patients according to clinical severity scores.

Keywords
- pulmonary embolism
- mortality
- symptom
- dyspnea

Introduction

Acute pulmonary embolism (APE) is the obstruction of the pulmonary artery and/or its branches by a thrombus or tumor, air, fat, or amniotic fluid originating from another part of the body. APE is the third most common cardiovascular disease in the world and can be fatal if not diagnosed and treated.[1]

Since it does not have a specific clinical picture, it is difficult to diagnose, and therefore it can result in mortality. As patients may be asymptomatic or sudden cardiac death may be the first symptom, it is difficult to determine the frequency and distribution of APE. Respiratory distress, chest pain, syncope or presyncope, and hemoptysis are the leading symptoms of this condition.[2] Patients with impaired

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hemodynamics due to pulmonary embolism may present with arterial hypotension and shock.[3] Deep vein thrombosis is an important cause of APE, and these patients may present with the complaint of leg swelling. Pulmonary embolism can be diagnosed incidentally in imaging tests performed for another reason without any complaints or findings, or at autopsy.[4]

Depending on the location of the embolism, chest pain may be pleuritic due to necrotic areas in the lung or typical angina caused by right heart failure.[5] While embolism in the main pulmonary veins results in severe dyspnea, embolism in more distal veins may cause mild respiratory distress and cough.[6,7] Patients with risk factors for venous thromboembolism are also at risk of APE, but 30% of those with a diagnosis of APE are reported to have no risk factor.[8] In this study, we aimed to evaluate the relationship between APE symptoms and short-term mortality in patients presenting to the emergency department.

Materials and Methods

Study Design

This retrospective observational study was conducted at University of Health Sciences Ümraniye Training and Research Hospital a 743-bed tertiary teaching hospital with 1,132 daily emergency department presentations (annual average of the study period). The data of patients who presented to the emergency department between September 01, 2022, and March 01, 2023 were retrospectively collected.

Study Population

The population of the study consisted of adult patients who presented to the emergency department with APE during the study period. The patients who were diagnosed with the International Classification of Diseases, 10th revision code I.26 of the World Health Organization medical classification concerning APE were identified through the computerized medical and medical history record system of the hospital. Patients with missing data were excluded from the study. The flowchart of the study is shown in ►**Fig. 1**.

Data Collection

The patients' demographic data, symptoms, comorbidities, and all-cause 30-day mortality were obtained from the hospital system. Symptoms were recorded as dyspnea, syncope, hemoptysis, fatigue, and extremity pain. Comorbidities such as diabetes mellitus, chronic obstructive pulmonary disease, hypertension, coronary artery disease, congestive heart failure, history of stroke, chronic renal failure, and active malignancy, and a history of deep vein thrombosis were noted. The national death registry system was used for

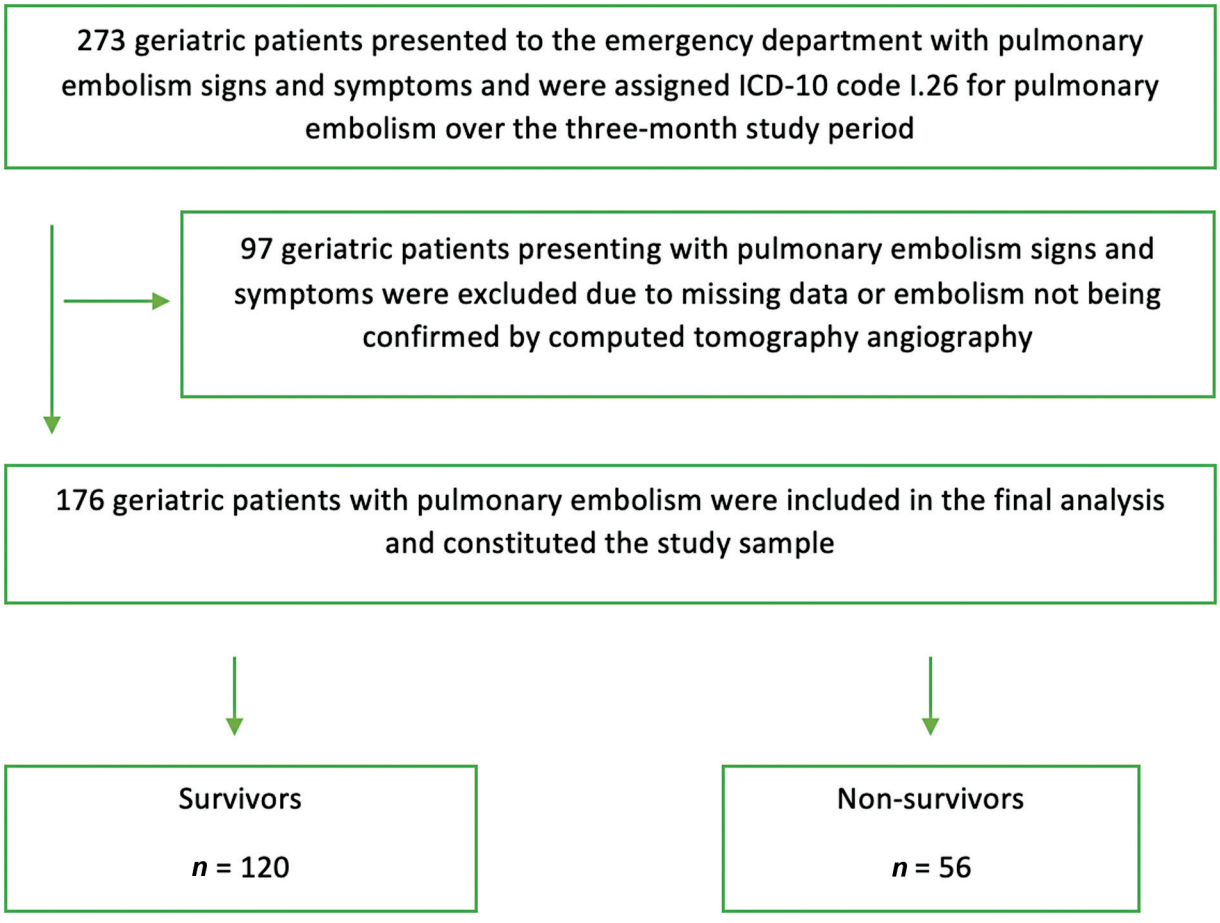

Fig. 1 Flowchart of the study. ICD-10, International Classification of Diseases, 10th revision.

the mortality data of the patients discharged from the hospital or referred to another center.

Statistical Analysis

Data were analyzed using Jamovi (Version 1.6.21.0; The Jamovi Project, 2020; R Core Team, 2019). To evaluate the conformance of variables to the normal distribution, the Shapiro–Wilk test was conducted. The non-normally distributed data were expressed as median and 25 to 75th percentile values. Quantitative variables were compared using the Mann–Whitney U test or Student's t-test according to the normality of distribution for the two groups. Categorical data were presented as the number of cases and percentages. Relationship between categorical data and mortality was calculated using chi-squared test. A *p*-value less than 0.05 was considered statistically significant.

Results

Of the 176 patients included in the final analysis, 55 (31.2%) patients were female. The median of age was 76 (25–75th percentile: 72–82.5) years. The mortality rate of our sample was 26.9%. The baseline characteristics of the enrolled patients and comparison of characteristics between the survivor and nonsurvivor groups are shown in ►**Table 1**. The most common symptoms were dyspnea (61.9%), fatigue (27.2%), and syncope (23.8%). The symptoms of the enrolled patients and their comparison between the survivor and nonsurvivor groups are shown in ►**Table 2**. There was no statistically significant difference between the two groups in terms of symptoms (*p*-values for dyspnea, syncope, chest pain, back pain, hemoptysis, extremity pain, and fatigue: 0.804, 0.765, 0.154, 0.543, 0.675, 0.342, and 0.943, respectively) (chi-squared test).

Discussion

In this study, we investigated the relationship between symptoms and mortality in patients with APE admitted to the emergency department. In our sample, the most common symptoms were dyspnea, fatigue, and syncope. According to the results of our study, there was no significant correlation between short-term mortality and symptoms.

It is important to use resources effectively in the emergency department and provide earlier medical support to the critically ill patient. Early recognition of critical patients and serious illnesses also ensures effective use of hospital bed capacity. Scoring systems consisting of physical examination findings, vital parameters and laboratory parameters and their combination are used for clinical decision-making and patient management.[9,10] Pulmonary embolism severity index (PESI), simplified PESI and geriatric PESI scores are used for APE.[11] In this study, we hypothesized and tested that clinical symptoms may be associated with short-term mortality in geriatric patients with APE in the emergency department. Our results revealed that clinical symptoms were not associated with short-term mortality. It showed that clinicians cannot use symptoms to predict mortality. We think that these results may have been affected by the different presentations of geriatric patients due to their accompanying comorbidities.

APE is the third most common cause of cardiovascular death and the most common cause of death after surgery.

Table 1 Baseline characteristics of the enrolled patients and their comparison between the survivor and nonsurvivor groups

Parameters	Total *n* = 176	Survivors *n* = 120 (73.1%)	Nonsurvivors *n* = 56 (26.9%)	*p*-Value
Age (years), median (25–75th percentile)	76 (72–82.5)	75 (71–80)	77 (73–83)	0.324
Gender (*n*, %)				
Male	121 (68.7%)	85 (70.8%)	36 (64.2%)	0.134
Female	55 (31.2%)	35 (29.1%)	20 (35.7%)	
Comorbidities (*n*, %)				
Congestive heart failure	36 (20.4%)	15 (12.5%)	21 (37.5%)	0.011
Coronary artery disease	42 (23.8%)	31 (25.8%)	11 (19.6%)	0.348
Active of malignancy	54 (30.6%)	32 (26.6%)	22 (39.2%)	0.012
Diabetes mellitus	38 (21.5%)	24 (20%)	14 (25%)	0.876
Chronic obstructive pulmonary disease	34 (19.3%)	23 (19.1%)	11 (19.6%)	0.126
Hypertension	121 (68.7%)	76 (63.3%)	45 (80.3%)	0.879
Vital parameters (median, 25th and 75th percentile)				
Fever	36.2 (36.1–36.9)	36.3 (36.1–36.8)	36.7 (36.1–37)	0.143
Heart rate (/minute)	99 (86–122)	99 (84–118)	111 (91–132)	0.005
Respiratory rate (/minute)	21 (19–24)	21 (19–22)	22 (18–26)	0.548
Systolic blood pressure (mm Hg)	119 (103–142)	122 (108–144)	101 (93–131)	<0.001
Diastolic blood pressure (mm Hg)	75 (63–87)	78 (67–91)	69 (54–79)	0.003

Table 2 Symptoms of the enrolled patients and their comparison between the survivor and nonsurvivor groups

Symptoms	Total *n* = 176	Survivors *n* = 120 (73.1%)	Nonsurvivors *n* = 56 (26.9%)	*p*-Value
Dyspnea	109 (61.9%)	76 (63.3%)	33 (58.9%)	0.804
Syncope	42 (23.8%)	29 (24.1%)	13 (23.2%)	0.765
Chest pain	29 (16.4%)	21 (17.5%)	8 (14.2%)	0.154
Back pain	8 (4.5%)	5 (4.1%)	3 (5.3%)	0.543
Hemoptysis	9 (5.1%)	6 (5%)	3 (5.3%)	0.675
Extremity pain	24 (13.6%)	15 (12.5%)	9 (16%)	0.342
Fatigue	48 (27.2%)	38 (31.6%)	10 (17.8%)	0.943

Prompt diagnosis and treatment at the time of first admission are important since they affect both mortality and long-term complications such as secondary pulmonary hypertension and cor pulmonale.[12,13] The absence of disease-specific clinical findings causes clinicians to encounter difficulties in diagnosis and treatment. Clinical findings vary according to the size, number, localization, and resolution rate of the embolism. Furthermore, the patient's cardiopulmonary reserve may also affect clinical manifestation.[14]

Dyspnea is perceived through neural activity related to the cortical structures responsible for the sensory perception of the brain. Since dyspnea is a perception, studies investigating its mechanism need to be defined on an individual basis but are limited due to the difficulty of measuring subjective complaints and underlying neural activity.[15] Patients often describe increased respiratory effort and increased accessory respiratory muscle activity as dyspnea. In a study investigating the role of exertional dyspnea in APE, Klok et al suggested that right ventricular dysfunction might be effective in dyspnea in these patients. They reported that cardiac and pulmonary factors had effects on the symptom of dyspnea in patients with APE.[16]

The difficulty in making the diagnosis is due to the low sensitivity and specificity of symptoms, findings, and the withdrawal of conventional or computed tomography angiography-associated contrast nephropathy required to confirm the diagnosis. One of these subtle and difficult to describe symptoms is fatigue.[17,18] A plausible pathogenesis for fatigue may be that latent hypoxia cannot be described, especially in geriatrics. Another logical explanation may be that fatigue is presented as a symptom caused by cytokines released from the infarct tissue. Additionally, fatigue may be an indicator of prominent right ventricular impulse.

Syncope may be the first and only finding in patients with APE and is a common symptom. APE is a physiological response to acute hemodynamic instability.[19] In a meta-analysis, Barco et al investigated the relationship of hemodynamic changes in syncope and pulmonary embolism and reported the association between the echocardiographic signs of right ventricular dysfunction, hemodynamic instability, and an elevated risk of APE-related adverse outcomes within 30 days of diagnosis with syncope in patients with APE. The authors also demonstrated that decreased cardiac output was effective in the development of syncope, especially in hypotensive patients. They suggested that syncope mechanisms, such as seizures, transient arrhythmias, or vasovagal reflex where cardiac output is not affected, might be involved in the pathogenesis of syncope in normotensive patients with APE. In our sample, the second most common symptom was syncope, consistent with the literature.[20]

The cornerstone in the management of the patient with APE symptoms is to exclude life-threatening pathologies. Central pulmonary artery occlusion can be severe and sudden, while peripheral pulmonary artery occlusion can be mild and temporary. Chest pain is one of the common symptoms. Pulmonary infarction occurs in patients with peripheral pulmonary artery occlusion. It causes irritation in the pleura and chest pain.[21] Angina-like pain due to right ventricular ischemia may also be observed in patients with central pulmonary artery occlusion.[22] Therefore, in patients presenting with chest pain, in addition to cardiovascular diseases such as acute coronary syndrome and aortic dissection, APE should also be considered in the differential diagnosis.

The most important limitation of the study is its retrospective and single-center design. The small number of patients can also be considered as a limitation. To increase the generalizability of the results, we recommend multicenter studies with larger patient populations.

Conclusion

In conclusion, according to the results of our study, in patients presenting to the emergency department with APE, clinicians should not prioritize based on symptoms but should evaluate patients according to clinical severity scores. However, there is a need for multicenter studies with larger populations to increase the generalizability of our results.

Ethical Statement

Compliance with Ethical Standards: The tenets of the Helsinki agreement were followed throughout.

Ethical Approval

Ethical approval for the study was received from the local ethics committee of University of Health Sciences Ümraniye Training and Research Hospital (date 08/10/2023-number 256).

Informed Consent

We retrospectively reviewed secondary data recorded from the computer-based patient data system of the hospital and these data did not include any personal identifiable information; therefore, informed consent was waived.

Funding and Sponsorship

None.

Conflict of Interest

None declared.

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