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Risk Factors and Clinical Presentation of Acute Pulmonary Embolism in Sudanese Patients at Alshaab Teaching Hospital

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Abstract

Pulmonary embolism (PE) occurs when a clot blocks a pulmonary artery, which can be fatal. Identifying high-risk patients allows for early interventions to prevent death. The symptoms and signs of PE are often vague and underdiagnosed. This study aims to investigate the clinical manifestations and risk factors of acute PE. A hospital-based cross-sectional study was conducted at Alshaab Teaching Hospital between May and December 2019, with data analyzed using SPSS software. The most common clinical symptoms, in order of frequency, were gradual-onset dyspnea (34.4%), pleuritic chest pain (29.5%), cough (27.9%), hemoptysis (14.8%), and leg swelling (11.5%). The leading risk factor was post-surgery, especially orthopedic surgery (27.9%), followed by the postpartum period and respiratory conditions (14.8%). Computer tomography (CT) scans were the primary diagnostic tool, while low molecular weight heparin was the main treatment. The study concluded that multiple risk factors are often present in cases of acute PE, and symptoms may be mild. Maintaining high suspicion is important for accurate diagnosis. The highest incidence was found in patients aged 41-60 years, with a higher frequency among females. Diagnostic techniques included clinical assessment, CTPA, transthoracic echocardiography, and Doppler ultrasound for cases with significant limb swelling. Treatment was performed according to established guidelines, and most patients were discharged with plans for outpatient follow-up. Early diagnosis can reduce complications and improve patient outcomes, allowing for preventive measures for high-risk groups and better management of risk factors.

Keywords: Pulmonary embolism, Clinical presentation of pulmonary embolism, Pulmonary embolism in Sudanese patients, Risk factors for pulmonary embolism

Introduction

Acute pulmonary embolism (PE) is a frequently encountered and potentially fatal condition. Timely and effective evaluation is crucial, ensuring that unnecessary tests are avoided while allowing rapid intervention to reduce the risk of severe outcomes, including death [1]. Diagnosis of acute PE requires an integration of patient history, physical examination, laboratory assessments, and appropriate imaging techniques. The clinical presentation of PE varies significantly between patients. Dyspnea is the most commonly reported symptom, with more severe cases of PE, such as massive embolism, often presenting with acute dyspnea, cyanosis, or syncope. In contrast, smaller PEs located peripherally typically manifest with pleuritic pain, cough, or hemoptysis [2]. Tachypnea is often observed during physical examination. Some patients, particularly those without preexisting cardiopulmonary conditions, may appear anxious but remain relatively stable despite a large PE. On the other hand, patients with massive PE may show signs of severe instability, including hypotension, cardiogenic shock, or even cardiac arrest. Sub-massive PE typically presents with a preserved systolic blood pressure, but signs of right ventricular

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failure are noticeable, such as tachycardia, distended neck veins, tricuspid regurgitation, and an accentuated pulmonic closure sound (P2) [3, 4].

Research supports the use of clinical pretest probability assessments to guide the diagnostic process for PE. The American College of Physicians recommends using validated clinical prediction rules to estimate the likelihood of PE before conducting diagnostic tests. Common scoring systems include the Modified Wells, Geneva, Simplified Charlotte, and Pisa models [5].

The D-dimer test, when used alongside clinical decision rules like Wells' and the revised Geneva score, offers a reliable method for ruling out venous thromboembolism (VTE) in outpatient and emergency settings [6]. However, D-dimer levels can increase with age or in hospitalized patients due to other acute conditions and co-existing illnesses. As a result, the ability to exclude VTE in hospitalized patients using D-dimer tests, with or without decision rules, remains a challenge. The age-adjusted D-dimer (AADD) is a useful tool in diagnosing PE when combined with other risk assessment scores [7]. Studies investigating the use of pO2 and pCO2 in diagnosing PE have concluded that these tests are not sufficiently sensitive or specific. As a result, arterial blood gas (ABG) testing alone is inadequate for diagnosing or ruling out PE [8].

Echocardiography is a non-invasive method used to assess pulmonary artery pressure and evaluate the right ventricle. It can provide useful evidence of pulmonary hypertension and right ventricular enlargement at the bedside, which supports the diagnosis of acute massive or sub-massive PE [9].

Currently, computed tomography pulmonary angiography (CTPA) is the preferred diagnostic tool for PE, offering detailed imaging of pulmonary vessels down to the subsegmental levels. The presence of right ventricular (RV) dysfunction and the extent of pulmonary artery obstruction seen on CT scans are valuable prognostic indicators. Patients with RV dysfunction associated with PE generally have a higher mortality risk [10].

Thrombolysis is currently recommended only for patients with massive PE. Those with moderate PE—characterized by hemodynamic stability, right ventricular enlargement or hypokinesia, and elevated biomarkers—require a more tailored approach to treatment [11].

In patients with an intermediate or high clinical likelihood of having pulmonary embolism (PE), anticoagulation therapy should be initiated without delay while diagnostic tests are being carried out. However, thrombolytic therapy is generally not required for such patients [12]. Data from the RIETE registry, which tracks patients with venous thromboembolism, indicate that only a small number of low-risk PE patients were either treated at home or hospitalized for fewer than five days. This reflects the varied approaches to PE management in different regions [13-17].

The main goal of this study is to examine the clinical signs, symptoms, and common risk factors associated with pulmonary embolism in adults attending healthcare facilities during the study period. The study will also aim to identify frequent risk factors and triggers of PE, assess the clinical presentation of the condition, and determine the distribution of age and gender among diagnosed patients.

Materials and Methods

Study design

The study was conducted as a cross-sectional, observational investigation in a hospital setting.

Study location

The research was carried out at Alshaab Teaching Hospital in Khartoum, the capital city of Sudan.

Study population and sample size

This study included all patients diagnosed with pulmonary embolism across various departments, such as the emergency room (ER), respiratory ICU, coronary care unit (CCU), and general wards, from May to December 2018.

Inclusion criteria

All individuals confirmed to have pulmonary embolism during the study period were included in the study.

Data collection

During the study, we interviewed patients diagnosed with PE in the designated areas of Alshaab Teaching Hospital. A structured questionnaire was used to gather sociodemographic information, clinical symptoms, diagnostic methods, risk factors, and treatments provided. The research objectives were explained to the patients, and written consent was obtained before data collection.

Statistical analysis

The collected data were entered into SPSS (version 17, Chicago, IL, USA) for analysis. Descriptive statistics were used, and percentages were calculated for quantitative data. The Chi-square test was applied to determine statistical significance, with a P-value of less than 0.05 considered significant.

Results and Discussion

A total of 61 patients participated in this study, with an average age of 55.83 years and a standard deviation of 15.2. As for the diagnostic methods used, the majority of patients (53, 86.9%) had their pulmonary embolism confirmed through computed tomography pulmonary angiography (CTPA) alone. Other diagnostic approaches included Doppler ultrasound in conjunction with clinical symptoms (4, 6.6%) and echocardiography alone (3, 4.9%), as illustrated in **Figure 1**.

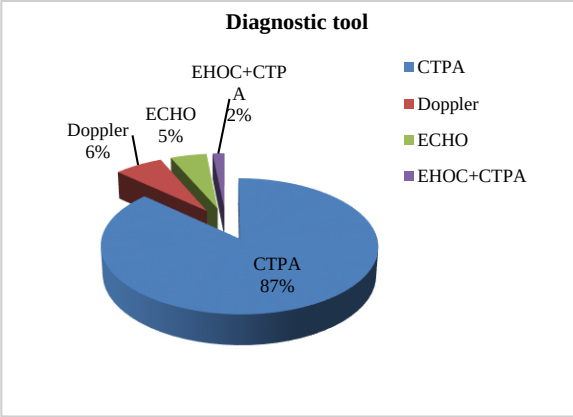

Figure 1. Distribution of the study population according to the diagnostic tool of PE

Among the 61 patients in our study, 38 (62.3%) presented with dyspnea, with 17 (27.9%) experiencing a sudden onset and 21 (34.4%) reporting a gradual onset. Chest pain was observed in 27 (44.3%) patients, of which 18 (29.5%) experienced pleuritic chest pain and 9 (13.1%) reported central chest pain. Hemoptysis was noted in 9 (14.8%) patients, while 17 (27.9%) complained of a cough. Unilateral lower limb swelling, which was painful, was seen in 7 (11.5%) patients. Tachycardia was found in 11 (18%) of the patients, and fainting or transient loss of consciousness was noted in 2 (3.3%) patients, while fever was reported in 2 (3.3%) patients. The onset-to-diagnosis interval was over 24 hours for 98.4% of the patients, with only 1.6% being diagnosed in less than 24 hours **(Figure 2)**.

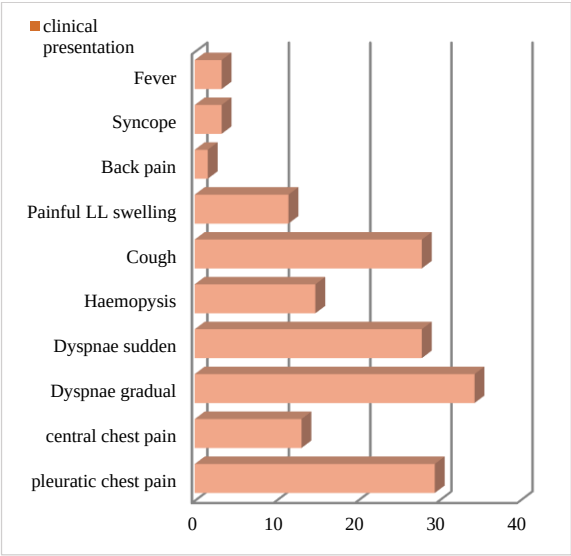

Figure 2. Distribution of the study population according to the clinical presentations of PE

Regarding risk factors, the majority of patients had multiple contributing factors. The most common risk was a history of recent surgery, seen in 17 (27.9%) patients, particularly those who had been immobile for over four weeks. The post-delivery and puerperium period was a risk factor in 9 (14.8%) patients, while 8 (13.1%) had active cancer and were either undergoing chemotherapy or receiving palliative care. These findings are illustrated in **Figure 3**.

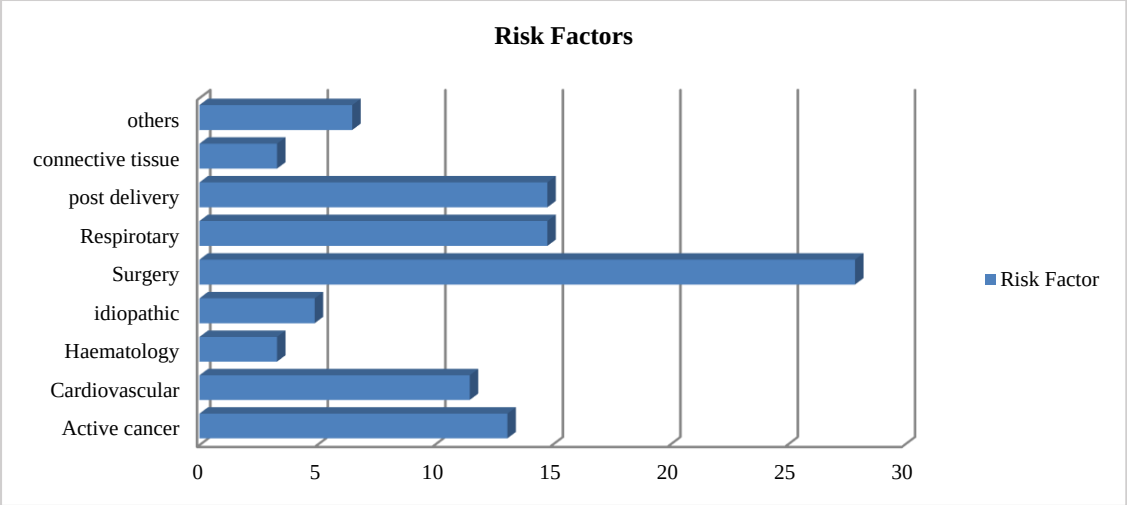

Figure 3. Distribution of the study population according to risk factors of PE

The initial management of acute PE in the hospital for the study population was as follows: 3 patients (4.9%) underwent thrombolysis, which was performed in the coronary care unit for patients with cardiovascular risk factors. Two patients (3.3%) were administered unfractionated heparin, while the majority, 91.8%, received low molecular weight heparin and warfarin.

In terms of outcomes, 57 patients (96.7%) were discharged and scheduled for follow-up in the outpatient clinic, while 2 patients (3.3%) died, as shown in **Table 1**.

Table 1. Patient outcomes after admission (n = 61)

Outcome	Number/percentage
Discharged	59 (96.7%)
Died	2 (3.3%)

Regarding prophylactic measures, 26 patients in total, who were post-surgical or post-delivery, were evaluated. Out of these, 7 (27%) received prophylaxis, while 19 (73%) did not, as shown in **Table 2**.

Table 2. Prophylaxis given to patients with PE (n = 61)

Prophylaxis status	Number/percentage
Received prophylaxis	7 (27%)
Did not receive prophylaxis	19 (73%)

The study showed that 39 females (63.9%) were included, which aligns with a multi-center study in Brazil where 57.9% of participants were female, and contrasts with a Chinese study that reported 46.8%. In terms of risk factors, most patients in both our study and the Chinese study were above 40 years of age (93.4%). Our study, like many international studies, identified cancer, pregnancy and postpartum, post-surgical procedures, and fractures as common risk factors for PE. However, unlike previous studies, stroke was not identified as a risk factor in our cohort. Congestive heart failure appeared in 11.5% of cases, consistent with findings from a case reported in 2021. The presence of previous DVT/PE as a risk factor was noted in 7 of 8 studies reviewed by Morrone and Morrone [18], and in our study as well.

Chronic respiratory diseases and cor pulmonale were risk factors in 14.8% of our patients, matching findings from a study by Shapira-Rootman. Dyspnea was the most common symptom, reported by 62.3% of patients, similar to the Chinese study (64.07%) but lower than findings from Brazil (78.4%). Chest pain, cough, hemoptysis, and syncope were also common, affecting 44.3%, 27.9%, 14.8%, and 3.3%, respectively, in our study, consistent with other international research.

Most diagnoses were made with CTPA (86.9%), and venous duplex was used in 6.6%, which mirrors data from a previous study by Warren and Matthews (87.7% and 2.4%). In terms of treatment, heparins (both unfractionated and low molecular weight) were the primary methods of management, with low molecular weight heparin used more frequently (91.8%) than unfractionated heparin (9.2%). Thrombolysis was employed in 4.9% of high-risk patients, consistent with other studies. Other treatment methods like vena cava filters and embolectomy were not used in this cohort.

Medical prophylaxis was not observed, though non-pharmacological prophylaxis (such as early mobility, leg elevation, pneumatic beds, and compression stockings) was used in 11.4% of cases. Prophylactic measures were

generally underutilized, contributing to the potential development of PE. The need for a more detailed study on patient risk stratification and the use of combined prophylactic methods, particularly in postoperative settings, is evident. Several international studies suggest extended prophylaxis post-discharge for high-risk surgical patients, with recommendations for up to 4 weeks after procedures like hip replacement or cancer surgery. Further prospective research is required to determine the optimal duration for antithrombotic therapy in different types of surgery [19-25].

Conclusion

Pulmonary embolism (PE) is often associated with multiple risk factors. It can present with mild symptoms, but a thorough clinical evaluation is crucial for determining the need for diagnostic testing. The condition was most common in individuals aged 41-60 years, particularly among females. Dyspnea with gradual onset and pleuritic chest pain were the most common clinical manifestations, while fever and syncope were less frequent and typically presented more than 24 hours after symptoms began. Post-surgical patients were at the highest risk for developing PE, followed by those in the post-delivery period and individuals with respiratory diseases. Diagnosis should incorporate clinical probability assessments alongside CTPA, echocardiography, and Doppler ultrasound when significant limb swelling is evident. Treatment methods adhered to international guidelines, and the majority of patients were discharged with plans for outpatient follow-up.

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