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Retrospective Analysis of Clinical Profile, Management and Outcomes of Pulmonary Embolism in Western Nepal, A Single Center Study

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ABSTRACT

Background: Pulmonary embolism (PE) is a potentially life threatening condition. Symptoms can be vague mimicking other conditions. Severity depends on the size and location of the embolism. A thorough medical history is crucial to identify the risk factors. This study aims at identifying clinical presentations, management and outcome of PE.

Methods: This was a retrospective analysis of the patients presenting with acute PE for four years, from May 2020 to May 2024 at Gautam Buddha Community Heart Hospital.

Results: Altogether 51 patients admitted for acute PE were included in the study. The mean age was 54.39±18. Majority were male 30(58.8%). The most common age group affected was 41–60 years (43.1%). The majority of them were categorized as low risk 37(72.5%). Clinically 16 patients (31.4%) had provoked conditions, whereas 35 patients (68.6%) presented with non-provoked conditions. The most common clinical presentation was shortness of breath 44(86%) followed by chest pain 15(23.4%). The most common ECG and Echocardiogram finding was sinus tachycardia 43(84.4%) and dilated right atrium and right ventricle 45(88.2%) respectively. Direct acting anticoagulants was used in 17(33.3%) patients. The mean hospital stay for the cohort was 4.4 ± 1.8 days. There were five mortalities with mean simplified PESI score of 3±0.7.

Conclusion: Acute PE is a life-threatening condition resulting from the obstruction of the pulmonary arteries. Prompt diagnosis and treatment are crucial to reducing morbidity and mortality.

Keywords: acute pulmonary embolism; provoked PE; simplified PESI score.

INTRODUCTION

Pulmonary embolism (PE) is a serious medical condition caused by the blockage of pulmonary arteries, most commonly due to thrombi originating from deep vein. As a significant component of venous thromboembolism (VTE), PE is a leading cause of cardiovascular mortality, accounting for up to 10-30% of deaths within the first month of diagnosis.[1] The condition affects an estimated 60 to 120 individuals per 100,000 annually, with 60,000 to 100,000 deaths attributed to PE each year in the United States.[2] PE exhibits a broad range of clinical presentations, ranging from asymptomatic cases to severe, life-threatening massive PE.[3] Clinical presentation also depends on the size of embolus with minor peripheral emboli causing pleuritic chest pain to massive PE leading to cardiogenic shock or cardiac arrest.[4] Various risk factors have been attributed to play the role in the causation of pulmonary embolism ranging from genetic predisposition to various predisposing factors which can be temporary and permanent.[5] Multidetector CTA is the gold standard for diagnosing acute PE.[6] Management strategies depends upon the clinical presentation. High risk patient who presents with hypotension (i.e. systolic blood pressure <90 mmHg) and do not have a high bleeding risk, primary reperfusion with systemic thrombolytic therapy is the treatment of choice.[4,5]

METHODS

This was a retrospective study carried out in our hospital for the duration of fou years (May 2020 to 2024). The detail evaluation of all the documents including the clinical presentation, history,

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investigations management and in hospital outcome was studied. CT pulmonary angiogram was performed and the presence of thrombus was required for the diagnosis of pulmonary embolism. Stratification of those patients among high risk and non high risk was done according to the presence or absence of low blood pressure with systolic blood pressure of <90mmHg as a high risk. The presence of risk factors contributing to PE was studies and presence of such risk factors termed as provoked PE and absence as unprovoked. D-dimer was studied in all the patients. ECG was studied and the presence of various patterns was recorded. Echocardiogram was performed by experienced cardiologist. Those patients who had an indication for thrombolysis were given streptokinase as per standard protocol followed by Heparin. Other remaining patients received Warfarin or direct acting anticoagulant (DOAC). S-PESI score was calculated for risk stratification.

RESULTS

This retrospective, observational, single-center study was conducted over a period of four years, from May 2020 to 2024. A total of 51 patients were included in the study cohort. The mean age was 54.39±18 years. The demographic distribution of the study population revealed that the majority were male, comprising 30 patients (58.8%), while females accounted for 21 patients (41.2%).

Table 1. Simplified PESI Score.	
Parameter	**Points**
Age	1
Cancer	1
Chronic Heart failure	1
Chronic Pulmonary disease	
Pulse rate >110bpm	1
Systolic blood pressure <100mmHg	1
Arterial oxygen saturation <90%	1
Risk stratification	
0 points = 30-day mortality risk 1.0% (95% CI 0.0%–2.1%)	
≥1 point(s) = 30-day mortality risk 10.9% (95% CI 8.5%–13.2%)	

Source: ESC Guidelines on the diagnosis and management of acute pulmonary embolism.[5]

The age distribution of the cohort was as follows: 12 patients (23.5%) were aged ≤40 years, 22 patients (43.1%) were aged between 41–60 years, 12 patients (23.5%) were aged between 61–80 years, and 5 patients (9.8%) were older than 80 years.

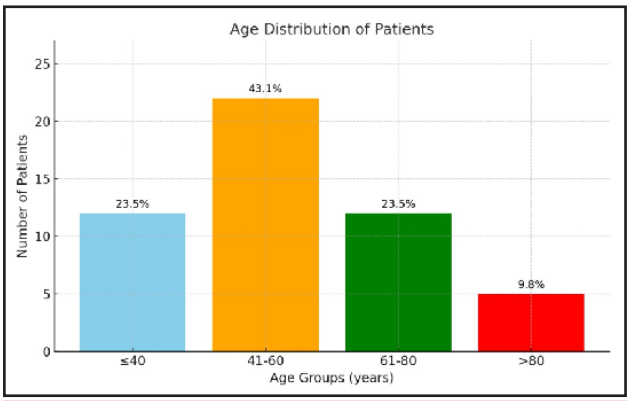

Figure 1. Age distribution of patients with acute PE.

Among the cohort, 14 patients (27.5%) were classified as high risk, while the majority, 37 patients (72.5%), were categorized as low risk. Regarding the clinical presentation, 16 patients (31.4%) had provoked conditions, whereas 35 patients (68.6%) presented with non-provoked conditions.

Risk Factor Analysis

Specific risk factors identified within provoked group included:

Table 2. Predisposing factors for acute PE. (n=16)	
Predisposing factors	**Frequency (%)**
Intravenous drug use (IVDU)	1(2)
Malignancy	2(3.9)
Post-surgery immobilization	3(5.9)
Prolonged bed rest or chronic illness	8(15.7)
Postpartum state	2(3.9)

The most common clinical presentation was shortness of breath 44(86%) followed by chest pain 15(23.4%).

The mean hospital stay for the cohort was 4.4 ± 1.8 days. The mean oxygen saturation was 88.7 ± 7.3%, and the mean s-PESI (simplified Pulmonary Embolism Severity Index) score was 2.3 ± 1.1.

All patients who were classified as a high risk were thrombolysed with streptokinase. All patients who were non high risk were anticoagulated with

intravenous low molecular weight heparin followed by oral medication. The utilization of direct oral anticoagulants (DOACs) was relatively low, with only 17 patients (33.3%) receiving these medications. The remaining patients were prescribed Warfarin, with an average dose of 5.1±1.93 mg. There were a total of 5 in hospital mortalities during the study period. Among the deceased patients, 4 (80%) were classified as high risk, and 1 (20%) was from the low-risk group. All individual with mortality had mean PESI score of 3±0.7.

Table 3. Diagnostic tools used in patients with acute PE.

Diagnostic tools	No. of Patients
ECG characteristics	
Sinus tachycardia	43
S1Q3T3	12
RBBB	6
Echo findings	
dilated RA and RV	45
Mc connel sign	35
Chest X ray	
Normal	35
Wedge shaped opacity	6
Collapse	4
Pleural effusion	6
D-dimer positive	40
Troponin positive	41

DISCUSSION

Acute pulmonary embolism (PE) is a potentially life-threatening condition with a wide spectrum of presentations and clinical outcomes, ranging from asymptomatic cases to severe, life-threatening situations. The condition is not uncommon because it is ranked third most common type of cardiovascular disease after coronary artery disease and stroke. Data have shown that most often the age group affected belongs to 60-70 years.[7] Our study showed the most common age group involved was 41-60 years 22(43.1%). This could be early recognition of signs and symptoms and also due to early utilization of health care facility.

Pulmonary embolism is referred to as provoked if associated with acquired risk factors that could be transient or persistent and unprovoked if there is no apparent clinical risk factor involved.[8] Altogether 16(31.4%) patients in our study had provoked PE and the distribution of different risk factors are shown in the table 1. The findings are in consistent with a similar study done by Kim HJ et al in Korea, of the 237 PE patients, 73 (30.8%) had provoked PE.[9] In a study done in National heart center, Nepal a study done by CM Adhikari et al 47.8% patients had provoked PE.[3]

Patients with acute PE presents with array of clinical findings and at times are even asymptomatic. However, the most common symptom is shortness of breath (SOB). In our study SOB was present in 44(86%) of the patients. This finding aligns with previous studies, which reported the incidence of shortness of breath as 81% in Kucher et al.[10] and 83% in Torbicki et al.[11] Various diagnostic methods are available to detect acute PE and assess its severity, while established scoring systems often incorporate multiple modalities to evaluate the pre-test probability of acute PE. Electrocardiogram (ECG) is one simple method useful particularly for ruling out the other life threatening that mimics acute PE but has different therapeutic approach like acute myocardial infarction.[12] The most common ECG finding in acute pulmonary embolism is sinus tachycardia.[13] Our study showed sinus tachycardia in 43(84.3%). Other ECG finding is the $S_1Q_3T_3$ sign (prominent S wave in lead I, Q wave and inverted T wave in lead III) which is a sign of acute cor pulmonale (acute pressure and volume overload of the right ventricle because of pulmonary hypertension) reflecting right ventricular strain.[14] This electrocardiogram (ECG) finding is observed in 15% to 25% of patients who are eventually diagnosed with pulmonary embolism (PE).[15] In our study, this specific sign was observed in 12 patients (23.5%).

Echocardiography is widely utilized for diagnosing and managing acute PE, offering critical insights into hemodynamic instability in emergency settings. It has been validated for early risk stratification and plays a significant role in guiding management strategies for acute PE.[16] There are many echocardiographic findings which can be observed in cases of acute pulmonary embolism. The findings are pulmonary artery dilation, right atrial enlargement, right ventricular hypokinesis

and enlargement, reduced left ventricular size, McConnell's sign, intraventricular septal flattening or paradoxical motion, direct thrombus visualization in the right heart or pulmonary artery, and inferior vena cava distention with diminished respiratory variation.[17] Research indicates that a considerable proportion of patients with acute pulmonary embolism (PE) present with a dilated right atrium (RA) and right ventricle (RV) on imaging. Studies suggest that approximately 40-60% of PE cases exhibit this characteristic, with the highest occurrence observed in individuals with large, central pulmonary emboli or bilateral PE.[18,19] Our study showed quiet significant number of patients 45(88.2%) had dilatation of RA and RV

The majority of studies suggest that DOACs have become the first-line treatment for acute PE, with a significant proportion of patients being discharged on DOAC therapy.[20] Key clinical trials, including EINSTEIN-PE (rivaroxaban), AMPLIFY (apixaban), and HOKUSAI-VTE (edoxaban), have demonstrated the efficacy and safety of direct oral anticoagulants (DOACs) in the treatment of pulmonary embolism (PE).[21] The proportion of patients receiving DOACs for PE varies based on the study population and healthcare setting, ranging from approximately 50% to nearly 80%. The use also depends on the patient's individual risk factors and the severity of the disease.[22] Use of DOACs in our setting is relatively low with the use increasing day by day for various indications. In this study, DOACs was used in 17(33%). We expect the number to increase in coming days. The majority of patients with acute pulmonary embolism (PE) initially receive parenteral heparin before transitioning to oral DOACs.[20] Similarly, our study observed that initial treatment was administered with parenteral heparin, followed by DOAC therapy. Compared to warfarin, DOACs typically require less frequent monitoring, offering a practical advantage in patient management.[23]

The sPESI score is a useful tool for risk stratification in patients with acute pulmonary embolism, aiding clinicians in identifying those who may need more intensive management and monitoring.[24] Studies utilizing the simplified Pulmonary Embolism Severity Index (sPESI) score show that the 30-day mortality rate for low-risk patients with acute pulmonary embolism (sPESI score of 0) is usually around 1%. In contrast, patients classified as high-risk (sPESI score of 1 or higher) experience a considerably higher mortality rate, typically ranging from 8% to 10%, depending on the study population.[24,25] Our study also showed four among the five mortalities had high sPESI score with mean score of 3±0.7.

CONCLUSION

Acute pulmonary embolism (PE) is a serious and potentially fatal condition caused by a blockage in the pulmonary arteries, often due to a clot traveling from deep vein thrombosis (DVT). Timely diagnosis and intervention are critical in reducing complications and improving patient outcomes. Advances in imaging techniques, anticoagulant therapies, and minimally invasive procedures have enhanced treatment effectiveness. Preventive strategies, such as risk assessment, thromboprophylaxis for high-risk individuals, and lifestyle adjustments, play a vital role in lowering PE occurrence. Early detection, swift treatment, and proper long-term care are key to improving survival rates and preventing complications.

Limitation: This was a retrospective study done in a single center. Sample size was relatively low. Further larger, prospective studies are needed to validate the findings of our study.

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