RESEARCH PAPER

Evaluation Of Pulmonary Embolism Using Ct Pulmonary Angiography In Patients Suspected Of Pulmonary Embolism

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Abstract

Background: Pulmonary embolism (pe) is a potentially fatal cardiovascular condition with nonspecific clinical presentation, making early and accurate diagnosis essential. Ct pulmonary angiography (ctpa) has emerged as the imaging modality of choice for evaluating suspected pe due to its high diagnostic accuracy.

Aim: To evaluate the role of ctpa in diagnosing pulmonary embolism in patients with clinical suspicion of pe.

Materials and Methods: This prospective observational study was conducted over a period of 6 months in the department of radiodiagnosis at maharishi markandeshwar institute of medical sciences and research, mullana, haryana. A total of 50 patients with suspected pe underwent ctpa. Clinical data, risk factors, and imaging findings were recorded and analyzed statistically.

Results: Pulmonary embolism was detected in 29 (58%) patients. A significant association was observed with increasing age ($p = 0.041$). Dyspnea, tachycardia, and hemoptysis showed significant correlation with pe ($p < 0.05$). Risk factors such as immobilization, malignancy, and previous dvt/pe were also significantly associated. The most common site of embolus was the lobar arteries (37.9%), followed by segmental arteries.

Conclusion: Ctpa is a highly sensitive and specific modality for diagnosing pulmonary embolism, enabling accurate detection and localization of thrombi. It plays a vital role in early diagnosis, risk assessment, and guiding appropriate management, thereby improving patient outcomes.

Keywords: Pulmonary Embolism, Ct Pulmonary Angiography, Dyspnea, Thromboembolism, Radiodiagnosis.

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INTRODUCTION

Pulmonary embolism (PE) is a potentially life-threatening condition characterized by the obstruction of pulmonary arteries by thromboemboli, most commonly originating from deep veins of the lower extremities. It represents a significant cause of cardiovascular morbidity and mortality worldwide, ranking as the third most common cause of cardiovascular death after myocardial infarction and stroke [1]. The clinical presentation of PE is often variable and nonspecific, ranging from asymptomatic cases to sudden cardiac death, which makes early diagnosis challenging. Common symptoms include dyspnea, chest pain, tachycardia, and hemoptysis, but these findings overlap with several other cardiopulmonary conditions, necessitating the use of reliable imaging modalities for accurate diagnosis [2].

In recent decades, computed tomography pulmonary angiography (CTPA) has emerged as the gold standard imaging technique for the evaluation of suspected PE due to its high sensitivity, specificity, and widespread availability. CTPA enables direct visualization of intraluminal thrombi within the pulmonary arterial tree and allows assessment of clot burden, distribution, and associated parenchymal and pleural abnormalities [3]. Additionally, it provides valuable information regarding right ventricular dysfunction, which is an important prognostic indicator in acute PE [4]. Compared to conventional pulmonary angiography, which was previously considered the reference standard, CTPA is less invasive, faster, and more accessible in emergency settings [5].

The diagnostic approach to suspected PE typically involves clinical probability assessment using validated scoring systems such as the Wells score or Geneva score, followed by D-dimer testing in low- to intermediate-risk patients. Patients with high clinical suspicion or positive D-dimer results are then referred for imaging, most commonly CTPA [6]. This stepwise approach helps to reduce unnecessary imaging and radiation exposure while maintaining diagnostic accuracy. However, indiscriminate use of CTPA may lead to overdiagnosis of clinically insignificant emboli and increased exposure to ionizing radiation and contrast-related complications, particularly in vulnerable populations such as pregnant women and patients with renal impairment [7].

CTPA not only confirms the presence of emboli but also aids in identifying alternative diagnoses such as pneumonia, malignancy, or aortic pathology, thereby influencing patient management [8]. Furthermore, advances in multidetector CT technology have significantly improved image quality, reduced acquisition time, and enabled detailed evaluation of subsegmental arteries, enhancing diagnostic confidence [9]. Despite these advantages, limitations such as motion artifacts, contraindications to iodinated contrast, and variability in interpretation remain important considerations.

Given the clinical importance of timely and accurate diagnosis, evaluation of pulmonary embolism using CTPA plays a pivotal role in modern clinical practice. This study aims to assess the role of CTPA in patients with suspected pulmonary embolism, focusing on its diagnostic efficacy, imaging findings, and correlation with clinical parameters. Understanding the utility and limitations of this modality is essential for optimizing patient outcomes and guiding appropriate therapeutic interventions [10].The aim of this study is to evaluate the role of CT pulmonary angiography in diagnosing pulmonary embolism in suspected patients. Objectives include assessing imaging findings, determining diagnostic accuracy, identifying clot location and severity, and correlating radiological features with clinical presentation to improve early diagnosis and guide effective management strategies.

MATERIALS AND METHODS

Study Design: Prospective observational study.

Study Duration: 6 months.

Sample Size: 50 patients.

Study Place: Department of Radiodiagnosis, Maharishi Markandeshwar Institute of Medical Sciences and Research, Mullana, Haryana, India.

Study Population: Patients clinically suspected of pulmonary embolism referred for CT pulmonary angiography (CTPA).

Inclusion Criteria:

- Patients with clinical suspicion of pulmonary embolism (e.g., dyspnea, chest pain, tachycardia).
- Patients referred for CTPA.
- Age ≥18 years.

Exclusion Criteria:

- Patients with known allergy to iodinated contrast media.
- Patients with renal insufficiency (elevated serum creatinine).
- Pregnant patients.
- Hemodynamically unstable patients unable to undergo CT scan.

Statistical Analysis: We put the data into Microsoft Excel and then used SPSS software version 27.0 (SPSS Inc., Chicago, IL, USA) and GraphPad Prism version 5 to look at it. Mean ± standard deviation was used to show continuous variables, and frequencies and percentages were used to show categorical variables. The unpaired t-test was utilized to examine continuous variables between independent groups, whereas the paired t-test was employed for comparisons within the same group. The Chi-square test or Fisher's exact test was used to look at categorical variables, depending on which one was better. A p-value of less than 0.05 was seen to be statistically important.

RESULT

Table 1. Age Group Distribution and Presence of Pulmonary Embolism

Age Group (years)	PE Present	PE Absent	Total	P-value
18–30	3 (6.0%)	5 (10.0%)	8 (16%)	**0.041**
31–50	9 (18.0%)	8 (16.0%)	17 (34%)	
51–70	12 (24.0%)	6 (12.0%)	18 (36%)	
>70	5 (10.0%)	2 (4.0%)	7 (14%)	
Total	29 (58%)	21 (42%)	50 (100%)	

Table 2. Gender Distribution and Pulmonary Embolism

Gender	PE Present	PE Absent	Total	P-value
Male	17 (34%)	10 (20%)	27 (54%)	0.612
Female	12 (24%)	11 (22%)	23 (46%)	
Total	29 (58%)	21 (42%)	50 (100%)	

Table 3. Clinical Symptoms and Association with PE

Symptom	PE Present	PE Absent	Total	P-value
Dyspnea	26 (52%)	12 (24%)	38 (76%)	0.018
Chest Pain	20 (40%)	9 (18%)	29 (58%)	0.072
Hemoptysis	8 (16%)	2 (4%)	10 (20%)	0.045
Tachycardia	22 (44%)	10 (20%)	32 (64%)	0.03

Table 4. Risk Factors Associated with Pulmonary Embolism

Risk Factor	PE Present	PE Absent	Total	P-value
Immobilization	15 (30%)	6 (12%)	21 (42%)	0.032
Recent Surgery	10 (20%)	5 (10%)	15 (30%)	0.089
Malignancy	7 (14%)	2 (4%)	9 (18%)	0.048
Previous DVT/PE	9 (18%)	3 (6%)	12 (24%)	0.041

Table 5. Location of Embolus on CTPA

Location of Thrombus	Number (n=29)	Percentage	P-value
Main Pulmonary Artery	6	20.70%	0.022
Lobar Artery	11	37.90%	
Segmental Artery	9	31.00%	
Subsegmental Artery	3	10.40%	

Figure: 1. Clinical Symptoms and Association with PE

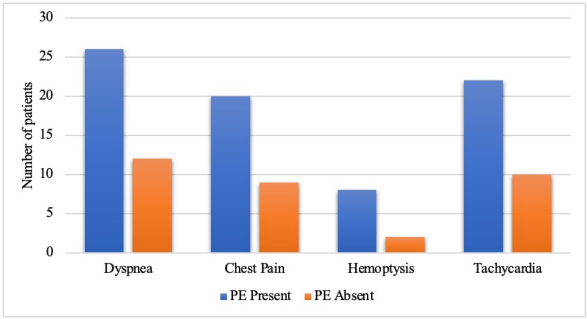

Figure: 2.Risk Factors Associated with Pulmonary Embolism

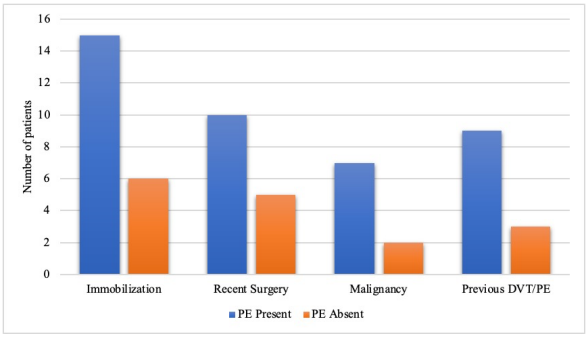

Table 1:

The distribution of pulmonary embolism (PE) across different age groups showed that the highest incidence was observed in the 51–70 years group, with 12 patients (24%), followed by 31–50 years with 9 patients (18%). In the >70 years group, 5 patients (10%) had PE, while only 3 patients (6%) in the 18–30 years group were positive for PE. A statistically significant association was found between increasing age and occurrence of PE ($p = 0.041$).

Table 2:

Among the study population, males constituted 27 (54%) and females 23 (46%). Pulmonary embolism was detected in 17 males (34%) and 12 females (24%). However, the association between gender and presence of PE was not statistically significant ($p = 0.612$), indicating no gender predilection in this study.

Table 3:

Analysis of clinical symptoms revealed that dyspnea was the most common symptom, present in 26 (52%) patients with PE compared to 12 (24%) without PE, showing a significant association ($p = 0.018$). Tachycardia was observed in 22 (44%) PE patients and was also significantly associated ($p = 0.030$). Hemoptysis was noted in 8 (16%) PE patients versus 2 (4%) without PE, demonstrating statistical significance ($p = 0.045$). Chest pain was seen in 20 (40%) patients with PE but did not show a statistically significant association ($p = 0.072$).

Table 4:

Among the risk factors, immobilization was present in 15 (30%) patients with PE and showed a significant

association (p = 0.032). Malignancy was noted in 7 (14%) PE patients compared to 2 (4%) without PE, also showing statistical significance (p = 0.048). Previous history of DVT/PE was found in 9 (18%) PE patients and was significantly associated (p = 0.041). Recent surgery was observed in 10 (20%) PE patients but did not reach statistical significance (p = 0.089).

Table 5:

CT pulmonary angiography findings showed that the most common site of thrombus was the lobar arteries in 11 cases (37.9%), followed by segmental arteries in 9 cases (31.0%). Main pulmonary artery involvement was seen in 6 cases (20.7%), while subsegmental arteries were involved in 3 cases (10.4%). The distribution of thrombus location was statistically significant (p = 0.022), indicating a predominance of central and lobar involvement in PE patients.

DISCUSSION

Age Distribution

In the present study, a statistically significant association was observed between increasing age and the occurrence of pulmonary embolism, with the highest incidence in the 51–70 years age group (24%, p = 0.041). This finding is consistent with the study by Heit et al. [11], who reported that the incidence of venous thromboembolism increases exponentially with age, particularly after the fifth decade of life. Similarly, Silverstein et al. [12] demonstrated that advancing age is an independent risk factor for PE due to factors such as reduced mobility, comorbidities, and endothelial dysfunction. Our results align closely with these observations, reinforcing the importance of age as a significant determinant in PE risk stratification.

Gender Distribution:

Although a higher proportion of males (34%) were found to have PE compared to females (24%) in this study, the difference was not statistically significant (p = 0.612). This is in agreement with the findings of Stein et al. [13], who reported no significant gender predilection in the incidence of PE. Likewise, the study by White [14] concluded that while certain gender-specific risk factors exist (e.g., hormonal therapy in females), overall, PE incidence remains comparable between males and females. Thus, our findings support the notion that gender alone is not a strong independent predictor of PE.

Clinical Symptoms

Dyspnea emerged as the most common and statistically significant symptom associated with PE (52%, p = 0.018), followed by tachycardia and hemoptysis, both showing significant associations. These findings are comparable to those reported by Miniati et al. [15], who identified dyspnea as the most frequent presenting symptom in PE patients. Additionally, Stein et al. [16] reported that tachycardia and hemoptysis, although less common, are important clinical indicators that increase suspicion for PE. Chest pain, although frequently observed in our study (40%), did not reach statistical significance, which is consistent with observations by Pollack et al. [17], suggesting that chest pain is a nonspecific symptom and may overlap with other cardiopulmonary conditions.

Risk Factors

Among the evaluated risk factors, immobilization, malignancy, and previous history of DVT/PE showed statistically significant associations with PE in our study. Immobilization (30%, p = 0.032) has been well established as a major predisposing factor due to venous stasis, as supported by Anderson and Spencer [18]. Malignancy was also significantly associated (p = 0.048), consistent with findings by Khorana et al. [19], who highlighted the hypercoagulable state in cancer patients as a key contributor to thromboembolism. Furthermore, a prior history of DVT/PE (p = 0.041) was significantly correlated, in line with Prandoni et al. [20], who reported a high recurrence rate of thromboembolic events in such patients. Although recent surgery showed a higher proportion in PE patients, it did not achieve statistical significance in our study, possibly due to the limited sample size.

CTPA Findings:

CT pulmonary angiography in this study revealed that the most common site of embolus was the lobar arteries (37.9%), followed by segmental and main pulmonary arteries, with statistically significant distribution (p = 0.022). These findings are comparable to those reported by Qanadli et al. [11], who demonstrated that emboli are most frequently located in central and lobar branches, which are more readily detected by CTPA. Similarly, Wittram et al. [12] emphasized the high sensitivity of multidetector CT in identifying emboli at the lobar and segmental levels. The predominance of central emboli in our study underscores the diagnostic value of CTPA in detecting clinically significant thrombi and guiding appropriate management.

CONCLUSION

In conclusion, this study demonstrates that CT pulmonary angiography (CTPA) is a highly effective and reliable imaging modality for the evaluation of

suspected pulmonary embolism. A significant association was observed between increasing age and the incidence of pulmonary embolism, while gender showed no significant correlation. Among clinical features, dyspnea, tachycardia, and hemoptysis were found to be significant predictors, highlighting their importance in early clinical suspicion. Key risk factors such as immobilization, malignancy, and prior history of thromboembolism were strongly associated with PE, emphasizing the need for careful risk assessment. CTPA not only enabled accurate detection of emboli but also provided precise localization, with a predominance of thrombi in lobar and segmental arteries. Overall, CTPA plays a crucial role in prompt diagnosis, risk stratification, and guiding appropriate management, thereby improving patient outcomes and reducing morbidity and mortality associated with pulmonary embolism.

REFERENCES

1. Goldhaber SZ, Bounameaux H. Pulmonary embolism and deep vein thrombosis. Lancet. 2012;379(9828):1835–46.
2. Stein PD, Henry JW. Clinical characteristics of patients with acute pulmonary embolism. Am J Med. 1997;103(5):371–7.
3. Remy-Jardin M, Remy J. Spiral CT angiography of the pulmonary circulation. Radiology. 1999;212(3):615–36.
4. Schoepf UJ, Kucher N, Kipfmueller F, Quiroz R, Costello P, Goldhaber SZ. Right ventricular enlargement on CT. Circulation. 2004;110(20):3276–80.
5. Stein PD, Fowler SE, Goodman LR, et al. Multidetector CT for acute pulmonary embolism. N Engl J Med. 2006;354(22):2317–27.
6. Wells PS, Anderson DR, Rodger M, et al. Excluding pulmonary embolism using clinical models. Ann Intern Med. 2001;135(2):98–107.
7. Wiener RS, Schwartz LM, Woloshin S. Time trends in pulmonary embolism diagnosis. Arch Intern Med. 2011;171(9):831–7.
8. van Belle A, Büller HR, Huisman MV, et al. Diagnostic management of acute pulmonary embolism. JAMA. 2006;295(2):172–9.
9. Wittram C, Maher MM, Yoo AJ, Kalra MK, Shepard JA, McLoud TC. CT angiography of pulmonary embolism. Radiographics. 2004;24(5):1219–38.
10. Konstantinides SV, Meyer G, Becattini C, et al. ESC guidelines for acute pulmonary embolism. Eur Heart J. 2020;41(4):543–603.
11. Heit JA, Silverstein MD, Mohr DN, et al. Risk factors for venous thromboembolism. Arch Intern Med. 2000;160(6):809–15.
12. Silverstein MD, Heit JA, Mohr DN, et al. Trends in the incidence of deep vein thrombosis and pulmonary embolism. Arch Intern Med. 1998;158(6):585–93.
13. Stein PD, Kayali F, Olson RE. Incidence of venous thromboembolism in different genders. Am J Cardiol. 2004;94(6):825–6.
14. White RH. The epidemiology of venous thromboembolism. Circulation. 2003;107(23 Suppl 1):I4–8.
15. Miniati M, Prediletto R, Formichi B, et al. Accuracy of clinical assessment in suspected pulmonary embolism. Am J Respir Crit Care Med. 1999;159(3):864–71.
16. Stein PD, Terrin ML, Hales CA, et al. Clinical characteristics of patients with acute PE. Am J Med. 1991;91(6):559–66.
17. Pollack CV Jr, Schreiber D, Goldhaber SZ, et al. Clinical characteristics and outcomes of patients with PE. J Am Coll Cardiol. 2011;57(6):700–6.
18. Anderson FA Jr, Spencer FA. Risk factors for venous thromboembolism. Circulation. 2003;107(23 Suppl 1):I9–16.
19. Khorana AA, Francis CW, Culakova E, et al. Thromboembolism in hospitalized cancer patients. J Clin Oncol. 2006;24(3):484–90.
20. Prandoni P, Lensing AW, Cogo A, et al. The long-term clinical course of acute DVT. Ann Intern Med. 1996;125(1):1–7.