



# SPIRAL CT VS PULMONARY ANGIOGRAPHY FOR ACUTE PULMONARY EMBOLISM- IS THERE REALLY ANY DIFFERENCE

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## ABSTRACT

Background- The use of spiral computed tomography (CT) for the diagnosis of pulmonary embolism has been compared to angiography, the current gold standard. However, the accuracy of CT has never been evaluated against an independent gold standard. The aim of this study was to compare contrast-enhanced spiral CT to pulmonary angiography for the detection of sub segmental sized pulmonary emboli.

Methods and materials- this is a retrospective observational study. Based on case records, 20 patients with acute pulmonary embolism were selected. After routine investigations, only if haemodynamically stable, Spiral CT was performed, followed by pulmonary angiography. Spiral CT and angiography were interpreted independently by two radiologists.

Results- Majority of the patients presented with dyspnoea. Spiral CT was performed, and 16/20 patients had evidence of acute pulmonary embolus in the sub segmental vessels. It was sub-optimal in 4 patients. Sensitivity and specificity for CT and angiography, respectively, were: 88% vs 93.33%, 75% vs 82.42% respectively. Accuracy of CT and angiography was comparable; 75.09% vs 76.14%.

Conclusion- There was no difference between spiral CT and angiography for detection of sub-segmental-sized pulmonary emboli. We conclude that spiral CT is comparable to angiography for detection of pulmonary emboli.

Keywords- computed tomography, pulmonary embolism, sub segmental disease

## INTRODUCTION

Acute pulmonary thromboembolism is considered an emergency, and can often lead to respiratory failure and death. However, when there are sub segmental emboli, it is often not diagnosed on basic modalities such as X-ray and ECHO. Ventilation perfusion scan was suggested previously as an alternative imaging modality. However, it has been observed that there are high rate of false negatives noted with this modality<sup>2</sup>.

The gold standard modality of diagnosis is still pulmonary angiography, due to its high accuracy. However, it is an invasive modality, and there are risks associated with the contrast and radiation exposure<sup>3</sup>. Moreover, it takes a longer time to perform. Hence, there is a need for a non-invasive, cost-effective and quicker modality of diagnosis<sup>4</sup>.

Spiral CT is a cheaper, safer and quicker imaging modality, and was first described by Remy-Jardin et al in 1991, for use in acute pulmonary embolism<sup>5</sup>. However, there are very studies comparing it against a gold standard for diagnosis of the same. Several studies have been performed since on the efficacy of CT angiography to diagnose segmental and sub segmental disease<sup>6-8</sup>. Studies have been performed comparing CT to V/Q scintigraphy, and they have unanimously concluded that CT might be a better investigation modality than V/Q scan for pulmonary embolism<sup>9-11</sup>.

Hence we set out to perform a study comparing this modality against a gold standard technique, i.e pulmonary angiography.

## METHODS AND MATERIALS

This is a retrospective observational study performed in the department of Radio-diagnosis in a tertiary care hospital. All patients with diagnosis of acute pulmonary thromboembolism were identified using ICD code, and the case records were analysed. All patients with Acute on Chronic embolism, those with IVC filters and those with missing data in the records were excluded.

A total of 34 patients were identified from Jan 2020 to Jan 2022 with acute pulmonary embolism. Of these, due to the above exclusion criteria, 24 were included in the study. The demographic details, clinical presentation, associated history and co-morbidities, findings of CT and pulmonary angiography was recorded in a semi-structured pro-forma.

The data was entered in an MS excel spreadsheet. Continuous variables were represented as mean, median and mode. Categorical variables were represented as percentage and frequency. Student's t test, Chi square test and Mann Whitney U test were used were appropriate.

Sensitivity and specificity of CT was evaluated against pulmonary angiography, which is the accepted gold standard.

## RESULTS

Twenty-four cases were retrospectively included in the study. We observed that the mean age of the study population was 42.34 years. The mean age of the males was higher than females (44.87 vs 39.06 years). We observed that 16/24 participants were males, and remaining were females. In majority of the patients, the most common complaint was dyspnoea on exertion (56.33%), followed by chest pain (24.05%).

65.44% of the study population had history of smoking and tobacco chewing, while 46.78% had history of chronic alcoholism. When we analysed the co-morbidities, we observed that 45.68% had type II diabetes mellitus, while 33.91% had hypertension. We also observed that 36.28% had underlying malignancy/ history of long bone fracture/ prolonged immobilization history prior to the onset of dyspnoea.

CT angiography was performed in all patients after stabilizing the patient’s haemodynamics. In 19/24, sub-segmental disease was identified. In these patients, pulmonary angiography was performed, and 23/24, sub-segmental disease was observed.

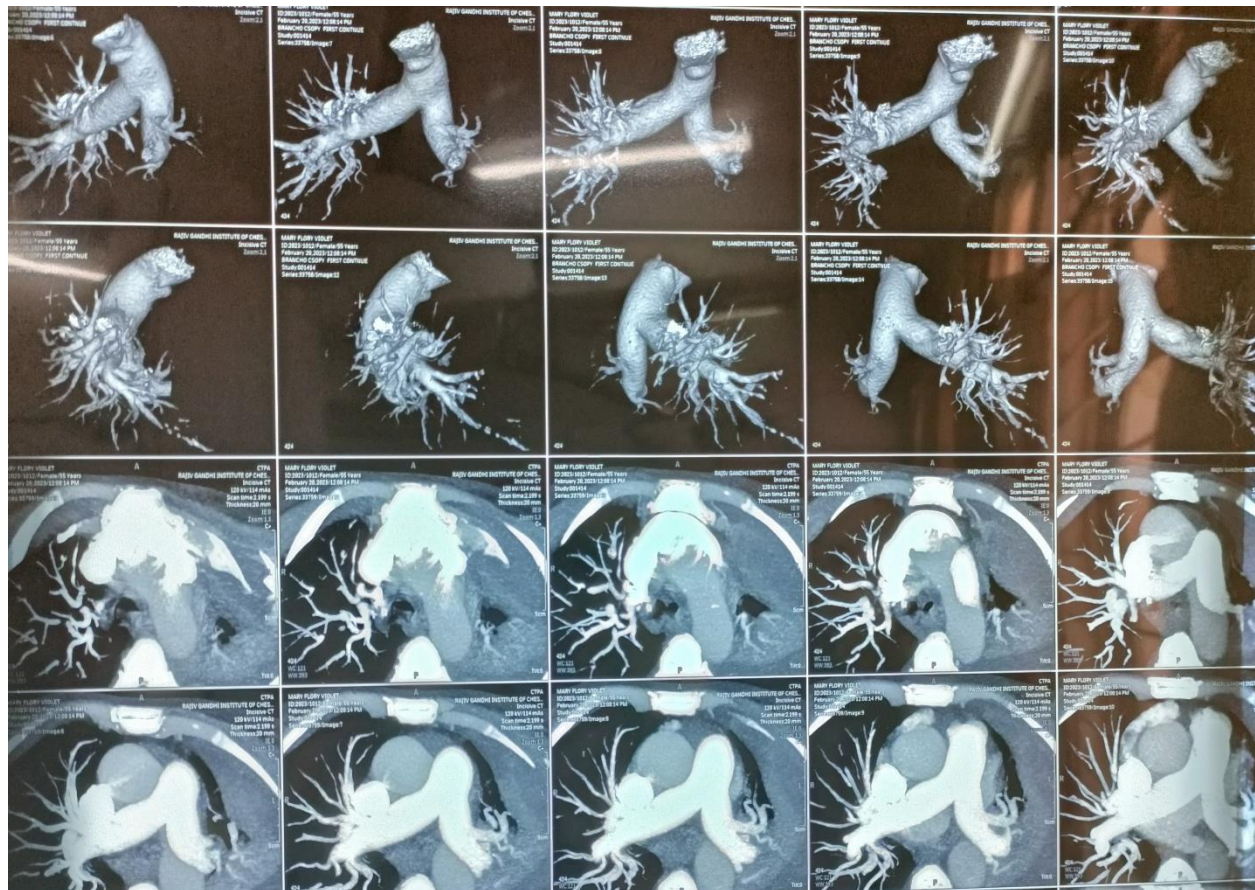


Figure 1:- Spiral CT for acute pulmonary embolism

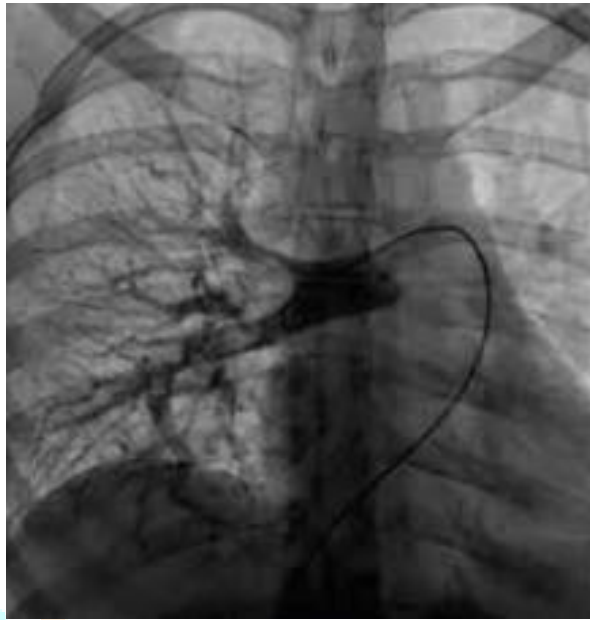


Figure 2:- pulmonary angiography showing subsegmental disease in right lung

Sensitivity of CT and pulmonary angiography was 88% vs 93.33%, while specificity was 75% vs 82.42% respectively. Accuracy of CT and angiography was comparable; 75.13% vs 79.14%.

Statistic	Value	95% CI
Sensitivity	88.00%	68.78% to 97.45%
Specificity	75.00%	19.41% to 99.37%
Positive Likelihood Ratio	3.52	0.64 to 19.34
Negative Likelihood Ratio	0.16	0.05 to 0.53
Disease prevalence (*)	1.00%	
Positive Predictive Value (*)	3.43%	0.64% to 16.34%
Negative Predictive Value (*)	99.84%	99.46% to 99.95%
Accuracy (*)	75.13%	55.67% to 89.19%

Table 1:- sensitivity and specificity of CTPA in acute PE

## DISCUSSION

While a high index of clinical suspicion is most often enough to diagnose acute PE, confirmation is always necessary prior to initiation of thrombolysis. Several investigative modalities exist, but are invasive and time-consuming, with a certain amount of associated morbidity and mortality<sup>1</sup>.

Pulmonary angiography and V/Q scan are still preferred for diagnosis of acute PE. However, these are invasive, and are mainly preferred for central PE. In case of sub-segmental disease, V/Q scan may not be useful<sup>2,3</sup>. In most tertiary care centres, CT scan is easily available and affordable. Apart for these advantages, the time-lag between diagnosis and treatment initiation is reduced with CT scan<sup>4,5</sup>.

In a meta-analysis done by Harvey et al in 2000<sup>6</sup>, they identified 11 studies comparing CT and pulmonary angiography. Of these 11, 5 studies analysed the role of these modalities in sub-segmental disease in 309 patients. They observed that CT showed a mean specificity of 0.91 in for patients with sub-segmental PE. However, they also observed that 44% of the study population had PE, suggesting a selection bias.

In a study done by A Shujaat et al<sup>4</sup>, it was observed that CT can be used for diagnosis of acute PE in an emergency setting too. In a study by Zhongua Sun et al, they observed that the diagnostic yield of CTPA scan in acute PE is higher than triple-phase CT scan for diagnosis of acute PE. Similar findings were observed in large clinical studies performed by Zantonelli et al.

Our study is limited by a small study population, and it being retrospective in nature. To better assess the diagnostic and prognostic role of CTPA in acute PE, large prospective clinical trials are necessary.

## CONCLUSION

We observed that there was no significant difference in the diagnostic potential with CTPA when compared with conventional pulmonary angiography.

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