

Diagnostic Comparison of the Radionuclide Imaging Modalities in the Pulmonary Embolism

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Abstract

Aim: With recent viral pandemics, special considerations have been made about radionuclide imaging of pulmonary embolism in recent years. Besides the increased frequency of occlusive diseases including pulmonary embolism, the ventilation scintigraphy part of the radionuclide imaging modality was omitted. This study aimed to compare the accuracy of radionuclide diagnostic imaging modalities in diagnosing pulmonary embolism.

Materials and Methods: Two hundred and six patients (65 M, 131 F, 59.4 ± 16.9 years old) who were referred for the diagnosis of pulmonary embolism were evaluated retrospectively. The perfusion scintigraphy planar SPECT and SPECT/CT images of the patients were obtained, and ventilation scintigraphy was performed in special circumstances. The imaging results were compared with clinical follow-up results as the gold standard.

Results: The sensitivity, specificity, accuracy, negative, and positive predictive value of the test were 97.5%, 92.9%, 95.63%, 95.16%, and 96.34, respectively in diagnosing pulmonary embolism.

Conclusion: According to the results of this study, SPECT-CT perfusion imaging as a single imaging modality has sufficient diagnostic accuracy in pulmonary embolism.

Keywords: pulmonary embolism, lung perfusion, ventilation, SPECT-CT

Introduction

In recent years, there has been a significant evolution of diagnostic radionuclide imaging modalities. Especially SPECT/CT imaging, with the recent technological advances, has led to a higher diagnostic impact in every scintigraphy. Scintigraphy of the lungs, ventilation, and perfusion scintigraphy were hampered due to the overlying tissues and interobserver variability. However, recent advances in this imaging modality, including SPECT and SPECT/CT, resulted in significantly higher accuracy according to previous studies (1). Additionally, the ventilation scintigraphy component of the imaging modality was questioned because it was omitted for a while due to the recent pandemics (2-4). According to recent comparative studies, there are conflicting results

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about the need for the ventilation component(5). Thus, the aim of this retrospective study was to evaluate the diagnostic accuracy of the perfusion scintigraphy and SPECT-CT in pulmonary embolism.

Materials and Methods

Two hundred and six patients (131 F, 65 M, 59.4 ± 16.9 years old) were the subjects of this study. The informed consents of the patients were obtained prior to the imaging procedure. The study was approved by the Local Ethic Committee.

Planar and SPECT-CT lung perfusion imaging was performed using a SPECT gamma camera and the CT portion of a PET-CT scanner. Before the imaging, the Tc-99m MAA was injected via venous line.

An experienced Nuclear Medicine evaluated the imaging results retrospectively and compared them with clinical follow-up results as the gold standard.

Results

The diagnosis of pulmonary embolism was decided according to the combination of the imaging results and clinical findings. The diagnostic accuracy, sensitivity, specificity, negative and positive predictive value of the imaging modality were 97.5%, 92.9%, 95.63%, 95.16%, and 96.34%, respectively in the diagnosis of pulmonary embolism. Some image examples are presented, including match and mismatch imaging findings respectively (Figure 1).

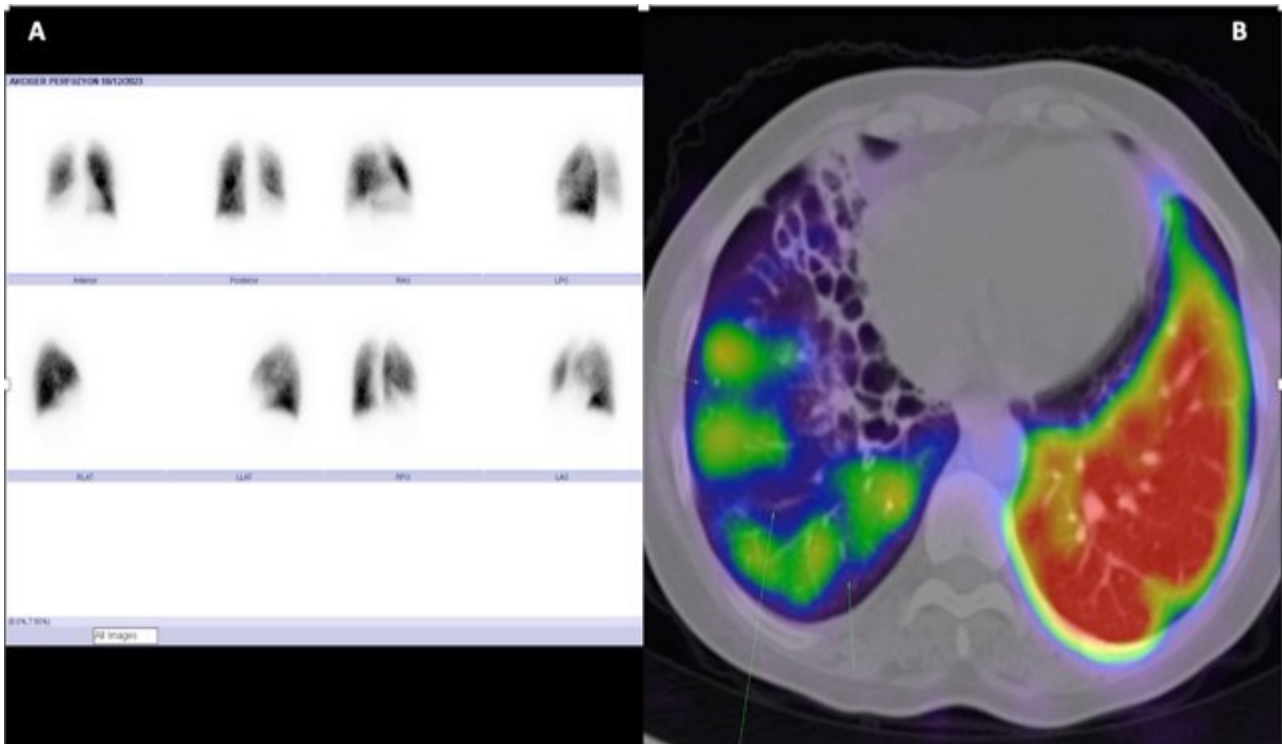


Figure 1. 52 years old female patient with median lobe defects in planar images (a) and match defect at this segments as well as anterior lateral and posterior basal segment mismatch defects in SPECT-CT images (b).

Discussion

The results of this analysis in a significant number of patients showed that the diagnostic efficiency of the lung perfusion SPECT-CT is significantly high in the diagnosis of pulmonary embolism. Thus, the need for ventilation scintigraphy might be questionable and evaluated by further studies.

A recent study comparing V/Q and Q-only SPECT/CT in the diagnosis of pulmonary embolism in 66 patients concluded that Q-only imaging significantly over-diagnosed pulmonary embolism in 12 patients (5). Another comparative study, including scintigraphy, SPECT, SPECT/CT, and CTPA, concluded that the most efficient method is V/Q SPECT/CT (6). According to previous studies, SPECT/CT imaging might also demonstrate alternative diagnosis in patients with suspicion of pulmonary embolism (5, 7). Another study showed that CXR has no clinical impact or influence on the interpretation of V/Q imaging (8). A previous meta-analysis mentioned that the first iteration of guidelines was in the direction of Q-only imaging, but this was relaxed with the second iteration (9). The analysis did not suggest ruling out the ventilation component (9). In most circumstances, the combination of SPECT and CTPA has not been suggested by previous studies (10). However, some studies demonstrate that the diagnostic accuracy of V/Q and Q only SPECT/CT are comparable (11).

The only significant limitation of this study was its retrospective design.

Conclusion

The lung perfusion scintigraphy with SPECT-CT has significantly high diagnostic accuracy in diagnosing pulmonary embolism.

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Authorship Contributions

Concept: M.S., Z.P.K., P.P.O., E.S.O., A.A.S., **Design:** M.S., Z.P.K., P.P.O., E.S.O., A.A.S., **Supervision:** M.S., Z.P.K., P.P.O., E.S.O., A.A.S., **Data Collection and/or Processing:** M.S., Z.P.K., **Analysis and/or Interpretation:** M.S., Z.P.K., **Literature Review:** M.S., Z.P.K., **Writer:** M.S.

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