False positive lung perfusion/ventilation scan due to rapidly resolved pulmonary abnormalities: Importance of SPECT/CT imaging

Case Report

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ABSTRACT

An eighty-year-old lady a with history of treated tuberculosis decades ago and polymerase chain reaction (PCR) proven COVID-19 pneumonia about four months ago was referred to our department for ventilation/perfusion scan due to deteriorating dyspnea to rule out P.E. Planar perfusion scan showed bilateral accentuated apical perfusion gradient and multiple segmental and non-segmental perfusion defects in both lungs, which were mismatched with relatively normal planar ventilation images. Perfusion SPECT images also showed multiple segmental, sub-segmental and semi-segmental perfusion defects, which proved to be concordant with consolidations, bilateral pleural effusion, right lung pneumothorax, and atelectasis which were consultant with CT findings. The ventilation SPECT/CT images also demonstrated uniform tracer activity throughout both lungs, with almost complete improvement in consolidations, lung pneumothorax, pleural effusion, and atelectasis. Our case highlights the importance of SPECT/CT imaging in avoiding false-positive interpretation of pulmonary embolism as well as the possibility for rapid resolution of the lung parenchymal abnormalities.

Key words: Lung perfusion/ventilation scan; SPECT/CT; False positive; Pulmonary embolism

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INTRODUCTION

Planar ventilation-perfusion (V/Q) scanning is often used to investigate pulmonary embolism, but it has several limitations. Compared with CT pulmonary angiography, SPECT has higher sensitivity, lower radiation exposure, fewer suboptimal studies, and no contrast-related complications. Any nuclear medicine department equipped with a modern hybrid scanner can perform combined V/Q SPECT with CT (with low-dose protocols) to enhance diagnostic capability [1, 2]. Any segmental defect on perfusion images without a corresponding ventilation defect is considered positive for pulmonary embolism. In principle, it is possible to detect any of these lung pathologies on the chest CT. So this technique may have the potential to replace Ventilation images in some cases [3].

Today, SPECT/CT hybrid imaging systems are increasingly applied in nuclear medicine departments. Still, it's not routinely performed in lung perfusion scans, which is the era in which this technique may have a significant impression.

CASE PRESENTATION

An eighty-year-old lady a with history of treated tuberculosis decades ago and polymerase chain reaction (PCR) proven COVID-19 pneumonia about four months ago, was referred to our department to perform ventilation/perfusion scan due to deteriorating dyspnea to rule out P.E. The aggravating dyspnea had started two weeks earlier. 148 MBq (4 mCi) of [^{99m}Tc]Tc-MAA (Macroaggregated Albumin) was injected, and lung perfusion scan along with SPECT/CT was done.

Planar perfusion scan, performed on December 10th, showed bilateral accentuated apical perfusion gradient and multiple segmental and non-segmental perfusion defects in both lungs, mismatched with relatively normal planar ventilation images (Figure 1).

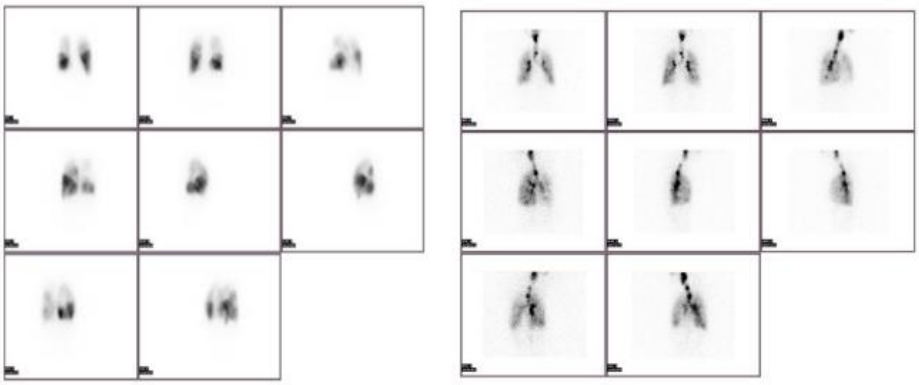

Fig 1. Segmental and non-segmental perfusion defects in both lungs were detected in the planar perfusion scan (left). These observations were mismatched with planar ventilation images (right).

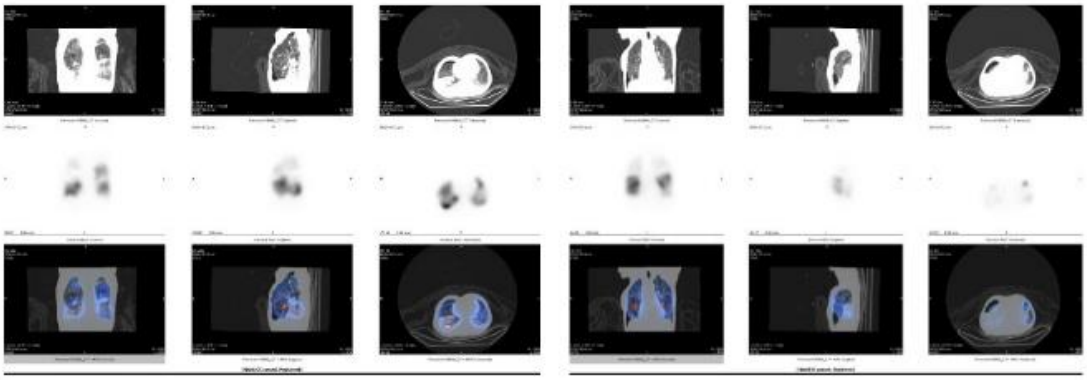

Fig 2. Images obtained from perfusion SPECT/CT scan revealed multiple segmental, sub-segmental and semi-segmental perfusion defects in accordance with consolidations, bilateral pleural effusion, right lung pneumothorax, and atelectasis on the CT component.

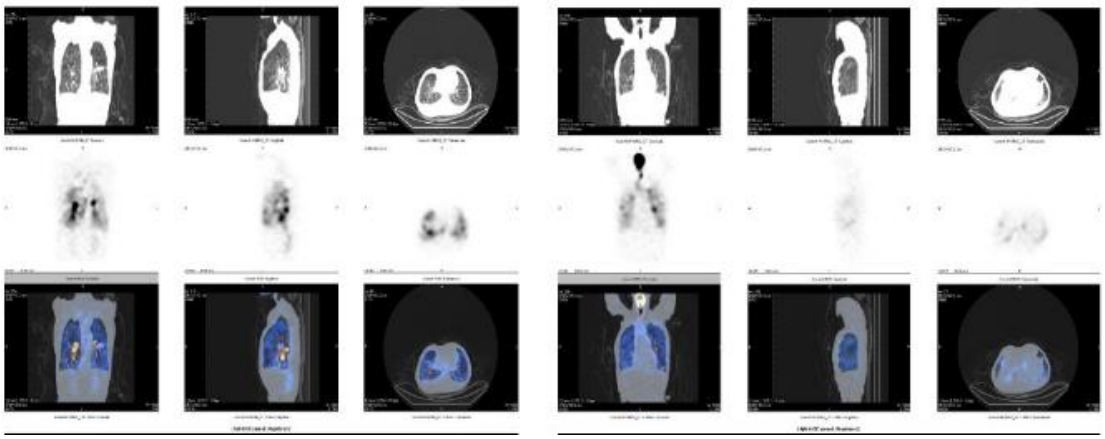

Fig 3. Lung ventilation SPECT/CT scan performed the following day manifested relatively uniform uptake, with nearly complete improvement in consolidations, lung pneumothorax, pleural effusion, and atelectasis in concurrent CT slices.

The SPECT/CT was performed for both perfusion and ventilation images. Perfusion SPECT images also showed multiple segmental, sub-segmental and semi-segmental perfusion defects concordant with patchy consolidations, bilateral pleural effusion, right lung pneumothorax, and evidence of atelectasis on the CT slices (Figure 2).

Lung ventilation scan and SPECT/CT were done on the following day (December 11th) using jet nebulizer after administrating 1110 MBq (30 mCi) of [^{99m}Tc]Tc-DTPA (Diethylenetriamine pentaacetate) aerosols. The static images demonstrated fairly uniform uptake. SPECT/CT images also demonstrated uniform tracer activity throughout both lungs, with almost complete improvement in consolidations, lung pneumothorax, pleural effusion, and atelectasis (Figure 3).

DISCUSSION

Clinical probability of PE can be assessed empirically by clinical judgment (holistically) or by clinical prediction rules, foremost Wells' and the revised Geneva scores. Lung imaging is required in patients with high or likely clinical probability [4-6]. The diagnosis of PE should be reported when a mismatch of one segment or two subsegments is found [7]. Tomographic imaging with V/Q SPECT has higher sensitivity and specificity for PE compared with planar imaging. When V/Q SPECT is combined with a low-dose CT, the specificity of the test can be further improved, especially in patients with underlying lung diseases [8, 9]. V/Q SPECT/CT has similar sensitivity as V/Q SPECT but slightly higher specificity. Using low-dose CT instead of ventilation images approximates the sensitivity for PE compared with V/Q SPECT/CT but has a higher rate of false positives. False-positive mis-matched defects without discrete segmental characteristics might be observed in the elderly, primarily due to known lung parenchymal disease. In addition, about the false-negative interpretation of the perfusion lung scan, it is worth mentioning that normal zones might shine through the possible abnormalities spuriously and reveal a normal scan. Thus, either SPECT or SPECT/CT acquisitions can affirm the apparent defect(s) [9]. To our knowledge, no similar cases were reported in the literature. Our case brings this point to the attention that ongoing lung improvement in the recovery phase can mimic V/Q planar and V/Q SPECT mismatched defects and make false interpretation of pulmonary embolism possible, which can be avoided by paying attention to V/Q SPECT/CT images. Resolution of the lung parenchymal abnormalities in less than 24 hours is another interesting finding in our case. We can conclude that it is better to perform a single-day perfusion/ventilation study in such cases with lung parenchymal abnormalities.

CONCLUSION

V/Q SPECT/CT can help the nuclear physician avoid false-positive interpretation of the lung scan. Our case highlights the importance of SPECT/CT imaging as well as the possibility for rapid resolution of the lung parenchymal abnormalities.

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