

# An aortic intra mural hematoma in ventilation/perfusion SPECT/CT

## A case report

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### Abstract

**Rationale:** Ventilation/perfusion (V/Q) single-photon-emission computed tomography (SPECT) has arisen as an alternative to computed tomography pulmonary angiography (CTPA) in patients with pulmonary embolism (PE) suspicion. The addition of low dose CT (ldCT) to V/Q SPECT improves the specificity of the test, allowing for potential alternative diagnosis.

**Patient concerns and diagnosis:** Here we presented a case of an aortic intramural hematoma (IMH) diagnosed on the ldCT portion of V/Q SPECT combined with CT. A 74-year-old man suffering from sudden-onset chest pain was referred to our nuclear medicine department for PE suspicion.

**Intervention and outcome:** A V/Q SPECT combined with nonenhanced ldCT ruled out PE diagnosis. Nevertheless, ldCT revealed high attenuation aortic wall thickening suggestive of aortic IMH. Chest CT angiography showed mild dilatation and circumferential thickening of aortic wall confirming Stanford type A IMH involving the entire ascending aorta.

**Lesson:** This case illustrates the potential usefulness of combining ldCT to V/Q SPECT in providing alternative diagnosis in suspected PE patients.

**Abbreviations:** CTPA = computed tomography pulmonary angiography, IMH = intramural hematoma, ldCT = low-dose computed tomography, PE = pulmonary embolism, SPECT = single-photon-emission computed tomography, V/Q = ventilation/perfusion.

**Keywords:** alternative diagnosis, case report, lung scan, pulmonary embolism, single-photon-emission computed tomography/computed tomography

## 1. Introduction

Pulmonary embolism (PE) remains a diagnostic challenge in daily routine. The diagnosis of PE is confirmed or refuted using ventilation/perfusion (V/Q) scan or computed tomography pulmonary angiography (CTPA). The V/Q single-photon-emission computed tomography (SPECT) has arisen as an

alternative to CTPA in patients with PE suspicion.<sup>[1]</sup> The addition of low dose CT (ldCT) to V/Q SPECT has been described to improve the diagnostic performance of the test, especially by improving the specificity of the test.<sup>[2]</sup> Here we presented a case of an aortic intramural hematoma (IMH) diagnosed on ldCT of a V/Q SPECT/CT.

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All procedures performed in this case report were in accordance with the ethical standards of the institutional research committee on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. Ethical review and approval was not required in accordance with the national and institutional requirements. Informed written consent was obtained from the patient for publication of this case report and accompanying images.

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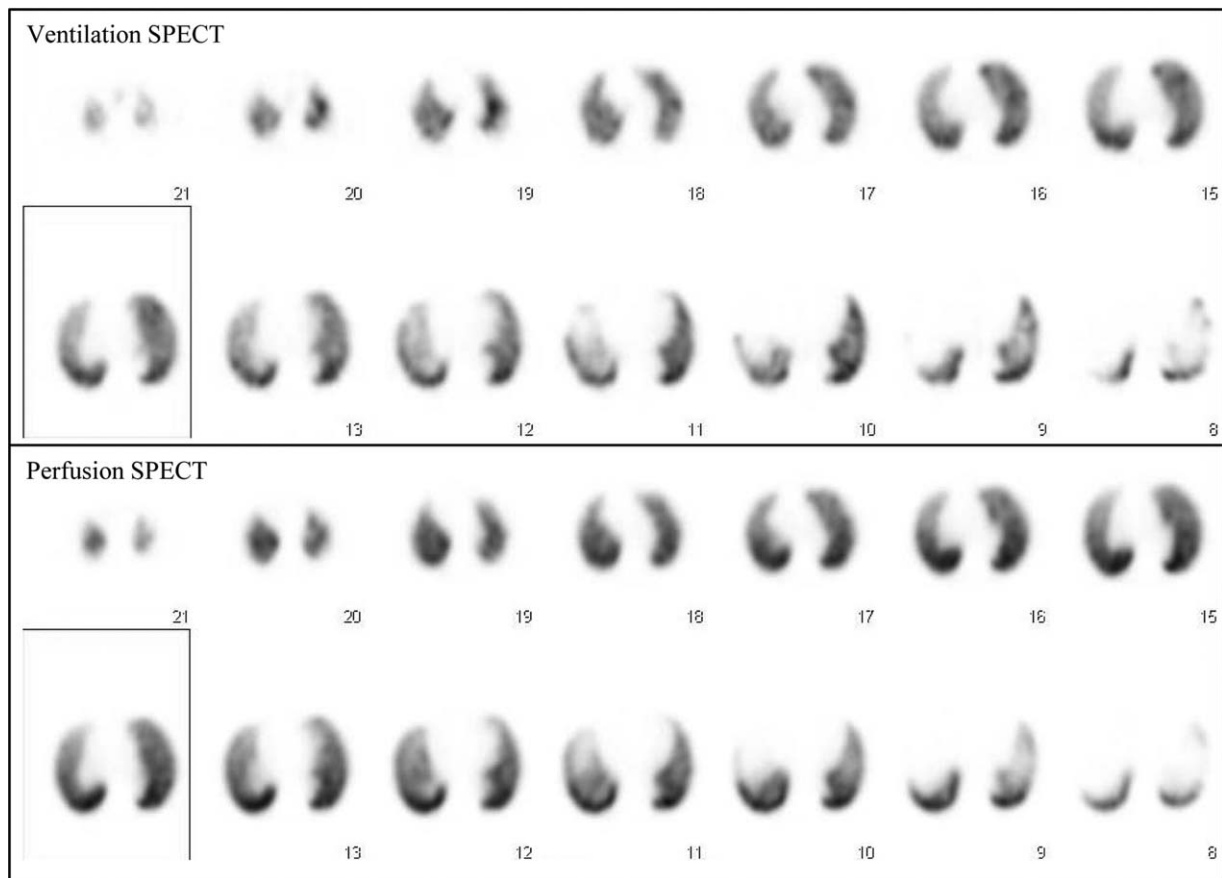
<http://dx.doi.org/10.1097/MD.00000000000012928>

## 2. Case presentation

A 74-year-old man, a former-smoker patient treated for hypertension, went to the emergency department of Brest University Hospital for sudden-onset chest pain, described as stabbing, radiating to the interscapular region, and worsening in dorsal decubitus. Informed written consent was obtained from the patient for publication of this case report and accompanying images. At admission, he was hypertensive (160/85 mm Hg), with no significant difference between arms, and symmetrical peripheral pulses. The patient was referred to nuclear medicine department for PE suspicion. Patient underwent V/Q SPECT combined with low dose CT (ldCT). V/Q SPECT images did not reveal segmental or sub-segmental defects on perfusion images (Fig. 1).

Three-dimensional reconstructed slices from ldCT showed high attenuation aortic wall thickening located in the ascending aorta suggestive of an aortic IMH (Fig. 2).

Chest CT angiography was then performed to investigate aortic abnormality and revealed mild dilatation of ascending aorta (65 mm) and crescentic thickened hyperattenuation aortic wall (15 mm) involving the entire ascending aorta, confirming Stanford type A IMH (Fig. 3).<sup>[3]</sup>



**Figure 1.** Axial ventilation/perfusion single-photon-emission computed tomography (SPECT) images. Perfusion images did not show segmental or subsegmental perfusion defects.

### 3. Discussion

The PE shares symptoms and signs with several life-threatening conditions including acute aortic syndrome (i.e., a group that includes aortic dissection, IMH, and symptomatic aortic ulcer), and no clinical sign is accurate enough to rule out or confirm the diagnosis.<sup>[4,5]</sup> Noninvasive diagnostic strategies for PE are therefore required, and rely on the sequential use of clinical probability assessment, D-dimer and thoracic imaging tests.

The V/Q scan was the cornerstone for more than 20 years but CTPA is currently the first-line imaging modality in most institutions for PE diagnosis, especially because CTPA allows for alternative diagnoses.<sup>[6]</sup> However, CTPA also has drawbacks including radiation dose or contra indications (i.e., renal failure, allergy).<sup>[7,8]</sup> In recent years, V/Q SPECT and then V/Q SPECT/CT has arisen as a potential alternative to CTPA.<sup>[1]</sup>

The combination of V/Q SPECT with CT has been described to improve the diagnostic performance of V/Q SPECT, especially by improving the specificity of the test.<sup>[2]</sup> Another potential advantage of adding IdCT to V/Q SPECT over V/Q SPECT alone is the possibility of providing alternative diagnosis (e.g., pneumothorax, pneumonia) in patients suspected with PE which has been reported as an advantage of CTPA, or the possibility of providing incidental but clinically relevant findings (e.g., breast tumor).<sup>[9,10]</sup> Moreover, some alternative diagnoses to PE, such as IMH, are life-threatening emergencies that need to be detected as early as possible.

The IdCT is performed immediately after the V/Q SPECT, without contrast enhancement, with the patient remaining supine, so that the increased acquisition time between SPECT alone versus SPECT combined with IdCT is low (i.e., approximately 1 minute). Moreover, using low-dose parameters, the radiation dose for IdCT acquisition is estimated to be approximately 0.5 mSv, <10% of the total dose of a dedicated CTPA.<sup>[11]</sup> Thus, the total radiation burden of a combined V/Q SPECT/IdCT remains significantly lower than the dose of a dedicated chest CTPA for PE diagnosis.

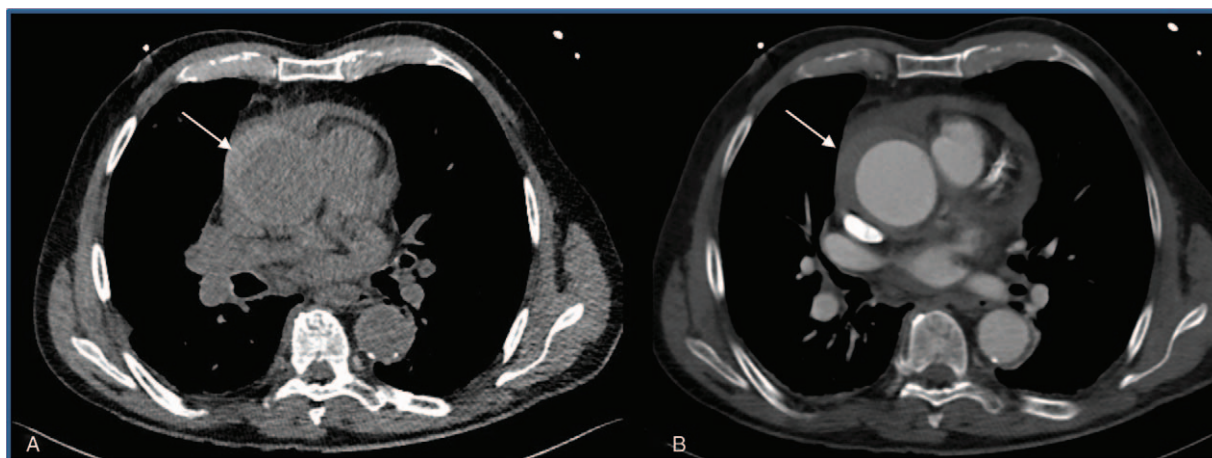
Most of the equipments in nuclear medicine departments are nowadays hybrid SPECT/CT systems. Indeed, most of the SPECT could be combined with CT providing an accurate attenuation correction of the nuclear medicine data, and anatomical information. Moreover, adding IdCT to V/Q SPECT does not necessarily increase the cost of examination, depending on reimbursement policies in some jurisdictions.

### 4. Conclusion

This case confirms the potential usefulness of adding a IdCT to V/Q SPECT in patients with suspected PE. The addition of IdCT allows identifying alternative nonthromboembolic causes for symptomatology, and contributes to improve the overall diagnostic yield of V/Q scan. Alternative diagnoses have to be especially thought when PE is ruled out by V/Q images. Therefore, special attention must be given to aorta on IdCT



**Figure 2.** Axial low-dose computed tomography (CT) slices of ventilation/perfusion single-photon-emission CT/CT. Image showed high attenuation aortic wall thickening (white arrows) located in the ascending aorta suggestive of an aortic intramural hematoma.



**Figure 3.** Axial slices of chest computed tomography (CT) angiography. (A) Acute intramural hematoma is better detected on nonenhanced images using of a narrow window (width, 200 HU; level, 40 HU) showing crescentic or circumferential aortic wall hyperattenuation (white arrow). (B) Contrast enhanced images revealed a decreased diameter of the aortic lumen without enhancement of the hematoma (white arrow).

without contrast media injection, in search of signs suggestive of acute aortic syndrome.

### Author contributions

**Conceptualization:** Philippe Robin, Olivier Delcroix, Pierre-Yves Le Roux, Pierre-Yves Salaun.

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**Methodology:** Philippe Robin.

**Supervision:** Ronan Abgral, Pierre-Yves Le Roux, Pierre-Yves Salaun.

**Validation:** Philippe Robin, Olivier Delcroix, Ronan Abgral, Pierre-Yves Le Roux, Pierre-Yves Salaun.

**Writing – original draft:** Philippe Robin, Olivier Delcroix, Ronan Abgral, Pierre-Yves Le Roux, Pierre-Yves Salaun.

**Writing – review & editing:** Philippe Robin, Olivier Delcroix, Ronan Abgral, Pierre-Yves Le Roux, Pierre-Yves Salaun.

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