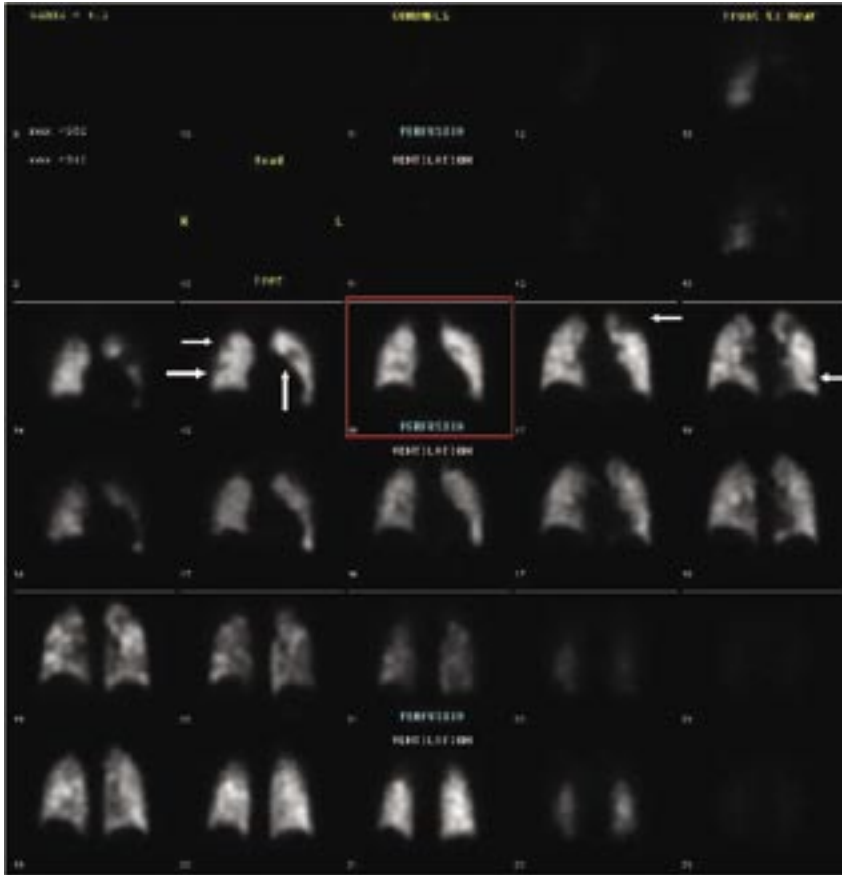


Case I

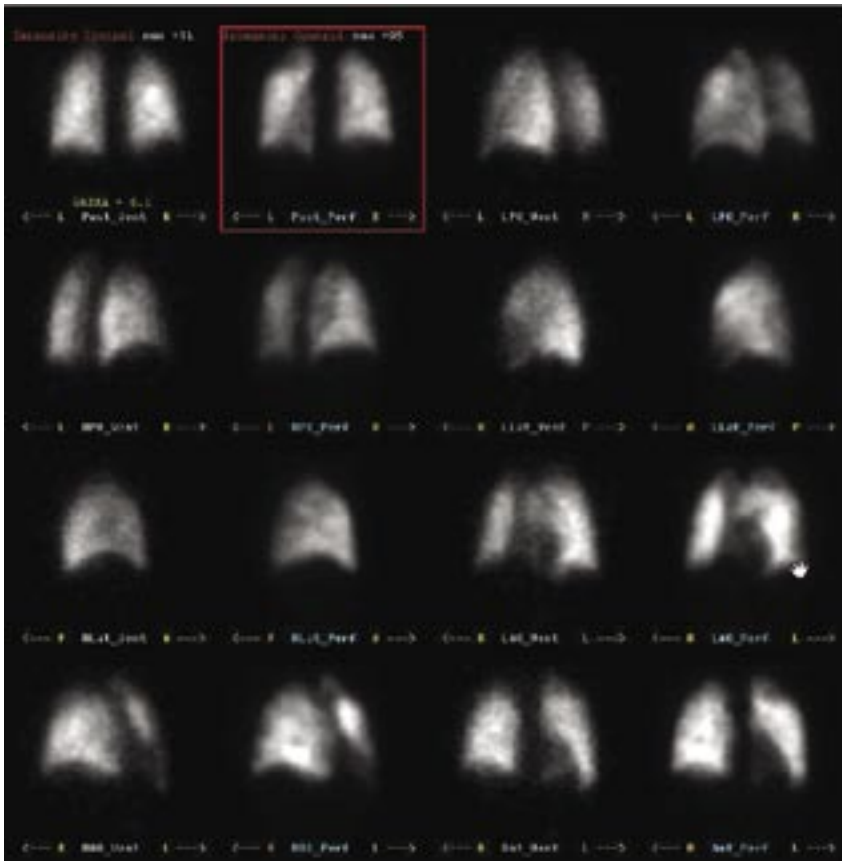
Michel Leblanc MD; RCPSC; ABNM

Head of the Nuclear Medicine Department,  
Centre Hospitalier Régional de Trois-Rivières,  
Clinical Professor, Centre Hospitalier Universitaire de Sherbrooke, Canada.  
email: michel.leblanc@dr.cgocable.ca



Prostate cancer.  
Finished treatment recently.  
Smoker. Angina.  
Presents sudden dyspnea and poorly defined chest pains.

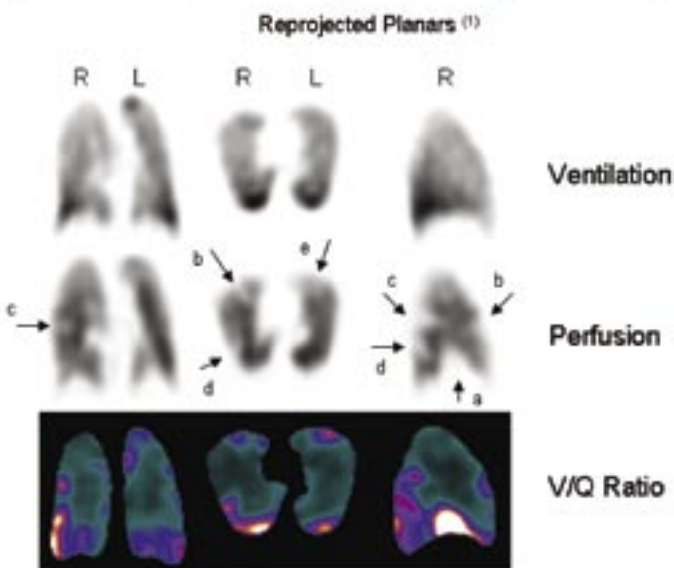
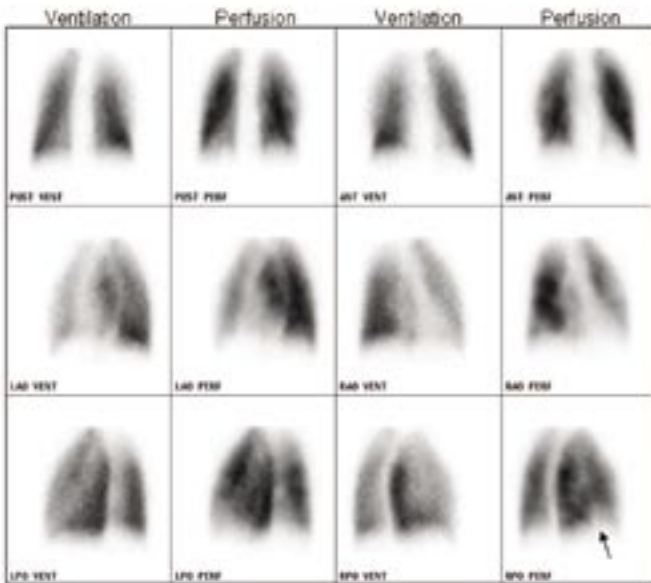
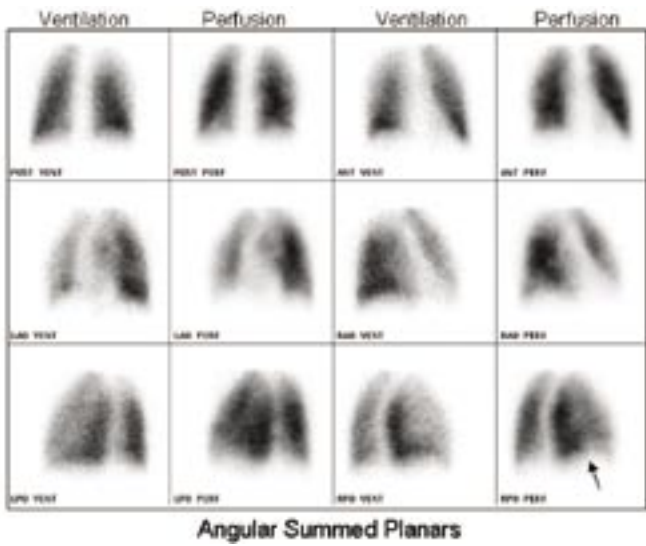
Planars show irregularities and at least one definite mismatch at the left apex.  
However, SPECT shows multiple well ventilated perfusion defects, allowing easy diagnosis.



## Case 2

**Nuclear Medicine Team**

Department of Nuclear Medicine  
 Royal North Shore Hospital, Sydney, Australia  
 Further details contact - Professor Paul Roach  
 email: proach@nscsahs.health.nsw.gov.au



**Presenting Symptoms**

- 59yo female
- Left soleal sinus DVT
- Retrosternal chest pain lasting 2hrs
- Described as ache
- Nil SOB, haemoptysis, or tachycardia
- PMHx:
  - hypertension
  - asthma since age 18, with 2 hospitalisations
  - nil diabetes or previous DVT
  - non-smoker
  - left ankle injury strapped
- V/Q Scan requested ?PE

**Interpretation**

- Normal ventilation
- SPECT confirms the perfusion defect in the (a) anterobasal segment of the right lower lobe identified on planar imaging
- However, SPECT also showed bilateral sub-segmental perfusion defects in (b) right middle lobe, (c) the apical segment and (d) basal segment of right lower lobe and in lingula
- Result is indicative of multiple PE

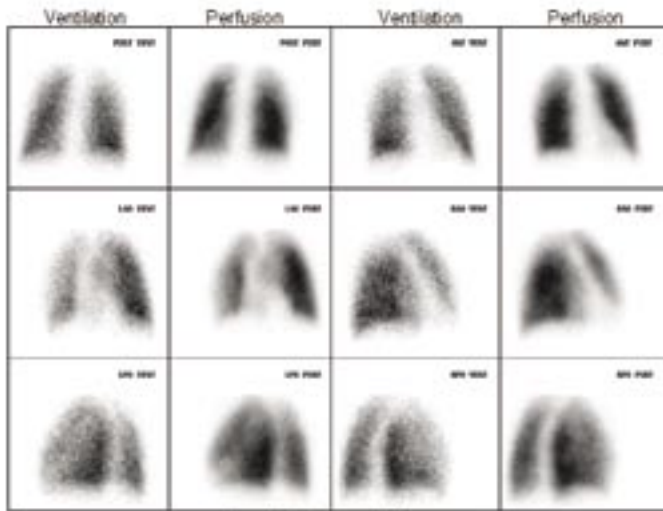
**Treatment**

- Patient treated with warfarin

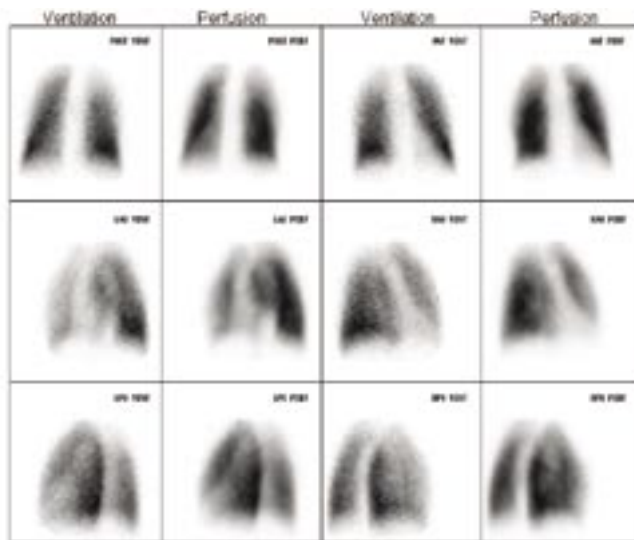
**Follow-up**

- Progress V/Q Scan 1 month later

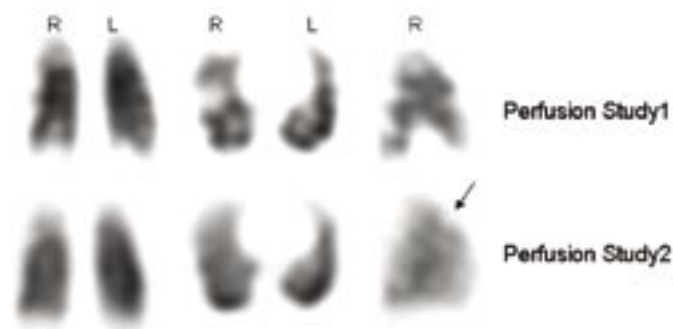
## Case 2



Angular Summed Planars



Reprojected Planars



### Interpretation

- Generalised improvement in perfusion to both lungs
- Now a small sub-segmental perfusion is seen in the anterior segment of the right upper lobe

### Comment

- Planar imaging demonstrates a possible single mismatch in the right base consistent with an intermediate probability for PE
- However, SPECT demonstrated multiple additional mismatched perfusion defects not identified on planar imaging and confirms a large mismatch in the right anterobasal segment
- The scan unequivocally demonstrates multiple PE

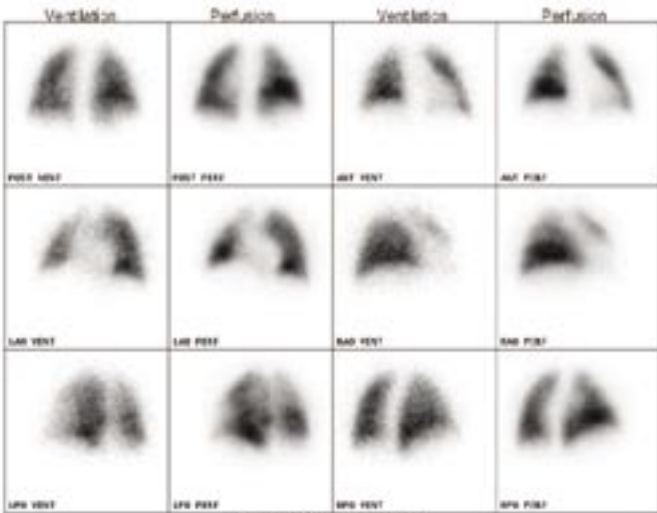
### Reference

1. Bailey DL, Schembri GP, Harris BE, Bailey EA, Cooper RA, Roach PJ. Generation of planar images from lung ventilation/perfusion SPECT. *Ann Nucl Med* 2008;22:437-45.

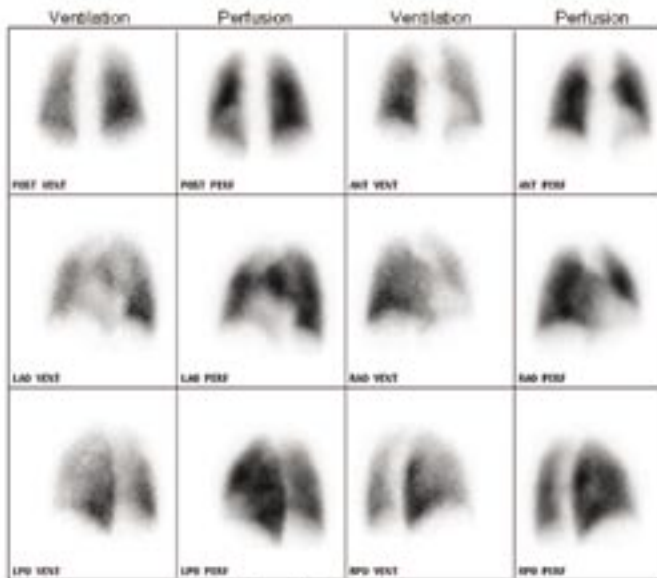
# Case 3

Nuclear Medicine Team

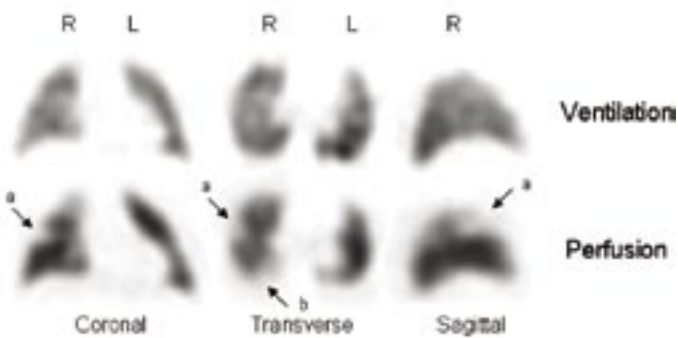
Department of Nuclear Medicine  
 Royal North Shore Hospital, Sydney, Australia  
 Further details contact - Professor Paul Roach  
 email: proach@nscchs.health.nsw.gov.au



Angular Summed Planars



Reprojected Planars



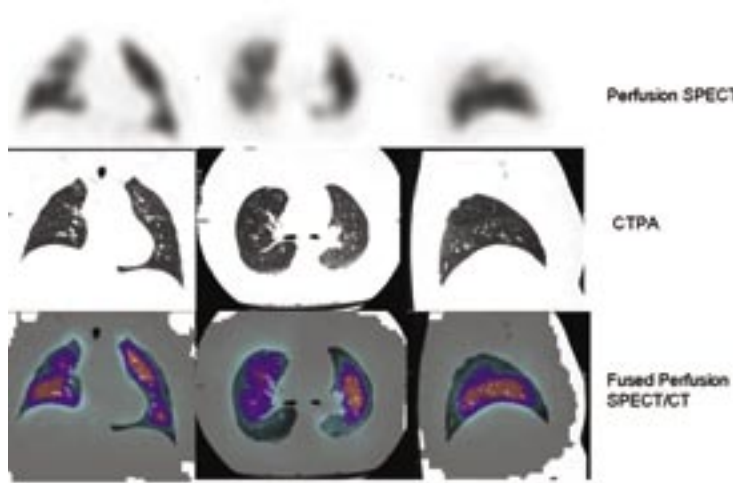
## Presenting Symptoms

- 40yo female
- Left-sided atypical chest pain
- D-dimer 0.67
- Nil SOB
- ↑BMI
- No calf swelling or tenderness
- PMHx: - cholecystectomy
  - never smoked
  - nil previous DVT or PE
- CXR:
  - mild pulmonary venous congestion but no alveolar oedema
  - no focal collapse or consolidation or pleural effusion

## Interpretation V/Q Scan

- Planar imaging identified no definite PE
- Normal Ventilation
- A large sub-segmental mismatch in the (a) anterior segment of right upper lobe and (b) posterobasal segment right lower lobe were seen
- Multiple PE

### Case 3



CTPA performed 24hrs after V/Q Scan

- No discrete filling defects to suggest thromboembolism in the pulmonary trunk, main pulmonary arteries or segmental pulmonary arteries
- No consolidation, pleural effusion or lymphadenopathy
- No PE identified

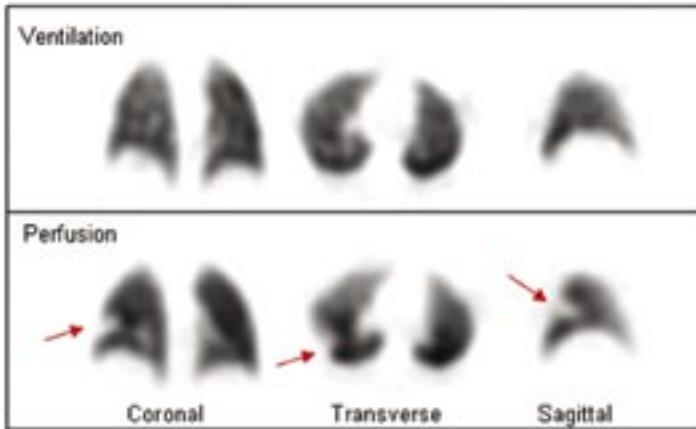
Comment:

- Multiple PE identified on V/Q SPECT scan with a negative result on CTPA

## Case 4

Nuclear Medicine Team

Department of Nuclear Medicine  
Royal North Shore Hospital, Sydney, Australia  
Further details contact - Professor Paul Roach  
email: proach@nscchs.health.nsw.gov.au



### Presenting Symptoms

- 48yo male
- Presented to ED with a single 20 second episode of left sided pleuritic chest pain
- Associated with SOB
- Slightly hypoxic on RA
- CXR/ECG/Troponin – NAD
- Slightly elevated d-dimer of 1.33
- PMHx: - asthma  
- heavy ex-smoker
- No risk factors for PE
- V/Q Scan requested ?PE

### Interpretation

- Normal ventilation
- Perfusion SPECT identified the presence of a large sub-segmental mismatched defect in the superior aspect of the lateral basal segment of the right lower lobe.
- Result probable PE

### Treatment

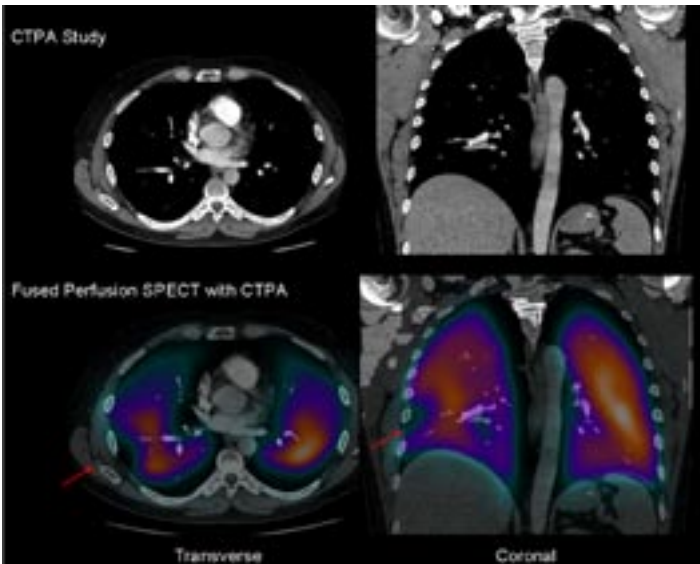
- Patient admitted and commenced on anticoagulant therapy
- Next morning CTPA study was performed

### CTPA Interpretation

- No PE identified
- Tiny area of atelectasis in the inferior lingula

### Treatment Following Review of CTPA

- Patient discharged with no anticoagulant therapy
- Next day, the SPECT study was fused with the CTPA and reviewed by both the NM Physician and the reporting radiologist
- On review, the consensus was that a filling defect was seen in a sub-segmental branch to the lateral basal segment of the right lower lobe, corresponding to the perfusion defect seen on V/Q scan, consistent with PE
- Patient was re-admitted and re-commenced on anti-coagulant therapy



### Comment

- V/Q SPECT identified a large single segmental perfusion mismatch which was not initially seen on CTPA
- Fusion of functional and anatomical imaging improved the confidence of the treating clinician and confirmed the presence PE
- The combination of both V/Q SPECT and CTPA unequivocally demonstrated PE



# Case 5

Dr Douglas Howarth FRACP

Consultant Physician in Nuclear Medicine  
Newcastle Nuclear Medicine, NSW Australia  
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Case. A 39 year old non-smoker male patient with claustrophobia presented for a V/Q lung scan following failed attempts to undergo multi-slice CT examination. The patient had an episode of acute dyspnoea and collapse without loss of consciousness. He had a history of previous deep vein thrombosis and was considered to be of moderate to high pre-test probability for pulmonary embolus. Arterial blood gases showed a mildly reduced pO<sub>2</sub> and pCO<sub>2</sub> without significant change in pH. The chest x-ray was normal. Electrocardiograph showed sinus rhythm at a resting rate of 88 beats per minute. No abnormality was found on physical examination. In particular, there was no evidence of peripheral deep vein thrombosis and no clinical evidence of right heart strain.

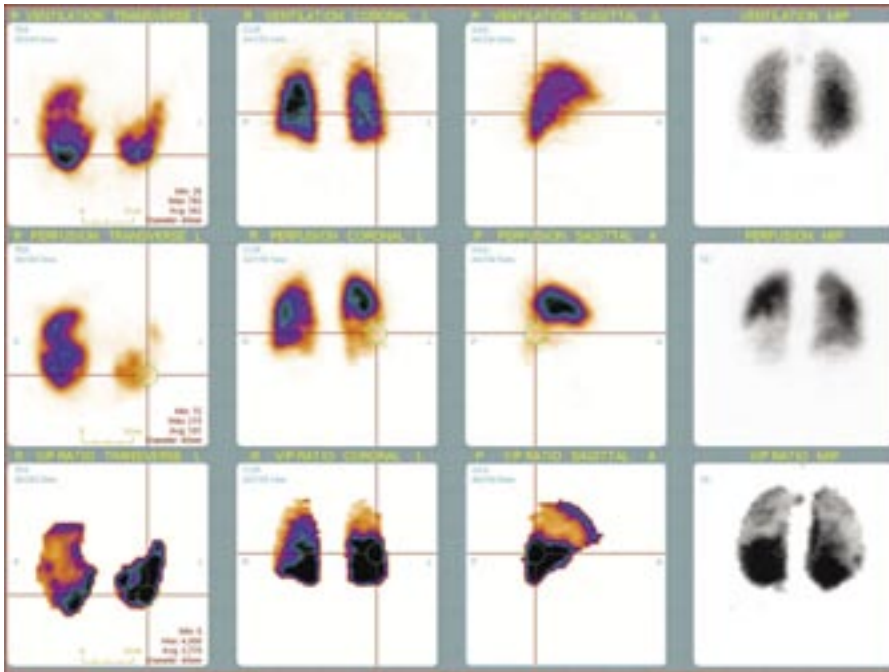
The V/Q scan (Above) showed relatively normal ventilation. Perfusion imaging showed loss of perfusion to multiple segments in the lower lobes bilaterally as well as the right middle lobe and lingula. The scan appearance was typical of recent extensive pulmonary emboli. The patient was commenced on intravenous heparin treatment and thereafter treated with warfarin over the next three months. At three months review it was noted that he was positive for the Factor V Leiden gene abnormality thus predisposing an increased risk of pulmonary-venous thrombosis. Consequently warfarin treatment was continued long-term.

Comment. Claustrophobia is relatively common amongst patients referred for CT or MRI examinations. This can be made more acute in patients who are unwell, particularly those with unexplained dyspnoea. V/Q lung scan is much better tolerated and it is exceedingly unusual for patients having V/Q scan to be unable to complete the scan. For this reason, V/Q scan should be regarded as the first line imaging investigation for suspected pulmonary-venous thrombosis. This case also demonstrates the need for V/Q scan to be performed at the time of the patient's presentation as this patient has a high likelihood of recurrent pulmonary emboli unless adequately anti-coagulated long-term. Despite the best intentions, anti-coagulation may be suboptimal from time to time, increasing the patient's risk. Factor V Leiden gene is present in approximately 10% (1-15% known measured range) of the Caucasian population. It is a mutated protein that reduces the action of activated protein C. Protein C is a plasma glycoprotein that has anticoagulant properties when activated by thrombin via inactivation of clotting factors Va and VIIIa. Factor V Leiden gene mutation confers a high risk of abnormal intravascular thrombosis and those with this gene may require management with long-term anti-coagulation therapy.

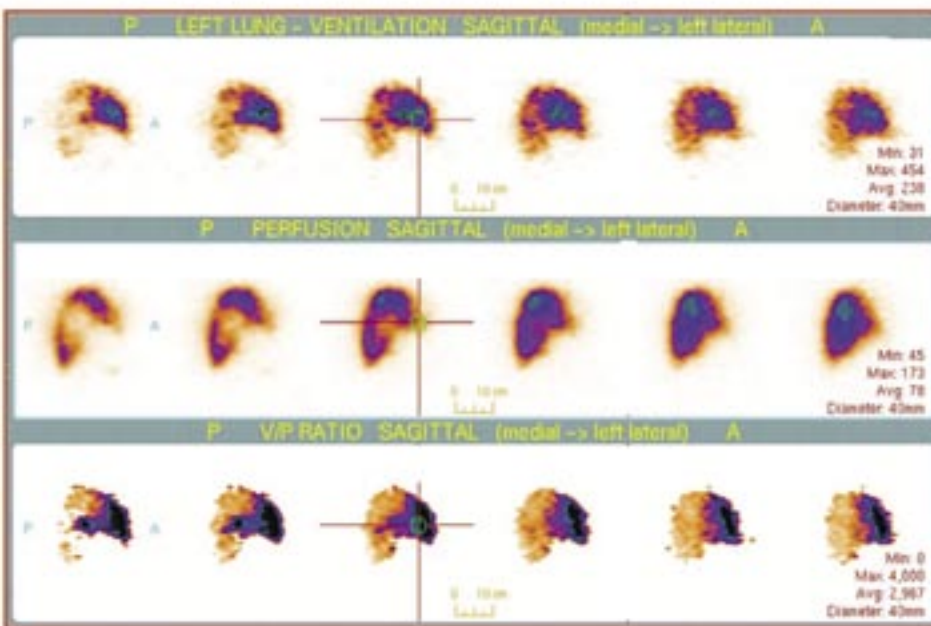
Case 6 & 7

Assoc. Professor Marika Bajc

University Hospital Lund, Sweden  
email: marika.bajc@med.lu.se



6.



7.

6. A man 42 years old (born 1967) with foot fracture immobilized in the middle of January. By end of January shortage of breath coming in the emergency. . Ultrasound legs and CT thorax normal. 2 weeks later chest pain, without breathlessness. Normal blood gas, D-dimer 1,6.  
V/P SPECT - PE, extension c:a 40% .

7. A women (born 1928) with chest pain, bad O<sub>2</sub> saturation (79%). Initially suspected for PE but CT was negative. Right bundle branch block on ECG. D-dim 0.4. chest x ray -pneumoni.  
V/P SPECT - PE extension 25% + pneumonia posterior in left lung. Total lost of function about 50-60%.



## Case 8

# V/Q SPECT-Imaging versus CTA for Pulmonary Thrombo-Embolism

Michael Lemb

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The pathophysiological process that lies behind pulmonary thrombo-embolism (PTE) is much more complicated than the simple blocking of a vessel by a clot might appear. The obstruction of a vessel by an embolus leads to the release of vasoactive substances like prostanooids and serotonin, which significantly contribute to the impairment of parenchymal perfusion. Hence, what we have to look for in PTE diagnosis are true positive parenchymal perfusion defects induced by arterial occlusion and not by bronchial obstruction. This is the classical task of V/Q-Imaging. It is very straightforward with the combination of ventilation/perfusion SPECT-studies using Technegas. The reason for using Technegas in this context is that true ventilation images can be acquired. By contrast with Krypton-studies (which are also much more expensive and not readily available), Technegas deposited in the lung generates a "frozen" image. Thus, SPECT acquisition is possible, followed by the classical MAA-image. These images can be clearly interpreted as Fig. A shows. No images with "intermediate probabilities" will be produced. The diagnosis of PTE in Fig. A is very clear.

Whilst many Radiologists will argue that CTA is now the method of choice, one should recognise that employing this diagnostic tool properly is not as easy as it might seem. The Radiologist has to search for defects within the flow of contrast medium. Many images need to be interpreted carefully and in context.

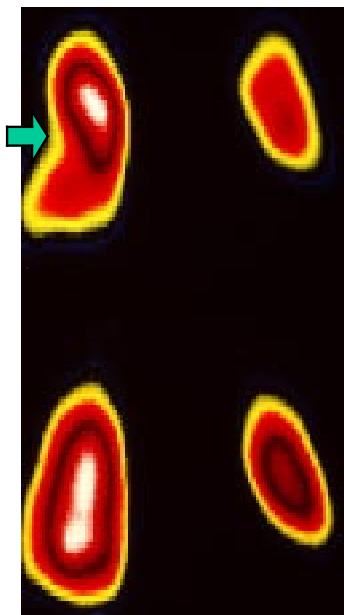
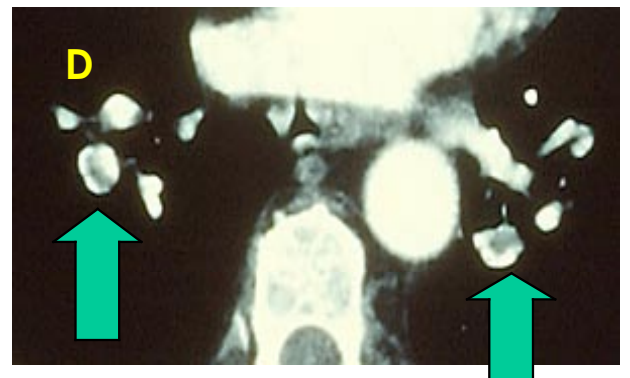
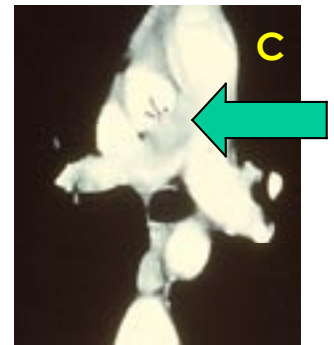
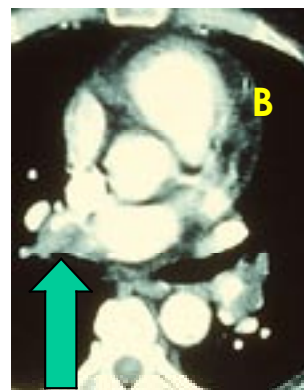


Fig. B shows a defect, induced by a benign tumour, fig. C shows perihilar lymphomas. In Fig. D however, thrombo-embolic clots can be detected.



Performing V/Q-SPECT-imaging using Technegas however, gives a clear insight into the basic pathophysiology of PTE. Even sub-segmental PTE will be detected clearly.

### Reference

M. Lemb, H. Pohlabein. Pulmonary thromboembolism: a retrospective study on the examination of 991 patients by ventilation/perfusion SPECT using Technegas. Nuklearmedizin 2001; 40: 179-86