

## Microscopic tumour emboli to the lungs: a hidden cause of dyspnoea and pulmonary hypertension

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Although the syndrome of "subacute cor pulmonale" caused by multiple tumour emboli to the pulmonary arteries has been well-described,<sup>1</sup> few reports have recorded detailed haemodynamic measurements from the pulmonary circulation in this setting. We describe a woman with known metastatic breast carcinoma who developed dyspnoea of hidden origin. Perfusion lung scanning and pulmonary angiography with haemodynamic recordings were performed, and the results demonstrate not only the development of remarkable pulmonary hypertension, but also the difficulty of antemortem diagnosis of the syndrome when emboli involve only the small arteries and arterioles.

### Case report

A 51-year-old woman underwent radical mastectomy for breast cancer in May 1977. All resected axillary lymph nodes contained tumour. She began adjuvant chemotherapy in June. Evidence of metastatic disease first appeared in October 1978, when a routine follow-up bone scan showed increased uptake of radionuclide in the right third rib anteriorly. It was not until two weeks later that she began to complain of discomfort in the right anterior chest. Shortly thereafter she developed rapidly progressive breathlessness and generalised weakness. After five days she presented for admission to the hospital, acutely ill and in marked respiratory distress. Her respiratory rate was 28/min at rest; she had tachycardia and was initially hypotensive. Chest examination revealed only a few fine crackles at the right base. There was a loud second heart sound. There was no peripheral oedema or calf tenderness.

Initial arterial blood gases on room air were:  $\text{PaO}_2$  43 mmHg (5.73 kPa)  $\text{Paco}_2$  23 mmHg (3.07 kPa) and pH 7.43. Her chest radiograph showed a minimal patchy infiltrate in the right middle lobe, a slightly enlarged cardiac silhouette, and the metastatic lesion in the third rib.

Perfusion lung scan with  $^{99\text{m}}$ technetium labelled macro-aggregated albumin demonstrated multiple subsegmental defects adjacent to the pleural surfaces involving all lobes of both lungs (fig 1).

On the day after admission a pulmonary angiogram was obtained. Haemodynamic studies at catheterisation

recorded a pulmonary artery pressure of 120/56 mm Hg with a mean pressure of 80 mm Hg. The mean right atrial pressure was 30 mm Hg, right ventricular pressure 120/30 mm Hg, and the pulmonary capillary wedge pressure approximately 20 mm Hg. The pulmonary vascular resistance was calculated to be 1714 dynes-s-cm<sup>-5</sup>. Selective angiography showed peripheral pruning of virtually all small arteries and only one small vessel cut-off in a segmental branch artery of the right lower lobe consistent with a single, haemodynamically insignificant pulmonary embolus.

The patient was treated with supplementary oxygen, anticoagulation, and digoxin. On the fourth hospital day she complained of the acute onset of chest pain with worsening dyspnoea. She became hypotensive and died that evening.

### Necropsy findings

There was evidence of metastatic carcinoma in the liver, vertebral bone marrow, and right rib. The lungs grossly appeared unremarkable except for their increased weight and a single small peripheral infarction in the left upper lobe. The heart showed mild right ventricular hypertrophy (wall thickness 0.4 cm) and dilatation with slight enlargement of the tricuspid ring (circumference 1.3 cm).

On microscopic examination, tumour emboli extensively filled the small pulmonary arteries, arterioles and capillaries throughout both lungs (fig 2). The embolic material showed various degrees of "maturity" in some vessels peripheral organisation of the tumour was already taking place.

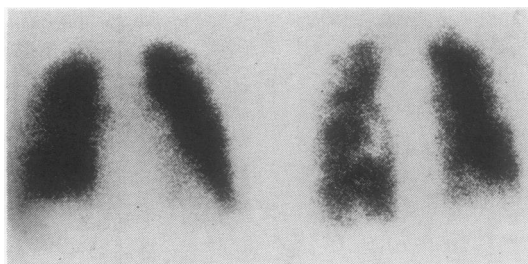


Fig 1 Perfusion lung scan with  $^{99\text{m}}$ technetium labelled macro-aggregated albumin. Anterior (on left) and posterior (on right) views demonstrate multiple subsegmental perfusion defects.

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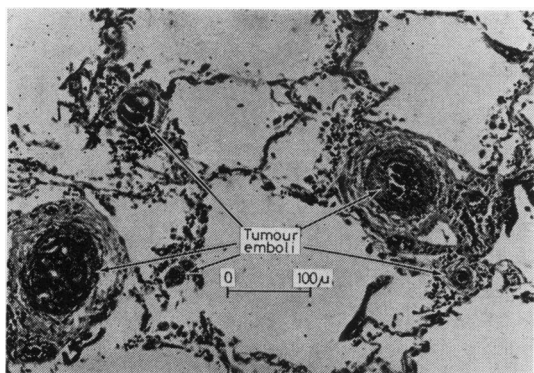


Fig 2 Representative section of left lung demonstrates small branch arterioles distended with embolic tumour cells. Diffuse involvement of the peripheral pulmonary circulation was characteristic of the histological findings throughout both lungs.

### Discussion

In most cases, clinically significant tumour emboli do not involve the major pulmonary arteries but are limited to the small peripheral pulmonary arteries and arterioles.<sup>1</sup> As was the case in our patient, and as has been well documented for multiple small pulmonary thromboemboli,<sup>2</sup> occlusion solely of the peripheral pulmonary vasculature (vessels less than 2 mm in diameter) can lead to severe dyspnoea, cor pulmonale with right heart failure, and cardiovascular collapse. As with multiple thromboemboli, this occurred in our patient with an essentially normal chest radiograph<sup>3</sup> and a non-diagnostic pulmonary angiogram.

The most instructive feature of this case was the extreme degree of pulmonary hypertension which this patient developed (pulmonary artery pressure 120/56 mm Hg, mean 80 mm Hg). This finding was un-

expected given the relatively brief duration of her dyspnoea (seven days), since with a previously normal right ventricle, acute massive pulmonary thromboembolism rarely causes mean pulmonary artery pressures of greater than 40 mm Hg without precipitating acute right heart failure and sudden death.<sup>4</sup> We conclude that the period of embolisation must have predated the development of symptoms by several days to weeks, a "subacute" duration necessary to account for the extensive embolic load and striking pulmonary hypertension, yet not of sufficient chronicity to cause more than mild right ventricular hypertrophy. The presence of organisation of some of the fibrin thrombi associated with tumour cells helps to date the embolic process to several weeks.

Although the outcome of multiple small tumour emboli to the lungs is generally fatal, survival of a patient in whom effective chemotherapeutic drugs for the primary tumour were available has been reported.<sup>5</sup> Correct premortem diagnosis of this not uncommon entity can be expected to become increasingly important as more effective chemotherapeutic regimens are discovered.

### References

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