$\dot{V}/\dot{Q}$ Mismatches Unassociated with Pulmonary Embolism: Case Report and Review of the Literature

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A case is reported in which an intrathoracic stomach produced a ventilation/perfusion ($\dot{V}/\dot{Q}$) mismatch on lung scan. Causes of $\dot{V}/\dot{Q}$ mismatch other than pulmonary embolism are reviewed.

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Perfusion lung scanning is a simple, safe screening procedure used in the diagnosis of pulmonary embolism. Although the lung scan provides a highly sensitive test, it lacks specificity. Combined ventilation/perfusion studies increase the specificity considerably, although not completely (*1,2*). An area of impaired perfusion that has normal ventilation may usually be ascribed to embolism. In this paper we report a case of a patient with an intrathoracic stomach producing a ventilation/perfusion ($\dot{V}/\dot{Q}$) mismatch and review other causes of $\dot{V}/\dot{Q}$ mismatch in patients suspected of pulmonary embolism.

CASE REPORT

A 78-year-old white woman was admitted with sudden onset of shortness of breath without chest pain. Her past medical history was negative for any cardiopulmonary disorder or thrombophlebitis. Physical examination revealed an irregular pulse rate of 110 and signs of mild congestive heart failure with bibasilar rales and peripheral edema. Calf tenderness was not present. EKG showed atrial fibrillation. An underpenetrated portable chest radiograph showed cardiomegaly (Fig. 1A).

The patient was digitalized and a lung scan performed a few hours later to rule out pulmonary embolism as the cause of atrial fibrillation. The Tc-99m macroaggregated albumin (MAA) perfusion scintigrams (Fig. 2) showed decreased perfusion to all of the basal segments of the left lower lobe. The xenon-133 ventilation study performed immediately after the perfusion study demonstrated a ventilation/perfusion mismatch (Fig. 3) with normal ventilation of the involved area on initial breath and no evidence of radionuclide retention during washout. The lung images were thus interpreted as being highly probable for pulmonary embolism. A repeat chest radiograph taken 24 hr later showed a large retrocardiac density (Fig. 1B). At that time pulmonary angiog-

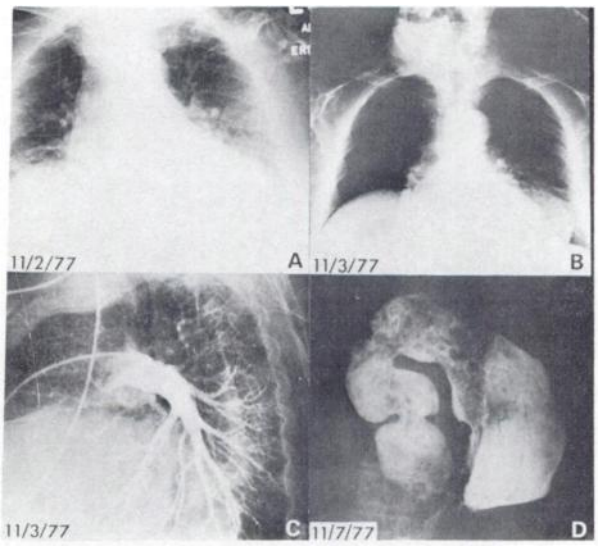

FIG. 1. Sequential radiographs. Initial underpenetrated portable chest radiograph (A) fails to demonstrate a retrocardiac mass that is obvious on better-penetrated posterior-anterior chest radiograph obtained next day (B). Selective pulmonary angiogram of left lower lobe is normal (C). A film from upper gastrointestinal examination shows retrocardiac mass to be an intrathoracic stomach that has undergone organoaxial rotation (D).

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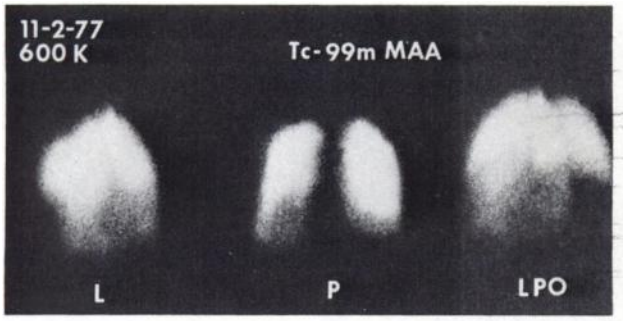

FIG. 2. Perfusion lung-scan results on admission. Left lateral, posterior and left posterior oblique views of perfusion study show decreased perfusion to basal segments of left lower lobe.

raphy, including selective left pulmonary artery injection, was normal (Fig. 1C). A subsequent upper gastrointestinal examination with barium showed the retrocardiac density to be an intrathoracic stomach that had undergone organoaxial rotation (Fig. 1D).

DISCUSSION

A perfusion scan accurately reflects the regional distribution of pulmonary blood flow. However, because almost any pulmonary disease, vascular or parenchymal, may alter regional pulmonary blood flow, perfusion abnormalities alone are not specific for pulmonary embolism. The addition of a ventilation study, however, increases the certainty with which pulmonary embolism can be diagnosed. Depending on the size of the perfusion defects, a ventilation/perfusion mismatch raises the probability of pulmonary embolism from 9% to 50% with multiple subsegmental defects; from 81% to 94% with multiple defects when the largest involves at least a lung or lobe; and from 50% to almost 100% with multiple defects when the largest defect involves at least a segment (*1*).

Ventilation/perfusion mismatches may be seen in clinical settings other than acute pulmonary embolism (Table 1). Of these, previous pulmonary embolism, pneumonia, bronchogenic carcinoma, and previous radiation therapy are the most frequently encountered. Fortunately the presence of many of these conditions can be appreciated clinically and from the chest radiographs. In most cases of emphysema and some cases of bronchogenic carcinoma, prolonged radionuclide retention during the washout phase of the ventilation study after a period of equilibration helps to differentiate it from pulmonary embolism by demonstrating the matching perfusion and ventilation abnormalities.

TABLE 1. DIFFERENTIAL DIAGNOSIS OF VENTILATION/PERFUSION MISMATCH

1. Acute pulmonary embolus
2. Previous pulmonary embolism (3)
3. Congenital pulmonary vascular abnormalities—e.g., pulmonary artery agenesis or stenosis (4)
4. Vasculitis—e.g., polyarteritis nodosa, tuberculosis (5,6)
5. Radiation therapy (7,8)
6. Intravenous drug abuse (9,10)
7. Bronchogenic carcinoma (11,12)
8. Pulmonary-artery sarcoma (13)
9. Lymphangitic carcinomatosis (14)
10. Pneumonia (1,15)
11. Fibrotic sarcoid (15)
12. Dog heartworm (*Dirofilaria immitis*) infestation (1)
13. Hemangioendotheliomatosis (16)
14. Pulmonary veno-occlusive disease (17)
15. Emphysema (18)

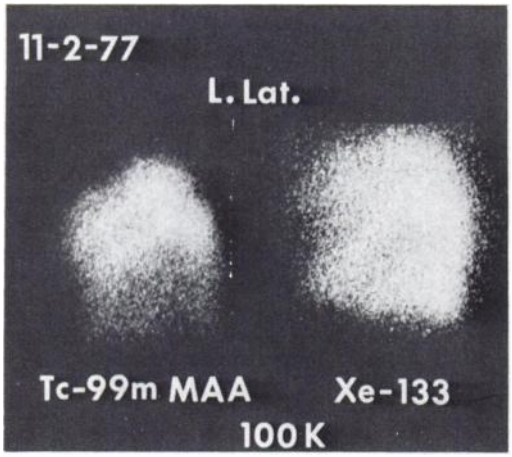

FIG. 3. Combined ventilation-perfusion scan results on admission. Left lateral view after initial single breath of xenon-133 (right) shows normal ventilation in region of perfusion abnormality in left lower lobe (left).

The reason for the ventilation/perfuison mismatch seen in this patient cannot be easily explained. Probably the best explanation is that at the time the mismatch was detected, the intrathoracic stomach produced greater compression on the pulmonary artery, a low-pressure vessel, than on the more rigid bronchus. This unequal compression resulted in decreased perfusion but normal ventilation. An analogous situation exists in some cases of bronchogenic carcinoma (*11,12*). For example, with a tumor close to the hilum there is some evidence that mechanical compression and distortion of hilar vessels adjacent to the tumor may occur without bronchial obstruction. The adjacent lung will therefore have reduced blood flow and perfectly patent bronchi, resulting in a ventilation/perfusion mismatch. The degree of distention of the stomach is probably also important. When the stomach is decompressed, the artery and bronchi are uncompromised. Perfusion and ventilation will then both be normal, as occurred in this case at the time of pulmonary angiography. With greater distention, the artery and bronchi may both be affected and abnormalities in the perfusion, as well as the ventilation study, are expected (*19*).

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Radionuclide Assessment of Gaucher's Disease

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Gaucher's disease involves multiple organs and may present with variable severity. The scintigraphic appearance of the reticuloendothelial system and bone are described in three patient's with Gaucher's disease. Scintigraphic abnormalities reflected the severity of organ involvement and correlated well with the patients' clinical status. Scintigraphy appears useful for the evaluation and followup of patients with Gaucher's disease.

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Gaucher's disease causes diffuse abnormalities of the reticuloendothelial system, affecting the spleen, liver, and bone marrow. Little attention has been paid to the scintigraphic appearance of this disease. Diffusely decreased uptake of Au-198 by the liver has been reported in one case (*1*). Gaucher's disease is also included in the differential diagnosis of splenomegaly (*2*). This paper describes the scintigraphic findings in three patients with varying severity of Gaucher's disease.

MATERIALS AND METHODS

Liver-spleen scintigraphy was performed 15 min after the i.v. administration of Tc-99m-labeled sulfur colloid. Microscopic analysis was performed routinely on each batch before injection. Seventy-five to 80% of the colloid particles were found to be between 0.25 and one micron in diameter. In normal patients, hepatic uptake was slightly greater than that in the spleen, and bone-marrow uptake was not visible on the images obtained with Polaroid Type 107 film.

Bone scintigraphy was performed with Tc-99m-labeled methylene diphosphonate. Scintigrams were performed approximately 3 hr after i.v. injection of 18–20 mCi of the tracer.

Patient 1 is a 42-year-old Jewish woman with Gaucher's disease initially diagnosed at age 21 during a hospitalization for acute appendicitis. Following an uncomplicated appendectomy, a bone-marrow biopsy was performed. Microscopic analysis revealed numerous Gaucher cells. The patient's twin sister was also affected with Gaucher's disease.

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