jnm/ CASE REPORT

RADIONUCLIDE DIAGNOSIS OF PULMONARY SEQUESTRATION

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Radionuclide studies demonstrated the lack of bronchial communication and the systemic arterial supply in a case of pulmonary sequestration. The examinations described are simple and innocuous. Such studies might serve for screening to determine vascular supply of pulmonary lesions as an aid in selection of a preferred route for angiography.

A posterior basilar lower lobe mass leads to the suspicion of pulmonary sequestration. Radionuclide studies can considerably increase the probability of the presence of pulmonary sequestration. With such information, one can proceed directly to the definitive diagnostic procedure—aortography with selective delineation of the blood supply to the lesion (*1,2*).

CASE HISTORY

An 18-year-old black man had a chest roentgenogram (Fig. 1) as part of an examination subsequent to an altercation and hand lacerations. A right lower lobe mass was identified leading to diagnostic examinations including radionuclide studies, tomograms, and thoracic aortography. Negative skin tests for tuberculosis, coccidioidomycosis, and histoplasmosis were obtained. The patient had a positive sputum and culture for acid-fast bacillus on one occasion, which could not be pursued because he left the hospital.

METHODS

Following intravenous administration of 20 mCi of ^{133}Xe dissolved in saline, an image was obtained during breathholding using the Anger camera. The patient was allowed to come to equilibrium for 2 min with an additional 20 mCi of ^{133}Xe gas in a spirometer and an image was obtained. An additional image was obtained after 3 min of washout with room air. Following the intravenous administration of 3 mCi of ^{99m}Tc-labeled iron hydroxide particles, the lungs were imaged from the anterior, posterior, and both lateral aspects.

Following intravenous administration of a bolus of 10 mCi of ^{113m}In-chloride, images were obtained over the mass during the pulmonary and systemic circulatory phases.

FINDINGS

The xenon study showed lack of activity in the medial basal portion of the right lower lung which did not fill during equilibration and showed no retained activity after washout (Fig. 2). The perfusion phase of the ^{133}Xe study and the particle perfusion study displayed a defect in the posterior medial basilar portion of the right lower lobe. The particle

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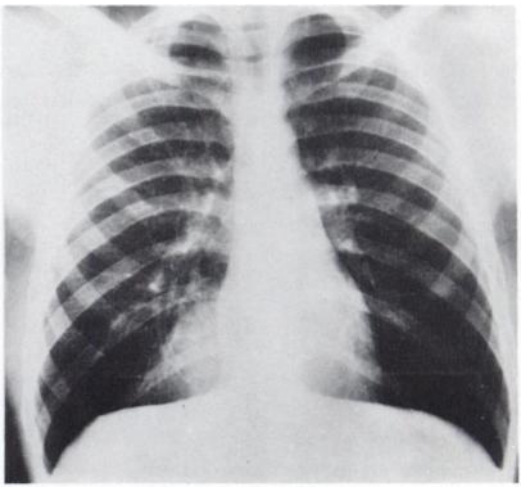

FIG. 1. Well-defined density can be seen in posterior basilar segment of right lower lobe.

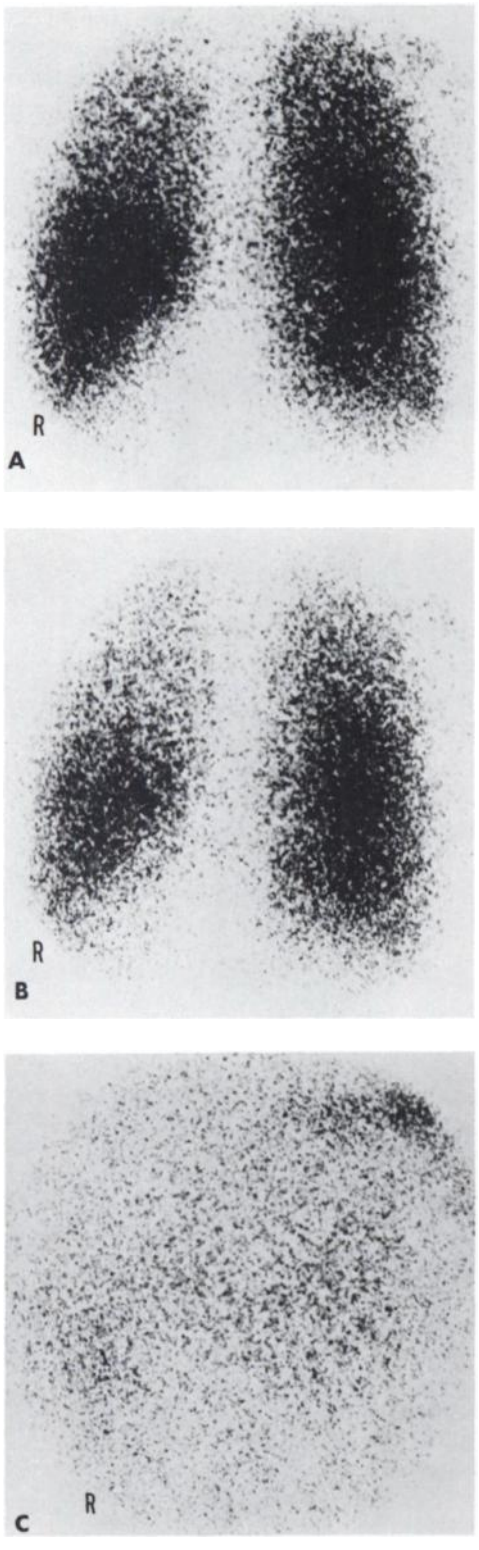

FIG. 2. Posterior view following intravenous injection of ^{133}Xe shows diminished perfusion to medial aspect of right lower lung field during breathholding, (A). Following closed system equilibration, (B), area still does not contain activity indicating lack of bronchial communication and collateral ventilation. Following 3 min of washout, (C), no retained activity can be seen in this area again confirming lack of aeration.

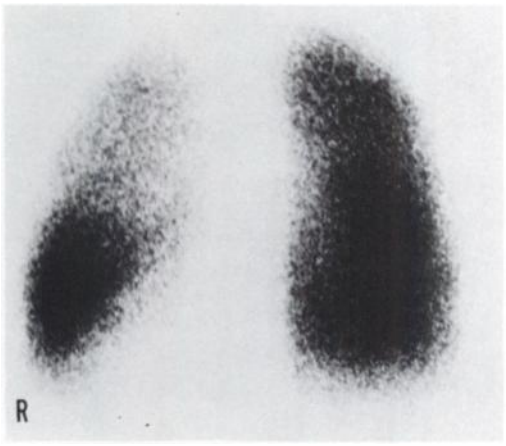

FIG. 3. Posterior view particle perfusion study confirms lack of perfusion to medial portion of right lower lobe and more clearly delineates upper lung field perfusion deficits, most pronounced on right.

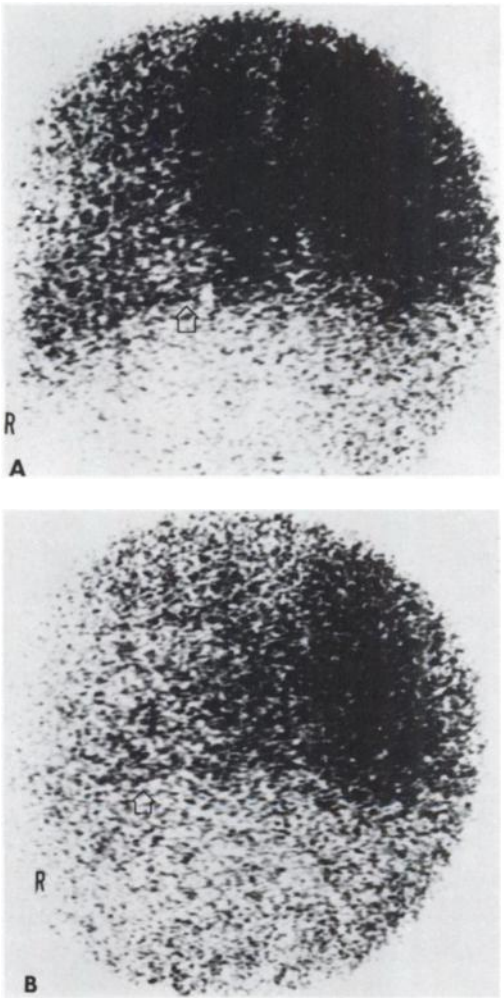

FIG. 4. Posterior perfusion study with ^{113m}In-chloride shows that medial area of right lower lung field has least activity during pulmonary phase, (A), before abdominal viscera contain activity. A few seconds later, when abdominal viscera contain activity, this same area contains more activity than any portion of right lung, (B).

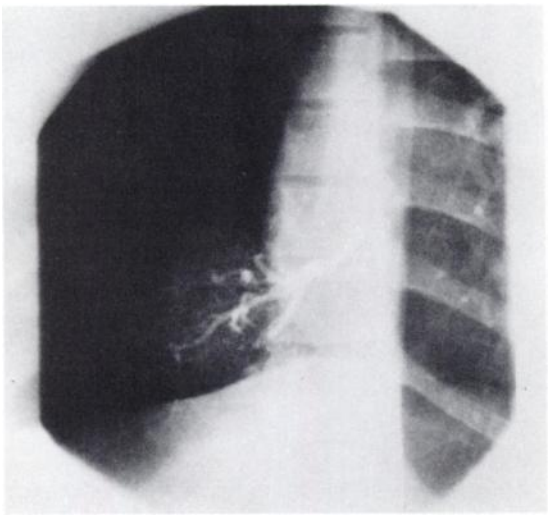

FIG. 5. Selective injection of vascular supply to mass from aortic catheter confirms diagnosis of sequestration. Venous return was not demonstrated.

study also showed diminished activity in the upper lung fields most marked on the right (Fig. 3). The radionuclide angiogram demonstrated no activity in the posterior medial basilar portion of the right lower lobe during the right heart phase with activity noted during the systemic phase (Fig. 4).

These findings suggested that the mass in the right lower lobe had no communication with the bronchial tree or alveoli and received its vascular supply from the aorta, thus supporting the diagnosis of sequestration. This diagnosis was confirmed by contrast angiography (Fig. 5).

DISCUSSION

Bronchopulmonary sequestration represents pulmonary tissue isolated from the normal bronchial tree with a systemic arterial vascular supply. Intralobar sequestration lies within the visceral pleura of a pulmonary lobe with venous drainage through the pulmonary venous system whereas extralobar sequestration is enclosed within its own visceral pleura with venous drainage through systemic (inferior vena cava, azygos, or hemiazygos) systems. Intralobar sequestration may develop communication with the normal bronchial tree as a result of infection. Extralobar types have less chance of being infected due to their pleural isolation.

The use of intravenously injected radioxenon proves helpful in establishing whether or not bronchial communication, interlobar, or intralobar collateral air drift exists. In most cases of bronchogenic carcinoma resulting in consolidative lung changes, although little activity enters the area during the perfusion phase, activity builds up in the poorly perfused region during equilibration and persists in this region during washout reflecting regional airway obstruction. Inflammatory bronchial disease such as bronchiectasis usually yields a similar appearance of poor perfusion combined with prolonged washout. On the other hand, alveolar pneumonia depicted as an ischemic area lacking activity during the perfusion phase shows entry of activity during equilibration but no visual evidence of delayed washout. Acute, complete lobar collapse can give the picture of a noncommunicating lesion since xenon activity may never enter the area during the equilibration phase and no washout data are obtained. There is relative increase in bronchial artery blood flow to parenchymal lung lesions such as bronchogenic carcinoma and bronchiectasis, but it is doubtful that these changes are of sufficient magnitude to be detected by the relatively gross imaging technique used in these studies.

The radionuclide image results reported are therefore not exclusively found in pulmonary sequestration and may in fact not be present when bronchial communication is present. However, they do give information concerning airway communication, airway obstruction, and vascular supply. The techniques require no preparation, carry no risk, have little discomfort for the patient, and may be accomplished during a single session. This type of screening procedure can furnish useful information concerning airway communication and the vascular supply of pulmonary lesions as this case demonstrates. Supply from the pulmonic or systemic system may be delineated and with the appropriate clinical findings expedite the choice of diagnostic procedures.

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