
Radionuclide Angiography in Pulmonary Sequestration

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We report a case diagnosed as pulmonary sequestration by radionuclide angiography prior to operation which showed anomalous arteries. Radionuclide angiography clearly revealed the condition of both the pulmonary artery and aorta, and is considered to be extremely useful in the diagnosis of pulmonary sequestration. It will probably be applied to more patients in the future.

J Nucl Med 26:1035-1038, 1985

Pulmonary sequestration is a condition involving abnormal intra or extralobar pulmonary tissue supplied by systemic circulation (i.e., a pulmonary malformation characterized by the presence of abnormal blood vessels). This disorder can be misdiagnosed as pulmonary cyst or tumor on the basis of various clinical observations, and, as a result, severe bleeding from an anomalous blood vessel during surgery has been reported (1). It is therefore important to examine the possibility of pulmonary sequestration by preoperative arteriography that can demonstrate the presence of an anomalous artery. Since this disorder is often found in pediatric cases, general anesthesia is frequently needed for angiography. On the other hand, radionuclide angiography is a convenient noninvasive method to examine vascular distribution in various disorders. We report a case in which radionuclide angiography imaging of an anomalous artery yielded a preoperative diagnosis of pulmonary sequestration.

CASE REPORT

A 7-yr-old male presented with fever and cough. Chest x-ray examination showed a uniform density shadow with a distinct border in the posteroinferior left lung region (S¹⁰) (Fig. 1). Computed tomography (CT) revealed a mass with a uniform density adjacent to the thoracic descending aorta in the posterior lower left lung (Fig. 2). From his history and laboratory test results, pulmonary sequestration was suspected, and radionuclide angiography of the cardiopulmonary

great arteries was performed. A bolus injection of 10 mCi Tc-99m pertechnetate was performed into the cubital vein. A 40° left anterior oblique image was performed with a gamma camera equipped with parallel-type multipurpose collimator* at a speed of 1 frame/sec. The pulmonary arterial phase showed a shadow defect in the posterior lower left lung, suggesting a mass not perfused by the pulmonary artery (Fig. 3 top). Furthermore, the aortic phase revealed abnormal blood vessels drawn towards the mass (Fig. 3 bottom). Consequently, the mass was concluded to be pulmonary sequestration supplied by the thoracic aorta. Operative findings concluded that the mass was easily separated from normal lung tissues. A total of three abnormal arteries (one 7 mm in diameter, and the others 3 mm each) from the thoracic aorta and a vein returning to the pulmonary vein were found. Resected specimen indicated that the pleura covering the mass was not connected with that covering the normal lung. Therefore, a diagnosis of extralobar pulmonary sequestration was made.

DISCUSSION

In 1777, Hüber reported abnormal lung tissue fed by an anomalous artery deriving from the aorta at autopsy. Thereafter, in 1946, Pryce named the disorder pulmonary sequestration (2-3). He also classified the sequestration into intralobar sequestration (ILS) and extralobar sequestration (ELS) depending on whether or not the abnormal lung tissue had pleura in common with normal lung tissue. Currently, various hypothesis have been presented for the mechanism of abnormal formation. Among those presented, Pryce's traction theory (2-3) is widely accepted. The theory contends that an anomalous artery enters the rudimentary lung, and sequestration results from separation of a tip of the

Received Jan. 17, 1985; revision accepted June 6, 1985.

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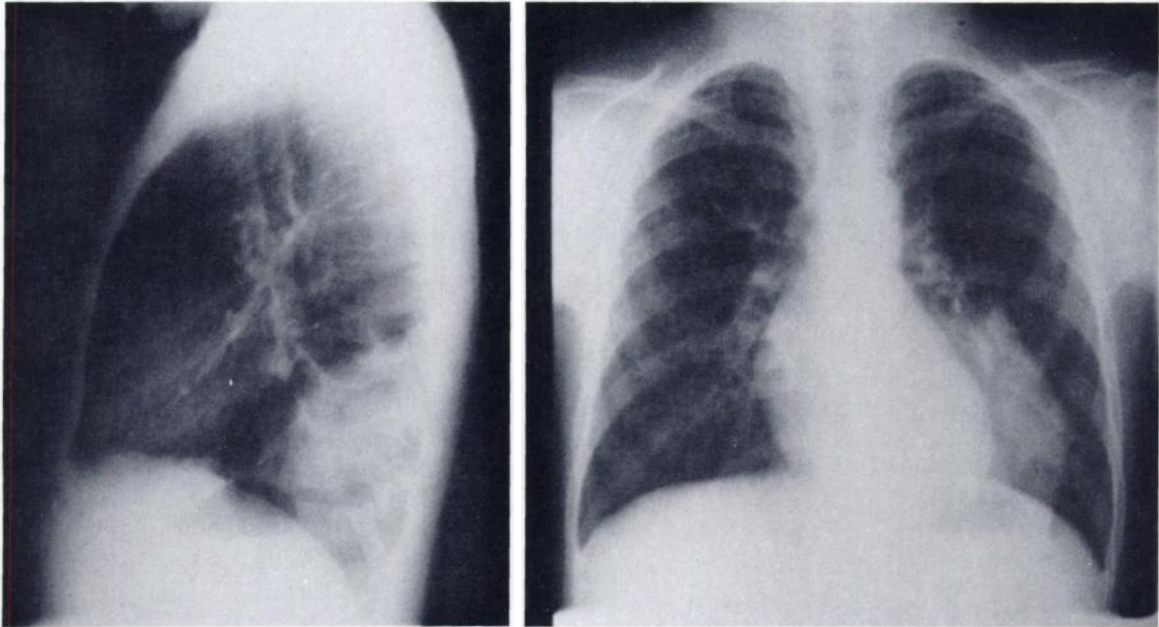


FIGURE 1
Chest x-ray shows uniform shadow with distinct boundary in posteroinferior left lung region (left: left lateral; right: anterior)

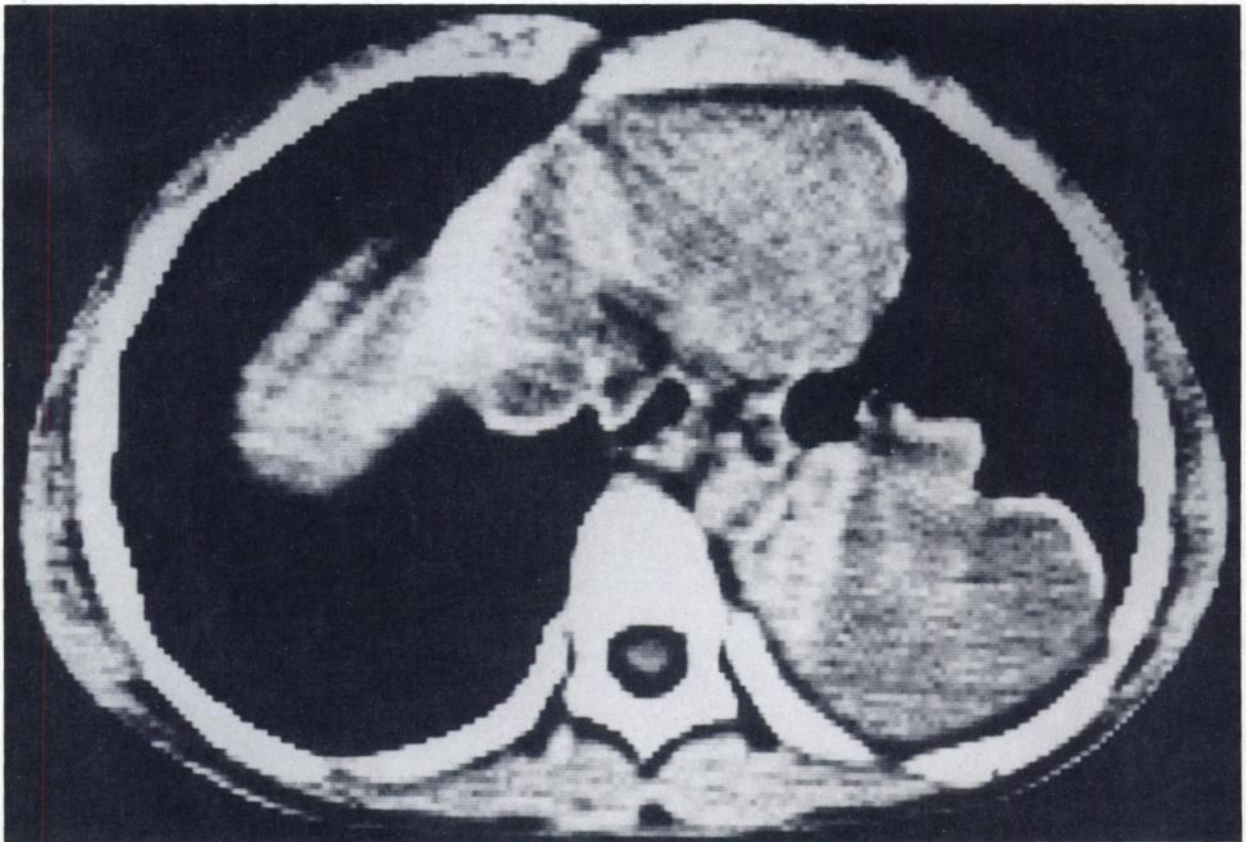
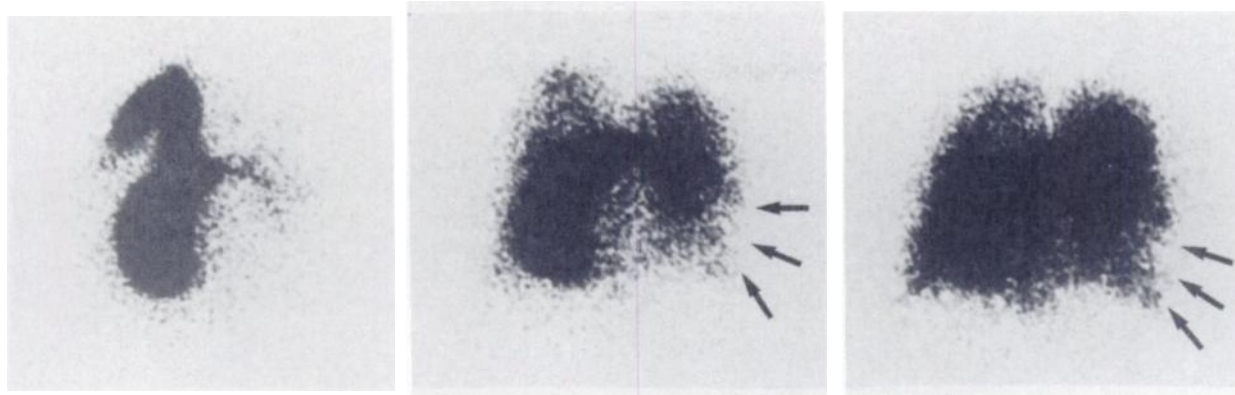


FIGURE 2
X-ray CT shows mass with uniform density adjacent to thoracic descending aorta in rear of lower left lung

PA phase



Ao phase

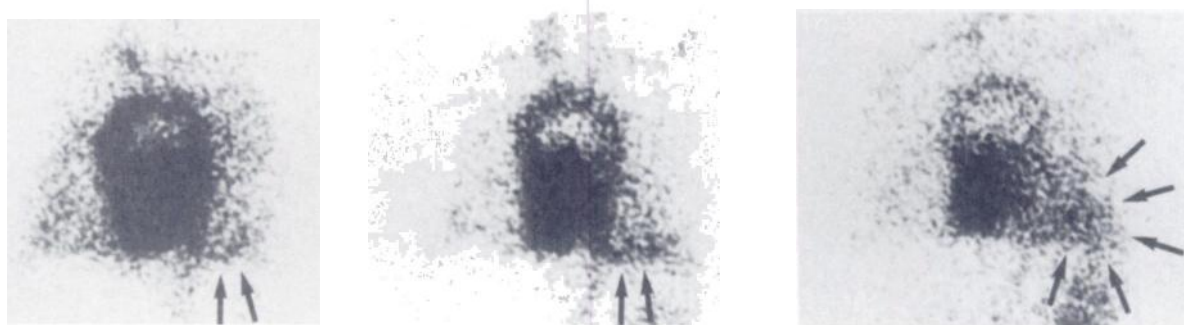


FIGURE 3

Radionuclide angiogram taken at speed of 1 frame/sec. Pulmonary arterial phase shows shadow defect (upper figure, indicated by arrows) in posterior lower left lung. Aortic phase shows anomalous artery and mass at same area

embryonic bronchial tree. This action is attributed to traction caused by the adventitious blood supply. The anomalous artery usually originates from the thoracic and abdominal aorta (4). The venous drainage is usually to the pulmonary vein in ILS, and in ELS to the azygos, hemiazygos, or portal vein (5).

For the diagnosis of this disorder, it is important to demonstrate an anomalous artery. Though this can be confirmed by arteriography using contrast medium, the procedure cannot be readily performed on children because it often requires general anesthesia. The recent development of noninvasive examination techniques makes it possible to show an anomalous artery by x-ray CT or ultrasound (6-8). The radionuclide venography devised by Rosenthal in 1966 (9) has been applied to examination of the vascular system. Because of its convenience, it is now widely used for the diagnosis of conditions affecting the cardio-pulmonary vasculature. Radionuclide angiography can provide images of both pulmonary arterial and aortic phases by a single injection into the cubital vein. Therefore, radionuclide angiography can be considered useful in the diagnosis of pulmonary sequestration supplied with blood by the

aorta, not by the pulmonary artery. There are, however, few reports on the subject (10-11).

In conclusion, the case reported here was first suspected to be a mediastinal tumor, but was finally diagnosed as pulmonary sequestration based on the observation of a defect lesion in the pulmonary arterial phase and abnormal artery and blood distribution to the lesion in the aortic phase. Although the effectiveness of radionuclide angiography as a diagnostic procedure may be affected by the characteristics of the sequestered lung or the diameter of the abnormal artery, it was concluded to have been useful and convenient for the diagnosis of pulmonary sequestration.

FOOTNOTE

* ZLC 3700, Siemens Medical Systems, Inc., Iselin, NJ

ACKNOWLEDGEMENT

The authors wish to thank Assoc. Prof. J. Patrick Barron, St. Marianna University School of Medicine, for revising the manuscript.

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