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Case report - Congenital

The role of contrast enhanced three-dimensional MR angiography in pulmonary sequestration

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Abstract

Pulmonary sequestration is a relatively rare but clinically significant form of congenital broncho-pulmonary foregut malformation. It is characterized by a segment of non-functioning lung parenchyma that receives its blood supply from anomalous systemic arteries. This report shows the role of contrast enhanced three-dimensional MR angiography, which demonstrated abnormal feeding artery to the sequestered from the thoracic aorta with draining pulmonary veins.
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Keywords: Pulmonary; Sequestration; MR angiography

1. Introduction

Pulmonary sequestration is a relatively rare but clinically significant form of congenital broncho-pulmonary foregut malformation. This disease is a spectrum of disorders involving the pulmonary airways, the arterial supply to the lungs, the lung parenchyma and its venous drainage. Depending on the morphologic subtype, venous drainage is achieved by either the pulmonary or systemic veins. A wide variety of imaging techniques have been used in the diagnosis of pulmonary sequestration, including routine chest radiography, tomography, radio nuclide scanning, bronchography, and, more recently sonography, computed tomography (CT), magnetic resonance imaging (MRI) [1]. Traditionally, the diagnosis of pulmonary sequestration has been made definitively with arterial angiography. This present report describes two cases, which were intralobar pulmonary sequestrations, in whom the definitive diagnosis was established with magnetic resonance angiography (MRA) and digital subtraction angiography (DSA).

2. Case reports

The first patient was a 15-year-old girl presented with the chief complaint of persistent productive cough of 3-month duration, following a respiratory tract infection. She reported several similar previous episodes of pneumonia. No pathologic sing was found on physical examination.

The second patient was a 39-year-old man who was referred to our department on suspicion of pulmonary sequestration. He had a complaint of persistent non-productive cough of 1-month duration, following a respiratory tract infection. He reported several similar previous episodes. Physical examination revealed a healthy-appearing man.

Routine laboratory studies and biochemical tests were normal. Both the patients had similar radiological findings. Plain films of the chest demonstrated ill-defined lobular cystic opacities in the posterior basal segment of the left lower lobe. CT scan with intravenous contrast medium demonstrated lobular cystic cavities in the left lower lobe.

MR angiographic examination was performed on a Signa 1.5 T super-conducting system (General Electric Medical System, Milwaukee, USA). Preliminary T1 and T2 weighted axial images were obtained to localize the lesions. This was followed by contrast enhanced MRA

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obtained with three-dimensional (3D) spoiled gradient echo sequence using the shortest possible repetition time and echo time (TR/TE = 5.2/1.5 ms). Thirty millilitres of gadopentetate dimeglumine (Magnevist, Shering AG, Germany) were injected intravenously by hand injection as a bolus. Data acquisition was started without time delay. Three-millimetres thick coronal images were obtained. The patients were instructed to hold their breath in full expiration during data acquisition. The dataset was processed on an independent workstation (Advantage Windows, General Electric Medical System). MRA was displayed on the maximum intensity projection (MIP). The MIP view of the MRA clearly demonstrated anomalous artery arising from the thoracic aorta, which were supplying the sequestrations in the left lower lobe localization. Venous drainage into the inferior pulmonary vein was also demonstrated in the first case (Figs. 1a and 2a).

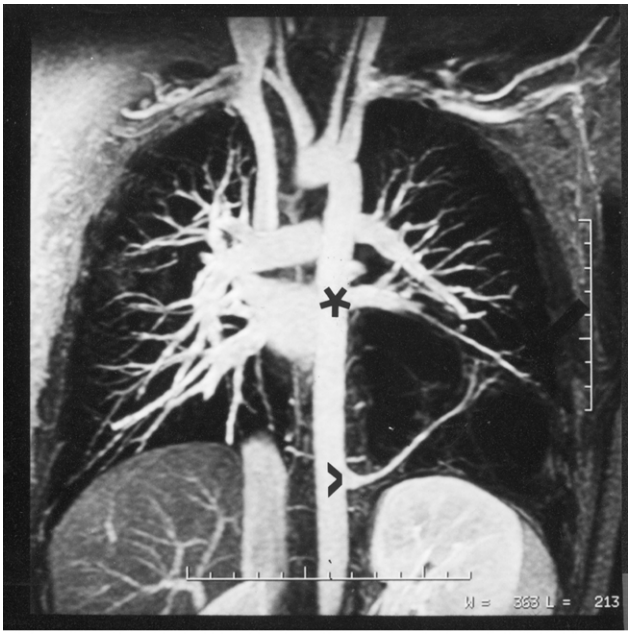
Thoracic aortography was performed for preoperative planning in both cases. The MRA findings were confirmed and well correlated with conventional angiography, which demonstrated a large aberrant artery, measuring 1 cm diameter at its origin in the first case and 2 cm in the second case, arising from the distal thoracic aorta (Figs. 1b and 2b). Venous drainage was into the inferior pulmonary veins.

3. Discussion

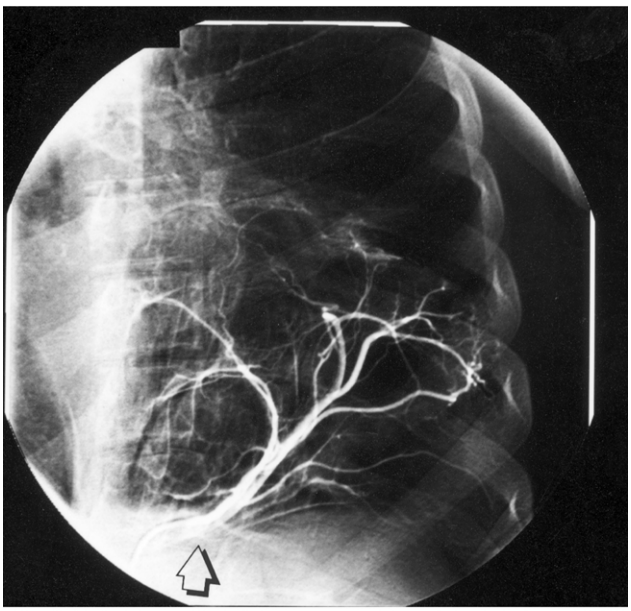
Pulmonary sequestration is an uncommon congenital malformation characterized by the presence of non-functioning, displastic, frequently cystic pulmonary tissue that usually has no communication with the normal bronchial tree and which receives its blood supply from an anomalous systemic artery [1]. It is an uncommon congenital anomaly that belongs to the spectrum of broncho-pulmonary foregut malformations. This artery usually arises from descending thoracic aorta or one of its branches [2,3]. Depending on the morphologic subtype, venous drainage is achieved by either the pulmonary or systemic veins [2]. Typically, the sequestered segment does not communicate with the normal bronchial tree. Bronchial communication can, however, occur as a sequel of infection in the sequestered lung [2]. Rarely, a fistulous communication between the sequestration and the oesophagus results from developmental arrest at a very early stage [4].

Treatment of symptomatic pulmonary sequestration is surgical intervention. Massive intraoperative haemorrhage is the most important problem. Because of this, demonstration of the vessels is of major importance to prevent massive intraoperative haemorrhage due to transection.

The determination of aberrant arterial supply and anomalous venous drainage is necessary in preoperative



(a)



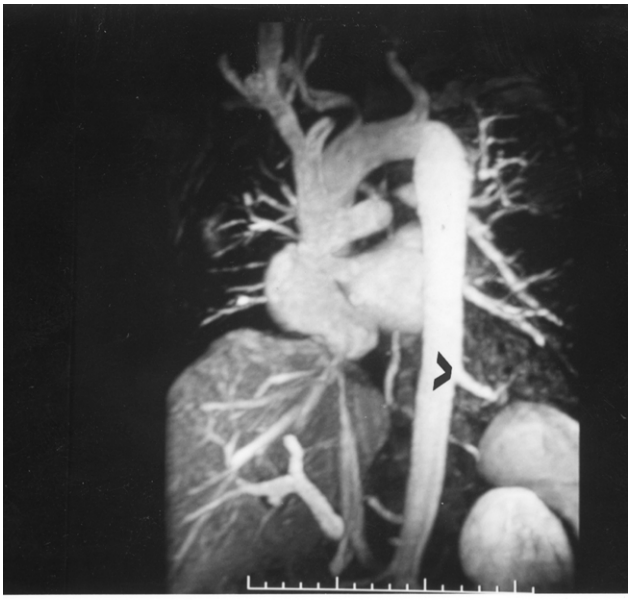
(b)

Fig. 1. (a) The MIP view of the 3D contrast enhanced MRA; anomalous artery arising from the thoracic aorta (arrow head), which was supplying the sequestrations and venous drainage into the inferior pulmonary vein (star). (b) DSA demonstrated a large aberrant artery arising from the distal thoracic aorta (arrow head).

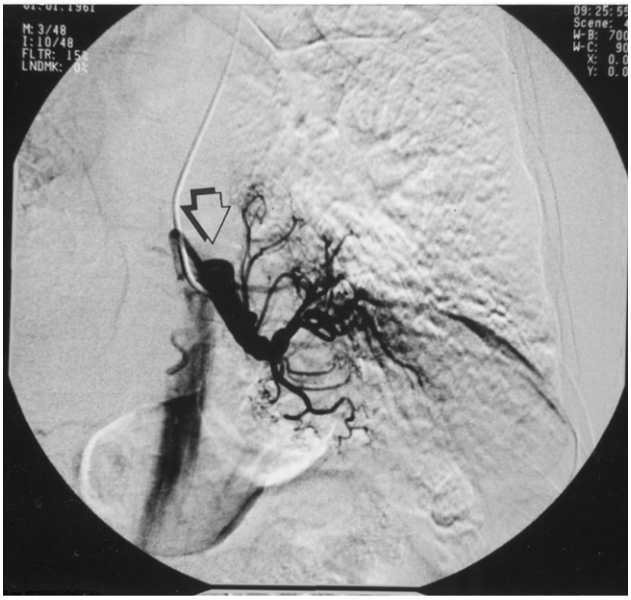
radiologic examination with DSA. However, this radiologic evaluation is sufficient. For a successful surgical treatment, abnormalities like communication with the bronchus or gastrointestinal tract, gross lung anomalous, defect of the diaphragm should be demonstrated.

A number of different imaging modalities have been used to demonstrate pulmonary sequestration. A CT of

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(a)



(b)

Fig. 2. (a) The MIP view of the 3D contrast enhanced MRA clearly demonstrated anomalous artery arising from the thoracic aorta (arrow head). (b) DSA revealed the sequestered arterial supply (arrow head).

the thorax can be performed to show abnormal vessels, pleural thickening or lung anomalies. Conventional angiography is the gold standard for demonstrating arterial supply and venous drainage and traditionally the diagnosis of pulmonary sequestration has been made definitively with arterial angiography. MRI and MRA showed its diagnostic potential to demonstrate vessels and to detect underlying parenchymal changes [5]. Tracheobronchial lesions like tracheoesophageal fistulas can be successfully shown by MRA.

After the introduction of MRI and MRA, an increasing number of patients with pulmonary sequestrations can be diagnosed in a non-invasive method [1,2,6,7]. Previous reports described the successful use of time-of-flight (TOF) MRA to display the blood supply in pulmonary sequestration [6]. Contrast enhanced MRA has been shown to be useful in evaluating the thoracic aorta and pulmonary vasculature [8]. Gadolinium shortens the T1 of blood, which enhances the contrast between vessels and surrounding structure. It is not dependent on inflow effects and is sensitive to flow artefacts. The ability to acquire images in a single breath-hold reduces the respiratory artefacts.

Contrast enhanced 3D MRA is a safe, efficient, and non-invasive imaging modality that can successfully demonstrate arterial and venous drainage of the sequestrations.

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