Abnormalities of the Pulmonary Artery Resembling Intrathoracic Neoplasms*

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The roentgen-ray finding of a mass in the chest presents a perplexing diagnostic problem. When this shadow has a smooth outer border and blends with the mediastinal structures, the differential diagnosis should include abnormality of the pulmonary artery. Angiocardiography is the quickest and the most accurate method of establishing or eliminating vascular abnormalities as the cause of such a shadow. Symptoms and physical signs may be absent or confusing. Fluoroscopy, laminography, bronchography, and bronchoscopy may fail to differentiate the vascular lesions. Under these circumstances, suspicion of the existence of a vascular lesion and the performance of angiocardiography can make an exploratory thoracotomy unnecessary.

Angiocardiography has been used to differentiate between aortic aneurysms, pulmonary artery enlargements, and malignant intrathoracic structures. The increasing use of chest x-ray film survey programs and the ready availability of thoracotomy have increased the importance of accurate diagnosis. Angiocardiography is a procedure available to physicians and surgeons dealing with chest diseases. This paper presents a brief summary of our experiences in differentiations between intrathoracic neoplasms and abnormalities of the pulmonary artery. Routine x-ray films, angiocardiograms, and clinical histories illustrate the salient features.

Material and Methods

The angiocardiograms were performed using a serial film changer. The contrast medium (usually warm diatrizoate sodium [90 per cent Hypaque]) was injected either through a Robb-Steinberg cannula into an antecubital vein, or through a Lehman catheter inserted into the right heart. All of the patients presented radiologic findings of a hilar mass with or without signs, symptoms, fluoroscopic, and bronchoscopic findings which led initially to a primary diagnosis of intrathoracic neoplasms. (Table 1).

Results and Discussions

Angiocardiography played a vital role in the differential diagnosis of abnormal shadows in the lung. Robb and Steinberg in their early communications on angiocardiography described the uses of this procedure in chest diseases. They presented one case of distorted pulmonary artery due to tuberculosis in the left upper lobe which resembles our fifth case. Since that time, angiocardiography has become more widely used in the diagnosis of cardiac disease, particularly congenital cardiac disease. The pulmonary disease applications of angiocardiography have not been

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FIGURE 1: The mass in the left hilar region was interpreted as a bronchogenic carcinoma with secondary atelectasis in the left mid-lung field. Injection of diatrizoate sodium (Hypaque) through a catheter revealed the mass to be pulmonary artery associated with fibrosis and bronchiectasis in adjacent lung.

widely appreciated. Angiocardiography has been used to predict the operability of neoplastic lesions, and was found to be of some value in the differential diagnosis of pulmonary neoplasms. Pulmonary angiocardiography and simultaneous bronchography has been used to recognize preoperatively areas of absent lung function.

In our material, abnormalities of the pulmonary artery that can be confused with intrathoracic neoplasm have been of two types. In the first type, there is a mediastinal mass with normal lung fields (cases 7 to 11), and in the second type the mass is associated with abnormal peripheral lung fields. The latter has been more common, (cases 1 to 6), and the associated lung pathology appears to contribute significantly to the production of an abnormal pulmonary artery. Congestive heart failure was present in four of these cases and further dilatation of the pulmonary arteries secondary to the failure may have contributed to the production of the abnormal x-ray shadow. It was necessary to make multiple diagnoses in these cases, such as bronchiectasis, associated

FIGURE 2: This 83 year-old man was thought to have bronchogenic carcinoma in the right upper lobe with distal atelectasis until angiocardiography revealed the mass to be an elevated pulmonary artery due to upper lobe fibrosis.
FIGURE 3: This 52 year-old woman was thought to have mediastinal neoplasm with pleural metastasis. The angiocardiogram proved the mediastinal masses to be pulmonary arteries and catheterization data established constrictive pericarditis as the cause of the pleural effusions.

dilatation of the pulmonary artery, and congestive heart failure. Of the remaining cases that were not in congestive heart failure at the time of the examination (cases 7 to 11), two had congenital intracardiac shunting, (cases 6 and 10), two idiopathic dilatation of the pulmonary artery, and one poststenotic pulmonic dilatation. In this second group, the abnormality was confined to the pulmonary artery and the lung fields were normal.

Greenberg' has defined idiopathic dilatation of the pulmonary artery as a simple dilatation of the pulmonary artery with the absence of shunting, no evidence of cardiac or pulmonary disease, and no intrinsic disease of the pulmonary artery. The recognition of this entity is usually not difficult and two of our cases actually were idiopathic dilatation of the pulmonary artery. We have encountered this entity on other occasions, but these cases were the only ones which were actually thought to have a neoplasm. Pulmonary artery aneurysm has been defined by Deterling' as the finding at necropsy of "a permanent more or less circumscribed dilatation of the pulmonary artery with some degeneration

FIGURE 4: This 36 year-old woman with a large left hilar mass was thought to have a lymphoma, but angiocardiography and catheterization data established a diagnosis of pulmonary infundibular stenosis and post-stenotic dilatation of the left pulmonary artery.
<table>
<thead>
<tr>
<th>Blood Pressure</th>
<th>Respiratory Rate</th>
<th>Heart Rate</th>
<th>Temperature</th>
<th>Abbreviations</th>
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</thead>
<tbody>
<tr>
<td>120/80 mmHg</td>
<td>12 breaths/min</td>
<td>90-110 bpm</td>
<td>37°C</td>
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**Diagnosis:** Pulmonary Hypertension

**Notes:**
- Hypoxemia
- Right heart failure
- Pulmonary edema

**Management:**
- Oxygen therapy
- Diuretics
- Vasodilators

**Follow-up:**
- Re-evaluation in 1 week
- Repeat echocardiogram

**References:**
- American College of Chest Physicians
- European Respiratory Society
- American Thoracic Society

**Keywords:** Pulmonary hypertension, right heart failure, hypoxemia, oxygen therapy, diuretics, vasodilators.
of the wall." Two of our cases (2 and 8 fit this diagnosis, but are still alive). The necropsy cases (1 and 6) are definitely not pulmonary artery aneurysms.

The widespread use of survey x-ray films as a method of early detection of intrathoracic pathology carries with it the obligation to separate significant disease which is neoplastic in origin and requires surgery from vascular shadows which are best left unmolested. If the possibility of dilated pulmonary artery is kept in mind, mistakes in this differentiation will be minimized. When there is serious doubt about the nature of the mediastinal hilar mass, angiocardioigraphy should be done. No chest diagnostic service is complete without angiocardiographic facilities.

Case 1: This 73 year-old white man gave a three month history of cough and hemoptysis. An x-ray film by his private physician resulted in a diagnosis of bronchogenic carcinoma. The electrocardiogram showed a right ventricular hypertrophy pattern. X-ray films of the chest revealed a mass in the left hilar area. Venous angiocardiography revealed a dilated left pulmonary artery as the cause of the mass. A postmortem examination one year after angiocardiography revealed a normal appearing pulmonary artery, evidence of arteriosclerotic heart disease, and chronic bronchiectasis in the apex of the lower lobe of the left lung.

Case 2: This 65 year-old Negro presented with a one year history of cough and hemoptysis. Physical examination revealed a diastolic shock over the left pericardium and a sharply accentuated second pulmonic tone. The electrocardiogram showed a left ventricular strain pattern. The x-ray film of the chest showed a large mediastinal mass with an infiltration extending into the left lung. The venous angiocardiography revealed a large dilatation of the pulmonary artery, which was thought to be an aneurysm.

Case 3: This 64 year-old white man sustained a fracture of the right hip and was admitted in congestive heart failure. Two years earlier, he underwent a resection of the left upper lobe for a lung abscess. Physical examination revealed a left posterior thoracotomy scar, rales in the right base, and signs of congestive heart failure. The electrocardiogram showed a right ventricular hypertrophy pattern. The bronchoscopy was negative. The chest x-ray film revealed a well-defined mass in the left hilar region. Venous angiocardiography revealed an elevated, twisted, left upper lobe artery.

Case 4: This 74 year-old man had rheumatic fever in childhood and was admitted in congestive heart failure. Cardiac examination revealed cardiomegaly with a grade IV systolic apical murmur, a grade II early diastolic murmur at the aortic area, and signs of congestive failure. The electrocardiogram revealed a right bundle branch block. The chest x-ray film revealed cardiomegaly and a mass in the right lower mediastinal region which was thought to be carcinoma. Bronchoscopy revealed an extrinsic mass causing narrowing of the right main bronchus from the anterior

FIGURE 5: This 18 year-old man was found to have a mass in the right lower hilar area on a school survey film. He underwent thoracotomy with a preoperative diagnosis of pulmonary neoplasm and was found to have a vascular lesion. After surgery, catheterization and angiocardiography revealed aneurysm of the right pulmonary artery that was filled with clot. He also had an Eisenmenger's complex with extreme pulmonary hypertension.
medial aspect. Several areas of epithelium were biopsied and were histologically normal. The venous angiocardiography revealed that the mass in the right lower lung field was pulmonary artery.

Case 5: This 83 year-old man gave a brief history of shortness of breath, cough and expectoration. Physical examination revealed that the trachea was deviated to the right and expiratory rhonchi were heard over both lung bases. The chest x-ray film showed an atelectasis of the right upper lobe and a mass in the right hilar region. Bronchoscopy revealed an extrinsic obstruction to the right upper lobe bronchus with partial obstruction of the right main bronchus. A biopsy from the area of obstruction revealed mild chronic bronchitis. Venous angiocardiography revealed that the mass was an elevated right pulmonary artery.

Case 6: This 52 year-old housewife experienced rheumatic fever in childhood. Nine months prior to examination she began to experience severe chest pain radiation down the left shoulder and into the back. The patient developed bilateral effusions and had repeated thoracenteses which revealed bloody fluid negative for neoplastic cells. The electrocardiogram showed auricular fibrillation with nonspecific T wave changes. The scalene lymph node biopsy and lupus erythematous preparations were negative. Cardiac catheterization and angiocardiography revealed that she had constrictive pericarditis as the cause for the bilateral pleural effusions. However, she succumbed and a necropsy proved this diagnosis to be correct.

Case 7: This 36 year-old woman complained of cough productive of yellow bloody material for seven weeks. She had diminished breath sounds and rales over the left lower lung field. A soft systolic murmur was heard at the cardiac apex. The chest x-ray film revealed a large left hilar mass with narrowing of the left main stem bronchus. The electrocardiogram showed right ventricular hypertrophy. She was thought to have a lymphoma with compression of the left main bronchus. The angiocardiography revealed a pulmonary infundibular stenosis with post-stenotic dilatation of the left pulmonary artery.

Case 8: A 19 year-old man was known to have congenital heart disease since early childhood. A routine school x-ray film survey revealed a shadow protruding from the right hilar region. Bronchoscopy was reported as negative. He underwent exploratory thoracotomy and the mass was found to be vascular in nature. After two unsuccessful attempts at cardiac catheterization, successful passage of the catheter to the pulmonary artery was obtained and selective angiocardiography revealed that the mass was a pulmonary artery aneurysm. The analysis of the catheterization findings resulted in a diagnosis of Eisenmenger's complex with a severe degree of pulmonary hypertension.

Case 9: A 34 year-old Negress with a lifelong history of asthma was found to have an abnormal cardiac silhouette on an x-ray film survey. The film showed an enlargement in the left hilar region and a diagnosis of lymphoma was made. She was given x-ray treatment over the left hilar region. There was no change in the size of the lesion after x-ray therapy, so she was referred for right heart catheterization and angiocardiography, which revealed the mass to be a dilated pulmonary artery (idiopathic).

Case 10: This 22 year-old white laborer complained of mild dyspnea on severe exertion for several years. Just prior to examination, he experienced severe melena.

FIGURE 6: This 34 year-old woman was given radiation treatment to the left hilar area for what was thought to be a lymphoma. There was no response to radiation. The angiocardiogram demonstrated a dilated left pulmonary artery (idiopathic).
On examination, he was found to have pulmonary edema of moderate degree and frank melena. Cardiomegaly was present; a soft apical systolic murmur and accentuated pulmonary second sound were heard. Polycythemia and an abnormal electrocardiogram were noted. The chest x-ray film showed right and left hilar enlargement and a pleural effusion. Biopsy of lymph nodes revealed lymphoma. The angiocardiogram revealed an overriding aorta with large dilated pulmonary arteries.

**Case 11:** This 54 year-old laborer complained of dyspnea, cough, and left chest pain for one year. Physical examination revealed subcrepitant rales in the right posterior thorax. Chest x-ray film revealed a left hilar mass. The angiocardiogram showed the left hilar mass to be a dilated pulmonary artery.

**SUMMARY**

1. Eleven cases of abnormalities of the pulmonary artery are reported.
2. All 11 were mistakenly diagnosed as intrathoracic neoplasm.
3. One case was subjected to thoracotomy and one was given therapeutic radiation because of incorrect diagnosis.
4. Significant associated diseases contributing to pulmonary artery dilatation were reported in cases 1 through 6.
5. In cases 7 through 11, the abnormality was confined to the pulmonary artery and the lung fields were normal.
6. The role of angiocardiography in the diagnosis of abnormal hilar shadows is emphasized.

**RESUMEN**

1. Se relatan once casos de anomalidades de la arteria pulmonar.
2. Todos los 11 casos se tomaron erróneamente como neoplasias de torax.
3. Un caso sufrió toracotomía y en uno se dió terapia de radiación con motivo del diagnóstico equivocado.
4. Se referen las enfermedades asociadas que contribuyeron a la dilatación de la arteria pulmonar en los casos del 1 al 6.
5. En los casos del 7 al 11 la anormalidad se limitó a la arteria pulmonar y los campos pulmonares eran normales.
6. El papel de la angiocardiografía de las sombras anormales del hilio se recalca.

**ZUSAMMENFASSUNG**

1. Es wird über 11 Fälle von Anomallen der arteria pulm. berichtet.
2. Alle 11 Fälle waren irrtümlicherweise als intrathorakale Neoplasmen diagnostiziert worden.
3. Ein Fall wurde einer Thorakotomie unterzogen, und ein Fall erhielt eine therapeutische Bestrahlung infolge unrichtiger Diagnose.
4. Wesentliche und zur Erweiterung der Pulmonalarterien beitragende Begleiterkrankungen wurden für die Fälle 1 bis einschließlich 6 mitgeteilt.
5. Bei den Fällen 7 bis einschließlich 11 war die Anomalie auf die Lungenarterien beschränkt und die Lungenfelder normal.
6. Die Rolle der Angiocardiografie für die Diagnose abnormer Hilusshatten wird hervorgehoben.

**REFERENCES**