Pericardial Pseudotumor*
Echocardiographic Observation of Juxtacardiac Pulmonary Collapse

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Despite its value in the diagnosis of pericardial disease, two-dimensional echocardiography also is known to produce confounding results. Ten patients had juxtacardiac masses simulating pericardial tumor implants on echocardiographic examination ("pericardial pseudotumor") caused by juxtacardiac pulmonary atelectasis or lobar collapse. The atelectatic nature of these masses was based on echocardiographic delineation of pericardial and pleural anatomy, combined with ancillary radiographic and CT studies. Drainage of pleural fluid also led to disappearance of the masses on echocardiographic examination, suggesting that the masses were an ultrasonic manifestation of pulmonary atelectasis resulting from surrounding compressive effusive fluid. Finally, clinical follow-up failed to show development of malignant disease in any patient. The possibility of pericardial pseudotumor should be considered when ultrasound studies show juxtacardiac masses within large collections of pleural fluid, especially in the clinical absence of malignant disease. (Chest 1988; 94:837-41)

The diagnosis of pericardial tumor involvement offers a grim prognosis and should be made with great care. Both M-mode and two-dimensional echocardiography have proved to be sensitive detectors of pericardial fluid resulting from primary or metastatic malignant disease.1-8 In addition, recent reports have documented the utility of echocardiography in the visualization of pericardial tumor implants.9,10 Unfortunately, nonneoplastic or extracardiac imitators of pericardial disease have also been described, and the ability of echocardiography to distinguish these masqueraders from actual pericardial pathology is sometimes problematic.11-20

We describe a new echocardiographic simulator of pericardial malignancy ("pericardial pseudotumor") caused by juxtacardiac pulmonary atelectasis located within large collections of pleural fluid.

Material and Methods

Patients

Between July 1983 and December 1986 we identified 12 patients presenting to the Boston City Hospital Noninvasive Cardiology Laboratory with echocardiographically documented juxtacardiac masses associated with known large pleural effusions. Of the 12 patients with this finding, two had documented malignant disease (colonic adenocarcinoma and large cell lung carcinoma) and were excluded from the study. The remaining ten patients had nonmalignant conditions known to be associated with the development of pleural effusions (Table 1).

Patient histories, clinical investigations at the time of the echocardiographic finding, and results of subsequent follow-up examinations were analyzed and, where available, independently read chest films, CT scans, and thoracocentesis results were obtained.

Echocardiographic Technique

All studies were performed with standard mechanical or phased-array cardiac sector scanners (Hewlett-Packard 77020A, Ires System 2-A, and Toshiba SSH-60A), with the patient placed in the left lateral decubitus position for parasternal views or in the supine position for subcostal imaging. In all cases, low-frequency (<3 mHz) ultrasonic transducers were used to optimize penetration and provide adequate resolution of deep-lying pleural and pericardial structures. Standard parasternal, apical, and subcostal echocardiographic views were obtained in all cases.

A pericardial pseudotumor was identified if the following criteria were met: (a) a mass was observed contiguous to and without separation from the pericardial border in at least one echocardiographic view, suggesting the appearance of epicardial tumor; and (b) maneuvering of the transducer in multiple views clearly defined the location of the mass as extrinsic to the pericardial border and situated within a collection of pleural fluid. A pleural effusion was

<table>
<thead>
<tr>
<th>Patient</th>
<th>Age</th>
<th>Underlying Disease</th>
<th>Heart Failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>57</td>
<td>Aortic aneurysm</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>repair</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>76</td>
<td>Cor pulmonale</td>
<td>Right-sided</td>
</tr>
<tr>
<td>3</td>
<td>28</td>
<td>Myocarditis</td>
<td>Bilateral</td>
</tr>
<tr>
<td>4</td>
<td>78</td>
<td>Dilated cardiomyopathy</td>
<td>Bilateral</td>
</tr>
<tr>
<td>5</td>
<td>51</td>
<td>Myocardial infarction</td>
<td>Bilateral</td>
</tr>
<tr>
<td>6</td>
<td>90</td>
<td>Ischemic cardiomyopathy, mitral regurgitation</td>
<td>Bilateral</td>
</tr>
<tr>
<td>7</td>
<td>38</td>
<td>Amyloid cardiomyopathy</td>
<td>Right-sided</td>
</tr>
<tr>
<td>8</td>
<td>31</td>
<td>Bacterial endocarditis, pneumonia</td>
<td>No</td>
</tr>
<tr>
<td>9</td>
<td>38</td>
<td>Mitral stenosis</td>
<td>Bilateral</td>
</tr>
<tr>
<td>10</td>
<td>34</td>
<td>Mitral stenosis, regurgitation</td>
<td>Right-sided</td>
</tr>
</tbody>
</table>

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diagnosed if an echo-free, juxtacardiac space was observed external to the pericardium. In all cases a pleural-pericardial interface was identified between small collections of pericardial fluid or subepicardial fat and pleural effusion. The observation of the masses within fluid clearly defined as external to this interface was strong evidence that the pseudotumors were actually located in the pleural space (Fig 1). In addition, left-sided pleural effusions were diagnosed only if they radiated posterior to the descending thoracic aorta. Thus, a pericardial pseudotumor was diagnosed when a mass initially appeared to be epicardial but, by identifying its relationship to the pericardial-pleural border, was eventually established as pleural in location.

RESULTS

Ten patients, aged 31 to 90 years, presenting with juxtacardiac masses and meeting the above diagnostic requirements were selected. Admission diagnoses are listed in Table 1. Five cases were associated with bilateral heart failure, and three had findings of isolated right heart failure. An infectious cause was found in one patient, and one pseudotumor occurred postthoracotomy without associated infection. No patient had evidence of malignant disease either on initial investigation or on subsequent clinical follow-up.

Echocardiography

In all patients large collections of pleural fluid surrounding the pseudotumors were clearly visualized echocardiographically. The masses were globular in seven cases and finger-like or wedge-shaped in three (Fig 1 to 4). While most pseudotumors were found in the left pleura, one mass was noted in the right pleura while imaging from the subcostal view (Fig 5). Pseudotumor could be found on at least one occasion in each of the standard echocardiographic windows (parasternal, apical, and subcostal), but was most frequently observed in the long-axis view taken from the left parasternal window. An associated pericardial effusion was found in only one case, but normal pericardial fluid limited to the atrioventricular groove could be visualized in all subjects, and it helped to define the mass as extrapericardial and intrapleural.

Follow-up echocardiographic studies were performed in seven patients, with resolution of the pleural effusions and masses observed in all of these cases (Fig 2). Two patients had persistent effusions with accom-
panying pseudotumors, but results of their thoracocenteses were negative for malignancy. Three patients either refused serial echocardiography or were lost to follow-up.

**Radiologic Findings**

Chest films were performed within one week of echocardiography and confirmed the echocardiographically documented pleural effusions in nine of ten patients. CT scan of the chest was done in two cases (Table 2). The single case without radiologic documentation had an asymptomatic right-sided effusion that was detectable with echocardiography.

In seven of the nine patients with radiologically documented pleural effusions, associated pulmonary atelectasis or lobar collapse was independently diag-
Table 2—Echocardiographic and Radiologic Features of Pericardial Pseudo-tumor

<table>
<thead>
<tr>
<th>Patient</th>
<th>Echocardiogram</th>
<th>Chest Film</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Finger-like, left-sided</td>
<td>Left pleural effusion, resolved</td>
<td>C-T +, Thor normal</td>
</tr>
<tr>
<td>2</td>
<td>Globular, left-sided</td>
<td>Left pleural effusion, atelectasis, resolved</td>
<td>C-T +, Thor normal</td>
</tr>
<tr>
<td>3</td>
<td>Globular, left-sided</td>
<td>Bilateral pleural effusions, left-sided atelectasis</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Globular, left-sided</td>
<td>Bilateral pleural effusions</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Globular, left-sided</td>
<td>Left pleural effusion, possible infiltrate</td>
<td>Thor normal</td>
</tr>
<tr>
<td>6</td>
<td>Globular, left-sided</td>
<td>Bilateral pleural effusions, left side atelectasis, resolved</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Globular, left-sided</td>
<td>Bilateral pleural effusions</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Globular, left-sided</td>
<td>Bilateral pleural effusions, left side atelectasis, resolved</td>
<td>25,000 WBC on thor, no malignancy</td>
</tr>
<tr>
<td>9</td>
<td>Globular, left-sided</td>
<td>Left-sided pleural effusion, atelectasis</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Wedge-shaped, right-sided</td>
<td>Not performed at time of echocardiogram</td>
<td></td>
</tr>
</tbody>
</table>

C-T = computerized tomography; Thor = thoracocentesis; + = atelectasis present.

nosed in the area of the pseudotumor either before or after thoracocentesis. Figure 3A, is a chest x-ray film of a patient with a large left pleural effusion which developed after thoracotomy. Left lower lobe collapse in the area of the left heart border became evident after pleural drainage with a chest tube (Fig 3B). An echocardiogram performed before pleural drainage demonstrated both the pleural effusion and a globular mass within the effusion, adjacent to the posterolateral left ventricular wall (Fig 3C). The finding of lobar collapse in the same area as pseudotumor provides strong evidence that such transient intrapleural masses are related to pulmonary compression in the presence of large pleural effusions. CT scan performed after pleural drainage provided additional confirmation of this collapsed lung segment (Fig 3D).

Further support for the atelectatic cause of pericardial pseudotumor was the echocardiographic resolution of the masses after pleural drainage and reexpansion of the lung in six of the cases (Fig 2). No significant improvement could be radiographically detected in three cases, and one case did not have echocardiographic follow-up. In the cases of unresolved pseudotumor there was also residual pleural effusion resulting from severe, therapeutically refractory right-sided congestive heart failure due to restrictive cardiomyopathy, cor pulmonale, or severe left-sided failure.

While malignant pericardial or pleural tumor was not excluded by autopsy or pleural biopsy in any case, thoracocentesis was performed on a total of four patients and was negative for malignant cells in all instances.

**DISCUSSION**

The advent of two-dimensional echocardiography has permitted *in vivo* documentation of malignant cardiac metastases. However, because nonmalignant conditions have been observed to simulate pericardial disease processes, echocardiographic confounders must be identified. In this report we describe an echocardiographic observation of a relatively benign process which has the potential for misdiagnosis as malignancy with the attendant dismal prognosis. Our series includes ten patients free of malignant disease on initial evaluation or on subsequent follow-up in whom routine echocardiography visualized masses adjacent to the pericardial border that were suggestive of pericardial tumor.

Our belief that the pericardial pseudotumors represent areas of pulmonary collapse is based on several lines of reasoning. First, the echocardiographic disappearance of the masses with resolution of the pleural fluid suggests a relationship between the two events. We postulate that the pseudotumors are areas of partial or total lobar collapse resulting from extrinsic compression by large, surrounding pleural effusions. Relief of this compression presumably leads to alveolar reexpansion and resolution of the pseudotumor as confirmed by ultrasonic and radiologic studies. Previous case reports of a similar phenomenon in pulmonary
sites distant from the mediastinum have been described in the radiology literature and support our contention. CT scanning has also documented this phenomenon. Paling and Griffin described how lower lobe collapse on either side can be caused by large pleural effusions. In 16 of their 40 reported cases, CT demonstrated juxtaposition of the ailerless pulmonary segment with the mediastinal border as in our two CT studies. Evidence supporting the nonmalignant nature of these masses derives from the absence of evidence of malignancy on subsequent clinical follow-up examination.

While we elected to exclude two patients with similar intrapleural masses from this report because they had malignant disease, their masses might also have represented benign pulmonary compression rather than metastatic spread. Our description of pseudotumor closely resembles that of Cohen and coworkers in patients said to have pericardial tumor involvement. Our nonmalignant cases are virtually indistinguishable from some examples published in that report. In fact, those investigators reported four cases of echocardiographically documented "nonneoplastic cardiac involvement by intrathoracic neoplasms", in patients with primary extracardiac malignancy. In only two cases was there histologic confirmation of direct, cardiac, or pleural tumor involvement. The other two cases may have been manifestations of pericardial pseudotumor, as we have described.

CONCLUSION

This report details the echocardiographic presentation of benign pericardial pseudotumor, which has previously been described in nonmediastinal locations with pulmonary ultrasonography and CT scan. While a juxtacardiac mass may represent metastatic tumor, a detailed echocardiographic investigation from multiple windows should attempt clearly to determine whether or not the mass is actually pleural by delineating its relationship to the pleural-pericardial interface. If the mass is located within pleural effusion, the diagnosis of tumor is in question, especially in the absence of additional evidence of malignant disease. Even in the case of a known extracardiac malignancy, such findings may represent pseudotumor within a nonmalignant pleural effusion. The prognostic implications may then be considerably different.

REFERENCES

25. Matalon TA, Neiman HL, Mintzer RA. Noncardiac chest sonography; the state of the art. Chest 1983; 83:675-78

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