A 74-Year-Old Man With an Incidental Right-Sided Pleural Effusion

A 74-year-old man was found to have an incidental right-sided pleural effusion during a renal ultrasound. Five months previous, he had an acute respiratory illness, including fever, chills, and cough productive of green sputum for several weeks. His cough resolved, but persistent dyspnea on exertion remained. A review of systems also revealed early satiety and vague abdominal pain. His medical history included urolithiasis and gastroesophageal reflux. Medications included esomeprazole, aspirin, zolpidem, and melatonin. He had a history of 30 pack-years of tobacco use.

Physical Examination

The patient appeared healthy, with normal vital signs and stable weight. Chest examination revealed decreased breath sounds and dullness to percussion at the right base. Cardiac examination showed a regular rate and rhythm. The patient’s abdomen was nontender without organomegaly, and his extremities showed no clubbing or edema.

Laboratory and Radiologic Findings

CBC count, electrolyte levels, and coagulation studies were normal. Liver function studies revealed the following values: bilirubin, 1.6 mg/dL; alkaline phosphatase, 119 IU/L (normal, 30-115 IU/L); and normal transaminases. Brain natriuretic peptide level was 133 pg/mL. Pleural fluid had a lactate dehydrogenase level of 50 IU/L (pleural fluid/serum ratio, 0.40); total protein level, 3.5 mg/dL (pleural fluid/serum ratio, 0.49); and glucose level, 112 mg/dL. Pleural fluid cytology was negative for malignancy.

Chest radiograph revealed a right-sided pleural effusion. A CT scan of the chest showed large right-sided simple pleural...
effusion, small pericardial effusion, minimal abdominal ascites, and reflux of contrast into the inferior vena cava and hepatic veins (Fig 1). A CT scan of the abdomen and pelvis revealed a small volume of ascites and multiple subcentimeter mesenteric lymph nodes. A CT scan angiogram was negative for pulmonary embolism. Echocardiogram revealed normal systolic function, dilation of the atria, and dilation of the inferior vena cava with < 50% respiratory variation.

Figure 1  Contrasted CT scan of the chest. Contrast dye is noted in the hepatic veins (arrowhead) and layering in the inferior vena cava (arrow).

What is the likely diagnosis? What study is indicated next?

Diagnosis: Constrictive pericarditis. Procedure to be performed is left-sided and right-sided cardiac catheterization

Left-sided and right-sided heart catheterization revealed equalization of diastolic pressures, a “square root” sign in the ventricular pressure waveform, and ventricular interdependence (Figs 2, 3). The patient was referred for pericardial stripping, which revealed constrictive pericarditis without pathologic evidence of an infectious or neoplastic process. His symptoms resolved promptly after surgery.
Figure 2  Simultaneous pressure tracings of the RV and LV. The RV diastolic pressure and LV diastolic pressure are equal and elevated and do not separate by > 5 mm Hg after a ventricular premature beat (arrow). Note the prominent square root sign (arrowhead). Ventricular systolic discordance is present. LV = left ventricle; RV = right ventricle.
Discussion

Diagnosing constrictive pericarditis often is a challenge that requires a high index of suspicion. A chest radiograph is negative for pericardial calcification in 50% of cases. Brain natriuretic peptide levels generally are only slightly elevated. The echocardiogram often shows nonspecific abnormalities, with a sensitivity of only 37% for pericardial thickening. Doppler echocardiogram can be helpful diagnostically. A CT scan is superior to echocardiogram for determining pericardial thickness; however, 20% of patients have normal pericardial thickness anatomically. Despite advances in cardiac MRI and CT imaging, catheterization remains the gold standard. The treatment—surgical stripping of the pericardium—is both curative and invasive; therefore, it is important to have diagnostic certainty.

Constrictive pericarditis is accompanied by a pleural effusion in 50% to 60% of cases. Effusions may present on either side or bilaterally and vary in size from minimal to massive (Table 1). The precise pathophysiology is unknown, with possibilities ranging from increased right- and left-sided hydrostatic pressure to impaired lymphatic drainage. Although more often regarded as a cause of transudative effusions, the reported cases show a similar incidence of exudates and transudates. Given the wide variability of presentations, it is possible that the pathophysiology varies among patients.

Table 1 -- Laterality of Pleural Effusions Due to Constrictive Pericarditis in Case Series

<table>
<thead>
<tr>
<th>Reference/Year</th>
<th>Left-Sided</th>
<th>Right-Sided</th>
<th>Bilateral</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tomaselli et al/1989</td>
<td>3</td>
<td>3</td>
<td>12</td>
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<tr>
<td>Weiss and Spodick/1983</td>
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<td>Heinz and Abrams/1957</td>
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<tr>
<td>Plumb et al/1957</td>
<td>0</td>
<td>9</td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td>6</td>
<td>15</td>
<td>31</td>
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</tbody>
</table>

Most patients with constrictive pericarditis present with systemic vascular congestion (eg, > 90% have elevated jugular venous pressure). It is unusual that our patient presented with an isolated effusion without prominent signs of systemic congestion (ie, peripheral edema, significant ascites, or pathologic weight gain). Jugular venous distension was not noted initially in this patient, and in retrospect, it is unclear when this sign was detected on physical examination. It has been noted in constrictive pericarditis that ascites is often disproportionately prominent compared with peripheral edema. It is possible that diaphragmatic defects, combined with negative intrathoracic pressure, facilitate the movement of ascitic fluid into the thoracic cavity; this may be analogous to the absence of clinical ascites in 20% of patients with hepatic hydrothorax. Alternatively, hypovolemia is known to mask several signs of pericarditis, and fluctuations in volume status could explain why the diagnosis was initially problematic.

Reflux of IV contrast into the inferior vena cava or hepatic veins is a sign of right-sided cardiac dysfunction, which can lead to a confident clinical diagnosis. This phenomenon has been described with right ventricular systolic dysfunction, pulmonary hypertension, tricuspid regurgitation, constrictive pericarditis, pericardial tamponade, restrictive cardiomyopathy, and acute pulmonary embolism. The sensitivity and specificity of this sign for right-sided heart dysfunction are 31% and 98%, respectively, with low contrast injection rate (< 3 mL/s) and 81% and 69%, respectively, with high contrast injection rate. The corresponding positive likelihood ratios for low and high contrast injection rates are 16 and 2.6, respectively. In our patient, the high-density contrast dye layered out in the dependent portion of his inferior vena cava, suggesting a significant degree of stasis. This finding has not been commented on previously, and we speculate that it may be a more specific sign for right-sided heart dysfunction than reflux into the inferior vena cava alone. Our patient had three CT scans: Two were performed with low contrast injection rates that demonstrated contrast layering in the inferior vena cava, and one was performed with a high contrast injection rate that showed reflux into the vena cava without layering. It has been shown that the severity of contrast reflux correlates with the severity of tricuspid regurgitation in the setting of chronic pulmonary hypertension as well as with a poor prognosis with acute pulmonary embolism. Careful attention to contrast reflux may provide a clue to previously occult cardiac disease or qualify the severity of a known disorder.

Clinical Pearls

1. Pleural effusions due to constrictive pericarditis may be either transudative or exudative and may be present on either side or bilaterally.
2. Constrictive pericarditis may present with pleural effusion in the absence of significant volume overload, such as peripheral edema, weight gain, or ascites.

3. Although patients with constrictive pericarditis typically have total body volume overload, when hypovolemia occurs, it may obscure abnormalities typically detected on physical examination, Doppler echocardiogram, and cardiac catheterization.

4. Reflux of contrast dye into the vena cava and hepatic veins may be a useful CT scan sign of right-sided heart dysfunction.

Acknowledgments

Financial/nonfinancial disclosures: The authors have reported to CHEST that no potential conflicts of interest exist with any companies/organizations whose products or services may be discussed in this article.

SUGGESTED READINGS:


Plum et al., 1957  Plum GE, Bruwer AJ, Clagett OT: Chronic constrictive pericarditis; roentgenologic findings in 35 surgically proved cases.  Proc Staff Meet Mayo Clin 32. (20): 555-566.1957;


