The Pleuropulmonary Manifestations of the Postcardiac Injury Syndrome*

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This study was designed to investigate the frequency and diagnostic importance of the pleuropulmonary manifestations of the postcardiac injury syndrome. A retrospective study of 35 patients (2 to 76 years old) with clearly defined postcardiac injury syndrome is presented. Twenty-one cases followed cardiac surgery, and 14 appeared after myocardial infarction. The onset of the syndrome was an average of 20 days following injury. The major clinical findings were pleurisy (91 percent; 32/35), fever (66 percent; 23/35), pericardial rub (63 percent; 22/35), dyspnea (57 percent; 20/35), rales (51 percent; 18/35), pleural rub (46 percent; 16/35), elevated erythrocyte sedimentation rate (96 percent; 25/26), and leukocytosis (49 percent; 17/35). The chest roentgenogram was abnormal in 94 percent (33/35). Pleural effusion was present in 83 percent (29/35), parenchymal infiltrates in 74 percent (26/35), and an enlarged cardiac silhouette in 49 percent (17/35). Analysis of pleural fluid was performed on 16 samples from 12 patients and revealed a bloody exudate with a pH greater than 7.40. The data presented document that pleuropulmonary involvement is a common manifestation of postcardiac injury syndrome. In addition, we discuss how these findings can be used to differentiate this syndrome from other clinical entities that may appear following cardiac injury, i.e., parapneumonic effusions, congestive heart failure, and pulmonary embolism.

The postcardiac injury syndrome occurs following a variety of myocardial or pericardial injuries.1-3 The syndrome has been described after cardiac surgery (postpericardiotomy syndrome),4,5 myocardial infarction (Dressler's syndrome),6 blunt trauma to the chest,7 percutaneous puncture of the left ventricle,8 and implantation of a pacemaker (postpericardial trauma syndrome).9,10

Postcardiac injury syndrome is characterized by the appearance of fever and signs of pericardial, pleural, and pulmonary parenchymal inflammation days or weeks following the initial injury.1,10,11 Despite clinical recognition of this entity for more than 30 years, the diagnosis is often elusive. In fact, considerable confusion exists in differentiating postcardiac injury syndrome from other complications seen in the postinfarctional or postcardiac surgical setting. Often the patient with postcardiac injury syndrome receives unnecessary and expensive diagnostic evaluations which can lead to iatrogenic complications due to inappropriate therapy for suspected congestive heart failure, pneumonia, or pulmonary embolism.1,3,10

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The current literature contains limited information regarding the pleural and pulmonary manifestations of postcardiac injury syndrome. Here we collected data from 35 patients with this syndrome in an attempt to define the pleuropulmonary manifestations of this syndrome and to describe the characteristics of the pleural fluid and other features which might aid in differentiating the syndrome from other conditions with which it is commonly confused. The details of this analysis form the basis of this report.

MATERIALS AND METHODS

We examined our experience with the postcardiac injury syndrome at the University of Colorado Health Sciences Center, Denver, between the years, 1971 to 1981. The records of all patients with acute myocardial infarction and those who had undergone cardiac surgery were examined for the presence of pericarditis, pleuritis, unexplained fever, treatment with anti-inflammatory agents, and a diagnosis of postcardiac injury syndrome, i.e., postmyocardial infarction (Dressler's syndrome) or postpericardiotomy syndrome. The hospital records, electrocardiograms (ECGs), and chest x-ray films were available for review in 75 patients, and 35 of these patients satisfied the criteria described herein for the diagnosis of the postcardiac injury syndrome. Criteria for inclusion were as follows: (1) the presence of unexplained fever (an oral or rectal temperature greater than 37.8°C which persisted beyond or developed after the first week after injury); (2) the presence of pleuritic pain in the chest; (3) the presence of pericardial inflammation, i.e., pleuropericardial pain in the chest, pericardial friction rub, and electrocardiographic ST-segment and T-wave abnormalities; and (4) the presence of other indicators of acute inflammation, i.e., elevations of the erythrocyte sedimentation rate (ESR), C-reactive protein, and leukocytosis. All patients included in this study had sustained some form of cardiac injury within the preceding six months and developed at least three of these four criteria. Patients were excluded from the study if any of the following were present: (1) fever considered of infectious cause with positive culture or Gram stain (or both) of a
known pathogen from sputum, blood, or other body fluids; (2) clinical suspicion of another cause of fever, ie, drug-induced, phlebitis, purulent sputum, or wound infection; (3) a clinical constellation suggesting congestive heart failure, ie, dyspnea, orthopnea, distended veins in the neck, hepatic engorgement, third heart sound, peripheral edema, or hemodynamic measurements consistent with left ventricular failure; (4) hepatosplenomegaly or atypical lymphocytosis suggesting the postperfusion syndrome; or (5) a high-probability ventilation-perfusion lung scan or pulmonary angiogram consistent with the diagnosis of pulmonary embolism.

RESULTS

Profile of Patients

The group under study was composed of 26 male and nine female subjects, with a mean age of 49 ± 3 (mean ± SE) years (ages ranging from 2 to 76 years). Twenty-one patients developed the syndrome following cardiac surgery. This included 11 coronary arterial bypass grafts, nine valvular replacements, and one implantation of a pacemaker. Fourteen patients developed the syndrome following acute myocardial infarction. Postcardiac injury syndrome developed 20 ± 3 days (range, 2 to 86 days) following the cardiac injury. Recurrent episodes were documented in 18 patients. Three patients sustained at least three documented recurrences.

Clinical Findings

The most common symptom was pleuritic-type pain in the chest, occurring in 91 percent (32/35) of the patients. The three patients in whom pleurisy was not recorded were all in the early pediatric age group (ie, less than four years of age). Other symptoms and signs included the following: fever in 66 percent (23/35), with a mean oral temperature of 38.6°C; pericardial rub in 63 percent (22/35); dyspnea or tachypnea (or both) in 57 percent (20/35); rales in 51 percent (18/35); and pleural rub in 46 percent (16/35). Hemoptysis was never seen. Three patients developed cardiac tamponade; none of these particular patients was receiving anticoagulant therapy or platelet-inhibiting drugs. Leukocytosis (mean peak white blood cell count [WBC], 12,000/cu mm) was present in 49 percent (17/35). An elevated ESR (mean, 62 mm/hr) was found in 96 percent (25/26) of the cases examined.

Thirty patients received treatment with anti-inflammatory agents, often a combination of prednisone and aspirin or indomethacin. One patient received azathioprine (Imuran) when long-term high-dose therapy with prednisone failed to control the symptoms. Eight patients were receiving anticoagulant therapy (seven received low-dose heparin subcutaneously, and one received full-dose heparin intravenously) at the time of the development of the syndrome.

Pleuropulmonary Findings

The chest roentgenogram was abnormal in 94 percent (33) of the 35 patients (Table 1). The most common abnormality, pleural effusion, was present in 83 percent (29/35) (Fig 1). Thirteen patients had isolated left-sided effusions, and 11 had bilateral effusions. Pneumonitis was present in 26 of the 35 patients and was in the left lower lobe in 16/26 (62 percent). An enlarged cardiac silhouette was found in 49 percent (17/35) (Fig 2).

Sixteen samples of pleural fluid were analyzed from 12 patients. The fluid was bloody or serosanguineous in 70 percent (11/16); the mean (± SE) red blood cell count (RBC) was 9,486/cu mm ± 3,179/cu mm. There appeared to be a relationship between the timing of thoracentesis and the onset of symptoms with the hemorrhagic appearance of the fluid; bloody effusions occurred early, with evolution to serous effusions after

Table 1—Radiographic Features of Postcardiac Injury Syndrome*

<table>
<thead>
<tr>
<th>Data</th>
<th>Present Series</th>
<th>Selected Reported Series</th>
<th>Combined Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of patients</td>
<td>35</td>
<td>98</td>
<td>133</td>
</tr>
<tr>
<td>Pleural effusion</td>
<td>29 (83)</td>
<td>79 (81)</td>
<td>108 (81)</td>
</tr>
<tr>
<td>Unilateral</td>
<td>18 (52)</td>
<td>37 (38)</td>
<td>55 (41)</td>
</tr>
<tr>
<td>Bilateral</td>
<td>11 (32)</td>
<td>42 (43)</td>
<td>53 (40)</td>
</tr>
<tr>
<td>Parenchymal</td>
<td>26 (74)†</td>
<td>43 (44)</td>
<td>69 (52)</td>
</tr>
<tr>
<td>infiltrate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enlarged cardiac</td>
<td>17 (49)</td>
<td>66 (67)</td>
<td>83 (62)</td>
</tr>
<tr>
<td>silhouette</td>
<td></td>
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</tbody>
</table>

*Table values are numbers of patients; numbers within parentheses are percents.
†One bilateral, 16 left-sided, and 9 right-sided.

![Figure 1](http://journal.publications.chestnet.org/pdffile.ashx?url=/data/journals/chest/21379/ on 06/21/2017)
pleural and pericardial effusions. A ventilation and perfusion lung scan was considered of moderate probability for pulmonary embolism, and the patient received heparin. Pulmonary angiograms and venograms were not performed. The recurrence of these symptoms and signs several days later, with prompt clinical response to anti-inflammatory therapy, confirmed the diagnosis of postcardiac injury syndrome.

**DISCUSSION**

The postcardiac injury syndrome has been recognized for over three decades. The etiology remains unknown. Heart-reactive antibodies have been identified in the serum of patients with this syndrome; however, these antibodies have been found in patients sustaining various forms of cardiac injury without the development of postcardiac injury syndrome. Engle and her co-workers have demonstrated an association between high titer to heart-reactive antibody and a rise in antiviral antibody to one or more of several common viruses. These investigators suggest that the syndrome is an autoimmune phenomenon triggered by a viral illness.

Because of the lack of a suitable diagnostic test and despite clinical awareness of the syndrome, considerable difficulty still exists in arriving at a secure clinical diagnosis. Pulmonary embolism with infarction, pneumonia, and congestive heart failure are three important diagnostic possibilities in this setting. Failure to differentiate postcardiac injury syndrome from these conditions may be detrimental for several reasons. First, failure to institute prompt therapy for postcardiac injury syndrome with anti-inflammatory agents may result in premature closure of grafts following coronary arterial bypass graft surgery. In addition, a number of iatrogenic complications have been reported due to erroneous therapy for postcardiac injury syndrome, such as cardiac tamponade due to anticoagulation for presumed pulmonary emboli, hypotension and electrolytic disturbances due to diuretic therapy for suspected congestive heart failure, and other complications relating to antibacterial therapy for presumed pneumonia.

This study has demonstrated that pleuropulmonary involvement is a very common manifestation of postcardiac injury syndrome, since the chest x-ray film is abnormal in 94 percent (33/35) of the patients. In Table 1, the findings of the present study are contrasted with 98 cases previously described in the literature. The incidence of pleural effusions is similar, but the current series demonstrated almost twice the number of parenchymal infiltrates.

Analysis of the pleural fluid in postcardiac injury syndrome has been poorly documented in the literature. Six patients in Dressler’s original series had
thoracocentesis; three were serous exudates, and three were hemorrhagic fluids. Anticoagulant therapy was a factor in causing a hemothorax in one case. Domy and Whitcomb reported a case of postcardiac injury syndrome where analysis of the pleural fluid revealed a bloody exudate with RBC of 20,000/cu mm and WBC of 1,800/cu mm (1 polymorphonuclear leukocyte, 51 lymphocytes, 9 monocytes, and 37 large mononuclear cells). We believe that detailed analysis of the pleural fluid in postcardiac injury syndrome will aid the practitioner’s clinical confirmation of this syndrome. Consequently, we have chosen to compare our analysis of pleural fluid with those obtained from patients with pulmonary emboli, parapneumonic effusions, and congestive heart failure.

Pleural effusions in postcardiac injury syndrome are exudative. Figure 3 shows the comparison of the protein level of the pleural fluid in postcardiac injury syndrome with the three previously mentioned clinical entities. The protein level of the pleural fluid in postcardiac injury syndrome is always ≥ 3.0 g/100 ml. Considerable overlap of the protein levels of the pleural fluid existed when comparing postcardiac injury syndrome with either pulmonary embolism or parapneumonic effusion; however, only minimal overlap was present when these values were compared with those from patients with congestive heart failure. Therefore, the finding of a protein level in the pleural fluid of less than 3.0 g/100 ml makes the diagnosis of the postcardiac injury syndrome unlikely.

The pH of the pleural fluid (Fig 4) in postcardiac injury syndrome was always more than 7.40. Considerable overlap existed in all of the clinical conditions except complicated parapneumonic effusions, in which case the pH is invariably less than 7.30. Therefore, the finding of a normal pH of the pleural fluid will eliminate the diagnosis of a complicated parapneu-

![Figure 3](http://journal.publications.chestnet.org/pdfsaccess.ashx?url=/data/journals/chest/21379/)

**Figure 3.** Protein level of pleural fluid in postcardiac injury syndrome (PCIS), pulmonary embolus, parapneumonic effusion, and congestive heart failure (CHF). Asterisk indicates data from Bynum and Wilson, dagger indicates data from Potts et al, and double dagger indicates data from Light et al.

![Figure 4](http://journal.publications.chestnet.org/pdfsaccess.ashx?url=/data/journals/chest/21379/)

**Figure 4.** Pleural fluid pH in postcardiac injury syndrome (PCIS), pulmonary embolus, parapneumonic effusion, and congestive heart failure (CHF). Asterisk indicates data from Potts et al and Good et al.

The finding of a serosanguineous or bloody effusion is most important in the differential diagnosis (Fig 5). Although pleural fluid from patients with pulmonary emboli also has been described as bloody in a similar percentage of patients, bloody fluid in either parapneumonic effusions or effusions secondary to congestive heart failure is uncommon. Therefore, the finding of bloody pleural fluid favors a diagnosis of either postcardiac injury syndrome or pulmonary embolism.

We have shown that pleuropulmonary manifestations of postcardiac injury syndrome are common but nonspecific. We were unable to identify any distinctive clinical or laboratory features of the syndrome, but were able to identify several characteristics of the pleural fluid, which, although not pathognomonic, would make the clinical diagnosis more likely. Specifically, the finding of a bloody exudative (protein level of the pleural fluid ≥ 3.0 g/100 ml) pleural effusion with pH greater than 7.40 makes a diagnosis of either congestive heart failure or parapneumonic effusion unlikely, but is compatible with a diagnosis of postcar-

![Figure 5](http://journal.publications.chestnet.org/pdfsaccess.ashx?url=/data/journals/chest/21379/)

**Figure 5.** Appearance of pleural fluid in postcardiac injury syndrome (PCIS), pulmonary embolus, parapneumonic effusion, and congestive heart failure (CHF). Asterisk indicates data from Bynum and Wilson, dagger indicates data from Potts et al, and double dagger indicates data from Griner.

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diagnostic injury syndrome or pulmonary embolism. We were unable to identify any features of the pleural fluid which could differentiate these two latter conditions. Finding evidence of pericardial inflammation by physical examination, ECG, or echocardiogram would favor a diagnosis of postcardiac injury syndrome; however, in the absence of pericarditis, ventilation-perfusion lung scanning or pulmonary angiographic studies are strongly recommended.

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