Primary *Streptococcus pneumoniae* pericarditis

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Although commonly fatal, bacterial pericarditis is often not diagnosed antemortem due to its infrequent occurrence and fulminant course. Historically, *Streptococcus pneumoniae* has been the most common cause of bacterial pericarditis. Over the past 70 years, however, it has become largely eliminated and now occurs almost exclusively in immunocompromised individuals with a preceding primary site of infection. Herein, we present a case of primary *S. pneumoniae* pericarditis that developed over the course of 3 to 4 weeks in an immunocompetent 45-year-old man. The patient, who developed cardiac tamponade shortly after admission, experienced a rapid resolution of symptoms following pericardial drainage and initiation of antibiotics.

Bacterial pericarditis requires prompt recognition due to its fulminant and often fatal course. While currently considered quite rare, many cases of bacterial pericarditis are likely undetected, as reflected by the large percentage of cases that are not identified until after death. Formerly *Streptococcus pneumoniae* was the most common cause of bacterial pericarditis. However, the combined introduction of antibiotics and the pneumococcal conjugate vaccine within the last 70 years has nearly wiped it out entirely, with most cases now occurring almost exclusively in immunocompromised patients with a preceding primary infection. Presented herein is an immunocompetent patient who developed symptoms of primary pericarditis over a period of 3 to 4 weeks before rapidly deteriorating and developing cardiac tamponade shortly after admission.

CASE DESCRIPTION

A 45-year-old African American man with no prior medical or surgical history experienced the onset of chest pain and dyspnea, which had progressively worsened over 3 to 4 weeks. The pain was sharp and was exacerbated by exertion or lying flat and was somewhat relieved by leaning forward. The patient denied fever, chills, or recent illness. He was born in Guyana and moved to the United States at the age of 12 and reported being homeless for the previous 3 months. He also stated that he was vegan and had lost a significant amount of weight over the past several months due to a lack of available dietary options.

His temperature was 98.2°F; blood pressure, 121/74 mm Hg; heart rate, 82 beats/minute; respiratory rate, 19 breaths/

minute; and oxygen saturation, 99% on room air. He had diffuse abdominal tenderness. The precordial examination was completely normal. His lung fields were clear and he had no subcutaneous edema. No jugular venous distention, Kussmaul's sign, pulsus paradoxus, or ascites were noted. Initial laboratory studies are noted in the *Table*. An electrocardiogram showed diffuse ST segment elevation, most prominent in the anterior precordial leads, with reciprocal ST segment depression in lead AVR and diffuse PR depression (*Figure 1*). A bedside transthoracic echocardiogram demonstrated a left ventricular ejection fraction >55% but a moderate-sized circumferential pericardial effusion (*Figure 2*). Chest radiograph revealed an enlarged cardiac silhouette but no other abnormalities. A diagnosis of pericarditis and pericardial effusion was made. He was treated initially with ibuprofen 600 mg every 8 hours and colchicine 0.6 mg every 12 hours.

Diagnostic workup included negative blood and sputum cultures, negative HIV and hepatitis panels, and negative serum antinuclear antibody, adenosine deaminase, and anti-double-stranded DNA tests. PPD revealed a maximal induration of 6 mm. Upon further questioning, the patient revealed that he may have had a Bacillus Calmette-Guerin vaccination while living in Guyana. Three sets of sputum smears and cultures for acid-fast bacilli were negative. Computed tomography of the chest and abdomen with contrast revealed a moderate pericardial effusion, a mildly thickened pericardium (without calcification), and a minimal amount of perihepatic ascitic fluid (the likely cause of the patient's abdominal tenderness).

By hospital day 5, the patient's symptoms had worsened. Examination revealed a blood pressure of 112/72 mm Hg, distant heart sounds, jugular venous distention, and new-onset lower extremity edema. Repeat electrocardiogram showed no signs of electrical alternans but, due to suspicion for cardiac tamponade, the patient urgently underwent right heart catheterization, which revealed equalization of intracardiac pressures (*Table*) and blunting of the descent on right atrial tracings (*Figure 3*). Emergent pericardiocentesis was performed and drained 450 cc

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Table. Chronological laboratory and hemodynamic findings

Variable	Day									
	0	1	2	3	4*	4†	5	6	7	8
Maximum temperature (°F)	98.7	98.2	99.0	98.5	98.9		98.7	98.9	98.2	98.7
Troponin I (ng/mL)	<0.05	<0.05			<0.05					
Brain natriuretic peptide (pg/mL)	154									
White blood cell count (10 ³ U/L)	9.8	10.1	9.3	8.5	9.1		8.3	7.4	8.1	7.9
Creatinine (serum) (mg/dL)	0.97	1.18	1.14	1.21	1.36		1.16	1.12	1.05	0.99
International normalized ratio	1.1	1.1	1.3	1.4	1.5		1.3	1.3	1.2	1.1
Aspartate aminotransferase (U/L)	86	95	138	145	185		146	114	58	35
Alanine aminotransferase (U/L)	92	118	156	205	237		167	136	82	51
Mean right atrial pressure (mm Hg)					18	4				
Right ventricular pressure (mm Hg)					29/18	24/0				
Pulmonary artery pressure (mm Hg)					27/18	22/8				
Mean pulmonary capillary wedge pressure (mm Hg)					18	6				

*Before pericardiocentesis.

†After pericardiocentesis.

Figure 1. Admission electrocardiogram demonstrating diffuse ST segment elevation, most prominent in the anterior precordial leads with reciprocal ST segment depression in lead AVR.

of bloody fluid, after which intracardiac pressures normalized (Table) and jugular venous distention disappeared.

Analysis of the pericardial fluid was limited by the large amount of blood and thrombus present, and no cell count could be performed. Cytological analysis, fungal culture, acid-fast bacilli, and adenosine deaminase studies of the pericardial fluid were all found to be negative. The initial Gram stain revealed the presence of gram-positive cocci in pairs. Antibiotic therapy was initiated (vancomycin 1 g intravenously every 12 hours and ceftriaxone 2 g intravenously every 24 hours), and ibuprofen and colchicine were discontinued. Despite initial improvement

immediately following the procedure, the patient rapidly experienced recurrence of chest pain and shortness of breath.

On postprocedure day 2, repeat transthoracic echocardiogram revealed the recurrence of a moderate-sized pericardial effusion. Accordingly, a pericardial window was placed and an additional 150 mL of serosanguinous fluid was withdrawn. Postoperatively, two Jackson-Pratt drains were inserted and drained an additional 25 mL of serosanguinous fluid over a course of 2 days before being removed. All repeat pericardial fluid studies were negative and pericardial biopsy revealed only inflammatory exudate.

Figure 2. Parasternal short-axis view of a transthoracic echocardiogram revealing a large echo-free space, suggesting an extensive circumferential pericardial effusion (see arrow and white bar). RV indicates right ventricle; LV, left ventricle.

The following day, culture from the initial pericardial fluid revealed heavy growth of *Streptococcus pneumoniae*. The antibiotic regimen was changed to 500 mg of oral penicillin V potassium every 6 hours. A subsequent workup for underlying immunodeficiency included tests for serum gamma globulin levels, serum C3 and C4, as well as total and

alternative complement activity, and all were within normal limits. The patient had no further symptoms and was discharged on a 14-day course of oral penicillin. In the 6 months following discharge, the patient has had no recurrence of his symptoms.

DISCUSSION

The list of etiologies of pericarditis in developed countries is extensive and varied. Possible causes include autoimmune disorders, underlying neoplasms, and bacterial infections, including tuberculosis. Often no specific cause of acute pericarditis is identified. In these cases the pericarditis is considered idiopathic, possibly due to an undetected underlying virus. In immunocompetent individuals, 80% to 90% of all cases of pericarditis are designated idiopathic (1–3). In contrast, bacterial infection is an infrequent cause of acute pericarditis in the United States, accounting for <1% of all cases (1, 4, 5). While idiopathic pericarditis typically is benign and usually resolves with nonsteroidal antiinflammatory therapy, bacterial pericarditis often has a fulminant course, requiring both immediate antibiotic administration and surgical drainage, with mortality approaching 100% if it is not promptly recognized and treated (6). With appropriate emergent treatment, mortality has been demonstrated to decrease to 20% (6, 7). Unfortunately, an antemortem diagnosis is made in only 10% to 20% of cases of bacterial pericarditis, and even in those patients in whom a diagnosis is made, there is an average delay of 21 days until treatment is initiated (8, 9).

Figure 3. Right heart catheterization tracing of the right atrium showing blunting of the y descent consistent with cardiac tamponade. The mean right atrial pressure was measured at 18 mm Hg.

There are several possible reasons why the clinical recognition of bacterial pericarditis is challenging. One major factor is the absence of classical physical findings such as a pericardial friction rub and pulsus paradoxus, which are reportedly present in only 30% of cases (9). Another important factor is a low level of clinical suspicion, since the condition is encountered infrequently. Bacterial pericarditis has never been common, but its incidence has declined drastically over the past 70 years. This decline strongly correlates with the near abolition of *S. pneumoniae* as the infecting agent. Following the introduction of antibiotics into clinical practice in the 1940s, the incidence of *S. pneumoniae* as an etiology has declined from 51% to 9% (10). Additionally, the implementation of the pneumococcal conjugate vaccine into standard childhood immunization schedules in 2000 has diminished the incidence of all pneumococcal infections (11). In fact, <25 cases of *S. pneumoniae* pericarditis have been reported in English publications since 1980 (11). These various factors may also play a role in the change in patient population experiencing *S. pneumoniae* pericarditis. Prior to 1943, *S. pneumoniae* pericarditis mainly occurred in children and young adults, usually in the setting of a concurrent pneumonia (8). More recently, the average age of affected patients has increased to 49, and the condition now occurs mainly in patients with underlying chronic disease (10). This change in demographics may also reflect the increase in the use of immunosuppressive agents and the increase in invasive procedures such as renal dialysis and thoracic surgery (10).

There are several reasons why we believe the present case to be unique. To our knowledge, ours is only the eighth case ever reported of primary pericarditis (without signs of underlying infection elsewhere) (11–14). The mechanism of pericardial involvement is believed to occur either via contiguous spread from a surrounding area, usually pneumonia (93%), or via hematogenous spread from an underlying infection elsewhere in the body, such as osteomyelitis, otitis media, mediastinitis, impetigo, or meningitis (10, 15). It has even been suggested that pneumococcal pericarditis is rarely, if ever, truly primary and that most cases are due to a small discrete area of pneumonia that is radiologically silent or to another occult infection (12, 13). Of the seven previously reported *S. pneumoniae* cases of primary pericarditis, five occurred either in patients under 1 year of age or patients with underlying major medical conditions such as hypogammaglobulinemia, alcoholism, and diabetes (9, 13). In one of the other two cases, reported in 1924, the diagnosis was questionable due to the lack of sophisticated imaging techniques and the subsequent development of pleural empyema during hospitalization (14). The remaining case, reported by Keersmaekers

et al from Belgium in 2002, is remarkably similar to our patient in that it involved an immunocompetent individual who presented without fever or leukocytosis (6). The main difference is that their patient had positive blood cultures in addition to a positive pericardial fluid (6). Finally, we believe that our patient was unusual because his symptoms developed gradually over a 3- to 4-week period, rather than presenting with the relatively fulminant picture usually associated with this disorder. Typically, individuals with bacterial pericarditis are hospitalized within 3 days of symptom onset (regardless of bacterial etiology) (16).

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