Review Article

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Cardiopulmonary Emergencies in Sarcoidosis

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Abstract

Sarcoidosis is a systemic disease that commonly involves the lungs and the heart. Although rare, life-threatening cardiopulmonary emergencies can occur. Acute respiratory failure, massive hemoptysis, and cardiac emergencies are described in sarcoidosis. These clinical manifestations can be the first clinical presentation of sarcoidosis. The subject of cardiopulmonary sarcoidosis is reviewed.

Keywords: Sarcoidosis, hemoptysis, respiratory failure, heart block, cardiac arrhythmia, congestive heart failure

Introduction

Sarcoidosis is a systemic granulomatous disease of unknown cause. Although sarcoidosis frequently involves the lungs and heart, acute cardiopulmonary complications are rare. The patients with sarcoidosis can present with acute respiratory failure, massive hemoptysis, and potentially fatal cardiac dysrhythmias. The subject of cardiopulmonary emergencies in sarcoidosis is reviewed.

Respiratory Failure

Although pulmonary disease is a very common manifestation of sarcoidosis, acute respiratory failure due to sarcoidosis is rare [1]. The etiology of acute respiratory failure in sarcoidosis is summarized in **Table 1**. Bacterial and fungal pneumonias should be excluded in these patients, especially if they are being treated with immunosuppressive therapy. Acute respiratory failure also can be the manifestation of methotrexate-induced lung toxicity [2]. Other causes of respiratory failure in sarcoidosis include: 1. Rapidly progressive pulmonary sarcoidosis, 2. Pneumothorax, 3. Upper airway disease, and 4. Neurosarcoidosis.

Rapidly progressive pulmonary sarcoidosis: Acute respiratory failure secondary to direct pulmonary involvement has been described in the literature. The clinical manifestations of rapidly progressive pulmonary sarcoidosis closely mimic bacterial pneumonia and include fever, cough, malaise, headache, and dyspnea. Hypoxemia and respiratory failure usually develop over one to three weeks. Physical examination may reveal tachycardia, tachypnea, and bilateral crackles. Chest radiograph may show diffuse pulmonary infiltrates. Bronchoalveolar lavage (BAL) usually shows increased percentage of lymphocytes. BAL cultures are important to exclude viral, bacterial, and fungal pathogens. Transbronhcial biopsy shows non-necrotizing granulomas. Rapidly progressive pulmonary sarcoidosis has been described as a first manifestation of sarcoidosis. The patients with bilateral pulmonary infiltrates and severe hypoxemia may fulfill the criteria for acute respiratory distress syndrome (ARDS). This extreme type pulmonary sarcoidosis is usually corticosteroid responsive and rapid improvement in respiratory status has been reported after treatment with prednisone [3-5].

Pneumothorax: Pneumothorax is rare in sarcoidosis. Pneumothorax is usually develops in advanced pulmonary

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TABLE 1. CAUSES OF ACUTE RESPIRATORY FAILURE IN SARCOIDOSIS

1. Rapidly progressive pulmonary sarcoidosis
2. Pneumothorax
3. Upper airway obstruction
4. Neurosarcoidosis (bilateral phrenic nerve sarcoidosis, central hypoventilation)
5. Drug-induced lung disease (methotrexate)
6. Infection

disease and fibrosis. Pneumothorax also can be the presenting manifestation of pulmonary sarcoidosis. Extensive non-necrotizing granulomatous infiltrates of pleura, necrotic subpleural nodules, and bullae can be seen. Patients with bilateral spontaneous pneumothoraces due sarcoidosis have also been described. These patients present with chest pain, dyspnea, and respiratory failure. The insertion of tube thoracostomy for drainage of pneumothorax is the urgent initial management. Persistent air-leak, subpleural bullae, or necrotic nodules are potential indications for video-assisted thoracic surgery. Prednisone therapy should be considered especially in patients with recurrent pneumothoraces [6-10].

Upper respiratory tract obstruction: The upper respiratory tract (URT) occurs in about 1% to 3% of patients with sarcoidosis [1,11]. The larynx is the most common anatomical location of URT sarcoidosis [11,12]. Although patients with laryngeal involvement usually present with hoarseness, almost half of these patients will develop dyspnea and stridor. In patients with a significant airway obstruction may result in life-threatening respiratory compromise. Tracheostomy may be needed in patients with respiratory distress. Systemic corticosteroid therapy is indicated in all patients with URT sarcoidosis and airway obstruction [13,14].

Neurosarcoidosis: Severe respiratory compromise necessitating intubation from diaphragmatic paralysis secondary to phrenic nerve sarcoidosis and central hypoventilation from involvement of respiratory center in brain stem have been described in neurosarcoidosis [15-17].

Massive Hemoptysis

Although pulmonary involvement is commonly seen in sarcoidosis, hemoptysis is a rare manifestation of pulmonary sarcoidosis. Only 6% of the patients with sarcoidosis have been reported to develop hemoptysis [18]. Massive hemoptysis is defined as expectoration of 300 to 600 ml of blood in 24 hours. Fatalities due massive hemoptysis are mostly due to asphyxiation and respiratory failure rather than hemorrhagic shock. Massive hemoptysis is a rare manifestation in sarcoidosis with incidence of 0.5% [18]. Fatalities secondary to massive hemoptysis in sarcoidosis have been described in the literature [19-22]. Hemoptysis can occur at any stage of the disease [23,24]. Mechanisms of hemoptysis in sarcoidosis (**Table2**) include: 1. aspergilloma formation in fibrocavitary pulmonary sarcoidosis [21], 2. necrotizing bronchial aspergillosis [25], 3. endobronchial sarcoidosis with hypervascullariztion of sarcoidosis granuloma [20], 4. bronchiectasis [26], 5. abnormal bronchopulmonary shunt [27], 6. granulomatous arteritis of pulmonary artery [19], 7. erosion of the pulmonary artery by necrotic sarcoidosis lesion [20,22], 8. ulceration of nasopharyngeal granulomata lesions [28], and 9. alveolar hemorrhage [29,30]. Fibrocavitary pulmonary sarcoidosis, *Aspergillus* colonization, and endobronchial sarcoidosis with endoluminal stenosis are risk factors for hemoptysis in sarcoidosis [20,31,32].

Cardiac Emergencies

Although sarcoidosis affecting the heart is lees common than other organ involvement, its presentation in the emergency setting can be ominous. Up to 25% of patients with sarcoidosis have histological evidence of cardiac involvement, and about 5% of them have clinical manifestations [33]. About two-thirds of these patients die suddenly, and as high as one-fifth are diagnosed after presenting with sudden death [33]. **Table 3** summarizes the cardiac emergencies in sarcoidosis.

Heart block: The most common cardiac emergency in sarcoidosis is complete heart block [33]. The granulomatous infiltration of the conduction system is the underlying pathology. The atrioventricular node appears to be the most vulnerable part of the conduction system in cardiac sarcoidosis. Generally, sarcoidosis patients with complete heart block present at an earlier age than does the general population and merit permanent pacemaker placement [33].

Ventricular dysrhythmias: Ventricular dysrhythmias are among the most prevalent clinical manifestations of cardiac sarcoidosis, and together with complete heart block make up nearly two-thirds of mortality attributable to car-

TABLE 2. MECHANISMS OF MASSIVE HEMOPTYSIS IN SARCOIDOSIS

1.	Aspergilloma formation in fibrocavitary pulmonary sarcoidosis
2.	Necrotizing bronchial aspergillosis
3.	Endobronchial sarcoidosis with hypervascullariztion of sarcoidosis granuloma
4.	Bronchiectasis
5.	Abnormal bronchopulmonary shunt
6.	Granulomatous arteritis of pulmonary artery
7.	Erosion of the pulmonary artery by necrotic sarcoidosis lesion
8.	Ulceration of nasopharyngeal granulomata lesions
9.	Alveolar hemorrhage

TABLE 3. CARDIAC EMERGENCIES IN SARCOIDOSIS

1.	Complete heart block
2.	Ventricular arrhythmias
3.	Congestive heart failure
4.	Pericardial tamponade (rare)
5.	Right ventricular rupture (rare)
6.	Supraventricular arrhythmias (rare)

diac sarcoidosis [33]. Granulomatous infiltration of the ventricular myocardium may results in premature ventricular complexes, nonsustained ventricular tachycardia, and stable and unstable ventricular tachycardias. Ventricular tachycardia secondary to sarcoidosis may not respond to antiarrhythmic therapies or may recur despite standard therapies. Early implantable cardioverter defibrillator (ICD) placement in these patients has been recommended by some experts; others recommend ICD placement only in patients who have refractory ventricular tachycardia or who have survived sudden cardiac death [33-35].

Congestive heart failure: Congestive heart failure is a significant sequela of cardiac sarcoidosis and after rhythm disturbances is the most common cause of mortality in patients with cardiac sarcoidosis. Granulomatous infiltration in the myocardium may lead to either systolic or diastolic left ventricular dysfunction. ICD placement is recommended in patients with congestive heart failure who demonstrate multiform ventricular tachycardia or in those who have an ejection fraction less than 35% and are symptomatic [33,36].

Miscellaneous cardiac emergencies: Cardiac sarcoidosis also may mimic acute coronary syndrome (ACS) – i.e. pseudoinfarction – valvular abnormalities, supraventricular tachyarrhytmias, pericardial tamponade, and rarely right ventricular rupture. Pseudoinfarction is a phenomenon in which cardiac sarcoidosis mimics the signs and symptoms of ACS, including changes on the electrocardiogram. If indeed the symptoms result purely from cardiac sarcoidosis, stress testing with imaging will show improvement or resolution of perfusion defects with stress, in contrast to findings in ischemic heart disease. Though rare, sarcoidosis can lead to valvular incompetence, most often involving the mitral valve. Supraventricular dysrhytmias are very rare and may include a range of dysrhythmias, such as atrial fibrillation and paroxysmal atrial tachycardia [33,37-40].

In general, a diagnosis of sarcoidosis may not be suspected in the emergency setting. The presence of hilar lymph adenopathy and interstitial infiltrates on chest radiographs may suggest the diagnosis of sarcoidosis. Radionuclide cardiac stress imaging can help to exclude ischemic heart disease. Magnetic resonance imaging (MRI) may have an increasingly important role in detecting cardiac involvement in sarcoidosis. MRI has demonstrated high sensitivity (100%) and relatively good specificity (78%) in identifying areas of cardiac involvement. MRI also has shown promise in tracking the progress of disease, particularly in the setting of corticosteroid treatment. However, one major limitation of MRI is that it cannot be used for patients who have a pacemaker or an ICD.

Endomyocardial biopsy has low sensitivity (20%) to detect cardiac sarcoidosis. Endomyocardial targeted biopsy with help of MRI may improve the diagnostic yield [33,41].

Electrophysiologic (EP) testing is useful for risk stratification and identification of sarcoidosis patients who will benefit from immediate ICD placement. In patients with spontaneous or inducible ventricular tachyarryhthmias during EP studies, ICD placement has been found beneficial. ICD placement is also recommended in patients with congestive heart failure who demonstrate multiform ventricular tachycardia or in symptomatic patients with an ejection fraction of less than 35%.

Corticosteroid therapy has been an important therapeutic element in the treatment of sarcoidosis. While no large prospective studies have been performed to confirm the benefit of corticosteroids in sarcoidosis, evidence to date suggests that they slow the progress of the disease and have an important role in early management of sarcoidosis. Patients who receive aggressive corticosteroid therapy prior to deterioration of ejection fraction below 50 percent appear to benefit significantly in five-year survival. It should be noted that corticosteroids do not replace the role of pacemakers and ICDs, when they are indicated [33,35,42].

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