pneumothorax, although one is suspected, or fails to provide sufficient information to allow management decisions to be made.

References

6 Wall SD, Federle MP, Jeffrey RB, et al. CT diagnosis of unsuspected pneumothorax after blunt abdominal trauma. AJR Am J Roentgenol 1984; 141:919-21
7 Ticino JM, Miller MH, Frederick PR, et al. CT detection of occult pneumothorax in head trauma. AJR Am J Roentgenol 1984; 143:987-90

Pneumothorax as a First Manifestation of Sarcoidosis*

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Pneumothorax is a rare manifestation of sarcoidosis, occurring usually late in the course of the disease. We report five cases of pneumothorax as a presenting manifestation of sarcoidosis. In two patients, thoracotomy showed extensive pleural infiltration by noncaseating granulomas. High-resolution CT scans showed cavitated subpleural nodules and subpleural bullae in one case. These findings support that necrosis of subpleural granulomas or rupture of a subpleural bullae, or both, are the mechanisms of pneumothorax in sarcoidosis. Three patients with a lung function impairment were treated with oral corticosteroids. One nontreated patient died due to progression of the disease.

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Key words: corticosteroids; diffuse interstitial lung disease; granuloma; granulomatous disease; pneumothorax; sarcoidosis

Abbreviations: CCT=conventional CT; HRCT=high-resolution CT

Pneumothorax occurs in 2 to 4% of patients with sarcoidosis.1-2 It is suggested that this rare manifestation of sarcoidosis is related to either rupture of a subpleural bleb or necrosis of a subpleural granuloma.8 Although pneumothorax is observed in the late evolution of sarcoidosis, it seems that it could occur in the early stages as well.3 We report five patients with pneumothorax as a presenting manifestation of sarcoidosis.

CASE REPORTS

We reviewed the cases of 193 patients who had sarcoidosis from 1981 to 1995. The cases of five patients were reported with pneumothorax noted as a revealing manifestation of sarcoidosis. Diagnosis was confirmed by transbronchial biopsy in three patients and by open-lung biopsy in two patients showing noncaseating granulomas. Absence of acid-fast bacilli and fungi was noted in sputum cultures, biopsy specimens, and body fluids. The Mantoux test was negative in all patients. The serum angiotensin-converting enzyme was elevated in all cases (mean, 92.4±17.7 IU/mL; normal range, 15 to 50 IU/mL). Urine and serum calcium values were normal in 4 and elevated in 1 patient (case 4). In all patients, lung function (spirometry and transfer factor) were measured 3 months after the resolution of pneumothorax. In two patients, lung function was normal, while in three patients a restrictive impairment was noted.

CASE 1

A 46-year-old man with a history of insulin-dependent diabetes was admitted to the hospital in July 1982 for a complete pneumothorax on the right side. After resolution of the pneumothorax, the chest x-ray film and the conventional CT (CCT) scan of the thorax showed diffuse reticular lesions with bilateral hilar and subcarinal lymphadenopathy. Because lung function was normal, it was decided only to do follow-up examinations on the patient. Three years later, the patient’s condition deteriorated. An attempt to introduce corticosteroid therapy failed because of the disregulation of his diabetes mellitus. The patient finally died 12 years later due to progression of sarcoidosis; however, no relapse of the pneumothorax was noted during the follow-up period.

CASE 2

A 33-year-old man was admitted to the hospital in April 1986 for a complete pneumothorax on the right side. After resolution

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of the pneumothorax, the chest x-ray film showed reticular infiltrates on the left upper and right lower lobes and bilateral hilar lymphadenopathy. The CCT confirmed the x-ray findings and revealed multiple bullous changes in both lungs. Lung function tests showed a mildly restrictive defect. Oral steroid therapy was prescribed with improvement in pulmonary lesions and lung function. No recurrence of the pneumothorax was noted during a 10-year follow-up period.

Case 3

A 40-year-old man was admitted for a complete pneumothorax on the right side associated with reticulonodular infiltrates on the left lung parenchyma in May 1989. He had a history of two previous instances of a pneumothorax on the right side (March 1975 and October 1976) requiring chest tube treatment. Chest x-ray films of those episodes were reported as "normal." A chest tube failed to resolve the pneumothorax. Thoracotomy revealed multiple granulomas involving the pleura associated with mediastinal lymph node enlargement. Noncaseating granulomas were seen in both lung and lymph node biopsy specimens. Lung function was mildly impaired (restricted). Oral steroid therapy was prescribed with improvement in pulmonary lesions and lung function. No recurrence of the pneumothorax was observed during a 7-year follow-up period.

Case 4

A 29-year-old woman was admitted to the hospital in August 1991 for an incomplete pneumothorax on the left side. A chest x-ray film disclosed multiple nodules in both lungs. High-resolution CT (HRCT) showed patchy areas of coalescent micronodules. Some micronodules at the peripheral and subpleural areas of both lungs showed central cavitation (Fig 1). In the upper lobe of the left lung, subpleural cysts with nodular wall thickening, as well as thick-walled dilated bronchi, were seen in the right upper lobe (Fig 2, top). The patient refused any further investigation for the diagnosis of the underlying disease. Fourteen months later, she was readmitted with recurrence of the pneumothorax on the left side. The nodular lesions had not changed. A thoracotomy revealed multiple granulomas involving the pleura associated with bullae on the left apex. The lung biopsy showed noncaseating granulomas. Lung function tests showed a moderately restrictive defect. Oral steroid therapy was prescribed with improvement in lung function. Six months later, HRCT showed regression of nodular lesions. Dilated bronchi had become thin-walled cystic bronchiectasis. Some bullae had partially collapsed and others had enlarged, but there were no further nodular elements in the bullae wall. Instead, evidence of mild fibrosis was present (Fig 2, bottom). No recurrence of the pneumothorax was observed during a 4-year follow-up period.

Case 5

A 42-year-old woman was admitted to the hospital in April 1992 for a complete pneumothorax of the left side associated with erythema nodosum. After resolution of the pneumothorax, the chest x-ray film showed bilateral hilar lymphadenopathy, and the CCT scan confirmed radiographic findings. Lung function was normal. The patient was simply followed up. She has been disease-free with no recurrence of the pneumothorax during a 4-year follow-up period.

Discussion

Sarcoidosis associated with pneumothorax is rare.1,2 This was first described by Freiman4 in 1948. Sharma,5 in

Figure 1. HRCT of patient 4 at two different levels of the upper lobe of right lung showing subpleural nodules with cavitation (small arrows). A bulla surrounded by micronodules is also depicted (large arrow), as well as coalescent micronodules in the peripheral and subpleural areas of the lung (arrowhead).

Figure 2. Top: HRCT from the same patient showing subpleural bullae in the upper lobe of left lung (large arrows), the dorsal bulla surrounded by ground-glass opacity and nodules. Thick-walled dilated bronchi (arrowhead) and subpleural nodular lesions are depicted in the upper lobe of right lung (small arrows). Bottom: HRCT at the same level 12 months after steroid therapy showing collapse of the ventral bulla and enlargement of the dorsal one, which now appears broad base to the pleura and partially surrounded by fibrosis (large arrow). Dilated bronchi became sacular bronchiectasis (small arrows). Subpleural and parenchymal infiltration is no longer seen.
his review of 180 sarcoid patients, noted 5 patients with pneumothorax (2.7%). Riley\(^2\) reported 2 cases of pneumothorax in 52 patients with sarcoidosis (3.7%). The occurrence of pneumothorax in our review of 193 patients with sarcoidosis was 2.5%.

In our series, pneumothorax was the presenting sign of the disease. In the medical literature, it was reported that pneumothorax occurred more often as a complication of already diagnosed sarcoidosis.\(^3,3,5,8\) In four of our five patients, a low-stage sarcoidosis was diagnosed at the occurrence of the pneumothorax. Few authors have reported the occurrence of pneumothorax at the early stage of the disease.\(^3,9,10\) Patients of Sharma\(^1\) and Scadding\(^6\) had an advanced-stage disease.

Sharma\(^1\) and Riley\(^2\) suggested that the necrosis of subpleural granuloma may be the mechanism of the pneumothorax. Scadding\(^6\) reported that in two of his patients, pneumothorax was related to an advanced-stage bullous and fibrotic disease. Thoracotomy in two of our patients (cases 3 and 4) showed extensive pleural infiltration by granulomas. CT scan in case 2 showed subpleural bullae and HRCT in case 4 showed cavitated subpleural nodules and subpleural bullae. Although it is known that HRCT is superior to CCT in detecting pleural lesions,\(^11\) neither HRCT nor the use of the pathologic specimen can confidently distinguish between pleural and subpleural involvement.\(^12\) These findings support theories of both Sharma\(^1\) and Riley.\(^2\) Furthermore, we can presume that obstruction of bronchi or bronchioles might be responsible for bullae formation\(^13\) in case 4, since sarcoid lesions surrounded subpleural cysts and bronchiectasis.

One patient (case 3) had a history of two previous instances of pneumothorax 14 years before diagnosis of sarcoidosis. There was no confirmation as to whether these previous instances of pneumothorax were related to a subclinical and subradiologic stage of sarcoidosis.\(^14\) To the best of our knowledge, there has been no report in the literature relating to the occurrence of pneumothorax so many years before the diagnosis of sarcoidosis.

All patients in our study had a noncomplicated unilateral pneumothorax although bilateral spontaneous pneumothorax seems to be common in sarcoid patients.\(^5,15\) As in our series, no preference as to side of pneumothorax was shown.\(^1,2,6\) Other pleural manifestations can be present in association with pneumothorax, such as hemoptysis\(^9\) and pleural effusion,\(^10\) but our patients showed none of them. The superimposition of pneumothorax on an already compromised ventilatory function can be fatal,\(^16\) but no such case was noted in our series.

Three of our patients received oral prednisone therapy (patients 2, 3, and 4).\(^17,18\) Although patients 1 and 5 took no steroid therapy and had no recurrence of pneumothorax, patient 4 had two instances of pneumothorax before steroid therapy. Sharma\(^1\) anticipated that early steroid therapy might be beneficial in pneumothorax relapse. In contrast, follow-up of our patients without steroid therapy showed no recurrence of pneumothorax and suggests that steroids may be useful in the advanced disease.

The described cases suggest that pneumothorax can be the first manifestation of advanced or early-stage sarcoidosis. The necrosis of subpleural granuloma or the rupture of bullae, or both, seems to be the mechanism of pneumothorax. HRCT contributes to the visualization of small parenchymal and pleural lesions and is useful in the management decisions. Oral steroid therapy may be reserved for advanced disease.

**References**