Rounded Atelectasis With Atypical Computed Tomography Findings

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Gary T Kinasewitz MD, and Jean I Keddissi MD

Rounded atelectasis is atelectasis of the peripheral part of the lung, typically in contact with thickened pleura, featuring characteristic computed tomography findings. In this case, a 61-year-old man with history of asbestos exposure presented with a right-middle-lobe nodule on chest radiograph, with computed tomography findings suspicious for neoplasm. The patient underwent surgical resection, which revealed rounded atelectasis. Our case raises a question about the sensitivity of radiographic criteria used in identifying rounded atelectasis, and it emphasizes the need to keep rounded atelectasis in the differential diagnosis of a single pulmonary nodule in a patient with a history of asbestos exposure. *Key words: atelectasis; asbestos; pleural disease; radiography, thoracic.*
[Respir Care 2006;51(7):761–763.

Introduction

Rounded atelectasis is atelectasis of a peripheral part of the lung, due to pleural adhesions and fibrosis that cause deformation of the lung and torsion of some small bronchi.[1] It was first described as a clinical entity in the late 1920s.[2] In 1966, an association with asbestos exposure was described.[3]

It is now accepted that any type of pleural inflammatory reaction can result in rounded atelectasis, as seen in congestive heart failure, pulmonary infarct, Dressler syndrome, and parapneumonic and tuberculous effusion.[4] It has a yearly incidence of 5–15 cases/100,000 people.[1] It has been described in patients between the ages of 20 and 92 years, with 80% being men.[5] A history of asbestos exposure is seen in 70–86% of the cases.[1,6]

Case Summary

A 61-year-old white man was referred to the pulmonary oncology clinic at the Oklahoma City Veterans Affair Medical Center for a right-middle-lobe lung nodule, found incidentally on a routine chest radiograph. He had no history of cough, hemoptysis, weight loss, or night sweats. He had a 90-pack-year history of smoking, but quit in 1996, after undergoing a single coronary vessel stent placement. His medical history was also notable for chronic obstructive pulmonary disease (forced expiratory volume in the first second [FEV_1] 2.0 L, which is 55% of predicted). He worked as an industrial contractor, with remote exposure to asbestos and sand blasting.

Physical examination was unremarkable, without any evidence of lymphadenopathy. A chest computed tomogram (CT) confirmed the presence of a 1.4 × 2.9 cm irregularly-shaped, enhancing density in the right middle lobe, suspicious for neoplasm, with nonspecific peribronchial, hilar, and mediastinal adenopathy (0.7–1.4 cm on the short axis) (Fig. 1). Scattered pleural plaques consistent with asbestos exposure were also identified on the chest CT. A 3-dimensional CT reconstruction showed the presence of a centrally located, right-middle-lobe, spiculated mass (Fig. 2).

Basic laboratory values were within normal limits. Fiberoptic bronchoscopy showed a normal endobronchial tree. Transbronchial biopsies at the level of the right middle lobe were negative for malignancy.

The case was presented to the thoracic oncology tumor board, which, in view of the high clinical and radiographic suspicion for malignancy, recommended surgical resection without any further diagnostic testing. Right thoracotomy found a small pleural effusion, pleural thickening, and

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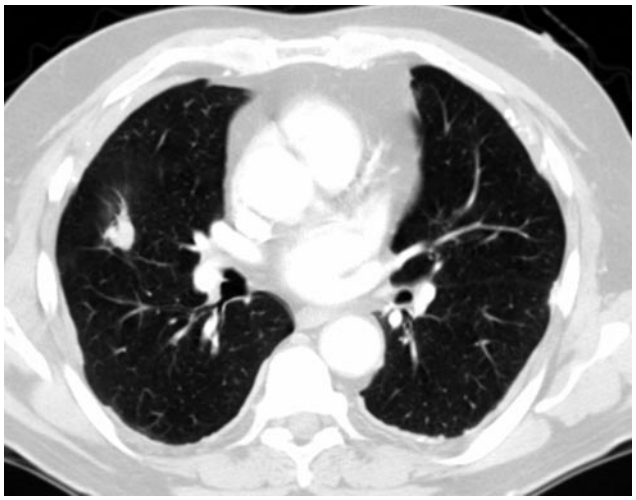

Fig. 1. Chest computed tomogram showing a 1.4 cm × 2.9 cm irregularly-shaped, enhancing density in the right middle lobe, suspicious for neoplasm.

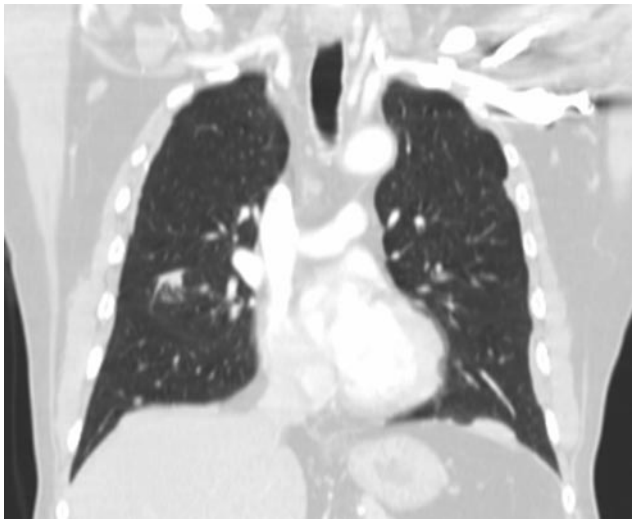

Fig. 2. This 3-dimensional computed tomogram reconstruction shows a centrally located, right-middle-lobe, spiculated mass.

benign plaques, grossly extending from the apex to the diaphragmatic surface. A right-middle-lobe lesion at the confluence of the minor and major fissures was resected with a right-middle lobectomy (Fig. 3). The pathology revealed hyaline plaques and rounded atelectasis. The pleural-fluid cytology was negative for malignancy.

The patient's postoperative course was uneventful, and he was discharged 1 week after admission.

Discussion

The pathophysiology of rounded atelectasis is controversial. There are 2 theories: the first was described by Hanke and Kretzschmar,[7] who posited that, within a pleural effusion, a part of the lung becomes atelectatic and adheres to another part of the lung. This adhesion persists after the resolution of the effusion, and cannot refill with air, leading to the formation of "trapped" lung. The other possible mechanism, described by Schneider et al,[8] and supported by Dernevik et al,[6] and Menzies and Fraser,[9] is that the primary event is a local pleuritis caused by irritants such as asbestos: the pleura contracts and thickens, then the underlying lung shrinks, and atelectasis develops in a round configuration. Others have suggested that both mechanisms can coexist and can lead to the formation of rounded atelectasis in a patient who has had substantial asbestos exposure.[1]

Fig. 3. Macroscopic view showing a violet/dark-red prolate ellipsoidal nodule (approximately 1.7 cm × 1.4 cm × 1 cm), with hyaline thickened white/tan pleura, projecting into the nodule.

Rounded atelectasis is typically subpleural in position, always in contact with the thickened pleura in at least one projection, mainly at the lung bases.[8] It is usually rounded or oval, measuring 2.5–5 cm in diameter.[10] The radiologic findings are usually characteristic. Gevenois et al[11] identified the following criteria to diagnose rounded atelectasis via high-resolution CT: (1) rounded or lenticular mass in contact with the pleura, (2) pleural thickening in contact with the rounded atelectasis, (3) acute angle between the pleura and the mass, and (4) the "comet tail" sign, which is due to the presence of vessels and bronchi that converge upon and appear to swirl around the mass. It extends from the mass toward the ipsilateral hilum. It is absent in atypical forms of lobar or segmental atelectasis, where there are no pleural changes.[8] Another uncommon CT feature is "crow's feet," which consists of linear bands radiating from the mass into the surrounding lung parenchyma.[12] Other possible radiographic signs are reduction in size of and hyperlucency of the affected lobe,[7] an air bronchogram

within the mass,[5] and the presence of asbestos-related pleuroparenchymal fibrosis.[1]

Rounded atelectasis is metabolically inactive on positron emission tomograms.[13] However, a major limitation to widespread use of positron emission tomography as a first-line imaging modality for solitary pulmonary nodules, including rounded atelectasis, is its limited availability and cost-effectiveness, especially in patients at high risk for malignancy.[14]

Rounded atelectasis is usually asymptomatic. Occasionally, an associated pleural effusion may cause signs and symptoms. However, a free pleural effusion is seldom, if ever, present at the time the mass is identified.[8,15]

No specific therapy is needed for rounded atelectasis. It is usually either stable or a very slowly growing process,[5,10] with possible spontaneous resolution.[16] However, since many cases are associated with lung cancer, follow up is necessary.[17]

With the associated increased incidence of mesothelioma and bronchogenic carcinoma in patients with asbestos exposure, it is imperative to have an accurate diagnosis in cases where the radiographic features are atypical. The role of positron emission tomography in such patients needs further study to assess the risks and benefits of observation versus surgical resection. Resection can be performed via standard thoracotomy, but less invasive techniques such as video-assisted thoracoscopic surgery may be used, especially in the presence of comorbid conditions.

In the case described above, although the patient had a history of asbestos exposure and pleural plaques on high-resolution CT, the CT findings did not meet the conventional criteria for rounded atelectasis: the lung nodule was irregularly shaped, with no evidence of a comet-tail sign, and it was not adjacent to the lateral chest wall pleural surface. Therefore, it probably arose from the interlobar visceral pleura, at the level of the major fissure, which may explain the absence of the comet-tail sign and the lack of visible adjacent pleural thickening on CT.

This case raises concerns about the accuracy of radiographic criteria in identifying rounded atelectasis, and it emphasizes the need to keep rounded atelectasis in the differential diagnosis of a single pulmonary nodule in a patient who has had asbestos exposure.

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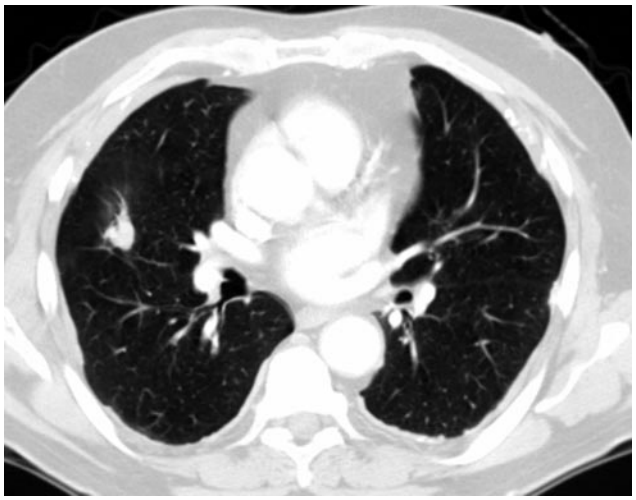

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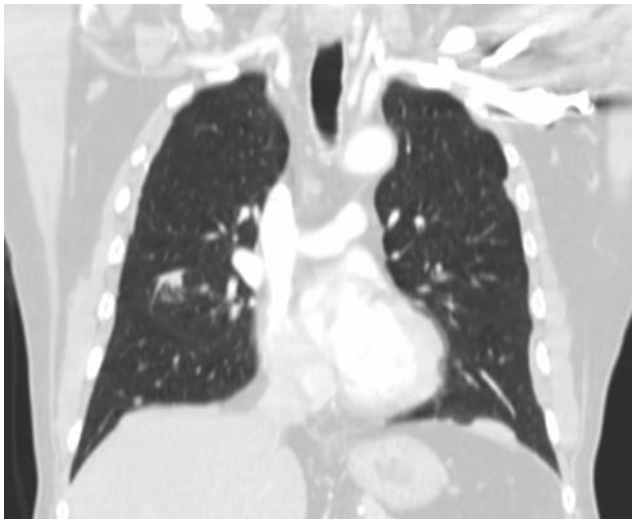

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