Journal of Thoracic Imaging
17:227–229 © 2002 Lippincott Williams & Wilkins, Inc., Philadelphia

Case Reports

Minute Pulmonary Meningothelial-like Nodules: High-Resolution Computed Tomography and Pathologic Correlations

Masaomi Kuroki, M.D.*, Hiroshi Nakata, M.D.*, Toshifumi Masuda, M.D.*, Norihisa Hashiguchi, M.D.*, Shozo Tamura, M.D.*, Kazuki Nabeshima, M.D.†, Yasunori Matsuzaki, M.D.‡, and Toshio Onitsuka, M.D.‡

Summary: Minute pulmonary meningothelial-like nodules (MPMNs), previously known as minute pulmonary chemodectomas, are relatively rare lesions. They are small (1–3 mm) and often multiple. Pathologically, they represent an interstitial nodular proliferation of small oval or spindle-shape cells arranged in a "zellenballen" nesting pattern. The function and origin of the cells are unknown. These nodules are associated with specific conditions, including thromboembolism, cardiac disease, and malignancy. We describe a patient with MPMNs and adenocarcinoma of the lung in whom HRCT showed tiny (1–3 mm in diameter) nodules of ground-glass attenuation.
Key Words: Minute pulmonary meningothelial-like nodules—High-resolution computed tomography.

A 2-cm pulmonary nodule was incidentally discovered on screening chest radiographs in a 55-year-old nonsmoking Japanese woman. She was referred to our institution for further evaluation and treatment. Both high-resolution CT (HRCT) and routine contrast-enhanced chest CT were obtained (10-mm collimation; WL: −500; WW: 2,000) for staging suspected lung cancer. The nodule was seen in the right upper lobe and showed inhomogeneous enhancement and an irregular border with fine spiculation. The nodule was surrounded by a zone of ground-glass opacity (Fig. 1 A). CT findings were thought to be consistent with a malignant tumor, most likely a well-differentiated adenocarcinoma. Laboratory evaluation showed an elevated carcinoembryonic antigen (CEA) (16.6 ng/mL; normal value: <4.7 ng/mL). Measurements of other tumor-marker levels (CYFRA, NSE, Pro-GRP) were within normal limits.

*Department of Radiology, †Department of Pathology, ‡Department of Second Surgery, Miyazaki Medical College, Kiyotake, Miyazaki, Japan.

Address correspondence to Masaomi Kuroki, M.D., Department of Radiology, Miyazaki Medical College, 5200 Oaza Kihara, Kiyotake, Miyazaki 889–1692, Japan. E-mail: mkuroki@post1.miyazaki-med.ac.jp

MATERIALS AND METHODS

In addition to the right upper lobe nodule, we also found, on HRCT, tiny nodules of ground-glass (1–3 mm in diameter) attenuation in the right upper lobe (Figs. 1 A,B). The findings were considered nonspecific. Differential considerations included atypical adenomatous hyperplasia, bronchioloalveolar cell carcinoma, and smoking-related respiratory bronchiolitis. Fiberoptic bronchoscopy was performed with cytologic examination of material obtained from the dominant tumor in the right upper lobe, suggesting malignancy. A right upper lobectomy was performed with the assumption that the patient had stage IA (T1N0M0) lung cancer. The pathologic

DOI: 10.1097/01.RTI.0000020148.28724.33

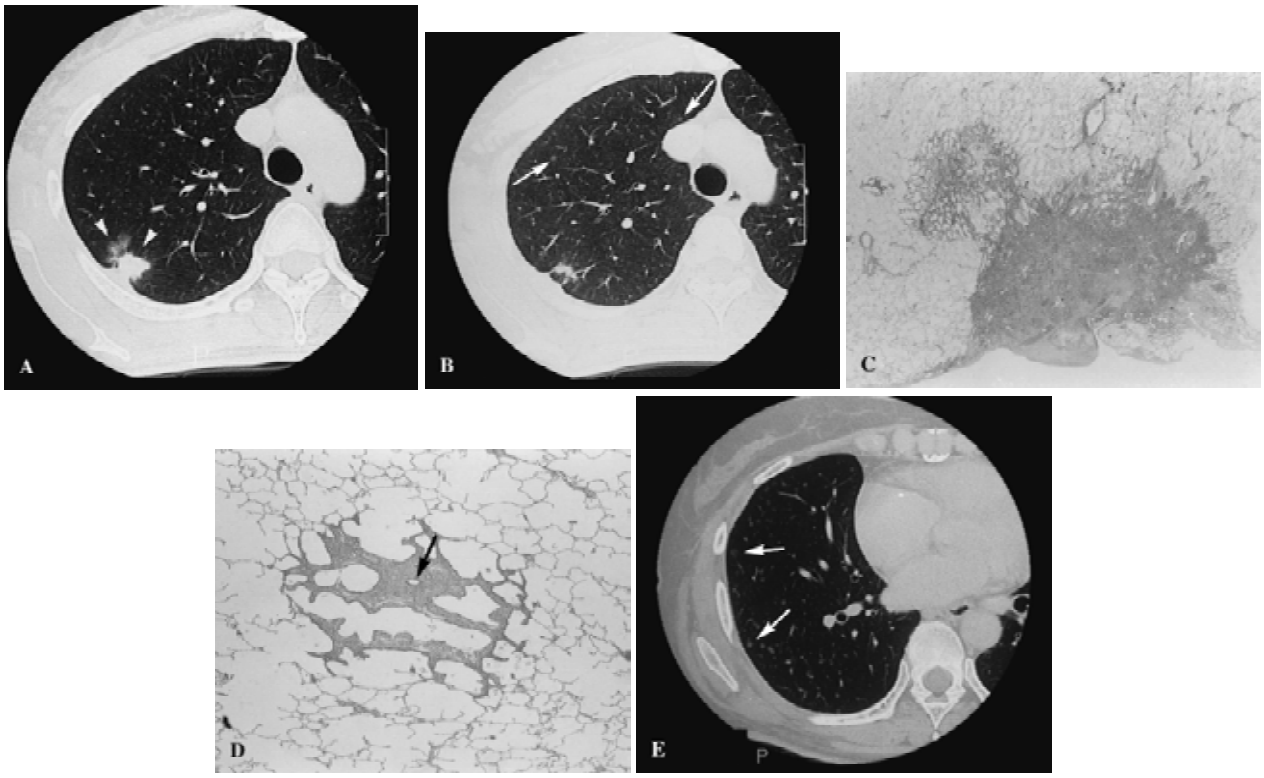

FIG. 1. A 55-year-old woman with MPMNs and adenocarcinoma of the lung. **A.** CT (2-mm collimation; WL: −500; WW: 2,000) scan shows a spiculated 2-cm nodule with adjacent ground-glass opacity (arrowheads) in the posterior segment of the right upper lobe, most suggestive of a primary adenocarcinoma. **B.** CT scan 5-mm cephalad to **A** shows tiny nodules of ground-glass attenuation (white arrows) in the right upper lobe. **C.** Low-power photomicrograph of the resected 2-cm nodule shows a well-differentiated adenocarcinoma, papillary subtype (H&E, ×10). **D.** Low-power photomicrograph shows cellular proliferations that are associated with a venule (arrow) and expand the alveolar walls with accompanying stromal fibrosis (H&E, ×40). **E.** Follow-up CT scan obtained 12 months after right upper lobectomy. Multiple small nodules (white arrows) are again evident and unchanged from HRCT performed 6 months postoperatively.

diagnosis of the main tumor was well-differentiated adenocarcinoma, papillary subtype (Fig. 1 C). The small nodules seen elsewhere in the right upper lobe were found to represent minute pulmonary meningothelial-like nodules (MPMNs) (Fig. 1 D). These lesions consisted of cellular proliferations of meningothelial-like cells with round to oval nuclei and indistinct cell borders associated with venules, which expanded the alveolar walls and were accompanied by stromal fibrosis.

A follow-up chest CT scan 6 months after lobectomy was performed to assess for tumor recurrence and to clarify the presence and the extension of MPMNs in other lung zones. Thin-section CT scans were obtained with 2-mm collimation at 15-mm intervals through the thorax during full inspiration. The scans revealed numerous small nodules of ground-glass attenuation that were thought to represent additional MPMNs (Fig. 1E). These lesions presented in a random distribution but had a tendency to be located in the peripheral lung zone. Retrospective review of the initial preoperative CT (10-mm collimation) revealed very tiny nodules corresponding to the nodules seen on the postoperative studies. The lesions showed no change in morphologic characteristics of the ground-glass nodules. Although the lesions seen in the other lobes were not sampled histologically, they were stable for an additional 6-month period.

DISCUSSION

To our knowledge, there is only a single description of MPMNs in the English literature (1). Although conventional CT and HRCT were performed in our case, only HRCT could accurately depict the scattered minute areas of ground-glass attenuation. The lesions presented in a random distribution but had a tendency to be located in the periphery of the lung. Microscopic examination of the resected lung demonstrated a greater profusion of nodules than were detected by HRCT. Pathologically, the lesions consist of cellular proliferations that expand the alveolar septa and are accompanied by stromal fibrosis. The airspaces remained patent within the lesions. In

our opinion, the spread of the lesion along the alveolar walls likely results in the ground-glass attenuation seen on HRCT.

Meningothelial-like nodules, previously known as minute pulmonary chemodectomas, are relatively rare lesions (2–7). They appear as millimeter-size, interstitial, nodular proliferations of small, oval and spindle-shape cells. The origin and nature of these lesions are unknown. However, recent studies indicate that the cells in these lesions are similar to those of meningiomas (2,7), hence the use of the descriptive term "meningothelial-like nodules."

Clinically, these nodules are incidental pathologic findings, usually discovered microscopically in resected surgical or autopsy specimens. The incidence of the lesions is estimated to be 0.3% to 4% in unselected autopsy cases (6). Korn et al. (4) described 19 cases, including 14 in females and four in males. Eighty-four percent of all cases to date have occurred in women. Meningothelial-like nodules in the lung have been found in people aged 12 to 91 years, being most common in the seventh decade. They are multiple in 30% to 50%. The lesions are associated with thromboembolism in up to 51% of cases, cardiac disease in 48%, and malignancy in 28% (6). A recent study of 357 cases of primary bronchogenic carcinoma found MPMNs in association with 10% of adenocarcinomas and 3.5% of squamous cell carcinomas (5). Minute pulmonary meningothelial-like nodules were seen in our patient with adenocarcinoma of the lung.

Multiple studies attempting to elucidate the origin of meningothelial-like nodules using various immunohistochemical analyses have not clarified the origin and the nature of these lesions (2–4). Gaffey et al. (2) reported that meningothelial-like nodules were immunoreactive for epithelial membrane antigen (EMA) and vimentin and were negative for cytokeratin, S-100 protein, neuron-specific enolase, and actin. The immunohistochemical features of these pulmonary nodules supported meningothelial differentiation. In contrast, Torikata and Mukai (3) reported positive immunoreactivity for myosin and vimentin in all meningothelial-like nodules.

Minute pulmonary meningothelial-like nodules are rare, and the HRCT findings are nonspecific. The final diagnosis of persistent small areas of ground-glass attenuation on HRCT requires histopathologic analysis. Although adenocarcinoma of lung may present as a multifocal process, it is important not to assume that ground-glass nodules in a lobe separate from the primary tumor in patients with adenocarcinoma reflects multifocal (and therefore unresectable) disease. Therefore, an awareness of the association of MPMNs presenting as ground-glass nodules in a patient with malignancy is important to guide appropriate management of the primary tumor.

REFERENCES

1. Sellami D, Gotway MB, Hanks DK, et al. Minute pulmonary meningothelial-like nodules: thin-section CT appearance. *J Comput Assist Tomogr* 2001;25(2):311–313.
2. Gaffey MJ, Mills SE, Askin FB. Minute pulmonary meningothelial-like nodules: A clinicopathologic study of so-called minute pulmonary chemodectoma. *Am J Surg Pathol* 1988;12:167–175.
3. Torikata C, Mukai M. So-called minute chemodectoma of the lung: An electron microscopic and immunohistochemical study. *Virchows Arch A* 1990;417:113–118.
4. Korn D, Bensch K, Liebow AA, et al. Multiple minute pulmonary tumors resembling chemodectomas. *Am J Pathol* 1960;37:641–672.
5. Niho S, Yokose T, Nishiwaki Y, et al. Immunohistochemical and clonal analysis of minute pulmonary meningothelial-like nodules. *Hum Pathol* 1999;30(4):425–429.
6. Colby TV, Koss MN, Travis WD. *Atlas of tumor pathology: Tumors of the lower respiratory tract*. Washington: AFIP; 1995:474–478.
7. Khun D, Askin FB. The fine structure of so-called minute pulmonary chemodectomas. *Hum Pathol* 1975;6:681–691.