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Metastatic Meningioma to the Lung With Multiple Pleural Metastases

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Meningiomas with both malignant clinical behavior and cytology are rare. Meningiomas comprise approximately 15% of the primary brain tumors. The majority are benign; less than 1% metastasize, most commonly to the lung (61%) followed by liver, lymph node, and bone. Approximately 130 cases of extracranial metastatic meningiomas have been described. Only 13% had more than three metastases, with few cases reported with extensive pleural involvement. We report an interesting case of a malignant meningioma that invaded through the skull in the frontal sinus that later metastasized to the left lung with multiple pulmonary and pleural nodules.
Key Words: Meningioma—Metastasis—Lung—Pleura.

Meningiomas with both malignant clinical behavior and cytology are rare. Meningiomas comprise approximately 15% of the primary brain tumors. The majority are benign; less than 1% metastasize, most commonly to the lung (61%) followed by liver, lymph node, and bone.[1] Approximately 130 cases of extracranial metastatic meningiomas have been described.[2–13] Only 13% had more than three metastases, with few cases reported with extensive pleural involvement.[6,14]

CASE REPORT

A 68-year-old male patient developed a bulge over his right frontal skull region in October 1996. His history was significant for prior radiation to the cranium for a hemangioma during childhood. A magnetic resonance imaging scan revealed a dural-based mass in the right anterior cranial fossa, and biopsy revealed a malignant neoplasm consistent with malignant meningioma. The patient underwent a craniotomy and resection in November 1996 for the right frontal lobe meningioma that invaded through the skull and in the right frontal sinus. Histologically, the tumor had broad-based pushing margins in the right frontal lobe, but no definitive brain invasion was seen (Fig. 1). Approximately half of the tumor had the typical appearance of a meningioma with syncytial and whorled meningothelial cells having bland cytology. In the remaining areas, the tumor cells sheeted out and focal areas of tumor necrosis were present. The cells in this area had atypical cytology and frequent mitoses (Fig. 2). The atypical cytology, the sheeting out of cells, tumor necrosis, and frequent mitoses were sufficient to classify this lesion as a malignant meningioma.

A postoperative magnetic resonance imaging scan in December 1996 revealed minimal enhancement consistent with either postsurgical inflammation or minimal residual tumor. The patient was then treated with radiotherapy to a dose of 6,120 cGy in 34 fractions. In July 1998, a magnetic resonance imaging scan demonstrated recurrent disease in the right frontal bone as well as a left parasagittal extraaxial mass. The patient was treated with stereotactic radiosurgery to a total dose of 3,200 cGy in 400-cGy fractions to the 80% isodose line from September 2, 1998 to September 14, 1998. He received a second course of stereotactic radiosurgery from June 8, 1999 to June 22, 1999 to a right temporal mass, right occipital lesion, and a right frontal lesion (Figs. 3A, B). During the course of his therapy, shortness of breath developed and he was noted to have near complete opacification of the left lung but no evidence of volume loss. There was no shift of the mediastinum, which suggests both atelectatic lung and a large pleural effusion (Fig. 4). A computed tomography scan on June 11, 1999 demonstrated a large left pleural effusion causing near complete atelectasis of the left lung. Within the left mid and lower parts of the chest, there were multiple pleural-based enhancing masses, particularly in the posterior costophrenic sulcus. There also appeared to be a lymph node posterior to the right pulmonary artery (Fig. 5). A thoracentesis was performed, and the cytopathology was nondiagnostic. On June 19, 1999, the patient underwent a computed tomography-guided biopsy of one of the pleural-based nodules.

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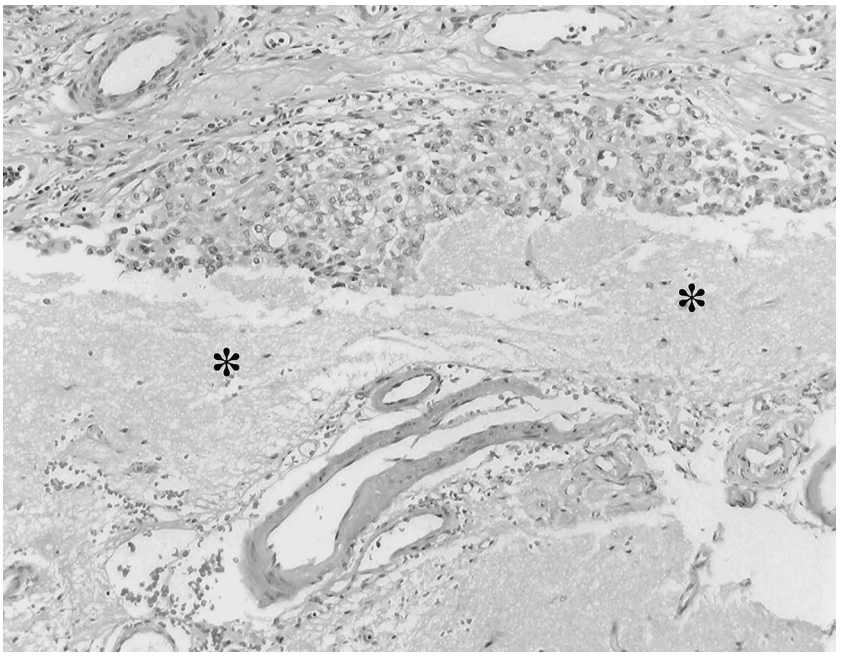

FIG. 1. Tumor (upper half of image) broadly pushes in brain (asterisk), but there was no definitive brain invasion. The tumor had extensive epidural invasion including invasion in the scalp and underlying respiratory mucosa of the frontal sinuses.

Cytopathology was consistent with metastasis from the patient's known intracranial meningioma. The biopsy specimen from the pleural-based nodule was moderately cellular and composed predominately of large tissue fragments, many of which exhibited ''epithelioid'' features. The fragments were composed of monomorphic cells with bland and round nuclei and moderate granular cytoplasm. Additionally, peripheral feathering of cells was present in many of the cellular groups. Immunohistochemical staining for epithelial membrane antigen revealed positive staining in the tumor cells, a finding consistent with a diagnosis of meningioma (Fig. 6). The patient's respiratory status continued to deteriorate, and he died approximately 31/2 years after his original presentation, but only 8 months after thoracic metastases developed.

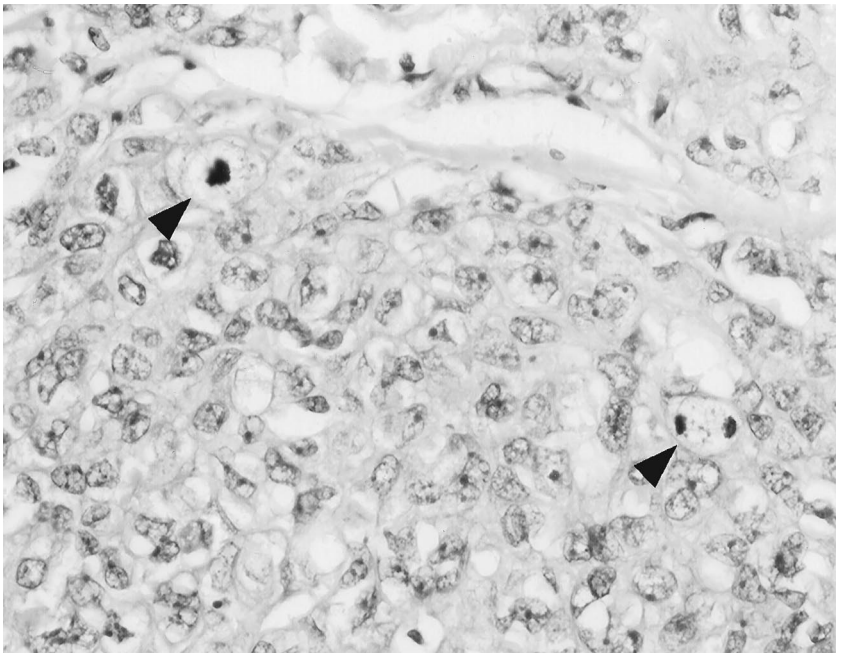

FIG. 2. High-power magnification shows sheets of tumor cells with frequent mitoses (arrowheads). Other areas of the tumor show tumor necrosis. These findings are consistent with a malignant meningioma.

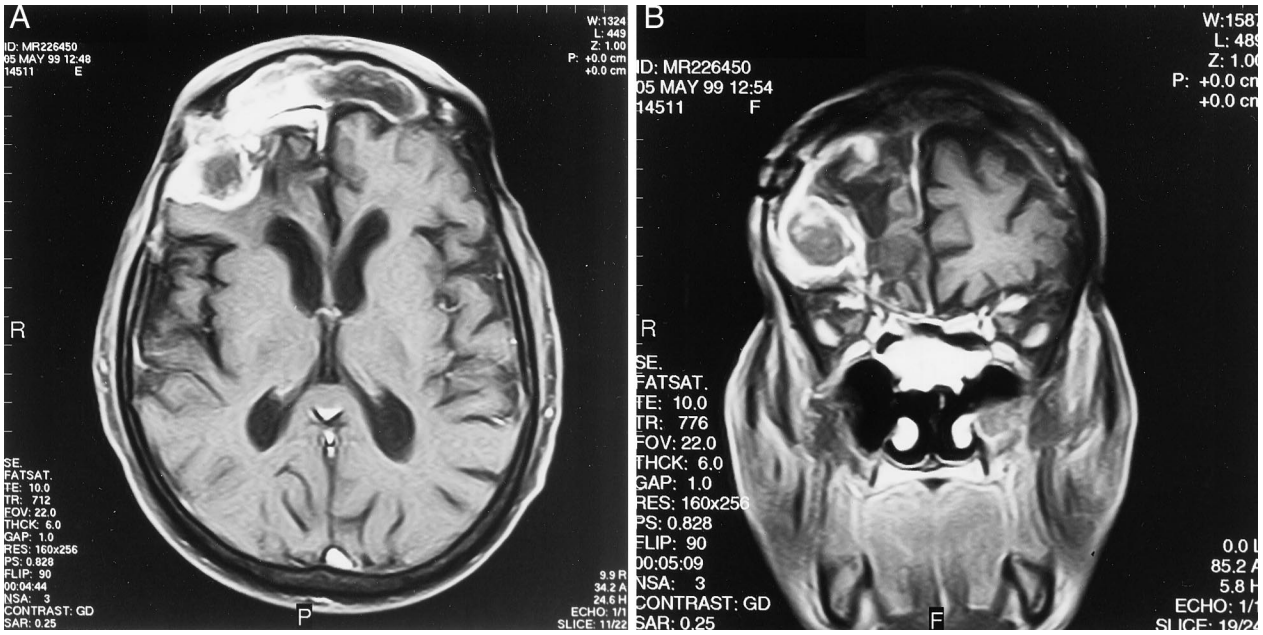

FIG. 3. T1-weighted contrast enhanced magnetic resonance imaging axial and coronal images show approximately a 4 × 4-cm ring enhancing mass in the right frontal lobe.

DISCUSSION

Meningiomas comprise 15% of intracranial neoplasms. Meningiomas occur at any age, but usually in women (2:1) between the ages of 20 and 60 years, with a peak incidence at age 45.[1] Malignant meningiomas occur in an almost equal frequency between men and women, with a peak incidence in the seventh decade.[4] Our patient was age 66 when seeking treatment and was male. Approximately a fourfold increase of meningiomas is found in those with previous cranial irradiation.[15] This patient had cranial irradiation for a hemangioma in childhood.

Intracranial meningiomas are typically slow growing, circumscribed tumors that compress but do not invade the brain. Malignant meningiomas, as in this patient's case, comprise as high as 1.8% of the of all meningiomas and have an incidence of metastasis of 43%.[11] Malignant meningiomas have one of the highest rates of metastasis for primary central nervous system tumors.

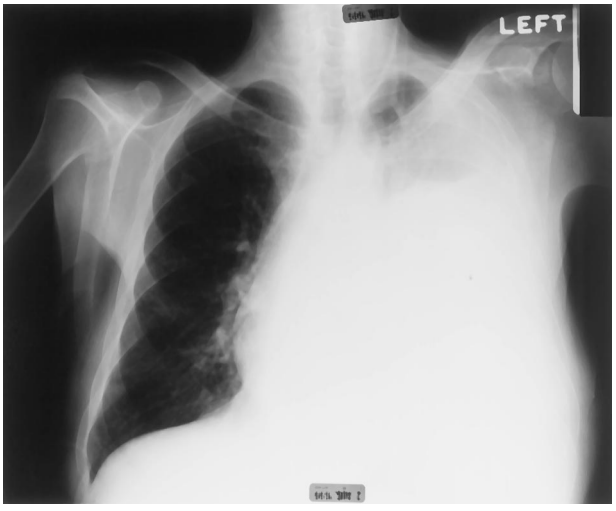

FIG. 4. A chest radiograph showing near complete collapse of the left lung.

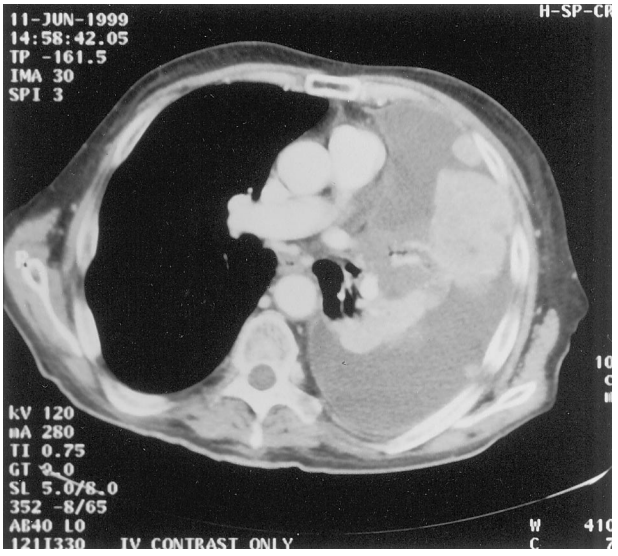

FIG. 5. An enhanced computed tomography scan of the chest demonstrating left pleural-based lesions.

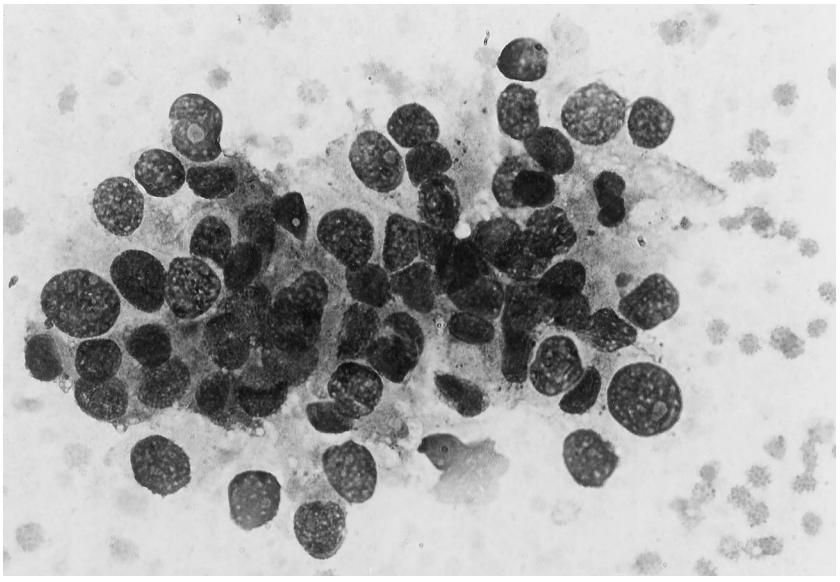

FIG. 6. Metastatic meningioma in the lung. Large tissue fragments are composed of monomorphic cells with bland round nuclei, moderate granular cytoplasm, and ''epithelioid'' cytomorphologic features. Peripheral feathering of cells is present (Diff-Quik stain, ×400).

It is possible that the tumor can metastasize to the lung by microembolization, because most meningiomas arise from the arachnoid cells packing the arachnoid villi. The likelihood of metastasis is 0.1% to 0.76%,[1,11] most often to the lungs, typically with less than three metastatic foci.[2] To our knowledge, few cases of extensive pleural involvement have been reported in detail.[6,14] This is the second case of pleural spread with absence of tumor cells in the pleural effusion.[14] Typically, meningiomas involve one focal area of the brain and recur in the area of resection, unlike this patient, in whom four areas of involvement with bilateral hemispheric involvement later developed. In this patient, both the primary and the metastatic lesions shared the same histologic features.

The differential diagnosis of tumors with epithelioid morphology in the lung and/or pleura includes a number of entities. A primary or metastatic adenocarcinoma would be the most common origin. However, the relative monomorphic appearance, lack of glandular differentiation or anaplasia, positive epithelial membrane antigen stain, low nuclear/cytoplasmic ratio, and history of a primary meningioma are all indicative of metastatic meningioma. Malignant epithelioid mesotheliomas show prominent pleomorphism and lack the monolayered and monomorphic appearance of meningiomas. The lack of cytoplasmic pigment, prominent nucleoli, and anaplasia are not suggestive of melanoma.

This case should raise the awareness of clinicians to the possibility of pulmonary metastases even with a negative pleural effusion in a patient with primary malignant meningioma.

REFERENCES

1. Kepes JJ. *Meningiomas. Biology, pathology, and differential diagnosis.* Vol. 4. New York: Masson Publishing, 1982.
2. Stoller JK, Kavuru M, Mehta AC, et al. Intracranial meningioma metastatic to the lung. *Cleve Clin J Med* 1987;54:521–7.
3. Safneck JR, Halliday WC, Quinonez G. Metastatic meningioma detected in pleural fluid. *Diagn Cytopathol* 1998;18:453–7.
4. Baisden BL, Hamper UM, Ali SZ. Metastatic meningioma in fine-needle aspiration of the lung. *Diagn Cytopathol* 1999;20: 291–4.
5. Slavin ML. Metastatic malignant meningioma. *J Clin Neuroophthalmol* 1989;9:55–9.
6. Tao LC. Pulmonary metastasis from intracranial meningioma diagnosed by aspiration biopsy cytology. *Acta Cytol* 1991;35:524–8.
7. Fischer HP, Schachennmayr W. Metastatic meningioma. *Pathologe* 1991;12:70–6.
8. Lee TT, Landy HJ. Spinal metastasis of malignant intracranial meningioma. *Surg Neurol* 1998;50:437–41.
9. Nabeya Y, Okazaki Y, Watanabe Y, et al. Metastatic malignant meningioma of the liver with hypoglycemia. *Surg Today* 1998;28: 953–8.
10. Tworek JA, Mikhail AA, Blaivas M. Meningioma: local recurrence and pulmonary metastasis diagnosed by fine needle aspiration. *Acta Cytol* 1997;41:946–7.
11. Enam SA, Abdulrauf S, Mehta B, et al. Metastasis in meningioma. *Acta Neurochir (Wien)* 1996;138:1172–7.
12. Murrah CP, Ferguson ER, Jannelle RL, et al. Resection of multiple pulmonary metastasis from a recurrent intracranial meningioma. *Ann Thorac Surg* 1996;61:1823–4.
13. Rawat B, Franchetto AA, Elavathil J. Extracranial metastasis of meningioma. *Neuroradiology* 1995;37:38–41.
14. Allen IV, McClure J, McCormick D, et al. LDH isoenzyme pattern in a meningioma with pulmonary metastasis. *J Pathol* 1977;123: 187–91.
15. Rubinstein AB, Shalit MN, Cohen ML, et al. Radiation-induced cerebral meningioma: a recognizable entity. *J Neurosurg* 1984;61: 966–71.