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Metastases to Meningioma

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Summary: We describe a patient with metastatic disease to an intracranial meningioma in which MR images showed multiple foci of intense enhancement within a background of moderate enhancement. The discrete foci proved to be metastatic disease from the patient's known breast carcinoma.

A number of cases of metastatic carcinoma to intracranial meningiomas have been reported; however, few reports have included imaging descriptions of this abnormality, and in no case was the correct preoperative diagnosis established with CT (1, 2). We describe the MR imaging appearance of a metastatic breast carcinoma to a large intracranial meningioma in which the metastases were visible as foci of marked enhancement.

Case Report

A 79-year-old woman was admitted to the hospital in status epilepticus. Her seizures were controlled with phenytoin and phenobarbital. Two years previously she had undergone a left-sided mastectomy and radiotherapy for localized breast carcinoma. Prior to the current admission she had no known metastatic disease, either on clinical or radiologic examination.

MR imaging showed a left frontal convexity extraaxial mass (Fig 1A–C). Infusion of contrast material resulted in moderate enhancement, with multiple foci of more intense enhancement within the lesion. These areas had different signal characteristics from that of the remainder of the mass, with most lesions appearing relatively hypointense on T2-weighted images, but some showing greater T2 prolongation. No evidence of hyperintense blood was seen on precontrast T1-weighted images, and noncontrast CT scans showed no evidence of foci of acute hemorrhage or calcification. There was thickening of the adjacent dura with an enhancing dural tail. No other lesions were observed. Conventional angiography disclosed a markedly enlarged left middle meningeal artery supplying the central portion of the tumor in a spoke-wheel pattern, with a dense homogeneous tumor blush.

The tumor was surgically exposed through a left paracentral craniotomy. Although the tumor had a vascular dural base, multiple feeding or draining vessels arose from the pia-arachnoid. After internal decompression, a plane between the tumor and adjacent pia-arachnoid was established. A circumferential dissection was completed with coagulation and division of feeding or draining pia-arachnoidal vessels. To a large extent, the pia-arachnoid was left intact; grossly, there was no brain invasion. The overlying calvaria did not appear abnormal, and a total gross resection of tumor was achieved.

Pathologic examination revealed a transitional-type meningioma with a basal attachment to the dura. The surface was lobulated (Fig 1D) and, at microscopic examination, some thin, adherent, discontinuous cerebral cortex was present that was not invaded by tumor. The meningioma was composed of sheets and loose whorls of meningotheliomatous cells without atypia or necrosis. Distinct from the meningioma were foci of metastatic carcinoma (Fig 1E). These consisted of infiltrating cords of cells with central lumina and fairly frequent mitoses, together with mucicarmine-positive material, mostly intraluminal but also intracytoplasmic. The centers of the foci were sclerotic rather than necrotic. Many cells showed estrogen-receptor positivity as compared with the minimal positivity of the meningotheliomatous cells. Only infrequently did the carcinoma extend to the surface, but neither it nor the meningioma invaded the cerebral cortex. The features were consistent with metastases from breast carcinoma to a well-differentiated transitional cell meningioma.

Postoperatively, the patient had intermittent seizures and episodes of respiratory distress. Six days later, she died of hypoxic asystolic arrest, presumed to be secondary to aspiration, related to a seizure. An autopsy was not performed.

Discussion

Although it is not uncommon for multiple types of tumor to arise within the same patient, metastases of one to the other are rare (3). In an epidemiological study of 193 patients with meningioma, only one had evidence of metastasis (4). Despite this low rate of occurrence, meningiomas are the most common primary intracranial tumor to harbor metastases, the majority of which arise from lung or breast carcinomas (1–3, 5, 6). Predisposing factors include the loss of a tumor-suppressor gene associated with syndromes of multiple primary tumors (often including meningioma), increasing the likelihood of two or more tumors coexisting in the same patient; a hormonal relationship between meningioma and breast cancer, also increasing the likelihood of both tumors coexisting; the rich vascular supply to many meningiomas; and the fact that tumors have poorer immune surveillance systems than do normal tissues. Oddly, in the case of metastases to intracranial lesions, metastases to the remainder of the brain are rare (1).

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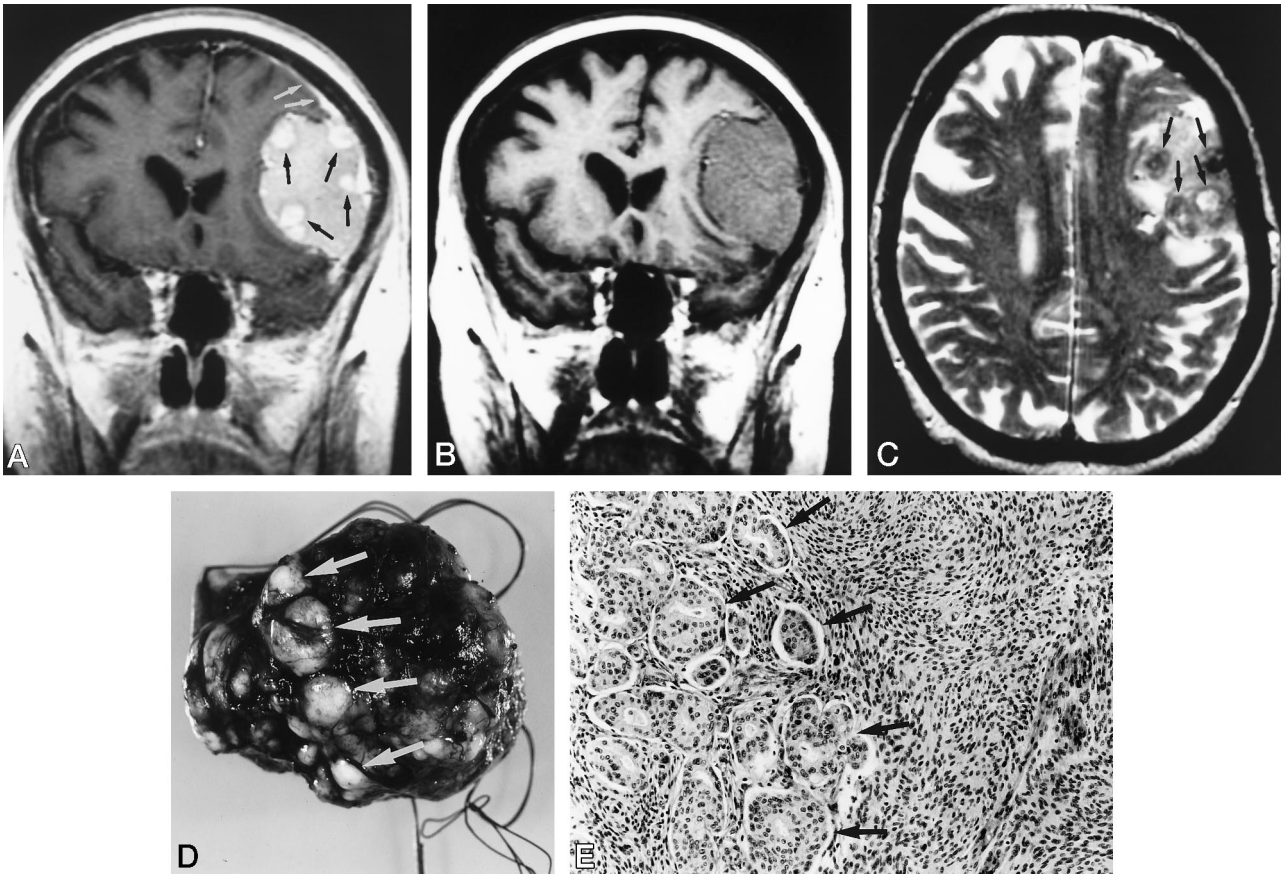

FIG 1. 79-year-old woman with seizures and history of breast carcinoma.

A, Contrast-enhanced coronal T1-weighted (500/11/2 [TR/TE/excitations]) MR image shows enhancing mass in the middle left frontal convexity and multiple foci of more intense enhancement, representing metastatic deposits (*black arrows*). Enhancing dural tail is also noted (*white arrows*).

B, Noncontrast coronal T1-weighted (500/11/2) MR image at the same level shows no evidence of hyperintensity in the mass to suggest foci of hemorrhage.

C, Axial T2-weighted (3400/102/1) MR image shows that the foci of more intense enhancement have different signal characteristics from the rest of the mass (*arrows*).

D, Grossly, the surgical specimen shows the smooth-surfaced lobulation common to meningiomas. In addition, several superficial nodules (*arrows*) correspond to the areas of differing signal seen on the MR images.

E, Microscopically, the sheets and loose whorls of the uniform meningotheliomatous cells (*right*) are quite distinct from the cords of infiltrating metastatic carcinoma (*arrows, left*) (original magnification ×100).

Although the majority of meningiomas show uniform enhancement on CT and MR studies after contrast administration, many histologically benign meningiomas show nonenhancing areas caused by cystic or necrotic change. In one study, 64% of 193 meningiomas showed nonhomogeneous enhancement (2). Nonenhancing areas are more frequent in atypical or malignant meningioma (7). The unique feature in this case was multiple discrete foci of *more* intense enhancement within the meningioma that were pathologically proved to be metastases from the patient's known breast carcinoma.

We have found two reports describing the CT characteristics of metastases to meningioma. In one case, an unusual, ring-enhancing, centrally hypodense focus was seen (3). In the other, the metastasis was indistinguishable from surrounding meningioma (4). These authors suggested that in patients with a history of cancer, a focal hypodensity within a meningioma should raise the possibility of metastatic disease. This appearance is, however, nonspecific and could be due to areas of calcification, hemorrhage, cystic or fatty degeneration, or necrosis (7).

Conclusion

Judging by the limited number of previous CT reports, not all metastases to meningioma would be expected to exhibit more intense enhancement than the background benign lesion; however, when this appearance is present on MR images, it should raise the suspicion of metastatic disease, particularly when there is a history of carcinoma.

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