

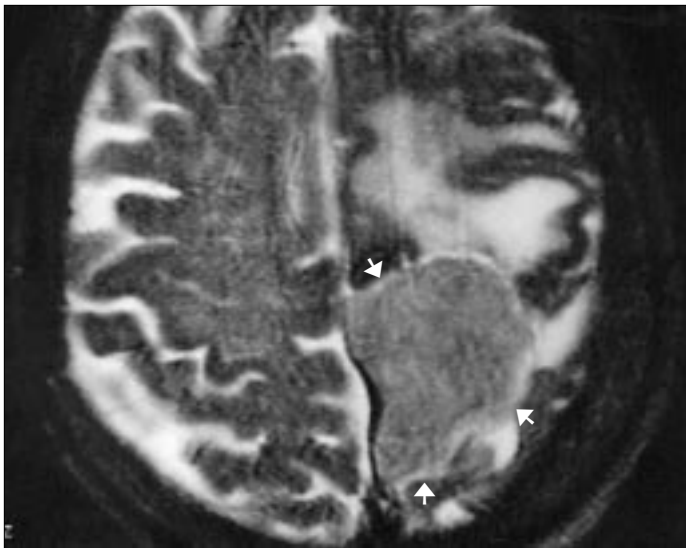
## Seizure, headaches, and right hemiparesis

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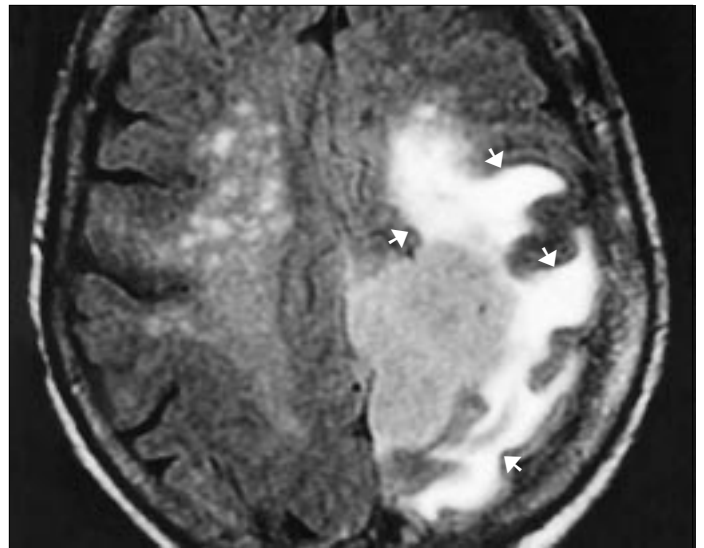
An 81-year-old woman consulted her physician because of a recent seizure. She also stated that she had frequent headaches and that her right arm and leg were weak. Radiographs of

the skull were normal. Magnetic resonance (MR) images are shown below (Figures 1–4).

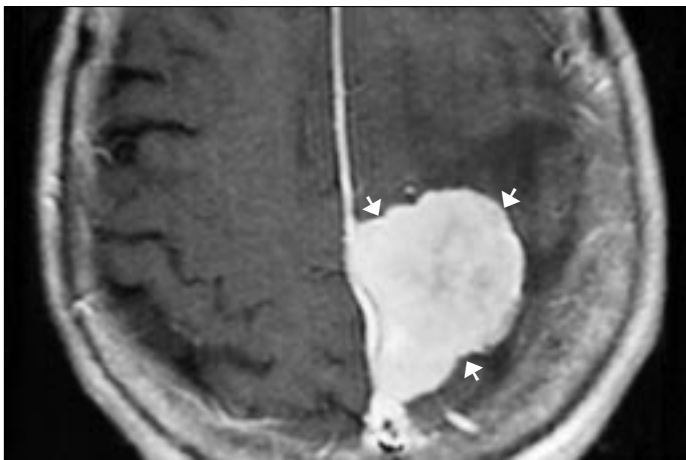
For diagnosis and discussion, see the following page.



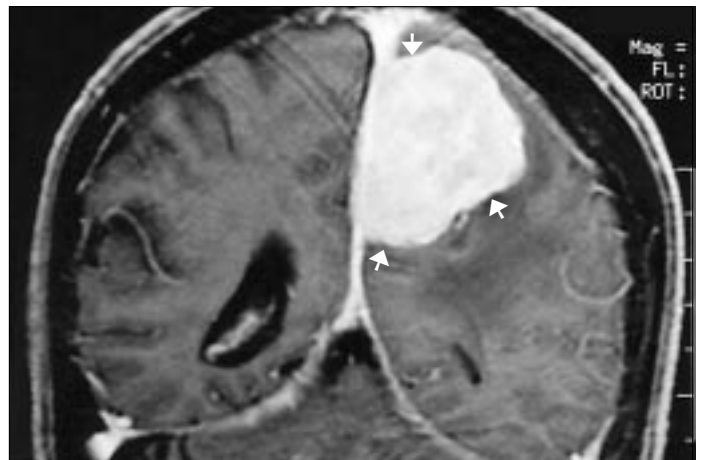
**Figure 1.** Axial T2-weighted MR image shows a left parasagittal mass (arrows) that is contiguous with the falx.



**Figure 2.** Axial fluid-attenuated inversion recovery MR image demonstrates a large amount of edema (arrows) in the white matter surrounding the mass.



**Figure 3.** Axial postcontrast T1-weighted MR image shows that the mass (arrows) enhances strongly after contrast administration.



**Figure 4.** Coronal postcontrast T1-weighted MR image demonstrates the strongly enhancing mass (arrows) contiguous with the falx.

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**DIAGNOSIS:** Meningioma.

## DISCUSSION

Meningiomas are relatively common, slow-growing, generally benign tumors with an incidence of 2% to 3% per 100,000 population (2). They are the most common extra-axial tumors in adults and the most common nonglial primary neoplasms of the brain. Meningiomas represent 15% to 18% of all primary intracranial tumors (1).

These tumors arise from meningotheial cells concentrated in the arachnoid villi that invade the dura (1). Most meningiomas are extra-axial, or outside of the brain parenchyma, and are dural based. Ninety percent of these tumors are supratentorial and are most often parasagittal, arising from the dura of the superior sagittal sinus (2). The second most common location is the cerebral convexities. These convexity meningiomas arise from the dura that covers the cerebral hemispheres. Other less common locations include the sphenoid bone, olfactory groove, parasellar regions, and intraventricular surfaces. Meningiomas are rare in children, but when they do occur, the most common location is the posterior fossa.

Meningiomas are typically single, globular masses with a broad, flattened base abutting the dural surface. A “dural tail” is a classic but nonspecific associated finding that represents thickened dura that tapers away from the tumor (2). The less common morphological appearance is that of a flat lesion, referred to as an “en plaque” meningioma. Although they are usually single, multiple meningiomas do occasionally occur and are seen in neurofibromatosis type 2. The typical globular lesions commonly displace the adjacent brain parenchyma secondary to the local mass effect of the tumor.

Meningiomas are twice as common in women as in men and typically occur in middle-aged and elderly patients (1). Patients with a history of radiation therapy are believed to be predisposed to developing these tumors (2). A relation between meningiomas and sex hormones is thought to exist: besides being more common in women, these tumors have a positive correlation with breast cancer, they have been known to grow larger during pregnancy, and many contain hormone receptors. Because <10% of meningiomas cause symptoms, most are found incidentally or at autopsy (2). When symptoms are present, they are related to tumor location and the compressive effects of the tumor. Common symptoms are seizures, headaches, hemiparesis, and cranial nerve palsies.

Nearly all meningiomas are histologically benign. Several classification schemes have been developed, but the one most commonly used is the World Health Organization (WHO) scheme, which is based on biological behavior (2). Meningiomas are graded as follows: grade I (typical), grade II (atypical), and grade III (malignant). Ninety percent of all meningiomas are classified as WHO grade I and are benign, 5% to 7% are WHO

grade II and have increased cellularity and mitosis, and 1% to 3% are WHO grade III and are anaplastic or malignant (3).

Malignant meningiomas are very rare, and the diagnosis is usually extremely difficult because the biological behavior of the tumor does not necessarily correlate with the histology of the tumor. Brain invasion, with or without pial disruption, constitutes by definition a malignant meningioma (4). Invasion of the brain parenchyma is usually associated with marked surrounding brain edema and reactive gliosis (2).

On computed tomography, >90% of meningiomas are solid and hyperdense, with striking enhancement after the administration of intravenous contrast (2). Approximately 25% contain calcifications (2), and the underlying skull is frequently hyperostotic. Many meningiomas elicit hyperostosis without invasion of the calvarium. However, some lesions will actually penetrate the skull, causing extensive bony thickening and osteoblastic reaction (4). Meningiomas can penetrate the entire skull and present as a scalp mass. While CT is good in detecting calvarial change, the multiplanar imaging capability of MR imaging makes it more sensitive in detecting calvarial invasion (4).

Meningiomas rarely contain hemorrhage. Approximately 60% have associated edema within the adjacent brain parenchyma (2). On MR imaging, these lesions are usually isointense to gray matter on both T1- and T2-weighted images. They also demonstrate significant enhancement with gadolinium. A “dural tail” is identified in approximately 60% of lesions (2). Angiographically, the vascular nidus within the tumor has a “sunburst” or “spoke-wheel” appearance (1). A prolonged angiographic blush can typically be demonstrated, which has been called the “mother-in-law sign,” as the angiographic contrast material, like many a mother-in-law, “comes early and stays late.”

Prognosis is usually good because most meningiomas are benign. The prognosis does, however, depend on the location and resectability of the tumor. For symptomatic or large lesions, surgical resection is the treatment of choice. Radiation therapy is an option for nonresectable tumors or for patients who are not surgical candidates. Some meningiomas can go untreated because they are benign and slow growing. The 5-year recurrence rate for typical, grade I meningiomas is 3% to 7%; for grade II tumors, approximately 33%; and for grade III tumors, as high as 75%. Metastatic disease occurs rarely. The histopathology of the tumor does not always correlate with tumor behavior—histologically benign tumors have been shown to metastasize, while some anaplastic tumors do not develop metastatic lesions (2).

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3. Osborn AG, Blaser SI, Salzman KL. *Pocket Radiologist. Brain. Top 100 Diagnoses*. Salt Lake City: Amirsys, 2002:150–152.
4. Atlas SW. *Magnetic Resonance Imaging of the Brain and Spine*, 2nd ed. Philadelphia: Lippincott-Raven, 1996:424–446.