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Pictorial Review

Dilemmas and diagnostic difficulties in meningioma

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This article will review the uncommon locations and morphological features of meningiomas, which are important to recognize in order to avoid misdiagnosis. Uncommon locations will be demonstrated at the cerebellopontine angle, pineal, optic, intraventricular, and intradiploic regions. Unusual imaging features including cysts, metaplastic changes, and peritumoural oedema will also be discussed.

Introduction

Meningiomas are the most common primary, non-glial tumours of the brain and spine, and represent the most common extra-axial lesions, accounting for 13–20% of all intracranial tumours.[1] They are predominantly benign neoplasms that are derived from meningothelial cells, and less than 10% ever cause clinical symptoms. The majority of meningiomas are sporadic, although several associations exist with 10% of multiple meningiomas associated with neurofibromatosis type 2.[2]

Characteristic imaging features have been described; however, there are several important variants of meningioma with unusual and potentially misleading radiological features. Several important mimics also exist. This article will highlight several examples of uncommon locations and morphological features of meningiomas, which are important to recognize in order to avoid misdiagnosis.

Classical features of meningioma

The typical meningioma is a dural-based, markedly enhancing extra-axial mass. The most common locations include over the cerebral convexity, in the parasagittal region, or arising from the sphenoid wing. They exhibit cortical buckling with trapped cerebrospinal fluid clefts or cortical vessels (Figs 1 and 2).[1,2]

At computed tomography (CT), typical diagnostic features include a well-circumscribed, smooth mass with a broad dural attachment. In 75% of cases, the meningioma is hyperdense, with homogeneous enhancement after the administration of contrast material. Hyperostosis of the adjacent calvarium and calcification (20–25%) are also common features. These findings can rarely be seen on plain radiographs.[1]

At magnetic resonance imaging (MRI), a typical well-circumscribed, unilobular mass is apparent with improved visualization of underlying “cortical buckling”. This feature is common to extra-axial masses and is characterized by compression of the grey matter deep to the lesion with distortion of the underlying white matter. Meningiomas are characteristically hypo to isointense on T1-weighted (T1W) images and iso to hyperintense on T2-weighted (T2W) images. Greater than 95% of the masses demonstrate homogeneous, intense enhancement on MRI images obtained following gadolinium.[1] On conventional angiography, a persistent contrast blush has also been described.[2]

On diffusion-weighted imaging, lower *apparent diffusion coefficient* values have been described in atypical or malignant variants of meningioma.[3] Magnetic resonance spectroscopy has been utilized with meningiomas demonstrating increased choline and reduced creatine. Coexistence of

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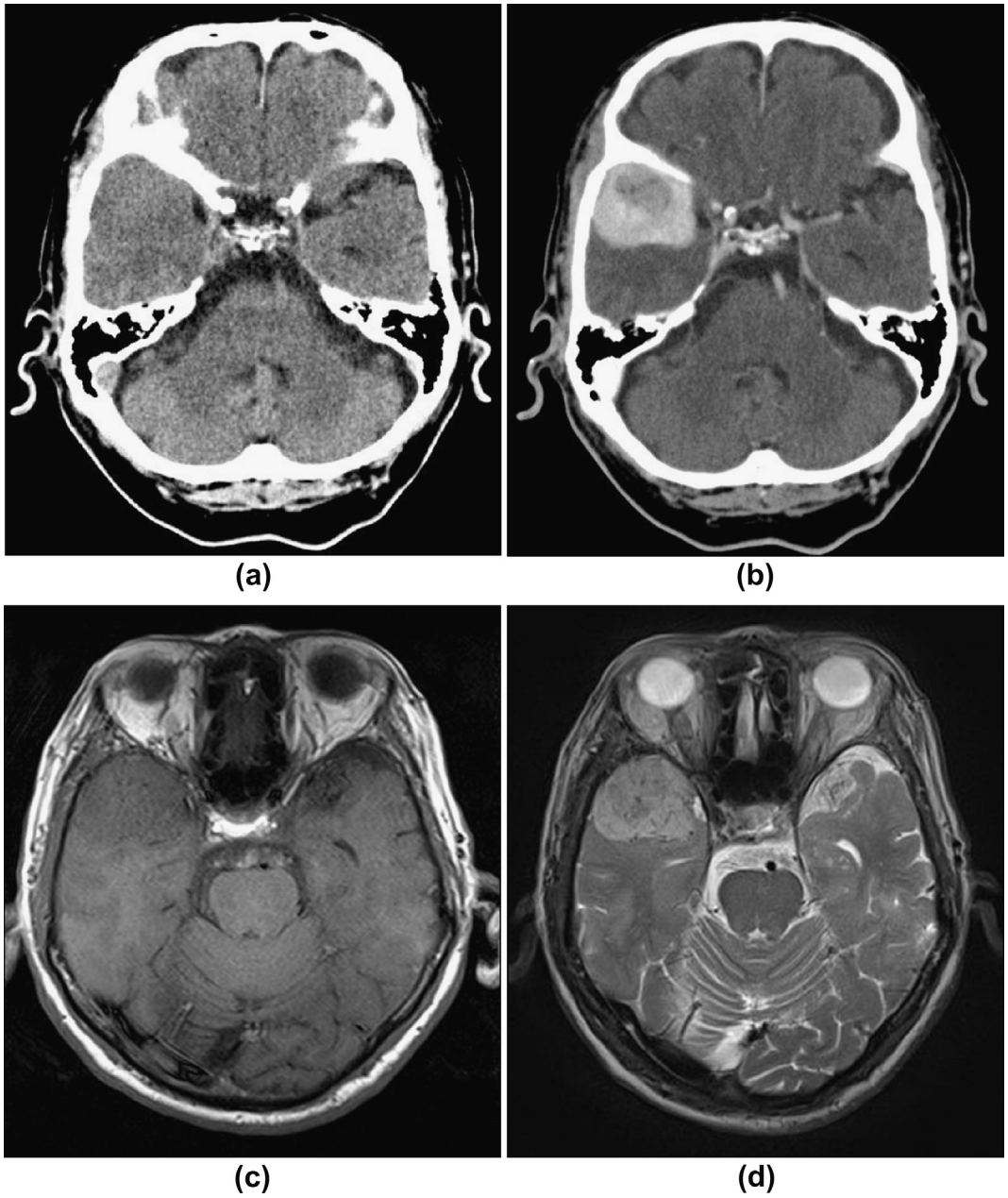

Figure 1 This 82-year-old man presented with a headache. The unenhanced CT image shows a lesion adjacent to the right sphenoid ridge, which is difficult to see due to the isodensity to the brain (a). The lesion shows homogeneous enhancement (b). The subsequent MRI reveals a (c) predominantly T1W hypointense and (d) T2W hyperintense lesion. Avid contrast enhancement with gadolinium was also apparent (not shown). Cortical buckling of the adjacent temporal lobe is seen. The mass appears hypervascular with multiple flow voids seen on the T2W images. These features and the location are characteristic of a right sphenoid ridge meningioma. This was confirmed histologically following complete surgical resection.

lactate and alanine has also been described producing a triplet-like spectral pattern.[4] These DWI/spectroscopy findings are currently unable to reliably grade meningiomas prior to resection.

Dilemmas in location

Meningiomas may originate from any meningothelial cell whether intracranial, spinal, or ectopic. The most common locations are along the convexity, parasagittal, and sphenoid regions (~75%) and spine (12%; Fig 3) with uncommon locations including the cerebellopontine angle (2–4%), intraventricular (2–5%), orbital (1%), and ectopic sites (<1%).[1] Given that complete surgical resection is the definitive treatment for symptomatic meningiomas, less common locations are important to recognize as this may affect surgical accessibility (Table 1).

Optic meningioma

These account for approximately 5% of primary tumours and less than 2% of cranial meningiomas (Fig 4). They present at a relatively small size due to early symptoms, most