Radiological sign

New description

Similarity of meningiomas with geranium leaf on Magnetic Resonance Imaging*

Martín Aguilar, Rosana Salvático

Resumen
Los meningiomas son los tumores endocraneanos primarios más frecuentes en el adulto. Constituyen muchas veces un hallazgo y no revisten demasiadas dificultades en su diagnóstico por su comportamiento típico en Resonancia Magnética (RM) y Tomografía Computada (TC).
La descripción de este signo, basado en la similitud morfológica de este tumor con la hoja de malvón, pretende ser una herramienta útil para aquellos casos en los que la presentación atípica o la falta de secuencias adecuadas puedan dificultar su caracterización.


Abstract
Similarity between meningiomas and geranium leaf on Magnetic Resonance Imaging.
Meningiomas are the most frequent primary intracranial tumors in adults. They are often a not difficult to diagnose finding, given their typical behavior on magnetic resonance imaging (MRI) and computed tomography (CT).
The description of this sign, based on the morphologic resemblance of this tumor to the geranium leaf, aims to be a useful tool for those cases where either the atypical presentation or the lack of appropriate sequences could hinder their characterization.

Keywords. Geranium leaf. Meningioma. Sign.

DISCUSSION

Meningiomas are the most frequent primary intracranial tumors in adults (13-20%), and arise from meningothelial cells, which are located in the arachnoid membrane (1,2).

Middle age and female predominance are generally reported, with slow growth in most of the cases. The most common histological type is meningothelial. Meningiomas are usually benign and asymptomatic. However, large meningiomas may be associated with clinical manifestations, such as intracranial hypertension syndrome, venous infarctions or compression of neighboring structures (optic nerves, cavernous sinus, trunk, etc.), among others.

Moreover, meningiomas presenting atypical behavior are characterized by rapid growth, involvement of the underlying parenchyma, or metastasis.

These extra-axial location tumors, usually solid and variable in size, are supratentorial in 90% of the cases (convexity of the brain, parasagittal and sphenoid wings). Less frequent locations are the orbit, the cisterns, the diploe and the spinal canal (1,2).

Necrosis, hemorrhage or cystic degeneration is observed in less than 20% of the cases.

On magnetic resonance (MR) imaging meningiomas usually reveal iso- to hypointense signal in T1WI sequences, and variable hyperintensity in T2 WI sequences (Fig. 1a). Intravenous administration of gadolinium generally contributes to homogeneous and usually early enhancement, due to large arterial vascular component nourishing the tumor (Fig. 1b).
Other findings are calcifications, seen on both computed tomography (CT) and MR –especially based on gradient-echo (GRE) sequences (Fig. 1c), and hyperostosis at the tumor’s implantation site (1,2,3).

The classic radiological sign described for this entity, known as “dural tail”, is frequently observed, though not pathognomonic. It consists of vascular ectasia, followed by meningeal thickening due to tumor compression.

Diffusion-weighted MR imaging (DWI) varies according to the composition of the meningioma. However, it is usually constraint by the dense tumor matrix (Fig. 2a).

The relative cerebral blood volume (rCBV) is commonly increased on perfusion weighted imaging (PWI).

MR spectroscopy (MRS) is characterized by alanine, the variable content of choline depending on the histological type, and the absence of N-acetylaspartate.

Macroscopically, the tumor shows lobulated margins and a vascular pedicle running along the meningioma fiber.

These characteristics are more clearly seen at T2 and GRE sequences, since the small amount of water in the tumor allows identifying these and other aspects, such as extra-axial tumor’s location, compres-
sion of the cerebral cortex, wide base of dural attachment, and the cerebrospinal fluid (CSF) band on the periphery.

Non-enhanced T1WI sequences are not of great value for the diagnosis, due to the abovementioned isointense signal of the tumor comparing the surrounding parenchyma. The avidity of the contrast media, especially when using T1-weighted volumetric acquisitions, allows highlighting these findings (Fig. 2b).

The geranium, whose scientific name is Pelargonium zonale (from the Geraniaceae family), is an ornamental plant from South Africa. It is frequently found in our mothers’ and grandmothers’ gardens. It is about 30-50 cm height and has simple and double flowers with elongated petals from different colors, mainly red and white.

The geranium has perennial leaves presenting lobulated margins and several nervations leading to a central structure known as petiole (Fig. 3).

Because of the similarity between the meningioma and the geranium leaf, better seen at T2WI, we decided to describe this sign, which compares the lobulated margins to the tumor margins, the nervations to the vascular pedicle, and the leaf’s structure to the fibrous matrix of the lesion (Fig. 4).

Even though meningiomas are not difficult to diagnose; incidental diagnosis may lead to certain difficulties. The comparison to the geranium leaf, especially in the absence of the adequate sequences, may contribute to its characterization.

**Fig. 1:** Right parietal meningioma. (a) Axial T2WI (FSE/TR4500; FOV 24x24/5.0thk/2.0sp;512x512/1 nex) depicting lobulated margins, fibrous matrix and wide base of dural attachment. (b) Post-contrast 3DSPGR (FOV: 24x24,1.5thk/ 0sp; 256x192/2.0 nex). Axial plane reconstruction depicting the tumor fibrous matrix and abundant irrigation. (c) Axial GRE (EPI/90; TR6000/TE20; FOV 28x28/2.4thk/ 2.0sp; 256x256/3.0nex), where calcifications can be seen (arrows).

**Fig. 2:** Meningioma located at both the velum interpositum cistern and the supravermian cistern. (a) Axial DWI (SE/EPI; TR10000/FOV24x24/51hk/0.0sp; 128x160/ 2.00nex). (b) Post-contrast 3DSPGR (FOV: 24x24,1.5thk/ 0sp; 256x192/2.0nex), with reconstruction in the sagittal plane.
Fig. 3: Geranium leaf (Pelargonium zonale, from the Geraniaceae family).

Fig. 4: Fusion of images. Image showing the similarity with geranium leaf.

References