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ORIGINAL ARTICLE

Role of intratumoral flow void signs in the differential diagnosis of intracranial solitary fibrous tumors and meningiomas

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KEYWORDS
Magnetic resonance imaging;
Flow void sign;
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Summary

Background and objective: An absence of signal on magnetic resonance (MR) images caused by blood or cerebral spinal fluid flow is known as a flow void, and may be related to intracranial tumors such as intracranial solitary fibrous tumor (SFT) or meningioma. However, the differential diagnosis of these neoplasms based on flow void configuration is controversial. This study investigated common intratumoral flow void patterns for differentiating intracranial SFT from meningioma.

Methods: From May 2008 to May 2015, 14 patients (10 men, 4 women; 14—63 y) received a pathologic diagnosis of primary intracranial SFT, and in 85 patients (23 men, 62 women; 20—76 y) a pathologic diagnosis of meningioma was made. Intratumoral flow void signs were retrospectively observed on MR images of all these patients and classified by radiologists blinded to the pathology findings. Statistical significance was established by chi-squared tests.

Results: In intracranial SFT patients, the sunburst flow void was detected in 1 case (7.1%) and the serpentine in 13 cases (92.9%). In meningioma patients, the sunburst flow void was detected in 82 cases (96.5%) and the serpentine in 3 cases (3.5%). The differences in the prevalence of the flow void types between the 2 groups were significant ($\chi^2 = 64.348$; $P < 0.01$).

Conclusion: Intracranial SFTs on MR images were more likely to show a serpentine than a sunburst flow void, while the sunburst pattern was far more typical of meningioma. Thus, the pattern of the intratumoral flow void sign may be a useful tool to assist in differentiating these tumors.

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Introduction

Intracranial solitary fibrous tumor (SFT) is rare, but well known for clinically aggressive growth and infiltration. Primary SFTs are rarely encountered first in the central nervous system, and they account for less than 1% of all central nervous system tumors [1—3]. SFT was once considered to arise in the meninges [4,5] and has certain features similar to other types of meningeal tumor.

Intracranial SFT and meningioma differ in clinical behaviors and histologic/immunohistochemical classification [6]. However, intracranial SFTs resemble meningiomas radiologically and can be difficult to distinguish [7,8]. Both occur in similar locations with broad dural attachment. They are both isointense with cortical grey matter on T1-weighted and T2-weighted magnetic resonance (MR) images, hyperdense on unenhanced computed tomographic (CT) images, and show intense enhancement on contrast images [9].

It is difficult to distinguish intracranial SFTs from meningiomas on traditional imaging, including MR imaging, and the misdiagnosis rate is very high [7,9—11]. According to a few reports, most cases of intracranial SFTs include an intratumoral flow void sign, especially an intratumoral flow void sign with a serpentine-like or arteriovenous malformation-like configuration. These may be considered characteristic of intracranial SFTs [12]. However, an intratumoral flow void sign is also seen in meningiomas, occasionally [13—16].

The intratumoral flow void sign is related to large intratumoral blood vessels, and is due to rapid blood flow through either dilated arteries supplying a hypervascular lesion, or dilated veins draining a lesion. It is usually observed in spin echo sequences (T1 and T2-weighted images) [15,16]. To assess the diagnostic usefulness of intratumoral flow void signs and their particular pattern or configuration for differentiating intracranial SFT from meningioma, we retrospectively reviewed the MR images of intracranial SFT and meningioma patients. To the best of our knowledge, this is the first study to compare the flow void signs of these tumors.

Methods

The institutional review board of our hospital (Nanfang Hospital, Southern Medical University) approved this retrospective study. The requirement to obtain informed consent from patients was waived.

The analysis included patients treated at our hospital from May 2008 to May 2015, specifically 15 SFT patients (11 men, 4 women; aged 39.47 y, range 14—63 y, median 39 y) and 107 meningioma patients (30 men, 77 women; aged 50.44 y, range 20—76 y, median 50 y). Among these patients, 23 were excluded for absence of an intratumoral flow void sign (1 SFT, 22 meningioma).

Finally, the study included 14 patients with an intratumoral flow void sign (10 men, 4 women; aged 39.14 y, range 14—63 y, median 39 y) who had received a pathologic diagnosis of primary intracranial SFT, and 85 patients with an intratumoral flow void sign (23 men, 62 women; aged 50 y, range 20—76 y, median 51 y) with a pathologic diagnosis of meningioma. These patients' medical records were retrospectively reviewed for this study.

MR imaging was performed using a 3T system (Achieva; Philips Medical System, Signa, GE) with an 8-channel sensitivity-encoding head coil. Our protocol included a plain scan and a contrast-enhancement scan. A routine sequence of a plain scan included axial T2-weighted and T1-weighted images and a sagittal T2-weighted image. The contrast-enhancement scan was performed by spin echo sequence, and the detailed imaging parameters were identical to the T1WI plain scan.

Achieva 3.0T imaging parameters

The detailed imaging parameters of Achieva 3.0T for the routine sequence were as follows.

For T2WI of axial:

- TR/TE, 3000/80 ms;
- flip angle, 90°;
- FOV, 24 cm;
- matrix, 512 × 512;
- slice thickness, 6 mm;
- number of sections, 20.

For T1WI of axial:

- TR/TE/TI, 2000/20/850 ms;
- FOV, 24 cm;
- matrix, 512 × 512;
- slice thickness, 6 mm;
- number of sections, 20.

For T2WI of sagittal:

- TR/TE, 3000/80 ms;
- flip angle, 90°;
- FOV, 22 cm;
- matrix, 512 × 512;
- slice thickness, 5 mm;
- number of sections, 16.

Signa 3.0T imaging parameters

The detailed imaging parameters of the Signa 3.0T for the routine sequence were as follows.

For T2WI of axial:

- TR/TE, 5100/130 ms;
- FOV, 24 cm;
- matrix, 512 × 288;
- slice thickness, 6 mm;
- number of sections, 20.

For T1WI of axial:

- TR/TE/TI, 1750/24/860 ms;
- FOV, 24 cm;
- matrix, 320 × 224;
- slice thickness, 6 mm;
- number of sections, 20.

For T2WI of sagittal: