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MRI findings in intraspinal mature teratoma

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AIM: To characterise and evaluate magnetic resonance imaging (MRI) images for their clinical value in diagnosing and assessing intraspinal mature teratoma.

MATERIALS AND METHODS: MRI images obtained from eight patients with a histopathologically verified intraspinal mature teratoma were analysed retrospectively regarding tumour location, size, and margins. Additionally, the signal intensity and enhancement pattern on MRI and other associated malformations were also assessed.

RESULTS: Three cases that contained fatty tissue showed markedly heterogeneous hyperintense signalling on T1-weighted images, and mixed hyperintense and hypointense signalling on T2-weighted images and fat-suppression sequences. All three of those cases showed an irregular peripheral fatty tissue signal, and one case showed additional patches of an interspersed calcification signal. The remaining five cases without fatty tissue displayed heterogeneous hyperintense signalling on T1-weighted images and T2-weighted images, and also on fat-suppression sequences. Four of the five cases showed additional patches of interspersed nodular calcification signals. Contrast-enhanced MRI images showed only slight enhancement (n=3).

CONCLUSIONS: MRI is regarded as the reference standard diagnostic technique to reveal the location of teratomas and the degree of spinal cord involvement. In most cases, MRI provides accurate anatomical and histological information, which is necessary for patients with suspected intraspinal mature teratoma.

Introduction

Teratomas are a type of tumour arising from pluripotent cells, and contain ectodermal, mesodermal, and endodermal components. Based on their degree of differentiation, teratomas are classified as mature, immature, or malignant.[1] Intraspinal teratomas are rarely encountered,[2] and account for only 0.2–0.5% of all spinal cord tumours.[3,4] To the authors' knowledge, only a few reports have described the imaging features associated with intraspinal teratomas.[5–7] Because the guidelines for treating intraspinal teratoma do not recommend radical resection,[8] an accurate preoperative diagnosis is very important when developing a surgical plan for treating an intraspinal mass. The purpose of the present study was to assess the MRI features of spinal cord teratoma.

Materials and methods

Patients

The present study was approved by the institutional ethics committee. Between July 2004 and January 2015,

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computed tomography (CT; n=3) and magnetic resonance imaging (MRI; n=8) images obtained from eight patients (five male and three female patients, mean age 29.1 years; range 10–56 years) with a histopathologically proven intraspinal mature teratoma were analysed retrospectively. The main clinical manifestations included backache (n=6), and numbness or weakness of the lower extremities without any obvious cause (n=3), occasionally accompanied by pain. The duration of symptoms prior to diagnosis ranged from 2 months to 20 years (median duration, 4 years). All eight patients had undergone surgery for their disease. Incomplete resection was undertaken in six cases, whereas in the other two cases, the tumour had been resected.

Imaging techniques

All eight patients were referred for MRI. Three patients underwent contrast-enhanced T1-weighted imaging (WI), whereas three further patients were examined using CT. T1- and T2-weighted spin-echo images were obtained from eight patients, and T2-weighted fast spin-echo (FSE) images with either fat saturation or short TI inversion recovery were obtained from six patients and two patients, respectively. In three patients, contrast-enhanced T1-weighted spin-echo images with fat saturation were obtained following intravenous injection of 0.1 mmol/kg gadolinium dimeglumine. T1-WI (500–700 ms repetition time [TR]; 15–30 ms echo time [TE], 200–360 mm field of view [FOV], 256–512×208–512 matrix), FSE T2-WI (3000–5000 ms TR; 60–90 ms TE, 200–360 mm field of view [FOV], 256–512×208–512 matrix) were performed. All images were obtained in at least three planes with 3 mm section thickness and a 1 mm intersection gap.

Three patients underwent CT performed according to the standard CT protocol for the spine. FOV of 200–400 mm, 512×512;matrix with images reconstructed using a section thickness of 1.5 mm and an increment of 1 mm using the soft-tissue algorithm. Both the sagittal and coronal images were reconstructed.

Imaging analysis

Two neuroradiologists, with 5 years of experience, who were not informed of the clinical and histopathological findings, independently reviewed the images for location (cervicothoracic, thoracolumbar, or lumbosacral region), shape (circular or lobulate), size, margins (well-defined or ill-defined), and signal intensity (high, low, or intermediate signal intensity; homogeneous or heterogeneous) on the unenhanced MRI images. Additionally, each lesion's enhancement pattern on contrast-enhanced MRI images was analysed and recorded. For size, the greatest single dimension was measured for each lesion. The spatial relationship between the lesion and the adjacent spinal cord (intradural extramedullary or intramedullary) was also assessed. Moreover, other associated malformations such as cysts, diastometomyelia, and spinal bifida occulta were recorded. The signal intensity of the spinal cord was used as a reference standard.

Fatty tissue displayed hyperintense signalling on T1- and T2WI and hypointense signalling on fat-suppression sequences, whereas areas of calcification displayed low signal intensity on all MRI sequences. The degree of enhancement was subjectively evaluated as either slight (less than or equal to that of the lesion on the unenhanced T1WI) or significant (greater than that of the lesion on the unenhanced T1WI).

Results

Six of the eight patients (75%) reported having backache, which was accompanied by varying degrees of lower-limb symptoms in three patients (37.5%) and sphincter disturbances in two patients (25%).

The CT and MRI features shown by the eight patients with an intraspinal mature teratoma are summarised in Table 1. The lesion was located in the thoracolumbar spine in five cases, and in the lumbosacral region in three cases. In six cases, the tumour was intradural extramedullary, whereas in the other two cases, the lesion was intramedullary. One intramedullary teratoma extended into the subdural space. The size of the lesion ranged from 16 to 59 mm, with a mean of 33.9 mm. All eight lesions displayed a clear boundary and a well-marginated, encapsulated mass. The majority of tumours (6/8) displayed a lobulate shape, whereas two were circular.

Three of the tumours were examined by CT, and the lesions showed heterogeneous soft-tissue masses that filled the vertebral canal. The soft-tissue masses displayed isodensity as compared with the spinal cord. The CT examinations revealed calcification in three tumours and fatty tissue in one tumour (Fig 1a). Some regions of tumour density displayed patches of interspersed slight or obvious hyperattenuation, plus irregular and dramatic peripheral hypo-attenuation. No lesion appeared to cause changes in the adjacent bone.

Histopathological examinations revealed elements of multiple germ cell layers. Examinations by light microscopy showed that a mature teratoma comprised fully differentiated components of mature glial tissue, fibrofatty connective tissue, mature cartilage tissue, dilated cysts lined with ciliated cuboidal epithelium, and skin fragments (Fig 2).

All eight lesions were examined using MRI, and the images showed mixed hyperintense and hypointense signalling on all sequences. Areas of fatty tissue displayed hyperintense signalling on T1- and T2WI, and hypointense signalling on fat suppression sequences. Areas of calcification displayed low signal intensity on all MRI sequences. Three tumours showed an irregular peripheral fatty tissue signal (Fig 1b–d), and five tumours displayed interspersed patches of a calcification signal (Figs 1b–d; 3b–e; 4a–d). Three tumours displayed markedly heterogeneous isointense signalling on T1WI (Fig 1b) and mixed hyperintense and hypointense signalling on T2WI (Fig 1c) and fat suppression sequences (Fig 1d). The majority of tumours (n=5) displayed thick-walled heterogeneous hyperintense signalling accompanied by interspersed nodular areas of hypointense signalling (n=4) on T1WI (Figs 3b and 4a), and