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CASE REPORT

Multiple focal nodular hyperplasia of the liver associated with spinal and pulmonary arteriovenous malformations

Multiples hyperplasies nodulaires focales hépatiques associées à des malformations artérioveineuses pulmonaire et spinale

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Available online 25 April 2009

KEYWORDS

Spinal cord
arteriovenous shunt;
Spinal MR
angiography;
Multiple focal nodular
hyperplasia syndrome

Summary Focal nodular hyperplasia (FNH) is frequently found incidentally in liver imaging but multiple FNH, especially when associated with systemic vascular malformations, are rare. We report on the case of a patient with lumbar sciatalgia and paraparesis. Spinal magnetic resonance angiography (MRA) showed a spinal cord arteriovenous shunt (SCAVS), its arterial feeders and venous drainage, which were later confirmed by digital subtraction angiography (DSA). MRA of the spine offers promising results in the characterization of SCAVS. Thoracoabdominal CT and MRI revealed multiple hepatic FNH and a pulmonary arteriovenous malformation (AVM). Indeed, this is the first reported case of the rare multiple FNH syndrome associated with a spinal AVM. © 2009 Elsevier Masson SAS. All rights reserved.

Introduction

A spinal cord arteriovenous shunt (SCAVS) is a rare disorder that frequently induces myelopathy (typically, the Foix–Alajouanine syndrome). Its clinical manifestations are diverse and usually seen distal to the SCAVS site, and its prompt diagnosis and management will make for a better neurological prognosis. Digital subtraction angiography (DSA) remains the gold standard for the pretherapeutic

characterization of SCAVS. Nevertheless, advances in spinal magnetic resonance angiography (MRA) with optimization of angiographic sequencing have led to promising results [1–3].

We describe here a case in which the initial suspicion of a disseminated tumor was drastically modified during the investigation. The final diagnosis turned out to be an exceedingly rare syndrome comprising the association of multiple focal nodular hyperplasia (FNH) and multisystemic vascular malformations. We describe here in detail this rare case of multiple FNH syndrome associated with lung and spinal arteriovenous malformations (AVM), and briefly discuss the possible pathophysiology underlying the association of these apparently unrelated lesions.

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Case report

A 29-year-old woman presented with back pain that extended down into her left leg with neurological claudication of one month's duration. Neurological examination showed spastic paraparesis when walking, and grade 3 force on dorsi- and plantar flexion of both feet. Spinal CT showed an intracanal expansile lesion and vertebral-canal widening at the level of the first lumbar (L1) vertebra (which also had an eroded posterior endplate). The hypothesis of a neoplastic lesion was considered. However, during the abdominal workup, 8-mode ultrasound examination showed several focal liver lesions, ranging from 1–5.4 cm in size. Endoscopy and colonoscopy showed no primary gastrointestinal tumor. Thoracoabdominal CT was carried out to allow characterization of the hepatic lesions, but also revealed cardiomegaly, a lobar pulmonary AVM (Fig. 1) and widening of the pulmonary vascular structures while confirming the presence of hypervascular liver nodules (Fig. 2). Subsequent abdominal MRI examination revealed findings consistent with multiple

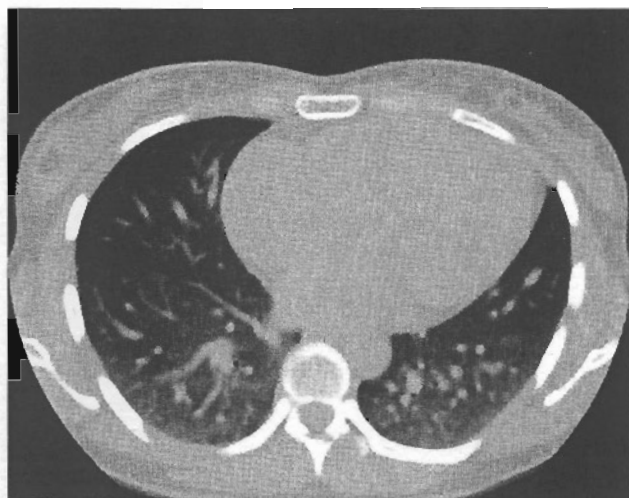


Figure 1 Enhanced CT scan showing an arteriovenous malformation (AVM) in the lower right lobe of the lung.

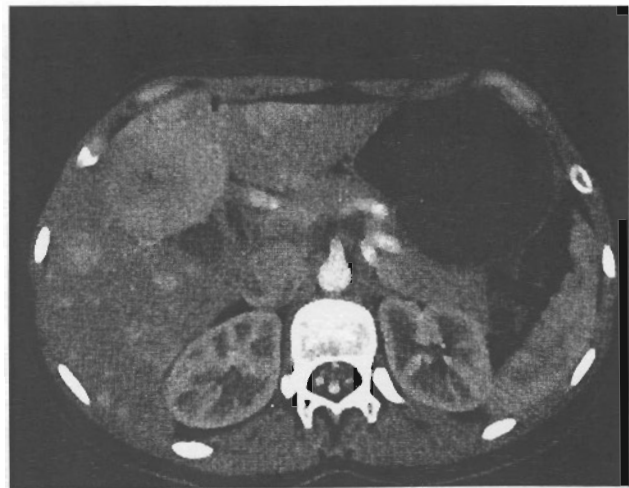


Figure 2 Enhanced CT scan in the arterial phase showing multiple focal nodular hyperplasia (FNH) in the liver.

FNH. An ultrasound-guided liver biopsy was then performed, which found no signs of metastatic disease.

Spinal MRI was performed using a 1.5-T scanner (Siemens Magnetom Symphony). Fast spin-echo T1- and T2-weighted images (T1/T2WI) revealed signs of spinal cord damage with T2WI hyperintensity at the level of the second lumbar (L2) vertebra.

MRA was performed first with a test bolus technique monitored by a fluoroscopic sequence, using a two-dimensional (2D) FLASH MR sequence that could obtain one image per second in the sagittal plane, encompassing the descending aorta at the level of the spinal lesion, followed by administration of 45 mL of gadolinium (Gd)-DTPA contrast at 0.5 M (0.3 mmol/kg of body weight) at a fixed rate of 3 mL/s. The MRA set was acquired in the sagittal plane to include the descending aorta and spine in the dorsomedial region. We used a 3D FLASH sequence, with acquisition beginning at the center of the K space and the following parameters: TR/TE/FA = 6.2/1.9 ms/35°; FOV 384 mm (vertical) × 160 mm (anteroposterior); 80 sagittal partitions at 1-mm intervals; matrix 384 × 136; and partial Fourier reconstruction: 85% (phase); 75% (partition). We performed three acquisitions (one before and two after the administration of contrast). Acquisition time for each image was 40 s. Images were post-processed on a dedicated workstation (ADW 4.4, GE Healthcare) with multiplanar reformats and 3D reconstructions.

A spinal AVM was also found (Figs. 3 and 4), and confirmed by DSA. Brain MRI showed no space-occupying or vascular lesions.

The patient refused treatment.

Discussion

Spinal AVM are usually classified as type I (dural arteriovenous fistulas or AVF), type II (intramedullary glomus AVM), type III (juvenile or combined AVM) and type IV (intradural perimedullary AVF). However, many new classifications have been proposed over the past few years, including those by Rodesch et al. [4], Spetzler et al. [5,6] and Zozulya et al. [7]. As the MRA images we obtained were of high-enough quality to allow classification of the AV shunt, we used the following classifications: type IV AVF (classical); macro-AVF [4]; conus medullaris AVM [5]; and intradural perimedullary AVF fed by a combination of radiculomedullary and anterior spinal arteries draining to the posterior perimedullary veins [7].

The pathophysiological mechanisms underlying neurological decline include venous hypertension, ischemia and a mass effect due to the typically hugely dilated venous structures.

The current clinical case has several major points of interest. First, the finding of an expansile lesion on spinal CT examination initially raised the possibility of a neoplasm. Although such lesions rarely metastasize, the multiple focal liver lesions were then initially interpreted as metastatic involvement as no other primary lesion could be identified. Liver CT (Fig. 2) and MRI finally made the diagnosis of multiple FNH, and MRI of the spine revealed an AVM (Figs. 3 and 4).

To the best of our knowledge, this is the first case report of multiple FNH syndrome (MFNHS), first described



Figure 3 Sagittal T2-weighted image of the lumbar spine shows dilated hypointense vascular structures, some of which are partially thrombosed.

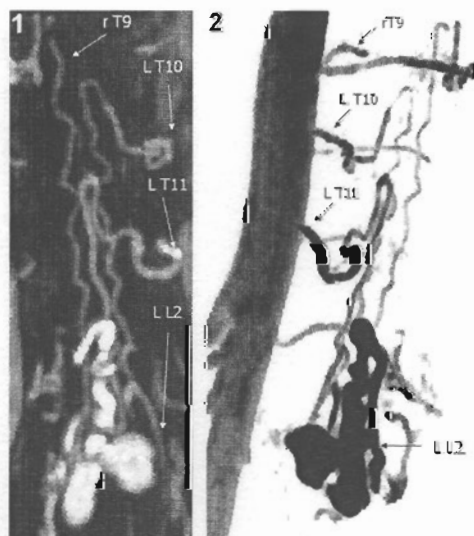


Figure 4 Magnetic resonance angiography (MRA) of the spine with thick maximum intensity projection (MIP) reconstruction (in the frontal [4.1] plane), and MIP reconstruction with inverted colors (left frontal [4.2] view) showing the arterial feeders of this SCAVS. rT9: right ninth aortic thoracic spinal branch; LT10: left tenth aortic thoracic spinal branch; LT11: left eleventh aortic thoracic spinal branch (Adamkiewicz artery); LL2: left second aortic lumbar spinal branch.

by Wanless et al. in 1989 [8], found in association with a spinal AVM. This rare syndrome—with only 10 cases reported so far [8,9]—is characterized by the presence of at least two sites of FNH and one of the following: hepatic hemangioma; arterial anomaly in another organ; and CNS vascular malformations (AVM, AVF or berry aneurysm) or neoplasms. Our patient fulfils the criteria for this diagnosis as she has multiple FNH, and pulmonary and spinal AVM.

Multiple AVM are, however, a feature of other syndromes, too. Hereditary hemorrhagic telangiectasia (HHT) is defined by the Curaçao criteria as comprising epistaxis, multiple telangiectases, a visceral AVM and/or a first-degree relative with HHT. The diagnosis is definitively established when three of the four above-mentioned features are present; such a diagnosis is considered possible when only two of the four are present and unlikely when fewer than two are found. Our patient had only the visceral AVM and, although FNH may be present in such cases [10], it is not included in the diagnostic criteria. Multiple FNH have also been associated with other vascular/proliferative syndromes such as Klippel-Trenaunay syndrome [11], and neurofibromatosis type I and von Hippel-Lindau diseases.

The pathogenesis of FNH is not known. One hypothesis is that an irregular arterial supply in the liver, with localized hyperfusion, leads to nodular areas of hepatocyte hyperproliferation [12]. There may be a systemic susceptibility—most likely of a genetic nature, but not necessarily so—that leads to vascular (arterial) malformation. The development of the AVM may vary according to various unknown factors. In the liver, they may lead to FNH secondary to the above-mentioned hyperperfusion. The specific histology of neuronal, glial and meningeal cells of the CNS may also respond with abnormal cell proliferation (tumors) as seen in the liver, or not (berry aneurysms and AVM), especially when it occurs near more differentiated neurons.

FNH is a benign lesion that is often found only incidentally and treated conservatively. Intracranial manifestations, however, are potentially fatal. Most berry aneurysms rupture, while subarachnoid hemorrhage carries a mortality rate of 45% within the first two months of diagnosis.

However, cases of multiple FNH of the liver are rare, and the percentage of cases associated with systemic AVM is unknown. For this reason, and given the accuracy and safety of the current diagnostic methods, and the high morbidity and mortality of undiagnosed cerebral aneurysms, we propose that patients with multiple FNH also undergo MRA of the head and spine to exclude vascular pathology in these organs. Although CT angiography has better spatial resolution, making it more sensitive and specific than MRA, it nevertheless involves the use of contrast and radiation, which are better avoided when the possibility of an aneurysm is low. MRA is also better at identifying brain and spinal AVM than is CT angiography.

Finally, it is worth mentioning that the current diagnostic capabilities of MRA, including its 3D reconstructions, allow it to display exquisite anatomical and morphological details that are similar to or even better than the information provided by DSA. MRA allows every arterial feeder to be identified and the venous drainage to be properly characterized. In contrast, DSA is invasive and time-consuming, involves ionizing radiation, comes with a small risk of major complications and is difficult to perform in patients with

aortic diseases. Also, its image quality can be degraded by bowel movements. For this reason, MRA should be considered the initial tool for orientation and exploration. Knowing *a priori* the AVM topography may save time, and avoid the radiation and contrast use of DSA.

Conflicts of interest: The authors have no conflicts of interest to declare.

Acknowledgments

The authors are grateful for the contributions of Drs Marcos Barbosa and Francisco Cabrita (neurosurgery), Drs Solange Lopes da Silva Rito and Cristina Moura (neuroradiology), Dr Miguel Areias (gastroenterology) and Jorge Brito (radiology).

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