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Imaging Appearances of Spinal Cavernous Malformations

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PURPOSE
Cavernous malformations (CMs) of the spinal cord can mimic the clinical presentation of other spinal lesions such as tumors, abscesses, hemorrhage, pediatric cases, and Chiari incursion cases can be confusing. The literature is inconsistent regarding genetic cases and MRI. We present the range of imaging findings and pitfalls, based on our own experience.

EDUCATIONAL OBJECTIVES
- Outline the various presentations of spinal CMs
- Understand the special challenges of diagnosing these, especially in the setting of acute hemorrhage
- Learn optimal techniques for imaging spinal CMs

TYPICAL APPEARANCE
Multifocal lesions have internal signal intensity and peripheral hypointensity. Typical imaging features include laboratory documentation of seizures, focal weakness, and a characteristic distribution in the spinal cord. Most are peripheral in locations in the spinal cord. (Figs. 2, 3)

ACUTE HEMORRHAGE
CMs that present with acute hemorrhage can be particularly confusing. Patients with seizures may have an MRI that shows no acute hemorrhage. The differential diagnosis includes abscess, bleeding tumor, and hemorrhagic edema. Axial fluid-attenuated inversion recovery (FLAIR) magnetic resonance image (MRI) can be helpful in the differential diagnosis (Fig. 4). Imaging in the setting of acute hemorrhage should be performed with sequences that do not suppress blood products (Fig. 5).

OBJECTIVE
1. To determine the nature of the lesion
2. To differentiate between acute hemorrhage and chronic hemosiderin deposition

NERVE ROOT CMS
In 2006, the first article was published on nerve root CMs. These are rare, with a total of 12 in the literature. One of our patients with multiple spinal cord CMs also had 2 nerve root CMs (Fig. 7).

METHODS:
We reviewed MRI findings from 12 patients with nerve root CMs. These patients were evaluated for a range of symptoms. Our institution is interested in the evaluation of nerve root CMs as a diagnostic tool and for surgical planning.

TYPICAL APPEARANCE: Spinal nerve root CMs are hypointense lesions on T1-weighted images. They are hyperintense on T2-weighted images and may be isointense on diffusion-weighted imaging. Gradient-based sequences can be helpful in evaluating the extent of the lesion.

ACUTE HEMORRHAGE: Imaging in the setting of acute hemorrhage should be performed with sequences that do not suppress blood products. Gradient-based sequences can be helpful in evaluating the extent of the lesion.

ISOTROPIC GRADIENT BASED IMAGING
Acute hemorrhage can sometimes be confused with an acute hemorrhagic tumor. Gradient-based imaging is a helpful tool in distinguishing acute hemorrhage from an acute hemorrhagic tumor. (Fig. 8)

LOOK AT THE BRAIN
In recent years, this phenomenon has been observed in a case of acute hemorrhage. The diagnosis of spinal cavernous malformation can prompt imaging of the brain. The presence of multiple lesions suggests familial rather than sporadic disease. These findings can be helpful in the patient’s family and genetic counseling. Additionally, finding more lesions in the brain can increase confidence in the diagnosis of a spinal cavernous malformation. (Fig. 14, also Figs. 3, 4, 5)

CONCLUSIONS—LEARNING POINTS:
- Spinal CMs are probably more common than genetic CMs diagnosed in the literature
- The possibility of familial or genetic CMs should be considered with hemorrhagic spinal cord lesions
- The appearance of spinal CMs with acute hemorrhage without acute cord expansion can be concerning
- The presence of fat saturation on post-contrast images can be helpful in differentiating acute hemorrhage from acute hemorrhagic tumor
- The diagnosis of spinal CMs can prompt imaging of the brain