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# Abnormal Spinal Cord Magnetic Resonance Signal: Approach to the Differential Diagnosis

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**T2-hyperintense signal abnormalities within the spinal cord on magnetic resonance imaging can evoke a broad differential diagnosis and can present a diagnostic dilemma. Here, we review and provide a succinct and relevant differential diagnosis based on imaging patterns and anatomical or physiopathologic correlation. Clues and imaging pearls are provided focusing on inflammatory, infectious, demyelinating, vascular, and metabolic involvement of the spinal cord.**
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## Introduction

Injury or disease processes may have a predilection for the central, anterior, anterolateral, posterior, or posterolateral spinal cord. Physiopathology of the disease often correlates with the anatomical involvement, which can provide diagnostic clues. Furthermore, involvement of specific white matter tracts may also provide important diagnostic information.

## Approach

In general, when confronting areas of hyperintensity on T2-weighted image (T2-WI) within the spinal cord, 2 important diseases—syrinx and tumor—should be excluded. Both entities would be briefly described as important considerations during the initial approach to signal abnormalities but are not the focus of this article. Generally speaking, syrinx and tumors have distinct appearances. Whereas syrinxes are well-defined fluid cavities (Fig. 1), tumors usually distort the architecture of the cord. Some tumors such as ependymoma or less likely astrocytoma can exhibit cystic components. These "cysts" are often accompanied by not only heterogeneous T2 and T1 signal within or surrounding but also may show irregular gadolinium enhancement (Fig. 2). True syrinx associated with tumor is also possible.

It is useful to evaluate the spinal cord on magnetic resonance imaging (MRI) in both longitudinal and cross-section involvement. An arbitrary definition in short- or long-segment involvement should begin our approach. When the abnormal cord signal is present in equal or less than 2 contiguous vertebral bodies, a short-segment myelopathy is considered. Likewise, signal compromising a longer area would be considered a long-segment or longitudinally extensive myelopathy (Table).

Short-segment involvement is typically seen with multiple sclerosis (MS) and its mimics, but also with compressive myelopathy. Long-segment involvement is seen with less common inflammatory or demyelinating diseases such as transverse myelitis or neuromyelitis optica (NMO), as well as with metabolic involvement (eg, vitamin B12 deficiency) and vascular diseases (eg, venous hypertension and arterial infarct). In both short- and long-segment myelopathies, the distribution of abnormal signal in cross section—entire cord, white matter columns, or central gray matter or all of these—is paramount for narrowing down the differential diagnosis.

On cross-sectional evaluation of the cord, demyelinating plaques of MS are usually asymmetric, having preference for subpial location, and are often wedge-shaped with a broad base adjacent to the subarachnoid space (Fig 3).[1] MS lesions involve not only the white matter tracts but also the gray matter, irrespective of gray and white boundaries (Fig. 3). Although typically described with a predominant compromise of the lateral or dorsal aspect of the cord, MS lesions can also involve the central aspect of the cord.[2-7] MS is a predominant central nervous system (CNS) disease, herein, there is abrupt

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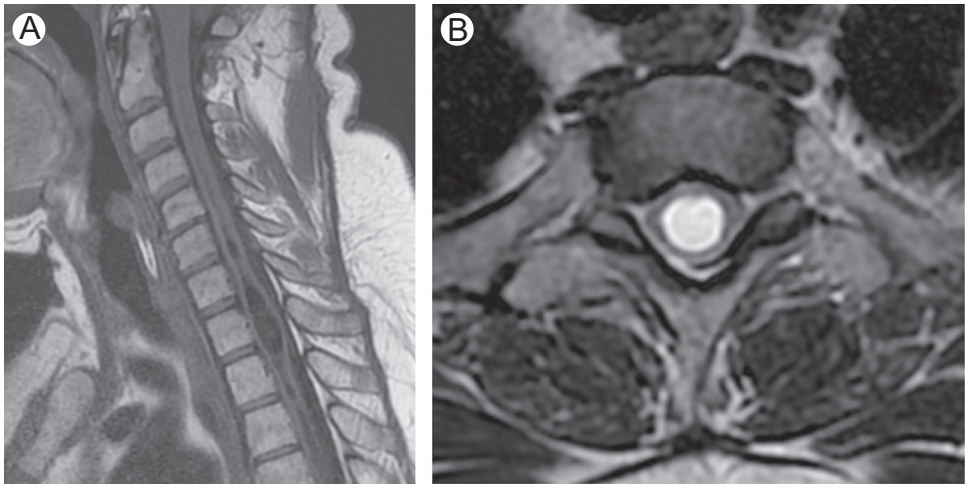


**Figure 1** Syringomyelia. (A) Sagittal T1-WI and (B) axial T2-WI show extensive area of "cavitation" within the central aspect of the cord with typical CSF-like signal (well-defined hypointense T1 and hyperintense T2 signal). "Septations" or heterogeneous signal could be seen on T2-WI due to CSF pulsation. Usually, sagittal T1-WI defines better dilation of the central canal as in this case.

absence of involvement of the peripheral myelin with preservation of the spinal nerve roots[1]; a feature that can help in the differential diagnosis as described later. Overall, patchy magnetic resonance (MR) signal in a short segment of the spinal cord and asymmetric cross-sectional distribution suggest a diagnosis of MS.

CNS involvement by sarcoidosis, vasculitis, or certain infectious process such as Lyme disease have typically been considered MS mimics. Spinal cord sarcoidosis can have MS-like distribution and appearance on MRI (Fig. 4); however, this pattern is not the most common. Spinal cord compromise is seen in approximately 4%-28% of cases of neurosarcoidosis.[8] When present, the most common pattern is a transverse myelitis–like involvement with longitudinally extensive abnormal signal involving most of the cord in cross section and with patchy areas of enhancement (Fig. 5).[9,10] Leptomeningeal or spinal nerve enhancement is not uncommon and can help in the differentiation of demyelinating diseases, where this type of enhancement is not seen. Primary CNS vasculitis (PCNSV) can compromise the spinal cord in approximately 5% of cases.[11,12] Clinically, it can mimic MS, but spinal PCNSV more commonly presents as an acute-subacute progressive myelopathy (transverse myelitis–like symptoms) with inadequate response to typical treatment.[11,13] To our knowledge, there is no comprehensive review of the MRI findings in spinal PCNSV. Multiple case reports demonstrate a longitudinally extensive involvement of the spinal cord on T2-WI.[14-16] The cross-section appearance is rarely described, ranging from entire cord abnormality to predominant involvement of the posterior aspect of the cord.[14,15] Postcontrast appearance is

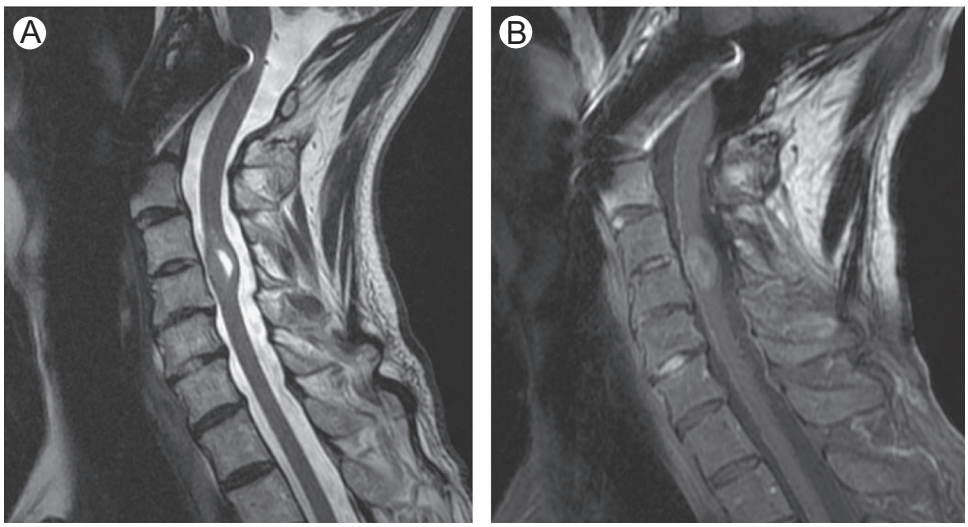


**Figure 2** Spinal cord tumor—ependymoma. (A) Sagittal T2-WI and (B) sagittal postcontrast T1-WI show focal expansion of the cervical spinal cord with mixed cysticlike and masslike isointense appearance on T2-WI. There is heterogeneous mass like enhancement after administration of contrast medium.