Childhood Transverse Myelitis and Its Mimics

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KEYWORDS

• Transverse myelitis • Children • Spinal cord • Demyelination • Magnetic resonance imaging

KEY POINTS

- Transverse myelitis presents with acute motor weakness or sensory deficits, usually accompanied by bladder or bowel incontinence. These symptoms evolve over hours to days.
- Determining a clinical "spinal cord level" aids the planning of spinal cord imaging.
- Adequate spinal cord imaging requires good-quality magnetic resonance imaging with a minimum of T2-weighted sequences in 2 planes.
- Mimics such as tumors, epidural abscess, arteriovenous malformation, and compressive bone disease may require urgent intervention.

INTRODUCTION

Transverse myelitis (TM) is a monophasic, likely postinfectious, inflammatory disorder of the spinal cord. In some children, TM may represent the first clinical event of a chronic demyelinating disorder such as multiple sclerosis (MS) or neuromyelitis optica (NMO). Diagnostic criteria requires signs and symptoms attributable to the spinal cord, that is, sensory, motor, or bladder and bowel dysfunction, with progression to nadir in less than 21 days from onset, and cerebrospinal fluid (CSF) or neuroimaging evidence of spinal cord inflammation.[1]

A variety of extra-axial and spinal cord disorders gives rise to acute and subacute signs and symptoms in the spinal cord. This article describes the clinical and radiologic features of TM and its mimics (**Box 1**).

Acute deficits constitute a medical emergency requiring urgent spinal imaging, as vascular disorders and spinal cord compression have a time-sensitive relationship of treatment to outcome.[2,3] In TM, a rapid evolution of symptoms usually signifies more severe disease.[4]

ANATOMIC CONSIDERATIONS IN SPINAL CORD DISORDERS

The spinal cord consists of 31 segments: 8 cervical, 12 thoracic, 5 lumbar, 5 sacral, and 1 vestigial coccygeal segment. These segments map to respective clinical myotomes and dermatomes, and are named according to their level of supply, thus the 8 pairs of spinal nerves arising from the cervical segment are called C1 to C8. The anatomic location of the spinal cord segments do not correspond to the vertebral bodies that make up the vertebral canal. Almost all of the spinal cord itself rests in the cervical and thoracic regions of the vertebral column; only the sacral segments reside in the upper 2 lumbar vertebrae. As there are only 7 cervical vertebrae, the first 7 cervical nerve roots exit in the intervertebral foramina above their respective vertical bodies, and the C8 nerve exits below the seventh cervical vertebra. The thoracic (T1–T12), lumbar (L1–L5), and sacral (S1–S5) nerves exit below their respective vertebrae (**Fig. 1**).

The descending corticospinal and ascending sensory tracts in the spinal cord are arranged in

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Box 1
Clinical and radiologic mimics of transverse myelitis

Extra-axial Compression, Disease

1. Vertebral spine disorders
   a. Trauma
   b. Atlantoaxial subluxation
      i. Trisomy 21
      ii. Mucopolysaccharidosis type IV
      iii. Grisel syndrome
   c. Destructive lesions
      i. Tuberculosis
      ii. Lymphoma
      iii. Langerhans cell histiocytosis
   d. Scheuermann disease
2. Epidural disease
   a. Tumor
      i. Neuroblastoma
      ii. Wilms tumor
   b. Abscess
      i. Associated dermal sinus, vertebral body infection
3. Arachnoiditis
   a. Tuberculosis
   b. Cryptococcosis
   c. Carcinomatous infiltration
4. Spinal nerve root inflammation
   a. Guillain-Barré syndrome

Spinal Cord Disorders

1. Congenital malformation
   a. Neurenteric cysts
   b. Spinal cord tethering
2. Infection
   a. Nonpolio enteroviruses
   b. West Nile virus
   c. Human T-lymphocyte virus 1
   d. Neurocysticercosis
3. Vascular disorders
   a. Arteriovenous malformation
   b. Cavernomas
   c. Cobb syndrome
   d. Fibrocartilaginous embolization
   e. Spinal cord infarction
4. Vasculitis
   a. Systemic lupus erythematosus
   b. Behçet disease
5. Nutritional disorders
   a. Vitamin B12 deficiency
      (Subacute combined degeneration)
6. Toxic injury
   a. Chemotherapy (eg, methotrexate)

longitudinal bundles and are oriented with the lower body and leg regions situated medially. These considerations are important in planning spinal cord imaging, especially in hospitals in resource-limited regions, or when imaging of the entire spinal cord may not be possible. A patient with motor and sensory deficits mapping to the lower lumbar and sacral spinal cord segments will first require careful imaging of the spinal cord residing in the lower thoracic–lumbar vertebral region. A negative study will then prompt the evaluation of the cervical and upper thoracic regions.

TECHNICAL ASPECTS OF SPINAL CORD IMAGING

Acute spinal cord neurologic signs and symptoms that trigger an MR imaging request should have sequences targeted to assess the spinal cord. For this reason the authors image with standard spin-echo or fast spin-echo (FSE) T1-weighted and T2-weighted sequences, usually in 2 planes. The standard imaging protocol would include sagittal and axial T2-weighted sequences throughout the spinal column followed by sagittal T1-weighted sequences precontrast in most circumstances. If a lesion is seen in the cord, postgadolinium sequences in the sagittal and axial plane will be applied. Extra sequences include thin-section axial T2-weighted sequences (targeted usually to a clinically suspected abnormal level) as well as sagittal diffusion and gradient-echo sequences to assess for cord ischemia and hemorrhage (**Table 1**).

It is important to discuss with the referring neurologist the clinical presentation. If the presentation is more consistent, for example with Guillain-Barré syndrome, sequences targeting the enhancement of the nerve roots such as axial and sagittal T1-weighted scans are used.

Scanning on a 1.5-T machine has been preferred to avoid multiple artifacts that occur in spinal cord imaging and which are magnified because of the higher signal-to-noise ratio with higher field magnets. However, improved pulse-sequence