Imaging of Dural Arteriovenous Fistula

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KEYWORDS

• Dural arteriovenous fistula • Vascular malformations of the spine • MR imaging • MR angiography • Spinal angiography

KEY POINTS

- Because of their nonspecific clinical presentation, spinal dural arterial venous fistulas (SDAVFs) are often overlooked.
- SDAVFs should be considered and neuroimaging with gadolinium obtained in an elderly patient with slowly progressive myelopathic symptoms.
- Neuroimaging findings of SDAVF include an enlarged spinal cord with intramedullary enhancement and T2 hyperintensity associated with prominent flow voids along the dorsal aspect of the cord.
- Three-dimensional (3D) spinal magnetic resonance (MR) angiography as well as phase cycling-fast imaging employing steady state acquisition (PC-FIESTA), 3D-constructive interference steady state (CISS), or other myelographic sequences should be obtained before angiography to help localize the level of the fistula.
- After treatment of the fistula, the T2 hyperintensity, prominent flow voids, and enhancement should decrease with time, but can persist for up to a year.

INTRODUCTION

Spinal vascular malformations are rare. They are divided into shunting lesions, including spinal arteriovenous malformations (AVM) and arteriovenous fistulas (AVF), and nonshunting lesions, including capillary telangiectasia and cavernous malformations (cavernomas). There are numerous classification schemes based on arterial supply,[1] genetics,[2] inborn versus acquired,[3] or morphology and angioarchitecture (**Table 1**).[4–6] Dural AVF is the most common of the vascular malformations, accounting for 50% to 85% of all lesions.[7–10] Although it is the most common type of AVM, a delay in diagnosis of SDAVFs persists despite more widespread clinical and radiographic appreciation of this entity. This delay is largely caused by its nonspecific clinical presentation, which may mimic more prevalent conditions such as myelopathy or neurogenic claudication caused by central canal compromise, demyelinating disease, or neoplasm.[11–17] Most commonly, these patients are elderly men[12,14–19] who present with varied lower extremity motor and sensory myelopathic symptoms that slowly progress over several years. Patients are frequently subjected to a variety of misdirected treatments, including surgery for stenosis and immunomodulation for transverse myelitis. The radiologist is often the first to suggest the diagnosis based on its MR imaging appearance; the imager must then be familiar with imaging strategies to, first, conclusively identify the presence of a dural AVF and, second, locate the fistula site to guide selective angiography and intervention. This article reviews spinal vascular anatomy, imaging appearances of dural AVF, and imaging strategies for determining the fistula location.

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Table 1
Classification of spinal malformations

	Type	Cause	Feeding Artery	Draining Vein	Pathophysiology	Age of Onset (y)	Therapy
AVM	Perimedullary fistula (type I–III) Glomerular Juvenile	Inborn	Radiculomedullary	Intramedullary and superficial spinal cord veins draining to epidural venous plexus (orthograde)	Intraparenchymal or subarachnoid hemorrhage, chronic venous congestion, space occupying lesion	20–40 <20 <15	Type I: surgery Type II–III coil embolization Particle or glue embolization Embolization and/or surgery
Cavernoma	—	Inborn	N/A	N/A	Hemorrhage and progressive myelopathy	20–60	Surgery
Dural fistula	—	Acquired	Radiculomeningeal	Radicular vein draining to perimedullary veins (retrograde)	Chronic venous congestion	40–60	Glue embolization or surgery