Contrast enhanced magnetic resonance angiography: a useful diagnostic tool in the evaluation of spinal vascular malformations

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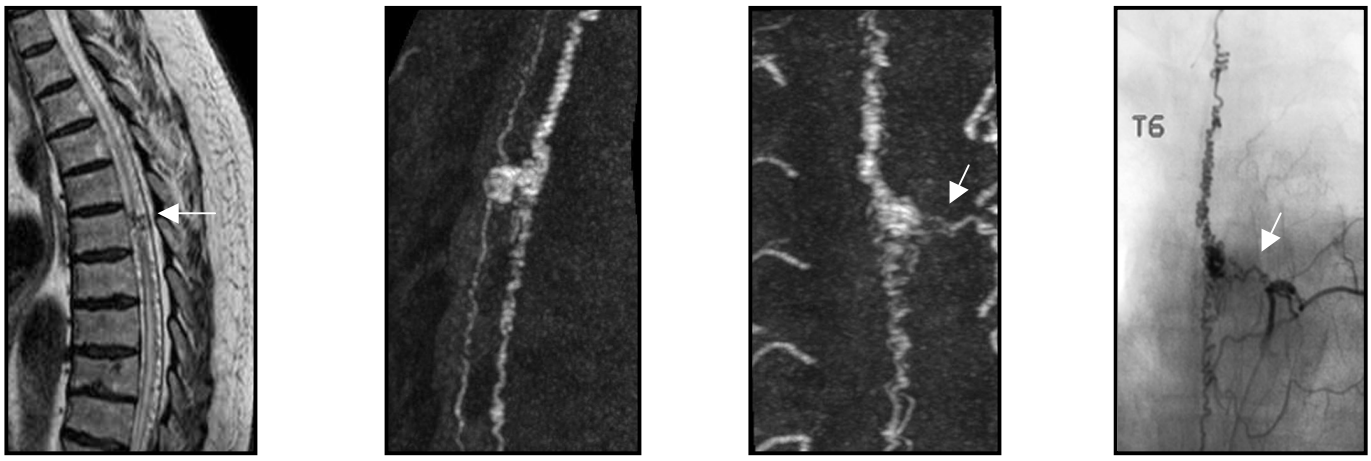
Purpose : to show that three dimensional contrast enhanced magnetic resonance angiography (3D CE MRA) is an effective tool in the diagnosis of spinal vascular malformations and to evaluate its role in providing screening information prior to conventional spinal angiography and in post treatment evaluation.

Materials and Methods : 7 consecutive patients were examined at this centre using both 3D CE MRA and conventional spinal angiography, between January 2001 and October 2003. The age range was 16-80 years and the male to female ratio was 3:4. Presenting symptoms and signs (duration acute onset to 18months) included progressive bilateral lower extremity motor weakness (5 patients), sensory deficits (3), bladder and bowel dysfunction (3), claudication (2), gait disturbance (2), radiculopathy (2) and acute onset paraparesis following spinal cord haemorrhage (1).
MR imaging was performed on a Philips (Eindhoven) Intera 1.5T scanner using version 8 software. Sequences included pre-contrast T1- spin echo and T2- weighted FSE sagittal images and T2-weighted axial gradient echo images as well as post-contrast T1-weighted sagittal and axial images. Magnetic resonance angiography was performed following bolus injection of a gadolinium contrast agent (gadopentetate dimeglumine at a dose of 0.2mmol/kg body weight) using a three dimensional technique (3D T1 FFE) with sagittal orientation. Imaging parameters were as follows: TR 4.8ms, TE 1.68ms, flip angle 40 degrees, matrix 1024 × 448 pixels (80% scan percentage), slice thickness 0.5 over 100 contiguous slices, 300mm rectangular FOV, acquisition time 93 secs, central K space filling.
Conventional spinal angiography included injection of all contributory vessels from vertebral arteries to median sacral artery to fully evaluate the spinal vasculature.

Results : imaging findings on standard MR sequences included vessel-like hypointensities in the subarachnoid space (7 patients), intramedullary high signal within the cord on the T2-weighted image (6), cord expansion (4) and haemorrhage into the cord (1).
2 native and one recurrent thoracic dural arteriovenous fistulae (DAVF) and two pial arteriovenous malformations were identified with 3D CE MRA and subsequently confirmed by conventional spinal angiography. In the patients with DAVF both the radicular arterial feeders and the medullary draining veins were demonstrated and the level of the DAVF confirmed. In the patients with pial arteriovenous malformation both the nidus and the dominant radiculopial supply were clearly identified by 3D CE MRA.
In two patients with DAVF abnormal vessels were identified on the cord surface but the level of the fistula could not be determined using 3D CE MRA. Subsequent spinal angiography revealed fistulae arising from the lateral sacral branch of the internal iliac artery in both cases.
Embolisation of the DAVF has been performed in four patients; postoperative 3D CE MRA demonstrated no evidence of residual DAVF in any patient to date. The cord T2- weighted hyperintensity improved in the treated group as demonstrated by follow-up MRI.

Conclusion : 3D CE MRA is a useful diagnostic tool in the evaluation of spinal vascular malformations, complementing conventional MR imaging. 3D CE MRA can limit the time spent on conventional spinal angiography by prior identification of the level of the vascular abnormality thus reducing the volume of contrast required and radiation dose to both patient and operator. This technique has a role in patient follow-up to confirm obliteration of the fistula and monitor results of treatment.



A **B** **C** **D**

Fig A : sagittal T2-W FSE demonstrates vessel-like hypointensities in the subarachnoid space at the level of a DAVF
Fig B : sagittal reconstruction of the CE MRA shows medullary draining veins on the cord surface (image left is anterior)
Fig C : coronal reconstruction of the CE MRA showing the left T6 DAVF (white arrow)
Fig D : spinal arteriogram confirms the level of the fistula at T6 on the left (white arrow)