Cervical Epidural Arteriovenous Fistula Presenting with Radiculopathy: Transvenous Embolization Using Onyx

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Summary

We present an uncommon case of cervical epidural arteriovenous fistula presenting with radiculopathy that was successfully treated with transvenous embolization using Onyx.

Introduction

Epidural arteriovenous fistulas (eAVF) are rare lesions representing approximately 1.6 to 4% of all spinal vascular malformations¹⁻³. They are supplied by dural or epidural arteries and drain primarily into the epidural venous plexus¹. These uncommon lesions are usually asymptomatic, but radiculopathy and myelopathy have been described due to mass effect from enlarged epidural veins and venous hypertension¹⁻¹¹. Endovascular embolization, using either transarterial and/or transvenous techniques, is the treatment of choice. The treatment should be aimed to alleviate the symptoms and/or to exclude aggressive venous drainage¹⁻¹¹. We describe a case of a cervical epidural fistula presenting with radiculopathy that was successfully treated transvenously with Onyx (ev3, Irvine, CA, USA) after the venous receptacle was framed using detachable coils.

Case Report

The patient is a 60-year-old woman who presented with right upper extremity tingling and numbness. A cervical MRI and a time-resolved

MRA (Figure 1) revealed a complex right eAVF centered at the level of C5. A complete cervical angiography was performed and demonstrated that the lesion was supplied predominantly by branches of the right vertebral and right deep cervical artery, but also by branches of the left vertebral and left deep cervical artery (Figure 2A-E). A focal area of significant stenosis was noted in the draining epidural vein distal to the venous receptacle (Figure 2A). After an unsuccessful attempt to treat the eAVF transarterially, it was decided that the transvenous approach would be the next step. For this purpose the left femoral vein was accessed and a 5 Fr guide-catheter was used to selectively catheterize the right internal jugular vein. An Echelon-10 (ev3, Irvine, CA, USA) microcatheter was navigated over a microwire to selectively catheterize the draining epidural vein through the suboccipital venous plexus. Microcatheter contrast injection was performed confirming selective microcatheterization of the venous receptacle (Figure 3). Detachable coils were then deployed framing the venous receptacle. Subsequently, under continuous fluoroscopic guidance, Onyx-18 was pulse-injected transvenously filling the venous receptacle and, retrogradely, occluding the small arterial branches that were feeding the eAVF. Approximately 1.6 mL of Onyx-18 was used. Toward the end of the procedure, care was taken not to overinject Onyx as the arterial feeders filled retrograde, so as not to reflux Onyx more proximally into the parent arteries, to guard against the risk of unwanted normal vessel occlusion. After the venous receptacle

Figure 1 Time-resolved MRA demonstrated early opacification of the cervical right epidural venous plexus starting at the level of C5.

and fistulous connections were obliterated, the microcatheter was slowly extracted from the Onyx plug and then discarded. The total injection time was 9 minutes. Final complete cervical angiography demonstrated complete occlusion of the eAVF (Figure 4A-F). At one-month clinical follow-up the patient tingling and numbness had completely resolved.

Discussion

Epidural arteriovenous fistula is an uncommon entity and may be related to trauma, neurofibromatosis or surgery, but is usually spontaneous¹⁻⁶. Although usually asymptomatic, eAVF may present with radiculopathy or myelopathy which are usually caused by mass effect from enlarged arterialized veins upon the nerve root and/or the spinal cord¹⁻¹¹. This was the case in our patient who presented with radiculopathy due to extrinsic venous compression. Uncommonly, myelopathic symptoms may be caused by intradural venous drainage, resulting in venous hypertension when the reflux-impeding mechanism within the dural sleeves fails^{1,5-9,11}.

Endovascular treatment is the method of choice whenever feasible². Transarterial as well as transvenous approaches have been used to treat this disease^{4,10}. A transarterial approach can be quite challenging due to the large number of small and tortuous feeders that the lesion might recruit^{1,9}. We initially attempted transarterial embolization but it was unsuccessful

due to the aforementioned reasons. Incomplete treatment of the eAVF usually results in recruitment of new arterial feeders². Moreover, the cervical vasculature is known to have prolific anastomotic capabilities and therefore injection of liquid embolic agent may alter the local hemodynamic pressure opening dangerous anastomosis with the vertebral artery or spinal arteries¹. On the other hand, transvenous embolization is usually safe and effective as long as the venous receptacle (location where the multiple arterial feeders reach the vein) is selectively catheterized. Occlusion of the venous receptacle can usually be accomplished with coil embolization^{1,10}. It is possible, however, that dense packing of the coil conglomerate resulting in distention of the venous receptacle might worsen the mass effect upon the nerve, making symptomatic recovery less likely, at least in the first weeks post intervention. Although controversial, this phenomenon of transient increase in mass effect has been seen after coil embolization of intracranial aneurysms, particularly in the posterior communicating region¹²⁻¹⁴. In our case, six coils were deployed framing and partially filling the venous receptacle with persistent opacification of the epidural venous outlet. The coils deployed were not densely packed on purpose, and provided a constricting frame within the venous receptacle and therefore the liquid embolic agent (Onyx) could be pulse-injected in a very controlled way filling the venous receptacle and, retrogradely, occluding the small arterial branches

that were feeding the eAVF. It is important to reinforce that understanding the local cervico-spinal vascular anatomy is crucial for a safe procedure. The liquid embolic agent injection was stopped once arterial reflux was evident avoiding unwanted embolization of the spinal arteries or reflux into the vertebral artery. Onyx is a non-adhesive liquid embolic agent (eth-

Figure 4 A-F) Final image of the embolic cast (A) and post embolization digital subtraction angiography of the right deep cervical artery in the arterial and venous phases (B and C respectively), right vertebral artery (D), left vertebral artery (E) and left deep cervical artery (F) revealed complete occlusion of the eAVF.

ylene-vinyl alcohol) dissolved in an organic solvent DMSO. Its major advantage compared to other embolic agents is non-adhesivity and increased predictability and control of deposition, which allows longer injections with controlled reflux and better penetration of the fistulous channels¹⁵⁻¹⁷. The patient's symptoms improved immediately after the procedure and

after one month had completely resolved. This is likely the result of a decrease in pressure and pulsation upon the nerve root⁴. In summary, we presented a case of eAVF successfully treated endovascularly with transvenous embolization using a combination of framing coils and Onyx. This approach is safe and effective and may be useful in similar eAVF cases.

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