CASE REPORT

Paraspinal arteriovenous malformation Onyx embolization via an Ascent balloon

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SUMMARY

Purely extradural lumbar spinal arteriovenous malformations (AVMs) are rare lesions that have diverse presentations and imaging features. The treatment of a symptomatic high flow paraspinal AVM with multiple feeders remains a challenge. We report the first use of an Ascent balloon (dual lumen balloon catheter) to deliver Onyx with excellent penetration to a paraspinal AVM.

BACKGROUND

Arteriovenous malformations (AVMs) of the spine and spinal cord can be categorized as spinal cord AVMs, spinal cord arteriovenous fistulas (AVFs), dural AVFs, and paravertebral AVMs/AVFs.¹ There is abundant literature regarding spinal cord AVMs, spinal cord AVFs, and dural AVFs but the literature

on paraspinal AVMs is limited to case reports and case series.² Paraspinal AVMs are rare³ lesions that have diverse presentations and imaging features.⁴ The endovascular treatment of a symptomatic high flow paraspinal AVM with multiple feeders remains a challenge and normally requires the use of many materials for several attempts.⁴ We report the first use of an Ascent balloon to deliver Onyx with excellent penetration to a paraspinal AVM/AVF.

CASE PRESENTATION

We present the case of 60-year-old woman with subacute radicular pain into the front of the right thigh.

INVESTIGATIONS

Imaging workup with MRI showed a paraspinal AVM of the right side with large ectatic venous

Figure 1 Axial (A) and sagittal (B) views. T2 weighted image obtained through the lumbar spine shows the presence of multiple flow voids (arrows) in the paravertebral space and L2 foramina.

To cite: Martínez-Galdámez M, Rodríguez-Arias CA, Utiel E, et al. *BMJ Case Rep* Published online: [please include Day Month Year] doi:10.1136/bcr-2012-010647

pouches within the L2 foramina and the paraspinal space. No intramedullary edema or intracranial anomalies were seen (figure 1A, B).

A transfemoral angiographic study confirmed a fistula-type paravertebral AVM with arterial supply from a hypertrophic segmentary right L2 artery, and a single venous drainage was into the ipsilateral azygos system (figure 2).

TREATMENT

The procedure was carried out in the vascular angiography room under general anesthesia without systemic heparinization, by means of coaxial catheterization through the right femoral artery using a 6 F Longsheath (Cook Medical Inc, Bloomington, Indiana, USA) and an Envoy 6 F guiding catheter in order to achieve a stable position allowing us to advance distally through it.

Due to the diameter of the hypertrophic afferent artery (6 mm), we thought that conventional Onyx (ethylene vinyl alcohol copolymer; ev3-covidien) embolization with a single microcatheter entailed the risk of reflux to the aorta artery as the creation of a 'plug' would be difficult and could cause retention of it.

Inflation of a proximal balloon creates a 'mechanical plug', allowing for immediate forward flow of Onyx. Additionally, the balloon increases the proximal resistance in the feeder, encouraging Onyx to penetrate more distally into the lesion.

We decide to use an Ascent balloon 6×9 mm (Codman Neurovascular, Raynham, Massachusetts, USA), which is a dual lumen balloon, dimethyl sulfoxide compatible, with a death space of 0.3 ml. During the first injection of Onyx, we achieved occlusion of almost all of the inferior component of the malformation and afterwards the balloon was deflated by syringe suction without difficulty (figure 3). As Onyx did not penetrate anymore, the catheter was removed immediately without noticeable adherence to the Onyx cast.

We used a second Ascent balloon to inject through the proximal small branches from the same artery, occluding the middle and upper components of the AVM. We injected four vials of Onyx 18 (6 ml) in total, achieving closure of over 95% of the lesion with significant reduction in arteriovenous shunting (figures 4, 5).

The final angiographic run showed small afferents from an artery at the level of L3 on the right side, feeding a minimal inferior component (figure 4).

OUTCOME AND FOLLOW-UP

The period immediately after the procedure was complication free, and on follow-up at 1 month the neurological examination was normal. The fact that the patient is asymptomatic despite the Onyx cast may be explained by the fact that the symptoms were probably secondary to a 'steal' phenomenon or venous hypertension rather than the mass effect.

DISCUSSION

The major forms of spinal vascular malformations can be classified on the basis of their location: intraspinal (ie, inside the spinal canal; intramedullary, perimedullary, or purely epidural or radicular); vertebral (hemangiomas); or paravertebral.¹ Paraspinal AVMs are rare lesions that have diverse presentations and imaging features.⁴ They can be direct arteriovenous shunts or real malformations with a nidus.⁴ Treatment of symptomatic cases with multiple feeders remains a challenge.⁴ Such a lesion often extends over multiple spinal levels and does not have a well defined nidus.² As the natural history of these types of malformations remains

Figure 2 Diagnostic angiography. Selective catheterization of the second right lumbar artery shows an epidural arteriovenous malformations/fistula, draining into the epidural vein. No medullary venous drainage can be seen.

Figure 3 Oblique digital subtraction angiography image shows the Ascent balloon catheter inflated in the afferent artery, creating a mechanical plug allowing Onyx penetration.

Figure 4 Control angiogram in the lateral view shows closure of over 95% of the lesion with significant reduction in arteriovenous shunting.

Figure 5 Onyx cast at the level of the L2 right foramina.

unknown,¹ we recommend reserving treatment for those symptomatic cases with radicular pain or denervation.⁵

Neurosurgical treatment is indicated in rare cases of epidural hematoma compression. In other cases the firstline endovascular treatment provides a progressive devascularization of the nidus by injection of polymerizing substances (isobutyl cyanoacrylate) or precipitate (Onyx).⁶ There have been previous reports of a balloon assisted technique using over the wire balloons.^{7–8} Inflation of a proximal balloon creates a ‘plug’, allowing for immediate forward flow of Onyx. Additionally, the balloon increases the proximal resistance in the feeder, encouraging Onyx to penetrate more distally into the lesion. The drawbacks of Onyx embolization include the time needed to create a proximal plug that allows forward flow of the agent into the lesion and/or the use of detachable tip microcatheters. Another drawback is proximal reflux of Onyx, which can compromise the normal vasculature and cause retention of the microcatheter.⁹

The Ascent balloon is dimethyl sulfoxide compatible and allows for balloon inflation and Onyx injection via two different lumens.⁸ In contrast with the use of an over the wire balloon, the Ascent balloon maintained apposition along the entire diameter of the arterial feeder preventing reflux of Onyx.

Although the Ascent balloon was originally designed as a remodeling balloon for aneurysm embolization,¹⁰ we believe that it can be used for embolization of AVMs⁹ with Onyx in any location.

Learning points

- ▶ Paraspinal arteriovenous malformations (AVMs) are rare lesions that have diverse presentations and imaging features.
- ▶ Endovascular treatment of symptomatic cases remains a challenge.
- ▶ The Ascent balloon can be used for embolization of AVMs with Onyx.

Contributors All authors contributed to the concept, authorship, revision, and final review of the manuscript.

Competing interests None.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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