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Clinical case

Minimally invasive approach for the treatment of lumbar epidural arteriovenous fistulas with intradural venous reflux

A. Najjar[a], F. Zairi[a,c,*], T. Sunna[a], A. Weil[a], L. Estrade[b], A. Weill[b], D. Shedid[a]

[a] Division of neurosurgery, department of surgery, Notre Dame hospital, university of Montreal, Montreal, Quebec, Canada
[b] Division of neuroradiology, department of radiology, Notre Dame hospital, Montreal, Quebec, Canada
[c] Department of neurosurgery, Lille university hospital, 59000 Lille, France

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ABSTRACT

Background. – Vascular lesions of the spinal cord are increasingly recognized. The most common types of these lesions are dural arteriovenous fistulas (AVFs) whereas, extradural AVFs are a very rare type of spinal AVF and can be associated with either extradural or intradural venous reflux. This results in neurological deficits through congestive or compressive myeloradiculopathy. These lesions must be treated to allow stabilization or improvement of neurologic status, either by endovascular therapy or microsurgical interruption. However, because some patients are not amenable to endovascular treatment, surgery is often warranted, which usually involves hemi- or bilateral laminectomy following a midline approach with bilateral muscle stripping. The main drawback of this procedure is directly related to the morbidity of the approach. Although, minimally invasive approaches are likely to overcome this drawback, there is a lack of reported experience supporting their use for treating spinal dural AVFs.
Case presentation. – Two patients, aged 62 and 79 years old, presented with rapidly progressive myelopathy characterized by paraparesis and sphincter disturbance. Spinal magnetic resonance imaging showed spinal cord oedema with perimedullary flow voids in both cases. Digital subtraction angiography revealed extradural AVFs associated with perimedullary venous reflux. Endovascular therapy was not feasible. Both patients were treated with microsurgical interruption of the intradural vein through a non-expendable retractor. Complete exclusion was confirmed on postoperative angiography, resulting in resolution of spinal cord edema and improved neurological functional status at 2-year follow-up.
Conclusion. – The minimally invasive surgical treatment of spinal AVFs with epidural venous reflux is safe and effective. This approach is a valuable alternative to endovascular therapy and the standard open microsurgical approach.

1. Introduction

Spinal extradural arteriovenous fistula (AVF) is a very rare spinal vascular lesion, characterized by an arteriovenous shunting located outside the dura mater. This differs from the more common dural AVF, where the shunt is located in the dura mater at the level of the nerve root [1–10]. Extradural AVFs are associated with either retrograde epidural or intradural venous drainage, and lead to neurological deficits through congestive myelopathy or epidural compression of spinal cord/nerve roots, respectively [11]. These lesions are either congenital or acquired, following spine trauma or surgery [1]. Like their dural AVF counterparts, the mainstay of treatment relies on interruption of the origin of the draining vein [12]. Endovascular treatment is an effective strategy consisting of the exclusion (coils or Onyx) of both the extra- and intradural components to prevent recurrence [1]. Although endovascular embolization offers a less invasive approach, that can be performed in the same setting as the diagnosis, it may be associated with a slightly higher rate of treatment failure [1,11]. In addition, subsets of patients with a spinal dural arteriovenous fistula (DAVF) are not candidates for embolization, such as those in which the DAVF feeders are small, multiple or located at the level or adjacent to the Adamkiewicz artery [1,11]. In these situations, microsurgical interruption represents a more valuable treatment option [1,11].

* Corresponding author. CHRU de Lille, rue Emile-Laine, 59000 Lille, France.
E-mail address: Fahed.zairi@gmail.com (F. Zairi).

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The treatment consists of identifying and interrupting the origin of the draining vein. Traditionally, this procedure is performed through an open laminectomy and a midline incision. The main drawback of this procedure is directly related to the morbidity of the approach that requires a wide muscle disinsertion which is likely to increase the overall morbidity (postoperative pain, infection rate, etc.). Recently, a minimally invasive approach has gained popularity for the treatment of various spinal pathologies with the aim to reduce the approach-related morbidity. Although, the feasibility of treating spinal dural AVFs using a minimally invasive muscle-splitting approach has been previously demonstrated [3,8,13], there is still a lack of reported experience in the literature. We report, to our knowledge, the first case of purely extradural AVFs with intradural venous reflux treated through a non-expendable tubular retractor. We also report the feasibility, advantages and potential pitfalls of this approach.

2. Case reports

2.1. Case 1

2.1.1. History and examination

A 62-year-old man presented with paresthesia of his lower limbs for 9 months and paraparesis for 6 months followed by urinary retention and fecal urgency for 3 months. Examination showed slight proximal bilateral lower limbs weakness with sensory level at T8. Preoperative MRI of the spine showed extensive cord edema from T8 down to the conus medullaris (Fig. 1). Selective digital subtraction angiography (DSA) showed an extradural fistula at the left L3 vertebral level with reflux into the perimedullary veins.

2.1.2. Operation

The patient underwent microsurgical interruption of the perimedullary vein through a minimally invasive approach. A 2.5-cm long skin incision was performed 1.5 cm off midline. The serial dilators and final 24-mm non-expandable tubular retractor system was docked over the left L3-L4 interlaminar space. A left L2-L3 hemilaminectomy was carried out using an electrical drilling system and dural opening is practiced under the surgical microscope to expose the arterialized perimedullary vein (Fig. 2). The vein is localized and coagulated. After ensuring hemostasis, the dura is closed using 4-0 silk sutures. There were no complications and no postoperative CSF leak. The operative time was 120 minutes with 150 cm^3 of blood loss.

2.1.3. Postoperative course

The patient was discharged 2 days after surgery with improved neurological outcome. Immediate postoperative DSA confirmed absence of reflux and significantly decrease in edema, respectively (Fig. 1). Urinary dysfunction was resolved 4 months after surgery. At last 2-year follow-up, he was neurologically improved and MRI showed the absence of spinal cord edema.

2.2. Case 2

2.2.1. History and examination

A 79-year-old woman with a history of hypertension, smoking, diverticulitis and a previous episode of thrombophlebitis was referred to our institution for the management of a complex pelvic vascular malformation. She presented with a 6-month history of rapidly progressive paraparesis. The patient had a very complex type of fistula fed by bilateral pelvic arteries (Fig. 3). The lesion was considered not amenable to endovascular therapy. Because the neurological manifestations were related to a congestive myelopathy from the intradural venous reflux, the decision was made to address the intradural perimedullary vein.

2.2.2. Operation

The patient underwent a minimally invasive approach occlusion of the draining vein using the same reported procedure, which was uneventful. The operative time was 140 minutes with 200 cm^3 of blood loss.

Postoperative DSA showed an occlusion of the draining vein and absence of reflux into the perimedullary venous system.

2.2.3. Postoperative course

She was discharged at day 3 with an improved neurological status. At last 2-year follow-up, she was neurologically intact and the MRI showed no spinal cord edema.

3. Discussion

Extradural AVFs are very rare spinal lesions, with less than 25 reported cases in the literature [1–15]. They have been recently included in the classification of spinal AVFs, and are characterized

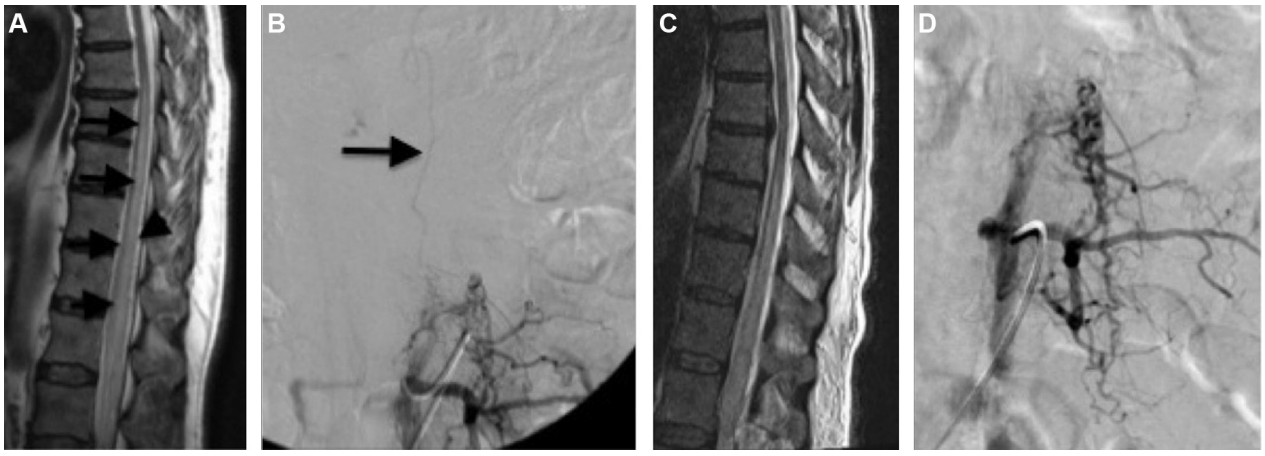

Fig. 1. A. Spinal sagittal T2 MRI showing extensive intramedullary hyperintensity consistent with spinal cord edema (arrows). There are tortuous perimedullary flow voids behind the cord (arrowhead). B. Selective anteroposterior angiography at L3 shows early opacification of the epidural venous plexus with reflux into the perimedullary vein. This early opacification differentiates it from the more common dural AVFs. C. Immediate postoperative sagittal T2WI MRI showing decreased cord hypersignal and disappearance of the perimedullary flow voids, which were seen preoperatively. D. Postoperative selective L3 angiography showing early opacification of the epidural venous plexus but no perimedullary venous reflux.

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