Spinal arteriovenous malformation – surgical treatment, with emphasis in the importance of the multidisciplinary discussion for therapeutic decision

Malformação arteriovenosa medular – tratamento cirúrgico, enfatizando a importância da discussão multidisciplinar para decisão terapêutica

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ABSTRACT

Spinal AVMs are complex lesions that can present as a nidus or more often as fistulae. Diagnosis is usually made by angiography and the treatment of election in most cases is embolization being surgery reserved for selected cases. In this report the classification of such lesions and their treatment are discussed. We also present a case that was submitted to surgery. Although usually managed by embolization, surgery of spinal AVMs also has a role in the treatment, bringing to evidence the necessity for a multidisciplinary discussion in the therapeutic decision making process.

Keywords: spinal arteriovenous malformation; embolization; surgery

RESUMO

MAVs medulares são lesões complexas que podem se apresentar como nidus ou mais frequentemente como fistulas. O diagnóstico é realizado através de arteriografia e o tratamento de eleição é geralmente a embolização, ficando a cirurgia reservada para casos selecionados. Neste artigo são discutidos as formas de classificação dessas lesões e seu tratamento. Apresenta-se ainda um caso onde foi realizado o tratamento cirúrgico. Embora geralmente tratadas por embolização, a cirurgia nas MAVs medulares também tem seu papel no tratamento evidenciando a necessidade da discussão multidisciplinar no processo de decisão terapêutica.

Palavras-chave: malformação arteriovenosa medular, embolização, cirurgia

INTRODUCTION

Spinal arteriovenous lesions are a collection of dissimilar and diverse uncommon entities which can be either fistulae or nidus. They can be classified according to anatomical factors, their potential relationships with genetics, vascular biological features and angiogenesis. Direct arteriovenous fistulas (AVF) are lesions most frequently located on the spinal cord surface; on the other hand, the true arteriovenous malformation (AVM) are lesions formed of capillary network (nidus) interposed among feeder arteries and venous drainage located on the spinal cord surface or at an intimate relationship with spinal cord parenchyma.

Embolization is usually chosen as first intention treatment and, in selected cases where it is not feasible, surgery could be indicated. These options may also be combined and in certain cases depending on the risks, no treatment at all should be considered.

This paper presents a case of a female patient with a spinal AVM where the diagnosis technique and the therapy employed are discussed.
CASE REPORT

A 21-year-old woman presented to our emergency unit with history of acute onset of neck pain and stiffness, without any motor or sensitive deficits and no changes in the level of consciousness two days prior to admission. CT scans did not show any abnormal findings, and cervical MRI showed changes in compatible with multiple abnormal vascular structures at the posterior region of the vertebral canal between C3 and C7. Spinal angiography was performed shortly after admission (fig. 1).

Figure 1 – Angiography of the cervical vertebral artery in the anterior-posterior (left) and lateral (right) plane showing retro-spinal AVM with several feeding arteries, central nidus and venous drainage, seeming there is no deep intramedullary outline.

After a multidisciplinary discussion that involved the interventional neuroradiologist and the neurosurgeon, surgical treatment was decided. Surgery was performed via an open-door C3 to C7 laminoplasty. The dura-mater was opened in the midline in order to expose the posterior aspect of the spinal cord and the AVM. The feeder arteries were identified. Guided by angiography findings, careful bipolar coagulation of the feeders was carried out beginning by the smaller vessels and followed by coagulation of the larger feeders. This diminishes the chance of abrupt changes in shunt hemodynamics, which could increase blood inflow through the smaller arteries, thus increasing the chance of AVM rupture or local congestion.

After complete occlusion of arterial supply, the nidus was carefully dissected from the pial surface, avoiding spinal cord injury; then, in the end of the procedure, removal of the draining vein was performed after its coagulation (fig. 2).

Figure 2 – Upper: intraoperative imaging of pial AVM after opening of the dura-mater, in the left there are feeding arteries, with central nidus, and in the right there is the venous drainage. Lower: intraoperative view of the lesion after coagulation of the arterial branches, dissection of the nidus and coagulation of the draining vein, the last two still presented in the image.

During the postoperative period, the patient was asymptomatic and remained with no deficits. For her comfort, she was discharged with a soft cervical collar a few days after the surgery.

DISCUSSION

Depending on the location, mass effect or the occurrence of bleeding, the venous drainage of a spinal AVM may be responsible for some of the clinical symptoms, causing pain, sensitive-motor disorders or even myelopathy. There may be acute symptoms of subarachnoid or intramedullary hemorrhage, hemodynamic disorders (such as cardiac overload or failure, in the newborn), or even intraventricular hemorrhage in cases where there is rostral shunt drainage to the posterior fossa with rupture in the venous drainage2,3,6,8-10.

The gold standard exam for the diagnosis and therapeutic planning is the spinal angiography. Magnetic resonance imaging and computed tomography are useful in the screening to locate the lesion (demonstrating its relation with the spinal cord and the meningeal spaces) and to show evidence of bleeding, swelling, atrophy, venous thrombosis, or intramedullary cavities3,5,8.

The primary goal of treatment is, whenever possible, the exclusion of the AVM from the circulation. Secondary goals of...
treatment are the alleviation of neurological symptoms, the relief of mass effect and of venous hypertension and congestion, and the prevention of hemorrhagic complications. This may be achieved with endovascular embolization alone, surgery, or the combination of both. Conservative treatment is chosen when aggressive treatment presents a high risk of producing neurological deficits.

Embolization can be curative in cases of high-flow AVFs. Nevertheless, cure using endovascular treatment is rare in the true AVM, due to the risk of occlusion of normal arteries, especially when the lesion is fed by the anterior medullary arteries. Surgical treatment for spinal AVMs presents a high risk of complications in inexperienced hands as, besides being located in an extremely eloquent area of the central nervous system, these lesions are uncommonly found in the average neurosurgeon’s daily practice.

However in specialized centers, curative surgery may be indicated in selected cases, such as low-flow AVFs and small AVMs presenting in the posterior spinal cord surface. Surgery could also be indicated for those patients with contraindication to endovascular treatment or those who had already been submitted to an endovascular procedure with partial occlusion in which the surgical resection presents small probability to cause new neurologic deficits.

Being its natural history quite different from brain AVMs and once acute rebleeding is uncommon, emergency surgery is rarely indicated for spinal AVMs.

In the case presented, the conclusion of a multidisciplinary discussion, was against embolization because the odds were that the procedure would not be curative due to the presence of stenosis in the origin of the small feeding arteries arising from the vertebral artery. Distal catheterization was also considered too difficult due to the extreme tortuosity of the vessels (see figure 1). On the other hand, as the nidus was small and had a posterior location surgery was considered the best option.

### Conclusion

Angiography remains the gold-standard to best analyze the anatomic, morphologic and architectural features of a spinal AVM, which are necessary for the therapeutic decision. Therefore a multidisciplinary discussion amongst experienced physicians is of paramount importance to achieving the best results in the treatment.

The first choice for treatment is usually embolization, carrying a somewhat lower risk of complications than the surgical treatment. In selected cases, such as those where the lesion is small, located posteriorly, and is difficult for a curative endovascular treatment, surgery may have better results.

### References


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