Pseudomeningocele after Traumatic Nerve Root Avulsion

A Novel Technique to Close the Fistula

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Key words: root avulsion, pseudomeningocele, traumatic brachial plexus

Summary

Traumatic brachial plexus complete avulsions and the subsequent formation of pseudomeningoceles are a well-known entity that usually remains asymptomatic. Pseudomeningocele is due to the dural sleeve encasing the damaged roots and the spinal liquid that may accumulate locally or in the supraclavicular soft tissues. The pseudomeningocele, added to the associated lesion of the plexus and usually the surrounding vessels, may become difficult to manage. We describe the novel management of a traumatic pseudomeningocele using an endovascular technique.

Introduction

Complete avulsion of the brachial plexus implies a preganglionic lesion located intradurally, and is usually due to traction injuries, motorcycle accidents being the most common cause^{1,2}. It can be associated with a subclavian artery lesion, constituting a complicated entity to manage³. The posterior formation of a symptomatic pseudomeningocele in the location of the traumatic injury entails a difficult surgical approach.

Material and Methods

A 51-year-old man was admitted to our hospital after a motorcycle accident, with the right brachial plexus completely avulsed and a sub-

clavian artery rupture. He also had multiple fractures, including a right femur comminuted fracture. He underwent emergency surgery for the fractures and a vascular repair of the subclavian artery, performing an end-to-end anastomosis of the artery. Magnetic resonance imaging (MRI) and an electromyogram (EMG) showed complete root avulsion of the brachial plexus. After a month, the patient presented orthostatic headache and a supraclavicular tumor that enlarged when the patient was in orthostatism. A cervicothoracic MRI revealed a lateral pseudomeningocele arising from the right T1-T2 intervertebral foramen (Figure 1), and a smaller one arising from the inferior foramen.

The patient underwent X-ray guided puncture of the pseudomeningocele and after the injection of contrast directly puncturing the pseudomeningocele, the direct fistula in the intervertebral T1-T2 foramen was localized. Then, a wire was constructed with coils and Glubran 2 was injected after positioning the microcatheter as proximally as possible to the fistula, stopping when retrograde flow was displayed in the pseudomeningocele, with the closure of the communication (Figure 2). Control MRI showed a displacement of the coils, and even if the patient had a smaller pseudomeningocele after the first procedure, a second injection was performed using the same technique but this time inserting coils and Onyx liquid embolic agent, resulting in complete occlusion of the communication and hence an improvement in the patient's symptoms (Figure 3).

Figure 1 Preoperative neuroradiological findings. Coronal myelogram (A) and MRI using FIESTA (fast imaging employing steady state) (B) acquisition sequence reveal a lateral pseudomeningocele arising from the right T1-T2 intervertebral foramen. We can also see the cerebrospinal fluid arising from the foramen in an axial view (C).

Figure 2 A,B) Fluoroscopic coronal images showing the wire built with coils and Glubran®.

Figure 3 A,B) Fluoroscopic coronal images of the second procedure showing the wire built with coils and Onyx. C) MRI showing complete occlusion of the pseudomeningocele.

Discussion

Traumatism where the brachial plexus is avulsed often include associated injuries, like artery lesions or fractures⁴, than can worsen the prognosis and limit the treatment. When the lesion is located intradurally (preganglionic), the dural sleeves encasing the avulsed roots usually tear. The cerebrospinal liquid then escapes and it is very common to find small pseudomeningoceles that are usually self-limited and asymptomatic. Pseudomeningoceles may also be found without a complete root avulsion, with varying degrees of a nerve root injury^{5,6}. Occasionally, the cerebrospinal liquid may accumulate in the supraclavicular tissues and cause local pain due to the enlarging fluid collection

and symptoms due to the leak that causes liquid hypotension in orthostatism.

The classic approach to repair these defects, where the nerves cannot be surgically repaired, is direct laminectomy and direct surgical suturing of the dural tears⁷. In our patient, as in the majority of cases with serious injuries of the brachial plexus, previous surgery in the location due to the subclavian artery rupture made the surgical approach to that area more difficult and dangerous.

In the first procedure, we used coils and Glubran 2, a kind of acrylic glue (GEM Srl, Viareggio, Italy) used for endovascular neuroradiological uses. We chose Glubran 2 instead of other glues, like Histoacryl, because it diffuses more completely and is less traumatic than oth-

er glues because it polymerizes at a lower temperature (40°C)⁸. After displacement of the coils, we decided to use a less “rigid” embolizing agent for the second procedure. In our experience, Onyx (Onyx System MicroTherapeutics, Inc., MTI, Irvine, CA, USA) shows an optimal occlusion of direct fistulas due to the continuous control and accuracy that can be achieved with a slow injection.

Endovascular vessel occlusion using microcoils is effective and well described^{9,10}, and its association with Onyx is approved for the treatment of intracranial arteriovenous malformations and intracranial aneurysms¹¹. The use of this technique is limited, as occurs in vascular

utilization, by the liquid flow. The liquid leak, in our case, had an outflow from the spinal canal, preventing the escape of Onyx inside it.

Conclusion

We describe the novel use of coils and Onyx for the treatment of a traumatic pseudomeningocele due to avulsion of the brachial plexus. This technique stops the continued leak through the intervertebral foramen with a lower risk than the traditional surgical procedure. It is rapid and safe, and should be considered a good option to treat complicated patients.

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