Editorial

Posterior fossa dural arteriovenous fistulas

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Dural arteriovenous fistulas (DAVF) s are a fascinating, evolving chapter of vascular neurosurgery. In this issue of the Journal of Neurosurgery, Mitsuhashi and coworkers1 review 2 specific subtypes of DAVFs that share numerous morphological, clinical, and therapeutic similarities: those draining into the petrosal vein or one of its equivalents, and those draining through the bridging vein of the lateral medulla.

DAVFs draining into the petrosal vein have only recently been recognized as a separate entity. Traditionally they have been grouped under the umbrella of “tentorial DAVFs.” As noted by the authors, these DAVFs have precise anatomical characteristics such as retrograde leptomeningeal drainage, usually without direct involvement of the petrosal sinus, supply from petrosal branches of the middle meningeal arteries and from branches of the meningohypophysial trunk, and frequent supply from dural branches of the vertebrobasilar system. These AVFs are not infrequently associated with intracranial hemorrhage or progressive neurological symptoms related to the mass effect of associated venous varices. The pattern of retrograde venous drainage is commonly from the petrosal complex through the lateromesencephalic vein to the vein of Rosenthal and then to the vein of Galen. Symptoms can be subtle. Occasionally, because of retrograde venous drainage to perimedullary veins, DAVFs of the petrosal vein can present with a progressive congestive myelopathy.

In the past, complex skull base approaches were used to treat these lesions. However, with a better understanding of their anatomy and pathophysiology, it has become clear that simple interruption of the main draining vein along the petrous ridge is sufficient to treat these lesions, even in apparently extremely complicated cases.2 Three-dimensional CT angiography provides excellent anatomical localization in these cases, showing the draining vein as it emerges from the dura of the posterior fossa.3 Traditionally these DAVFs have been difficult to treat endovascularly. As the authors note, the transarterial approach with N-butyl cyanoacrylate often led to incomplete obliteration because of the difficulty in effectively obliterating the proximal segment of the draining vein from the transarterial route. The transvenous approach is difficult and dangerous due to the risks associated with microcatheterization of tortuous leptomeningeal veins. Therefore, most of these skull base DAVFs have been treated with open surgery. As mentioned before, surgery for these lesions is straightforward and associated with a very low risk of complications. However, endovascular treatment is a moving target, and with the advent of Onyx and the ability to achieve better penetration from the transarterial route, more and more of these “surgical DAVFs” are being treated instead with this method. It would be interesting to know what Mitsuhashi and coworkers1 think about the role of transarterial Onyx embolization for petrosal DAVFs.

Medulla bridging vein–draining DAVFs have traditionally been called cranovertebral junction DAVFs. These DAVFs often present with subarachnoid hemorrhage and can be missed unless a complete angiogram, including selective catheterization of both vertebral arteries and external carotid arteries is performed. Once localized, these DAVFs, similar to petrosal DAVFs, are easily treated surgically by interruption of the draining vein. Even in the current “Onyx era,” transarterial embolization in this area is not without intrinsic risks, as outlined by these authors, because of potential or inadvertent embolization of the ascending pharyngeal artery branches.

Based on embryological considerations, demographic distribution (high prevalence in men as opposed to the high female prevalence in the more common transverse-sigmoid sinus DAVFs), pattern of venous drainage, and common surgical strategy, Mitsuhashi et al.1 consider petrosal vein and medulla bridging vein DAVFs analogous to spinal DAVFs, and group them along with anterior cranial fossa and other lateral middle fossa DAVFs in a “lateral epidural” group. Although the demographic and angiographic analogies among these lateral DAVFs are compelling, there are substantial clinical differences that make such a classification of dubious practical utility. Spinal DAVFs virtually never present with hemorrhage, and this is a very important and critical difference.

The article by Mitsuhashi and coworkers1 is illustrated with beautiful angiographic pictures. The aristocratic, at times provocative and dogmatic, but always stimulating intellectual analysis of the disease and the artistic depiction of the angiographic anatomy are typical of the senior author, the late Professor Lasjaunias. Although not everybody would agree with the conclusions of this article, this analysis should be a reminder to all of us that behind the mere execution of a procedure (surgical or endovascular)
there must be a detailed knowledge of the disease and of the underlying normal and pathological anatomy. It is the combination of knowledge, judgment, and technical skills—this magic mixing of art and science that makes our field so fascinating and never boring. Once again, thank you Professor Lasjaunias for your teachings!

References


Response

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We deeply appreciate the interest of Drs. Lanzino and Boccardi in our article. They clearly discussed their ideas, similar to our own, about the angioarchitectural, clinical, and therapeutic features of DA VFs with direct drainage into the petrosal vein or medulla bridging vein. They also raised some issues to be elucidated in the future.

The different incidence of the hemorrhagic manifestation between these DA VFs and spinal DA VFs is still a matter of discussion. Indeed, thoracolumbar DA VFs show no hemorrhagic tendency. Although we postulate that it might be attributed to the different original blood flow between the cranial and the lower spinal region, a definitive explanation is not assured. However, to understand the essential characteristics of petrosal vein–draining or medulla bridging vein–draining DA VFs, we believe that categorizing them as homologs of the spinal DA VFs is rational and useful.

We need to know more about the histopathological features of these extrasinusoidal DA VFs, as well as the normal anatomy of the venous system of the posterior fossa. Although there are some reports describing the microscopic histological characteristics of the extrasinusoidal type of DA VF, 2 it is still unclear how dural arteries have a direct connection to the bridging vein. We mentioned in our article that the shunt is localized to the dural zone around the termination of the bridging vein, but this is just conceptual. Regarding the normal anatomy of the venous system of the posterior fossa, recently a very interesting work was published. Kiyosue et al. 3 evaluated the anatomical variations in the anterior medullary and anterior pontomesencephalic venous system using contrast-enhanced MR imaging. These authors paid close attention to anastomoses between the vessels in the pial venous system and the bridging vein connecting them to the epidural venous system of the posterior fossa, such as the posterior part of the cavernous sinus, inferior petrosal sinus, marginal sinus, or occipital cavernous sinus. The “lateral” type of DA VFs in the posterior fossa must involve these bridging veins and pial venous system.

Currently, direct surgical interruption of the affected bridging vein is the most safe and effective therapeutic approach for these DA VFs. However, we await the emergence of less invasive and safer new endovascular choices. Although we have scant experience with the use of Onyx, it might provide a new modality for the treatment of these DA VFs. Cognard and colleagues 1 reported their experience using Onyx for transarterial embolization of DA VFs with cortical venous drainage, including tentorial or foramen magnum DA VFs, and its advantageous ability to administer a large volume via a long-duration injection to penetrate the shunt with less risk of gluing the catheter. On the other hand, caution may be necessary to avoid the risk of undesirable distal venous migration or parent artery reflux.

We are deeply grateful to our late master professor Lasjaunias, who introduced us to such a fascinating and interesting world of neurovascular anatomy. We also thank all those who helped us to complete our article in Bicêtre.

References


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