VIA MEDICA

CASE REPORT

Folia Morphol.
Vol. 67, No. 4, pp. 292–295

ISSN 0015–5659
www.fm.viamedica.pl

Aneurysm of the meningeal branch of the occipital artery connecting with the distal portion of the posteroinferior cerebellar artery by the dural fistula

P. Słoniewski[1], J. Dzierżanowski[1], W. Och[2]

[1]*Department of Neurosurgery, Medical University of Gdańsk, Poland*
[2]*Department of Neurosurgery, Specialist Hospital, Olsztyn, Poland*

[Received 2 June 2008; Accepted 11 October 20008]

We describe a case involving a ruptured intradural aneurysm of the meningeal branch of the occipital artery arising from the external carotid artery and connecting with the caudal loop of the posteroinferior cerebellar artery (PICA) by the dural fistula. Angiography of the left external carotid artery showed a saccular aneurysm of the occipital artery, but the picture of the left vertebral artery was normal and no vascular pathology such as an aneurysm or a dural fistula was noticeable between the meningeal branch of the occipital artery and the PICA. The diagnosis was confirmed by three-dimensional reconstruction computed tomography (CT) angiography, magnetic resonance imaging and magnetic resonance angiography (MRA).

In the knowledge, based on the radiological examinations, that the aneurysm was located intracranially below the tonsil, compressing the lateral surface of the medulla oblongata at the level of the foramen magnum, we decided to operate from the far-lateral suboccipital approach, without removing the arc of the C1. An aneurysm was visualised at the site of the connection of the caudal loop of the PICA and an anastomosis of the meningeal branch of the occipital artery. The aneurysm was successfully clipped and the vascular fistula was coagulated and dissected in the extradural section.

To our knowledge, the case presented here is the first report of this kind of vascular pathology. Careful analysis of a cross-sectional CT angiogram, MRA and arteriography is necessary for the proper diagnosis of such atypical vascular pathology. In the study presented we focus our attention on the diversity of the PICA anatomy. (Folia Morphol 2008; 67: 292–295)

Key words: posteroinferior cerebellar artery (PICA), aneurysm of the distal PICA, far-lateral approach, dural fistula

CLINICAL PRESENTATION

A 52-year-old man, in whom subarachnoid haemorrhage had been identified in computed tomography (CT), underwent cerebral angiography, which showed a saccular aneurysm of a branch of the occipital artery. There was no other noticeable vascular pathology, especially on the left posteroinferior cerebellar artery (PICA) (Fig. 1A, B).

Three-dimensional reconstruction of CT angiography and magnetic resonance angiography (MRA)

Address for correspondence: J. Dzierżanowski, Department of Neurosurgery, Medical University of Gdańsk, Dębinki 7, 80–957 Gdańsk, Poland, tel: +48 58 349 23 31, fax: +48 58 345 58 88, e-mail: jaroslaw_dz@wp.pl

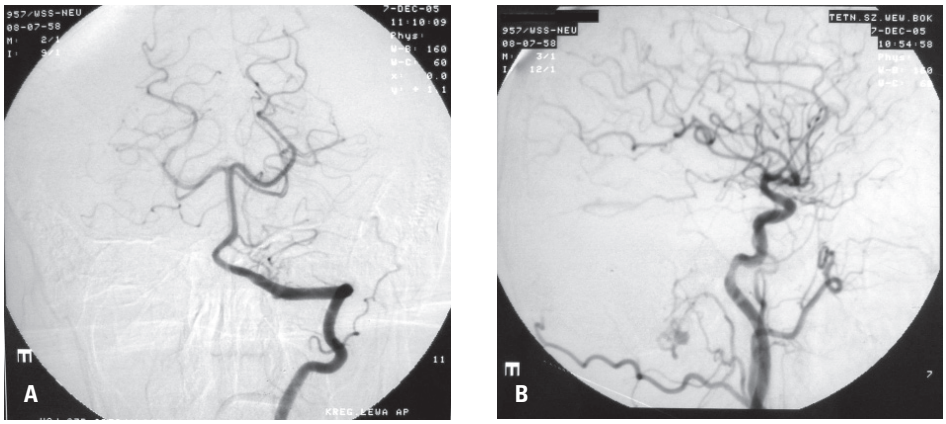

Figure 1. A. Angiogram of the left vertebral arteries: the posteroinferior cerebellar artery is following a standard course without anastomosis and aneurysm. **B.** Angiogram of the internal and external carotid artery (contrast was given to the common carotid artery). A saccular aneurysm is demonstrated in the occipital artery.

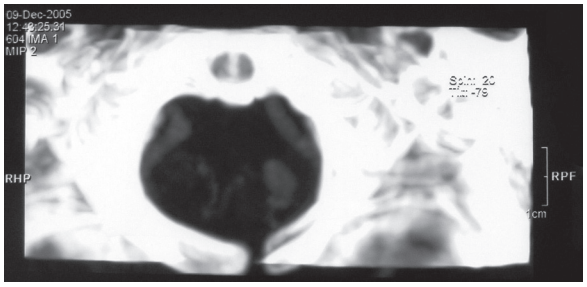

Figure 2. A three-dimensional reconstruction computed tomography angiogram showed the aneurysm located on the level of the foramen magnum and modelled a lateral surface of the medulla oblongata.

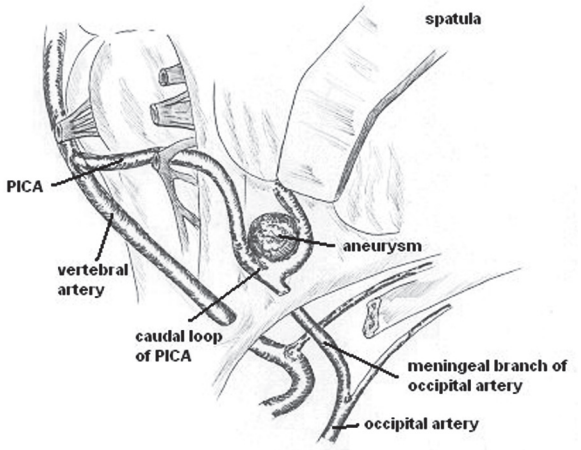

Figure 3. After retraction of the cerebellum structures with a spatula, the saccular aneurysm of the vascular complex is noticeable, consisting of a caudal loop of the tonsillomedullary segment of the posteroinferior cerebellar artery (PICA) and the dural fistula, the meningeal branch of the occipital artery arising from the external carotid artery.

showed that the aneurysm located at the level of the foramen magnum and modelled the lateral surface of the medulla oblongata (Fig. 2).

During the operation the vascular complex was exposed intradurally (Fig. 3, 4). This consisted of a low situated caudal loop of the third segment of the PICA and an aneurysm at the site of the connection with the meningeal branch of the occipital artery by the dural fistula.

The meningeal branch was coagulated, clipped and cut extradurally, but the aneurysm still demonstrated blood flow, which was confirmed by the use of micro-Doppler ultrasonography. This suggested a second source of vascularisation from the PICA, despite the absence of correct images of the left vertebral angiography. The aneurysm was clipped successfully, and this was verified during postoperative vascular examination.

DISCUSSION

Aneurysms of the distal PICA are relatively rare, and their origin and clinical features are poorly

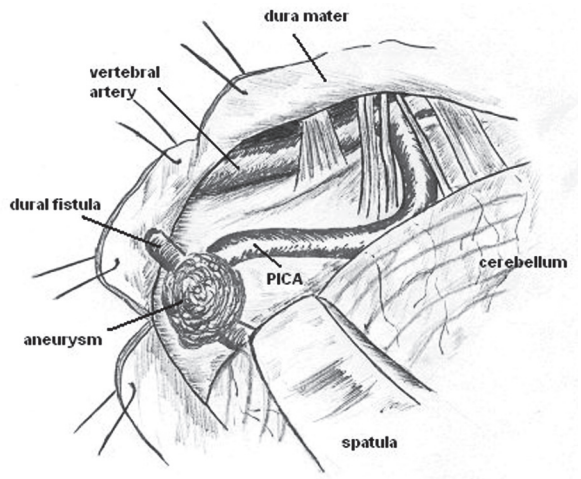

Figure 4. The view in the operating area after lateral suboccipital craniectomy, opening of the dura mater and retraction of the cerebellum. An aneurysm at the point of connection of the caudal loop of the posteroinferior cerebellar artery (PICA) and the dural fistula is visible.

understood [5, 13]. On the basis of published studies, aneurysms of the vertebral-posterior interior cerebellar artery junction account for about 3% of all intracranial aneurysms, while aneurysms arising from the peripheral segments of the PICA represent 0.3 to 0.7% of the total [3, 7, 9, 13, 14]. The most common site of distal aneurysms is in the telovelotonsillar segment of the PICA (29.6–34.0%) [3, 5].

A detailed classification of distal and proximal PICA aneurysms has not yet been drawn up. Mernesniemi et al. [10] proposed a classification whereby proximal PICA aneurysms are usually located within approximately 1 cm of its origin, whereas distal PICA aneurysms were located more than 1 cm away. Nussbaum et al. [12] defined the aneurysm as a distal one if there was a clear segment of normal artery proximal to the aneurysm. Other authors suggest that distal PICA aneurysms are located proximal to or on the telovelotonsillar segment [11].

The typical five-segmental anatomy of the PICA is well known). It should be emphasised that it has the most complex and variable course in relation to the adjacent vessels, nerves and osseous structures of all the cerebellar arteries [14]. This knowledge is essential for the planning of surgical approaches to treat pathologies of this region.

In 80–95% of cases the first anterior medullary segment arises from the intracranial and intradural portion of the vertebral artery, about 8.6 mm above the foramen magnum (from 14.0 mm below to 26.0 mm above) and approximately 17.0 mm proximal to the vertebrobasilar junction [2, 6]. In a review of normal arteriograms it was seen to originate below the foramen magnum in 18% of cases, at the level of the foramen magnum in 4% and above it in 57% [8]. It is reported that in 20% of cases it arises from the extradural segment of the vertebral artery below the foramen magnum, between C1–C2, and in 7% to 10% of all cases it is a branch from the basilar artery [4, 15]. According to Lang [4], who analysed 50 anatomical preparations, in cerebral angiography the artery was absent in 8.5% of cases, occurred bilaterally in 2% and arose from a duplicate trunk in 2.4%.

The second (lateral medullary) segment extends from the level of the most prominent part of the olive to the level of the rootlets of the low cranial nerves (IX, X, XI) and has the most complex relationship with them. According to Rhoton [14], the PICA passes between the rootlets of the accessory nerves in 38.1% of cases, in 31.0% between the vagus and accessory nerves, in 23.8% between the rootlets of the vagus nerve, in 2.4% between the glossopharyngeal and vagus nerves and in 4.8% between the glossopharyngeal and vestibulocochlear nerves.

The third (tonsillomedullary) segment extends from the level of the roots of the low cranial nerves around the caudal half of the tonsil and forms a caudal loop which can sometimes descend below the foramen magnum, even to the atlas [6]. The range of sites of the caudal loop is wide and covers an area from 7 mm below to 18 mm above the foramen magnum [6]. There may be a situation in which, although the proximal portion of the PICA is located intracranially, the distal segment is located extracranially. In some cases a caudal loop is not observed, when the point of origin from the vertebral artery is very low, and the whole course of the artery in the first four segments is ascending [14].

The telovelotonsillar segment of the PICA extends from the midlevel of the tonsil toward the roof of the IV ventricle and ends in a fissure among the vermis, while the tonsil and the hemisphere of the cerebellum pass over to the cortical segment of the PICA [14]. The fourth segment forms a cranial or supratonsillar loop, which is located about 9 mm (between 1.0 and 18.0 mm) below the fastigium [6].

The cortical portion bifurcates in a medial and lateral trunk (in 88% of cases) and ends on the surface of the cerebellum [6]. The course of the PICA, presented briefly, shows how many anatomical options should be taken into account before planning surgical treatment of vascular pathology in this region.

A very interesting and unresolved issue is the process of saccular distal PICA aneurysm formation. This pathology usually originates from the bifurcation of arteries and not from the straight segment of the vessel. A fusiform aneurysm is more likely to arise than a saccular one. Some authors suggest that on the basis of embryological vascular development, the basilar and vertebral arteries arise from plexiform formations around the brainstem from transverse branches connected by longitudinal remnants of the prominent lateral channel [3]. This embryogenesis may, in association with haemodynamic stress in the vessels, be responsible for branchless aneurysm formation. This theory can also explain the coincidence of a distal PICA aneurysm with other vascular pathology such as additional intracranial aneurysms, dural fistula, further cerebral aneurysms and hypoplastic vertebral artery or arteriovenous malformations. The incidence of these may be as high as 30% [1, 5, 13].

CONCLUSIONS

In conclusion, there is, to the best of our knowledge, no description of a similar case of vascular pathology available in the published studies. Taking into account the diversity of the anatomy of the posteroinferior cerebellar artery, careful analysis of a cross-sectional computed tomographic angiogram, computed tomographic scan, magnetic resonance image or arteriography is required for correct evaluation of the location of an aneurysm and its vascularisation, especially in questionable cases such as that presented.

REFERENCES

1. Batjer H (2005) Comments to: Orakcioglu B, Schuknecht B, Otani N, Khan N, Imhof HG, Yonekawa Y. Distal posterior inferior cerebellar artery aneurysms: clinical characteristics and surgical management Acta Neurochir, 147: 1131–1139.
2. Fine AD, Cardoso A, Rhoton AL Jr (1999) Microsurgical anatomy of the extracranial-extradural origin of the posterior inferior cerebellar artery. J Neurosurg, 91: 645–652.
3. Horiuchi T, Tanaka Y, Hongo K, Nitta J, Kusano Y, Kobayashi S (2003) Characteristics of distal posteroinferior cerebellar artery aneurysms. Neurosurgery, 53: 589–596.
4. Lang J (1985) Extradural origins of the posterior inferior cerebellar artery and their clinical importance [in German]. Neurochirugia, 28: 183–187.
5. Lewis SB, Dongwoo J Chang, Peace DA, LaFrantz PJ, Day AL (2002) Distal posterior inferior cerebellar artery aneurysms: clinical features and management J Neurosurg, 97: 756–766.
6. Lister JR, Rhoton AL Jr, Matsushima T (1982) Microsurgical anatomy of the posterior inferior cerebellar artery. Neurosurgery, 10: 170–199.
7. Locksley HB (1966) Report on the cooperative study of intracranial aneurysms and subarachnoid hemorrhage. Section V, Part 1. Natural history of subarachnoid hemorrhage, intracranial aneurysms and arteriovenous malformations. Based on 6368 cases in the cooperative study. J Neurosurg, 25: 219–239.
8. Margolis MT, Newton TH (1971) An angiographic sign of cerebellar tonsillar herniation. Neuroradiology, 2: 3–8.
9. Matsushita Y, Kawabata S, Kamo M, Hamada M, Matsukawa M, Taniguchi H, Kuroiwa T (2006) Ruptured aneurysm at the cortical segment of the posterior inferior cerebellar artery. J Clin Neurosc, 13: 777–781.
10. Mernesniemi J, Niemena N, Ishii K (2004) Comments to: D'Ambrosio A, Kreiter K, Bush C, Sciacca R, Mayer S, Solomon R, Connolly E Jr. Far lateral suboccipital approach for the treatment of proximal posteroinferior cerebellar artery aneurysms: surgical results and long-term outcome. Neurosurgery, 55; 39–54.
11. Nishizaki T, Tamaki N, Nishida Y, Fujita K, Matsumoto S (1985) Aneurysms of the distal posterior inferior cerebellar arteries: experience with three cases and review of the literature. Neurosurgery, 16: 829–832.
12. Nussbaum ES, Mendez A, Camarata P, Sebring L (2003) Surgical management of fusiform aneurysms of the peripheral posteroinferior cerebellar artery. Neurosurgery, 53: 831–835.
13. Orakcioglu B, Schuknecht B, Otani N, Khan N, Imhof HG, Yonekawa Y. (2005) Distal posterior inferior cerebellar artery aneurysms: clinical characteristics and surgical management Acta Neurochir, 147: 1131–1139.
14. Rothon AL (2000) The cerebellar arteries. Neurosurgery, Supl. 47: S29–S68.
15. Tanaka A, Kimura M, Yoshinaga S, Tomonaga M (1993) Extracranial aneurysm of the posterior inferior cerebellar artery: case report. Neurosurgery, 33: 742–745.