http://www.medscidiscovery.com
OPEN ACCESS JOURNAL

ISSN: 2148-6832

MSD Medical Science and Discovery
2016; 3(9):334-8

Case Report Doi: 10.17546/msd.88261

Aneurysm of the Internal Carotid Artery Pressing on Dorello's Canal in a Patient with Bilateral Abducens Nerve Palsy: Case Report

Ferhat Cuce[1], Cem Ozgonul[2], Ahmet Eroglu[3*], Ozgur Bulent Oztimucin[4], Samet Verim[1]

Abstract

Objective: Abducens nerve palsy (ANP) has an incidence of 11.3/100,000. ANP related to pressure on an aneurysm on Dorello's canal is unusual. We report a case of bilateral ANP following head trauma.

Case: A 31-year-old woman was admitted for evalu¬ation of diplopia that began after a trauma. In the diagnostic imaging, the magnetic resonance imaging (MRI) revealed a normal course of the bilateral abducens nerve (AN) in the pontine cistern. The adjacent anatomy of the right AN from the pons to the ocular bulb was normal. But the distal part of the left ICA petrous segment at the level of the foramen lacerum had a remarkable loss of signal void. Multidetector computed tomography angiogram demonstrated a left distal petrous ICA aneurysm which was under Dorello's canal and was remodeling the clivus.

Conclusion: We estimated that the left ANP was caused by the pressure of the aneurysm. and the right ANP was probably due to the trauma the patient had experienced.

Keywords: Abducens Palsy, Aneurysm, Dorello's Canal, MRI, Trauma

Introduction

The abducens nerve (AN) enters Dorello's canal after passing through the pontine cistern. The canal is located between the meningeal and periosteal layers of the dura mater just below the posterior clinoidal process. Trauma is the most common reason for bilateral abducens nerve palsy (ANP).

The nerve is injured by the shearing effect of trauma within the canal, where the nerve is held tightly (1). The second most common cause of ANP is subarachnoid hemorrhage of aneurysms and arteriovenous malformations (2), and the third most common cause is brain tumor, either because of direct invasion or as an effect of increased intracranial pressure (2).

ANP caused by tumor invasion generally occurs at the brainstem, in the pontine cistern, or at the cavernous sinus (3-5).

Here, we report a case of bilateral isolated ANP caused by head trauma on the right side and an unruptured aneurysm of the petrous internal carotid artery at the foramen lacerum pressing on Dorello's canal on the left side.

Aneurysm of the internal carotid artery (ICA) located at the level of the skull base has rarely been mentioned in the literature (6), and we have not found any report specifically describing an aneurysm in the petrous portion of the ICA pressing on Dorello's canal.

Case Report

A 31-year-old woman presented with the complaint of binocular horizontal diplopia at distance fixation in the primary position after an incident of head trauma 1 week prior (Fig. 1). She stated she had hit her head to the kitchen marble while standing up. . She had been seen by an ophthalmologist 2 months earlier, when she presented with a 1-month history of diplopia of both the right and left lateral gazes.

On ophthalmological examination, her vision was 20/20 with the Snellen Chart. Examination of the anterior segment and fundus revealed no abnormality. The patient's pupils were equal, round, and reactive to light without any afferent pupillary defect. A 12-prism diopter (PD) esotropia was measured at a distance, and there was a limitation of abduction in both eyes.

Received 25-06-2016 **Accepted** 28-06-2016 **Available Online** 15-09-2016
1 Mevki Military Hospital , Dept of Radiology, Ankara, Turkey
2 Van Military Hospital, Dept of Ophthalmology, Van, Turkey
3 Van Military Hospital, Dept of Neurosurgery, Van, Turkey
4 Istanbul Hospital, Dept of Ophthalmology, Van, Turkey
*** Corresponding Author:** Ahmet Eroglu **E-mail:** drahmeteroglu@gmail.com **Phone:** + 90 432 222 0244

She had no systemic diseases such as diabetes mellitus, hypertension, or collagen tissue disorders. To investigate the etiology of bilateral ANP, magnetic resonance imaging (MRI) including the constructive interference in steady state (CISS) sequence of the brainstem and pontine cistern was initially scheduled.

The CISS sequence images through the medulla and pons demonstrated a normal course of the bilateral ANs (Fig. 2) ascending from the pontomedullary junction to Dorello's canal.

The course of the right AN from the pons up to the lateral rectus muscle of the ocular bulb and the adjacent anatomy was normal. But in the axial images of the skull base, especially on T2WI, the distal part of the left ICA petrous segment at the level of the foramen lacerum had a remarkable loss of signal void (Fig.3). Multi-detector computed tomography (MDCT) angiography demonstrated a left distal petrous ICA aneurysm located under Dorello's canal that was remodeling the clivus (Fig. 4a, b).

The size of the aneurysm was 12.6 × 9.3 × 8.6 mm. We conjectured that the left ANP was caused by the pressure of the aneurysm on Dorello's canal, and the right ANP was probably due to the trauma the patient had experienced.

Anticoagulation therapy was administered to the patient, and endovascular intervention of the aneurysm was planned for treatment of the left ANP. The patient was also administered systemic corticosteroid therapy for the traumatic ANP on the right side.

Two days after the placement of a carotid stent in the left ICA aneurysm (Fig. 5a, b), the patient's left eye was completely recovered from esotropia and the limitation of abduction. The palsy of the right abducens nerve improved within a month.

Figure 1. Eye movements of the patient demonstrating bilateral abducens palsy

http://dx.doi.org/10.17546/msd.88261

Figure 2. The CISS sequence in axial plane shows the cisternal portion of the abducens nerves at the level of the origin of Dorello´s canal (white arrows).

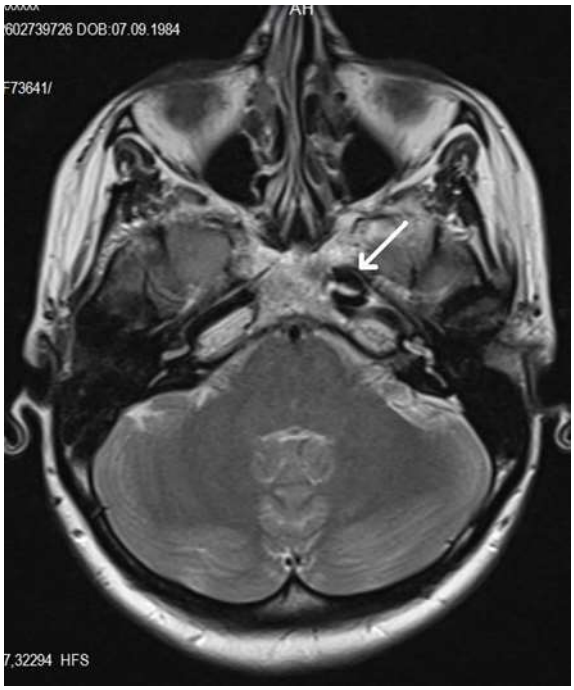

Figure 3. The axial image of T2-weighted sequence at the level close to the Dorello's canal. The distal part of the left ICA petrous segment had a remarkable loss of signal void in the central lumen (white arrow).

Discussion

The nucleus of the AN is located in the dorsal pons. Its course from the nucleus to its innervation of the lateral rectus muscle can be divided into four parts: the nucleus and intraparenchymal portion, cisternal portion, cavernous sinus portion, and orbital portion. The AN passes through the pontine cistern and enters the dura at the base of the skull, where it courses through Dorello's canal before entering the cavernous sinus (7). Dorello's canal has been defined as the small space located between the two dural leaves below the posterior clinoid process and the most anteromedial portion of the petrous ridge (8). The canal extends from the point where the AN pierces the dura mater to its entrance into the cavernous sinus. Its length is 4 to 13 mm (9). The petrosphenoidal ligament, or Gruber's ligament, is the posteromedial limit of the canal, connecting the petrous ridge to the clivus. The AN sheath has multiple connective tissue attachments to Gruber's ligament and the endosteal dura mater in Dorello's canal. These attachments limit the mobility of the nerve in compressive or stretch injuries, and the part of the nerve affected by trauma is generally this segment within the canal (1, 10). Avulsion injury may be the mechanism of ANP in the absence of evident fractures, as in the present case. While Dorello's canal cannot be directly revealed with radiological imaging techniques, the surrounding structures constituting the canal can be assessed. All 4 portions of the nerve should be radiologically normal for isolated posttraumatic ANP to be diagnosed.

In the literature, ANP related to an aneurysm is generally bilateral and results from bleeding of the aneurysm (11). Subarachnoid bleeding affects the cisternal portion of the AN.ANP can also be caused by a direct aneurys-mal mass effect without bleeding on the AN, and this rare effect usually occurs at the cavernous sinus (12). ANP does not frequently occur because of pressure from an aneurysm on Dorello's can; the left nerve palsy of our patient was due to the pressure of the distal petrous ICA aneurysm on the canal, as indicated by the patient's quick recovery from nerve palsy after stent treatment.

The main radiological approach to investigating ANP is MRI. But it is difficult to identify the AN clearly using conventional MRI sequencing due to its long course up to the cavernous sinus from the brainstem. Advanced MRI sequences have improved our ability to visualize the cisternal portion of the AN. In particular, T1-weighted 3D magnetization-prepared rapid gradient-echo (MP-RAGE) imaging and heavily T2*-weighted 3D CISS sequences with 1-mm section thickness on the axial and sagittal planes can provide detailed images of the cisternal portion of the AN (13).

http://dx.doi.org/10.17546/msd.88261

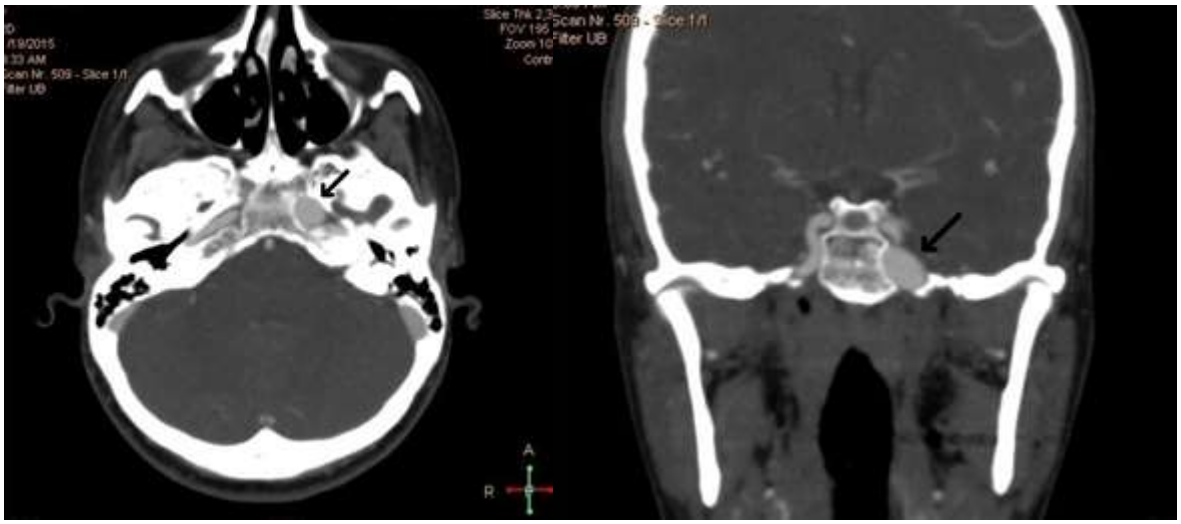

Figure 4a/b. MDCT angiogram in axial and coronal plane image. There was a left petrous ICA aneurysm at the level of foramen lacerum which was close to the Dorello's canal and remodeling the clivus (black arrows)

To investigate neural parenchyma-induced etiologies, the fluid-attenuated inversion recovery (FLAIR) sequence should be performed to confirm suspicion of multiple sclerosis in young patients, and DWI should be performed for suspicion of ischemia in elderly patients (14, 15). In order to assess the level of the nerve between the cisternal and orbital portion, axial and coronal T1WI with contrast medium is needed to search for a possible brainstem tumor, infectious or malignant meningeal disease in the basal cisterns, cavernous sinus infectious disease, or a sellar mass (16).

As in our patient, the skull base should be carefully evaluated to investigate the etiology of ANP because of the possibility for an aneurysm or mass to be settled in this region. In the diagnosis of subarachnoid hemorrhage and hydrocephalus causing ANP after trauma or ruptured aneurysm, CT is the first imaging modality that should be performed. CT and MR angiography are minimally invasive imaging methods and should be the first choices for investigating an aneurysm on the circle of Willis.

Traumatic ANPs are usually observed immediately after a head trauma, and the rate of spontaneous recovery from ANP without underlying etiology is 84% in unilateral palsy and 38% in bilateral palsy 1. The main treatment of ANP is intented to the etiology.

Abducens nerve palsy related to pressure of an aneurysm on Dorello's canal has not yet been reported in the literature.

Accordingly, the skull base should be carefully evaluated to investigate the etiology of abducens palsy.

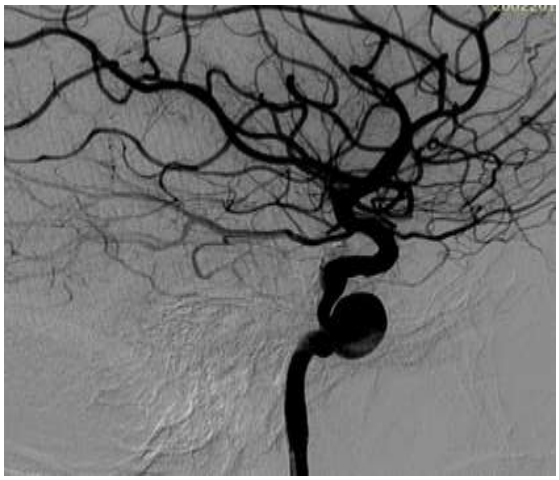

Figure 5a. Lateral angiogram obtained before treatment shows a left petrous ICA aneurysm**.**

Figure 5b. Posttreatment lateral view shows exclusion of the aneurysm and the reconstructed internal carotid artery.

References

1. Tubbs RS, Radcliff V, Shoja MM, Naftel RP, Mortazavi MM, Zurada A. Dorello canal revisited: an observation that potentially explains the frequency of abducens nerve injury after head injury. World Neurosurg 2012; 77;119–121.

2. Durkin SR, Tennekoon S, Kleinschmidt A, Casson RJ, Selva D, Crompton JL. Bilateral sixth nerve palsy. Ophthalmology. 2006; 113;2108-2109.

3. Berlit P, Reinhardt-Eckstein J, Krause KH. Isolated abducens paralysis-a retrospective study of 165 patients. Fortschr Neurol Psychiatr 1989; 57;32–40.

4. Raveenthiran V, Reshma KB. Sixth cranial nerve palsy due to arachnoid cyst. J Pediatr Ophthalmol Strabismus 2014;51;58–61.

5. Reyes KB, Lee HY, Ng I, Goh KY. Abducens (sixth) nerve palsy presenting as a rare case of isolated brainstem metastasis from a primary breast carcinoma. Singapore Med J 2011;52;220–222.

6. Palacios E, Gómez J, Alvernia JE, Jacob C. Aneurysm of the petrous portion of the internal carotid artery at the foramen lacerum: anatomic, imaging, and otologic findings. Ear Nose Throat J 2010;89;303–305.

7. De Ridder D. The abducens nerve and skull base surgery. World Neurosurg 2012; 77;53–54.

8. Kshettry VR, Lee JH, Ammirati M. The Dorello canal: historical development, controversies in microsurgical anatomy, and clinical implications. Neurosurg Focus 2013;34:E4.

9. Ezer H, Banerjee AD, Thakur JD, Nanda A. Dorello's canal for laymen: A lego-like presentation. J Neurol Surg B Skull Base 2012;73:183–189.

10. Sam B, Ozveren MF Akdemir I, Topsakal C Cobanoglu B, Baydar CL, et al. The mechanism of injury of the abducens nerve in severe head trauma: a postmortem study. Forensic Sci Int 2004;140:25–32.

11. Koskela E, Laakso A, Kivisaari R, Setälä K, Hijazy F, Hernesniemi J. Eye movement abnormalities after a ruptured ıntracranial aneurysm. World Neurosurg 2014 Apr 19, Epub ahead of print

12. Caroli M, Bertani G, Fetoni V, Sasanelli F, Gaini SM, Samis Zella MA. Bilateral intracavernous carotid artery aneurysms presenting as abducens nerve palsy: case report. J Neurosurg Sci 2009;53;169–170.

13. Held P, Nitz W, Seitz J, Fründ R, Müller HM, Haffke T et al. Comparison of 2D and 3D MRI of the optic and oculomotor nerve anatomy. Clin Imaging 2000; 24;337–343.

14. Ogawa K, Tougou M, Oishi M, Kamei S, Mizutani T. Case of pontine infarction causing alternating hemiplegia with ipsilateral abducens nerve palsyand contralateral supranuclear facial nerve palsy. Rinsho Shinkeigaku 2008;48;135–138.

15. Rose JW, Digre KB, Lynch SG, Harnsberger RH. Acute VIth cranial nerve dysfunction in multiple sclerosis. Evaluation by magnetic resonance imaging. J Clin Neuroophthalmol 1992;12;17–20.

16. Moy WL, Ooi ST. Abducens nerve palsy and meningitis by Rickettsia typhi. Am J Trop Med Hyg 2014;92; 620–624.