



Case Report

Microvascular decompression is effective for oculomotor nerve palsy caused by posterior cerebral artery compression: A case report

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ABSTRACT

Background: Oculomotor nerve palsy is often associated with diabetes mellitus or caused by compression by a cerebral aneurysm. Here, we report a rare case of oculomotor nerve palsy caused by compression by the posterior cerebral artery (PCA).

Case Description: A 66-year-old woman suddenly developed diplopia and right blepharoptosis. Her symptoms suggested incomplete right oculomotor nerve palsy. Magnetic resonance imaging showed that a sharp curve in the right PCA had compressed the right oculomotor nerve. Microvascular decompression surgery was performed. Intraoperative findings showed that the P2 portion of the PCA had caused an indentation in the oculomotor nerve in the prepontine cistern. The transposition of the PCA with a prosthesis released the pressure. After the operation, her right blepharoptosis gradually improved. She had fully recovered by 48 days after the operation.

Conclusion: Neurovascular compression (NVC) is recognized as the cause of hemifacial spasms, trigeminal neuralgia, and glossopharyngeal neuralgia. This case report demonstrated that NVC can also cause oculomotor nerve palsy. A high index of clinical suspicion can detect vascular compression of the oculomotor nerve. Prompt diagnosis and appropriate surgical management can achieve clinical improvement.

Keywords: Microvascular decompression, Oculomotor nerve palsy, Posterior cerebral artery

INTRODUCTION

Compression caused by cerebral aneurysms and diabetes mellitus are well-known causes of oculomotor nerve palsy.^[4,9] However, no definite cause was identified in approximately 20% of patients with oculomotor nerve palsy.^[11] Neurovascular compression (NVC) syndrome usually involves compression of the cranial nerves by blood vessels, resulting in hemifacial spasm, trigeminal neuralgia, and glossopharyngeal neuralgia.^[7] However, NVC has not been established as a cause of oculomotor nerve palsy. Only nine cases of oculomotor nerve palsy have been reported, four of which were treated by microvascular decompression (MVD).^[1,2,5,8,10,13-16] Here, we report a case of incomplete oculomotor nerve palsy caused by compression of the oculomotor nerve by the posterior cerebral artery (PCA). Accurate diagnosis and surgical decompression

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of the oculomotor nerve may improve clinical outcomes in these cases.

CASE REPORT

A 66-year-old woman suddenly developed diplopia and right blepharoptosis. Neurological examination revealed impaired supraduction of the right eyeball, slightly mydriatic pupil with sluggish indirect light reflex, and right blepharoptosis, indicating incomplete right oculomotor palsy [Figure 1a]. She had a medical history of hypertension and hyperlipidemia but not of diabetes mellitus. Magnetic resonance (MR) angiography did not show any cerebral aneurysms. However, heavily T2-weighted MR imaging demonstrated possible compression of the right oculomotor nerve by the right PCA [Figures 1b and c]. NVC was considered to explain the symptoms in the absence of any other possible causes of oculomotor nerve palsy.

The patient underwent MVD of the right oculomotor nerve through the subtemporal approach. Surgical findings indicated a caudal bend in the P2 segment of the right PCA, which had compressed the oculomotor nerve, resulting in an indentation in the nerve [Figures 2a and b]. Transposition of the P2 segment was not possible due to the limited space, but the insertion of a prosthesis achieved decompression of

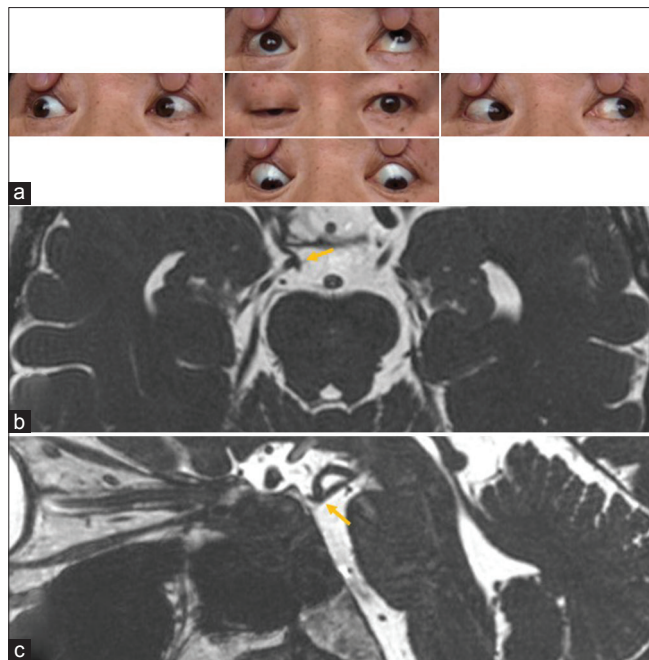


Figure 1: Preoperative findings. (a) Photographs of the patient's eyes showing right blepharoptosis and moderate supraduction. Adduction and infraduction are not clearly observed. Her right pupil is not dilated. (b and c) Preoperative axial (b) and sagittal (c) heavily T2-weighted magnetic resonance images demonstrating the right posterior cerebral artery bent caudally and apparently conflicting with the right oculomotor nerve.

the oculomotor nerve [Figure 2c]. Postoperative neurological examination revealed gradual improvement of her right blepharoptosis. The patient had fully recovered 48 days after surgery.

DISCUSSION

NVC syndrome presenting with oculomotor nerve palsy is a rare condition that has not yet gained widespread recognition. Therefore, in previous patients with oculomotor nerve palsy without a definite cause, the true cause may have been overlooked. Of the past 10 cases of oculomotor nerve palsy thought to be caused by NVC, improvement in symptoms was confirmed in all five cases in which MVD was performed [Table 1]. Considering that MVD can be a definitive treatment for oculomotor nerve palsy, high clinical suspicion and accurate diagnosis followed by MVD procedures are key to the successful management of this condition.

NVC syndrome can be classified into hyperactive dysfunction and hypoactive dysfunction.^[14] Hemifacial spasms, trigeminal neuralgia, and glossopharyngeal neuralgia are hyperactive dysfunctions. Oculomotor nerve palsy is a hypoactive dysfunction. NVC in the central nerve segment with a central myelin sheath is considered to cause hyperactive dysfunction. In contrast, NVC in the

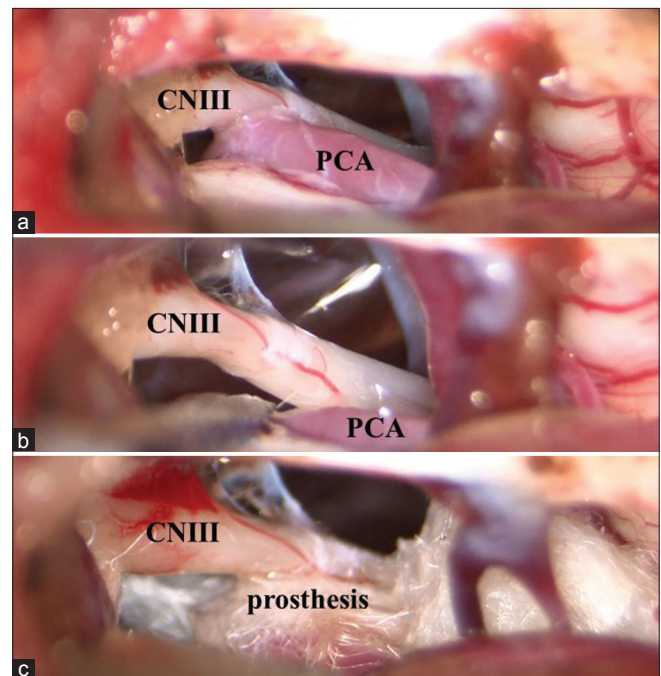


Figure 2: Intraoperative photographs. (a) P2 segment of the right posterior cerebral artery (PCA) compressing the oculomotor nerve (third cranial nerve: CN III). (b) Indentation in the oculomotor nerve. (c) Insertion of a large prosthesis between the P1 segment and the superior cerebellar artery.

Table 1: Reported cases of oculomotor nerve palsy due to neurovascular compression.

Case no.	Authors and year	Age and sex	Symptoms	Compressing arteries	MVD
1	Nakagawa <i>et al.</i> , 1991 ^[14]	59, M	Diplopia, Ptosis	PCA	Improved
2	Hashimoto <i>et al.</i> , 1998 ^[5]	74, F	Diplopia	BA	-
3	Mulderink <i>et al.</i> , 2001 ^[13]	69, M	Diplopia, Ptosis, Mydriasis	PCoMA	Improved
4	Albayram <i>et al.</i> , 2006 ^[1]	24, F	Mydriasis	PCA and SCA	-
5	Suzuki <i>et al.</i> , 2008 ^[16]	76, M	Diplopia, Ptosis, Mydriasis	PCA and SCA	Improved
6	Silva <i>et al.</i> , 2010 ^[15]	56, M	Diplopia, Ptosis	PCA and SCA	-
7	Demetriou and Bell, 2014 ^[2]	86, F	Diplopia, Ptosis	ICA	-
8	Jo <i>et al.</i> , 2015 ^[8]	48, M	Diplopia, Ptosis	PCA	-
9	Kheshafati <i>et al.</i> , 2016 ^[10]	16, M	Diplopia, Ptosis	PCA	Improved
10	Present case	66, F	Diplopia, Ptosis, Mydriasis	PCA	Improved

No.: Number, M: Male, F: Female, PCA: Posterior cerebral artery, PCoMA: Posterior communicating artery, SCA: Superior cerebellar artery, BA: Basilar artery, ICA: Internal carotid artery, MVD: Microvascular decompression

peripheral nerve segment is considered to cause hypoactive dysfunction.^[14] In fact, in oculomotor nerve palsy due to NVC that has been reported so far, preoperative MR imaging or intraoperative findings indicated that the compressed part of the oculomotor nerve was located peripherally.^[1,2,5,8,10,13-16] The central nerve segment of the oculomotor nerve has a length of 1.88 mm.^[12] In the present case as well, the MR imaging and intraoperative findings confirmed compression of the peripheral nerve segment [Figure 3].

Interestingly, few case reports on hyperactive dysfunction of the oculomotor nerve and ocular neuromyotonia caused by vascular compression have been published.^[17,18] Ocular neuromyotonia is characterized by spasms of the extraocular muscle caused by continuous activity of the ocular nerves.^[3] In ocular neuromyotonia, the proximal portion of the oculomotor nerve passes between the PCA and the superior cerebellar artery.^[18] One case of ocular neuromyotonia was caused by compression of the right oculomotor nerve by the basilar artery.^[17]

We treated a patient with oculomotor nerve palsy caused by compression by the PCA. MVD surgery led to the complete remission of symptoms. Our patient had incomplete oculomotor nerve palsy, manifesting as moderately impaired supraduction but intact adduction and infraduction. The clinical course of this patient not only shows that NVC can cause oculomotor nerve palsy but also provides anatomical suggestions about the oculomotor nerve fibers. The oculomotor nerve divides into the upper and lower branches in the fissure segment.^[6] The upper branch supplies the superior rectus and the levator palpebrae superioris, so the blepharoptosis and moderate impairment of supraduction, in our case, indicated upper branch palsy. Preoperative MR imaging showed that the PCA had compressed the superior portion of the oculomotor nerve in the cisternal segment [Figures 1b and c]. These findings suggested that the upper and lower branch fibers of the oculomotor nerve

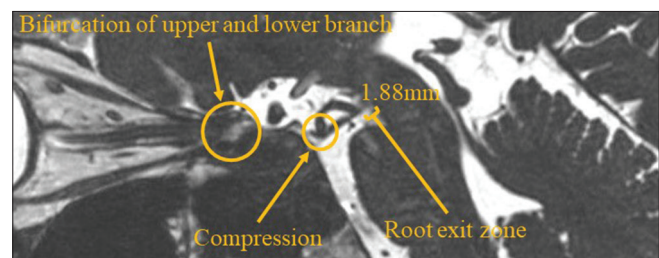


Figure 3: Preoperative sagittal heavily T2-weighted magnetic resonance image showing neurovascular compression on the peripheral side of the root exit zone.

run segmentally before anatomical division in the fissure segment.

CONCLUSION

Vascular compression of the peripheral oculomotor nerve can cause oculomotor nerve palsy. A high index of clinical suspicion can detect vascular compression of the oculomotor nerve. Prompt diagnosis and appropriate surgical management can achieve clinical improvement.

Ethical approval

Institutional Review Board approval is not required.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Conflicts of interest

There are no conflicts of interest.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

REFERENCES

- Albayram S, Ozer H, Sarici A, Murphy K, Miller N. Unilateral mydriasis without ophthalmoplegia--a sign of neurovascular compression? Case report. *Neurosurgery* 2006;58:E582-3.
- Demetriou GA, Bell D. Isolated third cranial nerve palsy from non-aneurysmal internal carotid artery compression. *QJM* 2014;107:855-6.
- Frohman EM, Zee DS. Ocular neuromyotonia: Clinical features, physiological mechanisms, and response to therapy. *Ann Neurol* 1995;37:620-6.
- Good EF. Ptosis as the sole manifestation of compression of the oculomotor nerve by an aneurysm of the posterior communicating artery. *J Clin Neuroophthalmol* 1990;10:59-61.
- Hashimoto M, Ohtsuka K, Akiba H, Harada K. Vascular compression of the oculomotor nerve disclosed by thin-slice magnetic resonance imaging. *Am J Ophthalmol* 1998;125:881-2.
- Iaconetta G, de Notaris M, Cavallo LM, Benet A, Ensenat J, Samii M, *et al.* The oculomotor nerve: Microanatomical and endoscopic study. *Neurosurgery* 2010;66:593-601.
- Jannetta PJ. Observations on the etiology of trigeminal neuralgia, hemifacial spasm, acoustic nerve dysfunction and glossopharyngeal neuralgia. Definitive microsurgical treatment and results in 117 patients. *Neurochirurgia (Stuttg)* 1997;20:145-54.
- Jo YS, Kim SK, Kim DH, Kim JH, Na SJ. Complete oculomotor nerve palsy caused by direct compression of the posterior cerebral artery. *J Stroke Cerebrovasc Dis* 2015;24:e189-90.
- Kasner SE, Liu GT, Galetta SL. Neuro-ophthalmologic aspects of aneurysms. *Neuroimaging Clin N Am* 1997;7:679-92.
- Kheshaifati H, Al-Otaibi F, Alhejji M. Microvascular decompression for oculomotor nerve palsy: A case report and literature review. *World Neurosurg* 2016;88:695.e1-3.
- Kumar MP, Vivekanand U, Umakanth S, Yashodhara BM. A study of etiology and prognosis of oculomotor nerve paralysis. *Edorium J Neurol* 2014;1:1-8.
- Lang J. *Clinical anatomy of the posterior cranial fossa and its foramina.* New York: Thieme Medical; 1991.
- Mulderink TA, Bendok BR, Yapor WY, Batjer HH. Third nerve paresis caused by vascular compression by the posterior communicating artery. *J Stroke Cerebrovasc Dis* 2001;10:139-41.
- Nakagawa H, Nakajima S, Nakajima Y, Furuta Y, Nishi O, Nishi K. Bilateral oculomotor nerve palsies due to posterior cerebral arterial compression relieved by microvascular decompression--case report. *Neurol Med Chir (Tokyo)* 1991;31:45-8.
- Silva EB Jr., Ramina R, Meneses MS, Kowacs PA, Silva EB. Bilateral oculomotor nerve palsies due to vascular conflict. *Arq Neuropsiquiatr* 2010;68:819-21.
- Suzuki K, Muroi A, Kujiraoka Y, Takano S, Matsumura A. Oculomotor palsy treated by microvascular decompression. *Surg Neurol* 2008;70:210-2.
- Tilikete C, Vial C, Niederlaender M, Bonnier PL, Vighetto A. Idiopathic ocular neuromyotonia: A neurovascular compression syndrome? *J Neurol Neurosurg Psychiatry* 2000;69:642-4.
- Tsuji M, Shima A, Suzuki F, Tsuji M, Shima A, Suzuki F, *et al.* Ocular neuromyotonia treated by microvascular decompression: Usefulness of preoperative 3D imaging: Case report. *J Neurosurg* 2012;117:1166-9.

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