Neurovascular compression of the abducent nerve causing abducent palsy treated by microvascular decompression

Case report

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Isolated abducent palsy is a symptom that can be caused by many different intracranial pathological conditions. In this report, the authors describe the case of a patient who suffered isolated abducent palsy resulting from vascular compression of the sixth cranial nerve; surgical treatment consisted of microvascular decompression (MVD).

This 56-year-old man presented with short-lasting episodes of a pulling sensation at the lateral side of his right eye, associated with intermittent diplopia, followed by a progressive palsy of the abducent nerve and constant diplopia. Magnetic resonance imaging revealed a neurovascular contact of a dolichoectatic basilar artery with the abducent nerve. The patient underwent surgery consisting of a combined supratentorial presigmoid and transmastoid approach and subsequent MVD of the abducent nerve. Postoperatively, the abducent nerve palsy resolved within days, and the patient remains free of symptoms with a follow-up time of 4 years.

This is the first report of a neurovascular compression of the abducent nerve treated successfully by MVD. (DOI: 10.3171/JNS-07/12/1231)

KEY WORDS • abducent nerve • microneurosurgery • neurovascular compression

A bducent nerve palsy is a frequent symptom in intracranial pathological conditions. It can be a sign of intracranial hyper- and hypotension, and it has been seen in vascular lesions of both the carotid artery and the vertebral artery, in tumors and trauma of the clivus and cavernous sinus, and in infections of the petrous bone. Only a few patients have been described with vascular compression of the abducent nerve as the presumptive cause of the abducent nerve palsy, but none of these patients were reported to have undergone surgery for their vascular compression.

In this case report, we describe a patient with isolated abducent palsy caused by vascular compression of the sixth cranial nerve by the BA. We also discuss the surgical treatment consisting of MVD.

Case Report

History and Examination. This 56-year-old man was referred to the department of neurosurgery by an ophthalmologist to exclude intracranial pathological conditions as the cause of the patient’s progressive right-sided abducent nerve palsy.

The patient’s symptoms initially started with intermittent short-lasting episodes of a pulling sensation at the lateral side of his right eye that was associated with intermittent diplopia. A near-total abducent nerve palsy with constant diplopia progressively developed, and the pulling sensations decreased in frequency and intensity.

His medical history revealed a large right-sided carotid aneurysm that was discovered due to development of a partial ipsilateral oculomotor nerve paresis. The aneurysm was clipped in 1983, but the oculomotor nerve paresis did not improve. Ophthalmological and neurological examination confirmed the right-sided abducent nerve palsy (Fig. 1) and a partial oculomotor nerve palsy also on the right side. No other neurological signs were found.

Imaging Studies. Selective angiography of the right carotid and vertebral artery demonstrated good position of the aneurysm clip. The BA was found to be dolichoectatic and curved to the right side. A high-resolution MR image with CISS sequences revealed a microvascular conflict of the sixth cranial nerve with the BA close to Dorello canal, distal from its root exit zone. The right abducent nerve was clearly compressed and dislocated by a tortuous BA (Fig. 2). No other abnormalities were observed.

Operation. Because we considered the vascular compression to be the cause of his abducent nerve palsy, the patient was offered surgery consisting of MVD of the sixth nerve. With the patient in prone position and his head rotated to the left, a right-sided combined supra- and infratentorial presigmoid and transmastoid approach was performed. After performing a mastoidectomy with preservation of the three semicircular canals, the infratemporal and presigmoid dura mater was incised, the superior petrosal sinus was ligated, and the tentorium was incised. The right abducent nerve and its entrance into the Dorello canal was ap-
proached and reached in a corridor between the trigeminal nerve and the seventh cranial nerve–eighth cranial nerve complex. The abducent nerve was adherent to the petrous bone over a distance of 6 to 7 mm and was compressed medially and anteriorly by a dolichoectatic BA curving to the right side (Fig. 3 upper). The nerve was detached from its adhesions, and Teflon felt was interposed between the nerve and the BA (Fig. 3 lower). The dura was closed and free fat grafts from the right thigh were used to fill the mastoid cavity, covered by a small bone flap.

Postoperative Course. The immediate postoperative course was uneventful. The abducent palsy improved by approximately 70% immediately on the 1st postoperative day, and further improvement of the abducent nerve function took place during the next few days with resolution of the diplopia (Fig. 4). No further neurological deficits were observed. Postoperative thin-slice MR imaging of the brainstem confirmed decompression of the abducent nerve by the Teflon felt (Fig. 5). After 3 months, a wound revision was performed for wound dehiscence. After a follow-up time of 4 years, the patient remains asymptomatic.

Discussion

Although neurovascular contact with the trigeminal nerve is a relatively common entity, such contact with cranial nerves controlling eye movements is very rare. So far, there have been only a few reports on neurovascular conflict of these nerves. Bringewald was the first to describe oculomotor dysfunction caused by neurovascular conflict, and since then several authors have reported on vascular compression of the oculomotor nerve, trochlear nerve, and abducent nerve as noted on thin-slice MR imaging. Before the availability of thin-slice MR imaging, vascular compression of the cranial nerves in vivo had not been reported because it was very difficult to disclose neurovascular conflict by standard MR imaging or computed tomography. Thin-slice MR imaging...
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with 3D CISS sequences is currently the imaging method of choice for detection of a neurovascular conflict in the subarachnoid space. In this patient, the clinical evolution followed a similar pattern often seen in hemifacial spasm due to neurovascular compression. At first, paroxysmal attacks of intermittent irregular tonic or clonic contractions of the muscles innervated by the facial nerve are present, and in time these attacks diminish and a progressive paresis of the facial nerve occurs. The clinical symptoms of our patient started with short-lasting episodes of a pulling sensation at the lateral side of his right eye followed progressively by a near total abducent nerve palsy while the pulling sensations decreased in frequency and intensity. In other words, this case showed that neurovascular conflict can result in episodic hyperfunction of the abducent nerve followed by hypofunction from vascular compression.

Microvascular decompression has been proposed as the causal treatment for vascular compression of the oculomotor nerve and trochlear nerve, both resulting in improvement of the dysfunctional eye movements and diplopia after surgery. Despite the fact that several cases on vascular compression of the abducent nerve as the presumptive cause of the abducent nerve palsy have been described, none of these reported patients have undergone surgery for their vascular compression. In two reports on vascular compression of the abducent nerve, the authors did not recommend surgery because the surgical risk outweighed the benefits. Indeed, the intracisternal portion of the abducent nerve and the Dorello canal is more difficult to reach than, for example, the trigeminal or facial nerve. Following the development of skull base techniques, however, the procedure can be straightforward with minimal technical difficulties when using a proper surgical approach. In our patient, we chose the combined supratentorial and infratentorial presigmoid approach with transection of the tentorium to obtain a more superoinferior inclination to visualize the Dorello canal and the abducent nerve between the trigemi-
nal and the facial nerve–cochlear nerve complex.\textsuperscript{17,18} There was a clear vascular compression by a dolichoectatic BA that could be decompressed by releasing adhesions and interposing a Teflon felt. The immediate improvements of the abducent nerve function after MVD supports the hypothesis that similar pathophysiological mechanisms are involved in established vascular compression syndromes such as trigeminal neuralgia or hemifacial spasm, that is, ectopic excitation of a nerve root by a compressing blood vessel.

Although other treatments that target the symptoms of isolated abducent nerve palsy (such as Fresnel, botulinum toxin injections in the ipsilateral medial rectus muscle, or both) are less invasive than MVD, the outcome in our patient was very positive and treated the preexisting cause. This result should encourage others to consider MVD as a treatment option for vascular compression of the abducent nerve.

Conclusions

To our knowledge, this is the first report of a neurovascular compression of the sixth cranial nerve treated successfully by MVD. In patients with isolated abducent nerve palsy, vascular compression should be considered as a cause of the symptoms, and subsequent MVD can lead to (near) complete resolution of the symptoms.

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