Magnetic resonance imaging findings of isolated abducence nerve palsy induced by vascular compression of vertebrobasilar dolichoectasia

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ABSTRACT

If the origin of isolated abducence nerve palsy cannot be found on neuroradiological examinations, diabetes mellitus is known as a probable cause; however, some cases show no potential causes of isolated abducence nerve palsy. Here, we report a 74-year-old male who suffered from diplopia due to isolated left abducence nerve palsy. Magnetic resonance angiography and fast imaging employing steady-state acquisition imaging clearly showed a dolichoectasis verteobasilar artery compressing the left abducence nerve upward and outward. There were no abnormal lesions in the brain stem, cavernous sinus, or orbital cavity. Laboratory data showed no abnormal findings. We concluded that neurovascular compression of the left abducence nerve might cause isolated left abducence nerve palsy. We observed him without surgical treatment considering his general condition with angina pectoris and old age. His symptom due to the left abducence nerve palsy persisted. From previous reports, conservative treatment could not improve abducence nerve palsy. Microvascular decompression should be considered for abducence nerve palsy due to vascular compression if patients are young, and their general condition is good. We also discuss interesting characteristics with a review of the literature.

Key words: abducence nerve palsy, basilar artery, dolichoectasia, fast imaging employing steady-state acquisition, vertebral artery

Introduction

Isolated abducence nerve palsy is sometimes detected in patients with head trauma, intracranial hyper- and hypotension, and tumor of the brain stem, cavernous sinus, or orbital cavity. Although these pathological conditions usually can be seen on computed tomography (CT) or magnetic resonance imaging findings (MRI), isolated abducence nerve palsy without radiological abnormality sometimes occurs. In such cases, diabetes mellitus or hypertension is a possible cause; however, some cases show no potential causes of isolated abducence nerve palsy. Recently, patients with abducence nerve palsy due to neurovascular compression have been reported; however, only a few report showed neurovascular compression clearly. Here, we report a patient with isolated abducence nerve palsy induced by neurovascular compression of vertebrobasilar dolichoectasia, which MRI with fast imaging employing steady-state acquisition (FIESTA) and magnetic resonance angiography (MRA) source images clearly showed. We also discuss the characteristics of these cases with a review of the literature.

Access this article online

Quick Response Code:

Website: www.ruralneuropractice.com

DOI:
10.4103/0976-3147.193529

How to cite this article: Arishima H, Kikuta K. Magnetic resonance imaging findings of isolated abducence nerve palsy induced by vascular compression of vertebrobasilar dolichoectasia. J Neurosci Rural Pract 2017;8:124-7.
Case Report

A 74-year-old male suffered from diplopia, and he saw an ophthalmologist who diagnosed left abducent nerve palsy without ocular pain. He took medicine for hypertension and hyperlipidemia. Two years earlier, he underwent percutaneous coronary intervention twice for angina pectoris and took antiplatelets. Neurological examination revealed no other findings of note. Laboratory tests showed no abnormal findings. MRI with gadolinium enhancement showed no brain stem, cavernous sinus, or orbital lesions. MRA and three-dimensional volume rendering of MRI [Figure 1a] showed dolichoectasia of the right vertebral artery (VA) and basilar artery (BA). A hypoplastic left VA was not seen. Thin-slice MRI with FIESTA clearly showed that the right abducent nerve was straight; however, the left abducent nerve was compressed upward and outward by an elongated BA [Figure 1b]. The left abducent nerves were distinguished from bilateral anteroinferior cerebellar arteries (AICA) on comparing MRA source images [Figure 1c]. We concluded that neurovascular compression of vertebrobasilar dolichoectasia caused left isolated abducent nerve palsy.

Considering his age and heart disease, we observed him without surgical treatment. His symptom was temporarily improved imperfectly; however, diplopia became worse again, and the left abducent nerve palsy persisted.

Discussion

To the best of our knowledge, 15 cases with abducent nerve palsy due to nonaneurysmal vascular compression have been reported. We summarize them in Table 1 in chronological order. Interestingly, all cases except for Case No. 4 were male, and most cases were not old, but middle-aged. Although the authors did not use the term “dolichoectasia” or “elongation” to describe Case No. 10, they described “the vertebrobasilar arteries shifting leftward,” which means the “elongation” of vertebrobasilar arteries. Therefore, “dolichoectasia” or “elongation” of vertebrobasilar arteries induced vascular compression of the abducent nerves in all cases except for Case No. 9 in which authors did not mention about “elongated” or “dolichoectasic” arteries. Usually, “dolichoectasia” means an atherosclerotic or a distinct arteriopathy characterized by elongation and dilation of the cerebral arteries; therefore, we speculate that “dolichoectasia” was used to be mostly the same as “elongation” in previous reports. Multivariate analyses by Pico et al. revealed an association between intracranial arterial dolichoectasia and the age (odds ratio: 1.04), male sex (3.31), hypertension (1.94), and previous myocardial infarction (2.68). The odds ratio of age for intracranial arterial dolichoectasia was relatively lower. In addition, we speculate that those with an old age may not be accurately examined by MRI. These may offer reasons why abducent nerve palsy due to nonaneurysmal vascular compression was frequently reported in middle-aged males.

Figure 1: Three-dimensional volume rendering of magnetic resonance imaging (a) showing dolichoectasia of the right vertebral artery and basilar artery. A hypoplastic left vertebral artery is not seen. Thin-slice magnetic resonance imaging with fast imaging employing steady-state acquisition (b), and magnetic resonance angiography source images (c). The right abducent nerve (black arrow) is straight; however, the left abducent nerve (white arrows) is compressed upward and outward by a basilar artery. Bilateral abducent nerves (black and white arrows) are distinguished from bilateral anteroinferior cerebellar arteries (arrowheads) shown in magnetic resonance angiography source images.
Table 1: Summary of reported patients with abducent nerve palsy caused by neurovascular compression

| Case number | Author            | Year | References | Age/sex | Pathogenesis          | Examination | Treatment                        | Outcome       |
|-------------|-------------------|------|------------|---------|------------------------|-------------|----------------------------------|---------------|
| 1           | Smoker et al.     | 1986 | [11]       | 59/male | Dolichoectasic left VA | CT          | ND                               | ND            |
| 2           | Ohtsuka et al.    | 1996 | [9]        | 46/male | Elongated right VA    | SPGR        | Observation                      | No change     |
| 3           | Narai et al.      | 2000 | [7]        | 47/male | Elongated left VA     | SPGR        | ND                               | ND            |
| 4           | Ohhashi et al.    | 2001 | [8]        | 71/female | Dolichoectasic BA    | CISS        | Antihypertensive drugs            | Mostly resolved |
| 5           | Goldberg-Cohen and Miller | 2004 | [5]       | 65/male | Dolichoectasic BA    | MRA and T1-WI (CE) | Observation                      | No change     |
| 6           | Giray et al.      | 2005 | [4]        | 53/male | Dolichoectasic left VA | MRA         | Observation                      | No change     |
| 7           | Zhu et al.        | 2005 | [15]       | 68/male | Elongated SA          | MRA and T1-WI (CE) | Medical rectus recession | Orthophoria |
| 8           | De Ridder and Menovsky | 2007 | [3]       | 56/male | Dolichoectasic BA    | CISS        | Glasses with prism               | ND            |
| 9           | Sandvand et al.   | 2008 | [10]       | 38/male | Right AICA            | CISS        | Observation                      | ND            |
| 10          | Kato et al.       | 2010 | [6]        | 50/male | BA and left AICA with leftward shifting VA | CISS | Observation                      | ND            |
| 11          | Taniguchi et al.  | 2011 | [12]       | 75/male | Bilateral AICA with dolichoectasic BA | Heavy T2-WI | Observation                      | Slightly improved |
| 12          | Tsai and Demer    | 2011 | [13]       | 11/male | Elongated AICA with dolichoectasic BA | Heavy T2-WI | ND                               | ND            |
| 13          | Tsai and Demer    | 2011 | [13]       | 52/male | Elongated AICA with dolichoectasic BA | Heavy T2-WI | ND                               | ND            |
| 14          | Yamazaki et al.   | 2015 | [14]       | 46/male | Elongated right VA    | CISS        | MVD                              | Fully resolved |
| 15          | Present case      |      |            | 74/male | Dolichoectasic BA    | FIESTA and MRA | Observation                      | Recurrence after slight improvement |

VA: Vertebral artery, BA: Basilar artery, AICA: Anteroinferior cerebellar artery, CT: Computed tomography, SPGR: Spoiled gradient-recalled-echo, MRA: Magnetic resonance angiography, CISS: Constructive interference in steady state, FIESTA: Fast imaging employing steady-state acquisition, MVD: Microvascular decompression, ND: Not described, CE: Contrast-enhanced, WI: Weighted imaging.

Radiological examination is important to understand this pathology. A compressed abducent nerve could not be clearly detected in the previous cases examined by CT or MRA.[4,5,8,9,12] As recent reports showed, heavy T2-weighted imaging (WI), constructive interference in steady state (CISS), and FIESTA are essential to demonstrate vascular compression of the abducent nerve.[3,6,8-15] Additional MRA source images may be useful to distinguish the compressed abducent nerve from AICA, which was shown in our report.

Microvascular decompression (MVD) was performed for only two cases in which abducent nerve palsy was completely resolved, and Yamazaki et al. and De Ridder and Menovsky similarly mentioned MVD as a treatment option.[3,14] In their reports, the cisternal portion of the abducent nerve is more difficult to reach than the trigeminal or facial nerves, which are easily detected in MVD for trigeminal neuralgia and hemifacial spasm. King et al. reported that about 70% of cases with isolated abducent nerve palsy of an undetermined etiology resolved spontaneously within 4–6 months.[2] Therefore, Yamazaki et al. stated the importance of considering the surgical indication, for example, the age or daily activity of patients.[14] Four cases did not have descriptions of treatments or outcomes.[7,11,13] Ophthalmological treatment was performed in two cases.[10,15] Seven cases including our case and a medicated case were observed without surgical treatment,[4,6,9,12] in which two cases showed incomplete recovery.[8,12] Recurrent abducent nerve palsy associated with neurovascular compression was reported.[6,10] In our case, the left abducent nerve palsy persisted. The spontaneous recovery rate of the abducent nerve due to vascular compression seemed to be lower than that with an undetermined etiology.[2]

In the future, abducent nerve palsy due to vascular compression may be detected more frequently by MRI with CISS or FIESTA, and we can clarify the natural history of abducent nerve palsy with vascular compression and a “truly” undetermined etiology, which may lead to establishing an effective treatment for abducent nerve palsy due to vascular compression.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

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