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CASE REPORTS

Isolated medial rectus paralysis caused by oculomotor dorsolateral nucleus infarction

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Abstract

Isolated internal rectus palsy secondary to midbrain infarction is extremely rare and mainly involves the internal rectus subnucleus of the oculomotor nerve. The subnucleus rectus motor neurons of the oculomotor nerve are composed of two independent regions, the dorsolateral nucleus and the ventral nucleus ventral. In the present case, a 44-year-old man developed isolated medial rectus palsy due to an oculomotor dorsolateral nucleus infarction. The presenting symptom was simple diplopia without other stroke manifestations. A 30-day follow-up visit was conducted, the symptom was alleviated completely. It was suggested that diplopia due to unilateral and isolated dorsolateral medial rectus nucleus paralysis may be the sole manifestation of midbrain infarction.

Keywords: Medial rectus paralysis, oculomotor nerve, medial rectus subdivision, acute infarction

INTRODUCTION

Isolated internal rectus palsy secondary to midbrain infarction is extremely rare and mainly involves the internal rectus subnucleus of the oculomotor nerve. The subnucleus rectus motor neurons of the oculomotor nerve are composed of two independent regions, the dorsolateral nucleus (DL) and the ventral nucleus ventral (VEN).

CASE REPORT

A 44-year-old gentleman with a history of diabetes and chronic smoking presented with a sudden onset of double vision for 16 hours with no overt trigger. He complained that the vision was separated horizontally and worsened when staring to the left but disappeared when gazing to the right or looking at objects with one eye. He denied any history of head trauma. Neurological and ophthalmic examinations revealed limited adduction of the right eye with no other abnormalities. Laboratory tests showed fasting glucose 8.8 mmol/L, two-hour postprandial glucose 13.99 mmol/L, glycosylated hemoglobin 9.92%, triglycerides 2.6 mmol/L, high-density lipoprotein cholesterol 0.89 mmol/L, and low-density lipoprotein cholesterol 4.32 mmol/L. The homocysteine, erythrocyte sedimentation rate, anti-nuclear antibody, anti-ENA antibody spectrum, thyroid function (FT3, FT4, TSH), hypersensitive C-reactive protein, *Treponema pallidum* antibody, HIV, and other laboratory tests were normal. Head magnetic resonance (MR) showed a punctate shadow (approximately 0.3cm in diameter) in the right paramedian midbrain at the superior colliculus level on both T1 and T2 imaging, corresponding with a high signal in the diffusion-weighted imaging (Figure 1, A and B). Head MR angiography showed stenosis of the left P2 segment of the posterior cerebral artery and atherosclerosis in the cavernous segment of the bilateral internal carotid artery (Fig.1, C). Transthoracic echocardiography, echocardiogram, and transcranial contrast doppler were negative. He was diagnosed with selective dorsolateral nucleus impairment of the right oculomotor nerve due to arteriolar arterial occlusion. After ten days of visual tracking exercise, dual antiplatelet therapy, and intensive lipid-lowering and glucose-lowering treatments, his symptom was alleviated. At the 30-day follow-up, the patient stated that the double vision had disappeared completely.

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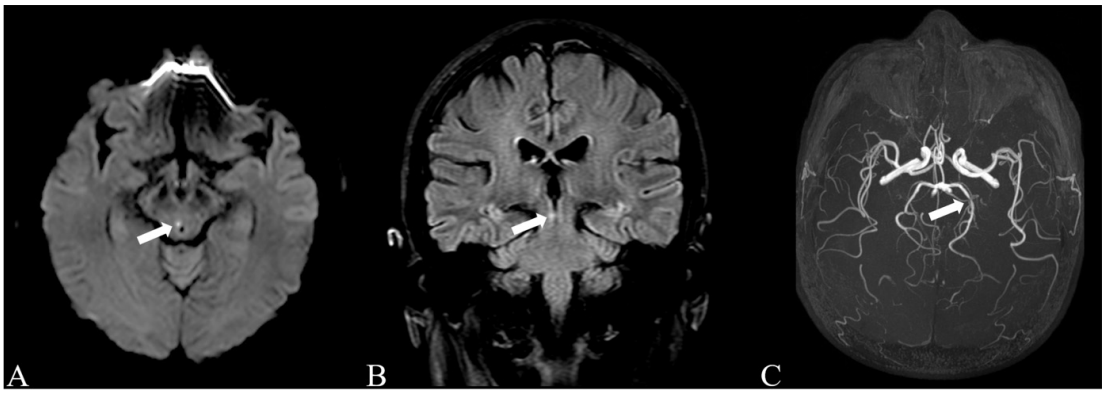

Figure 1. (A and B) The brain axial diffusion-weighted and coronal fluid-attenuation inversion recovery were showing a circumscribed acute infarction in the right paramedian midbrain. (C) Magnetic resonance angiography showed severe stenosis of the P2 segment of the posterior cerebral artery.

DISCUSSION

The oculomotor nucleus is located in the gray matter ventral to the aqueduct at the superior colliculus level in the brainstem. It includes seven subnuclei: central caudal nucleus, dorsolateral nucleus, dorsal medial nucleus, central nucleus, ventral nucleus, Perlia nucleus, and Edinger-Westphal nucleus. These subnuclei are tightly packed in the gray matter of the midbrain[1]; therefore, isolated medial rectus muscle palsy caused by ischemia in the medial rectus subdivision of oculomotor nuclei is rare.[2] The medial rectus subdivision of the oculomotor nuclei consists of two groups, i.e., the dorsolateral group and the ventral group (Figure 2). This dual-region medial rectus subdivision is common in primates, but its purpose is still unclear. More importantly, the dorsolateral group comprises an independent region at the caudal plane of the oculomotor nucleus.[1]

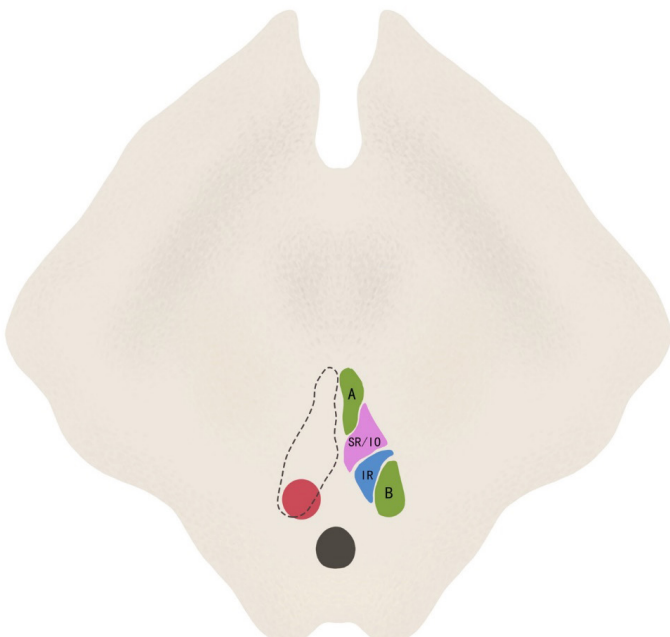

Figure 2. Models proposed for individual subgroups of motoneurons in the human oculomotor nucleus (Redrawn from the figure in the article of Che Ngwa *et al*.[1])
B: The dorsolateral B-group of the medial rectus muscles. A: The dorsolateral A-group of the medial rectus muscles. IO: inferior oblique muscles. SR: superior rectus muscles. IR: inferior rectus muscles. Dotted circle: The slightly hyperintense lesion of DWI

It is difficult to accurately assess the incidence of isolated midbrain infarction since it can only be diagnosed with MRI. Previous studies reported that the incidence of isolated midbrain infarction was 0.6% ~ 2.3% in patients with ischemic stroke[3-5], and the ventral para-central midbrain region was involved mostly.[3] Of note, only ten cases, including the presenting case, of isolated medial rectus palsy caused by midbrain infarction of the medial rectus subdivision had been reported.[6-9] Among these ten patients, nine were male with an average age of 59.5±20.64 (ranged from 22 to 83) years old, and the left side was more commonly afflicted. Hypertension, diabetes, smoking, and hyperhomocysteinemia were common risk factors for medial rectus subnuclei infarction. Of the eight patients being followed up, seven had optimal outcomes, and only one case had no clinical improvement after treatment.

The lesion of the present case was small. With the provision that the ischemic area was visually restricted to the dorsolateral nucleus of the oculomotor nerve as shown on the MR diffusion imaging, we believe that the lesion was limited to the dorsolateral nucleus of the medial rectus subdivision. This suggests that unilateral infarction of the oculomotor nerve dorsolateral nucleus could lead to isolated medial rectus palsy.

Differential diagnoses to oculomotor palsy caused by stroke include aneurysm, diabetes, pituitary tumor, cavernous sinus fistula, cavernous hemangioma, cavernous sinus thrombosis, painful ophthalmoplegia, and trauma.[10] In addition, isolated medial rectus palsy should be differentiated from internuclear ophthalmoplegia caused by medial longitudinal tract injury. A patient afflicted with internuclear ophthalmoplegia commonly manifests single ocular nystagmus of the contralateral eye innervated by adductor abducens nerve without innervation of the medial rectus muscle.[2] In this case, abduction of the left eye without nystagmus excluded internuclear ophthalmoplegia. There were no histories of trauma or ocular symptoms. MR and MR angiography excluded cerebral hernia, tumor, aneurysm, or other space-occupying lesions. In addition, thyroid function tests ruled out thyroid diseases.

In summary, eye movement abnormalities generally indicate brainstem or cerebral neuropathy, which should be attentively evaluated. Diplopia that is caused by isolated unilateral dorsolateral nucleus palsy of the medial rectus subdivision may be the only manifestation of midbrain infarction. In addition, our case provided evidence to support the map of the external ocular motor nucleus theory in human beings proposed by Che Ngwa[1], and suggested that the isolated dorsolateral nucleus impairment of the medial rectus subdivision alone could cause medial rectus palsy.

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DISCLOSURE

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Conflict of interest: None

Ethics approval: This study protocol was reviewed and approved by Ethics Committee of Jilin People's Hospital, approval number 2021015.

Consent to publish: Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

Data availability: All datasets generated for this study are included in the article.

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