CASE REPORT

Clinico-anatomical Analysis of the Fibers to the Inferior Rectus Muscle in the Oculomotor Fascicles

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Abstract

We report two cases of isolated unilateral pupil-sparing partial fascicular oculomotor paresis. Patient 1 was a 72-year-old man who developed left-sided palsy of the inferior rectus muscle (IR), medial rectus muscle (MR), superior rectus muscle (SR), inferior oblique muscle (IO), and levator palpebrae superioris (LP) due to infarction of the left paramedian thalamic artery. Patient 2 was a 70-year-old woman who developed right-sided palsy of MR, SR, IO and LP due to infarction of the right superior paramedian mesencephalic artery. These results suggest that the fibers to IR may be located in the most rostral portion of the oculomotor fascicles.

Key words: infarction, midbrain, ophthalmoplegia, paramedian thalamic artery, partial fascicular oculomotor paresis, superior paramedian mesencephalic artery


Introduction

The vessels that penetrate the posterior perforated substance and the anterior mesencephalic tegmentum are classified as the paramedian thalamic artery (PTA), superior paramedian mesencephalic artery (SPMA), and inferior paramedian mesencephalic artery (1). Human evidence of oculomotor fascicular arrangement in the midbrain has been a topic of debate (2-7). Here, we describe two cases of pupil-sparing partial fascicular oculomotor paresis (PFOP) due to infarction of PTA and SPMA, respectively, and emphasize that the fibers to the inferior rectus muscle (IR) may be located in the oculomotor fascicles (OF), which was previously proposed by Tsuda et al. (2)

Case Reports

Patient 1

A 72-year-old Japanese man with diabetes mellitus complained of sudden onset of diplopia in January 2012. Corrected visual acuity was 1.2 in both eyes. Funduscopic examination demonstrated diabetic retinopathy in both eyes. The diameter of the pupil was 3 mm bilaterally in an illuminated room (Fig. 1). Pupil responses to close light were prompt in both eyes. There was no relative afferent pupillary defect. Palpebral aperture measured 9 mm in the right eye and 5 mm in the left eye. Left-sided palsy of IR, the medial rectus muscle (MR), superior rectus muscle (SR), inferior oblique muscle (IO), and levator palpebrae superioris (LP) was observed (Fig. 1). There were no other neurological abnormalities. Cranial magnetic resonance imaging (MRI) demonstrated an infarct lesion in the territory of the PTA on the left side (Fig. 2). Orbital MRI as well as cranial magnetic resonance angiography demonstrated no abnormalities. By administration of anti-platelet agents, left-sided PFOP was resolved within 7 days.

Patient 2

A 70-year-old Japanese woman with essential hypertension suddenly complained of diplopia in December 2011. Corrected visual acuity was 1.2 in both eyes. Funduscopic examination demonstrated no abnormalities in either eye. The diameter of the pupil was 3 mm bilaterally in an illuminated room (Fig. 3). Pupil responses to close light were prompt in both eyes. There was no relative afferent pupillary defect. Palpebral aperture measured 0 mm in the right eye...
Figure 1. In patient 1, left-sided paresis of the inferior rectus muscle, medial rectus muscle, superior rectus muscle, inferior oblique muscle, and levator palpebrae superioris was observed. Pupil diameter was 3 mm in both eyes in an illuminated room.

Figure 2. In patient 1, cranial magnetic resonance imaging on axial image (A, B: T2-weighted image, C-E: diffusion-weighted image) demonstrated an infarct lesion in the territory of the paramedian thalamic artery on the left side (arrow).

and 9 mm in the left eye. Right-sided palsy of MR, SR, IO and LP was observed (Fig. 3). There were no other neurological abnormalities. Cranial MRI demonstrated an infarct lesion in the territory of the SPMA on the right side (Fig. 4). Not only orbital MRI but also cranial magnetic resonance angiography demonstrated no abnormalities. Thereafter, by administration of anti-platelet agents, right-sided PFOP disappeared within 4 weeks.

Discussion

In 1990, Castro et al. (3) speculated that OF might be a
Figure 3. In patient 2, right-sided paresis of the medial rectus muscle, superior rectus muscle, inferior oblique muscle, and levator palpebrae superioris was observed. Pupil diameter was 3 mm in both eyes in an illuminated room.

Figure 4. In patient 2, cranial magnetic resonance imaging on axial image (A, B: diffusion-weighted image) demonstrated an infarct lesion in the territory of the superior paramedian mesencephalic artery on the right side (arrow).

two-dimensional arrangement, in which each fiber to the ocular muscles was located somatotopically in the ventral midbrain from lateral to medial as follows: IO, SR, MR, LP, IR and sphincter muscle (SP). In 1994, Ksiazek et al. (4) hypothesized the three-dimensional arrangement of the OF (Fig. 5A). Furthermore, in 1995, Schwartz et al. (5) proposed a corrected model of the three-dimensional arrangement of the OF (Fig. 5B). To date, both models are well recognized by neurologists and demonstrate that the fibers to SP might be located in its most medial and rostral portion (4, 5). Conversely, in 2003, Tsuda et al. (2) noted that the fibers to IR might be located in the most medial and rostral portion of the OF, and the fibers to SP in its caudal portion, based on two cases of PFOP. In one case, isolated IR paresis was induced by infarction of PTA and, in the other case, palsy of SR, MR and LP was caused by SPMA infarction, respectively (2). In 2005, Tsuda et al. (6) described a case of isolated PFOP presenting with palsy of SR, MR and SP, despite sparing IR secondary to SPMA infarction. Consequently, this finding (6) suggested that the fibers to SR, MR and SP might be conjoined in the OF. Moreover, in 2009, Chen et al. (7) reported a case of PFOP and stated that the fibers to LP and SP might be adjacent in the OF. These neuro-ophthalmological findings in both cases (6, 7) were not compatible with previously proposed models of the OF (3-5).

In the present patient 1, IR palsy was caused by infarction of PTA, while in patient 2, IR was preserved under SPMA infarction. In both patients, SP was spared. These results support the theory that the fibers to IR might be located in the most medial and rostral portion of the OF, and the fibers to SP in its caudal portion, which was previously proposed
by Tsuda et al. (2)

The authors state that they have no Conflict of Interest (COI).

References