

# Wall-Eyed Bilateral Internuclear Ophthalmoplegia by Ischemic Stroke

## Case Report and Literature Review

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**Introduction:** Wall-eyed bilateral internuclear ophthalmoplegia (WEBINO) is a rare symptom. Several studies have reported that a small brainstem lesion could cause WEBINO.

**Case Report:** The authors present the case of an 88-year-old female individual who developed sudden-onset diplopia and gait disturbance. Neurological examination revealed WEBINO with convergence impairment, gaze-evoked upward nystagmus on upward gaze, and bilateral limb ataxia. Brain magnetic resonance imaging revealed a small paramedian pontine tegmentum infarction, responsible for the symptoms. A literature review of WEBINO in ischemic stroke revealed that most patients exhibited impaired convergence and other neurological symptoms.

**Conclusion:** Gaze-evoked upward nystagmus on upward gaze and bilateral limb ataxia accompanied by WEBINO due to a small brainstem lesion were the characteristic findings of our case.

**Key Words:** brainstem, convergence, stroke, gaze-evoked upward nystagmus at upward gaze, wall-eyed bilateral internuclear ophthalmoplegia

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Wall-eyed bilateral internuclear ophthalmoplegia (WEBINO) is a relatively rare neuro-ophthalmological disorder characterized by bilateral adduction deficits, bilateral abducting nystagmus, and a large-angle exotropia in primary gaze.<sup>1</sup> It is believed that the primary lesion in WEBINO is in the bilateral medial longitudinal fasciculi (MLF). Reportedly, a brainstem lesion from cerebrovascular diseases can cause WEBINO.<sup>2–11</sup> Here we report the case of a patient with ischemic stroke affecting the paramedian pontine tegmentum who developed gaze-evoked upward nystagmus and limb ataxia, accompanied by WEBINO. We also conducted a literature review of patients with WEBINO owing to ischemic stroke.

### CASE REPORT

An 88-year-old right-handed female individual with a history of diabetes mellitus and hyperlipidemia was admitted to our hospital

because of sudden onset of diplopia and gait disturbance. On admission, she was alert and her blood pressure was 173/94 mm Hg. Neurological examination revealed WEBINO [bilateral MLF syndrome (adduction deficits and bilateral abducting nystagmus) and exotropia in primary gaze] with convergence impairment and gaze-evoked upward nystagmus on upward gaze; she was unable to walk because of bilateral limb ataxia. No bulbar palsy, limb weakness, or sensory disturbance were noted. Figure 1 shows WEBINO, the characteristic disorder of eye movements observed in this patient. Brain magnetic resonance imaging using diffusion-weighted imaging revealed a hyperintense lesion in the paramedian pontine tegmentum, and brain magnetic resonance angiography revealed stenosis of the right vertebral artery (Fig. 1, lower). Her electrocardiogram was normal. We hypothesized that the ischemia was caused by small-vessel occlusion, and she underwent oral antiplatelet therapy. Her symptoms including eye movement disorders gradually improved, and she was discharged without neurological deficit 5 weeks after the onset of symptoms.

### DISCUSSION

This report presents the case of an 88-year-old female individual who developed WEBINO with convergence impairment, gaze-evoked upward nystagmus, and bilateral limb ataxia owing to a small infarction located in the paramedian pontine tegmentum. We performed a literature review of patients with WEBINO owing to ischemic stroke.<sup>2–11</sup> Table 1 summarizes these and the present case. The responsible lesions were located at the paramedian tegmentum of the midbrain to the pons in all cases. All cases exhibited convergence impairment (2 cases had no description). Of note, pure WEBINO was observed in only 2 cases. The clinical prognosis of WEBINO was generally good.

In this case, the eye movement was unique and compatible with WEBINO. Reportedly, the bilateral MLF at the midbrain or the pons could be the causative lesion of WEBINO.<sup>4,6</sup> Most reported stroke patients with WEBINO exhibited other manifestations such as vertical gaze palsy, consciousness disturbance, and ataxia.<sup>2–11</sup> Remarkably, impaired convergence was commonly established in reported cases and it was present in this case. It has been reported that internuclear ophthalmoplegia and impaired convergence were induced by directly injecting lidocaine into the MLF despite medial rectus subnuclei preservation.<sup>9,12</sup> Hence, almost all patients developed WEBINO with impaired convergence. Regarding the upbeat nystagmus, localized lesions surrounding the perihypoglossal nucleus, pontomedullary junction, and pontomesencephalic junction have been reported in some cases.<sup>13</sup> Regarding the bilateral cerebellar

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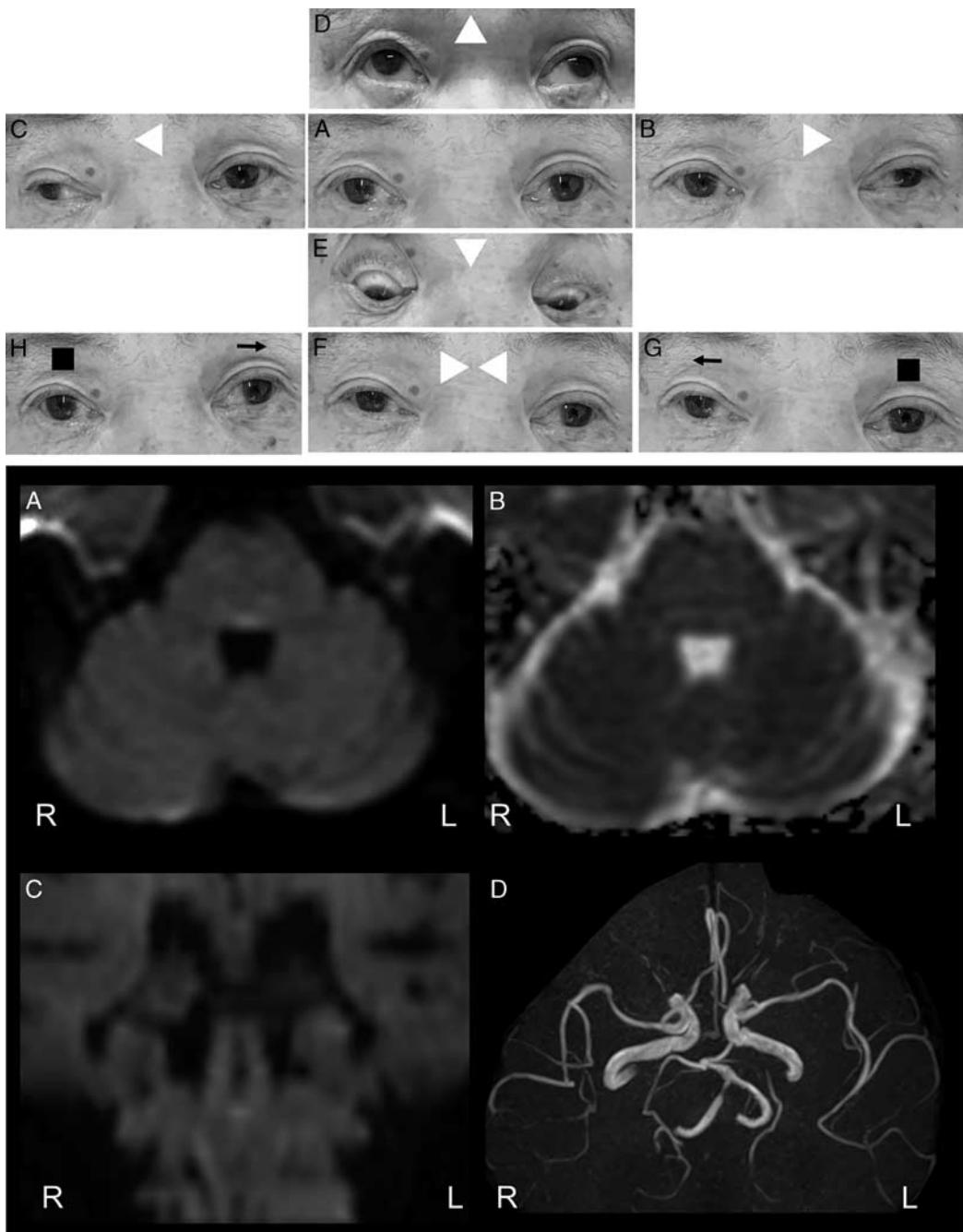
The authors declare no conflict of interest.

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**FIGURE 1.** Upper: eye movements on admission. A, Primary gaze: exotropia of the right eye. B and C, Horizontal gaze: adduction deficits and bilateral abducting nystagmus. D and E, Intact vertical gaze with gaze-evoked upward nystagmus. F, Impaired convergence. G and H, Alternating exotropia: when looking at an object using 1 eye (■), exotropia in the other eye (arrow: → or ←). Arrowheads mean the gaze direction (B–F). Lower: Brain magnetic resonance imaging on admission revealed a new lesion at the paramedian pontine tegmentum using diffusion-weighted imaging (A, C) and apparent diffusion coefficient (B). Magnetic resonance angiography (D).

ataxia, the decussation of the superior cerebellar peduncle was considered the responsible lesion. In our patient, the pontomesencephalic junction and decussation of the superior cerebellar peduncles were damaged by the stroke, which might have caused gaze-evoked upward nystagmus and bilateral limb ataxia, respectively.

In conclusion, WEBINO could be caused by a small lesion at the medial dorsal pons or the midbrain resulting from an ischemic stroke and is normally accompanied by other symptoms such as impaired convergence; the prognosis is usually good. Clinicians should be aware of such a condition in patients with brainstem infarction.

**TABLE 1.** Patients With WEBINO Caused by an Ischemic Stroke

| References                        | Age (y)/Sex | Responsible Lesion                     | Convergence | Other Symptoms  | Prognosis of WEBINO    |
|-----------------------------------|-------------|--|-------------|---|------------------------|
| Takamatsu and Ohta <sup>2</sup>   | 61/M        | Paramedian pontine tegmentum           | Impaired    | One-and-a-half syndrome, paralytic pontine exotropia            | Good recovery          |
| Furiya et al <sup>3</sup>         | 79/F        | Pons, paramedian midbrain              | NA          | Tetraplegia, cons dist, ocular bobbing, one-and-a-half syndrome | NA                     |
| Chen and Lin <sup>4</sup>         | 66/M        | Paramedian midbrain                    | Impaired    | Impaired upgaze   | Good recovery          |
| Chen and Lin <sup>4</sup>         | 84/M        | Paramedian pons-midbrain tegmentum     | Impaired    | Impaired upgaze   | Good recovery          |
| Chen and Lin <sup>4</sup>         | 51/F        | Entire rostrocaudal extent of the pons | NA          | Inability to walk, cons dist, right hemiparesis                 | Not recovered          |
| Chen and Lin <sup>4</sup>         | 65/F        | Entire rostrocaudal extent of the pons | Impaired    | None  | Not recovered          |
| Shinohara et al <sup>5</sup>      | 72/F        | Paramedian midbrain-pontine tegmentum  | Impaired    | Cons dist, dysarthria, ataxia, myorhythmia                      | Good recovery          |
| Kim et al <sup>6</sup>            | 78/M        | Midbrain tegmentum                     | Impaired    | Impaired vertical saccades and smooth pursuit                   | NA                     |
| Sierra-Hidalgo et al <sup>7</sup> | 55/M        | Medial midbrain tegmentum              | Impaired    | Ptosis, mydriasis, vertical gaze palsy                          | Good recovery          |
| Sakamoto et al <sup>8</sup>       | 64/M        | Median pontine tegmentum               | Impaired    | None  | Improved               |
| Beh and Frohman <sup>9</sup>      | 69/M        | Midbrain-pontine tegmentum             | Impaired    | Dysmetria, tremor, dysdiadochokinesia, stuttered speech         | NA                     |
| Kadoya et al <sup>10</sup>        | 85/M        | Paramedian pontine tegmentum           | Impaired    | Ataxia, facial numbness   | Not recovered          |
| Man et al <sup>11</sup>           | 84/M        | Paramedian mesencephalic tegmentum     | Impaired    | Impaired vertical gaze (Rt)                                     | Improved significantly |
| Present case                      | 88/F        | Paramedian pontine tegmentum           | Impaired    | Gaze-evoked upward nystagmus, bilateral limbs ataxia            | Full recovery          |

Cons dist indicates consciousness disturbance; F, female; M, male; NA, not available; WEBINO, Wall-eyed bilateral internuclear ophthalmoplegia.

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