

# Wall-eyed bilateral internuclear ophthalmoplegia (WEBINO) syndrome secondary to dorsal pontine infarction

Lin-Yuan Zhang , Ming Zhu, Yu Wang, Guo-Dong Wang, Yan Wang, Yun-Cheng Wu, Xiao-Ying Zhu 

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L-YZ and MZ contributed equally.

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Department of Neurology, Shanghai General Hospital, Shanghai Jiao Tong University School of Medicine, Shanghai, China

## Correspondence to

Dr Xiao-Ying Zhu;  
docxiaoying@163.com

Dr Yun-Cheng Wu;  
yunchw@medmail.com.cn

## ABSTRACT

**Background** Wall-eyed bilateral internuclear ophthalmoplegia (WEBINO) is an uncommon ocular motor disorder which is featured by binocular exotropia and bilateral internuclear ophthalmoplegia.

**Methods** A 71-year-old man with hypertension presented to the emergency department with sudden-onset diplopia. Neurological examination, neuroimaging, blood and cerebrospinal fluid (CSF) testing were performed.

**Results** We presented a typical WEBINO syndrome case with a clear dorsal pontine infarction involving bilateral medial longitudinal fasciculi (MLF) on brain MR scan. The patient's eye movement abnormalities improved and MR lesions disappeared at 60-day follow-up after treatment of clopidogrel and atorvastatin. Furthermore, we summarised the aetiology and pathophysiology of WEBINO by retrospectively analysing all published WEBINO cases. We found that WEBINO can result from various underlying pathologies, with inflammation most common in the young, and stroke most common in the elderly. Simultaneous lesions of bilateral MLF definitely contribute to the pathophysiology of WEBINO.

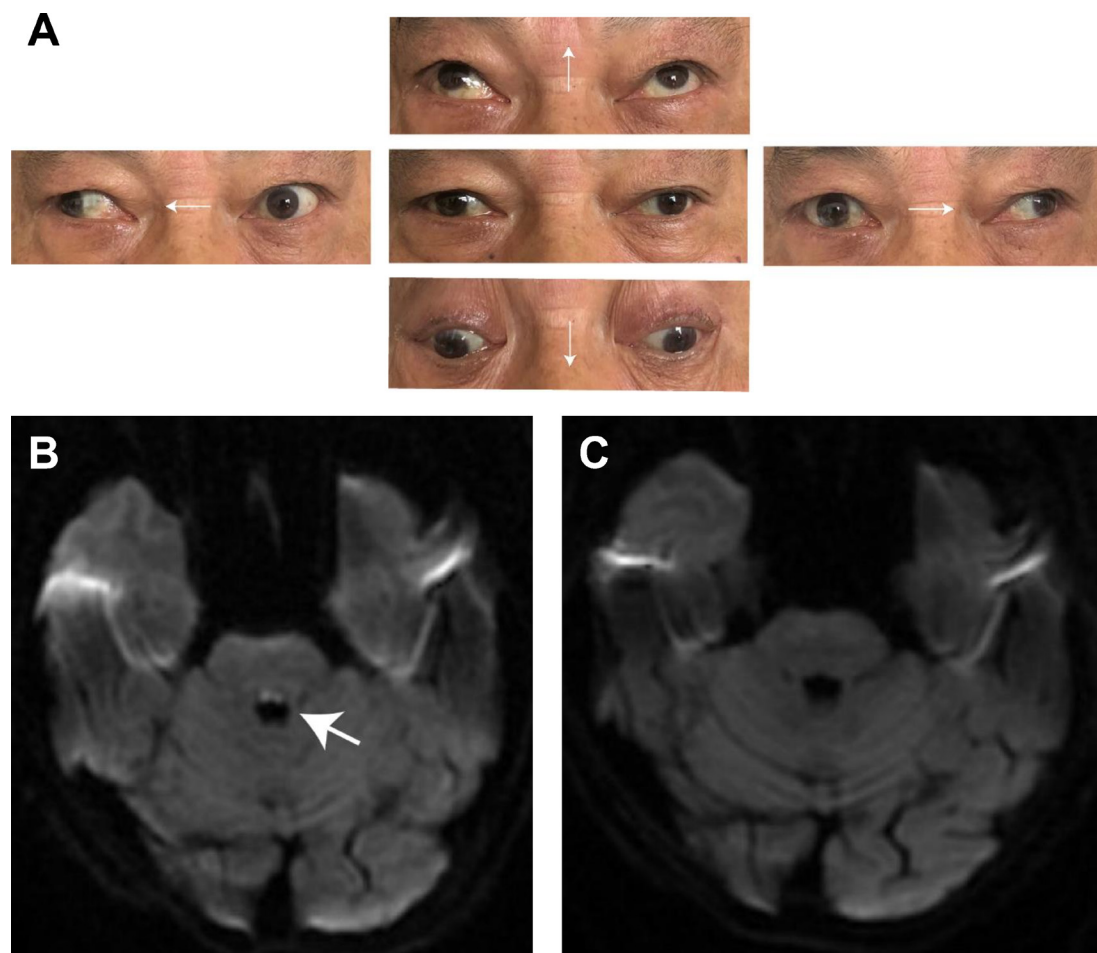
**Conclusions** This case underscores the importance of early recognising WEBINO in the emergency department. A timely diagnosis of stroke-induced WEBINO is important so that acute treatment can be considered and for initiating secondary stroke preventive measures to potentially improve the prognosis.

A 71-year-old man with hypertension presented to the emergency department with sudden-onset diplopia. Neurological examination demonstrated exotropia of both eyes on primary, upgaze and downgaze position, as well as bilateral adduction deficits accompanied with nystagmus of the abducted eye on horizontal gaze. He also presented gaze-evoked vertical nystagmus and impaired convergence ([figure 1A](#) and online supplemental video 1). Direct and indirect pupil reflex to light were normal. MR scan of brain revealed bilateral symmetric diffusion restriction in the dorsal pons adjacent to the fourth ventricle, corresponding to bilateral medial longitudinal fasciculi (MLF) ([figure 1B](#)). Blood tests indicated impaired

glucose tolerance. CSF testing showed normal open pressure, cell count, protein and glucose levels. Oligoclonal bands were negative and no malignant cells were found. Anti-central nervous system (anti-CNS) auto-antibodies (antibodies against AQP4, MOG, NMDAR, AMPAR1, AMPAR2, LGI1, CASPR2, GABABR, IgLON5, and GQ1b) in both CSF and serum were negative. Wall-eyed bilateral internuclear ophthalmoplegia (WEBINO) syndrome secondary to pontine infarction was diagnosed. Clopidogrel 75 mg and atorvastatin 20 mg per day were prescribed. At 60-day follow-up, his eye movement abnormalities improved and MRI lesions disappeared ([figure 1C](#)).

WEBINO is a rare ocular motor disorder which is characterised by binocular exotropia and bilateral internuclear ophthalmoplegia.<sup>1–3</sup> Some cases are associated with other neuro-ophthalmic abnormalities including loss of convergence, vertical gaze paralysis, vertical nystagmus, ptosis, pupil abnormality and skew deviation. This patient showed exotropia in primary position, binocular adduction deficit, loss of convergence, which were the most common ocular motor abnormalities of WEBINO reported in the literature.

Inflammation has been suggested as the most common aetiology of WEBINO.<sup>4</sup> However, we retrospectively summarised all 48 WEBINO cases published from 1985 to 2023 (online supplemental table 1), and found that infarction is the most frequent (21/48, 43.8%) followed by inflammation including demyelination, infection, non-infective inflammatory or immune-mediated conditions (11/48, 22.9%). Interestingly, the third most common cause is progressive supranuclear palsy (10/48, 20.8%), which is followed by brainstem compression (5/48, 10.4%) due to hydrocephalus, tumour or herniation. Other uncommon causes include



**Figure 1** Extraocular movements and axial MR scan of the brain. (A) Exotropia of both eyes (wall eyed) in primary, upgaze and downgaze position, as well as bilateral adduction deficits in horizontal gaze were shown. (B) Axial diffusion-weighted imaging of the brain revealed hyperintense lesions in dorsal pons (arrow), where bilateral medial longitudinal fasciculi were involved. (C) The lesions disappeared at 60-day follow-up.

microhaemorrhage, postoperative complication and toxic-metabolic injury. In summary, WEBINO can result from various underlying pathologies, with inflammation most common in the young, and stroke most common in the elderly. In rare situations, stroke-like onset WEBINO in elderly patients with a history of autoimmune diseases, CSF examination containing anti-CNS antibodies could provide additional information to help determine the aetiology,<sup>5</sup> although we would accept that there will be a range of opinions as to whether the extensive antibody testing in this case was necessary.

Simultaneous lesions of bilateral MLF definitely contribute to the pathophysiology of WEBINO. However, damage in the medial rectus subnuclei of bilateral oculomotor nuclei<sup>6</sup> or overexcitation of each median pontine reticular formation (PPRF)<sup>7</sup> is still debated. Several patients, including this patient, do not show lesions of the medial rectus subnuclei or PPRF, suggesting that these two locations are not necessarily involved in WEBINO. Of 22 WEBINO caused by stroke in the literature (21 infarction and 1 microhaemorrhage), 10 (45.5%) involved midbrain, 6 (27.3%) involved pons and 6 affected both areas (27.3%). The patient presented here is one such

case with an explicit ischaemic dorsal pontine lesion corresponding to bilateral MLF.

This case and literature review implicate stroke as the most common cause of WEBINO among elderly patients and emphasise the importance of its early recognition in the emergency department given the treatment is very time sensitive. As a general rule, sudden-onset WEBINO in the adult with cerebrovascular risk factors strongly suggests a dorsal brainstem infarction caused by small vessel disease or cardioembolism. A timely diagnosis of stroke-induced WEBINO is important so that acute treatment can be considered and for initiating secondary stroke preventive measures to potentially improve the prognosis.

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#### ORCID iDs

Lin-Yuan Zhang <http://orcid.org/0000-0002-5657-4957>

Xiao-Ying Zhu <http://orcid.org/0009-0007-6003-3989>

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