

## CASE REPORT

# Sudden deafness as a sign of stroke with normal diffusion-weighted brain MRI

HYON-AH YI<sup>1</sup>, SEONG-RYONG LEE<sup>2</sup>, HYUNG LEE<sup>1,2</sup>, BYUNG-HOON AHN<sup>3</sup>,  
BYUNG-RIM PARK<sup>4,5</sup> & GREGORY T. WHITMAN<sup>6</sup>

<sup>1</sup>Department of Neurology, <sup>2</sup>Brain Research Institute and <sup>3</sup>Department of Otorhinolaryngology, Keimyung University School of Medicine, Daegu, South Korea, <sup>4</sup>Departments of Physiology, <sup>5</sup>Medicine and <sup>6</sup>Hanbang Brain Disease Research Center, Wonkwang University School of Medicine, Iksan, South Korea, & <sup>6</sup>Department of Neurology, University of California Irvine College of Medicine, Irvine, California, USA

### Abstract

Sudden deafness without associated neurological signs and symptoms is typically attributed to a viral inflammation of the labyrinth. Sudden deafness as a heralding manifestation of basilar occlusion has rarely been described. A 60-year-old male with hypertension presented with an acute onset of isolated sudden deafness with vertigo. On admission, initial brain MRI, including diffusion-weighted images, was normal. Two days after the onset of symptoms, the patient presented with an exacerbation of vertigo. A follow-up MRI scan revealed new infarcts involving the right middle cerebellar peduncle, right dorsolateral pons and right anterior cerebellum. In this patient, the acute onset of isolated sudden deafness with vertigo may have been a heralding manifestation of the pontocerebellar infarction.

**Keywords:** Deafness, heralding manifestation, new infarcts, normal MRI

### Introduction

The acute onset of dysarthria, vertigo, cranial nerve signs and weakness usually suggests stroke. Deafness is a less widely appreciated and less common sign of stroke [1–5]. It presumably results from ischemia in the distribution of the internal auditory artery, which is a branch of the anterior inferior cerebellar artery (AICA) [6]. Clinicians often rely on diffusion-weighted MRI scans for diagnosis. Unusual cases such as that described herein serve as a reminder that a good clinical examination may reveal disorders missed by MRI.

### Case report

A 60-year-old male with hypertension developed sudden right-sided deafness together with vertigo, nausea and vomiting. In addition to hearing loss, examination revealed spontaneous left-beating

horizontal–torsional nystagmus in the primary position and when gazing to the right or left.

The patient did not have dysarthria, ophthalmoparesis, dysphagia, Horner's syndrome, limb weakness, dysmetria or sensory loss. Extensive blood tests, including liver function tests, a complete blood count and determination of urea nitrogen, creatinine, the erythrocyte sedimentation rate, circulating immune complex and serum electrolytes, were all normal. Tests for antinuclear antibody, rheumatoid factor, C-reactive protein, HIV serology and treponemal serology (Venereal Disease Reference Laboratory) were unremarkable. Pure-tone audiometry showed sensorineural hearing loss of 102 dB in the right ear (Figure 1). Electronystagmography showed no response to caloric stimulation on the right side. Axial T2- and diffusion-weighted brain MRI scans performed 2 days after the onset of symptoms were normal (Figure 2). Brain magnetic resonance angio-

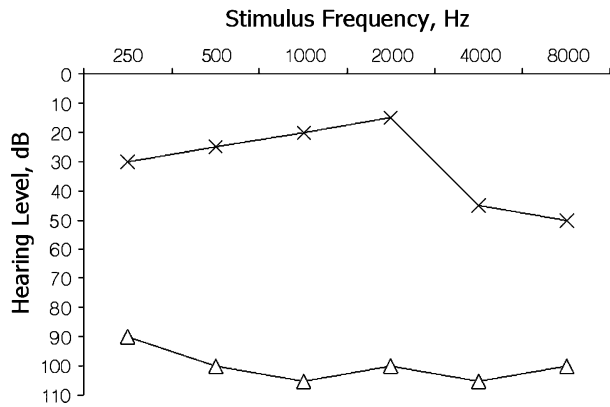


Figure 1. Pure-tone air-conduction audiogram showing profound hearing loss on the right side. *Triangles* = air conduction (masked) on the right side; *crosses* = air conduction (unmasked) on the left side.

graphy (MRA) revealed mild stenosis of the middle third of the basilar artery. The left distal vertebral artery was not visualized by MRA, suggesting occlusion or severe stenosis. Low-dose (100 mg) aspirin therapy was started. The hearing loss per-

sisted, but the vertigo improved steadily over the course of the next few days. Two days after the onset of hearing loss, the patient reported exacerbation of vertigo, accompanied by nausea and vomiting, and difficulty in standing. Examination revealed spontaneous left-beating horizontal-torsional nystagmus in primary gaze. This nystagmus was essentially unmodified on leftward gaze but switched to right-beating horizontal-torsional nystagmus on rightward gaze. There was diminished right facial sensation, and dysmetria of the right limbs. A follow-up MRI scan was consistent with acute infarcts in the right middle cerebellar peduncle, right dorsolateral pons and right anterior cerebellum (Figure 2). The patient's right limb coordination and gait improved steadily over the course of several weeks, but there was no improvement in hearing in his right ear.

**Discussion**

Vertebrobasilar stroke can cause sudden deafness as the blood supply to most of the auditory system

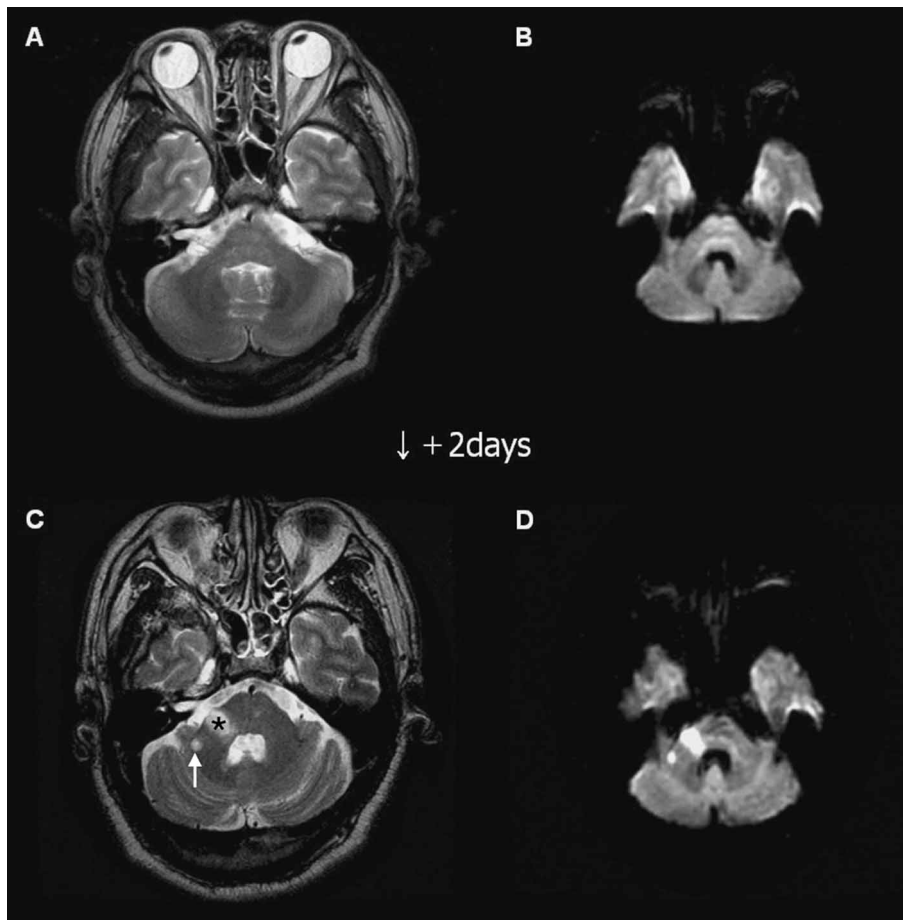


Figure 2. (A) Axial T2- and (B) diffusion-weighted brain MRI scans performed 1 day after the onset of sudden deafness showed no abnormalities in brain parenchyma. Two days later, (C) axial T2- and (D) diffusion-weighted MRI scans of the brain demonstrated hyperintense foci involving the right middle cerebellar peduncle (*star*), right dorsolateral pons and right anterior cerebellum (*arrow*).

arises from the vertebrobasilar system [6]. Characteristically, acute audiovestibular loss due to vertebrobasilar ischemia is associated with multiple brainstem or cerebellar signs [7–11].

Considering the available data from our case, including the new AICA infarct several days after the onset of sudden deafness, the vascular risk factors, the fact that extensive blood tests revealed no abnormalities (excluding other causes of sudden deafness), stenosis of the basilar artery on brain MRA and the absence of vestibular function on caloric stimulation, the deafness that preceded the AICA infarction may have resulted from cochlear ischemia. There have been several previous reports [1,4,6,8] on sudden deafness as a clinical clue to stroke. However, in those reports, normal diffusion-weighted MRI was not described at the time of a syndrome consisting of sudden deafness and peripheral-type nystagmus.

The vascular supply to the peripheral auditory system, including the inner ear and cochlear nerve, comes from the vertebrobasilar system [6]. The inner ear is particularly vulnerable to ischemia as it requires a high-energy metabolism and has a completely absent collateral circulation [6,12]. By contrast, the retrocochlear acoustic nerve has an abundant collateral blood supply [13].

It is generally accepted [14] that false-negative diffusion-weighted imaging (DWI) is possible, particularly for ischemia referable to the posterior fossa. However, in our case, the time between the onset of exacerbation of symptoms and the follow-up MRI scan was similar to that for the first MRI scan. Thus, it is unlikely that our case had false-negative DWI at the first MRI scan. Although the differential diagnosis of sudden deafness is known to include stroke, we believe this is the first report of AICA stroke with normal DWI. In the case of patients with a classical acute peripheral-type syndrome, e.g. hearing loss, vertigo and unidirectional nystagmus, the clinician should bear in mind the differential diagnosis of a posterior circulation stroke.

## Acknowledgements

This study was supported by a grant from the Oriental Medicine R&D Project (No. 03-PJ9-PG6-SO02-0001), Ministry of Health & Welfare, South Korea.

## References

- [1] Lee H, Whitman GT, Lim JG, Lee SD, Park YC. Bilateral sudden deafness as a prodrome of anterior inferior cerebellar artery infarction. *Arch Neurol* 2001;58:1287–9.
- [2] Lee H, Sohn SI, Jung DK, Cho YW, Lim JG, Yi SD, et al. Sudden deafness and anterior inferior cerebellar artery infarction. *Stroke* 2002;33:2807–12.
- [3] Amarenco P, Hauw J-J. Cerebellar infarction in the territory of the anterior and inferior cerebellar artery. *Brain* 1990; 113:139–55.
- [4] Deschauer M, Georgiadis D, Lindner A. Hearing loss as the leading symptom in anterior inferior cerebellar artery infarction. *Fortschr Neurol Psychiatr* 1998;66:109–12.
- [5] Lee H, Ahn BH, Baloh RW. Sudden deafness with vertigo as a sole manifestation of anterior inferior cerebellar infarction. *J Neurol Sci* 2004;222:105–7.
- [6] Oas JG, Baloh RW. Vertigo and the anterior inferior cerebellar artery syndrome. *Neurology* 1992;42:2274–9.
- [7] Huang MH, Huang CC, Ryu SJ, Chu NS. Sudden bilateral hearing impairment in vertebrobasilar occlusive disease. *Stroke* 1993;24:132–7.
- [8] Toyoda K, Hirano T, Kumai Y, Fujii K, Kiritoshi S, Ibayashi S. Bilateral deafness as a prodromal symptom of basilar artery occlusion. *J Neurol Sci* 2002;193:147–50.
- [9] Stephan H, Wappenschmidt J, Kiefer H. Occlusion of the basilar artery. *Neurosurg Rev* 1981;4:41–52.
- [10] Deplanque D, Godeferoy D, Guerouaou D, Laureau E, Desaulty A. Sudden bilateral deafness: lateral inferior pontine infarction. *J Neurol Neurosurg Psychiatry* 1998; 64:817–8.
- [11] Sunose H, Toshima M, Mitani S, Suzuki M, Yoshida F, Takasaka T. Sudden bilateral hearing loss and dizziness occurred with cerebellar infarction. *Otolaryngol Head Neck Surg* 2000;122:146–7.
- [12] Grad A, Baloh RW. Vertigo of vascular origin: clinical and electronystagmographic features in 84 cases. *Arch Neurol* 1989;46:281–4.
- [13] Mazzoni A. Internal auditory artery supply to the petrous bone. *Ann Otol Rhinol Laryngol* 1972;81:13–21.
- [14] Ay H, Buonanno FS, Rordorf G, Schaefer PW, Schwamm LH, Wu O, et al. Normal diffusion-weighted MRI during stroke-like deficits. *Neurology* 1999;52:1784–92.

Copyright of Acta Oto-Laryngologica is the property of Taylor & Francis Ltd. The copyright in an individual article may be maintained by the author in certain cases. Content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.