Sudden bilateral simultaneous deafness with vertigo as a sole manifestation of vertebrobasilar insufficiency

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A 68 year old woman presented with bilateral sudden simultaneous hearing loss and transient spontaneous vertigo as a sole manifestation of vertebrobasilar insufficiency. Extensive investigation to exclude other causes was unremarkable. Magnetic resonance imaging of the brain, including diffusion images, showed no abnormalities. A magnetic resonance angiogram showed severe stenosis of the middle third of the basilar artery. A pure tone audiogram showed moderate sensorineural-type hearing loss bilaterally. The localisation and mechanism of an isolated cochleovestibular dysfunction are discussed.

Vertebrobasilar insufficiency (VBI) can cause sudden bilateral deafness because the vertebrobasilar system supplies most of the auditory system including the inner ears. Characteristically, sudden bilateral deafness due to VBI is associated with multiple brain stem or cerebellar signs. To our knowledge, sudden bilateral simultaneous deafness with vertigo has not been reported as a sole manifestation of VBI.

We report on a patient who presented purely with sudden bilateral deafness and vertigo. This unusual presentation was due to a selective involvement of the inner ears supplied by the internal auditory arteries, ordinarily branches of the anterior inferior cerebellar artery (AICA).

Abbreviations: AICA, anterior inferior cerebellar artery; VBI, vertebrobasilar insufficiency

Figure 1 Pure-tone air conduction audiograms obtained on two different dates, 15 days apart (+15). The patient’s hearing levels are plotted against stimulus frequency on a logarithmic scale. The decibels were measured according to the American National Standards Institute, 1989.
Deafness is also associated with VBI. Due to VBI have also described associated neurological symptoms such as mental change, motor weakness, sensory loss, or cranial nerve palsy. Brain magnetic resonance images characteristically showed hyperintensities involving the brain stem, cerebellum, or both. In 1981, Stephan et al described a patient with sudden bilateral deafness caused by basilar artery occlusion who later developed bilateral weakness and died 10 hours after the onset. In 1993, Huang et al described seven patients with sudden bilateral deafness caused by VBI, all of whom had brain stem signs including facial palsy, diplopia, swallowing difficulty, and bilateral weakness. Brain computed tomography in six patients showed multiple hypodense lesions in brain stem and cerebellum. The report did not mention audiometric data, limiting localisation. In 1995, Buttner et al reported on a patient who had a bilateral vestibulocochlear loss due to VBI without any other neurological symptoms or signs, as in our case. In comparison with our patient, however, the patient described by Buttner et al had continuous prolonged vertigo and bilateral canal paresis on caloric stimulation. They did not conduct specialised auditory testing to localise the site of hearing loss. In 1998, Deplanque et al reported on a patient with unilateral lateral inferior pontine infarction who presented with bilateral deafness, facial palsy, Horner syndrome, and ataxia. In 2000, Sunose et al described a patient with bilateral cerebellar infarction who had acute onset of hearing impairment bilaterally, dizziness, oculomotor abnormalities, and numbness in the right extremity. In 2001, Lee et al described a patient who had a bilateral sudden deafness as a prodrome of pontocerebellar infarction in the territory of the AICA. In 2002, Toyoda et al reported on two patients with basilar artery occlusion who had bilateral deafness as a warning sign of impending stroke. Both patients died of extensive infarction in the brain stem and cerebellum. All of these patients except one had multiple neurological signs in addition to bilateral hearing loss.

**Localisation of sudden bilateral deafness**

Without pathological confirmation, it is impossible to determine precisely the locus of injury responsible for hearing loss in our patient. However, in our patient, speech discrimination and stapedial reflex testing were normal, as were brain stem auditory evoked potentials, indicating a cochlear site of lesion.

**DISCUSSION**

The differential diagnosis of bilateral sudden sensorineural hearing loss includes trauma, autoimmune inner ear disease, meningitis, syphilis, HIV, and ototoxic drugs. Sudden bilateral deafness is also associated with VBI. Our patient developed sudden onset of symptoms and had definite vascular risk factors with longstanding hypertension and diabetes mellitus. Furthermore, the magnetic resonance angiogram showed severe stenosis of the middle third of the basilar artery and blockage of the right distal vertebral artery (fig 2). A transthoracic echocardiogram and an electrocardiogram showed no abnormalities. The patient was treated acutely with a platelet aggregation inhibitor. Fifteen days later, a follow up pure tone audiogram documented notable improvement on both sides to 35 dB pure tone average (fig 1). At last follow up, the patient had no specific complaints and has had no further neurological attacks.

**Sudden bilateral deafness and VBI**

There have been several reports of bilateral deafness due to VBI. However, most previous reports of bilateral deafness due to VBI have also described associated neurological symptoms such as mental change, motor weakness, sensory loss, or cranial nerve palsy. Brain magnetic resonance images characteristically showed hyperintensities involving the brain stem, cerebellum, or both. In 1981, Stephan et al described a patient with sudden bilateral deafness caused by basilar artery occlusion who later developed bilateral weakness and died 10 hours after the onset. In 1993, Huang et al described seven patients with sudden bilateral deafness caused by VBI, all of whom had brain stem signs including facial palsy, diplopia, swallowing difficulty, and bilateral weakness. Brain computed tomography in six patients showed multiple hypodense lesions in brain stem and cerebellum. The report did not mention audiometric data, limiting localisation. In 1995, Buttner et al reported on a patient who had a bilateral vestibulocochlear loss due to VBI without any other neurological symptoms or signs, as in our case. In comparison with our patient, however, the patient described by Buttner et al had continuous prolonged vertigo and bilateral canal paresis on caloric stimulation. They did not conduct specialised auditory testing to localise the site of hearing loss. In 1998, Deplanque et al reported on a patient with unilateral lateral inferior pontine infarction who presented with bilateral deafness, facial palsy, Horner syndrome, and ataxia. In 2000, Sunose et al described a patient with bilateral cerebellar infarction who had acute onset of hearing impairment bilaterally, dizziness, oculomotor abnormalities, and numbness in the right extremity. In 2001, Lee et al described a patient who had a bilateral sudden deafness as a prodrome of pontocerebellar infarction in the territory of the AICA. In 2002, Toyoda et al reported on two patients with basilar artery occlusion who had bilateral deafness as a warning sign of impending stroke. Both patients died of extensive infarction in the brain stem and cerebellum. All of these patients except one had multiple neurological signs in addition to bilateral hearing loss.

**Localisation of sudden bilateral deafness**

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Predominantly low frequency hearing loss on the pure tone audiogram suggests that the vascular insufficiency involved small arterioles within the apex of the cochlea, which is considered to be a particularly vulnerable site to ischaemia.10

Mechanism of sudden bilateral deafness
Strokes in the territory of the AICA are usually associated with basilar occlusive disease.5 Because the brain magnetic resonance angiogram in our patient documented a severe stenosis of the basilar artery close to the origin the AICA, it is possible that an atheromatous plaque within the basilar artery extended into the AICA ostia. By this mechanism, decreased blood flow in both AICA may selectively damage the inner ear because of its high energy requirements and the lack of collaterals.10 It is also possible that the hearing loss resulted from emboli originating in the basilar or vertebral arteries, but the bilateral simultaneous onset would be atypical. Previous reports10,11 of experimental transient occlusion of the internal auditory artery have shown that the cochlea is more sensitive to ischaemia than the vestibular labyrinth. We speculate that the prominence of hearing symptoms and the absence of the other neurological symptoms or signs are best explained by the selective vulnerability of the cochlea to ischaemia.

Clinical relevance
We have previously reported hearing loss as a prodrome of AICA infarction. Together, these reports highlight the importance of hearing loss as either a sole manifestation or a warning of impending brain stem infarction. Clinicians should be aware of the possibility of VBI in patients with bilateral sudden deafness, even when brain stem or cerebellar signs are absent.

References
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