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Case report

Neuromyelitis optica spectrum disorder with deafness and an extensive brainstem lesion

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ABSTRACT

A 49-year-old woman developed vomiting, hiccups, double vision, and bilateral ptosis, after which tinnitus and deafness appeared. Head magnetic resonance imaging (MRI) showed a brainstem lesion focused on the midbrain and pons. Anti-aquaporin 4 (AQP4) antibody was positive, and there was no evidence of optic neuritis or myelitis, leading to the diagnosis of neuromyelitis optica spectrum disorder (NMOSD). The auditory brainstem response (ABR) showed no derivation of wave V on left stimulation and extended latency between waves III and V on right stimulation, so impairment between the midbrain and pons was suspected. It was useful to evaluate head MRI and the ABR for identification of the location of auditory pathway dysfunction.

1. Introduction

Neuromyelitis optica (NMO)/neuromyelitis optica spectrum disorder (NMOSD) has a wide variety of symptoms and lesions. Although brainstem lesions are not rare [1], deafness is a rare symptom in NMOSD [2, 3]. In this case, head magnetic resonance imaging (MRI) and the auditory brainstem response (ABR) were useful for identifying the sites of auditory tract impairment.

2. Case report

A 49-year-old woman with no past history developed vomiting and oral feeding difficulty in September 2014. She also had a 1-week history of hiccups. Three months later, she could take meals, but she was found to have double vision and bilateral ptosis and unknown behavior at times. Four months later, she could only communicate by writing because of tinnitus that was like static on television and deafness. Head MRI showed a brainstem lesion, and she was admitted to our hospital.

On physical examination, she had lost 10 kg of weight in four months. Her vital signs at admission were: temperature, 37.4 °C; pulse, 105 beats per minute; and blood pressure, 116/65 mmHg. Her consciousness was clear. She had diplopia, bilateral ptosis, bilateral disability of downward eye movement, double vision, bilateral tinnitus, and deafness. She could not keep the Mann limb position or perform tandem gait, leading to truncal ataxia.

On laboratory testing, there were no abnormalities in the initial basic blood investigations. Anti-nuclear antibody (58.4 IU/ml), anti-Sjögren's syndrome (SS)-A antibody (122.0 U/ml), and anti-SS-B antibody (18.2 U/ml) were elevated. Anti-double stranded DNA (dsDNA) antibody, anti-cardiolipin antibody, anti-β2 glycoprotein I (β2GPI) antibody, lupus anticoagulant, proteinase 3 anti-neutrophil cytoplasmic antibody (PR3-ANCA), myeloperoxidase anti-neutrophil cytoplasmic antibody (MPO-ANCA), vitamin B1, vitamin B12, folic acid, angiotensin-converting enzyme (ACE), and soluble interleukin-2 receptor (sIL-2R) were all within normal ranges. Anti-acetylcholine receptor (AChR) antibody was negative. Anti-aquaporin 4 (AQP4) antibody (7.0 U/ml; ELISA) was positive. On cerebrospinal fluid examination, pressure (50 mmH_2O) was lower limit of normal, cells (17/μl, mononucleosis 100%) and the IgG index (0.96) were elevated, and protein (41 mg/dl) and glucose (46 mg/dl) were within normal ranges. An oligoclonal band was positive, and myelin basic protein was elevated (284 pg/ml). Cytodiagnosis was class II. Pure tone audiometry showed unmeasurable severe bilateral sensorineural deafness. The ABR showed no derivation of wave V on left stimulation and extended latency between waves III and V (2.58 s; normal range 1.92 ± 0.13 s) on right stimulation (Figure 1). Head MRI showed a brainstem lesion focused on the midbrain, pons, dorsal side of the medulla, and around the fourth ventricle without contrast enhancement (Figure 1). There was no evidence of myelitis or optic neuritis on the medical examination and on MRI. Optical coherence tomography (OCT) and the visual evoked potential (VEP) were not performed.

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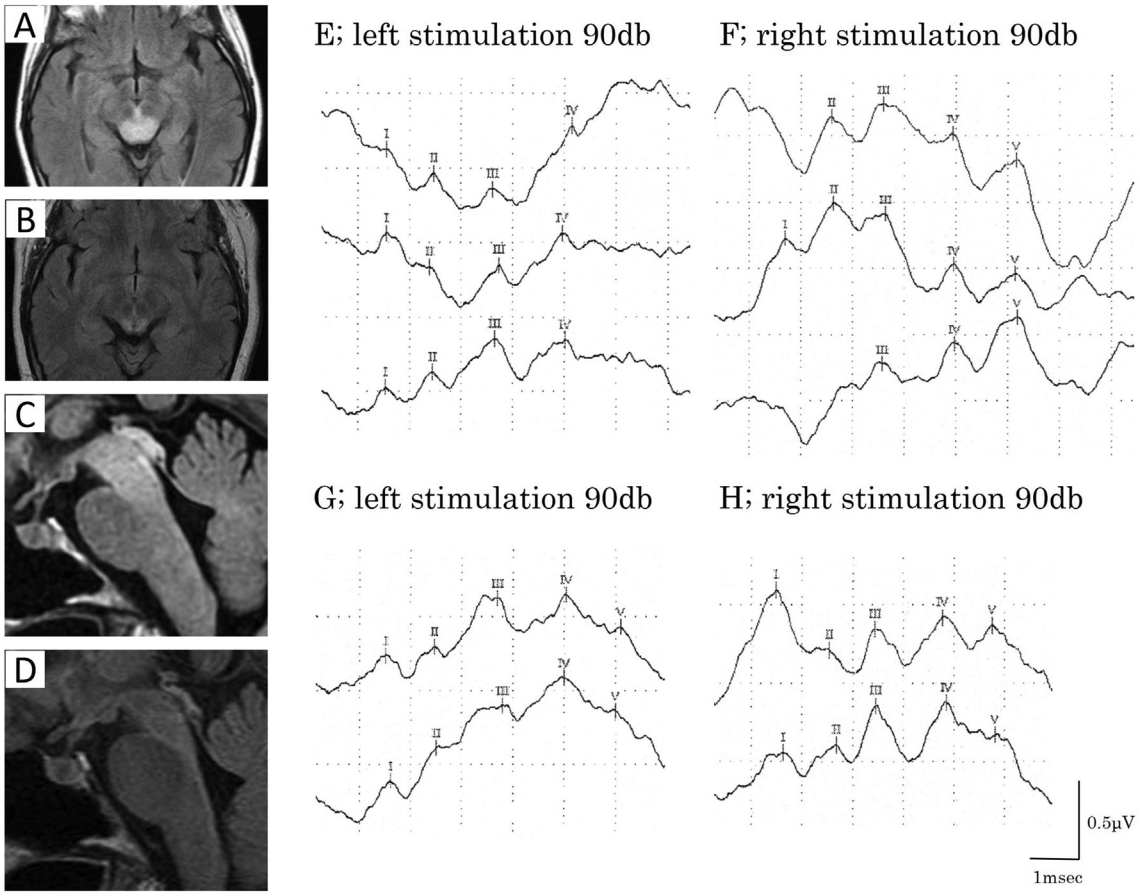

Figure 1. A (axial), C (sagital) head MRI before treatment. B (axial), D (sagital) head MRI after treatment. E, ABR on left stimulation before treatment. F, ABR on right stimulation before treatment. G, ABR on left stimulation after treatment. H, ABR on right stimulation after treatment.

Based on the above results, a diagnosis of NMOSD with anti-AQP4 antibody was made. The patient was given steroid pulse therapy (methylprednisolone 1 g/day 3 times). After four courses of steroid pulse therapy, her ptosis and disability of downward eye movement improved, but severe deafness and tinnitus remained. Therefore, she was started on 20 mg oral prednisolone and plasma exchange (albumin replacement) (7 times). Her symptoms of deafness and tinnitus, head MRI, and pure tone audiometry then improved gradually. The ABR also showed improvement of derivation of wave V on left stimulation and extended latency between waves III and V (from 2.58 s to 2.13 s) on right stimulation (Figure 1). She could then have a conversation without writing. Informed consent was obtained from the patient.

3. Discussion

We diagnosed this case as NMOSD because of the positive anti-AQP4 antibody and the presence of symptomatic brain lesions. There was no evidence of optic neuritis on the medical examination and on MRI. Recently, OCT has been shown to be useful in the evaluation of subclinical involvement of the visual system [4]. In this case, OCT was not performed, so the presence of visual system impairment could not be completely ruled out.

Anti-AQP4 antibody-positive cases sometimes have cerebral and brainstem lesions. A lesion of the dorsal side of the medulla is associated with intractable hiccups and vomiting, and other brainstem symptoms include dysphagia, oculomotor dysfunction, ptosis, and laryngeal spasm [1]. In the present case, the brainstem lesion caused the patient's symptoms. In particular, deafness and tinnitus were the factors resulting in a decline of instrumental activities of daily living (IADL). In one previous

Table 1. NMO/NMOSD cases showing deafness.

Case/age(y)/sex	symptoms	head MRI	ABR	reference number
1/40/female	right deafness	no brain stem lesion	right; wavеI(+), II~V(-)	[5]
2/54/female	bilateral deafness	middle cerebellar peduncle inferior cerebellar peduncle	bilateral; wavеI(+), II~V(-)	[6]
3/51/male	left deafness	no brain stem lesion	ND	[7]
4/49/female	bilateral deafness	midbrain, pons, dorsal side of medulla, around fourth ventricle	left; poor derivation of wave V right; extended latency between wave III and V	present

report, deafness was observed in 1 (1.0%) of 101 patients with NMOSD, and in another report, deafness was observed in 3 (1.16%) of 258 patients with NMO/NMOSD. [2, 3] There were three detailed reports that referred to deafness in NMO/NMOSD (Table 1). [5,6,7] Two of them had no brainstem lesions, but one of them showed middle cerebellar peduncle and inferior cerebellar peduncle lesions. Two of them underwent ABR, showing derivation of wave I and no derivation of waves II-V, suggesting dysfunction at the medulla. The present case showed no derivation of wave V on left stimulation and extended latency between waves III and V on right stimulation, so that impairment between the midbrain and pons conformed with the MRI lesion. This is the first case in which impairment between the midbrain and pons was proven by ABR. After the treatment, these changes on MRI and ABR improved, as well as her symptoms. It was useful to evaluate the head MRI and the ABR to identify the location of auditory pathway impairment and evaluate the therapeutic effect.

4. Conclusion

We should consider evaluating the ABR if a patient with NMO/NMOSD has deafness.

Declarations

Author contribution statement

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Data availability statement

Data will be made available on request.

Declaration of interests statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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