Comparison of the vestibular aqueduct between acute low-tone sensorineural hearing loss and Meniere’s disease

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INTRODUCTION

Acute low-tone sensorineural hearing loss (ALHL) is defined as sudden sensorineural hearing loss limited to low tones without vertigo, and this pathology may be multifactorial[9]. Several reports have supported this idea, showing similar clinical features or abnormal functional test results in ALHL patients[10].

Most ALHL improves over time, but some patients develop typical Meniere’s disease (MD), suggesting an association between ALHL and MD. As some patients develop cochlear or classic MD in the long term, ALHL may be caused by endolymphatic hydrops (EH) confined to the cochlea.

The vestibular aqueduct (VA) in MD is known to often be poorly developed as compared to normal controls, and is considered a predisposing factor in the development of EH. This study investigated associations between ALHL and MD from the perspective of development of the VA as measured on 3-dimensional (3D) computed tomography (CT).

SUBJECT AND METHODS

This study was approved by the ethics committee at Iwate Medical University (H26-36).

The criteria for ALHL in this study were those proposed by the Sudden Deafness Research Committee of the Japanese Ministry of Health, Labor and Welfare, as follows:

1. Sudden onset of hearing loss; patient can say clearly when symptom appeared
2. Sensorineural hearing loss, usually severe
3. Unknown cause

Accessory symptoms
1. May be accompanied by tinnitus
2. May be accompanied by vertigo, nausea and/or vomiting without recurrent episodes
3. No cranial nerve symptoms other than from the eighth cranial nerve

Definite: meeting all of the above criteria
Probable: meeting main symptoms 1 and 2
Fifty-three patients with unilateral ALHL (mean age, 43.5 years; 16 males, 37 females; 18 right side, 35 left side), 38 patients with unilateral MD (mean age, 52.5 years; 15 males, 23 females; 12 right side, 26 left side), 12 ears of 11 normal controls (mean age, 33.3 years; 11 males), length of the external aperture of the VA (EAVA) was measured on 3-dimensional computed tomography. Results were then compared among groups.

Results: Mean length of the EAVA was significantly shorter in MD patients (4.2±2.0 mm) than in ALHL patients (5.7±2.5 mm) or controls (6.5±1.5 mm). Among ALHL patients, the EAVA was significantly shorter in patients with recurrence (4.5±1.9 mm) than in those without recurrence (6.3±2.5 mm).

Conclusion: Hypoplasia of the endolympathic sac (ES) may represent a predisposing factor for recurrence of ALHL and/or MD, as development of the ES is known to correlate with length of the EAVA.

RESULTS

Mean length of the EAVA was 5.7±2.5 mm in ALHL patients, 4.2±2.0 mm in MD patients, and 6.5±1.5 mm in controls (Table 1). The EAVA was significantly shorter in MD than in ALHL or controls (Fig. 2). Among patients with ALHL, mean length of the EAVA was 6.3±2.5 mm in patients without recurrence, 4.5±2.0 mm in patients with recurrence, and 4.3±1.7 mm in patients who developed MD (Table 1). The EAVA was significantly longer for ALHL without recurrence than for ALHL with recurrence or MD, but no significant difference was evident between ALHL without recurrence and controls (Fig. 3). Length of the EAVA did not differ significantly between ALHL with recurrence, ALHL that developed into MD and MD, but was significantly shorter in ALHL with recurrence than in controls (Fig. 3). Length of the EAVA in cases of ALHL that developed into MD was not significantly different from that of MD, but was significantly shorter than that of controls (Fig. 3).

DISCUSSION

ALHL was first reported in 1982 by Abe[1], who described the clinical characteristics of 39 patients showing sudden low-tone hearing loss without fluctuation or recurrence as a mild type of sudden hearing loss with pathophysiologic features that might differ from those of MD[1]. By contrast, sudden low-tone hearing loss was well known to occur frequently in the early stages of MD[2].

Between April 2004 and March 2005, the Sudden Deafness Research Committee of the Japanese Ministry of Health, Labor and Welfare conducted an epidemiological survey in Kanagawa and Iwate Prefectures to determine the number of patients being treated. ALHL was found to be most frequent form of acute sensorineural hearing loss. In 1968, Clems and Valvassori measured length of the EAVA in patients with MD by pluridirectional tomography and reported narrowing or non-visualization of the VA in several patients[3]. Table 1 shows lengths of the EAVA as measured in the present series and other studies[4-13]. The EAVA was shorter in patients with MD than in controls in all of these studies.

The present study is the first to compare the length of the EAVA between MD and ALHL. We found that the EAVA was significantly longer in ALHL without recurrence than in ALHL with recurrence or MD, although no significant difference was noted between ALHL without recurrence and controls. The EAVA in both ALHL with recurrence and ALHL that developed into MD showed no significant difference from that in MD, but was significantly shorter than that in controls.

These results indicate hypoplasia of the VA may be associated with recurrent ALHL or development from ALHL into MD. Measurement of the length of the EAVA in ALHL by 3D-CT may predict the risk of recurrence or development into MD.

CONCLUSION

Hypoplasia of the ES may represent a predisposing factor for the recurrence of ALHL and/or the development of MD. By measuring the length of the EAVA, whether ALHL will recur or develop into MD may be able to be predicted to some extent.

REFERENCES