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Brief Report

Endolymphatic Hydrops on 3 Tesla MRI and Its Clinical and Radiological Correlation in Patients with Ménière's Disease

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Abstract

Background: Endolymphatic hydrops is a characteristic pathological finding in Ménière's disease and can be visualized using dedicated inner-ear magnetic resonance imaging (MRI) protocols. However, the relationship between the degree of endolymphatic hydrops and clinical, auditory, and vestibular manifestations remains incompletely understood.

Objective: To investigate the correlation between endolymphatic hydrops detected on 3 Tesla MRI and clinical, auditory, and vestibular findings in patients with Ménière's disease.

Methods: This retrospective observational study included 15 patients with a clinical diagnosis of Ménière's disease who underwent dedicated 3 Tesla inner-ear MRI. Cochlear and vestibular hydrops were graded according to the Inui classification. Clinical and audiovestibular parameters, including hearing loss, tinnitus, aural fullness, vertigo frequency and duration, interictal unsteadiness, horizontal video head impulse test (vHIT) gain, corrective saccades, and Tumarkin otolithic crises, were evaluated. Associations were assessed using Spearman's rank correlation, and cochlear hydrops grades were compared between patients with and without hearing loss using the Mann–Whitney U test. Statistical significance was set at $p < 0.05$.

Results: The study included 15 patients, with a mean age of 63 years (range, 21–90 years); 53% were female. Bilateral disease was observed in 26.6% of patients, while right-sided involvement accounted for 57% of unilateral cases. Cochlear hydrops demonstrated a significant positive correlation with hearing loss ($r_s = 0.718$, $p = 0.013$). Patients with hearing loss also had significantly higher cochlear hydrops grades ($U = 2.0$, $p = 0.012$). The association between cochlear hydrops and tinnitus did not reach statistical significance ($r_s = 0.597$, $p = 0.055$). No statistically significant correlations were identified between vestibular hydrops and horizontal vHIT gain, vertigo frequency or duration, corrective saccades, or Tumarkin otolithic crises. One patient exhibited clinical symptoms despite the absence of MRI-detected hydrops.

Conclusion: Cochlear hydrops grade was significantly associated with hearing loss in patients with Ménière's disease. However, significant associations between vestibular hydrops and the evaluated vestibular parameters were not demonstrated. These findings should be interpreted cautiously because of the small sample size and retrospective study design. Larger prospective studies are warranted to further investigate the relationship between MRI-detected endolymphatic hydrops and clinical manifestations of Ménière's disease.

Introduction

Magnetic Resonance Imaging (MRI) using dedicated inner ear protocols enables the in vivo visualization of endolymphatic hydrops, a condition classically associated with Ménière's disease. However, endolymphatic hydrops may also be observed in other conditions, raising questions about its relationship with clinical manifestations. Evaluating the association between MRI findings and auditory and vestibular symptoms may help clarify the clinical significance of endolymphatic hydrops. This study aimed to investigate the relationship between MRI-detected endolymphatic hydrops and auditory and vestibular symptoms in patients with Ménière's disease, with particular emphasis on the grades of cochlear and vestibular hydrops and their associations with clinical findings.

Materials and Methods

Study Design and Participants

This retrospective observational study included 15 patients with a clinical diagnosis of Ménière's disease who underwent MRI using a dedicated inner ear protocol at 3 Tesla. Clinical and radiological variables were collected retrospectively from the available patient records.

Clinical Assessment

Auditory and vestibular variables were evaluated. Auditory variables included hearing loss, classified into audiometric grades 1 to 4; tinnitus, assessed using the Ishida classification (2008); aural fullness, evaluated using a visual analogue scale ranging from 0 to 10; and hearing fluctuation, defined as a change greater than 15 dB at two or more frequencies on pure-tone audiometry. Vestibular variables included the presence or absence of vertigo, the mean number of vertigo attacks during the preceding year, the mean duration of attacks in hours, the presence or absence of interictal unsteadiness, mean horizontal vestibulo-ocular reflex gain measured using the video head impulse test (vHIT), and the presence or absence of corrective saccades. The presence of Tumarkin otolithic crises was also recorded.

Radiological Assessment

Radiological variables included the presence or absence of endolymphatic hydrops and its grade according to anatomical location. Cochlear hydrops was graded from C1 to C4, and vestibular hydrops was graded from V1 to V4, according to the Inui classification (2021).

Statistical Analysis

Spearman's rank correlation coefficient was used to assess the relationships between hydrops grades and clinical variables. The Mann–Whitney U test was used to compare cochlear hydrops grades between patients with and without hearing loss. A p-value of less than 0.05 was considered statistically significant.

Results

Demographic and Clinical Characteristics

The mean age of the 15 patients was 63 years, with a range of 21 to 90 years, and 53% were female. Bilateral disease was reported in 26.6% of patients. Among patients with unilateral disease, 57% had right-sided involvement. The mean annual number of vertigo attacks was 11.2, and the mean duration of attacks was 7.9 hours. Interictal unsteadiness was reported by 83% of patients, and 26.6% had experienced Tumarkin otolithic crises.

MRI Findings and Auditory Correlations

Endolymphatic hydrops was identified on MRI in most patients. One patient had auditory and vestibular symptoms without MRI evidence of hydrops. The grade of cochlear hydrops showed a strong positive correlation with hearing loss (Spearman's rank correlation coefficient, $r_s = 0.718$; $p = 0.013$). This finding indicates that higher cochlear hydrops grades were associated with greater hearing loss in the study sample. A moderate positive correlation was observed between cochlear hydrops grade and tinnitus ($r_s = 0.597$; $p = 0.055$). However, this association did not reach statistical significance. Patients with hearing loss had significantly higher cochlear hydrops grades than those without hearing loss (Mann–Whitney $U = 2.0$; $p = 0.012$). This finding is consistent with the observed correlation between cochlear hydrops grade and hearing loss.

MRI Findings and Vestibular Correlations

Mean horizontal vHIT gain showed a weak negative correlation with vestibular hydrops grade ($r_s = -0.274$; $p = 0.512$). This association was not statistically significant. No statistically significant associations were reported between vestibular hydrops grade and the frequency or duration of vertigo attacks or the presence of corrective saccades. A moderate negative correlation was observed between vestibular hydrops grade and the presence of Tumarkin attacks ($r_s = -0.498$; $p = 0.118$). However, this association also did not reach statistical significance.

Although hydrops was identified in most patients, the clinical manifestations varied. These findings suggest that the presence and grade of radiologically detectable hydrops do not necessarily correspond directly to the severity of clinical symptoms in every patient.

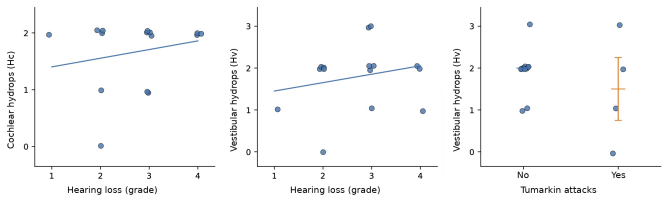


Figure 1: Relationship between MRI-detected endolymphatic hydrops and clinical findings. Left: cochlear hydrops grade in relation to hearing loss. Middle: vestibular hydrops grade in relation to hearing loss. Right: vestibular hydrops grade according to the presence or absence of Tumarkin attacks.

Discussion

This study investigated the relationship between MRI-detected endolymphatic hydrops and auditory and vestibular manifestations in patients with Ménière's disease. The principal finding was a strong positive correlation between cochlear hydrops grade and hearing loss. In contrast, the association between cochlear hydrops and tinnitus did not reach statistical significance. No statistically significant associations were observed between vestibular hydrops grade and the assessed vestibular variables. The strong correlation between cochlear hydrops and hearing loss suggests that the degree of cochlear involvement on MRI may be associated with the severity of auditory impairment in patients with Ménière's disease. The significantly higher cochlear hydrops grades observed in patients with hearing loss further support this finding. However, the observed association does not establish a causal relationship between hydrops and hearing loss. The results should also be interpreted cautiously because of the small sample size. A moderate positive correlation was observed between cochlear hydrops grade and tinnitus. Nevertheless, the p-value of 0.055 did not meet the prespecified threshold for statistical significance. Although this finding may warrant further investigation, the present results do not establish a statistically significant relationship between cochlear hydrops and tinnitus.

The vestibular findings were less conclusive. The weak negative correlation between vestibular hydrops grade and mean horizontal vHIT gain was not statistically significant. Similarly, no statistically significant associations were reported between vestibular hydrops grade and vertigo attack frequency, attack duration, or corrective saccades. The moderate negative correlation between vestibular hydrops and Tumarkin attacks was also nonsignificant. Therefore, the findings do not establish a clear relationship between vestibular hydrops grade and the vestibular manifestations assessed in this study. The observation that one patient had auditory and vestibular symptoms without MRI evidence of hydrops, while other patients presented with varying clinical manifestations despite radiologically detectable hydrops, suggests that imaging findings and clinical presentations may not correspond directly in every case. However, these observations alone cannot establish the diagnostic accuracy of MRI or determine its effectiveness in identifying early or atypical Ménière's disease.

Limitations

This study has several limitations. First, the small sample size limits statistical power and the generalizability of the findings. Second, the retrospective observational design may introduce selection and information bias. Third, the assessment of multiple clinical variables increases the possibility of chance findings arising from multiple statistical comparisons. The absence of a comparison group also limits the assessment of the specificity of MRI-detected hydrops for Ménière's disease. In addition, the clinical significance of the observed correlations requires further investigation in larger populations. Prospective studies using standardized MRI protocols, clearly defined clinical assessment criteria, and appropriate comparison groups would help clarify the relationships between cochlear and vestibular hydrops and their corresponding clinical manifestations.

Conclusions

Cochlear endolymphatic hydrops detected on 3 Tesla MRI showed a strong positive correlation with the grade of hearing loss in this sample of patients with Ménière's disease. Patients with hearing loss also had significantly higher cochlear hydrops grades than those without hearing loss. These findings suggest that cochlear hydrops grade may be associated with the severity of auditory impairment. A moderate positive correlation was observed between cochlear hydrops grade and tinnitus, although this association did not reach statistical significance. No statistically significant

associations were observed between vestibular hydrops grade and mean horizontal vHIT gain, vertigo attack frequency, attack duration, or corrective saccades. The observed relationship between vestibular hydrops and Tumarkin attacks was also not statistically significant. Overall, MRI assessment of endolymphatic hydrops may provide complementary information when evaluating auditory manifestations of Ménière's disease. However, the findings should be interpreted cautiously in view of the small sample size and retrospective study design. Further research involving larger patient populations, standardized imaging protocols, and appropriate comparison groups is needed to clarify the clinical significance of MRI-detected endolymphatic hydrops.

Ethics approval and consent to participate: Not applicable.

Consent for publication: Not applicable.

Declaration of Competing Interest: The authors declare to have no competing interests.

References

1. Inui H, Kitahara T, Ito T, Sakamoto T (2021) Magnetic resonance 3D measurement of the endolymphatic space in 100 control human subjects. J Int Adv Otol 17(6): 536-540.
2. Ito T, Inoue T, Inui H, Miyasaka T, Yamanaka T, et al. (2021) Novel magnetic resonance imaging-based method for accurate diagnosis of Meniere's disease. Front Surg 8: 671624.
3. Kobayashi M, Yoshida T, Fukunaga Y, Hara D, Naganawa S, et al. (2024) Perilymphatic enhancement and endolymphatic hydrops: MRI findings and clinical associations. Laryngoscope Investig Otolaryngol 9(5): e1312.
4. Diorflar S, Guigou C, Daguet E, Bensimon JL, Toupet M, et al. (2023) Confrontation of endolymphatic hydrops diagnosis on 3-Tesla MRI to clinical and audiovestibular findings in Meniere's disease. Front Neurol 14: 1105461.