

The diagnostic value of 3D-FLAIR MRI after intratympanic administration of Gd-DTPA in Meniere's disease

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Target audience: Radiologists and ENT (ear-nose-throat) doctors interested in Meniere's disease will benefit from this research.

Purpose: After intratympanic gadolinium administration through the tympanic membrane, three dimensional fluid attenuated inversion recovery magnetic resonance imaging (3D-FLAIR MRI) was performed to evaluate endolymphatic visualization and its diagnostic value in Meniere's disease.

Methods: This study was approved by local institutional review board, and informed consent was obtained. Twenty-four hours after bilateral intratympanic gadolinium administration through the tympanic membrane, 32 patients with unilateral Meniere's disease diagnosed clinically underwent 3D-FLAIR and 3D-Balanced-FFE (3D-B-FFE) imaging at a 3.0 Tesla MRI system (Achieva 3.0T TX, Philips Healthcare, Best, The Netherlands). The enhanced imaging of perilymphatic space in bilateral cochlea, vestibular and canal on 3D-FLAIR imaging were observed by two radiologists independently. Scala tympani and scala vestibule of bilateral cochlear basal turn were scored subjectively (2 = display was good and had no obvious changes compared with corresponding total lymph width on 3D-B-FFE images; 1 = display was not so good or obviously narrowed compared with corresponding total lymph width on 3D-B-FFE images; 0 = display was not clear or not visualized). The maximum enhanced range of bilateral vestibule and the signal intensity ratio (SIR) between the vestibule and the brain stem on 3D-FLAIR images were measured objectively. Wilcoxon tests and paired t tests were used respectively.

Results: Gadolinium appeared in the perilymph of cochlea and vestibular, so the endolymphatic space was clearly visualized on 3D-FLAIR images. The score of scala tympani between the affected side (24 cases scored 2, 5 cases scored 1, 3 cases scored 0) and the healthy side (23 cases scored 2, 9 cases scored 1, 0 cases scored 0) were no statistically significant different ($U=0.535$, $P>0.05$). The score of scala vestibuli between the affected side (3 cases scored 2, 15 cases scored 1, 14 cases scored 0) and the healthy side (21 cases scored 2, 8 cases scored 1, 3 cases scored 0) were statistically significant different ($U=4.221$, $P<0.05$). The developing area of vestibular were (5.80 ± 2.81) mm² and (8.33 ± 3.02) mm² for the affected side and the healthy side respectively, which were statistically significant different ($t=3.983$, $P<0.05$). The SIR of the vestibule and the brain stem were (0.91 ± 0.51) and (1.10 ± 0.58) for the affected side and the healthy side respectively, which were statistically significant different ($t=2.573$, $P<0.05$).

Discussion: Because of narrowed perilymphatic space caused by endolymphatic hydrops in Meniere's disease, the area of signal enhancement in cochlea and vestibule became narrowing or disappeared, prompting corresponding endolymphatic hydrops. The score of affected scala vestibuli and the measurement of affected vestibule in this research were coincided with the pathological change of Meniere's disease (Figure 1).

Conclusion: According to 3D-B-FFE MRI and the enhancement of perilymphatic space, 3D-FLAIR MRI with intratympanic gadolinium injection through the tympanic membrane can be used to show the border between the perilymph and the endolymph and confirm endolymphatic hydrops, thus providing radiographic evidence for the diagnosis of Meniere's disease.

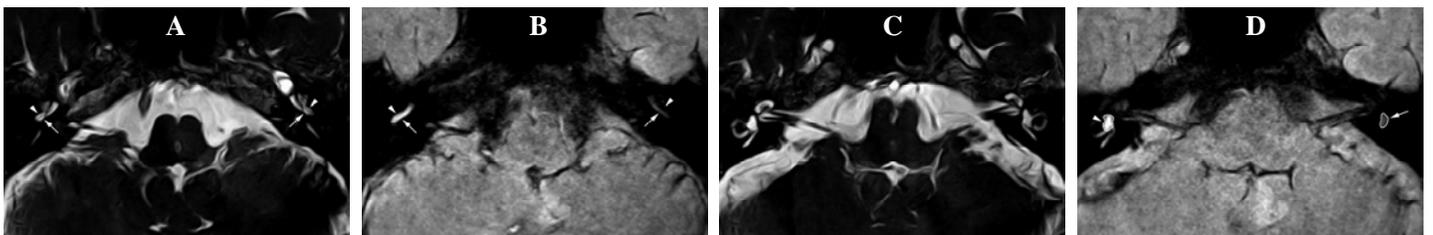


Figure 1: MR images of a 53-year-old man with left-sided Meniere's disease. **A.** 3D-B-FFE image for cochlear basal turn slice. The low signal linear zone between scala tympani (long arrow) and scala vestibule (arrow head) was osseous spiral lamina. **B.** 3D-FLAIR image for cochlear basal turn slice, same location as A. Right scala tympani (long arrow) and right scala vestibule (arrow head) were scored 2. Left scala tympani (long arrow) was scored 1 and left scala vestibule (arrow head) was scored 0. **C.** 3D-B-FFE image for vestibule slice. **D.** 3D-FLAIR image for vestibule slice, same location as C. The enhanced range and the signal intensity of left vestibule (long arrow) were both significantly lower than the right (arrow head).