



Editorial: Hydropic Ear Disease: Imaging and Functional Evaluation

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Editorial on the Research Topic

Hydropic Ear Disease: Imaging and functional evaluation

Recent developments and advances in the objective methods of evaluating endolymphatic hydrops and its related inner ear diseases have led to a better understanding of inner ear disease. Twenty-one valuable articles have been published in this issue of the research topic “Hydropic Ear Disease: Imaging and functional evaluation” on the advances in diagnostic imaging and techniques for measuring the function of the six sensory organs present in the inner ear. As of the beginning of April 2022, it has already recorded more than 47,500 views, which means that readers are very interested in this project. Fifteen out of the 21 papers report on magnetic resonance imaging (MRI) of the patients.

MRI depiction of endolymphatic hydrops in the patients with Meniere's disease was firstly achieved in 2007 with 3D-fluid attenuated inversion recovery (FLAIR) obtained 24 h after intratympanic gadolinium contrast administration (1). A clinically feasible method using a heavily T2-weighted 3D-FLAIR after 4 hours of intravenous injection of a standard dose of gadolinium contrast agent was achieved in 2010 (2). After these developments, many technical improvements have been reported including the development of HYDROPS (HYbriD of Reversed image Of Positive endolymph signal and native image of positive perilymph Signal) technique, which utilized the subtraction of two kinds of images (3). After these developments, many institutions began to acquire the MR imaging of endolymphatic hydrops. Subsequently, an update of endolymphatic hydrops assessment using MR imaging has been proposed for the management of inner ear disease (4–7).

A number of attempts have been made to perform the assessment of endolymphatic hydrops by MRI without the use of gadolinium contrast media (8–12). However, these are unfortunately unreliable because they do not adequately distinguish between artifact and imaging findings (13–15). Recognition of the endolymphatic space on non-contrast MRI is still possible only in very exceptional cases. These exceptional cases include hemorrhage into the ampulla (16), reflux of proteinous fluid in the enlarged endolymphatic duct and sac syndrome (17), and the compositional change of perilymph due to vestibular schwannomas (18). In general, contrast-enhanced MRI evaluation of endolymphatic hydrops is the most reliable method of examination at this time.

In this research topic, Fukushima et al. have reported on the use of MRI of endolymphatic hydrops to observe the effect of positive pressure therapy in a Meniere's disease patient (<https://www.frontiersin.org/articles/10.3389/fsurg.2021.606100/full>). Although this is a case report, this

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is a new and interesting proposal for the valuable and practical use of the MR imaging of endolymphatic hydrops.

In a review article of this research topic, that is co-authored by Topic editors, the authors tried to discuss and present a consensus on patient selection, imaging techniques, and evaluation methods at the occasion of 15 years after the invention of the MR imaging of the endolymphatic hydrops (<https://www.frontiersin.org/articles/10.3389/fsurg.2022.874971/abstract>).

REFERENCES

- Nakashima T, Naganawa S, Sugiura M, Teranishi M, Sone M, Hayashi H, et al. Visualization of endolymphatic hydrops in patients with Meniere's disease. *Laryngoscope*. (2007) 117:415–20. doi: 10.1097/MLG.0b013e31802c300c
- Naganawa S, Yamazaki M, Kawai H, Bokura K, Sone M, Nakashima T. Visualization of endolymphatic hydrops in Ménière's disease with single-dose intravenous gadolinium-based contrast media using heavily T(2)-weighted 3D-FLAIR. *Magn Reson Med Sci*. (2010) 9:237–42. doi: 10.2463/mrms.9.237
- Naganawa S, Yamazaki M, Kawai H, Bokura K, Sone M, Nakashima T. Imaging of Ménière's disease after intravenous administration of single-dose gadodiamide: utility of subtraction images with different inversion time. *Magn Reson Med Sci*. (2012) 11:213–19. doi: 10.2463/mrms.11.213
- Nakashima T, Pyykkö I, Arroll MA, Casselbrant ML, Foster CA, Manzoor NF, et al. Meniere's disease. *Nat Rev Dis Primers*. (2016) 2:16028. doi: 10.1038/nrdp.2016.28
- Gürkov R. Ménière and friends: imaging and classification of hydropic ear disease. *Otol Neurotol*. (2017) 38:e539–e544. doi: 10.1097/MAO.0000000000001479
- Iwasaki S, Shojaku H, Murofushi T, Seo T, Kitahara T, Origasa H, et al. Committee for clinical practice guidelines of Japan Society for equilibrium research. Diagnostic and therapeutic strategies for Meniere's disease of the Japan Society for Equilibrium Research. *Auris Nasus Larynx*. (2021) 48:15–22. doi: 10.1016/j.anl.2020.10.009
- Pyykkö I, Nakashima T, Yoshida T, Zou J, Naganawa S. Meniere's disease: a reappraisal supported by a variable latency of symptoms and the MRI visualisation of endolymphatic hydrops. *BMJ Open*. (2013) 3(2):e001555. doi: 10.1136/bmjopen-2012-001555
- Fukutomi H, Hamitouche L, Yamamoto T, Denat L, Zhang L, Zhang B, et al. Visualization of the saccule and utricle with non-contrast-enhanced FLAIR sequences. *Eur Radiol*. (2021). doi: 10.1007/s00330-021-08403-w
- Keller JH, Hirsch BE, Marovich RS, Branstetter 4th BF. Detection of endolymphatic hydrops using traditional MR imaging sequences. *Am J Otolaryngol*. (2017) 38:442–6. doi: 10.1016/j.amjoto.2017.01.038
- Simon F, Guichard J-P, Kania R, Franc J, Herman P, Hautefort C. Saccular measurements in routine MRI can predict hydrops in Ménière's disease. *Eur Arch Otorhinolaryngol*. (2017) 274:4113–20. doi: 10.1007/s00405-017-4756-8
- van der Lubbe MFJA, Vaidyanathan A, de Wit M, van den Burg EL, Postma AA, Bruinjes TD, et al. A non-invasive, automated diagnosis of Ménière's disease using radiomics and machine learning on conventional magnetic resonance imaging: a multicentric, case-controlled feasibility study. *Radiol Med*. (2022) 127:72–82. doi: 10.1007/s11547-021-01425-w
- Venkatasamy A, Veillon F, Fleury A, Eliezer M, Abu Eid M, Romain B, et al. Imaging of the saccule for the diagnosis of endolymphatic hydrops in Meniere disease, using a three-dimensional T2-weighted steady state free precession sequence: accurate, fast, and without contrast material intravenous injection. *Eur Radiol Exp*. (2017) 1(14). doi: 10.1186/s41747-017-0020-7
- Naganawa S, Ito R, Taoka T, Yoshida T, Sone M. Letter to editor on the article "A non-invasive, automated diagnosis of Ménière's disease using radiomics and machine learning on conventional magnetic resonance imaging: a multicentric, case-controlled feasibility study" by van der Lubbe MFJA et al. *Radiol Med*. (2022). doi: 10.1007/s11547-022-01486-5
- Naganawa S, Sone M. Letter to Editors: Detection of endolymphatic hydrops using traditional MR imaging sequences. *Am J Otolaryngol*. (2017) 38:637–8. doi: 10.1016/j.amjoto.2017.06.014
- Dominguez P, Naganawa S. Letter to the editor on the article "Saccular measurements in routine MRI can predict hydrops in Ménière's disease" by Simon F, et al. *Eur Arch Otorhinolaryngol*. (2018) 275:311–12. doi: 10.1007/s00405-017-4794-2
- Naganawa S, Ishihara S, Iwano S, Sone M, Nakashima T. Detection of presumed hemorrhage in the ampullar endolymph of the semicircular canal: a case report. *Magn Reson Med Sci*. (2009) 8:187–91. doi: 10.2463/mrms.8.187
- Naganawa S, Sone M, Otake H, Nakashima T. Endolymphatic hydrops of the labyrinth visualized on noncontrast MR imaging: a case report. *Magn Reson Med Sci*. (2009) 8:43–6. doi: 10.2463/mrms.8.43
- Yamazaki M, Naganawa S, Kawai H, Nishihashi T, Fukatsu H, Nakashima T. Increased signal intensity of the cochlea on pre- and post-contrast enhanced 3D-FLAIR in patients with vestibular schwannoma. *Neuroradiology*. (2009) 51:855–63. doi: 10.1007/s00234-009-0588-6

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