

3D visualization of endolymphatic hydrops after intratympanic injection of Gd-DTPA; optimization of 3D-real IR TSE sequence and utilization of 32ch head coil at 3T

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Introduction

For the certain diagnosis of Meniere's disease, histopathologic confirmation is necessary, however it is virtually impossible to obtain the histological confirmation in patients. Visualization of endolymphatic hydrops by imaging method has long been desired. Recently, separate visualization of endo- and perilymph space has been made possible by the intratympanic injection of Gd-DTPA and 3D-inversion recovery sequence with real reconstruction (3D-real IR) at 3T [1, 2]. Labyrinthine structure is very complex, thus 3D visualization of endo-/perilymph space is necessary for proper diagnosis. However, due to the low signal to noise ratio of the reported method, slice thickness was as thick as 2mm even with 15 minutes scan time at 3T. The purpose of this study was to increase the spatial resolution by the further optimization of the sequence and the utilization of 32 channel head coil and to challenge 3D visualization of endolymphatic hydrops.

Materials and methods

3D-real IR sequence was optimized using diluted Gd phantom lines. The concentration of Gd-DTPA in the labyrinth after intratympanic injection has been assumed as between 1/4000 and 1/32000 of original solution. TR, TE, and echo train length of TSE readout were optimized. Optimized sequence showed 40% increase of CNR per unit time compared to the previously reported one. SNR of 32ch coil shows approximately 25% increase in the vicinity of inner ear compared to that of 12 ch coil. Thus the voxel size was decreased from 0.4x0.4x2.0 to 0.4x0.4x0.8mm (60% reduction of voxel size). After IRB approval and informed consent, 11 patients with the suspect of Meniere's disease received intratympanic injection of diluted Gd-DTPA and were scanned using the optimized method 24 hours after injection. CISS images with 0.4mm isotropic voxel was also obtained.

Results and Conclusions

Optimized parameters for 3D-real IR were TR of 6000, TE of 182, TI of 1500, 27 ETL and GRAPPA x2. 3D-real IR images visualized enlargement of endolymphatic space as negative signal, perilymph space with distribution of Gd as high signal and surrounding bone as zero signal in all patients (Fig. 1a). The optimized sequence allowed the 3D volume rendering (VR) of perilymph space (Fig. 1b). By comparing the 3D-VR of total fluid space (endolymph + perilymph) by CISS (Fig. 1c), degree of endolymphatic hydrops can be well appreciated.

The optimized method combined with 32ch coil at 3T opens the door to the volume quantification of each lymph space for the precise understanding of Meniere's disease.

References [1] Nakashima T, et al. *Laryngoscope*. 2007;117(3):415-20. [2] Naganawa S, et al. *Eur Radiol*. 2008;18(5):920-4.



Fig. 1 59-year-old man with left Meniere's disease. (a, left image) 3D-real IR image shows endolymphatic space as negative signal (arrows). (b, middle image) 3D-VR image of 3D-real IR. This shows volumetric view of perilymph space. (c, right image) 3D-VR image of CISS. This shows total fluid space.