

Size of vestibular endolymph in patients with isolated lateral semicircular canal dysplasia

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Target audience: Radiologists and physicists, especially those who are responsible for the setup of clinical MR protocols

Purpose: Isolated vestibular-lateral semicircular canal dysplasia (LSCCD) is one of the most common inner ear anomalies. However, endolymphatic size in LSCCD is unknown. This study aimed to measure endolymph size in the vestibule of patients with LSCCD and compare that with the size measured in patients without LSCCD.

Methods: From our radiology report database, 1102 MR studies for the evaluation of endolymphatic hydrops (EH) were extracted. Among these 1102 MR examinations, 15 ears from 11 patients with LSCCD were found; four patients had bilateral abnormalities. There were 7 ears with aplasia and 8 ears with hypoplasia of the lateral semicircular canal (LSCC). The control group consisted of 26 ears from 13 randomly selected patients without LSCCD. The endolymph area of the vestibule (ELA), total vestibular lymph fluid area (TLA) and the area of the central bony island (CBI) of the LSCC were measured from axial MR images obtained after intratympanic [1] or intravenous [2] administration of gadolinium-based contrast material. The %EL was defined as "%EL=ELA/TLA x 100".

The correlation between %EL and the CBI area was evaluated. Age, %EL, degree of cochlear EH, hearing level, and presence of rotating vertigo were compared among the 3 groups (aplasia, hypoplasia, and control).

Results: The mean %EL was 76.7% in the aplasia group, 50.0% in the hypoplasia group, and 27.8% in the control group ($p < 0.001$)(Fig. 1). There was a relatively strong linear correlation between the CBI area and %EL ($r=-0.767$)(Fig. 2). There was no significant difference in patient age, mean hearing level, degree of cochlear EH or presence of vertigo attacks among the groups ($p > 0.05$).

Discussion and conclusions:

The size of vestibular endolymph in the aplasia or hypoplasia group was larger than in the control group. Thus, the current diagnostic cut-off value for significant vestibular EH (>50%) might not be appropriate for ears with LSCCD.

References:

- [1] Nakashima T, Naganawa S, Sugiura M, et al. Visualization of endolymphatic hydrops in patients with Meniere's disease. *Laryngoscope* 117(3): 415-420, 2007
- [2] Naganawa S, Yamazaki M, Kawai H, et al. 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* 9(4):237-242, 2010

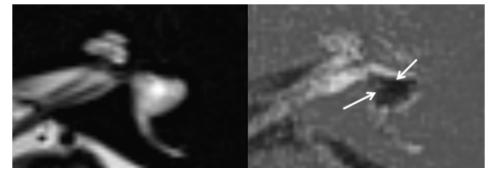


Fig. 1 A 65-year-old man with an aplastic left lateral semicircular canal (LSCC).

In this patient, the area of the central bony island (CBI) of the left LSCC is 0.0 mm^2 . MR images were obtained 4 hours after intravenous administration of a single dose of gadolinium-based contrast material. MR cisternography (left image) shows the total lymph fluid space as a bright signal. The HYDROPS2 image shows the extremely dilated vestibular endolymph area as a black space (arrows, right image).

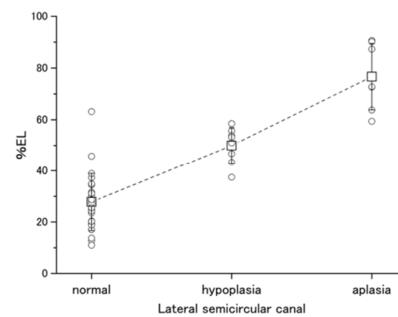


Fig. 2 Distribution of %EL for normal, hypoplasia, and aplasia of the LSCC. There is a statistically significant difference in the mean %EL among the three types of LSCC ($p < 0.001$)

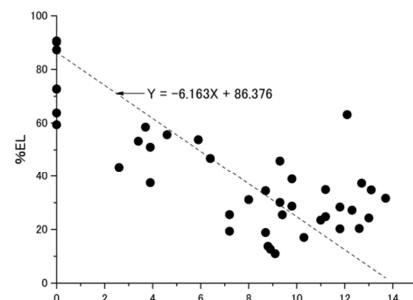


Fig. 3 Scattergram showing the area of the CBI and %EL. A relatively strong linear correlation was observed between the area of the CBI and the %EL; Pearson's correlation coefficient (r) was -0.767 ($p < 0.001$).