**Abstract**

Objective: Endolymphatic hydrops has been well described in patients with Meniere's disease; however, causation has not been established. Decompression of the endolymphatic sac has been proposed as a means to relieve hydrops and improve vertigo symptoms, but the efficacy of the surgery is debated. Until recently, there have been few objective measures of efficacy other than patients' subjective symptoms. Recent archival human temporal bone studies have shown that patients continue to have hydrops after shunt surgery. We propose using high resolution MRI to determine the efficacy of endolymphatic shunt surgery (ELS) in patients who continue to experience vertigo.

Setting: Academic tertiary care referral center

Patients: Four patients presented with continued vertigo after unilateral endolymphatic shunt surgery. Mean age was 56 years old. Surgery was performed at two different institutions.

Interventions: Magnetic resonance imaging sequences included “cisternographic” three-dimensional T2, and delayed intravenous-enhanced three-dimensional fluid-attenuation inversion recovery (DIVE-3D-FLAIR) sequences, performed with 2350 ms (bright perilymph) and 2050 ms (bright endolymph) inversion times. The bright endolymph images were subtracted from bright perilymph images to create a composite image with bright perilymph, dark endolymph, and intermediate bone signals.

Main outcome measures: MRI finding of endolymphatic hydrops

Results: In all four patients who continued to experience severe vertigo, hydrops was found on high resolution MRI on the operated ear. The appearance on MRI was no different than in patients with EH who have not had surgery.

Conclusions: The present study demonstrates the persistence of endolymphatic hydrops in patients who have failed endolymphatic shunt surgery. Future studies evaluating for the presence or absence of endolymphatic hydrops in patients who claim to obtain relief from endolymphatic shunt surgery.

**Materials and Methods**

Imaging was done on a 3-T scanner (Skrya, Siemens Healthcare, Erlangen, Germany) using a 12-channel head coil, 4 hours after administration of 0.2 mmol/kg gadobutrol intravenous contrast (Gadavist, Bayer HealthCare). Imaging consisted of three sequences: 1) “Cisternographic” 3D turbo spin echo T2; 2) Perilymph bright, endolymph dark heavily T2-weighted (T2w)–3D-FLAIR, obtained with an inversion time of 2350 ms, 3) “Endolymph bright, perilymph dark” T2w–3D-FLAIR, obtained with inversion time of 2050 ms. All sequences were acquired in the axial plane along the infraorbital area, as three dimensional volumetric scans. The cisternographic T2 was obtained with 0.3 x 0.3 x 0.3 mm isotropic voxels. The 3D-FLAIR sequences were obtained with 0.8 mm isotropic voxels. The endolymph bright T2w–3D-FLAIR images were subtracted from the bright perilymph bright T2w–3D-FLAIR images, in order to obtain an image with bright perilymph, dark endolymph, and intermediate signal bone. The cisternographic T2 was used to assist with anatomic reference.

**Results**

A 58-year-old female presented with a 5 year history of episodic vertigo, nausea, vomiting, and tinnitus in the right ear. The episodes were occurring several times a week and lasting 8-9 hours each time. A year prior to presentation, the patient had a shunt placed in the right ear, but she continued to have the same symptoms. MRI demonstrated hydrops on the right side (figure 2). The patient subsequently underwent right retrosigmoid vestibular neurectomy, and 6 months postoperatively reports complete resolution of vertigo and improvement in hearing. A 44-year-old male presented with a two year history of episodic vertigo. He underwent ELS without improvement in his symptoms. He underwent MRI showing left-sided hydrops. He tried multiple medications and had brief relief of his symptoms with medical management. While his symptoms were controlled, he underwent an MRI, which showed resolution of hydrops. However, his symptoms returned, and he opted for a vestibular neurectomy. One year after a left-sided vestibular neurectomy, the patient is doing well without suffering any further vertigo attacks after surgery.

A 60-year-old male presented for intractable recurrent episodic vertigo who previously underwent ELS. Postoperatively, he noted profound sensorineural hearing loss in that ear. Quantitative vestibular testing demonstrated unilateral canal paresis. MRI demonstrated presence of hydrops on the operated ear. Due to his persistent symptoms, he elected to proceed with transmastoid labyrinthectomy. He has been fully asymptomatic since the surgery without any further vertigo spells.

**References**

5. Portmann G. The sacculus endolymphaticus and an operation for draining the same for relief of vertigo. J Laryngol Otol. 1907;2:809-819.