An abnormal portal blood flow in the inner ear – a possible pathogenesis to Menière's disease

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ABSTRACT

The endolymphatic sac, a part of the inner ear, has characteristics as an endocrine gland and seems to produce a natriuretic hormone which might have an effect on the fluid regulation in the inner ear. A dysregulation of the fluids in the inner ear is a possible pathogenesis to Menière's disease. Menière's disease is an abnormality of the inner ear characterized by symptoms of episodic dizziness (vertigo), tinnitus, fluctuating hearing loss and the sensation of pressure in the affected ear. The symptoms might be associated to a dysregulation of the fluids in the inner ear (endolymph and perilymph) and/or a disturbance of the blood flow to and from the endolymphatic sac.

Temporal bones from patients with Menière's disease show enlargement of the compartment in the inner ear containing the endolymph, named an "endolymphatic hydrops". An endolymphatic hydrops can experimental be induced in animals, e.g. by blocking the endolymphatic duct or by disturbing the arterial and venous blood flow to and from the endolymphatic sac.

The purpose of the present PhD-dissertation was:

1. To visualize the blood flow in the endolymphatic sac in living rats. Access to the posterior cranial fossa was fascilitated by an intracranial approach. Movie files were recorded by video fluorescence microscopy.
2. To describe the main draining vein from the endolymphatic sac, the vein of the vestibular aqueduct (VVA), by scanning electron microscopy (SEM), corrosion casting and computer-assisted three-dimensional imaging.
3. To obstruct the venous outflow from the endolymphatic sac this may mimic Menière's disease-like symptoms in patients with different space-occupying tumours around the endolymphatic sac.

It was demonstrated that the endolymphatic sac is highly vascular and supplied by a single artery. The endolymphatic sac had a typical microcirculatory architecture with arcades and circular blood flow patterns. The VVA drains most of the blood from the vestibular apparatus and the endolymphatic sac. In its extraosseous course, from the external aperture of the vestibular aqueduct to the sigmoid sinus, it is interposed between the endolymphatic sac and the operculum.

Obstruction of the distal part of the VVA just before it empties into the sinus sigmoideus reverses the flow of blood in the VVA towards the inner ear. The reverted blood flow is consistent with our proposal of a portal shunt through the VVA as a cause of Menière's disease and diseases mimicking Menière's disease.