Hypertrophic olivary degeneration

Ischemic and hemorrhagic strokes in the brainstem and cerebellum with injury to the functional loop of the Triangle of Guillain and Mollaret can trigger a series of events that result in secondary trans-synaptic neurodegeneration of the inferior olivary nucleus. In an unknown percentage of patients, this leads to a condition called hypertrophic olivary degeneration (HOD).

Characteristic clinical symptoms of HOD progress slowly over months and consist of a rhythmic palatal tremor, vertical pendular nystagmus, and Holmes tremor of the upper limbs.

Diffusion Tensor Imaging (DTI) with tractography is a promising method to identify functional pathway lesions along the cerebello-thalamo-cortical connectivity and to generate a deeper understanding of the HOD pathophysiology. The incidence of HOD development following stroke and the timeline of clinical symptoms have not yet been determined in prospective studies-a prerequisite for the surveillance of patients at risk. Methods and Analysis: Patients with ischemic and hemorrhagic strokes in the brainstem and cerebellum with a topo-anatomical relation to the GMT are recruited within certified stroke units of the Interdisciplinary Neurovascular Network of the Rhine-Main. Matching lesions are identified using a predefined MRI template. Eligible patients are prospectively followed up and present at 4 and 8 months after the index event. During study visits, a clinical neurological examination and brain MRI, including high-resolution T2-, proton-density-weighted imaging, and DTI tractography, are performed. Fiberoptic endoscopic evaluation of swallowing is optional if palatal tremor is encountered. Study Outcomes: The primary endpoint of this prospective clinical multicenter study is to determine the frequency of radiological HOD development in patients with a posterior fossa stroke affecting the GMT at 8 months after the index event. Secondary endpoints are identification of (1) the timeline and relevance of clinical symptoms, (2) lesion localizations more prone to HOD occurrence, and (3) the best MR-imaging regimen for HOD identification. Additionally, (4) DTI tractography data are used to analyze individual pathway lesions. The aim is to contribute to the epidemiological and pathophysiological understanding of HOD and hereby facilitate future research on therapeutic and prophylactic measures. Clinical Trial Registration: HOD-IS is a registered trial at https://www.drks.de/drks_web/navigate.do?navigationId=trial.HTML&TRIAL_ID=DRKS00020549 [1].

Orman et al. applied diffusion tensor imaging (DTI) to investigate longitudinal changes of the GMT components in a child with HOD after neurosurgery for a midbrain tumor. Diffusion tensor imaging data were acquired on a 1.5-T MRI scanner using a balanced pair of diffusion gradients along 20 noncollinear directions 1 day and 3, 6, and 9 months after surgery. Measurements from regions of interest (ROIs) were sampled in the affected inferior olivary nucleus, ipsilateral red nucleus, and contralateral superior and inferior cerebellar peduncles and dentate nucleus. For each ROI, fractional anisotropy and the mean, axial, and radial diffusivities were calculated. In the affected inferior olivary nucleus, the authors found a decrease in fractional anisotropy and an increase in mean, axial, and radial diffusivities 3 months after surgery, while 3 months later fractional anisotropy increased and diffusivities decreased. For all other GMT components, changes in DTI scalars were less pronounced, and fractional anisotropy mildly decreased over time. A detailed analysis of longitudinal DTI scalars in the various GMT components may shed light on a better understanding of the dynamic complex histopathological processes occurring in pediatric HOD over time [2].

Treatment

Deep brain stimulation

Bilateral deep brain stimulation of the red nucleus in one patient with oculopalatal tremor (and failure of medical treatment) was tested. This study failed to show any improvement in eye oscillation. The failure of this intervention may be explained by an erroneous interpretation of the mechanism of OPT. The hypothesis was to interfere with the rhythmicity of the olivocerebellar circuit, but the target was the afferent dentato–olivary pathway within the red nucleus region [3].

A 67-year-old man displayed a repetitive, rhythmic, slow 2-3 Hz movement, 6 months after suffering a pontomesencephalic hypertensive hematoma (pontine hemorrhage). The kinetic phenomenon affected the orbicular and low facial muscles, the neck, the thorax and the upper limbs. Furthermore, he exhibited tremors of the soft palate and pendular nystagmus. On T2-weighted magnetic resonance imaging, Hypertrophic olivary degeneration of the inferior olivary nucleus complex was seen. He was diagnosed with secondary myorhythmia and multiple pharmacological treatments were tested but failed. Ultimately, deep brain stimulation with bilateral electrodes placed in the thalamic ventralis intermedius nucleus was offered. Unfortunately, no alleviation of the symptoms was achieved other than mild improvement in involuntary eye movements.

For Mosteiro et al. this is the first case to report the use of deep brain stimulation for myorhythmia. A better understanding of the pathophysiology of this condition, and localization of the pacemaker, may allow the identification of reliable neurosurgical therapeutic targets [4].

Case reports

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A 20-year-old male patient presented with a case of primary intracranial germinoma originating from right brachium pontis with HOD manifesting as ocular myoclonus, nystagmus in both eyes, ataxic gait and incoordination of the limbs. Magnetic resonance imaging (MRI) revealed an irregular patchy lesion with hyperintensity on T2-weighted images (T2 weighted image) and T2 fluid-attenuated inversion

recovery (FLAIR) without enhancement by gadolinium (Gd). Furthermore, a focal hyperintense nodule on T2 weighted image in the left inferior olive nucleus (ION) of the medulla oblongata was considered hypertrophic olivary degeneration (HOD) based on the patient's symptoms and neuroimaging findings. Due to suspected demyelinating disease and low-grade glioma (LGG), a biopsy was planned. The pathological diagnosis was germinoma. Subsequently, he received chemoradiation therapy, resulting in the improvement of neurological deficits and the disappearance of the lesion on MRI.

Conclusion: A case of “Primary right brachium pontis germinoma with HOD” is reported for the first time. A preoperative diagnosis is challenging due to the fact of absence of clinical signs and symptoms and neuroimaging characteristics. However, patients can have favourable prognoses with appropriate evaluation and treatment [6].

2015

Unusual case of posterior fossa syndrome and bilateral hypertrophic olivary degeneration after surgical removal of a large fourth ventricle ependymoma in an adult [7].

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