

Oral Presentation

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Changes in local cerebral blood flow were associated with functional improvement of patients with idiopathic Normal-pressure hydrocephalus after shunt-treatment – a $^{15}\text{O-H}_2\text{O-PET}$ -Study

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Clinical background

In idiopathic Normal pressure hydrocephalus (iNPH) symptoms, the "locus of dysfunction" is still not fully understood. The authors investigated local cerebral blood flow in patients before and after shunt treatment questioning whether regional metabolic disturbances might be of relevance to the patients outcome.

Materials and Methods

$^{15}\text{O-H}_2\text{O-PET-CBF}$ studies (Siemens ECAT 951/31, Erlangen, Germany) were performed in 65 patients (76 ± 13 years) with idiopathic normal-pressure hydrocephalus selected for shunt surgery based on clinical and radiological criteria and the presence of B-waves and/or increased CSF-resistance values obtained by a constant lumbar infusion test. PET-CBF studies were done before, at one week and at 7 months after VP-shunt. Clinical outcome was determined at 7 months after shunt placement by grading (scoring) the patients clinical status based on the degree of functional impairment according to the STEIN and LANGFITT scale. Thereby, patients were classified into responders ($n = 33$) and non-responders ($n = 32$). Regional specific effects in the $^{15}\text{O-H}_2\text{O}$ -uptake were assessed using statistical parametric mapping (SPM99, Wellcome Department, London, UK). An uncorrected $P < 0.001$ ($Z > 3.09$) on voxel level was selected as a threshold of significance.

Results

A high degree of functional impairment obtained by the clinical scale correlated with a reduced $^{15}\text{O-H}_2\text{O}$ -uptake in an extended area (1239 voxel) in the mesial frontal cortex ($Z = 4.41$) and the anterior temporal cortex (469 voxel, $Z = 4.07$). After shunting, $^{15}\text{O-H}_2\text{O}$ -uptake in the superior

frontomesial and frontolateral cortex, both encompassing parts of the supplementary motor areas (Brodmann area 6,8,9), increased in responders (241 voxel, $Z = 4.35$), while non-responders displayed corresponding decreases in the $^{15}\text{O-H}_2\text{O}$ -uptake (955 voxel, $Z = 4.55$). Furthermore, in non-responders a significant symmetric reduction in the sensory motor cortex before surgery was found (right: 140 voxel, $Z = 3.83$, left: 48 voxel, $Z = 3.78$).

Conclusion

Local cerebral blood flow and its changes after shunting correlated with both clinical impairment before and functional outcome after shunt treatment. Thereby, the relevance of regional metabolic disturbances for symptomatology and functional outcome in idiopathic NPH is underlined. The findings in the frontomesial and the supplementary motor cortex correlate with activation studies in Parkinson's disease, however, might indicate the significance of supplementary motor areas for initiation and control of movements in idiopathic NPH-patients.