Does hemodynamic response function change in Alzheimer disease?

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Abstract – **Background:** Differences of BOLD response in functional MRI data in task-related or resting state fMRI between Alzheimer's diseae (AD) and healthy controls have been constantly reported assuming an unvaried hemodynamic response function. However, from direct assessment of hemodynamic response function (HRF) using retinal vessel analysis we demonstrated previously that retinal vessel response to flicker is altered in Alzheimer's disease (AD): patients with dementia due to AD (ADD) showed more emphasized and delayed reactive dilation. Thus, we searched for variations between healthy controls and AD patients in the HRF of fMRI.

Methods: Data of a previous task related fMRI study was used. 17 patients with prodromal AD (pAD; i.e., with MCI and biological signs of AD) and 15 healthy older adults were investigated. Participants underwent a course of attention-demanding tasks with different difficulty levels. The fMRI data were generated by an EPI (echo planar imaging) – gradient echo sequence. Median of mean grey values of eight points with 1 mm^3 voxel size (1x1x1) of posterior default mode network (pDMN) were automatically extracted using a LabVIEW program in order to derive multiple-stimulus HRF and to evaluate neuronal activity during the stimulation course in each participant. All the individual responses were mathematically filtered and their signal-to-noise-ratio was improved.

Results: Individual HRFs of patients visually differs from those in the control group. In addition, the shape of HRF could be visualized on single subject level. **Conclusions:** This novel algorithm to visualize HRF allows to pick up individual changes of HRF and provides the opportunity to use fMRI signal for diagnosis, monitoring and prediction of AD.

Keywords: fMRI, Alzheimer's disease, posterior default mode network (pDMN), hemodynamic response function (HRF)

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