Brain temperature measured using proton magnetic resonance spectroscopy detects cerebral hemodynamic impairment in patients with unilateral chronic major cerebral artery steno-occlusive disease: comparison with positron emission tomography

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Abstract

Background and Purpose: Brain temperature is determined by the balance between heat produced by cerebral energy turnover and heat removed by cerebral blood flow. The purpose of the present study was to investigate whether brain temperature measured noninvasively using proton magnetic resonance (MR) spectroscopy (MRS) can detect cerebral hemodynamic impairment in patients with unilateral chronic internal carotid or middle cerebral artery occlusive disease when compared with positron emission tomography (PET).

Methods: Brain temperature, cerebral blood flow and metabolism were measured using proton MRS and 15O-PET, respectively, in 21 normal subjects and 37 patients. PET images were coregistered with MR images and resliced automatically using image analysis software. Regions of interest placed in both cerebral hemispheres on MR images were automatically superimposed in these resliced PET images.

Results: A significant correlation was observed between brain temperature difference (affected hemisphere - contralateral hemisphere) and both cerebral blood volume (CBV) and oxygen extraction fraction (OEF) ratio (affected hemisphere/contralateral hemisphere) (r=0.607; P=0.0004 and r=0.631; P=0.0002). With abnormally elevated CBV or OEF ratio defined as higher than the mean +2 standard deviations obtained from normal subjects, brain temperature difference provided 86% or 92% sensitivity and 87% or 84% specificity, with 80% or 73% positive- and 91% or 95% negativepredictive values for detecting abnormally elevated CBV or OEF ratio, respectively.

Conclusions: Brain temperature measured using proton MRS can detect cerebral hemodynamic impairment in patients with unilateral chronic major cerebral artery steno-occlusive disease.