

Hypoxic tissue in human chronic cerebral ischemia due to unilateral atherosclerotic major cerebral artery steno-occlusive disease

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Abstract

Background and Purpose: Positron emission tomography (PET) with radiolabeled 2-nitroimidazoles detects hypoxic but viable tissue that exists in the penumbra area in acute ischemic stroke. the purpose of the present study using PET with a new radiolabeled 2-nitroimidazoles, 1-(2-¹⁸F-fluoro-1-[hydroxymethyl]ethoxy) methyl-2-nitroimidazole (¹⁸F-FRP-170) was to determine whether viable tissue under the hypoxic condition exists in human chronic cerebral ischemia due to unilateral atherosclerotic major cerebral artery steno-occlusive disease.

Methods: ¹⁸F-FRP-170 PET was performed and cerebral blood flow and metabolism were assessed using ¹⁵O-gas PET in 10 healthy subjects and 30 patients. All images were transformed into the standard brain size and shape by linear and nonlinear transformation using SPM2 for anatomic standardization. A region of interest (ROI) was automatically placed in three segments of the middle cerebral artery territory in both the cerebral hemispheres using a three-dimensional stereotaxic ROI template and the ratio of the value in the affected hemisphere to that in the contralateral hemisphere was calculated in each image.

Results: A significant correlation was observed between oxygen extraction fraction (OEF) ratios and ¹⁸F-FRP-170 ratios ($r=0.593$; $P<0.0001$).

Conclusions: Viable tissue under the hypoxic condition exists in human chronic cerebral ischemia with a combination of misery perfusion and moderately reduced oxygen metabolism due to unilateral atherosclerotic major cerebral artery steno-occlusive disease.