

Central benzodiazepine receptor binding potential and CBF images on SPECT correlate with oxygen extraction fraction images on PET in the cerebral cortex with unilateral major cerebral artery occlusive disease

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Abstract

Oxygen extraction fraction (OEF) is a key predictor of stroke recurrence in patients with symptomatic major cerebral arterial occlusive disease. The purpose of the present study was to compare central benzodiazepine receptor binding potential (BRBP) and cerebral blood flow (CBF) images on SPECT with OEF images on PET in patients with chronic unilateral middle cerebral artery (MCA) or internal carotid artery (ICA) occlusive disease. OEF, CBF, and BRBP were assessed using ¹⁵O PET and N-isopropyl-p-¹²³I-iodoamphetamine and ¹²³I-iomazenil SPECT, respectively, in 20 healthy subjects and in 34 patients with unilateral MCA or ICA occlusive disease. All images were transformed into the standard brain size and shape by linear and nonlinear transformation using statistical parametric mapping for anatomic standardization. A region of interest (ROI) was automatically placed according to the arterial supply using a 3-dimensional stereotactic ROI template, and the ratio of the value in the affected side to that in the contralateral side was calculated in each image. Among patients with occlusive disease, a significant positive correlation was observed between PET OEF and SPECT BRBP/CBF ratios in 3 cerebral cortical regions ($r = 0.851$, $P < 0.0001$, for anterior cerebral artery [ACA] ROI; $r = 0.807$, $P < 0.0001$, for MCA ROI; and $r = 0.774$, $P < 0.0001$, for posterior cerebral artery [PCA] ROI), but there were no correlations between these 2 parameters in the basal ganglia or the cerebellum. When an abnormally elevated PET OEF ratio was defined as a value greater than the mean + 2 SDs obtained in healthy subjects, sensitivity and specificity were, respectively, 100% and 96% for the ACA ROI, 100% and 89% for the MCA ROI, and 100% and 93% for the PCA ROI for the SPECT BRBP/CBF ratio for detecting an abnormally elevated PET OEF ratio. BRBP/CBF images on SPECT correlate with OEF images on PET in a specific clinical setting—that is, in the cerebral cortex of patients with chronic unilateral MCA or ICA occlusive disease.