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Preliminary evaluation of [1-^{11}C]octanoate as a PET tracer for studying cerebral ischemia: A PET study in rat and canine models of focal cerebral ischemia

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Octanoate is taken up into the brain and is converted in astrocytes to glutamine through the TCA cycle after β-oxidation. We speculate that [1-^{11}C]octanoate may be used as a tracer for astroglial functions and/or fatty acid metabolism in the brain and may be useful for studying cerebral ischemia. In the present study we investigated brain distribution of [1-^{11}C]octanoate and compared it with cerebral blood flow (CBF) by using rat and canine models of middle cerebral artery (MCA) occlusion and a high resolution PET. In rats brain distribution of [^{15}O]H_2O measured 1–2 h and 5–6 h after insult was compared with that of [1-^{11}C]octanoate measured 3–4 h after insult. Radioactivity ratios of lesioned to normal hemispheres determined with [^{15}O]H_2O were lower than those determined with [1-^{11}C]octanoate. These results were confirmed by a study on a canine model of MCA-occlusion. Twenty-four hours after insult, CBF decreased in the MCA-territory of the occluded hemisphere, whereas normal or higher accumulation of [1-^{11}C]octanoate was observed in the ischemic regions. The uptake of [1-^{11}C]octanoate-derived radioactivity therefore increased relative to CBF in the ischemic regions, indicating that [1-^{11}C]octanoate provides functional information different from CBF. In conclusion, we found that [1-^{11}C]octanoate is a potential radiopharmaceutical for studying the pathophysiology of cerebral ischemia.

Key words: [1-^{11}C]octanoate, positron emission tomography, cerebral ischemia, rat, dog