PET imaging of brain cancer with positron emitter-labeled liposomes

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Cancer is the first leading cause of death in Japan, and the diagnosis of cancer at the early stages is quite important for the healthy longevity. Positron emission tomography (PET) is one of strong tools for diagnosis, therapeutic evaluation, and prognostic evaluation of cancer. [2-^{18}F]-2-Deoxyfluoro-D-glucose (FDG) is the most widely used positron emitter for cancer diagnosis. However, the utility of FDG-PET imaging for detection of brain cancer such as glioblastomas that are known to be aggressive and invasive is controversial due to the high demand for glucose in the brain. By the way, nanomedicines such as liposomal drugs are known to accumulate in tumors due to the enhanced permeability of tumor blood vessels and the retention effect. In the present study, we applied polyethylene glycol (PEG)-modified and APRPG-PEG-modified liposomes entrapping a positron-emitter to brain tumor imaging by PET: PEG-modified liposomes are known to accumulate in tumors by passive targeting and those modified with APRPG are known to home to tumor angiogenic sites. PET imaging of brain cancers was achieved by use of 1-[^{18}F]fluoro-3,6-dioxatetracosane ([^{18}F]Step2)-labeled liposomes. [^{18}F]Step2 was developed previously for labeling preformed lipidic nanocarriers and medicines such as liposomes and liposomal drugs. C6-glioma-beaing model rats were injected with the positron-emitter labeled liposomes. As a result, the brain tumor was clearly imaged with quite low background. Moreover, even a 1-mm diameter brain tumor could be imaged by PET. Therefore, nanocarrier-based imaging of brain tumors is promising for the diagnosis of brain cancer and possible drug delivery-based therapy.