Glucose Analogues as Tumor Tracers

Tumor cells consume more glucose than normal ones to feed their proliferation and to compensate their insufficient use of glucose. Glucose analogue is therefore an excellent tumor-diagnosis tracer whose uptake level correlates with tumor aggressivity. 18-F-FDG has been very successful in positron imaging of tumors such as PET. In the Center for Gamma-Ray Imaging, our group has been collaborating with the researchers at the Department of Radiology to investigate new glucose analogues that can be used in gamma-ray imaging or fluorescence imaging, namely 99m-Tc-ECDG (Cell>Point) and fluorescent 2-NBDG (Molecular Probe).

A planar tumor model has been developed in a skin-fold clamped by a dorsal skin chamber on the back of a mouse. The model is being applied to study the glucose analogues on a colon cancer cell line transfected with red fluorescent protein (RFP) implanted in mice. The dynamic fluorescence images of 2-NBDG show a faster uptake and washout rate in tumor cells than in normal ones. The dynamic electron images of 18-F-FDG with our novel high-resolution high-sensitivity electron imager confirm the characteristic uptake dynamics of FDG and a higher FDG accumulation in tumor cells. The electron images of 99m-Tc-ECDG show differential uptakes between tumor cells and normal ones. These initial data suggest that 2-NBDG does not appear to be retained in tumor cells, behaving somewhat differently from FDG. ECDG appears to be retained more in tumor cells than normal ones, similar to FDG. The achievable labeling efficiency of Tc-99m onto ECDG in our lab is less than that reported by its manufacturer, which requires further improvements.

The results are still inconclusive to date, and more studies are necessary to understand the mechanisms of the new tracers. The current findings are valuable, and the new investigation methods are original. A number of manuscripts to report the current findings and the methods are in preparation.