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Preferential sequestration of a vanadyl chelate by cancer tissue facilitates 2-(fluorine-18)-2-deoxyglucose (FDG) uptake for positron emission tomography (PET) imaging

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PET imaging with FDG as the tracer molecule for cancer detection is biochemically based and is associated with high specificity. However, FDG PET imaging relies on tumor size and the local metabolic characteristics of the type of cancer. Some breast cancer types characterized by low glucose uptake give rise to false negatives. *Bis* (acetylacetonato) oxidovanadium (IV) [VO (acac)2] exhibits high stability in solution and displays a high capacity to enhance cellular glucose uptake. We observed that enhanced FDG uptake by MDA-MB-231 cultured human breast carcinoma cells was facilitated by VO(acac)2 over the 1-8 μM range in the presence of a background 5 mM glucose concentration, equivalent to the fasting level of blood glucose in a normal adult. Generating MDA-MB-231 xenograft tumors in SCID mice, we observed maximum FDG uptake approximately 4 hours post-VO(acac)2 injection. This observation closely correlates with the time of 3.5-4 hours for maximum preferential sequestration of the chelate by tumor tissue. Longer intervals between intraperitoneal injection of VO(acac)2 and the onset of FDG PET imaging showed decreased FDG uptake. We have observed up to 6-fold enhanced FDG uptake compared to controls with a two-fold higher dose of VO(acac)2. These preliminary results indicate that use of VO(acac)2 as a pharmacologic agent to enhance FDG uptake by malignant tissue has the potential to improve detection of both small tumors and tumors of low metabolic activity by FDG PET imaging.

Biography

Marvin W Makinen has pursued research on the structural basis of enzyme action and enzyme mechanism using electron paramagnetic resonance and electron nuclear double resonance methods. The present research directed at cancer detection is derived from earlier research on inhibition of protein tyrosine phosphatase-1B by vanadyl (VO^{2+}) chelates.

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