AbstractID: 3550 Title: Compartment Modeling Analysis of Cu-ATSM Dynamic PET Images

Compartment Modeling Analysis of Cu-ATSM Dynamic PET Images

Purpose:

Copper labeled diacetyl-bis(N4-methylthiosemicarbazone) (Cu-ATSM) has been reported to selectively bind to hypoxic tumor cells. This makes Cu-ATSM PET a promising modality to image tumor hypoxia. However, intravascular Cu-ATSM that is not related to hypoxia, can also contribute to the PET signal. The purpose of this study is to use compartment modeling analysis to separate tumor tissue time-activity Cu-ATSM signal into intravascular and extravascular components.

Method and Materials:

A dynamic Cu-ATSM PET scanning was performed on tumor-bearing (R3230 mammary adenocarcinoma) rats. The Cu-ATSM concentration is separated into an intravascular concentration (C_p) with vascular volume fraction (v_p) and extravascular concentration (C_e). The transfer between the intra- and extra-vascular compartments is described by rate constant k. The time activity data of Cu-ATSM were fed into the compartment model. After non-linear least square (NLLS) fitting of the model, tumor signal was separated into intravascular and extravascular components. Vascular volume fraction v_p and rate constant k were also obtained from the fitting.

Results:

The time courses of the intravascular and extravascular Cu-ATSM signals were obtained from the NLLS fitting and are shown in figure 1 in the supporting document. The fitted Cu-

ATSM uptake signals match closely with the measured results. The vascular volume fraction obtained from the fitting for three tumors was 2.4%, 2.3% and 2.9%, and the transfer rate from blood to tissue was 0.045, 0.043, and 0.047 (1/minute), respectively.

Conclusion:

Compartment modeling analysis can effectively remove the intravascular Cu-ATSM signal from the overall tissue signals, reflecting more accurately the tissue uptake and tumor hypoxia. Tumor vascular volume fraction and Cu-ATSM transfer rate constant can be obtained from the compartment modeling analysis.

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