AbstractID: 12885 Title: Optimization of scanning protocol for combined FDG and NaF PET kinetic analysis – a simulation study

Objective

^{18}F-Fluorodeoxyglucose (FDG) is a metabolic activity marker, with limited use for skeletal lesions. Sodium ^{18}F-flouride (NaF) is a bone imaging agent that complements the FDG limitations for skeletal lesions. The kinetic analysis of combined NaF/FDG PET scan promises concurrent determination of both, tumor metabolism and vasculature parameters as well as successful separation of each tracer uptake. The aim of this work is to optimize the combined NaF/FDG PET scanning protocol in order to maximize accuracy in kinetic model estimation of the tumor's parameters.

Materials and Methods

Simulations assessed the feasibility and accuracy of kinetic analysis of combined NaF/FDG PET images. Tissue time activity curves (tTAC) were generated with randomized parameters and PET voxel-wise noise level. Various time delays between NaF and FDG injection times were simulated, while keeping the total scan duration at 60 minutes. Parameters were estimated with two simplified versions of the model used for tTAC's generation. Estimated parameters were compared against the simulated parameters. The optimized sequence was tested on canine NaF/FDG PET data.

Results

Parameter estimation accuracy was maximized if the NaF was injected first, followed by the FDG injection of at least 40 minutes later. The estimation accuracy for k_1 parameters ranged from 15% to 20% for FDG and 25% to 30% for NaF. K_i estimation accuracy ranged from 40% to 55% for FDG and 10% to 25% for NaF. Vasculature fraction estimation accuracy ranged from 20% to 40%. Results of clinical data kinetic analysis shows that both k_1 parameters are highly correlated, which implies that it might be common for both radiopharmaceuticals in our model.

Conclusions

This study has shown that kinetic analysis of combined NaF/FDG PET images is feasible using an optimized injection and scanning protocol. For the given cases, we found the optimal scanning protocol and quantified parameter estimation accuracy.