**Introduction**

- **Aim:** To improve the efficacy and safety of 3D functional imaging by optimizing, among others, the knowledge of the temporal variation of the radiopharmaceuticals’ uptake in and clearance from tumour and healthy tissues.

- **Patients and data:** Data of one patient undergoing diagnostic studies with $^{18}$F-choline. Uptake in selected organs and morphological information obtained with PET/CT scans. Additionally collection of blood and urine samples, measured in a gamma counter (see Poster 106 by Uusijärvi et al.).

- **Method:** Compartment analysis has been applied in order to set up preliminary model structures.

**Initial model structure**

A simple initial structure was devised based on the available data as measured in the patient.

**ASSUMPTIONS:**
- Bolus administration into Blood ($e_1$).
- Blood as central compartment exchanging with other organs/tissues

$s_x$ = sampling site

$R_oB$ = Rest of Body

**The Forcing Function approach**

The model is split into several subsystems that are modeled separately. By describing activity in blood with a forcing function the subsystems are decoupled. After obtaining the parameters for the subsystems, the model is recombined and all parameters are estimated together.

**Fits with initial model**

Red triangles: values as measured in the patient

Blue dots: values corrected for the physical decay (pure biological behaviour)

Very fast uptake of choline in the organs and tissues and apparently no washout during the diagnostic procedure

Acceptable fit of the biological behaviour

Problems in fitting the physical (actual) behaviour

**NEED TO USE A MORE REFINED MODELING APPROACH**

**FORCING FUNCTIONS**

**Preliminary structure of the complete model**

**Conclusions**

This very preliminary model will be evaluated and characterized with data from further patients. By means of the compartmental analysis it will be possible to suggest an optimized time schedule for data collection in patients, with specific attention on the ratio between activity in the organs and signal noise due to activity in the surrounding soft tissues. Together with improved methodologies for image reconstruction and noise reduction it will be possible to perform good quality diagnostic studies while administering less radioactivity to the patients, thus leading to a reduction of the patient exposure in terms of organ doses.

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