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KINETIC PARAMETER ESTIMATION FROM SPECT PROJECTION MEASUREMENTS. **RH Huesman, BW Reutter, GL Zeng, and GT Gullberg. Lawrence Berkeley National Laboratory, Berkeley, CA and University of Utah, Salt Lake City, UT.**

Kinetic parameters are commonly estimated from dynamically acquired nuclear medicine data by first reconstructing a dynamic sequence of images and subsequently fitting the parameters to time activity curves generated from regions of interest overlaid upon the image sequence. Since SPECT data acquisition involves movement of the gantry and the distribution of radiopharmaceutical changes during the acquisition, the image reconstruction step can produce erroneous results which lead to biases in the estimated kinetic parameters.

To overcome this problem we have investigated the estimation of kinetic parameters directly from projection data by modeling the data acquisition process of a time-varying distribution of radiopharmaceutical detected by a rotating SPECT system. To accomplish this it was necessary to parameterize the spatial and temporal distribution of the radiopharmaceutical within the SPECT field of view. The blood input function was assumed known, and simple one compartment models were used within 4 regions of interest of a simulated transverse slice of the myocardium. Boundaries of the myocardial regions were assumed known, and background activity was proportional to the input function. There were 13 parameters to estimate: the amplitudes, decay rates, and vascular fractions for the 4 myocardial regions and the amplitude of the overall background. Parameters were estimated by minimizing a weighted sum of squared differences between the projection data and the model predicted values.

The 15 minute data acquisition protocol consisted of 10 revolutions of a single headed SPECT system, acquiring 120 angles per revolution and 60 lateral samples per angle. Neither attenuation nor scatter were included.

Parameter estimates from conventional analysis of noiseless simulated data had significant biases (up to $\approx$15%). Estimation of parameters directly from the noiseless projection data was unbiased as expected, since the model used for fitting was faithful to the simulation. In addition, multiple local minima have not been encountered regardless of noise levels simulated. Parameter uncertainties for one million detected events ranged between 0.5–11% for the uptake parameters and between 1–8% for the washout parameters.

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