

Correction for time delay between PET and blood data

This document reviews the methods that are used to account for the time offset or shift between the plasma input function measured from the arterial or venous line and the tissue radioactivity time course measured by PET.

Delay correction in Turku PET Centre

Time delay between blood and tissue curve is corrected with program `fitdelay`. The methods used are based on Meyer (1989) and van den Hoff et al (1993). For most cases the count rate curve is used to represent overall tissue curve, but also averaged curves from region of interest can be used.

Fit time is defined by the user and obviously it should include the curve at least up to the peak.

The time where plasma curve starts to rise is automatically determined by integrating original plasma data and searching the time when integral is $\geq 1/1000$ of final integral. Blood curve is shifted with different delay times and a linearized three-compartment model (Blomqvist et al. 1984) with parameters K_1 - K_4 and V_b is fitted to the data. The curve that fits best is determined by finding the lowest sum-of-squares value. Based on the knowledge about the shift in that blood curve, the estimate for delay is chosen. If several tissue curves are presented, then delay is determined separately for each of them and the median of all delay estimates is set to be the overall delay.

Delay in literature

Determining the bolus arrival time

Cheong et al. (2004) presented a method of fitting two regression lines, or line and quadratic function, to the initial phase of the curve. They tested the method only on simulated MRI data, but noted that the performance was not good when the curve peak was not sharp.

Model fitting with delay as a parameter

- Method described by Koeppe et al. (1991) for [^{11}C]flumazenil

Time shift was estimated by fitting the summed activity curve of a brain image plane to a three-compartment, four-parameter model using 90-min data set and assuming the cerebral blood volume (CBV) to be 3.5%. This was repeated to four other image planes. The average time delay from these five image planes was used in the subsequent fits of each brain region; K_1 , k_2 and CBV were estimated using 10-min data set. After that, parameters K_1 and k_2 were fitted for whole using regionally fixed CBV and time delay fixed separately for each subject.

References

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