Simulating the effect of cerebral blood flow changes on regional quantification of [18F]flutemetamol and [18F]florbetaben studies

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Abstract:

Global and regional changes in cerebral blood flow (CBF) can result in biased quantitative estimates of amyloid load by PET imaging. Therefore, the current simulation study assessed effects of these changes on amyloid quantification using a reference tissue approach for [18F]flutemetamol and [18F]florbetaben. Previously validated pharmacokinetic rate constants were used to simulate time-activity curves (TACs) corresponding to full dynamic and dual-time-window acquisition protocols. CBF changes were simulated by varying the tracer delivery (K1) from +25 to −25%. The standardized uptake value ratio (SUVr) was computed and TACs were fitted using reference Logan (RLogan) and the simplified reference tissue model (SRTM) to obtain the relative delivery rate (R1) and volume of distribution ratio (DVR). RLogan was least affected by CBF changes ($\chi 2 = 583$ $p < 0.001$, $\chi 2 = 81$ $p < 0.001$, for [18F]flutemetamol and [18F]florbetaben, respectively) and the extent of CBF sensitivity generally increased for higher levels of amyloid. Further, SRTM-derived R1 changes correlated well with simulated CBF changes ($R2 > 0.95$) and SUVr's sensitivity to CBF changes improved for later uptake-times, with the exception of [18F]flutemetamol cortical changes. In conclusion, RLogan is the preferred method for amyloid quantification of [18F]flutemetamol and [18F]florbetaben studies and SRTM could be additionally used for obtaining a CBF proxy.

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