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Double-injection FDG method to measure cerebral glucose metabolism twice in a single procedure

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[^{18}F]fluorodeoxyglucose (FDG) and positron emission tomography (PET) may be used to examine changes in cerebral glucose metabolism in two physiological conditions. We proposed and evaluated a double injection-single session FDG method with biological constraints for this purpose. ***Methods:*** Simulated brain time-radioactivity curves (TACs) generated by using a plasma TAC from an actual study and physiological combinations of input values in a kinetic model were analyzed to evaluate the accuracy of the proposed method. The reproducibility of the estimated values obtained by this method was tested in five normal volunteers who were studied with a dynamic PET scan and two injections of FDG in a single session while fasting. ***Results:*** The simulation study showed that the estimated values obtained by the proposed method agreed well with the input values. In the human study, plasma glucose levels were 5.3 ± 0.2 and 5.0 ± 0.2 mM in the first and second measurements, respectively. The difference between the plasma glucose measurements was small but statistically significant ($p < 0.05$). Although no systematic deviations were noted in K^*_1 or rCMRglc, there were small deviations in K* (less than 10%) and LC (less than 5%) with a statistical significance ($p < 0.01$). ***Conclusion:*** The deviation between the measurements in K* and LC seemed to relate to the difference in the plasma glucose level. The double-injection FDG method with biological constraints can be used to estimate rCMRglc and LC sequentially in a single PET scanning session.

Key words: positron emission tomography, constrained FDG method, double-injection, kinetic analysis