ORIGINAL ARTICLE

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Measurement of regional cerebral blood flow with ^{123}I-IMP using one-point venous blood sampling and causality analysis: Evaluation by comparison with conventional continuous arterial blood sampling

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Objective: Arterial input function represents the delivery of intravascular tracer to the brain. The optimal setting of this function is essential for measuring regional cerebral blood flow (rCBF) based on the microsphere model using *N*-isopropyl-4-[^{123}I]iodoamphetamine (^{123}I-IMP), in which the arterial ^{123}I-IMP concentration (integral value) during the initial 5 min is usually applied. We developed a novel method in which the arterial ^{123}I-IMP concentration is estimated from that in venous blood samples. ***Methods:*** Brain perfusion SPECT with ^{123}I-IMP was performed in 110 patients with disorders of the central nervous system. A causality analysis determined the relationship between various SPECT parameters and the ratio of the octanol-extracted arterial radioactivity concentration during the first 5 min (Caoct) to the octanol-extracted venous radioactivity concentration at 27 min after an intravenous injection of ^{123}I-IMP (Cvoct). The Caoct/Cvoct value was estimated using various SPECT parameters and compared with the directly measured value. ***Results:*** The measured and estimated values of Caoct/ Cvoct ($r = 0.856$, $n = 50$) closely correlated when the following 7 parameters were included in the regression formula: radioactivity concentration in venous blood sampled at 27 min (Cv), Cvoct, Cvoct/Cv, and 4 parameters related to cerebral tissue accumulation that were measured using a four-head gamma camera 5 and 28 min after ^{123}I-IMP injection. Furthermore, the rCBF values obtained using the input function estimated by this method also closely correlated with the rCBF values measured using the continuous arterial blood sampling ($r = 0.912$, $n = 180$). ***Conclusion:*** These results suggest that this method would serve as a convenient and less invasive method of rCBF measurement in the clinical setting.

Key words: regional cerebral blood flow, ^{123}I-IMP, SPECT, venous sampling, causality analysis