

Assessment of cerebral hemodynamics before and after revascularization in patients with occlusive cerebrovascular disease by means of quantitative IMP-SPECT with double-injection protocol

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The purpose of this study was to validate a double-injection (DI) method with *N*-isopropyl-[¹²³I]*p*-iodoamphetamine (IMP) to measure regional cerebral blood flow (rCBF) twice in a single session of dynamic SPECT and to elucidate a possible role of this method to identify patients with occlusive disease of major cerebral arteries, who might benefit from cerebral revascularization procedures (CR). **Materials and Methods:** Fourteen patients with occlusion or severe stenosis of the internal carotid or middle cerebral artery were studied before and after CR to assess hemodynamic changes after revascularization treatment. We quantitatively measured rCBF before and after acetazolamide (ACZ) challenge along with cerebrovascular reserve capacity (CVR) with two injections of IMP in a single session of dynamic SPECT scans (DI method). The reliability and reproducibility of the DI method were validated by means of a simulation study and in eight patients who were examined without ACZ challenge to measure baseline rCBF twice. **Results:** The analysis of simulated noisy data with realistic noise levels showed that the errors of the estimates for the first and the second rCBF and for the increase in rCBF were 2.6%, 8.1% and 10.4%, respectively. In the 8 patients examined by the DI method to measure baseline rCBF twice, the mean and the SD of percentage differences between the two consecutive measurements in rCBF were -1.3% and 5.5%, respectively. Eight out of 14 patients with occlusive disease had at least one region with a CVR less than 10%. They showed a significant increase in resting rCBF after CR, not only in the ipsilateral hemisphere (from 26.1 ± 6.4 to 33.4 ± 4.7) but also in the contralateral one (from 28.3 ± 7.0 to 34.7 ± 4.7) with a recovery of the ipsilateral CVR from 9.3 ± 17.2 to $41.2 \pm 20.1\%$. The remaining six patients with good-moderate CVR did not show an increase in rCBF after CR (from 28.0 ± 2.7 to 28.3 ± 3.4). The three of them with a moderate CVR (10–25%) before CR showed normalization of CVR after CR. **Conclusion:** Patients with decreased rCBF and reduced CVR benefited from CR in terms of an increase in rCBF and recovery of CVR. The quantitative double-injection IMP-SPECT has the ability to identify those patients who may benefit from CR.

Key words: ¹²³I-IMP, cerebral blood flow, single photon emission computed tomography (SPECT), cerebrovascular reserve capacity