

Assessment of cerebral hemodynamics in childhood moyamoya disease using a quantitative and a semiquantitative IMP-SPECT study

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Background: We evaluated the cerebral hemodynamics in childhood moyamoya disease patients before and after surgery to assess both surgical indication and the effect of revascularization using single photon emission computed tomography (SPECT) study with *N*-isopropyl-*p*-¹²³I-iodoamphetamine (IMP). We compared results of quantitative and semi-quantitative SPECT studies to determine parameters by the semi-quantitative method to define severe hemodynamic ischemia. **Methods:** There were 14 pediatric patients with moyamoya disease who suffered transient ischemic attacks (TIAs) in the anterior circulation. Before and after surgical revascularization by STA-MCA bypass and encephalomyosynangiosis (EMS), quantitative IMP-SPECT studies using the autoradiographic method (IMP-ARG method) were performed. Resting regional cerebral blood flow (rCBF) and regional vascular reserve (rVR) were measured in bilateral cortical territories (ROI) and cerebellum. Semi-quantitative parameters were calculated from the ratio of ROI counts to the dominant cerebellar counts (ROI/Ce ratio) at resting and acetazolamide-activated conditions. **Results:** Before surgery, the mean resting rCBF and rVR in bilateral ACA and MCA territories were less than 40 ml/100 g/min and less than 10%, respectively, indicating severe hemodynamic ischemia. Except for the ACA territories, both the mean resting rCBF and mean rVR values in the entire cortex increased significantly after surgery ($p < 0.05$). By semi-quantitative studies, before surgery, the mean resting and acetazolamide-activated ROI/Ce ratios in bilateral ACA and MCA territories were less than 0.90 and 0.80, respectively. The mean resting and acetazolamide-activated ROI/Ce ratios increased significantly in the MCA territory after surgery. Severe hemodynamic ischemia, which categorized by the quantitative thresholds (resting rCBF < 40 ml/100 g/min and rVR < 10%) was diagnosed by the semi-quantitative thresholds (resting ROI/Ce ratio < 0.90 and acetazolamide-activated ROI/Ce ratio < 0.85), the sensitivity and specificity of which were 87.5% and 90.9%, respectively. **Conclusions:** The cerebral hemodynamics in childhood moyamoya disease was improved entirely after surgery. Severe hemodynamic cerebral ischemia was diagnosed by not only quantitative but also semi-quantitative IMP-SPECT studies.

Key words: moyamoya disease, hemodynamic cerebral ischemia, single photon emission tomography, cerebral blood flow, vascular reserve