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A scanning technique to measure regional cerebral blood flow and oxyhemoglobin level.

Nakase H, Sakaki T, Kempski O.

Department of Neurosurgery, Nara Medical University, Japan. nakasehi@nmu-gw.naramed-u.ac.jp

OBJECTIVE: The application of a laser scanning technique to measure regional cerebral blood flow (CBF) and tissue hemoglobin oxygenation (HbO2) using the rat closed cranial window preparation is described. METHODS: Twenty-nine male Wistar rats were used to consecutively measure local CBF by laser Doppler flowmetry and tissue HbO2 by a microspectrophotometric method at multiple corresponding cortical locations. The scanning technique used a computer-controlled micromanipulator. Data from three experimental models are presented: the whisker stimulation model, the ischemia-reperfusion model, and the sinus-vein thrombosis model. Sequential changes in local CBF and HbO2 data before, during, and after stimulation, ischemia, and sinus thrombosis were examined. Data from predefined locations within the same region were correlated with the topographical location and then arranged in a three-dimensional image. RESULTS: In the whisker stimulation model, we found a disproportionate increase in CBF (32 +/- 12%) as compared with that of HbO2 (9 +/- 4%) during stimulation. In the ischemia-reperfusion model, the three-dimensional image showed heterogeneous low CBF (depending on the area) and homogeneous HbO2 at a reduced level during ischemia and postischemic hyperperfusion. However, the range of oxygenation was normal after reperfusion. In the sinus-vein thrombosis model, drainage of the unsaturated blood via the collateral pathways was noted. CONCLUSION: The laser scanning technique is useful for visualizing sequential changes in hemodynamic-metabolic interactions of cortical brain tissue. This technique can reveal phenomena not detected by traditional monitoring procedures.

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