MAE Seminar Series

Changes in Cerebral Perfusion and Tissue Oxygenation Using External-to-Internal Carotid Artery Flow Diversion Method

Afshin A. Divani, PhD

Director of Stroke Research, Minnesota Stroke Initiative
Departments of Neurology, Neurosurgery, and Radiology

Abstract

The objective of this study was to assess the effect of flow diversion by external carotid artery (ECA) occlusion on ipsilateral regional cerebral blood flow (rCBF). Local cerebral hyperperfusion in rats (n=12) was induced by ligating the right ECA. Ipsilateral rCBF was determined pre and post-ligation for 120 min using a laser Doppler flow meter. Sham animals (n=6) were subjected to the craniotomy without ligation of the right ECA. In a separate series of rats (n=5), brain tissue oxygen levels (pO2) in the right and left brain hemispheres were determined before and 90 min after ligation of the right ECA using a tissue oxygenation monitoring unit. We investigated the effect of ECA occlusion hemispheric changes in rCBF in one clinical case as a proof of concept. Ligation of ECA resulted in a statistically significant increase in rCBF on the ipsilateral side compared to the sham-operated rats ($p<0.0001$). On average we observed a 34% increase (95% CI: 24%-45%) in rCBF in the ipsilateral territory in the treated group compared with sham-operated rats. There was no significant variation in MAP for the treated animals. Vascular permeability and cerebral water content in the right hemisphere after ligation of ECA did not significantly differ from the contralateral hemisphere. Ipsilateral hemisphere tissue pO2 was significantly higher compared to the contralateral area ($p<0.002$) post-ligation or to the ipsilateral area ($p<0.001$) prior to ligation. In the clinical case, occlusion of ECA resulted in 3.6% and 12.1% increase in peak value and rise-time of the time-density curves. Flow diversion by temporary occlusion of the ECA can result in increased rCBF and cerebral pO2 on the ipsilateral side. This strategy may represent a viable option to augment rCBF in focal cerebral ischemia.

Bio

Dr. Divani received his Bachelor of Science degree from Youngstown State University, Youngstown, Ohio, and his masters and doctorate degree from the State University of New York at Buffalo. He completed a research fellowship in sleep disorder at the Pulmonary and Critical Care Division of the Department of Medicine, SUNY at Buffalo. He also completed a stroke research fellowship in the Department of Neurology and Neurosciences, New Jersey Medical School. Dr. Divani is currently holding an appointment as Assistant Professor in the Departments of Neurology, Neurosurgery, and Radiology at the University of Minnesota. He also serves as Director of Stroke Research at the same institution. Dr. Divani has been a primary or co-investigator on different funded projects by the National Institute of Health (NIH), American Heart Association (AHA), and private industry. Dr. Divani has participated in Spinal Cord Injury and Traumatic Brain Injury study sections review for the Department of Defense and the Henry M. Jackson Foundation for the Advancement of Military Science. His research interests include hemodynamics, cerebrovascular diseases, medical and endovascular devices, and medical imaging. Dr. Divani is a Fellow of the American Heart Association (FAHA) and a member of various academic and professional organizations. Dr. Divani has contributed to over 40 peer-reviewed scientific publications, has written 3 book chapters, and has made 200 presentations at various national and international meetings.

110 Knox Hall
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Contact person: Professor David Forliti, dforliti@buffalo.edu, tel. (716) 645-2593 ext. 2321