Paper ID: 17370
student

SPACE LIFE SCIENCES SYMPOSIUM (A1)
Human Physiology in Space (2)

Author: Dr. Derek Nusbaum
United States, nusbaum@bcm.edu

Dr. Jonathan Clark
United States, jclark1@bcm.edu
Dr. Ken Brady
United States, kmbrady@texaschildrens.org
Ms. Kathy Kibler
Baylor University, United States, kxkibler@texaschildrens.org
Prof. Jeffrey Sutton
National Space and Biomedical Research Institute, United States, jps@bcm.edu
Dr. Ronald Blaine Easley
Baylor University, United States, rbeasley@texaschildrens.org

ALTERATION IN THE LOWER LIMIT OF AUTOREGULATION WITH ELEVATIONS IN CEPHALIC VENOUS PRESSURE.

Abstract

BACKGROUND: Recent studies suggest that elevated intracranial pressure (ICP), created by hydrocephalus, can alter the lower limit of autoregulation. However, ICP can become elevated by other clinical scenarios, including those, like microgravity, that can elevate cephalic venous pressure. Our objective in the present study was to determine if ICP elevation from cerebral venous outflow obstruction would result in comparable alterations in the lower limit of cerebrovascular autoregulation (LLA). METHODS: Anesthetized juvenile pigs were assigned to 1 of 2 groups: naïve ICP (n = 15) or elevated ICP (>20 mmHg; n = 20). To elevate ICP through venous obstruction, a modified 5F esophageal balloon catheter was inserted via the right external jugular vein into the superior vena cava and inflated to maintain an ICP of >20 mmHg. Gradual hypotension was induced by continuous hemorrhage from a catheter in the femoral vein. The LLA was determined by monitoring cortical laser-Doppler flux and cerebral blood volume by near-infrared spectroscopy (NIRS). Pressure reactivity index (PRx) and NIRS-determined absolute hemoglobin concentration (HVx) autoregulation curves were created using normalized LLA. Then, receiver operating characteristic (ROC) curves for PRx and HVx were created using the LLA as the cutoff point. RESULTS: The naïve ICP group had an average LLA of 45 mmHg (95% CI: 41–49 mmHg) by laser Doppler, and the elevated ICP group had a LLA of 71 mmHg (95% CI: 66–77 mmHg). The LLA was significantly different between the two groups ($p < 0.0001$), and correlated significantly with ICP ($R = 0.7468$, $p < 0.0001$). The area under the curve for the ROC curves were 0.9920 and 1.000 respectively for PRx and HVx. CONCLUSIONS: Elevated ICP from cephalic venous engorgement leads to an increase in the LLA in piglets. This suggests that environments, like microgravity, which can lead to elevations in cephalic venous pressure may put individuals at increased risk for brain damage and lends support to the idea that compensating for an acute increase in ICP with an equal increase in arterial blood pressure may be insufficient to prevent cerebral ischemia.