THE HARTWELL FOUNDATION

2006 Individual Biomedical Research Award

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Measuring Vascular Reactivity in Children with Brain Injury: Defining Autoregulation to Improve ICU Care

Dr. Brady proposes a systematic examination of how the developing brain keeps blood flow from varying passively with pressure changes, a physiologic process referred to as cerebral pressure autoregulation. When blood pressure is not constant, the brain has a mechanism to respond to pressure changes by keeping flow in the correct range. It does so by changing the diameter of the blood vessels to keep blood flow from changing passively with pressure changes. Following trauma to the head, the brain can lose its innate ability to regulate blood flow so the range of tolerated blood pressures is much narrower. Resulting inflammation promotes further injury when blood flow is uncontrolled, with excessive or inadequate blood pressure a threatening consequence. Guidelines for the management of brain injury for adults have been available since 1996. However, only vague pediatric guidelines exist today, which offer no *standard of care*. While blood pressure manipulation remains the only currently available method of protecting a child with head trauma, very little information is available about how to manage blood flow to the developing brain. Using a piglet model of the infant brain in comparison with direct observation of pediatric patients, Brady intends to derive a new approach to ascertaining healthy blood flow to the brain. He proposes that describing pressure-autoregulation by means of a pressure-reactivity index (PRx) should provide a convenient and clinically useful gauge of the ability of the brain to respond properly to changes in blood pressure, thus defining the limits of acceptable autoregulation. He will utilize innovative software and measurement technologies to monitor dynamically several physiologic parameters. If successful, the results will offer a guide to the process of treatment and intervention to substantiate blood pressure goals in the ICU, minimizing risk and improving clinical outcomes for pediatric patients suffering brain trauma.