THE HARTWELL FOUNDATION

2010 Individual Biomedical Research Award

Review of Proposed Research

Investigator: **Joshua E. Medow, MD**
Assistant Professor
Neurological Surgery

Institution: **The University of Wisconsin Madison**

Proposal: **Implantable Intracranial Pressure Monitor**

Dr. Medow proposes an innovative improvement to the most common neurosurgical procedure for children: intracranial shunt revision. Abnormal accumulation of cerebrospinal fluid in the brain affects one in 500 live births and as a congenital defect is more common than either Down syndrome or deafness; moreover there is no permanent cure. Installation of an intracranial shunt is required to drain the accumulated cerebrospinal fluid to reduce intracranial pressure (ICP). An increase in ICP can lead to irreparable brain damage, including loss of cognitive function and other neurodegenerative defects. The need for revision can be caused by obstruction of normal drainage, impaired reabsorption, or excessive fluid production that causes the clinical condition known as hydrocephalus (water on the brain). The placement of a tube (shunt) into the ventricles to drain the excess fluid via a tract that leads into other body cavities is the most common palliative;~~,~~ unfortunately, half of all shunts fail within two years due to shunt malfunction or infection, including infection of the shunt tract. The symptoms of shunt failure are not specific; headaches, nausea, vomiting, double-vision, and an alteration of consciousness and can be misinterpreted. Failed shunts require timely surgical revision to replace the components. With an estimated 700,000 affected children and adults in the US, annual healthcare costs exceed $1B per year. The consequences of undetected shunt failure can be death or permanent disability. Many children suffer profound neurologic impairment because they were not shunted at the time they needed to be. There are also children with profound disability because they were over shunted (removing too much fluid). Given that the shunt failure rate 2 years after implantation has been estimated to be as high as 50%, scores of children have endured repeated shunt revisions, often for indeterminate and non-specific symptoms. To address the imposition and associated morbidity that shunt revision has on affected children, Josh proposes to develop an innovative, permanently implanted ICP sensor that will provide caregivers critical knowledge that a hydrocephalic child requires prompt medical attention. The ICP information gathered by the sensor will have the capability to wirelessly transmit data to the attending clinician for real-time assessment. If successful, his approach will reduce the risk of brain damage by making the diagnosis of shunt failure early, more conclusive, eliminating repetitive clinical evaluations and perhaps, unnecessary shunt revision.