THE HARTWELL FOUNDATION

2013 Individual Biomedical Research Award

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Brain Activity During Birth for Prediction of Newborns at Risk for Brain Injury

The birth transition occurs when the fetus becomes a newborn by taking its first breath. Remarkably, of the almost four million babies born each year in the United States, 1 in 10 babies will require resuscitation to complete the birth transition and start breathing. If the transition is unsuccessful or incomplete the newborn will be deprived of oxygen (asphyxia), which will adversely affect cells in the brain more so than any other organ; resulting in life-long neurocognitive impairment and physical disabilities, including cerebral palsy. A very effective treatment for overcoming the effects of asphyxia is therapeutic hypothermia, achieved by deliberately lowering body temperature for several days in an intensive care unit. Hypothermia reduces morbidity and mortality and improves developmental outcomes, but to be effective it must be started within six hours of birth. Unfortunately, many newborns require transfer to a hospital that is properly equipped to administer the therapy. Early recognition of birth transition asphyxia is critical, especially since identifying asphyxiated newborns is difficult and delays can be devastating. Unfortunately, the clinical signs of asphyxia are subtle and easily missed. Diagnosis of asphyxia is best made by a neurologist specializing in newborn brain injury, but a newborn resuscitation team is routinely only comprised of a nurse and neonatologist or pediatrician. Availability of a robust, alternative method to quickly identify asphyxiated newborns is critically needed. Very recent evidence suggests that abnormal electrical brain activity during the first minutes of the birth transition may be predictive of asphyxia. However, conventional technology for measuring brain activity consists of bulky wired electrodes and instrumentation that requires special expertise and a lengthy set-up time. To address the need for early recognition of abnormal electrical brain activity in newborns, Mary Jo proposes to optimize a wireless approach based upon utilization of a thin patch of micro-circuitry (ultrathin electrodes, electronics, sensors, and wireless power and communication systems) that can be conveniently and quickly applied to the skin. If she is successful, availability of this epidermal electronic technology will readily allow early identification of asphyxiated newborns. Early detection of birth asphyxia will thus enable those requiring resuscitation the chance to complete the birth transition by receiving life-saving hypothermia, thereby reducing post-natal deaths and poor neurological outcomes in affected infants.