# Protein found to predict brain injury in children on 'ECMO' life support

22 November 2010

Johns Hopkins Children's Center scientists have discovered that high blood levels of a protein commonly found in the central nervous system can predict brain injury and death in critically ill children on a form of life support called extra-corporeal membrane oxygenation or ECMO.

ECMO, used to temporarily oxygenate the blood of patients whose heart and lungs are too weak or damaged to do so on their own, is most often used as a last resort because it can increase the risk for brain bleeding, brain swelling, stroke and death in some patients.

A detailed report of the Hopkins team's findings is published ahead of print Nov. 4 in the journal *Pediatric Critical Care Medicine*.

Following 22 ECMO patients, ranging from two days to 9 years of age, the researchers found that those with abnormally high levels of glial fibrillary acidic protein (GFAP) were 13 times more likely to die and 11 times more likely to suffer brain injury than children with normal GFAP levels. GFAP levels are already used as a marker of neurologic damage in adults who suffer strokes and traumatic brain injuries.

Although preliminary, the team's findings may pave the way to a much-needed way to monitor the precarious neurologic status of children on ECMO without using imaging tests like ultrasounds or CT scans. Periodic blood tests measuring GFAP levels may be one such tool to monitor brain function and help ward off brain injury and death, the researchers say.

"A simple, fast and easy-to-use test has been needed to monitor, predict and prevent brain damage in children on ECMO because these children are unresponsive or heavily sedated, and doctors cannot easily gauge their neurologic function," says study lead investigator Melania Bembea, M.D., M.P. H., a pediatric critical-care specialist at Hopkins Children's.

"Early detection of brain injury can help us prevent further harm by changing medication doses and rapidly weaning the patient from ECMO support," she adds.

The findings may have implications beyond ECMO, the researchers say, as they offer a way to monitor brain damage in other high-risk situations, including heart surgery and severely premature birth.

"Our long-term goal is to make lifesaving therapies like ECMO and heart surgery safer and more effective by improving protection of the brain, and GFAP and other biomarkers can give us a much-needed benchmark around which we can make these therapies safer," says senior investigator Allen Everett, M.D., a cardiologist at Hopkins Children's.

In the study, seven of the 22 children on ECMO developed brain bleeding or brain swelling, five of whom died subsequently. These children had much higher peak levels of GFAP than children without brain injury - 5.9 nanograms per milliliter of blood compared to 0.09 in children without brain injury. GFAP levels were also markedly higher among eight of the 22 children in the study who had poor neurologic outcomes after ECMO (3.6 ng/ml) than in those children who had good neurologic outcomes (0.09 ng/ml).

Researchers also measured GFAP levels among healthy children and among newborns without neurologic injuries. Their median GFAP level was 0.055 nanograms per milliliter of blood and as high as 0.436 in some cases. By comparison, overall GFAP levels in children with neurologic injuries were 13 times greater than GFAP levels in healthy children.

The researchers caution that their findings should be replicated in a larger trial with more patients and

that future studies must clarify the relationship between a rise in GFAP levels and the onset of brain injury. In the current study, GFAP levels rose sharply in some patients one or two days before their brain damage was discovered on ultrasound.

ECMO is used in about 1,000 children each year. Between 10 percent and 60 percent of children who survive ECMO suffer neurologic damage either because of their underlying disease or complications during ECMO therapy, the researchers say.

Hopkins Children's is Maryland's only hospital providing pediatric ECMO service.

Provided by Johns Hopkins Medical Institutions