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Researchers develop device to measure brain temperature non-invasively

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Doctors have long sought a way to directly measure the brain's temperature without inserting a probe through the skull. Now researchers have developed a way to get the brain's precise temperature with a device the diameter of a poker-chip that rests on a patient's head, according to findings presented May 1 at the annual meeting of the Pediatric Academic Societies in Denver.

"This is the first time that anyone has presented data on the brain temperature of a human obtained non-invasively," said principal researcher Dr, Thomas Bass, a neonatologist at Children's Hospital of The King's Daughters in Norfolk, Va., and a professor of pediatrics at the hospital's academic partner, Eastern Virginia Medical School.

The research also suggests that an injured brain can be significantly warmer than the body, a finding critical to cooling therapies that reduce brain damage in everyone from elderly heart attack victims to hypoxic newborns.

"Knowing the actual brain temperature may allow us to improve outcomes by keeping the brain at an optimum temperature," said Dr. Bass.

With the help of a $750,000 National Institutes of Health grant, a research team led by Dr. Bass adapted an instrument that calculates temperatures by detecting microwave emissions produced by all human tissue.

Those microwaves pass unimpeded through the skull, like light passing through a sheet of glass. As tissue temperatures increase, the emissions grow more intense. Engineers calibrated the device to measure the temperature of brain tissue 1.5 centimeters beneath the skull.

In the trial whose results were presented, the device was placed on the heads of infants undergoing cooling therapy at CHKD. The device's brain temperature readings were correlated with rectal and esophageal temperatures. The difference in temperature between the brain and the body recorded by other means was as high as 5.4% Fahrenheit.

"That's difference is larger than we expected," Dr. Bass said.

Dr. Bass, who pioneered research on cooling therapy for hypoxic newborns, and set about this research because he believed the therapy could be improved if doctors knew precise temperature of the damaged organ, the brain.

Hypoxic brain damage in infants occurs most often in full-term births when the child suffers oxygen loss either immediately before or during delivery. Because of a quirk in the brain, a child can be revived but brain cells continue to die over several days, resulting in brain damage or death. Doctors could do little to stop this progression; parents often watched helplessly as their sons and daughters literally died before their eyes.

Based on the observation that children rescued from freezing ponds after extended periods of time suffered little or no brain damage, cooling therapy involves chilling an infant's body to 92 degrees for 72 hours after brain injury.

A clinical trial on the therapy showed that cooling the child stops or reduces the progression of brain cell death, drastically reducing brain

damage and death. The results were so positive that the therapy is now standard in advanced neonatal intensive-care units worldwide.

Cooling therapy is now used with other patients as well, including heart attack victims whose brains have suffered oxygen deprivation.

Because cooling therapy's success relies on the temperature of the brain, precise readings of the brain's temperature is likely to improve a therapy that's already proven remarkably effective.

Provided by Children's Hospital of The King's Daughters