

Therapeutic cooling effectively targets site of brain injury

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Dr. Tai-Wei Wu (second from right) and his team transport a baby to the MRI while baby is undergoing therapeutic cooling therapy. Credit: Children's Hospital Los Angeles

When a newborn suffers lack of oxygen before or during birth, doctors have very little time to save precious brain tissue. The only proven effective way to treat babies with hypoxic brain injuries is by reducing body temperature through controlled cooling. In a new study, Children's Hospital Los Angeles neonatologist Tai-Wei Wu, MD, uses leading-edge imaging to measure temperature deep in the brains of these patients. The results demonstrate effective cooling in the deep areas of the brain, which are most often damaged by lack of oxygen.

The study, published in *The Journal of Pediatrics* this week, provides the foundation clinicians need to personalize this therapy in the future. In order to optimize this neuroprotective technique, the investigators need to understand precisely how [therapeutic hypothermia](#) affects a baby's [brain](#) temperature.

"First and foremost, we want to make sure we are

effectively [cooling](#) the center of the brain," says Dr. Wu. "It's usually the core that is hit the hardest by injuries arising from lack of oxygen. These injuries can result in lifelong neurological deficits like [cerebral palsy](#)" The results showed that the core of the brain was effectively cooled. Unexpectedly, it was the coldest part of the brain.

"We thought that the core of the brain would be warmer than the outer portions," he says. "This is usually how body temperature works." Dr. Wu explains that the observed effect could be due to cooled blood. The center of the brain receives the cooled blood first, before reaching peripheral parts of the brain, and may get colder for this reason. "Almost every patient showed this pattern," he says, "so the effect is real."

The study represents a critical proof of concept showing that the therapy is reaching the site most likely to be injured.

"Cooling babies after hypoxic injury gives brain cells their best chance at survival," says Dr. Wu. Research found that the brain is in a state of energy failure after hypoxic injury. Multiple [clinical trials](#) showed that lowering body temperature several degrees for 72 hours improved neurological outcome. "The cooling of the brain decreased energy demand and prevented energy failure," he says. Therapeutic hypothermia has been standard of care at Children's Hospital Los Angeles for the past 10 years.

Dr. Wu is no stranger to pushing the edge of technology to save babies. Dr. Wu is the Director of the hospital's therapeutic hypothermia program, and also developed the transport protocol that allows doctors to safely conduct imaging studies without interrupting the cooling therapy.

This study marks an important achievement in the field of therapeutic cooling. Measuring temperature in an inaccessible location like the brain is already

no easy task. Taking this a step further, Dr. Wu wanted to make temperature measurements for multiple, different brain areas during the cooling therapy.

Fortunately, the radiology department at CHLA has Stefan Bluml, Ph.D., a [magnetic resonance imaging](#) and spectroscopy expert who specializes in adapting these techniques for out-of-the-box experimental questions.

"We were really excited to find out that we could measure [temperature](#) in different areas of the brain with great accuracy," says Dr. Wu. The team detected changes as small as 0.2 degrees Celsius between [brain regions](#)—all non-invasively and without disrupting treatment.

The findings also show that temperatures were not the same everywhere in the brain. "The fact brain isn't homogenously cooled is important information to have," says Dr. Wu. Knowing how the treatment affects different brain regions could allow investigators to tailor treatments to individual babies and their unique patterns of damage. "The outer portion of the brain is hit harder in about 20% of hypoxic patients," he says. "So, this study shows us how we could better serve individual babies. And better outcomes really are our goal."

More information: Tai-Wei Wu et al, An In Vivo Assessment of Regional Brain Temperature during Whole-Body Cooling for Neonatal Encephalopathy, *The Journal of Pediatrics* (2020). [DOI: 10.1016/j.jpeds.2020.01.019](#)

Provided by Children's Hospital Los Angeles

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