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Can Measurement of Brain Perfusion Detect the Newborns That Will Develop Brain Injury Despite Hypothermia?

What is this research about?

Hypoxic-ischemic encephalopathy (HIE) occurs when a baby suffers from a lack of oxygen and/or blood during birth. Brain damages in neonatal HIE is a two-step process. It is initiated by the HI event leading to decreased blood flow in the brain (primary lesions, “necrosis”). It is then followed by the restoration of blood flow in an injured brain and the initiation of a cascade of pathways (secondary lesions, “reperfusion injury”) leading to cell death (“apoptosis”) and definitive brain damages. The second step of this process is the main target for neuroprotective interventions. These interventions are currently limited due to a lack of knowledge of when treatment is the most effective in newborns. One such treatment that has been used is hypothermia. This treatment cools the body and may lead to a decrease in cerebral blood flow (CBF) and to less brain damages.

What did the researchers do?

The study assessed the pattern of brain perfusion in the first week of life in newborns with HIE. Brain magnetic resonance imaging (MRI) and arterial spin labeling perfusion imaging (ASL-PI) were used. The researchers wanted to know

What you need to know:

Babies that develop hypoxic-ischemic encephalopathy (HIE) due to a lack of oxygen and/or blood around birth may be helped by having their temperature lowered. Cerebral blood flow (CBF) can be decreased by lowering body temperature through hypothermia. This may prevent brain damage in newborns with HIE.

if abnormalities found in MRI and ASL-PI during the first week of life were connected with brain injuries seen after hypothermia treatment.

18 newborns who displayed various degrees of HIE due to asphyxia were enrolled for the study. The researchers also enrolled 4 newborns who served as control participants. 11 asphyxiated newborns were treated with hypothermia. Eligible newborns received whole-body cooling that was started in the first 6 hours of life, and continued for 72 hours. They were then slowly rewarmed. MRI and ASL-PI were performed on all 18 newborns with HIE as well as the 4 control newborns. Imaging allowed for measurement of cerebral blood flow values. It also assesses the extent of brain damages. These measurements were then compared between the newborns.

What did the researchers find?

The researchers found that:

- In the first week of life, brain perfusion values were notably different between newborns developing brain damages, and those who did not.
- Early hyperperfusion was linked with later brain damages, even in infants treated with induced hypothermia.
- Systemic cooling of the newborns for 72 hours did not prevent brain damages in all of the treated newborns.

Hyperperfusion appeared in the areas of the brain that showed later brain injury in asphyxiated newborns who were or were not treated with hypothermia. These areas first showed an initial hypoperfusion phase (for example, a decrease in blood flow). This was followed by a second stage of hyperperfusion (for example, increase in blood flow).

How can you use this research?

ASL-PI of the brain may be a useful tool for identifying asphyxiated newborns with a higher risk of developing brain damage during hypothermia treatment. It may also help identify asphyxiated newborns who would potentially benefit from more intense hypothermia treatment or other treatments.

About the Researchers

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Keywords

Perfusion, Newborn, Hypothermia, Asphyxia, Hypoxic-ischemic encephalopathy, Brain injury

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