Blood test could diagnose baby brain damage just hours after birth

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An early blood test could detect which babies deprived of oxygen at birth are at risk of serious neurodisabilities like cerebral palsy and epilepsy.

The prototype test looks for certain genes being switched on and off that are linked to long-term neurological issues. Further investigations of these genes may provide new targets for treating the brain damage before it becomes permanent.

The team behind the test, led by Imperial College London researchers in collaboration with groups in India, Italy and the USA, have published their findings today in the journal *Scientific Reports*.

The research was conducted in Indian hospitals, where there are around 0.5-1.0 million cases of birth asphyxia (oxygen deprivation) per year. Babies can suffer oxygen deprivation at birth for a number of reasons, including when the mother has too little oxygen in her blood, infection, or through complications with the umbilical cord during birth.

Following oxygen deprivation at birth, brain injury can develop over hours to months and affect different regions of the brain, resulting in a variety of potential neurodisabilities such as cerebral palsy, epilepsy, deafness or blindness.

This makes it hard to determine which babies are most at risk of complications and to design interventions that can prevent the worst outcomes.

Now, in preliminary study of 45 babies that experienced oxygen deprivation at birth, researchers have identified changes to a raft of genes in their blood that could identify those that go on to develop neurodisabilities.

The babies had their blood taken within six hours after birth and were followed up after 18 months old to see which had developed neurodisabilities. The blood was examined with next-generation sequencing to determine any difference in gene expression—the

'switching on or off' of genes—between those babies that developed neurodisabilities and those that didn't.

The team found 855 genes were expressed differently between the two groups, with two showing the most significant difference.

Examining these two genes in particular, and what processes their expression causes within cells, could lead to a deeper understanding of the causes of neurodisabilities prompted by oxygen deprivation, and potentially how to disrupt them, improving outcomes.

Lead author Dr. Paolo Montaldo, from the Centre for Perinatal Neuroscience at Imperial, said: "We know that early intervention is key to preventing the worst outcomes in babies following oxygen deprivation, but knowing which babies need this help, and how best to help them, remains a challenge."

Senior author Professor Sudhin Thayyil, from the Centre for Perinatal Neuroscience at Imperial, said: "The results from these blood tests will allow us to gain more insight into disease mechanisms that are responsible for brain injury and allow us to develop new therapeutic interventions or improve those which are already available."

The babies were part of a trial called Hypothermia for Encephalopathy in Low and middle-income countries (HELIX), which also examines the use of hypothermia (extreme cooling) on babies to prevent brain injuries developing following oxygen deprivation.

In higher-income countries this is known to reduce the chances of babies developing neurodisabilities, but in lower income settings cooling may not be feasible, and even with cooling 30 percent of babies still have adverse outcomes, so new therapies are still needed.

The team will next expand their blood testing study to a larger number of babies and examine the genes that appear to show the most difference between the groups.

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