Newborns' genetic code sends infection distress signal

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Babies suffering from life-threatening bacterial infections such as sepsis could benefit from improved treatment, thanks to a ground-breaking study.

For the first time, researchers have been able to detect and decode a signal generated from a baby's DNA that can tell doctors whether or not a bacterial infection is present in the bloodstream.

The findings could help develop a test for bacterial infection in newborns, using a single drop of blood.

Immediate detection of such infections, which are a major cause of death among young children, is currently impossible as no simple test exists.

Accurate diagnosis of infection could limit overuse of antibiotics, which can lead to drug resistance.

The University of Edinburgh team has identified a signal consisting of 52 molecular characters – like a biological tweet – that is specific to bacterial infection.

The researchers, who have spent the past decade trying to unravel the complexities of blood poisoning and its treatment among premature and full-term babies, say that the genome's signal provides critical, immediate information on the infection.

Using blood samples from newborn babies in Edinburgh, the study investigated thousands of signals written in biological code known as messenger RNAs.

Through meticulous code-breaking the scientists were able to decipher with close to 100 per cent accuracy the signals generated by an infant's genome that specifically tell that they are suffering from sepsis.

Diagnosing sepsis in newborns is extremely difficult, as signs of infection, such as a high temperature, may not occur – or if they do, they may not be due to an infection.

Currently the most reliable way to detect infection is by detecting the bacteria in the blood but this requires a relatively large volume of blood.

An antibody test cannot be used as it only provides historical information about an infant's illness.

Professor Peter Ghazal, Professor of Molecular Genetics and Biomedicine at the University of Edinburgh's Division of Pathway Medicine, explained: "Just as a Twitter user can send a 140 character message so a baby's genome produces short messages or signals that produce code information to communicate with the infant's immune and metabolic systems so that it can fight the infection. The 52-character 'tweet' or message that we have identified appears to be specific for bacterial but not viral infection. This type of signal could also be used to detect infection in children and adults. We are now working on ways of using a single drop of blood to detect this vital signal. This work is also leading us onto a response to tackling antibiotics resistance."

Dr Claire Smith, Consultant Neonatologist at the Simpson Centre for Reproductive Health, Royal Infirmary of Edinburgh, added: "This study has the potential to provide real clinical benefits in the future. Despite

advances in neonatal care, infection in newborn babies remains a significant issue. Infection is responsible for a significant proportion of neonatal deaths worldwide, and also increases the risk of long-term disability in survivors. There is a pressing clinical need for more accurate and rapid testing for neonatal infection than is currently available. This work is enabling us to move towards being able to distinguish between babies with true infection who need urgent treatment, and those who are not infected and therefore don't require antibiotics. The potential benefits to babies and their families are important. We are grateful to the families who consented to take part in the study."

The research paper is published in *Nature Communications*.

Provided by University of Edinburgh