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First treatment closer for fatal disease affecting premature babies

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Melbourne researchers have published a breakthrough study that will accelerate new treatments for an often-fatal disease affecting premature babies in intensive care, called necrotising enterocolitis (NEC).

The condition can trigger massive inflammation causing parts of preterm babies' small and large intestine to die, posing a major challenge that clinicians treating these babies in neonatal intensive care units face, with fatality rates remaining unchanged for the past 50 years at around 20 to 30 percent. Approximately a third of babies with NEC require surgery, and up to two thirds of these babies with surgical NEC die.

The new study sheds crucial light on how necrotising enterocolitis develops, discovered possible treatment targets, and identified the potential for new or existing drugs to treat the condition, for the first time.

The international discovery, published in *Nature Communications*, was led by Associate Professor Claudia Nold (Hudson Institute) and Professor Marcel Nold (Department of Pediatrics at Monash University; Hudson Institute; and Neonatologist at Monash Newborn, Monash Children's Hospital).

Urgent need for necrotising enterocolitis treatment

Prof Nold said the immune response and inflammation that drives NEC is poorly understood, and clinical diagnosis and management is difficult because of the limited treatment options and because it is hard to diagnose the condition in its early stages.

"By the time it is confirmed that a baby has NEC, the infant often is in a critical condition with sepsis (widespread bacterial infection) and sometimes also life-threatening multi-organ failure. A targeted treatment is urgently needed—but no such treatment exists," he said. "At the moment, we can only offer basic support such as fluids and antibiotics to babies afflicted by NEC."

A/Prof Claudia Nold said, "To many neonatologists, NEC is a looming

specter that haunts neonatal intensive care units and strikes unpredictably. Neonatologists do a fantastic job keeping extremely premature babies alive, but the increase in the number of survivors comes at the price of a rising incidence of severe diseases, including necrotising enterocolitis. By substantially advancing scientific knowledge about NEC, our team's work has made this terrible disease easier to understand, handing scientists and clinicians the tools to propel drug development."

At a glance

- Researchers elucidated the impact of NEC on the immune system—and vice versa—revealing potential options for targeted NEC therapies.
- One such discovery was that the anti-inflammatory immune modulator IL-37 and its receptor are suppressed in samples from human babies with NEC.
- In pre-clinical models of NEC, IL-37 showed protection against the disease.
- A lab-made treatment of IL-37 could therefore provide protection against intestinal destruction for the tiniest of patients. The team will now further investigate IL-37, to establish timing, dosage and routes of administration for IL-37 treatment in NEC.

Hope for babies and families with promising new treatments on the horizon

Currently, no drug to treat or prevent NEC is available. By revealing valuable new insights into the signaling pathways involved in disease progression, the study identifies promising opportunities for novel medications or repurposing of existing treatments.

For example, the study highlights the potential of a novel medication,

IL-37, to bring substantial relief to babies in neonatal intensive care with NEC. Giving premature babies IL-37 early could help prevent the excessive inflammatory response, Prof Marcel Nold said.

"Our data in pre-clinical models suggest that supplementing babies who have NEC with an IL-37 therapeutic may prevent or treat the condition," Prof Nold said.

"Despite decades of research, NEC remains a major challenge in the neonatal intensive care unit because of its insidious onset, rapid progression and the absence of an effective therapy. This renders neonatologists powerless to treat what still is for many babies a deadly disease and for survivors a severely disabling condition," he said.

"We suggest that IL-37 and other strategies could provide our tiniest patients with a much-needed therapy to shield them from the ever-looming specter of NEC," he said.

Next steps

Researchers recommended that as a next step towards developing an IL-37 based treatment, the dosage, timing, and how the drug should be given should be examined.

Note: The study's first author was Dr. Steven Cho, a former Hudson Institute and Monash University Ph.D. student, now Assistant Professor at the University of Hokkaido, Japan.

Necrotising enterocolitis (NEC) facts

- Necrotising enterocolitis (NEC) is a serious disease faced by the one in 10 babies born prematurely in Australia each year
- It causes parts of the small and large intestine to die

- NEC affects between one and three in 1000 live births
- Incidence rises to 11 percent of very low birth weight babies (