Toll-like receptors play role in brain damage in newborns

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Two out of every 1000 babies are at risk of brain damage in connection with birth. Credit: Photo: University of Gothenburg

Two out of every thousand babies are at risk of brain damage in connection with birth. Researchers at the Sahlgrenska Academy at the University of Gothenburg, Sweden, have identified mechanisms behind these injuries, which could lead to better treatment and a richer life for the infants affected. Roughly two in every thousand babies are at risk of suffering brain damage as a result of events before, during and after delivery. Infections in the blood or a reduced supply of oxygen and blood can lead to inflammation in the brain, causing injury. This type of brain damage, which is much more common in premature babies, can result in neurological problems such as cerebral palsy, learning difficulties and epilepsy.

Toll-like receptors

Researchers at the University of Gothenburg's Sahlgrenska Academy have now found that toll-like receptors (TLRs) in the innate immune system play a major role in the state of the brain in newborns. The discovery could lead to better treatment and a richer life for many children.

Key role in the immature brain

Research into TLRs, which was rewarded with this year's Nobel Prize in Physiology or Medicine, has previously shown that these receptors are involved in stroke-related brain damage in adults. The researchers in Gothenburg have now shown that TLRs are also present in the immature brain and play an important role there. "By understanding the role of toll-like receptors in the inflammatory process following brain injury, we hope eventually to find more effective treatment strategies," says Linnea Stridh from the Sahlgrenska Academy, who presents the results in her thesis.

Simulated brain injuries

Stridh and her colleagues used mice in their studies to simulate the brain injuries seen in newborn babies. They found that special TLRs contribute to brain damage following hypoxia, where the brain is starved of oxygen. "An infection can activate these receptors, making the brain more sensitive to hypoxia, resulting in worse brain damage," Stridh explains. "If these signals are blocked, the degree of brain damage is reduced."

Barrier opened

In her thesis, Stridh also looks at a protein called occludin, which has the role of gluing together cells in the blood-brain barrier.

"Our results show that there is a reduction in occludin at a genetic level following infection," she explains. "This can lead to the opening of the barrier, making it easier for inflammatory molecules and cells in the blood to get into the brain and cause inflammation."

Toll-like receptors (TLRs) are found on both the outside and inside of cells where they specialise in detecting specific molecules from hostile microorganisms. When a TLR detects a microorganism, the innate immune system is activated, causing inflammation to destroy the microorganism. Research on Toll-like receptors was awarded with the Nobel Prize in medicine 2012.

Provided by University of Gothenburg