Increased Inflammatory Indices at Birth Are Associated with Brain Structure at 1-Month

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BACKGROUND

- The developing fetal brain is sensitive to maternal health and wellbeing.
- Inflammatory processes in the placenta and fetal compartment influence early brain maturation and may contribute to the underlying pathophysiology of neurobehavioral disorders during childhood.
- However, relative vulnerability of different neural processes and brain regions is not known.
- Thus, it is critical to examine the brain during the perinatal period to better understand the relative vulnerability of different neural processes and brain regions that may contribute to future differential developmental outcomes.

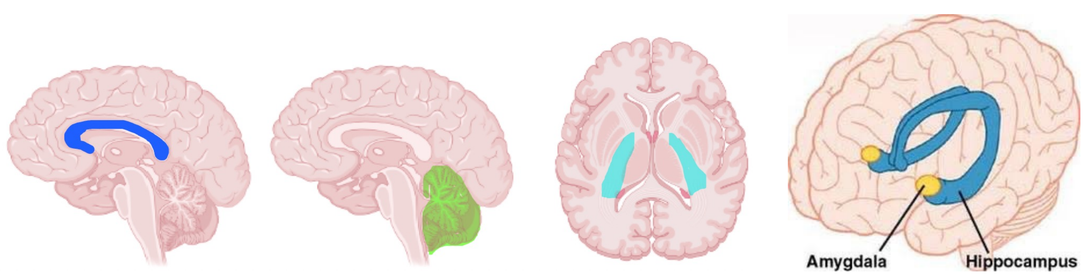
METHODS

- This analysis included 45 full-term healthy infants with cord blood (CB) collected at delivery and MRI (diffusion & structural) data collected at 1-month of age.
- Diffusion tensor imaging (DTI) and neurite orientation dispersion and density imaging (NODDI) were used to characterize white matter (WM) microstructure of the posterior limb of the internal capsule (PLIC) and cerebellar hemispheres (CH).
- Volumetric measures of the hippocampus and amygdala were derived from structural images.
- Pro-inflammatory cytokines, including IL-6 and TNF-α, were assayed from CB. Linear models were used to assess the association between CB cytokine levels and brain structure at 1-month, controlling for gestation corrected age and sex.
- Volumetric analyses also considered the influence of total brain volume.

Perinatal inflammation is associated with white matter microstructure and volume at 1-month of age.

RESULTS

- TNF-α significantly predicted axial diffusivity (DTI - AD) in the left PLIC.
- IL-6 was positively related to AD, mean and radial diffusivity, and negatively related to neurite dispersion (NODDI-ODI) in the WM of the left CH.
- TNF-α was positively associated with right hippocampal volume.



Corpus callosum | Cerebellar Hemisphere | Posterior limb of internal capsule

CONCLUSIONS

- Our study suggest inflammatory activity, i.e. CB cytokines at delivery, is associated with brain development.
- Associations were found with the PLIC, cerebellum, and hippocampus at 1-month.
- Left lateralized WM microstructural associations were observed in the left PLIC and left CH, whereas hippocampal volumetric differences were evident on the right.
- The findings may highlight differential effects of prenatal immune activation on early WM microstructural and volumetric organization.
- Using NODDI to understand these relationships will inform perinatal influences on neurodevelopment.

ADDITIONAL KEY INFORMATION

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