Prematurity affects brain connectivity networks and their relationship to neurological performance

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In her master’s thesis, Pauliina Yrjölä, a Biomedical Engineering student from Aalto University, investigates the effects of preterm birth to functional brain networks and their link to neurological performance. She found distinct group differences in the phase-based functional networks and correlations to neurological performance unique to preterm infants. These findings contribute to the knowledge of the development of functional brain connectivity and have clinical potential in indicating individuals at risk of neurocognitive deficits. The study was conducted at BABA Center, Children’s Hospital, Helsinki University Central Hospital.

Preterm birth affects 10 % of all newborns annually and is associated with an increased risk of many lifelong neurocognitive deficits. It coincides with the critical time in brain development, and it is associated with extensive structural and functional disruptions in the brain networks. However, there is little detailed knowledge about how the early development of functional connectivity is affected by prematurity, and further, how these effects correlate with neurological performance.

The results of this study show widespread differences in the connectivity of early preterm infants (< 26 weeks of gestation) compared to full-term healthy controls. Significantly, a strong correlation between connectivity strength and newborn neurological performance was found in the preterm infants but not the healthy controls. A possible explanation of the physiology underlying this finding could be that, as preterm infants have dramatic disruptions in brain volume, the strength of the remaining connections is important for neurocognitive development, whereas healthy controls have more variable and flexible networks to support it.

The present findings demonstrate prominent effects of prematurity on the early phase-based networks of cortical function. The results together suggest that prematurity affects not only the cortical networks, but also their relationship to neurological performance. The measures of phase-based cortical connectivity may offer a potential functional biomarker in the early neurodevelopment, which may be valuable for benchmarking early therapeutic interventions.

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In her master’s thesis, Pauliina Yrjölä explored the differences in the functional brain networks of preterm infants compared to full-term healthy controls. She found distinct group differences and a correlation between network strength and newborn neurological performance unique to preterm infants.