September 18th, 2021 08:30 - 10:30

## PARALLEL SESSION 32 - BRAIN 6

# ID 59. Disrupted functional brain organization in children born extremely preterm

MD PhD Nelly Padilla[1], Ms. Anira Escrichs[2], Dr. Hedvig Kanta[1], MD PhD Hugo Lagercrantz[1], MD, PhD Morten Kringelbach[3], Phys, PhD Gustavo Deco[2], MD, PhD Ulrika Ådén[1]
*[1]Karolinska Institute, Stockholm, Sweden, [2]Center for Brain and Cognition, Universitat Pompeo Fabra, SpainCenter for Brain and Cognition, Universitat Pompeo Fabra, Barcelona, Spain, [3]Department of Psychiatry, University of Oxford, Warneford Hospital, Oxford, Unite Kingdom*

BACKGROUND
The brain's functional organization is dynamic and reconfigures across time implying the capability of brain regions to propagate neural activity (ignition events) and to switch between brain states (metastability). This ensures that the information processing function operates at an optimal level supporting cognition and behaviour. Any disturbance to these dynamics, such as extreme prematurity, can have a significant impact on healthy brain functioning. Here, we aimed to investigate how extreme prematurity (born below 28 weeks of gestation) disturbs the functional organization of the brain at 10 years of age by adopting an intrinsic ignition and metastability network-based framework using resting state functional MRI. Our second aim was to explore the relationships between brain ignition and metastability measures and cognitive function.

METHODS
Sample: 33 extremely preterm (EPT) children (23.5–26.6 weeks of gestation) and 28 term controls (37.3–41.5 weeks of gestation) scanned at 10 years of age and assessed with WISC-V at 12 years. Intrinsic-ignition and metastability were calculated using an appropriate algorithm on each functional network. We defined seven networks (default mode network-DMN, limbic, motor, visual, dorsal attention network-DAN, salience and fronto-parietal) based on a functional brain atlas. Differences were tested between EPT and term using Monte-Carlo permutations corrected for multiple comparisons. Spearman's correlation between brain data and developmental scores were performed.

RESULTS

Compared to the term group, EPT children showed reduced mean ignition and metastability in the DMN (p= 0.002 and p=0.00001 respectively) and DAN (p= 0.011 and p=0.00001 respectively). Metastability was also reduced in the salience network (p=0.02) (Figure 1). Significant correlations between brain data and developmental scores were found only in the term group. Metastability in the DAN was positively correlated with processing speed (rs=0.49, p=0.02), visuospatial (rs=0.50, p=0.02), and IQ (rs 0.56, p=0.008). All survived FDR correction.

CONCLUSIONS

EPT birth disturbs the signatures of functional brain organization at rest involving three core higher-order networks (DMN, salience and DAN). This may have a key role in related cognitive impairments described in this population.

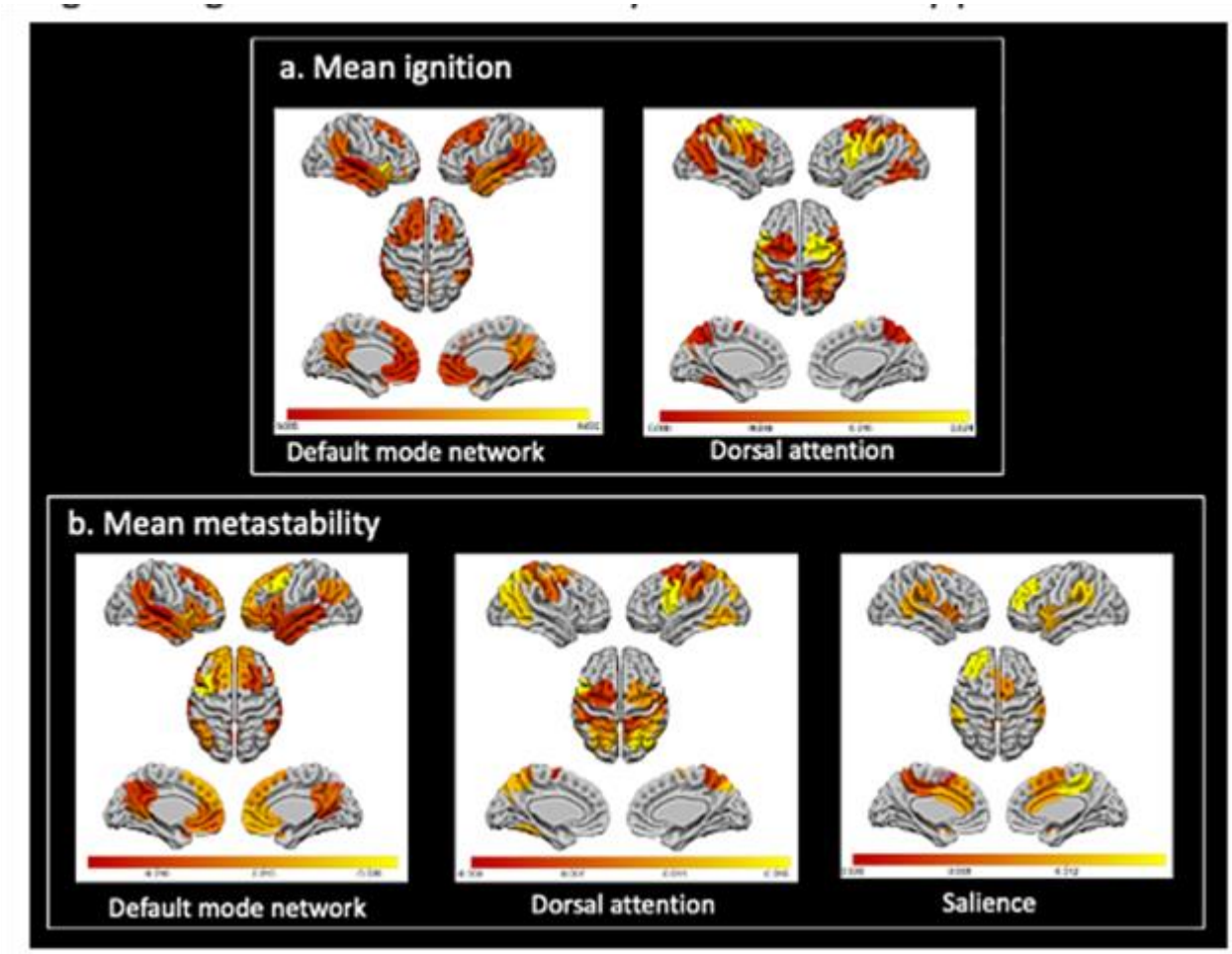


Figure 1. Ignition and Metastability in the extremely preterm brain
Comparisons between extremely preterm and term children (yellow-red areas). a. Reduced ignition. b. Reduced metastability

Figure 1. Ignition and Metastability in the extremely preterm brain
Comparisons between extremely preterm and term children (yellow-red areas). a. Reduced ignition. b. Reduced metastability

None declared

jENS Congress of joint European Neonatal Societies
VIRTUAL SPACE TO BE
European Society for Paediatric Research
EFCNI european foundation for the care of newborn infants
UENPS Union of European Neonatal & Perinatal Societies
LIVE ONLINE CONGRESS
14-18 September 2021
jenscongress.eu
PRE-CONGRESS COURSES
11-12 September 2021

# ID 422. PARENTAL PERCEPTIONS ON THE VALUE OF NEONATAL BRAIN MRI

BA Vera W. Aalbers[1], BA Sara Rapuc[1], Dr. Jeroen Dudink[1], Dr. Maria Luisa Tataranno[1], Dr. Marjolijn Ketelaar[2], Dr. Karen A. de Bijl-Marcus[1], Prof. dr. Manon J.N.L. Benders[1]

*[1]Department of Neonatology, Wilhelmina Children's Hospital, University Medical Center Utrecht, Utrecht University, Utrecht, the Netherlands, [2]Center of Excellence for Rehabilitation Medicine, UMC Utrecht Brain Center, University Medical Center Utrecht, Utrecht University and De Hoogstraat Rehabilitation, Utrecht, the Netherlands*

BACKGROUND

Brain MRI is often part of routine screening in extremely preterm infants (EPI, <28 weeks of gestation) to provide neurodevelopmental prognoses. Little research has been done on parental perceptions on routine MRI, while parents have to handle the results. This study aims to describe parental perceptions on the value and communication of routine MRI.

METHODS

Parents of 205 EPI who were admitted to the neonatal intensive care of the Wilhelmina Children's Hospital between 2016 and 2021 were invited to complete an online survey on neonatal MRI. Data were analysed by frequency distributions and Fisher-Freeman-Halton exact tests to determine associations between different prognoses and responses about MRI. Bivariate analyses excluded parents who answered "do not remember", causing different total numbers per analysis.

RESULTS

The analysis included parental responses of 85 EPI (41.5% response rate). 81% recalled being informed about the advantages of MRI, whereas only 44% recalled hearing about possible risks. 34.5% felt they had no choice regarding MRI and 37.3% were not asked whether they wanted to know the results. While the results were useful for 94.8% of parents and 63.2% reported that they reassured them about their child's development, 74% did not think their child received adjusted treatment based on the results. However, all parents who received a worrisome prognosis (n=5) reported that their child received adjusted treatment after MRI, opposing 7.7% (n=26) of parents who received a good prognosis (p = <.001). For 66.7% of parents who received a worrisome prognosis (n=6), the results caused anxiety about their child's development, opposing no parents (n=29) who received a good prognosis (p = <.001). Moreover, the poorer the prognosis, the more often parents reported that their child developed better than predicted (p = <.001).

CONCLUSION

In this sample, parental perceptions on MRI are mainly positive. However, worrisome prognoses can cause parental anxiety, while these parents also reported their child to develop better than expected based on the prognosis. This suggests that such prognoses should be carefully discussed with parents. Additionally, communication can be improved by explaining both advantages and risks, and by presenting MRI as shared decision-making, with an important voice of parents.

None declared

# ID 138. DOPPLER ULTRASOUND IN THE DIAGNOSIS OF ACUTE NEONATAL ARTERIAL ISHEMIC STROKE

Doctor Yulia Bykova[1], Doctor Lubov Ushakova[1], Doctor Elena Filippova[1], Doctor Anna Sugak[1], Professor Konstantin Vatolin[2], Doctor Vladimir Bychenko[1], Professor Victor Zubkov[1], Professor Dmitry Degtyarev[1], Doctor Irina Nikitina[1]

*[1]National Medical Research Center For Obstetrics, Gynecology And Perinatology Named After Academician V.i. Kulakov, Moscow, Russian Federation, [2]Russian Medical Academy of Continuing Professional Education, Moscow, Russian Federation*

Background. Arterial ischemic stroke (AIS) is an actual problem in neonatology. It can develop antenatally or after birth in children with different gestational age. The clinical symptoms of neonatal AIS are often nonspecific and its diagnosis is impossible without neuroimaging. The goal of the study is to evaluate the role of Doppler ultrasound in the diagnosis of AIS in term and preterm neonates.
Methods. Cranial ultrasound with Doppler assessment of blood flow in the anterior and middle cerebral (MCA) arteries performed in 12 term and 6 preterm neonates with AIS. Brain MRI were performed in 17 cases.
Results. AIS are visualized as heterogeneous area of increased echogenicity in all terms in the cortical/subcortical regions, in 5 preterms – in the thalamic/basal ganglia region, in 1 preterm – in the cortical/subcortical region, from the end of the 2 to the beginning of the 3 day of injury. Doppler ultrasound in terms revealed increased velocities and decreased resistance index in MCA on the affected site compared with non-affected site ($p<0,05$) and hypervascularization in the affected area according to color Doppler imaging; in preterms - hypervascularization in the affected area according to color Doppler imaging without asymmetry of blood flow parameters in CMA ($p>0,05$) from the 1 to the 3-5 day of injury.
Conclusion. Localization of the ischemic focus depends on the degree of maturity of the brain and its vascular system at the time of stroke. The acute phase of AIS is accompanied by local vasoparesis with increasing of the blood flow velocities and a decreasing of peripheral resistance in the affected region. With cortical infarcts these changes are detected in the trunk of the MCA and in its branches. With infarcts in the deep parts of the hemispheres, the blood flow in the trunk of the MCA does not change, only hypervascularization in the focus of ischemia is noted due to increased blood flow in the lenticulostriar arteries. Doppler ultrasound can identify injury earlier than cranial ultrasound.
None declared

# ID 348. THE IMPACT OF PRETERM BIRTH ON THE BRAIN CONNECTIVITY DYNAMICS IN 8-TO-9-YEAR-OLD CHILDREN

Doctor Solange Denervaud[1], Doctor Céline J. Fischer Fumeaux[1], Mrs Cléo Huguenin-Virchaux[1], Professor Patric Hagmann[1], Professor Anita C Truttmann[1], Doctor Juliane Schneider[1]
[1]*University Hospital Center of Lausanne, Lausanne, Switzerland*

Background
Preterm infants are cerebrally vulnerable due to a combination of alterations in brain development and growth, and a propensity for brain injuries. There is a need for further data on long-term brain dynamics and trajectories. Recent advances in analytical frameworks bridging functional and structural brain connectivity are promising tools allowing such explorations. We hypothesized that, compared to full-term born children, preterm children would show durable changes in spatial and temporal brain dynamics, primarily in sensory, attentional, and executive functional systems.

Methods
In a prospective cohort study of 51 children born prematurely < 30 gestational weeks in a Swiss level-III center, 43 children aged 8-9 years were recruited for a multimodal brain magnetic resonance imaging (MRI) session. We leveraged anatomical, diffusion-weighted, and resting-state functional imaging data to investigate the spatial and temporal reorganization of brain activity over time. So far, we compared data from 15 children to those of a reference group of 15 similar age full-term children recruited in the same period and area in a parallel study using identical MRI protocol. We computed two metrics of brain connectivity (i.e., systems diversity and spatio-temporal diversity) for each group. The between-group comparisons were based on 50'000 permutations of subjects for each metric at both levels.

Results
Compared to full-term children aged 8-9 years, preterm children showed no significant differences in spatial and temporal brain dynamics at the whole-brain level ($p > 0.05$). However, a comparison of functional systems revealed that prematurity was associated with lower system integration over time in systems related to sensory processing ($p < 0.05$), executive and attentional controls ($p < 0.01$). Furthermore, functional systems implied in cognitive flexibility (default and executive networks) were less stable across time (both $p < 0.05$).

Conclusion
This is one of the first evidence that prematurity affects the long-term development of children's brain connectivity, investigated using spatio-temporal brain dynamics studies. These patterns are coherent with clinical outcomes, such as attentional deficits, or diminished cognitive flexibility. Future studies include long-term longitudinal assessment of the brain dynamic development and its correlation with functional outcomes to identify early preventive interventions and assess their long-term impact.

None declared