September 20th, 2023 15:00 - 17:00

PARALLEL SESSION 8 - BRAIN 2

ID 766. Predictors of cerebellar hemorrhage volume and location in preterm infants.

Doctor Marta Ybarra[1], Thiviya Selvanathan[1], Ting Guo[1], Vann Chau[1], Helen.M Branson[2], Linh G Ly[1], Anne R Synnes[3], Edmond Kelly[1,4], Ruth E Grunau[3], Steven P Miller[1,3], Emily WY Tam[1,3]

[1]Pediatrics, The Hospital for Sick Children and University of Toronto, Toronto, Canada, [2]Diagnostic Imaging, The Hospital for Sick Children and Medical Imaging, University of Toronto, Toronto, Canada, [3]Pediatrics, Children's Hospitals and University of British Columbia, Vancouver, Canada, [4]Pediatrics, Mount Sinai Hospital, Toronto, Canada

Background: Cerebellar hemorrhage (CbH) contributes to motor and cognitive disabilities in preterm infants. Location and size of CbH has been shown to be important for neurodevelopment outcomes. A complicated neonatal course including hemodynamic disturbances may be related to an increased risk for CbH, vermis involvement and larger CbH volumes.

Objective: To define risk factors related to cardiovascular insufficiency in preterm infants for CbH location and volume.

Methods: Early-life and term-equivalent age (TEA) brain MRIs were performed in a prospective cohort of very preterm infants born <32 weeks postmenstrual age (PMA). Presence of CbH (T1, T2 and SWI) was assessed by a pediatric neuroradiologist. A cut-off of 4mm was used to distinguish punctate vs. large hemorrhages. Vermis hemorrhage was noted. CbH volume was measured by manual segmentation using

Display software by two trained raters. Hypotension requiring treatment, presence of a PDA requiring treatment, and the SNAPii Score (used to quantify illness severity in first 12 hours of life) together with other comorbidities were recorded., Outcome variables for uni– and multivariate regression analyses were presence of CbH, presence of vermis hemorrhage, CbH severity (punctate vs large), and CbH volume.

Results

A total of 309 very preterm infants (27.6±2.3 week PMA at birth) were included. 60 infants (18.3%) had CbH, classified as punctate in 43 infants (71.3%) and vermis involvement in 14 (23.3%). Median CbH volume was 19mm3 (range 1–411mm3). 42 infants with CbH had both early–life and TEA MRI; CbH was not detected on the early–life scan in 4 infants. Univariable regression analyses are presented in figure 1. On multivariable regression, hypotension (OR 2.80, 95%CI 1.34–5.84, P=0.006) and IVH (OR 2.36, 95%CI 1.17–4.72, p=0.01) were significantly associated with CbH. Although hypotension was not a significant risk factor for vermis involvement (OR 3.49, 95%CI 0.90–13.48, p=0.07), it was the only independent predictor of larger CbH volumes (4.35mm3, 95%CI 1.04–7.67, p=0.01).

Conclusion

This study highlights the important role that hemodynamic disturbances play in CbH, with hypotension being an independent risk factor for large CbH. Further investigations are needed regarding risk factors for vermis hemorrhage.

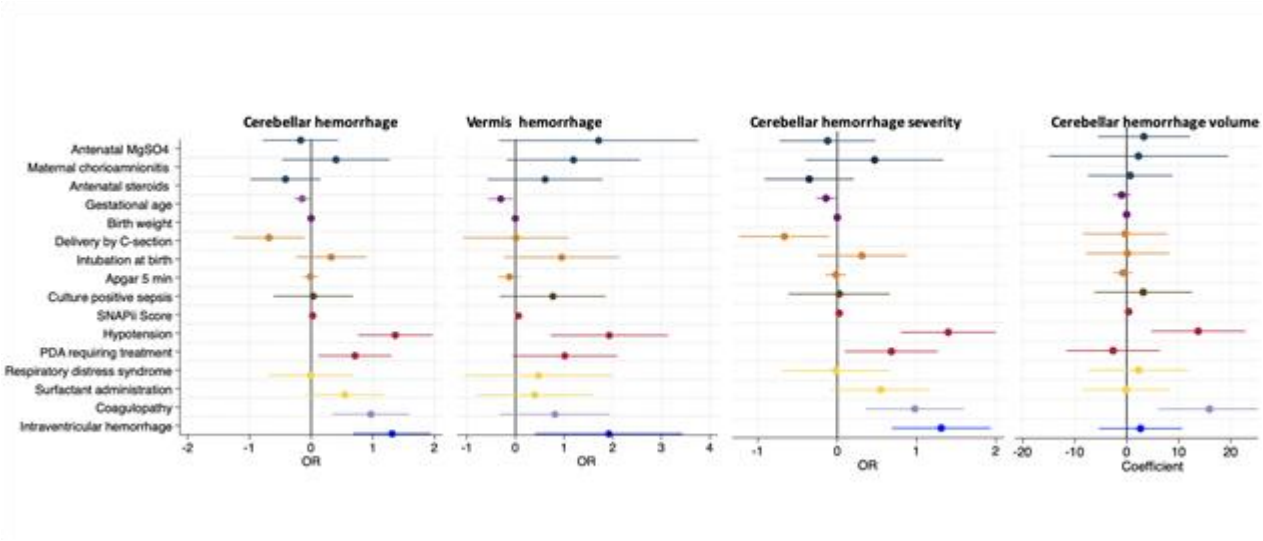

Figure 1. Univariable regression

Figure 1. Univariable regression

None declared

ID 602. Newborn's neural representation of instrumental and vocal music as revealed by fMRI: a dynamic effective brain connectivity study

Doctor Manuela Filippa[1,3], Dr Serafeim Loukas[1,2], Dr Joana Sa De Almeida[1], Dr Cristina Borradori Tolsa[1], Dr Francisca Barcos-Munoz[1], Professor Didier Grandjean[3], Professor Dimitri Van de Ville[2,5], Professor Petra Huppi[1]

[1]Geneva University Hospital, Geneva, Switzerland, [2]Institute of Bioengineering, École Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland, [3]Swiss Center for Affective Sciences, Department of Psychology and Educational Sciences, University of Geneva, Geneva, Switzerland, [4]Division of Pediatric Intensive Care and Neonatology, Department of Women, Children and Adolescents, University Hospital of Geneva, Geneva, Switzerland, [5]Department of Radiology and Medical Informatics, University of Geneva, Geneva, Switzerland

Bachground.
Music is ubiquitous, both in its instrumental or vocal forms. The ontogeny of instrument and voice neural representation has yet to be defined.
Aim. To assess the origins of the ability to discriminate instrumental or vocal melodies, 45 newborns were scanned using functional magnetic resonance imaging while listening to a melody played by a musical instrument, a flute or sang by a female voice.

Methods.
To investigate the dynamic task-based effective connectivity, we employed a psychophysiological interaction of co-activation patterns (PPI-CAPs) analysis, using the auditory cortices as seed region, to investigate moment-to-moment changes in task-driven modulation of cortical activity during an fMRI task.

Results.

Our findings revealed unique, condition–specific, dynamically occurring patterns of co–activation (PPI–CAPs). During vocal condition, auditory cortex co–activated with sensorimotor and salience network, while during instrumental condition, it co–activated with visual and superior frontal cortex. In line with adult studies, the vocal condition was recognized as relevant stimulus (salience activation) in CAP1, it induced somatomotor network activations, evoking motor responses. In CAP2 a cognitively oriented network with temporal pole activation rTPG, while the instrumental condition activated (CAP3/4) visual imaginary and mind wandering networks. Common neural signatures for vocal and instrumental melodies were found in the precuneus and posterior cingulate gyrus, indicating a perceived musicality of the sound stimuli.

Conclusions.

This study adds knowledge on the dynamic brain connectivity underlying the newborns capability of early and specialized auditory processing, highlighting the relevance of dynamic approaches to study brain function in newborn populations.

None declared

ID 871. The protective role of active sleep in maturation of the posterior limb of the internal capsule

Miss Eline de Groot[1], Miss Xiaowan Wang[1], Miss Klaudia Wojtal[1], Miss Els Janson[1], Dr. Thomas Alderliesten[1], Dr. Maria Luisa Tataranno[1], Prof. dr. Manon Benders[1], Dr. Jeroen Dudink[1]

[1]Department of Neonatology, University Medical Center Utrecht, Utrecht, Netherlands

Background

Preterm brain development is influenced by a plethora of factors. Days of invasive ventilation (DOV) and maturation of the posterior limb of the internal capsule (PLIC — part of the sensorimotor tracts) are among the most predictive for future outcome in preterm infants. Although sleep is also thought to be essential for brain development, it is rarely considered as a moderator of brain development. Animal research has found an association between active sleep (AS) and development of the white matter expressed by sensorimotor pathways (e.g. the corticospinal tract; CST). The aim of the current research was to explore the role of AS in preterm CST — and more specifically PLIC — maturation.

Methods

In a retrospective cohort of 50 preterm infants (born 24.6–29.4 weeks gestational age, 52% female) sleep states were continuously measured during 5–7 consecutive days between 29+0 and 31+6 weeks postmenstrual age. Every minute sleep stages were predicted using an in–house developed sleep staging algorithm. Furthermore, a DTI scan was made at term equivalent age as part of standard care. Infants without overt brain injury or congenital malformations and with a good quality DTI scan were included. After quality assessment, tract based spatial statistics (TBSS) analysis was performed, followed by region of interest analysis of the bilateral PLIC. Finally, the

CST was analyzed using tractography. For all analyses, DOV, gestational age at birth and postmenstrual age at scan were included as covariates.

Results

TBSS analyses suggested a positive trend, associating AS with fractional anisotropy (FA) of the medial lemniscus and left inferior CST ($p < 0.10$). However, DOV was negatively associated with FA throughout the brain ($p < 0.05$). Furthermore, analyses showed a significant interaction effect between AS and DOV for FA of the PLIC ($p = 0.01$; Figure 1) and for radial diffusivity of the PLIC ($p = 0.03$).

Conclusion

In very preterm infants, invasive ventilation has a negative effect on white matter tract maturation throughout the brain. However, active sleep may play a protective role for the most vulnerable infants by supporting the maturation of the PLIC, which is crucial for long–term neurodevelopmental outcomes.

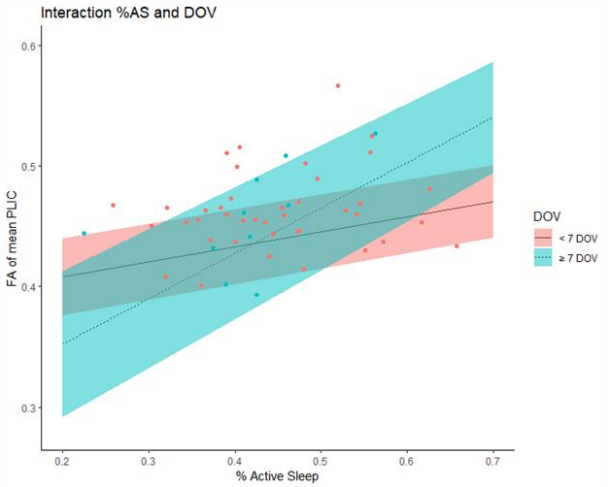

Figure 1. Interaction between DOV and %AS for FA values of the bilateral PLIC.

Figure 1. Interaction between DOV and %AS for FA values of the bilateral PLIC.

None declared

ID 841. Longitudinal Assessment of Brain Development and Long Term Outcomes in Extremely Preterm Infants up to 9 Years of Age

Doctor Francesco Dianori[1], Maria Luisa Tataranno[2], Elise Roze[2], Professor Jeroen Dudink[2], Femke Lammertink[2], Corine Koopmans[2], Henriette Swarenburg-deVeye[3], Caterina Coviello[5], Professor Carlo Dani[4], Professor Manon JNL Benders[2]
[1]Università degli studi di Firenze, Firenze, Italy, [2]Department of Neonatology, Wilhemina Children's Hospital, University Medical Center Utrecht, Utrecht, The Netherlands, [3]Psychosocial Department, Wilhelmina Children's Hospital, University Medical Center Utrecht, Utrecht, Utrecht, The Netherlands, [4]Università degli studi di Firenze, AOU Careggi, Firenze, Italy, [5]AOU Careggi, Firenze, Italy

Background
Premature infants exhibit distinct pattern of brain development compared to full-term, but this has been evaluated longitudinally in only a small number of studies. This longitudinal study aims to analyze serial magnetic resonance imaging (MRI) scans of extremely preterm infants (<28 weeks of gestation) to assess brain development and injuries and investigate their relationship with long-term outcome.

Methods
One hundred-thirty-four extremely preterm infants born at the Wilhelmina Children's Hospital in Utrecht, The Netherlands (2008-2012) were included. Serial MRI images were collected at around 30 and 40 weeks of postmenstrual age and at 9 years. Neonatal MRI images were analyzed using the dHCP Structural-Pipeline, 9 years images were segmented using Freesurfer. Most relevant maternal and perinatal data were collected and the presence of brain injury at term was assessed using the Kidokoro MRI score. Follow up at 9 years was performed using Movement

Assessment Battery for Children (Movement–ABC) and Wechsler Intelligence Scale for Children version–V (WISC–V) tests. Adjusted correlation analysis was conducted between the volumes and their ratios to the total brain volume, and the outcome scores, with correction for gender and age at scan.

Results

Segmentation analysis was performed only on good–quality scans (N=77 at 30wks, N=129 at 40wks and N=105 at 8–12y) obtaining volumes of 87 brain regions. No significant correlations were observed volumes at 30 wks postmenstrual age and long term outcomes. Brain volumes at term–equivalent age were significantly and positively correlated with 9 years intelligence quotient, with the strongest correlation observed for cortical grey matter and the brainstem. Moreover, Kidokoro total white matter injury score at term negatively correlated with long–term motor and cognitive scores at 9 years. Cortical grey matter and basal ganglia volumes measured at 9 years MRI were also significantly correlated with 9 years total intelligence quotient.

Conclusions

Our findings underscore the long–term impact of preterm birth on neurodevelopment and highlight the crucial role of term equilavent age MRI for prognosis and long term outcome prediction. Early diagnosis and identification of high–risk infants are crucial and can potentially provide an important window for intervention.

None declared