The Neonatal Society

Spring Meeting

Royal Society of Medicine, 1 Wimpole Street, London, W1G 0AE

10th March 2022
Meeting Virtual Link: To be emailed to delegates on 9th March 2022

Session 1
9:00. Aneurin Young
Plasma urea is not a sufficient marker of adequate protein intake in very preterm infants

9:15. Michelle Fernandes
Neurodevelopmental outcomes of extremely preterm infants: theoretical and epidemiological perspectives to guide shared-care decision-making

9:30. Katie Gallagher
Healthcare professionals’ attitudes towards extremely preterm birth: a Q-methodological study

9:45. Emily van Blankenstein
Views of parents, ex-patients and professionals on linkage of routinely recorded data of preterm babies

10:00. Tea / coffee

Session 2
10:15. Fergus Harnden
Caring for babies with palliative care needs and/or multiple complex health needs with an uncertain future in England and Wales 2015-2020

10:30. Maria-Sofia Kalogeropoulou
Continuous glucose monitoring during therapeutic hypothermia for hypoxic ischaemic encephalopathy

10:45. Rory Teed
Incidental findings on 3T brain mri at term-equivalent age in a research cohort of very preterm infants and term-born controls

11:00. Lucy Vanes
Longitudinal Neonatal Brain Development and Infant Psychopathology Following Preterm Birth

11:15. Tea / coffee

Session 3
11:30 Keynote Lecture
Dr David MacIntyre, Reader in Reproductive Systems Medicine, Imperial College London
Vaginal microbiota-host interactions and preterm birth

12:30. Lunch break

Session 4
14:00. Abi Fukami-Gartner
Individualised assessment of regional brain volumes in neonates with Down syndrome reveals extreme deviation in white matter and cerebellum
14:15. Gemma Sullivan
Early breast milk exposure is associated with cortical maturation in preterm infants

14:30. Lisa Mills
Comparison of 18 months cognition, motor, and language outcomes with early childhood WPPSI IV and Movement Assessment Battery (MABC-2) in children with moderate or severe HIE

14:45. Divyen Shah
Signatures of altered energy metabolism in the urine of newborns with substantial brain injury after hypoxic ischaemic encephalopathy

15:00 Lucy Fullerton
Neonates in need of clinical care escalation were transferred later during the COVID-19 pandemic

15:15. Afternoon Tea / Coffee

**Session 5**

15:30. Rising Star Annual Invited Lecture
**Dr Harry Leitch Academic Clinical Lecturer in Genetics & Medical Research Council Investigator, Imperial College London**
Pluripotent stem cell disease modelling approaches in acutely unwell neonates

16:00. Ilia Bresesti
Tidal volumes at birth in extremely preterm infants using different T-piece resuscitation devices

16:15. Ourania Kaltsogianni
Cumulative hypoxia, socioeconomic deprivation and neurodevelopmental outcomes in preterm infants

16:30. Rebecca Lee
Work of breathing at different tidal volume targets in newborn infants with congenital diaphragmatic hernia

**Session 6**

16:45. Prize for best presentation by a trainee

16:55. McCance Lecture – Introduced by Professor Andy Ewer, President
**Prof David FitzPatrick, Professor and Consultant in Paediatric Genetics, Group Head MRC Human Genetics Unit, University of Edinburgh**
Paediatric genomics: new methods for diagnosing rare disease in infants

17:55. Close of meeting
Self Certificate of Attendance

Neonatal Society Spring Meeting
London
10th March 2022

Name of person claiming CPD points:
(Block letters)………………………………………………

Place of Work:……………………………………………………………………………………………………

Number of CPD points claimed :……
(1 point per hour of attendance – up to a maximum of 10 CPD Points)

Claimant’s Signature…………………………

Name and signature of Neonatal Society Committee member

…………………………………………………………
PLASMA UREA IS NOT A SUFFICIENT MARKER OF ADEQUATE PROTEIN INTAKE IN VERY PRETERM INFANTS

Authors (Presenting author underlined. If no author is a Society member please provide the name of the member introducing the author to the Society)

Aneurin Young1,2, Rodney Gilbert1, Hang Phan1,2, Guo Cheng2, Sarah Ennis2, R Mark Beattie1,2, Mark J Johnson1,2

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Institution(s)

1. NIHR Southampton Biomedical Research Centre, University Hospital Southampton NHS Foundation Trust
2. University of Southampton

Introduction (include hypothesis)

Preterm infants require a very high relative intake of protein or amino acid to prevent catabolism and support growth. However, protein requirements are likely to differ depending on the individual and the prevailing clinical context, leading to efforts to assess blood urea concentration as a marker of adequate protein intake to support growth. This study aimed to describe the relationship between protein intake, plasma urea and growth during neonatal admission and after initial weight loss (day 14 to day 42 of life) in very preterm infants.

Methods (include source of funding and ethical approval if required)

Growth, nutritional intake and clinical data were prospectively gathered for infants born before 30 weeks gestational age. The influence of recent protein intake on plasma urea measurements was assessed by mixed effects regression to adjust for repeated measures and likely covariates. Growth was expressed as change in weight and head circumference SD score, and multiple linear regression was used to assess the effect of mean daily protein intake on plasma urea and on growth, adjusted for covariates. The GAP study is funded by the NIHR Southampton BRC and is approved by Oxford A REC (14/SC/1275).

Results

Data were available for 353 infants. Mixed effects regression, adjusting for repeated measures on the same infant and for likely covariates (gestational age, postnatal age, sex, birthweight SD score, estimated glomerular filtration rate, c-reactive protein and non-protein energy intake), demonstrated that each increase in protein of 1g/kg/day was associated with an increase in plasma urea of 1.5 mmol/l (95%CI 1.3-1.6). This effect was strongest for infants receiving parenteral nutrition (3.0; 95%CI 2.2-3.9). No threshold of urea performed well as a predictor of protein adequacy (>3.5g/kg/day protein, ROC curve AUC: 0.57), and a score derived from urea along with demographic and other blood test variables was little better (ROC AUC: 0.72).

Higher protein intake was associated with greater weight gain (increase of 1g/kg/day protein associated with weight SD score +0.4 [95%CI +0.2 to +0.6]) but plasma urea was not. Likewise, higher protein intake was associated with increased head growth (+0.7; 95% CI: 0.4 to 1.1), but plasma urea was not.

Conclusions

These data demonstrate a positive relationship between protein intake and plasma urea. They also confirm a known association between increased protein intake and faster weight gain and head growth. However, no urea threshold was reliably indicative of adequate protein intake, nor was plasma urea related to growth velocity.

References (include acknowledgement here if appropriate)

The authors acknowledge the contribution of the NIHR Southampton BRC Data Science Cross-Cutting Theme and the research nurses of the University Hospital Southampton Neonatal Unit, led by Philippa Crowley.

Check box if presenting author is a trainee: basic science trainee ☐ clinical trainee ☒

All authors have approved the abstract, actual or potential conflicts of interest have been declared to the meetings secretary, and the abstract has not been presented previously: ☒

Senior author supporting presentation on day of meeting: Mark J Johnson
NEURODEVELOPMENTAL OUTCOMES OF EXTREMELY PRETERM INFANTS: THEORETICAL AND EPIDEMIOLOGICAL PERSPECTIVES TO GUIDE SHARED-CARE DECISION-MAKING

Authors (Presenting author underlined. If no author is a Society member please provide the name of the member introducing the author to the Society)

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Institution(s)

1Lifecourse Epidemiology Centre & Human Development and Health Academic Unit, University of Southampton; 2Nuffield Department of Women’s & Reproductive Health, University of Oxford; 3Department of Neonatal Medicine, Princess Anne Hospital, Southampton; 4School of Medicine, St. George’s University, Grenada.

Introduction (include hypothesis)

Improvements in the survival of extremely preterm infants (EPIs), in recent years, have not been matched with improvements in neurodevelopmental outcomes, especially for those born at ≤25 weeks. Several national EPI cohorts have, however, advanced our understanding of extreme prematurity’s developmental and life-course consequences. Analyzing the findings from 13 such cohorts, we discuss the theoretical and epidemiological perspectives of NDIs in EPIs to guide communication with families and shared-care decision-making.

Methods (include source of funding and ethical approval if required)

We undertook a descriptive review of multi-centre cohorts including data from ≥4 neonatal units within a specific geographical region(s), in which neurodevelopmental impairments (NDIs) in EPIs were assessed on standardized tests and presented by gestational week. Cohorts initiated before 1 January 1990, those included in randomized or non-randomized intervention studies and those with a sample size ≤70 at 2 years were excluded. We identified 13 multi-centre EPT cohorts cumulatively representing 12,704 EPIs from 10 countries.

Results

Across cohorts, EPIs had (1) lower cognitive, motor, and intelligence scores than term-born peers, (2) higher rates and more severe NDIs, particularly at lower gestational weeks and (3) higher rates of neurobehavioural and psychiatric morbidity during school age and adolescence. Among outcomes, cognition, vision/hearing and cerebral palsy (CP) were most affected. The gestational week threshold for a significant decrease in the risk of cognitive delay was 25 weeks; for CP, motor delay and vision and/or hearing impairments this was 24 weeks. The gestational week threshold for a significant decrease in the risk of severe, moderate-to-severe and moderate NDI was 25, 24 and 24 weeks, respectively. EPI neurocognitive trajectories remained stable across school-age and adolescence. Specific risk factors increased the cumulative risk for NDIs in EPIs above the baseline risk associated with uncomplicated preterm birth. To support health professionals in effectively communicating meaningful information to parents about the current evidence linking NDI risk to extreme prematurity, we compiled a framework consisting of 6 cardinal points to guide shared-care decision-making.

Conclusions

This review summarizes the most up-to-date evidence linking EPT birth with NDI risk from 13 multi-centre cohorts. It is important to highlight the varying aspects of NDI risk when communicating with families who are presented with an imminent extreme preterm birth, both prenatally and throughout their infant’s postnatal care.

References (include acknowledgement here if appropriate)


All authors have approved the abstract, actual or potential conflicts of interest have been declared to the meetings secretary, and the abstract has not been presented previously: ☒

Senior author supporting presentation on day of meeting:
HEALTHCARE PROFESSIONALS’ ATTITUDES TOWARDS EXTREMELY PRETERM BIRTH: A Q-METHODOLOGICAL STUDY

Authors (Presenting author underlined. If no author is a Society member please provide the name of the member introducing the author to the Society)

Dr Katie Gallagher1 introduced by Professor Narendra Aladangady2 Dr Chloe Shaw1, Dr Maryam Parisaei3, Professor Neil Marlow1

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Institution(s)

Institute for Women’s Health, University College London
Homerton University Hospital NHS Foundation Trust; Bart’s and the London School of Medicine & Dentistry
Homerton University Hospital NHS Foundation Trust

Introduction (include hypothesis)

Regional variation in infant outcomes throughout the UK suggests different approaches, knowledge and biases towards infant outcomes and decision making during high-risk delivery, with potential implications for professionals’ ability to communicate prognostic uncertainty with parents.1-3 The aim of this study was to explore the attitudes of maternity and neonatal healthcare professionals towards extremely preterm infants.

Methods (include source of funding and ethical approval if required)

Q methodology explored the attitudes of 160 healthcare professionals (40 midwives, obstetricians, neonatal nurses, neonatologists respectively from perinatal centres) across 4 different NHS Trusts between Jan 2019 – May 2021. This process involved the development of 53 statements from the literature which participants were asked to rank order from strongly agree to disagree in a forced distribution grid, using online software.4 Data was manually entered into PQMethod and analysed by person using centroid factor analysis.

Results

By-person factor analysis identified a number of attitudes both within and across professional groups which significantly differed in their positioning of statements regarding preterm birth (p<0.5). There were 3 groups of attitudes within the midwives, 4 within the obstetricians, 4 within the neonatal nurses and 5 within the neonatologists. Analysis identified only one statement of the 53 where all professional groups reached consensus. Differences in groups of attitudes reflected opinions towards the involvement of parents in decision making, the importance of adverse outcomes on decision making and the impact of technological advances in neonatal care.

Conclusions

Attitudes of healthcare professionals involved in decision making during preterm birth have significant variation within and between professional groups. This has potential implications for both the counselling of parents at the centre of the decision-making process and multidisciplinary relationships.

References (include acknowledgement here if appropriate)


Check box if presenting author is a trainee: basic science trainee ☐ clinical trainee ☐

All authors have approved the abstract, actual or potential conflicts of interest have been declared to the meetings secretary, and the abstract has not been presented previously: ☒

Senior author supporting presentation on day of meeting: Professor Narendra Aladangady
Title (Upper case)

VIEWS OF PARENTS, EX-PATIENTS AND PROFESSIONALS ON LINKAGE OF ROUTINELY RECORDED DATA OF PRETERM BABIES

Authors (Presenting author underlined. If no author is a Society member please provide the name of the member introducing the author to the Society)

M Sawtell¹, E van Blankenstein², T Hall, L Juniper, J Lee, J Kotsoni, T Bilal, N Modi², C Battersby²

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Institution(s)

1. Social Research Unit, UCL Institute of Education, University College London, UK
2. School of Public Health, Faculty of Medicine, Imperial College London, UK

Introduction (include hypothesis)

Linkage of existing datasets offers feasible and low-cost population-level long-term data that are currently lacking, but requires the use of identifiers, temporarily, for linkage purposes. This study aimed to explore the views of parents of preterm babies, adults born preterm, and professionals, on the acceptability of linkage of routinely recorded electronic health and education data for research, as part of an NIHR-funded award (NIHR 300617) held by CB; neoWONDER (neonatal whole population data linkage to improve lifelong health and wellbeing of preterm babies) (1).

Methods (include source of funding and ethical approval if required)

We carried out a mixed method observational study. Focus groups informed the design of a nationally disseminated survey for parents and adults born preterm. This survey explored views on the acceptability of linkage of routine health and educational data. Semi-structured interviews were carried out with respondents who expressed uncertain views, and with health and educational professionals. These were coded and analysed. Survey and interview findings were triangulated using an integrated approach to explore key themes and patterns of shared meaning. Research ethics approvals were obtained (20/YH/0330 IRAS 291612).

Results

Focus groups were conducted with 17 parents. The survey was completed by 543 individuals (499 parents, 44 adults born preterm). Twelve interviews were conducted: six with parents, one with an adult born preterm and five with professionals (three clinicians and two teachers.). Three themes emerged. Theme 1: Data linkage and opt-out consent make sense for improving future outcomes. Theme 2: Information requirements: what, how and when. Theme 3: Looking to the future; the rights of the young person. In theme 1 we found clear demand for better information on long term outcomes and strong support for data linkage with opt-out consent as a method of achieving this. In theme 2 we found support for discussing linkage near to, or following discharge from the neonatal unit, but not sooner than this. In theme 3 we found participants wanted the individuals born preterm to be consulted in the future for their views on the use of their data. All professionals interviewed were strongly supportive of data linkage.

Conclusions

With appropriate information provision, at the right time, parents, adults born preterm, and professionals are supportive of data linkage for research purposes, including where temporary identifiers are used and consent is opt-out. Resources are being co-produced with parents, adults born preterm, and professionals to improve communication and understanding of routine data linkage.

References (include acknowledgement here if appropriate)


Check box if presenting author is a trainee: basic science trainee ☐ clinical trainee ☒

All authors have approved the abstract, actual or potential conflicts of interest have been declared to the meetings secretary, and the abstract has not been presented previously: ☒

Senior author supporting presentation on day of meeting: Dr Cheryl Battersby
Title (Upper case)
CARING FOR BABIES WITH PALLIATIVE CARE NEEDS AND/OR MULTIPLE COMPLEX HEALTH NEEDS WITH AN UNCERTAIN FUTURE IN ENGLAND AND WALES 2015-2020

Authors (Presenting author underlined. If no author is a Society member please provide the name of the member introducing the author to the Society)
Fergus Hamden, Sabita Uthaya, Neena Modi, Julia Lanoue, Cheryl Battersby

Corresponding author e-mail address: c.battersby@imperial.ac.uk

Institution(s)
Chelsea & Westminster Hospital NHS Foundation Trust, Imperial College London

Introduction (include hypothesis)
The prevalence of life-limiting conditions in children is rising, with the highest prevalence in infants under one year of age (1). Neonatal palliative care provision is essential but there is a paucity of data-driven studies to inform the resources needed to support babies and families. We aimed to quantify the number and proportion of babies admitted to neonatal units in England & Wales 2015-2020 with potential requirement for palliative care according to criteria in the 2010 British Association for Perinatal Medicine (BAPM) practice framework (2).

Methods (include source of funding and ethical approval if required)
With the input of an expert group of neonatal and paediatric health professionals, diagnoses and clinical attributes indicating a high likelihood of requiring palliative care were compiled and mapped to categories in the BAPM framework (Figure 1). We extracted data on all babies born and admitted to neonatal units in England & Wales between 1 Jan 2015 and 31 Dec 2020 from the National Neonatal Research Database (NNRD). We report the number and proportion of babies who fulfilled BAPM categories over time, discharge outcomes, and length of stay. Additionally, we examined data for babies who died during the study period and report the proportion who did not fulfil any BAPM category, their gestation, and length of stay. Funding was received from Chelsea & Westminster NHS Foundation Trust, its charity CW+, and True Colours Trust; Research Ethics Committee approval 21/LO/0024.

Results
In total, 12,123/574,954 (2.1%) babies met our pre-defined criteria over the 6 year period. 51% comprised babies in category 4 (postnatal conditions with high risk of severe impairment), 31% category 2 (high risk of significant morbidity or death), 12% category 3 (born at the margins of viability), 3% multiple categories, and 2% category 1 (not compatible with long term survival) (figure 1).
Overall, 6,814/12,123 (56%) of those who conformed to one or more BAPM category were discharged home, 2,385 (20%) were discharged to other settings and 2,914 (24%) died before final neonatal discharge. Over time, numbers in category 3 (birth gestation <24 weeks) increased from 192 babies in 2015 to 264 in 2020. Among babies who met BAPM criteria, median (IQR) length of stay was 3 (1, 12) days in babies who died and 20 (5, 70) days in those who survived to discharge.
Of the 5,914 babies who died during the study period, 3,000 (51%) did not conform to any BAPM category. Of these, 2,630/3,000 (88%) were born prematurely with median (IQR) birth gestation 27 (25, 32) weeks; median (IQR) length of stay was 7 (1, 24) days.

Conclusions
We show that around 2,000 babies admitted to neonatal units each year may have palliative care needs according to existing BAPM categories, as defined following the input of our expert stakeholder group. Around half of babies who die before neonatal discharge are not captured by the current BAPM categories, the majority of whom were born preterm at 24 to 27 weeks gestation.

References (include acknowledgement here if appropriate)
2. BAPM 2010. Palliative Care- A Framework for Clinical Practice
We thank the multiple health professionals whose contributions informed our data definitions for the BAPM categories.

Check box if presenting author is a trainee: basic science trainee ☐ clinical trainee ☒

All authors have approved the abstract, actual or potential conflicts of interest have been declared to the meetings secretary, and the abstract has not been presented previously: ☒

Senior author supporting presentation on day of meeting: Cheryl Battersby
**Figure 1. Outcomes for all babies during study timeframe**

Whole cohort n=574,954

- Any BAPM category met n=12,123
  - BAPM Category 1 n=288
    - 105 discharged home (37%)
    - 128 died (44%)
  - Category 2 n=3,796
    - 1,359 discharged home (36%)
    - 951 died (25%)
  - Category 3 n=1,399
    - 490 discharged home (35%)
    - 779 died (56%)
  - Category 4 n=6,239
    - 4,674 discharged home (75%)
    - 924 died (15%)
  - Multiple categories n=401
    - 186 discharged home (46%)
    - 132 died (33%)

- No BAPM category met n=562,831
  - 369,037 discharged home (65%)
  - 189,045 discharged elsewhere (34%)
  - 3,000 died (<1%)

_BAPM Category 1._ An antenatal or postnatal diagnosis of a condition which is not compatible with long term survival.

_BAPM Category 2._ An antenatal or postnatal diagnosis of a condition which carries a high risk of significant morbidity or death.

_BAPM Category 3._ Babies born at the margins of viability, where intensive care has been deemed inappropriate.

_BAPM Category 4._ Postnatal clinical conditions with a high risk of severe impairment of quality of life and when the baby is receiving life support or may at some point require life support.
CONTINUOUS GLUCOSE MONITORING DURING THERAPEUTIC HYPOTHERMIA FOR HYPOXIC ISCHAEMIC ENCEPHALOPATHY

Authors (Presenting author underlined. If no author is a Society member please provide the name of the member introducing the author to the Society)

Maria-Sofia Kalogeropoulou, Lynn Thomson, Kathryn Beardsall

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Institution(s)

University of Cambridge, Cambridge, UK, Cambridge University Hospitals NHS Foundation Trust, Cambridge Biomedical Campus Cambridge, UK

Introduction (include hypothesis)

Glucose dysregulation is common in infants with hypoxic ischaemic encephalopathy (HIE) and may well exacerbate cerebral injury. Standard methods of glucose measurement result in infrequent and intermittent glucose monitoring. Continuous glucose monitors (CGM) are increasingly being used in patients at risk of glucose dysregulation, but their accuracy could be affected by therapeutic hypothermia. We aimed to evaluate the potential use of CGM in these infants, with the hypothesis that CGM could be a useful adjunct to glucose monitoring and management in infants with HIE.

Methods (include source of funding and ethical approval if required)

This was a single centre feasibility study. Eligibility criteria included: infants >37 weeks gestation, <48 hours of age being managed with therapeutic hypothermia for a diagnosis of HIE, and parental consent. A CGM sensor (DexCom Inc California) was inserted and left in situ for up to 7 days. The clinical staff were blinded to the CGM recordings with clinical decisions based on blood glucose assays. CGM values were compared to time-matched glucose values from the blood gas analyser and NovaStat® Strips, using a Bland-Altman analysis. The study received ethics approval and was sponsored by Cambridge University Hospitals NHS Foundation Trust.

Results

Consent was received from 17 infants with 1827 hours of CGM data being analysed from 16 babies (one infant was withdrawn). CGM values were accurate despite therapeutic hypothermia, mean difference of -0.03mmol/L compared to blood glucose values. The values outside the limits of agreement indicated that CGM under-reads glucose values compared to point of care blood glucose values. There was wide variation in percent time outside the target range (2.6-10mmol/L) between infants. Three patterns of abnormal glucose control: hypoglycaemia (<2.6mmol/L, n=3), hyperglycaemia (>10mmol/L, n=4) and labile glucose (n=4). CGM identified that 44% of infants had ≥1 episodes of hypoglycaemia (<2.6mmol/L) and 50% had ≥1 episodes of hyperglycaemia (>10mmol/L). No adverse events related to CGM were observed.

Conclusions

CGM appears sufficiently accurate to be an adjunct to clinical management during cooling of HIE infants. There is wide variation in glucose dysregulation in infants with HIE, with significant exposure to both hypo- and hyperglycaemia. CGM could be a useful adjunct in the management of babies with HIE to reduce the risk of exposure to both hypoglycaemia and hyperglycaemia.

References (include acknowledgement here if appropriate)

Check box if presenting author is a trainee: basic science trainee ☒ clinical trainee ☐

All authors have approved the abstract, actual or potential conflicts of interest have been declared to the meetings secretary, and the abstract has not been presented previously: ☒

Senior author supporting presentation on day of meeting: Kathryn Beardsall
**Introduction (include hypothesis)**

MRI is a valuable research tool to study the developing brain because it provides unprecedented information about morphology, structural/functional connectivity, and microstructural properties of tissues. All neuroimaging research has the potential to detect incidental findings that can impact individuals and health services; knowledge of the types and prevalence of incidental findings in the neonatal population is growing. Here, we report incidental findings from 3T brain MRI in a research cohort of very preterm infants scanned at term-equivalent age and healthy term-born controls.

**Methods (include source of funding and ethical approval if required)**

Participants were preterm infants born before 32 completed weeks' gestation and healthy term-born controls recruited to the Theirworld Edinburgh Birth Cohort. Exclusion criteria were major congenital malformation, chromosomal abnormality, congenital infection and parenchymal brain injury. 3T MRI brain was performed during natural sleep at term-equivalent age. Images were reported by a paediatric radiologist using a structured system and incidental findings were recorded. Ethical approval was obtained from the National Research Ethics Service (16/SS/0154) and the study was funded by Theirworld.

**Results**

Brain MRI data were available for 291 infants: 190 preterm infants (mean GA 29.3, range 22.1 to 32.6) and 101 term born controls (mean GA 39.4, range 36.3 to 42.1). Incidental findings were detected in 12 (6%) preterm infants including developmental venous anomaly (n=2), focal ischaemic white matter injury (n=2), subarachnoid haemorrhage (n=2), giant cisterna magna (n=1), subdural collection following meningitis (n=1), unusually shaped choroid (n=1), suspected pontine cerebellar hypoplasia (n=1), arachnoid cyst (n=1), and a large middle cranial fossa cyst (n=1). Incidental findings were detected in 32 (32%) healthy term-born infants. The most frequent abnormality was subdural haemorrhage which affected 23 infants (23%). 4 had punctate white matter lesions, 3 had cysts identified (1 subependymal, 1 arachnoid, 1 neuroepithelial) and 4 had mild ventricular enlargement or prominence of extra-axial spaces. 1 infant had low lying cerebellar tonsils and 1 had a developmental venous anomaly. Ten (3%) infants (8/190 preterm and 2/101 term) were referred to clinical services for further assessment with repeat MRI and/or multidisciplinary assessment.

**Conclusions**

Incidental findings are relatively common in very preterm infants and term-born controls imaged at term-equivalent age and should be anticipated in research scans. These data will assist in optimising the accuracy of information sharing with families, informed consent processes and the development of care pathways for managing incidental findings.

**References (include acknowledgement here if appropriate)**


**Check box if presenting author is a trainee: basic science trainee ☐ clinical trainee ☑ (med student)**

All authors have approved the abstract, actual or potential conflicts of interest have been declared to the meetings secretary, and the abstract has not been presented previously: ☑

Senior author supporting presentation on day of meeting: Gemma Sullivan
Introduction (include hypothesis)

Preterm birth results in premature exposure of the brain to the extrauterine environment during a critical period of neurodevelopment with loss of placental support and the intrauterine milieu. This study investigated the association between early brain development and behavioural outcomes at around 18 months of age. We hypothesised that the rate of change in cerebral regional volumes and functional connectivity in the first weeks after birth would be associated with cognitive and emotional development.

Methods (include source of funding and ethical approval if required)

As part of the Developing Human Connectome Project (ERC-funded; ethical approval no: 14/LO/1169), 205 infants born preterm (<37 weeks’ gestation) underwent at least one MRI session in the neonatal period. Infants were imaged either shortly after birth (median postmenstrual age (PMA) at scan: 34.43 weeks, range: 26.71–36.86), at term-equivalent age (median PMA at scan: 41.00 weeks, range: 37.00–45.14), or both (N = 97). Of these, 133 participants underwent neurodevelopmental and psychopathology assessments at 18 months and were included in further analyses. Components reflecting covarying facets of neurodevelopment and psychopathology were derived using principal component analysis (PCA). Relative regional brain volumes and functional connectivity were modelled longitudinally, testing effects of 18-month outcome and longitudinal time-by-outcome interaction on brain structure or function using the Sandwich Estimator Toolbox (Guillaume et al. 2014), controlling for gestational age at birth, sex, motion, and postmenstrual age at scan. Family-wise error corrected cluster-level inference was achieved via a wild bootstrapping procedure (Guillaume and Nichols 2015).

Results

PCA resulted in two significant behavioural components: PC1, reflecting increased psychopathology with concomitant psychomotor delay, and PC2, reflecting increased psychopathology independent of psychomotor delay. Neither brain structure or function were significantly associated with PC1 or time-by-PC1 interaction. However, there was a significant negative effect of time-by-PC2 on left medial orbitofrontal (gyrus rectus) volume (p = .023, 3838 voxels), reflecting that a steeper increase in brain-size adjusted medial orbitofrontal volume was associated with lower expression of PC2. There was also a significant negative time-by-PC2 effect on functional connectivity of left sensorimotor cortex (p = .003, 111 voxels) and precuneus (p = .021, 39 voxels), indicating that a steeper decline in functional connectivity of these regions with the rest of the brain was associated with greater expression of PC2.

Conclusions

Our findings indicate that the rate of longitudinal structural and functional brain development in the first weeks after preterm birth is associated with a behavioural dimension at 18 months reflecting increased psychopathology despite good cognitive, motor and language development.

References (include acknowledgement here if appropriate)


Individualised assessment of regional brain volumes in neonates with Down syndrome reveals extreme deviation in white matter and cerebellum.

Authors (Presenting author underlined. If no author is a Society member please provide the name of the member introducing the author to the Society)

Abi Fukami-Gartner\textsuperscript{1,2}, Ana A. Baburamani\textsuperscript{1}, Ralica Dimitrova\textsuperscript{1}, Prachi A. Patkee\textsuperscript{1}, Jonathan O’Muircheartaigh\textsuperscript{1,2}, and Mary A. Rutherford\textsuperscript{1,2}.

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Institution(s)

1. Centre for the Developing Brain, School of Biomedical Engineering and Imaging Sciences, King’s College London, St. Thomas’ Hospital, London, SE1 7EH, UK.
2. MRC Centre for Neurodevelopmental Disorders, King’s College London, London, SE1 1UL, UK.

Introduction (include hypothesis)

There are relatively few early neuroimaging studies of Down syndrome (DS), despite being the most common genetic cause of intellectual disability affecting approximately 1 in 1000 births worldwide. The aim of this study was to identify brain regions, and tissue types, which deviate significantly in volume from norm in neonates with DS using z-scores extracted from robust normative modelling. We hypothesised that, in particular, the frontal white matter would be smaller than norm in neonates with DS.

Methods (include source of funding and ethical approval if required)

T2-weighted brain scans were acquired on a Philips Achieva 3T MRI scanner at St Thomas’ Hospital (London) for neonates with DS (n = 20, 50% female) and typically developing controls (TDC, n = 493, 49% female) from the developing Human Connectome Project (dHCP). We generated growth curves of typical brain development from 32–46 weeks post-menstrual age using Gaussian Process Regression (accounting for sex and age) allowing z-scores for each brain region to be extracted for each individual neonate\textsuperscript{1}.

Results

Once corrected for sex and age, birth weight and scan weight were not significantly different between DS and TDC neonates. However, whole brain volumes for the DS group were significantly smaller than TDC (total tissue volume, TTV, median z-score = -1.64, pFDR <0.0001). Looking at specific tissue segments, and controlling for differences in brain size (i.e., TTV), the cingulate white matter (WM) (median z-score = -2.55, pFDR <0.0001), the cerebellum (median z-score = -1.73, pFDR <0.0001), the frontal WM (median z-score = -1.64, pFDR = 0.003), the insular WM (median z-score = -1.62, pFDR <0.0001), and the occipital WM (median z-score = -0.99, pFDR <0.0001) occupied significantly smaller proportions of the brain in DS neonates compared to TDCs. Furthermore, the lateral ventricles (median z-score = +1.07, pFDR <0.0001) were significantly larger than norm.

Conclusions

In addition to well-documented cerebellar hypoplasia and ventriculomegaly, here we have identified that neonates with DS have markedly reduced volumes in the cingulate, frontal, insular and occipital WM segments compared to TDC.

References (include acknowledgement here if appropriate)


Check box if presenting author is a trainee: basic science trainee ☒ clinical trainee ☐

All authors have approved the abstract, actual or potential conflicts of interest have been declared to the meetings secretary, and the abstract has not been presented previously: ☒

Senior author supporting presentation on day of meeting: Professor Mary Rutherford (+ introduced by Professor David Edwards to the Neonatal Society Spring Meeting).
EARLY BREAST MILK EXPOSURE IS ASSOCIATED WITH CORTICAL MATURATION IN PRETERM INFANTS

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Institution(s)

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Introduction (include hypothesis)

Breast milk exposure is associated with improved neurocognitive outcomes following preterm birth but the neural substrates linking nutrition with outcome are uncertain. Neonatal MRI studies have shown that high breast milk exposure enhances white matter microstructure but effects on the developing cortex have not yet been described. By combining nutritional data with brain MRI, we tested the hypothesis that high versus low breast milk exposure in preterm infants during neonatal care results in a cerebral cortical morphology that more closely resembles that of infants born at term.

Methods (include source of funding and ethical approval if required)

We studied 135 preterm (mean GA 30±2 weeks, range 22±1 to 32±6) and 77 term-born infants (mean GA 39±4 weeks, range 36±3 to 42±1). Ethical approval was obtained from the National Research Ethics Service (16/SS/0154) and the study was funded by Theirworld. Daily nutritional intake was collected from birth until hospital discharge to identify the proportion (%) of days preterm infants received exclusive breast milk feeds. Structural and diffusion MRI were performed at term-equivalent age. Cortical indices (volume, thickness, surface area, gyrification index, sulcal depth and curvature) and water diffusion parameters (fractional anisotropy [FA], mean diffusivity [MD], radial diffusivity [RD], axial diffusivity [AD], neurite density index [NDI], and orientation dispersion index [ODI]) were calculated. Brain imaging features residualised against age at MRI were compared between preterm infants who received exclusive breast milk for <75% of inpatient days, preterm infants who received exclusive breast milk for ≥75% of inpatient days and healthy term-born controls using one-way ANOVA or Kruskal Wallis. Pairwise comparisons were performed using post hoc t-test or Mann Whitney U. Reported p-values were adjusted for false-discovery rate and effect sizes were calculated using Cohen’s d.

Results

68 preterm infants received exclusive breast milk for <75% of inpatient days and 67 preterm infants received exclusive breast milk for ≥75% of inpatient days. High compared with low breast milk exposure was associated with reduced cortical grey matter volume (d=0.47, p=0.014), thickness (d=0.42, p=0.039) and RD (d=0.38, p=0.039), and increased FA (d=0.38, p=0.037) after adjustment for age at MRI. The gyrification index, surface area, MD, AD and ODI were significantly different in preterm infants when compared to term-born controls but within the preterm group there was no effect of breast milk on these features.

Conclusions

High versus low breast milk exposure in the weeks following preterm birth is associated with a cerebral cortical imaging phenotype that more closely resembles the brain morphology of healthy infants born at term. Breast milk may offer an intervention to optimise early cortical development following preterm birth.

Check box if presenting author is a trainee: basic science trainee ☐ clinical trainee ☐

All authors have approved the abstract, actual or potential conflicts of interest have been declared to the meetings secretary, and the abstract has not been presented previously: ☒

Senior author supporting presentation on day of meeting: James Boardman
Comparison of 18 months cognition, motor, and language outcomes with early childhood WPPSI IV and Movement Assessment Battery (MABC-2) in children with moderate or severe HIE.

Authors (Presenting author underlined. If no author is a Society member please provide the name of the member introducing the author to the Society)

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Introduction (include hypothesis)

Sequela from hypoxic-ischemic-encephalopathy (HIE) is a leading cause of disability in term infants. BayleyIII is the preferred standardised developmental outcome assessment for HIE populations at 18 months and yields norm-referenced and age-adjusted measures of cognition, language and motor skills. Different standardised assessment tools have been developed for use at later ages. We explored whether BayleyIII at 18mths can predict age-adjusted measures of cognition, language, and motor skills at 3-5yrs. In this investigation, we used WPPSI-IV (language, Full Scale IQ (FSIQ)) and MABC-2 for Children.

Methods (include source of funding and ethical approval if required)

The validity of the methods used for developmental assessment at two subsequent time-points was established prior to outcome analysis in a study of 82 term-born infants with moderate or severe HIE undergoing therapeutic hypothermia (TH) only or TH+ breathing 50%Xenon gas for 18h (ethics: 09/H0106/64&62382). BayleyIII scores at 18±1mths were compared with WPPSI-IV and MABC-2 scores at 3-5yrs of age. Six children with severe developmental delay at 3-5yrs were re-tested with BayleyIII with comparison of raw scores. For the available testable children (n=55), stepwise regression analyses with 7 independent variables: BayleyIII cognition, language & motor standardised scores (median 100 SD=15), sex, test-age (years) at 2nd examination, Deprivation Indices (Gov.UK) from birth address and Maternal education (1-4) were used to predict WPPSI-IV FSIQ (mean100 SD=15) and MABC-2 total scores (mean10SD=3).

Results

61 participants, 33♂, 28♀ completed testing at both time points. Tests used did not have gender specific norms. For the 6 children with severe CP, BayleyIII raw scores between the two assessment time points showed little change for cognition. Language and motor raw scores numerically improved at 3-5yrs, however only corresponding to the same developmental level as at 18mth $R^2=0.53-0.93$. For the 55 testable children, regression analysis found BayleyIII motor & cognitive scores, test-age, and maternal education as significant predictors of FSIQ ($R^2 =0.657$, $p <0.05$). Only BayleyIII motor scores and test-age were significant for MABC-2 total scores ($R^2=0.546; p<0.05$). Language skills (WPPSI-IV verbal comprehension) had $R^2=0.4$ with two significant variables; BayleyIII combined cognition and language and testing-age. For all regressions, exact test-age in years was a significant variable with a 5.7-point decrease in FSIQ each year and 1.2 point increase in annual MABC-2 total score. Sex and Deprivation Score were never significant predictors in the regressions.

Conclusions

For children with severe developmental delay, not testable with WPPSI, BayleyIII raw scores were excellent outcome predictors both at 18mths and 3-5 years in all domains. For normal (testable) children, the WPPSI test battery is age-adjusted allowing study design to include a range of ages at test point. However, in our HIE cohort, there was a strong age dependence of FSIQ results which need accounting for. HIE children in a prospective study should preferably be examined at the same age.

References (include acknowledgement here if appropriate)


Check box if presenting author is a trainee: clinical trainee ☑️. All authors have approved the abstract ☑️, actual or potential conflicts of interest have been declared to the meetings secretary, and the abstract has not been presented previously.
SIGNATURES OF ALTERED ENERGY METABOLISM IN THE URINE OF NEWBORNS WITH SUBSTANTIAL BRAIN INJURY AFTER HYPOXIC ISCHAEMIC ENCEPHALOPATHY.

Authors (Presenting author underlined. If no author is a Society member please provide the name of the member introducing the author to the Society)

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Introduction (include hypothesis)

Hypoxic Ischaemic Encephalopathy (HIE) is an important condition with substantial morbidity and mortality, that is often associated with brain injury (1). Establishing specific metabolomic signatures in the urine of cooled newborns with substantial brain injury could potentially aid in the determination of which babies are suitable for neuroprotective treatment. Hypothesis: metabolomic profiling of urine from babies undergoing therapeutic hypothermia (TH) may reveal differential expression of major energy metabolism pathways associated with substantial brain injury.

Methods (include source of funding and ethical approval if required)

Urine samples were collected on day 1 from babies undergoing TH between January 2014 and August 2015 as part of the Brain Injury Biomarkers in Newborns Study (BIBiNS) from four tertiary neonatal centres. Untargeted metabolomic analysis was performed on the 57 collected samples of urine, using H-NMR spectroscopy.

Results

Of 53 newborns for whom urine samples and cerebral MR images were available, 20 had images predictive of adverse neurodevelopmental outcomes (2). In newborns with substantial brain injury, the abundance of 11 compounds was significantly altered including pyruvate, lactate, citrate, succinate and fumarate (p=0.04). These metabolites are key components of the major energy metabolism pathways including glycolysis, pyruvate oxidation, and the citric acid or Krebs cycle. The upregulation of pyruvate, citrate, succinate and fumarate suggests an increase in aerobic respiration in the newborns with substantial brain injury. However we speculate that the upregulation of lactate suggests that the aerobic metabolic pathway may be reaching saturation, hence resulting in anaerobic glycolysis. We also noted a significant change in the urine metabolome composition between days 1 to 5 in newborns undergoing TH.

Conclusions

This exploratory study demonstrates that as early as day 1, a metabolomic signature is present in the urine of newborns undergoing TH, that reflects an alteration in energy metabolism when the consequence of HIE is substantial brain injury. Such metabolomic signatures may be useful in the future in selecting babies for neuroprotective treatment.

References (include acknowledgement here if appropriate)


Check box if presenting author is a trainee:  basic science trainee ☐  clinical trainee ✔

All authors have approved the abstract, actual or potential conflicts of interest have been declared to the meetings secretary, and the abstract has not been presented previously: ☐

Senior author supporting presentation on day of meeting:
The Neonatal Transfer Service London (NTS) became concerned that the COVID-19 pandemic had inadvertently affected transfer patterns during a non-targeted, retrospective annual service review. We therefore explored the hypothesis that 2020 was associated with later emergency transfers for neonates requiring clinical care escalation to a tertiary neonatal unit.

Methods (include source of funding and ethical approval if required)

We compared emergency uplift postnatal transfers from January 1st to December 31st in 2018, 2019 and 2020 using data from the electronic medical record system ‘BadgerNet’ (Clevermed, UK). The outcome measures were number of transferred neonates and postnatal age at transfer with patient stratification by gestational age at birth (extremely preterm <28 weeks, very preterm <29-31 weeks, moderate to late preterm 32-36 weeks and term ≥ 37 weeks) and birth weight. Linear regression was applied to postnatal age at transfer across the three years and mean values were adjusted for the covariates birth weight and month of transfer. This service evaluation was registered with the Clinical Effectiveness Unit at Barts Health NHS Trust. Ethics committee approval and consent were not required as per UK Health Research Authority guidance and there was no funding.

Results

The total number of emergency transfers was similar across the three year period and there were no differences between birth gestational age (p=0.08) and birth weight (p=0.07). There were differences in the postnatal age of neonates transferred. Emergency transfers were undertaken at an older postnatal age in 2020 for neonates born extremely preterm (2018: 1.8±0.3, 2019: 1.7±0.4, 2020: 3.5±0.7 days; p=0.01, adjusted p=0.02), very preterm (2018: 3.7±0.4, 2019: 4.6±0.5, 2020: 5.3±0.5 days; p=0.03, adjusted p=0.04) and term (2018: 1.8±0.1, 2019: 2.0±0.1, 2020: 2.5±0.1 days; p<0.001, adjusted p=0.001). Emergency transfers for neonates born moderate to late preterm were undertaken at similar postnatal age across the three years (2018: 3.4±0.3, 2019: 3.8±0.2, 2020: 3.7±0.3 days; p=0.5, adjusted p=0.4).

Conclusions

The COVID-19 pandemic was associated with a later postnatal age for emergency uplift transfers to tertiary neonatal units of extremely preterm, very preterm and term neonates despite the number of transfers, patient numbers and characteristics remaining similar across the three years. We highlight this subtle change in the management of neonates requiring intensive care because of its potential to adversely affect clinical outcomes akin to those reported in the paediatric patient population during the pandemic.

Check box if presenting author is a trainee:  basic science trainee ☐  clinical trainee X

All authors have approved the abstract, actual or potential conflicts of interest have been declared to the meetings secretary, and the abstract has not been presented previously: X

Senior author supporting presentation on day of meeting: Burak Salgin
Introduction

Many infants born preterm require respiratory support at birth with positive pressure ventilation (PPV), delivered by T-piece device. Some are known to deliver a pressure ‘spike’ more than the set peak inspiratory pressure (PIP) in benchtop testing\(^1,2,3\). We sought to determine if this spike occurred in clinical practice during PPV and explored its correlation with tidal volume (Vt) delivered.

Methods

This analysis includes data from studies using RFM (respiratory function monitor) in two neonatal tertiary centers (“V. Buzzi” Children’s Hospital, Milan, Italy, and at John Radcliffe Hospital, Oxford, UK) using two different T-piece devices (Neo Puff, Fisher & Paykel, Auckland, New Zealand, and GE Panda, GE Medical, Chicago, Illinois, USA) for resuscitation of preterm infants. RFM (New Life Box; Neo-RSD; Advanced Life diagnostics UG, Weener, Germany) recorded the first 15 minutes after birth and starting flow was 8-10 l/min in both centers. All the inflations were analysed on a breath-by-breath basis and considered if leakage < 30%, Vte was ≥ 2 ml/kg (obstruction, glottis closure) and no spontaneous breaths were detectable within the inflations. Vte with GE Panda was calculated as the cumulative Vte of the spike and the plateau. To account for physiological changes during the initial transition which might affect lung response to the pressure delivered, dynamic lung compliance (Cdyn) was calculated for every inflation. Thus, we divided inflations according to different Cdyn (≤ 0.3 ml/cmH\(_2\)O/kg and > 0.3 ml/cmH\(_2\)O/kg). Local IRBs approved the study.

Results

A total of 128 inflations in 8 babies (4 in each center) were analysed. The mean gestational age was 25.2 weeks (±0.4), and the mean birth weight was 756 g (±157). PIP spikes were visible in all inflations delivered with GE Panda, and in none of those delivered with Neo-Puff. The mean spike duration was 131 ms (±24.6) and the max PIP during spike was 43.6 cmH\(_2\)O. There was no significant difference in mean Vte/kg between devices during the low Cdyn phase, 4.24 ml (±1.20) with GE Panda vs 4.45 ml (1.29) with Neo-Puff (p=0.53), nor during the high Cdyn phase, 7.20 ml (±1.15) with GE Panda vs 7.84 ml (±2.51) with Neo-Puff (p=0.18). Vti and Vte are significantly correlated with the spike’s duration (Pearson correlation 0.51 and 0.614 respectively, p<0.001).

Conclusions

The PIP spike seen in benchtop testing is visible in all PPV breaths given with the GE Panda device. Our data showed that spikes are not related to an increase in volume delivered, which is not significantly different between Panda and Neo-Puff, irrespective of the lung compliance variations. This is explainable with the short duration of the spikes. Worryingly, there is a positive correlation between the duration of the spike and the volume delivered with GE Panda. Further research is needed to ascertain the clinical significance of these PIP spikes and whether they may have a detrimental effect on preterm lungs.

References


Check box if presenting author is a trainee:  
- basic science trainee  
- clinical trainee  

All authors have approved the abstract, actual or potential conflicts of interest have been declared to the meetings secretary, and the abstract has not been presented previously: x

Senior author supporting presentation on day of meeting: Sanja Zivanovic
CUMULATIVE HYPOXIA, SOCIOECONOMIC DEPRIVATION AND NEURODEVELOPMENTAL OUTCOMES IN PRETERM INFANTS

Authors (Presenting author underlined. If no author is a Society member please provide the name of the member introducing the author to the Society)

Ouralia Kaltsogianni1, Theodore Dassios1,2 Poonam Belani, Anusha Arasu³, Anne Greenough1,3.

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Introduction (include hypothesis)

Hypoxia and socioeconomic deprivation can adversely affect cognition and neurodevelopmental outcomes (1). Conversely, higher levels of educational attainment of the primary caregiver seem to ameliorate neurocognitive and academic outcomes (2). We have tested the hypothesis that hypoxia and socioeconomic deprivation would be independently associated with impaired neurodevelopment in preterm infants and would have opposing effects and that higher maternal education might mitigate the effects of hypoxia.

Methods (include source of funding and ethical approval if required)

A retrospective cohort study was undertaken at a tertiary neonatal unit between 2015 and 2018. The percentage of time with pulse oximetry (SpO₂) <75% was measured from the nursing records, from admission to 36 weeks postmenstrual age in infants born <30 weeks gestational age. The multiple deprivation index (MDI) and the main care giver’s education domain of the MDI were also recorded. The motor, cognitive and language domain scores of the Bayley-III assessment were recorded at 24 months of postmenstrual age.

Results

A total of 93,767 data points from 80 infants (34 male) with a median (IQR) gestational age of 27.9 (25.9-29.0) weeks and a birth weight of 0.94 (0.74-1.23) kg were analysed. The median (IQR) motor score [103 (91-110)] was significantly related to the median (IQR) time with SpO₂<75% [1.5 (0.9-3.4)]% (adjusted p=0.020). The median (IQR) cognitive score [100 (90-105)] was negatively significantly related to the time with SpO₂<75% (adjusted p=0.012) and the median (IQR) education decile of the MDI [7 (6-9), (adjusted p=0.011)]. The median (IQR) language score [91 (77-100)] was significantly positively related to the education domain of the MDI (adjusted p=0.025). In the infants with severe hypoxia (N=20), the education decile did not significantly correlate with either motor (p=0.732), cognitive (p=0.957) or language (p=0.578) scores of the Bayley’s assessment. In the infants without severe hypoxia (N=60), the education decile correlated significantly with the motor (p<0.001), cognitive (p<0.001) and language scores (p<0.001) of the Bayley’s assessment.

Conclusions

Hypoxia in preterm infants exerts a negative effect on motor function and cognition in preterm infants and conversely, higher educational attainment had a positive effect on cognition and language at two years of age, particularly in those who had not suffered severe hypoxia.

References (include acknowledgement here if appropriate)


Check box if presenting author is a trainee: basic science trainee ☐ clinical trainee ☑

All authors have approved the abstract, actual or potential conflicts of interest have been declared to the meetings secretary, and the abstract has not been presented previously: ☑

Senior author supporting presentation on day of meeting: Professor Anne Greenough
WORK OF BREATHING AT DIFFERENT TIDAL VOLUME TARGETS IN NEWBORN INFANTS WITH CONGENITAL DIAPHRAGMATIC HERNIA

Authors
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Introduction
Congenital diaphragmatic hernia (CDH) results in varying degrees of pulmonary hypoplasia. Volume targeted ventilation (VTV) is a lung protective strategy1 utilised in many neonatal populations, but the optimal target tidal volume in CDH infants has not previously been studied. The aim of this study was to test the hypothesis that lower targeted volumes would be better in CDH infants as determined by measuring the work of breathing (WOB) in CDH infants, at three different targeted tidal volumes.

Methods
A randomised cross-over study of infants born with CDH after surgical repair of the diaphragmatic defect was conducted. Targeted tidal volumes of 4, 5, and 6ml/kg were each delivered in random order for 20 minute periods with 20 minute periods of baseline (pressure limited) ventilation in between. The primary outcome of the WOB was assessed using the pressure-time product of the diaphragm (PTPdi) calculated at the end of each 20 minute period. Study approved by the London – Camden and King’s Cross REC and the HRA, (16/LO/0887)

Results
Nine infants with a median gestational age at birth of 38+4 (range 36+4 - 40+6) weeks and median birth weight 3202 (range 2855 - 3800) grams were studied. One infant had a right sided defect. One infant had a fetal endoscopic tracheal occlusion sited (FETO), which was removed in utero at 34 weeks of gestation. The antenatally observed/expected lung-to-head ratio (LHR) was available for six infants, with a median LHR of 42% (range 24 – 55%). Two infants were diagnosed with CDH postnatally. Comparison of the PTPdi at the different levels of volume targeting was statistically significant <0.001 at the adjusted significance level (p=<0.01) to conduct the interim analysis. Post hoc analysis with Bonferroni correction, identified the PTPdi was significantly higher at 4ml/kg than at both 5ml/kg, p=0.008, and 6ml/kg, p= 0.012. There was no significant difference between the PTPdi at 5ml/kg and 6ml/kg.

Conclusions
Volume targeted ventilation (VTV) of 5ml/kg reduced the work of breathing, measured by PTPdi, in post-op infants with predominantly mild-moderate CDH. VTV of 4ml/kg demonstrated an increased WOB compared to baseline ventilation and all other VTV levels studied.

References

All authors have approved the abstract, actual or potential conflicts of interest have been declared to the meetings secretary, and the abstract has not been presented previously:

Senior author supporting presentation on day of meeting: Professor Anne Greenough