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

PARALLEL SESSION 9 - CIRCULATION 1

ID 205. OPTICLAMP - A QUALITY IMPROVEMENT PROJECT INCREASING OPTIMAL CORD MANAGEMENT IN PRETERM BABIES IN A NEONATAL INTENSIVE CARE UNIT (NICU) IN THE UNITED KINGDOM (UK).

Doctor Helen McDermott[1], Mrs Helen Cockcroft[1], Dr Shammah Gbenga–Ojo[1], Charlotte Pearce[2], Georgina Morris[2], Gishi Sashidharan[1], Dr Miriam Watts[1], Dr Sarah Louise Williamson[1]

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Background

Deferring umbilical cord clamping for >60 seconds after birth, known as optimal cord management (OCM) is the recommended management for babies <34 weeks in the UK. It is associated with a 27% reduction in mortality risk, reduction in blood transfusion and need for inotropic support in the preterm population. Our NICU was identified as having a low OCM rate compared to national data in 2021.

Aim

To improve from 20.4% from 2021 National Neonatal Audit Project (NNAP) data, to 80% of babies <34 weeks with OCM over a 12–month period.

Methods

We formed a core team of maternity and neonatal professionals and completed process mapping, cause and effect and driver diagrams. This identified four key target areas: education, environment, equipment and processes.

Results

From February 2022 to February 2023, the percentage of babies <34 weeks receiving >60 seconds of OCM has improved from 37% to 79% (fig1). It has continued to improve throughout 2023.

The first PDSA cycle was to change our resuscitation documentation to include a section to specifically record this and transfer onto electronic records.

The second PDSA cycle was increasing awareness, through safety and champion meetings, labour ward specialty council and an expanded core group to include obstetric and theatre representatives.

We performed a staff survey to identify barriers, motivating factors and understanding between PDSA cycles two and three. This identified education as a key factor and the provision of clocks in visible areas.

The third PDSA cycle was to change our practice, so a neonatal practitioner was present in theatre during surgical deliveries to facilitate joint decision making and support maternity colleagues.

The fourth PDSA cycle is underway with targeted education sessions being delivered to obstetric, midwifery, neonatal medic and nursing teams. Anaesthetic and theatre staff will also be included.

We have monitored admission temperature to ensure OCM does not have an intended negative consequence of increasing rates of hypothermia.

Conclusion

This demonstrates significant improvement using current staff members and existing equipment. Ongoing work to sustain this improvement includes a clinical guideline, education, simulation sessions and exploring the possibility of stabilisation with the cord intact.

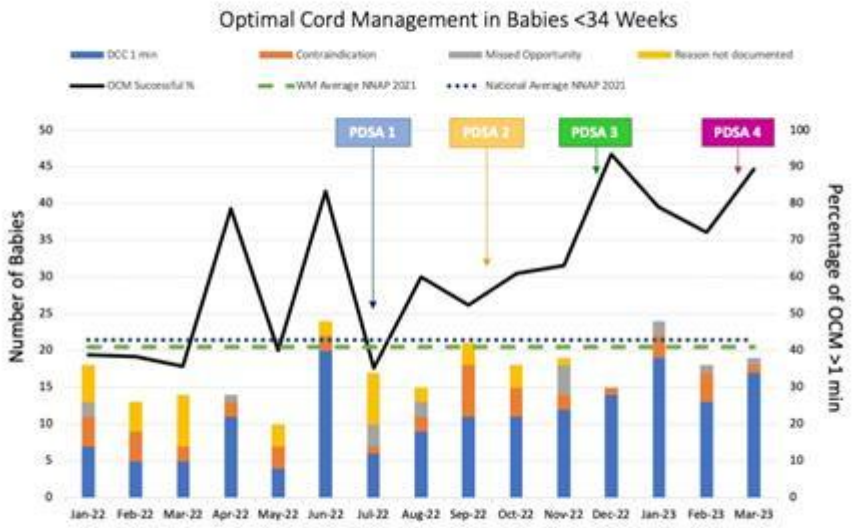

Fig 1.

None declared

ID 304. ASSESSMENT OF MYOCARDIAL FUNCTION IN INFANTS OF MOTHERS WITH GESTATIONAL DIABETES MELLITUS USING DEFORMATION IMAGING OVER THE FIRST YEAR OF AGE

Doctor Aisling Smith[1], Professor Orla Franklin[2], Professor Naomi McCallion[1,3], Professor Fionnuala Breathnach[4], Professor Afif EL–Khuffash[1,3]

[1]Department of Neonatology, The Rotunda Hospital, Dublin, Ireland, [2]Children's Health Ireland at Crumlin, Dublin, Ireland, [3]Department of Paediatrics, The Royal College of Surgeons in Ireland, Dublin, Ireland, [4]Department of Obstetrics & Gynaecology, The Rotunda Hospital, Dublin, Ireland

Introduction

An increasing number of studies have highlighted impaired biventricular myocardial function and altered pulmonary haemodynamics during the early newborn period in infants of mothers with gestational diabetes mellitus (GDM). The aim of this study was to serially assess myocardial performance and pulmonary vascular resistance (PVR) in infants of mothers with GDM over the first year of age and to compare them to a group of controls.

Methods

This was a prospective, observational study. Echocardiography was performed at birth, 6 months and 1 year of age. Pulmonary artery acceleration time (PAAT) and left ventricular (LV) eccentricity index (LVEI) provided measurements of PVR. Biventricular function was assessed using deformation analysis.

Results

Fifty infants of mothers with GDM were compared to 50 controls with no difference in gestation (38.9 ± 0.8 vs 39.3 ± 0.9 weeks, p = 0.05) or birthweight (3.55 ± 0.49 vs 3.56 ± 0.41 Kg, p=0.95). Mothers with GDM had a higher BMI (31 ± 6 vs 25 ± 5, p < 0.01). At one year of age PAAT was lower (70 ± 11 vs 79 ± 10, p=0.01) and LVEI higher (1.1 ± 0.2 vs 1.0 ± 0.1, p<0.01) in the GDM group. LV global longitudinal strain (24.7 ± 1.9 vs 28.8 ± 1.8 %, p<0.01), LV systolic strain rate (1.8 ± 0.2 vs 2.1 ± 0.3 1/s, p<0.01) [Figure 1], and RV free wall strain (31.1 ± 4.8 vs 34.6 ± 3.9 %, p<0.01) were lower in the GDM cohort at 1 year of age (all p values adjusted for gestation, mode of delivery and maternal BMI).

Conclusion

Our findings demonstrate sustained abnormal elevation of pulmonary pressures and impaired biventricular performance in infants of mothers with GDM in comparison to controls that do not normalise by one year of age. At present data is limited to explain the biological underpinnings of the findings described in our study. Overall there is a now a growing body of evidence suggesting that GDM is a significant neonatal cardiovascular risk factor and greater surveillance of infants of mothers with GDM with increasing age may be warranted.

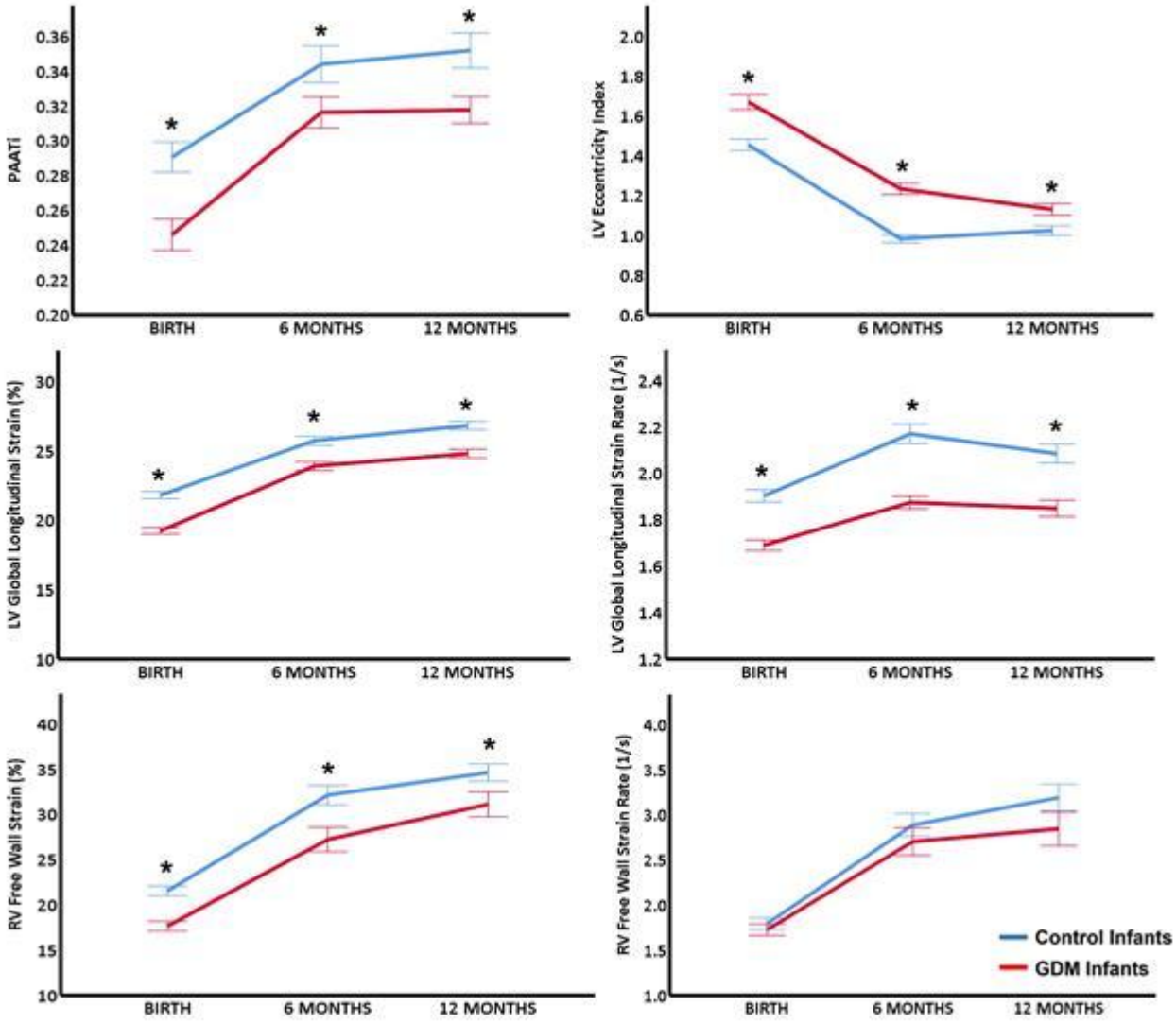

Figure 1: Pulmonary Haemodynamics & Biventricular Myocardial Function Over The First Year of Age in the GDM and Control Cohorts

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None declared

ID 164. Predicting fluid responsiveness with ultrasound in a neonatal intensive care setting

Professor Koert de Waal[1,2], Dr Enrico Petoello[1]

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Background

There are strong and consistent associations between fluid overload and adverse clinical outcomes in intensive care patients, so it is important to assess each patient's fluid status and fluid responsiveness before additional fluid is administered. The mini–fluid challenge test uses the Frank–Starling principles to assess dynamic fluid responsiveness based on changes in stroke volume. The aim of this study is to test the feasibility of a standardized mini–fluid challenge in a neonatal intensive care setting and predict fluid responsiveness.

Methods

This prospective observational study included any infant in our neonatal intensive care where a fluid bolus was prescribed for clinical reasons. Cardiac ultrasound was used to measure left ventricular peak velocity of stroke volume before and after a 3 ml/kg fluid bolus was given over 5 minutes. An increase of more than 15% was considered fluid responsive. The outcome of the mini–fluid challenge was not used to guide additional treatments. Short term clinical outcomes within 4 hours after the mini–fluid challenge were collected to detail additional fluid boluses and/or start of inotropes, and an oxygenation index was calculated to describe respiratory support changes as proxy for extravascular lung water changes.

Results

Thus far 11 preterm infants with late onset sepsis and 5 infants with other pathology were studied (table). Four infants (25%) were fluid responsive. Fluid non-responders showed a higher rise in oxygenation index compared to responders (+0.7 versus +0.4). Clinical outcomes and requirement of additional fluid or inotropes in the 4 hours after the mini-fluid challenge was not directly associated with fluid responsiveness.

Conclusion

The mini-fluid challenge is feasible in the neonatal intensive care setting and followed the physiological principles of stroke volume and extravascular lung water changes. The mini-fluid test enhanced the clinicians' ability to determine the need for fluid compared to clinical changes alone. Further study will be required to review the optimal bolus volume and definition of fluid responsiveness in preterm and term neonates.

Nr	Gestation (weeks)	Indication for prescribing fluid	Main pathophysiology	% change in stroke volume	change in oxygenation index
1	24	Hypotension	LOS	+5	+1.9
2	25	Hypotension	LOS	+17	+1.2
3	25	Hypotension	LOS	+5	+4.9
4	26	Hypotension	LOS	+5	+1.1
5	27	Hypotension	LOS	+9	-0.7
6	25	Hypotension	LOS	+16	-0.1
7	28	Hypotension	LOS	+18	-0.4
8	28	Poor perfusion	LOS	+4	-0.2
9	25	Poor perfusion	LOS	+3	-1.6
10	26	Poor perfusion	LOS	+12	+1.6
11	27	Tachycardia	LOS	+2	+0.1
12	34	Poor perfusion	Gastroschisis	-10	-1.0
13	37	Poor perfusion	Gastroschisis	-1	+0.0
14	32	Poor perfusion	congenital CMV	-14	-1.1
15	41	Tachycardia	Meconium	+7	+3.1
16	36	Hypotension	HIE	+37	+0.8

Mini–fluid challenge and outcomes in 16 neonates. LOS, late onset sepsis, HIE, hypoxic ischemic encephalopathy

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none declared

ID 954. Decoding Sleep Patterns in Preterm Infants: Leveraging Convolutional Neural Networks and Multi-Modal Feature Extraction from Near-Infrared Spectroscopy

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Decoding Sleep Patterns in Preterm Infants: Leveraging Convolutional Neural Networks and Multi–Modal Feature Extraction from Near–Infrared Spectroscopy

Background:

Sleep is important for brain development in (pre)term infants. Accurate and non–invasive monitoring of sleep stages active sleep (AS) and quiet sleep (QS) is essential for assessing the quality of sleep, guiding clinical interventions, and thereby optimizing sleep in the neonatal intensive care unit (NICU). Cerebral Near–Infrared Spectroscopy (NIRS) is more and more common in the NICU, and signals are affected by physiological processes that can be potentially used for sleep quantification. We aimed to assess AS and QS by means of a single (NIRS) sensor.

Methods

A single NIRS sensor was placed on the forehead and NIRS was recorded at 100Hz in 10 preterm infants admitted to our NICU. We extracted eight features from the raw NIRS signals, including heart rate (HR) and respiratory rate (RR). These features were then fed to a deep convolutional neural network (CNN) model to classify AS versus

QS. We assessed the performance of the proposed CNN model in two cross–validation approaches (i.e., data pooling and leave–one–subject–out (LOSO)). The accuracy, balanced accuracy, F1–score, and Kappa were assessed. We also compare the performance of the classifier with six benchmark classifiers including K–Nearest Neighbors, Naive Bayes, Support Vector Machines, Random Forest, AdaBoost, and XGBoost.

Results:
The results showed an outperformance of the proposed CNN model over the benchmark classifiers in terms of accuracy (average at 88%), balanced accuracy (94%), F1–score (91%), and Kappa (95%) in the data pooling cross–validation. Likewise, the model outperformed the benchmark classifiers in the LOSO cross–validation approach.

Conclusion
The study demonstrated that using a single Near–Infrared Spectroscopy (NIRS) sensor and a deep convolutional neural network (CNN) model can effectively classify active and quiet sleep stages in preterm infants in the neonatal intensive care unit. This research suggests that the combination of NIRS and CNN holds great potential for optimizing neonatal sleep monitoring and thereby guiding interventions to improve the quality of sleep in infants admitted to the NICU.

None declared