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Abstracts

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ABS 1

MOLECULAR AND GENETIC MARKERS FOR PREDICTION OF RESISTANCE TO INOTROPIC THERAPY IN NEWBORNS WITH ARTERIAL HYPOTENSION

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INTRODUCTION

Arterial hypotension is a common problem in NICU. The incidence of arterial hypotension is 16-52%. Various therapeutic strategies are used for cardiovascular support, including volume expansion, inotropes (mainly dopamine), corticosteroids. But there is a group of premature newborns, who demand a higher dose of dopamine for BP normalization or need a longer therapy, in comparison with newborns of the same gestational age. The goal of our study was to evaluate molecular-genetic markers of dopamine tolerance in newborn with hypotension.

METHODS

Criteria of inclusion: preterm newborn + arterial hypotension (mean BP < GA in weeks) + dopamine therapy. Criteria of exclusion: congenital anomalies, obvious signs of a hypovolemia and shock. We checked efficiency of therapy (BP normalization [mBP ≥ GA]), total duration of inotrope support and total dose of dopamine, which was required. SNPs were genotyped by PCR for predictors, associated with arterial hypertension (ACE:287bp Ins>Del;ADD1:1378G>T[Gly460Trp];AGT:704[803]T>C[Met235Thr];AGT:521C>T[Thr174Met];AGTR1:1166A>C;AGTR2:1675G>A;CYP11B2:-344C>T;GNB3:825C>T[Ser275Ser];NOS3:-786T>C;NOS3:894G>T[Glu298Asp];EDN1:G>T[Lys198Asn];ADRA2A:-1291C>G;ADRB2:79C>G[Gln27Glu];PRCP:449A>C[Asp112Glu];MMP9:-1562C>T) and genes polymorphism, associated with expression of dopamine and serotonin receptors (HTR1A-1019[1016]C>G;HTR2A102C>T[S34S];SLC6A2-182T>C;DRD2C32806TC>T[Glu713Lys];DRD3C>T[Gly9Ser];DRD4C-521TC>T).

RESULTS

51 newborns were accepted according to the criteria of inclusion. Genes polymorphism was interpreted depending on the response to therapy. The total dose of dopamine was 360-329,820 mkg/kg (Me-13,740 mkg/kg), the total duration was 3-720 h (Me-67 h). Newborns were split into 2 groups: with low tolerance, total dose less than 13,740 mkg/kg (n = 26) and high tolerance, dose higher than 13,740 mkg/kg (n = 25). BW was 1,570 ± 731 g and 1,597 ± 770 g (p = 0.698), GA was 31.3 ± 3.4 w and 30.6 ± 3.8 w (p = 0.49). 1378G>T genotype in ADD1(rs4961), -1291C>G genotype in ADRA2A(rs1800544), -182T>C genotype in SLC6A2(rs2242446) and 287bp Ins>Del genotype in ACE(rs4340) were associated with high tolerance to dopamine (p = 0.039, p = 0.00054, p = 0.026, p = 0.024). The created mathematical model allows predicting the response to therapy of arterial hypotension on a genotype of the patient (sensitivity 88%, specificity 94%).

CONCLUSIONS

Several SNPs of genes coding ADD1, ADRA2A, SLC6A2 and ACE can predict high tolerance to dopamine therapy in newborns with hypotension. Considering that these SNPs associated with high risk of arterial hypertension in adult, we can propose, that high tolerance to dopamine in newborns can predict the higher risk of arterial hypertension in adults. Further research is needed.

ABS 2

GUT AND CEREBRAL OXYGENATION FROM BIRTH TO SIX WEEKS OF LIFE IN PRETERM INFANTS: WHAT IS NORMAL?

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INTRODUCTION

Near Infrared Spectroscopy (NIRS) provides a non-invasive, contemporaneous bedside measurement of regional tissue oxygenation reflecting perfusion and metabolism. To date the majority of articles regarding the neonatal clinical application of NIRS focus on cerebral measurements, but there is an increasing interest in its use measuring gut/splanchnic oxygenation. NIRS could give a better understanding of how neonatal physiology changes over time, potentially offering a window to identify disease processes earlier. We aim to establish currently lacking norms of gut and cerebral oxygenation for preterm infants of different gestational/postnatal ages.

METHODS

We examined the first 20 infants < 30 w gestation admitted to Homerton Hospital NICU recruited to our study (after REC approval and consent) from Oct 2016 to May 2017. Exclusion criteria: birthweight ≤ 2nd centile, abnormal antenatal Doppler or major congenital anomalies. NIRS (NIRO-300, Hamamatsu KK, Japan) probes were placed on the abdomen and forehead weekly for 60 minutes allowing simultaneous measurement of gut and cerebral Tissue Oxygenation Index (TOI). Subsequently Fractional Tissue Oxygen Extraction (FTOE) and Splanchnic Cerebral Oxygenation Ratio (SCOR) were calculated. Each NIRS recording was analysed in 5 minute epochs (noisy epochs removed) and an average taken to give the final results for each individual infant's weekly recordings. Weekly clinical status was also recorded.

RESULTS

Study infants had a median gestational age of 25^{+5} weeks (range 23^{+4} to 28^{+5}), median birthweight of 850 g (range 550 g to 1,160 g) and 55% were female. 80% were Caucasian/White and 20% were Asian/Afro-Caribbean. Two of the recruited infants developed necrotising enterocolitis (NEC); both developed it in week 5 of life. One was medically treated and one transferred to a surgical centre but died before surgery. Four of the infants developed haemorrhagic parenchymal infarcts (HPI); three in week 1 of life and one in week 3 of life. One infant developed both NEC and a HPI. Data from these infants was excluded from the subsequent analysis of the weekly NIRS recording. The mean weekly gut and cerebral TOI, FTOE, SCOR, as well as haemoglobin level and volume of enteral feeds (measured on the same day as the NIRS recording) of the study group after these exclusions are presented in **Tab. 1**.

CONCLUSIONS

Our initial results (recruitment ongoing: target 50) show cerebral TOI (cTOI) is greater than splanchnic TOI (sTOI), but splanchnic FTOE (sFTOE) is greater than cerebral FTOE (cFTOE). As far as we know regional oxygenation for the first 6 weeks of life in preterm infants has not been studied before. Once regional norms are established it increases the clinical potential of NIRS on neonatal units to alert clinicians to deviations from the norm, potentially allowing identification of important diseases sooner.

ABS 3

CHANGES OF NT-PROBNP CONCENTRATION WITHIN THE FIRST WEEK OF LIFE IN PRETERM NEWBORNS WITH BIRTH WEIGHT ≤ 1,200 G

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Table 1 (ABS 2). Weekly cerebral and splanchnic perfusion measurements, haemoglobin and volume of enteral feeds.

Week of life	Mean cTOI (std)	Mean cFTOE (std)	Mean sTOI (std)	Mean sFTOE (std)	Mean SCOR (std)	Mean haemoglobin [g/dl] (std)	Mean volume of enteral feeds [ml/kg/day] (std)
1 (n = 13)	72.4 (10.8)	0.20 (0.12)	46.7 (23.0)	0.49 (0.26)	0.61 (0.29)	127.4 (15.8)	14.8 (20.4)
2 (n = 12)	70.0 (8.8)	0.26 (0.10)	37.7 (17.6)	0.58 (0.20)	0.57 (0.25)	117.1 (12.7)	66.4 (51.4)
3 (n = 11)	59.5 (12.2)	0.33 (0.14)	42.8 (14.6)	0.53 (0.17)	0.73 (0.25)	108.4 (14.3)	93.3 (64.2)
4 (n = 13)	61.9 (8.4)	0.31 (0.09)	54.4 (15.3)	0.39 (0.18)	0.80 (0.17)	102.8 (17.9)	121.8 (53.1)
5 (n = 11)	61.3 (4.4)	0.33 (0.07)	44.4 (17.0)	0.51 (0.19)	0.73 (0.23)	108.9 (15.5)	138.9 (42.7)
6 (n = 8)	65.7 (10.3)	0.27 (0.11)	48.7 (10.1)	0.46 (0.11)	0.76 (0.20)	98.0 (13.9)	149.6 (53.9)

cTOI: cerebral Tissue Oxygenation Index (TOI); cFTOE: cerebral Fractional Tissue Oxygen Extraction (FTOE); sTOI: splanchnic TOI; sFTOE: splanchnic FTOE; SCOR: Splanchnic Cerebral Oxygenation Ratio (splanchnic TOI/cerebral TOI).

INTRODUCTION

NT-proBNP is a peptide produced mainly by cardiomyocytes as a by-product, during production of BNP. It has no confirmed biological activity. The main cause for over secretion of this peptide is heart congestion (especially left ventricle congestion). Transition period and massive changes in circulation in this time influence on changes in NT-proBNP concentration. Patent arterial duct as common health problem of extremely preterm newborns is responsible for increase in Nt-proBNP concentration. Some authors propose NT-proBNP as an indicator of significance of PDA, but there is no threshold values determining the hemodynamic significance of PDA. In this work we try to examine the fluctuations of NT-proBNP concentrations during the first week of life in preterm newborns with birth weight ≤ 1,200 g. The effort to evaluate the influence of PDA hemodynamic status on differences in NT-proBNP concentration was done.

METHODS

51 infants were included in the study. An average maturity was 26.3 weeks of GA and mean birth weight was 836.4 g. Parents of all babies, gave written informed consent. All infants participating in the study were born in the Polish Mather's Memorial Hospital and were treated in The Department of Neonatology. In each infant, the concentration of NT-proBNP was determined four times (respectively in the 1st, 2nd, 4th, 7th day of life) (**Fig. 1**). Simultaneously with blood collection (± 2 hours) echocardiography was performed. The data obtained were subjected to statistical analysis. The maximum, minimum, mean and median concentration was checked for all population and compared in group with different PDA status.

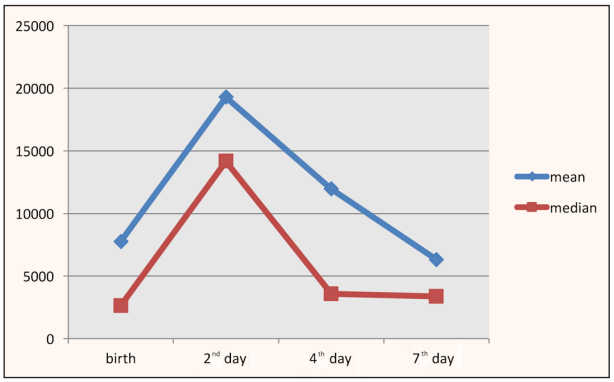

Figure 1 (ABS 3). Changes in mean and median NT-proBNP concentration in all examined babies (pg/ml).

RESULTS

The highest concentrations of NT-proBNP were observed on the second day of life. There was no significant difference in serum NT-proBNP dependent on sex, weight, maturity at birth. There were significant correlations between NT-proBNP and the diameter of the PDA and the ratio LA/Ao on the second and the fourth day of life. The strength of this correlation decreases in the subsequent days of life. The mean concentration of NT-proBNP was higher in patients with hsPDA compared to patients without hsPDA on each tested day. The largest differences were noted on the second day of life (respectively median: 31,540 pg/ml vs. 7,582 pg/ml).

CONCLUSIONS

Postnatal period has a pronounced effect on the concentration of NT-proBNP, with increase in concentration just after a birth and a subsequent fall to perinatal levels till the 7th day of life. The strongest correlation between NT-proBNP and hemodynamic significance of PDA occurs on the 2nd day of life. Therefore, concentrations of NT-proBNP assessed during the second day of life seem to have the best value in assessing the hemodynamic significance of PDA. Serum concentration of NT-proBNP, especially in the second day of life, as well as the maximum increase in the concentration of NT-proBNP from birth to the second day of life, can be a useful tool to qualify for the early-targeted therapy due to hsPDA.

DECLARATION OF INTEREST

The study was funded by Ministry of Science and Higher Education Republic of Poland from the budget for science in the years 2010-2013 as a research project.

ABS 4

RESISTANCE INDEX (RI) OF ARTERIA CEREBRI ANTERIOR AND CEREBRAL OXYGENATION IN PRETERM INFANTS

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INTRODUCTION

To investigate, the influence of resistance index (RI) on cerebral oxygenation (cTOI) in preterm infants during the first 24 hours after birth.

METHODS
This is a part-analysis of the prospective randomised controlled study "Avoiding Hypotension In Preterm infants". The cTOI was measured using near infrared spectroscopy (NIRS) (NIRO 200NX, Hamamatsu, Japan) in preterm neonates. NIRS sensor was placed on the left forehead as soon as possible after birth and cTOI was measured continuously after placement for 24 hours. Peripheral arterial oxygen saturation (SpO_2) was continuously measured by pulse oximetry. During the first 24 hours a cranial ultrasound was performed in every preterm infant routinely including the measurement of resistance index (RI) in arteria cerebri anterior. A Correlation-analysis was performed between RI and cTOI as well as between RI and SpO_2.
RESULTS
Between October 2013 and July 2015, 60 preterm infants were included and data of 51 preterm infants were analysed in this study. The mean gestational age was 32.6 ± 1.95 weeks and the mean birth weight was 1,869.9 ± 514.3 g. The mean cTOI and RI were 70.5 ± 8.5% und 0.75 ± 0.09. There was a statistically significant negative correlation between RI and cTOI as well as between RI and SpO_2 ($p = 0.015$, $\varrho = -0.338$).
CONCLUSIONS
In preterm infants during the first 24 hours after birth, RI has an influence on the cerebral oxygenation. Increasing RI values were associated with lower cerebral tissue oxygenation in preterm infants.

ABS 5

THE INFLUENCE OF MATERNAL MEDICATION ON CLOSURE OF THE DUCTUS ARTERIOSUS IN THE PREMATURE NEWBORN

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INTRODUCTION
The aim of this study is to evaluate which maternal medication administered during pregnancy might be associated with an altered incidence of patent ductus arteriosus (PDA) and/or an altered response to postnatal treatment with ibuprofen. Acquiring more insight in factors that affect ductal closure could eventually give reason to implement a more active approach in selective cases than the frequently preferred watchful waiting.
METHODS
Premature infants admitted to the Neonatal Intensive Care Unit with gestational age ≤ 28 weeks and/or birth weight ≤ 1,000 g were recruited from the Department of Neonatology at the Radboudumc, classified by ductal status and divided in two groups: one without a PDA or with a PDA for which an expectant management was considered to be sufficient, and one with a PDA for which treatment was indicated. Exclusion criteria were congenital heart defects, chromosomal anomalies, pulmonary hypertension and death before the age of 7 days. In each group of infants, data concerning all maternal pharmaceuticals administered during pregnancy were retrospectively collected from medical records.
RESULTS
The group without a treated PDA comprised 65 infants; the group with a treated PDA consisted of 67 infants. Initially, maternal exposure to indomethacin seemed to be significantly more frequent in the infants with a relevant PDA (23.1% compared to 3.1% in the other group, $p = 0.019$). After adjustment for differences in gestational age and birth weight between the two groups however, statistical significance was lost ($p = 0.055$). Maternal exposure to methyldopa was remarkably more frequent, although not statistically significant, in the infants without a relevant PDA compared to infants with a treated PDA (32.8% and 13.8% respectively). Calcium channel blockers and antimicrobial agents showed strikingly yet not significantly more frequent maternal exposure in the group of infants with a relevant PDA.
CONCLUSIONS
The results suggest that very low birth weight infants antenatally exposed to indomethacin have no significantly increased risk of a PDA with treatment indication. However, the increased incidence may have been statistically significant in a larger cohort. More research is needed in order to decide whether a more active approach concerning the screening and treatment of PDA is warranted in infants antenatally exposed to indomethacin.

ABS 6

INFLUENCE OF GLOBAL HYPOXIA AND REMOTE ISCHEMIC POSTCONDITIONING ON NATRIURETIC PEPTIDE EXPRESSION IN NEWBORN PIGLET HEART CHAMBERS

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INTRODUCTION

Neonatal encephalopathy (NE) caused by perinatal hypoxia-ischemia (HI) occurs in 1 to 3 out of 1,000 newborns. It carries significant morbidity and mortality. Ischemia due to cardiovascular dysfunction may increase the severity of the NE. Remote ischemic postconditioning (RIPC) may be neuroprotective after NE. To our knowledge, the effect of RIPC on the multi-organ damage seen after HI has not been investigated. RIPC is known to reduce cardiac ischemia-reperfusion injury, and it is possible that the effect of RIPC on NE is in part mediated by ameliorating cardiac injury. Natriuretic peptide (NP) and vascular endothelial growth factor A (VEGF) are possible biomarkers of cardiac HI.

METHODS

In this study we investigated whether RIPC affects myocardial mRNA expression of NP and VEGF in a newborn piglet HI model. A standardized global HI insult was conducted in 50 piglets randomised post HI to RIPC or supportive treatment alone. Anesthesia only was performed in four sham piglets. Piglets were euthanized 72 hours after HI and transmural biopsies from each heart chamber were frozen immediately. mRNA expression of brain natriuretic peptide (BNP), atrial natriuretic peptide (ANP) and VEGF were measured in heart biopsies (**Fig. 1A**). To examine the contribution of genetic make-up to intra-group variability we performed a

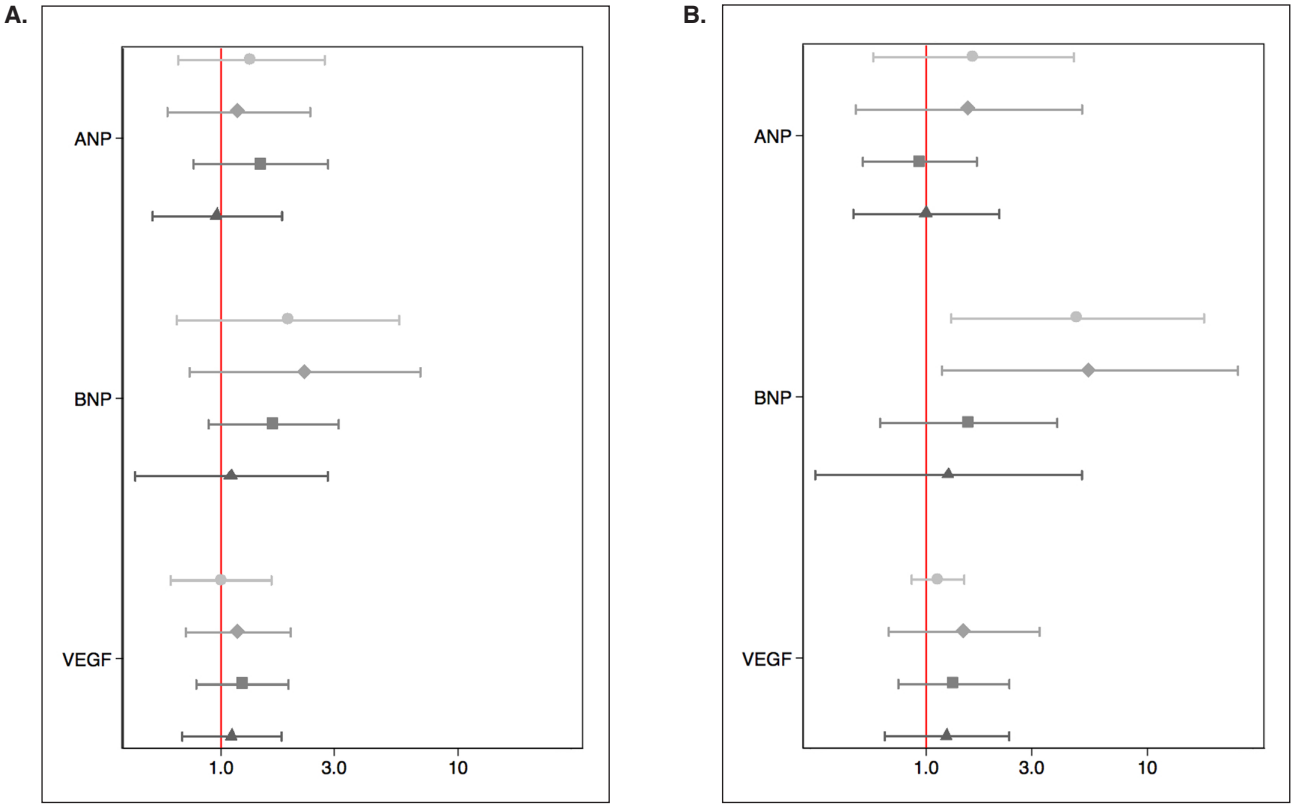

Figure 1 (ABS 6). Effect of remote ischemic postconditioning (RIPC) on mRNA expression. **A.** Unadjusted data. **B.** Within litter comparison.
Ratios of RIPC/No treatment. Mean with 95% CI.
ANP: atrial natriuretic peptide; BNP: brain natriuretic peptide; VEGF: vascular endothelial growth factor A.
Circle: left ventricle; diamond: right ventricle; square: left atrium; triangle: right atrium.

secondary analysis comparing RIPC to supportive treatment by litter (cluster analysis) (**Fig. 1B**).

RESULTS

mRNA expression in the heart chambers showed the expected distribution with the highest levels of ANP expressed in the atria and the highest level of VEGF in the ventricles. BNP did not differ between atria and ventricles. In our primary analysis myocardial BNP, ANP and VEGF mRNA expression at 72 h after HI were not influenced by RIPC. A secondary analysis of sibling pairs revealed a significantly higher level of BNP after RIPC in both ventricles.

CONCLUSIONS

RIPC did not alter BNP, ANP or VEGF mRNA expression in piglet myocardium after HI. Within litters comparisons showed higher ventricle BNP levels after RIPC, suggesting that RIPC does have some influence on myocardial BNP expression. The lack of association between RIPC and myocardial ANP and VEGF mRNA expression indicate that any potential neuroprotective effect from RIPC may not ne mediated by an effect on the myocardium.

ABS 7

EXPERIENCE OF INFANTS BORN WITH A DIAGNOSIS OF DOWN SYNDROME IN A TERTIARY NEONATAL CENTRE: BURDEN OF DISEASE AND LENGTH OF HOSPITAL STAY

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INTRODUCTION

The incidence of structural abnormalities and early neonatal morbidity in infants with Down syndrome (DS) is under-reported. Many advocate keeping infants with confirmed or suspected DS on the postnatal ward to facilitate early bonding and the establishment of feeding. We hypothesize that the majority of infants with a suspected or confirmed diagnosis of DS require admission due to the high incidence of early neonatal morbidities. We aimed to examine the rate of admission to the postnatal ward (PNW) versus primary NICU admission, and to present the rate of important morbidities including congenital heart disease (CHD), echocardiography confirmed persistent pulmonary hypertension of the newborn (PPHN) and gastrointestinal disorders.

METHODS

This was a retrospective cohort study of infants born with DS between January 2011 and June 2016. Relevant clinical demographics, admission details, early neonatal morbidities, NICU related treatments, neonatal outcomes and length of hospital stay were recorded.

RESULTS

121 infants were included. Forty nine (41%) were delivered via a cesarean section with a median maternal age and parity of 37 [33-39] years and 2 [1-3] respectively. Antenatal diagnosis occurred in 31 (26%) who had a higher overall rate of structural anomalies (19/31 [61%] vs. 21/90 [23%], $p < 0.01$). There was a high incidence of structural anomalies and neonatal morbidities: 84 (69%) CHD; 41 (34%) PPHN; 21 (17%) polycythaemia; 15 (12%) gastrointestinal morbidity; and 60 (49%) neonatal jaundice. 67 (55%) were admitted directly to NICU while 54 (45%) infants were initially cared for on PNW of which 38 were later admitted to NICU; only 16 (13%) remained on the PNW prior to discharge. **Tab. 1** illustrates the morbidities in the three admission groups. PPHN was an independent predictor of death before discharge (adjusted OR 11 [95% CI 2-110]).

CONCLUSIONS

The incidence of echocardiography confirmed that PPHN in our cohort is much higher than that reported in the literature. The presence of identifiable antenatal anomalies increases the likelihood of an antenatal diagnosis. However, infants initially admitted to the PNW have a high likelihood of requiring NICU admission and have a high rate of neonatal morbidity. Therefore, elective admission of all infants with Down syndrome is recommended to screen for PPHN, CHD and other important co-morbidities, facilitating timely diagnoses and shorter overall hospital stays.

Table 1 (ABS 7). Demographics and morbidities in the three admission groups.

	Primary NICU admission (n = 67)	NICU after PNW (n = 38)	PNW care only (n = 16)	p
Gestation (weeks)	38.0 [34.4-39.0]	38.5 [37.7-39.1]	38.9 [37.1-39.6]	0.10
< 34 weeks	11 (16)	0	0	< 0.01
Birth weight (kg)	2.9 [2.3-3.4]	2.9 [2.7-3.3]	3.1 [2.7-3.7]	0.51
Caesarean section	35 (52)	10 (26)	4 (25)	0.01
Small for gestation	17 (25)	7 (8)	0	0.07
Male gender	29 (43)	23 (61)	10 (63)	0.15
5 minute Apgar score	9 [8-10]	10 [9-10]	10 [10-10]	< 0.01
Antenatal diagnosis	28 (42)	2 (5)	1 (6)	< 0.01
Any CHD	56 (84)	24 (63)	4 (25)	< 0.01
AVSD	20 (30)	3 (8)	1 (6)	< 0.01
PPHN	28 (42)	11 (29)	1 (13)	0.06
GI morbidity	12 (18)	3 (8)	0	0.09
Polycythaemia	13 (19)	8 (21)	NA	0.14
Jaundice	32 (48)	19 (50)	9 (56)	0.83
Ventilation days	4 [2-9]	4 [3-4]	NA	0.62
O_2 days	13 [5-26]	13 [8-16]	NA	0.63
Inotropes	15 (22)	5 (13)	0	0.08
Nitric Oxide	14 (21)	4 (11)	0	0.07
First pH	7.34 [7.28-7.37]	7.36 [7.33-7.38]	NA	0.04
pCO_2 (Kpa)	6.0 [5.6-7.0]	5.5 [4.8-6.2]	NA	< 0.01
HCO_3- (mmol/L)	23.4 [21.0-25.0]	23.1 [21.6-25.0]	NA	0.91
First haemoglobin (g/L)	197 [186-206]	215 [201-208]	NA	0.02
Platelets (10^3/microL)	151 [100-201]	169 [102-208]	NA	0.39
White blood cells (x10^9/L)	18.6 [12.9-24.0]	21.1 [16.4-26.7]	NA	0.02
TAM	5 (8)	1 (3)	0	0.34
Days on TPN	7 [2-11]	3 [2-11]	NA	0.69
Hospital days	26 [11-47]	26 [19-29]	NA	0.20
Death	7 (10)	0	0	0.05

Data are presented as medians [IQR] or count (%) and compared using the Kruskal-Wallis test or Chi square/Fisher's exact test as appropriate. CHD: congenital heart disease; AVSD: atrioventricular septal defect; PPHN: persistent pulmonary hypertension of the newborn; GI: gastrointestinal; TAM: transient abnormal myelopoiesis; TPN: total parenteral nutrition; NA: not applicable.

ABS 8

LEFT AND RIGHT MYOCARDIAL PERFORMANCE ASSESSMENT IN INFANTS BORN TO MOTHERS WITH GESTATIONAL HYPERTENSION

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INTRODUCTION

Assessment of myocardial performance in neonates using advanced techniques such as deformation imaging and rotational mechanics has gained considerable interest. Their applicability in elucidating abnormal myocardial performance in various clinical scenarios is becoming established. We hypothesise that infants born late preterm/term to mothers with gestational hypertension (GH) may have impaired left (LV) and right (RV) ventricular performance during the early neonatal period. We aimed to assess LV and RV function over the first 48 hours of age using conventional and advanced

Table 1 (ABS 8). Myocardial function in the two groups.

	Gestational hypertension (n = 15)	Control (n = 30)	p
Time of scan (hours after birth)	27 [23-46]	27 [14-42]	0.53
Heart rate	128 (9)	119 (15)	0.07
PDA and LV dimensions			
PDA presence	1 (8%)	9 (31%)	0.13
PDA diameter (mm)	2.8	2.0 (0.6)	0.22
LA: Ao	1.3 (0.2)	1.2 (0.1)	0.72
MV annular diameter (mm)	9.9 (1.3)	9.4 (1.1)	0.21
LVEDD (mm)	18 (2)	18 (2)	0.94
Septal wall thickness (mm)	2.6 (0.5)	2.6 (0.4)	0.96
LV posterior wall thickness (mm)	2.0 (0.5)	2.3 (0.6)	0.14
LV length (mm)	27 (2)	28 (2)	0.34
LV function			
Ejection fraction (%)	53 (6)	61 (6)	< 0.01
Global longitudinal strain (%)	-21 (2)	-25 (3)	< 0.01
Global longitudinal systolic SR (1/s)	-1.8 (0.3)	-2.0 (0.3)	0.07
Apical rotation (°)	12 (6)	17 (5)	0.01
Basal rotation (°)	1.6 (3.6)	0.9 (4.3)	0.63
Twist (°)	10 (6)	16 (6)	0.02
Twist rate (°/s)	114 (40)	151 (47)	0.04
Untwist rate (°/s)	-147 (69)	-188 (53)	0.06
RV function and dimensions			
RV length (mm)	26 (4)	27 (2)	0.39
TV annular diameter (mm)	9.8 (1.6)	9.9 (1.4)	0.89
RV mid cavity diameter (mm)	12.4 (1.1)	12.9 (1.4)	0.26
TAPSE (mm)	8.2 (1.6)	8.4 (1.1)	0.59
RV fractional area change (%)	24 (6)	25 (4)	0.88
RV longitudinal strain (%)	-24 (5)	-25 (4)	0.75
RV longitudinal SR (1/s)	-1.9 (0.5)	-2.3 (0.8)	0.27

Values are presented as medians [inter-quartile range], means (SD) or absolute value (%).
PDA: patent ductus arteriosus; LA:Ao: left atrial to aortic root ratio; MV: mitral valve; LVEDD: left ventricular end diastolic diameter; LV: left ventricle; SR: strain rate; RV: right ventricle; TV: tricuspid valve; TAPSE: tricuspid annular plain systolic excursion.

functional techniques in infants born to mothers with GH (who were in receipt of antihypertensive medication) and compare them to infants born to healthy mothers.

METHODS

This was a cross sectional study carried out over the first 48 hours of age in term/late preterm infants (> 33^{+6} weeks gestation) born to mothers with GH. We excluded mothers who subsequently developed diabetes, preeclampsia, clinical chorioamnionitis, absent/reversed end diastolic flow in the umbilical arteries anytime during the pregnancy. A control group comprising infants born to healthy mothers was used for comparison. Infants underwent comprehensive echocardiographic assessment to measure biventricular function using conventional methods (ejection fraction [EF]), deformation imaging (LV and RV systolic longitudinal strain and systolic strain rate), LV rotational mechanics (apical rotation, basal rotation, twist, twist rate and untwist rate), and RV-specific functional parameters (tricuspid annular plane systolic excursion [TAPSE] and fractional area change [FAC]).

RESULTS

Fifteen infants with maternal GH and 30 age matched controls were enrolled. GH infants exhibited no difference in birth weight, LV or RV length but had lower EF, LV global longitudinal strain, apical rotation, LV twist and twist rate (**Tab. 1**, all $p < 0.05$). There were no differences in any of the RV functional parameters. On linear regression, Group assignment (GH vs. Control) remained

independently associated with LV GLS, EF, apical rotation, LV twist but not twist rate (controlling for maternal age and birthweight).

CONCLUSIONS

We have identified with the use of novel echocardiography techniques that infants born to mothers receiving antihypertensive therapy for gestational hypertension have evidence of left ventricular dysfunction when compared to healthy controls. Right ventricular function appears to be spared. Further research is warranted to explore the impact of an abnormal *in utero* haemodynamic environment and exposure to cardio-tropic medication on both fetal and neonatal myocardial performance and to evaluate the potential long-term implications of this.

ABS 9

CHRONOLOGICAL EX-UTERINE ADAPTATION OF HEMODYNAMIC PERFORMANCE IN VERY LOW BIRTH WEIGHT (VLBW) PRETERM INFANTS

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INTRODUCTION

Severe complications of preterm birth often arise from failure of hemodynamic adaptation from fetal to neonatal life. Recent application of electrical cardiometry (EC) provides a new opportunity for noninvasive, continuous and real-time assessment of hemodynamic performance in preterm infants. The aim of this study was to explore the chronological changes of hemodynamic performance in the very immature infants, and to compare them between the normal and the diseased.

METHODS

We prospectively enrolled VLBW (birth weight < 1,500 g) infants who were admitted to our NICU within the first day of life from Dec. 2015-Jun 2016. EC was applied by the standard method using 4 ECG leads. Cardiac index (CI, cardiac output adjusted by BSA), stroke volume (SV), index of contractility (ICON), heart rate (HR), mean arterial blood pressure (MAP) and systemic vascular resistance (SVR) were measured every 5 minutes and continuously for the first 72 hours of life. Signals with quality of less than 80% and patients with major structural congenital anomalies were excluded. Normal group was infants without birth asphyxia, hemodynamic significant PDA (hsPDA), sepsis or Gr. 3/4 IVH. Diseased group comprised of patients with hsPDA, Gr. 3/4 IVH or death within 7 days of life. Independent t-test was made to compare the data between two study groups. General estimating equation (GEE) was made to compare the chronological data within time and between groups.

RESULTS

There were 22 normal and 17 diseased. Gestational age, birth weight, gender ratio was 28.4 ± 2.7 (mean ± SD) weeks, 1,077 ± 292 g, 15:7 (M:F) and 25.5 ± 1.9 (mean ± SD) weeks, 820 ± 180 g, 13:4 (M:F), in normal and diseased groups, respectively. Sequential values in the normal infants are as follows: Hours 0-24, 25-48, 49-60; CI-BSA (L/min/m^2) 2.13 ± 0.43, 2.20 ± 0.29, 2.48 ± 0.61; SV (mL) 1.47 ± 0.58, 1.52 ± 0.45, 1.64 ± 0.59; ICON 68.8 ± 20.2, 73.2 ± 15.4, 91.0 ± 37.5; HR (bpm) 142 ± 11, 147 ± 11, 154 ± 11; MAP (mmHg) 37 ± 8, 37 ± 6, 37 ± 7; SVR (dyn • s/cm^5) 15,437 ± 5,858, 13,470 ± 3,801, 12,520 ± 4,173. In comparison to the normal group, contractility (ICON), SV and MAP were lower in the diseased, and HR was elevated, from day 1 to day 3.

CONCLUSIONS

Cardiac output increases chronologically within the first 3 days of life. Postnatal increase in cardiac output is attributable to both increases in HR and contractility. Hemodynamic compromise is correlated to detrimental events during the immediate postnatal life.

ABS 10

HEMODYNAMIC RELEVANCE OF PATENT DUCTUS ARTERIOSUS IN PRETERM INFANTS ASSESSED BY CEREBRAL OXYGENATION OF FREQUENCY DOMAIN NEAR-INFRARED SPECTROSCOPY, ECHOCARDIOGRAPHIC AND DOPPLER-ULTRASOUND PARAMETERS AND NT-PROBNP: A PROSPECTIVE OBSERVATIONAL STUDY

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INTRODUCTION

What constitutes a hemodynamically relevant patent ductus arteriosus (hrPDA) in preterm infants is unclear. Different clinical and echocardiographic parameters are used, but a gold standard definition is lacking. The objective was to evaluate regional cerebral tissue oxygen saturation $rcStO_2$ and fraction of tissue oxygen extraction $rcFtO_2E$ measured by frequency domain near-infrared spectroscopy (FD-NIRS) and their correlation to echocardiographic, Doppler-ultrasound, N-terminal proBNP (NT-proBNP) and clinical parameters in preterm infants with and without a hrPDA.

METHODS

In this prospective observational study, 22 infants < 1,500 g (mean [± SD]: gestational age 28.6 [± 1.8] weeks, birth weight 1,076 [± 284] g, median (interquartile range) postnatal age at measurement 7.6 [4.6-12.9] d) with a clinical suspicion of ductal patency were analysed. 12 infants had left-to-right shunt through PDA, and in 6 of these the PDA was classified as hrPDA based on pre-defined clinical and echocardiographic criteria. FD-NIRS, echocardiographic and Doppler-ultrasound examinations were performed and levels of NT-proBNP determined. After identification of blood haemoglobin (Hb) as confounding factor, $rcStO_2$ and $rcFtO_2E$ were corrected for this effect.

RESULTS

Overall mean ± standard deviation (normalized to a median HB of 13.8 mg/dl) was 57 ± 5% for $rcStO_2$ and 0.39 ± 0.05 for $rcFtO_2E$. Comparing no-hrPDA with hrPDA infants, there were no significant differences in mean $rcStO_2$ (58 ± 5% vs. 54 ± 5%; p = 0.09), but in mean $rcFtO_2E$ (0.38 ± 0.05 vs. 0.43 ± 0.05; p = 0.03). Echocardiographic parameter, Doppler indices and NT-proBNP (n = 17) did not correlate with cerebral oxygenation.

CONCLUSIONS

Oxygen transport capacity of the blood should be taken into account in NIRS data interpretation. Cerebral oxygenation determined by FD-NIRS provides additional information for treatment decisions for PDA not provided by either echocardiographic, Doppler-ultrasound or NT-proBNP measurements.

ABS 11

PREDICTIONS OF CARDIORESPIRATORY MORBIDITY AFTER DISCHARGE FROM THE NICU IN THE EXTREME PRETERM INFANT WITHOUT CHRONIC LUNG DISEASE

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INTRODUCTION

Pulmonary vascular disease (PVD) and cardiac dysfunction are recognized components of chronic lung disease (CLD) and contribute to significant morbidity beyond the neonatal period. Impairments of the developing pulmonary circulation in the preterm infant without CLD may not be severe enough to be clinically recognized as pulmonary hypertension, but may still lead to pulmonary morbidity. The objective of this study is to determine which measures of PVD and cardiac function at 36 weeks postmenstrual age (PMA) predict pulmonary morbidity beyond NICU discharge in infants without CLD.

METHODS

We prospectively recruited 117 preterm infants (< 29 weeks) enrolled through the Prematurity and Respiratory Outcomes Program (U01HL101794) and longitudinally followed them to 1 year corrected age (CA). Echocardiograms were performed at 36 weeks PMA to measure: a) ejection fraction, ventricular and septal wall strain for LV function; b) tricuspid annular plane systolic excursion (TAPSE) and fractional area change (FAC) for RV function; and c) tricuspid regurgitation jet and pulmonary artery acceleration time (PAAT) for pulmonary hemodynamics. Pulmonary morbidity beyond NICU discharge was defined as post-prematurity respiratory disease (PRD) and determined via questionnaires at 3, 6, 9, and 12 months as morbidity in 1 of 4 post-NICU discharge domains (respiratory medications; hospitalizations for a pulmonary cause; respiratory symptoms; or home technology dependence) from at least 2 time points in the 1st year. A stepwise selection in multiple logistical regressions was performed to produce a model to detect which

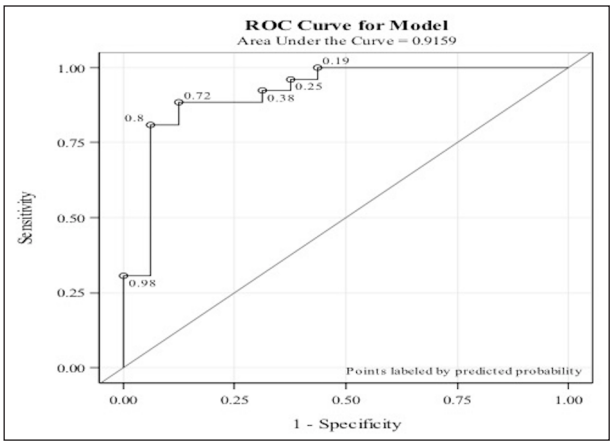

Figure 1 (ABS 11). ROC Curve analysis to determine specific cutoff values in predicting post-prematurity respiratory disease (PRD).
For detection of PRD in the asymptomatic preterm infant without BPD, a predictive combination of pulmonary artery acceleration time (PAAT) < 64 msec, septal strain < -18%, and RV fractional area change (FAC) < -34% resulted in sensitivity of 88% and specificity of 88% (AUC = 0.916). The model has a probability of 0.72 and accounted for common infant (gender, gestational age, respiratory support) and maternal (chorioamnionitis, gestational hypertension and diabetes) confounders.

echo measures at 36 weeks PMA can predict PRD by 1 year CA.

RESULTS

CLD, defined as the need for any respiratory support at 36 weeks PMA, was diagnosed in 69 (58%) of the preterm infants, of which 57 (83%) had PRD. Of the 48 preterm infants without CLD, 29 (60%) developed PRD. In preterm infants without CLD, a combination of PAAT < 64 msec, septal strain < -18%, and FAC < -34% at 36 weeks PMA resulted in sensitivity of 88% and specificity of 88% (AUC = 0.916) for prediction of PRD at 1 year CA, (**Fig. 1**). The model has a probability of 72% after adjusting for common infant/maternal confounders. CLD alone predicted PRD in the model.

CONCLUSIONS

Preterm infants without CLD are at risk to develop pulmonary morbidity post-discharge from the NICU. Echocardiographic measures of PVD and cardiac dysfunction can be used to predict PRD for risk stratification of infants who warrant intervention and long term follow up beyond discharge.

ABS 12

LEFT VENTRICULAR (LV) FUNCTION IN PRETERM NEONATES ASSESSMENT OF LV ROTATIONAL MECHANICS FROM 32 WEEKS POST-MENSTRUAL AGE TO ONE YEAR

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INTRODUCTION

Left ventricular (LV) rotational mechanics are an important component of LV performance. The measurement of LV torsion and twist using two-dimensional speckle-tracking echocardiography (2DSTE) is feasible in preterm infants, however; longitudinal reference values accounting for maturational changes are lacking. The objective of this study was to determine the maturational changes in preterm infants from 32 weeks post-menstrual age (PMA) to one year of corrected age (CA) and establish age- and weight-related reference values of torsion and twist.

METHODS

60 preterm infants (< 29 weeks and < 1,500 grams at birth) were enrolled in a prospective longitudinal study through the Premature and Respiratory Outcomes Program (NCT01435187). Basal and apical rotations were measured from the parasternal short axis view at the appropriate level using 2DSTE with a validated protocol for image acquisition at 32 and 36 weeks PMA, and 1 year CA. LV twist (°) and LV torsion (°/cm) were calculated by offline analysis using a vendor-customized software (GE EchoPac). Data was adjusted for weight, gestational age at birth, heart rate, and blood pressure.

RESULTS

Basal rotation was clockwise with an initial counterclockwise component and both remained unchanged from 32 weeks PMA to 1 year. CA. Apical rotation was counterclockwise with an initial clockwise component. The apical counterclockwise rotation increased significantly from 32 weeks to 36 weeks PMA only to decrease by 1 year CA. Accordingly twist initially increased from 32 to 36 weeks PMA and then decreased by 1 year CA (**Tab. 1**). When normalized against LV length, torsion decreased from 32 weeks to 1 year CA.

CONCLUSIONS

In premature infants, enhanced LV apical rotation, but not LV basal rotation, occurs from 32 to 1 year CA in postnatal maturation suggesting dominant maturation of apical subepicardial myofibers. Both rotations have unique initial counter-directional

Table 1 (ABS 12). Maturational patterns of rotational mechanics in preterm infants.

	32 weeks PMA (n = 60)	36 weeks PMA (n = 60)	One year CA (n = 60)	p-value
Basal rotation (°)				
Initial counterclockwise	2.2 (2.2)	2.5 (2.1)	2.9 (2.5)	0.33
Clockwise	-6.4 (3.9)	-6.9 (4.4)	-6.9 (4.6)	0.78
Apical rotation (°)				
Initial clockwise	-1.0 (2.3)	-1.2 (1.8)	-2.3 (2.3)	0.02
Counterclockwise	8.3 (4.2)	9.2 (3.8)	6.7 (4.2)	0.02
Twist (°)	12.9 (5.8)	14.9 (5.6)	12.1 (5.01)	0.04
Length (cm)	2.4 (0.2)	2.8 (0.3)	4.4 (0.34)	< 0.01
Torsion (°/cm)	5.2 (2.5)	5.3 (2.0)	2.7 (1.2)	< 0.01

Data is presented as means (standard deviation).
PMA: postmenstrual age; CA: corrected age.
One way ANOVA with repeated measures was used to compare the three time points.
Clockwise (-); Counterclockwise (+)

motion. The decrease in torsion with postnatal maturation is reflective of an increase in LV length and longitudinal myofibers. This study establishes reference values of LV rotational mechanics in preterm infants and may facilitate their use in the clinical assessment of LV function in infants.

ABS 13

TWO YEAR OUTCOMES IN EXTREMELY PRETERM INFANTS WITH DIFFERING BLOOD PRESSURE MANAGEMENT

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INTRODUCTION

There is concern that hypotension in the extremely preterm infant is associated with adverse outcome [1], but normative data for blood pressure is lacking, leading to variation in the definition of hypotension at any particular weight, gestation and postnatal age [2]. Use of inotropes differs between neonatal units [3]. We have shown that there are few differences in the short term outcome of babies born in tertiary neonatal units using targeted and permissive blood pressure strategies [4], but whether long term outcome is affected is unclear. We sought to examine the long term outcome for this cohort.

METHODS

Two year outcomes were compared between two hospitals: A has a targeted approach to hypotension; inotropes are used to maintain a mean blood pressure of 30 mmHg. B has a permissive approach; use of inotropes is guided by clinical parameters such as lactate, urine output, and perfusion. Data were collected retrospectively for all babies born < 29 weeks gestation in each hospital between 2007 and 2011. These infants are followed up to two years corrected age within the clinical service. Data were retrieved from the national neonatal database, or if unavailable, from correspondence with the responsible clinician. Results were compared by hospital, as a proxy for blood pressure management. Fisher's exact test was used to compare demographic variables and outcomes between the two groups.

RESULTS

671 infants were included in the study. 160 died before discharge; A: 56 (21.3%); B: 104 (25.5%). 511 children were eligible for follow up. Two year outcome data were collected for 315 (61.6%) children. For 215 (68.3%), that data came from the national neonatal database. There were no demographic differences between those followed and lost to follow up or by source of data. Significant differences occurred in ethnicity between the two hospitals: A had more families of Asian background and B of Black and Caucasian background. There were no differences in long term outcome, as determined by neuromotor delay, developmental delay, and cerebral palsy, between the two hospitals (**Tab. 1**).

Table 1 (ABS 13). Two year outcome between hospitals with differing blood pressure management.

Domain	Overall[a] N (%)	Hospital A (%)	Hospital B (%)	p-value
Neuromotor	307	120	187	0.285
Normal/mild	269 (87.6)	104 (86.7)	165 (88.2)	
Moderate	15 (4.9)	4 (3.3)	11 (5.9)	
Severe	23 (7.5)	12 (10)	11 (5.9)	
Cerebral palsy	273	107	166	0.227
Yes	12 (4.4)	7 (6.5)	5 (3.0)	
Developmental delay	289	115	174	0.386
Normal/mild	252 (87.2)	104 (90.4)	148 (85.1)	
Moderate	26 (9.0)	7 (6.1)	19 (10.9)	
Severe	11 (3.8)	4 (3.5)	7 (4.0)	

[a]Data was not available for all domains for some children.

CONCLUSIONS

There were no differences in two year outcomes, including cerebral palsy, for babies born extremely preterm and managed by either a targeted blood pressure approach or by allowing permissive hypotension. Further prospective studies of this important issue are warranted.

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ABS 14

AVOIDING HYPOTENSION IN PRETERM NEONATES (AHIP) – A SINGLE-CENTER RANDOMISED CONTROLLED STUDY

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INTRODUCTION

Hypotension, irrespective of definition, occurs in up to 20% of preterm infants, most commonly during the first 48 hours after birth. Up to 50% of preterm infants receive treatment for cardio-circulatory support. The most frequent indication for therapeutic intervention is low systemic blood pressure in the first days of life. The aim of the present study was to assess, if simultaneous monitoring of cerebral (cTOI) and peripheral (pTOI) tissue oxygenation index using near-infrared spectroscopy (NIRS) for early detection of centralisation in combination with early intervention guidelines may help avoiding hypotension in preterm neonates.

METHODS

Preterm neonates < 37 weeks of gestation were included in a single-center prospective randomised-controlled study. In a NIRS-group simultaneous continuous cTOI and pTOI monitoring was used starting within six hours after birth during 24 hours to calculate changes in cTOI/pTOI ratio over time. Depending on these changes, defined interventions including echocardiography, administration of volume or patent ductus arteriosus treatment were performed. In a control-group routine monitoring and treatment were performed. Blood pressure was measured non-invasively every 30 minutes or invasively continuously. The primary outcome was burden of hypotension – defined as mean arterial

blood pressure below weeks of gestation measured in millimetres of mercury in hours (mmHg-hour) – during 48 hours after beginning of NIRS monitoring.

RESULTS

49 preterm neonates were included in each group: NIRS group 33.1 (32.0-34.0) (median; 25th-75th centile) weeks of gestation, and control group 33.4 (32.3-34.3) weeks of gestation. In the NIRS-visible group in 17 preterm neonates an echocardiography was performed due to NIRS measurements, whereby six neonates received further treatment. Percentage of neonates with any hypotensive episode during the 48 hours observational period was in the NIRS-visible group 33% and in the control group 45% [p = 0.214]. Burden of hypotension was in the NIRS-visible group 0.0 (0.0-2.1) mmHg-hours and in the control group 0.4 (0.0-3.3) mmHg-hours [p = 0.313], whereby observed burden of hypotension was low in both groups. No severe adverse reactions were observed.

CONCLUSIONS

In the present study of preterm neonates using simultaneous peripheral and cerebral NIRS measurements followed by defined interventions led to a trend towards a reduction of burden of arterial hypotension during the first 48 hours after birth, which was nevertheless not significant.

ClinicalTrials.gov Identifier: NCT01910467.

DECLARATION OF INTEREST

The study was supported by a grant of the "Jubiläumsfond" of the "Österreichische Nationalbank" (Grant Number: 15351).

ABS 15

PATENT DUCTUS ARTERIOSUS, CEREBRAL HAEMODYNAMICS AND INTRAVENTRICULAR HAEMORRHAGE IN PRETERM NEONATES: A CAUSAL PATHWAY STUDY

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INTRODUCTION

Patent ductus arteriosus (PDA) has an impact on the incidence of intraventricular haemorrhage (IVH) that is possibly mediated by effects on cerebral oxygenation, electrical activity and blood flow. We aimed to assess each step of this model.

METHODS

Population: Extremely preterm neonates < 29 weeks' gestation without pre-existing severe intraventricular haemorrhage or other congenital malformations. Patients were assessed daily in the first three days after birth, subsequently once weekly until PDA closure and finally at discharge. PDA size was assessed by echocardiography. Cerebral tissue oxygenation index (COI) was measured by near infrared spectroscopy. A metric of cerebral maturity (Burdjalov score) was measured by amplitude integrated electroencephalography (aEEG). Anterior cerebral artery velocity ratio (ACAr) was measured by transcranial Doppler. IVH severity was assessed according to Papile system and dichotomised (Grade 0-2: mild, Grade 3-4: severe). Statistics: To avoid discarding observations, a multiple imputation procedure (using additive regression, bootstrapping and predictive mean matching) has been applied. The relationship between IVH and other variables was assessed using logistic regression with a backward variable selection (using Akaike's information criterion to select the factors) has then been applied on the fitted model. The relationship between other variables was assessed using smoothed local polynomial regression fits (with 95% confidence intervals) of PDA vs. NIRS, aEEG and ACAr. The interaction of PDA with IVH severity (severe IVH) was also included in the regressions. Since each subject has repeated measurements taken in time, potential intra-subject correlation of observations has been taken into account by robust estimation of the covariance matrix of the model parameters.

RESULTS

52 neonates were included in the study with a total of 268 observations. Number of assessments: PDA size (259/268, 97%), COI (257/268, 96%), ACAr (211/268, 79%) and aEEG (253/268, 94%). The participants had a median gestational age of 26.6 weeks (Interquartile range [IQR] 25.7-28.0) and median birth weight of 900 grams (IQR 760-1,250 g). 9 neonates (17%) died in the first 3 weeks after birth and 6 developed severe IVH (12%). PDA size was significantly associated with ACAr, aEEG ($p < 0.001$) and COI ($p = 0.017$), but when IVH severity interaction was included in the model this association became non significant as indicated

Table 1 (ABS 15). A. Association between patent ductus arteriosus (PDA) and cerebral tissue oxygenation index (COI), amplitude integrated electroencephalography (aEEG) or anterior cerebral artery velocity ratio (ACAr). **B.** Association between intraventricular haemorrhage (IVH) severity and PDA, COI, aEEG and ACAr. **C.** A backward variable selection applied on the fitted model.

A.

Association	F	p-value
COI	4.16	0.017
IVH interaction	0.19	0.67
aEEG (non-linear)	12.55	< 0.0001
IVH interaction	0.37	0.54
ACAr	19.78	< 0.0001
IVH interaction	0.75	0.39

B.

Factor	Chi-square	p-value
PDA	5.09	0.28
COI	10.10	0.0064
aEEG	2.24	0.33
ACAr	2.54	0.28
Interactions of PDA with the other factors	3.18	0.36

C.

Factor	Coef	Z	p-value
PDA	0.526	3.002	0.00268
COI	-0.0829	-2.867	0.00414

in the **Tab. 1A**. A logistic regression model was designed to estimate the association between the factors (including interactions of PDA with the remaining factors) and IVH outcome. The model investigated the impact of the observed factors on the separation of the classes (mild vs severe IVH). Only cerebral oxygenation was associated with severity of IVH (p = 0.0064) as indicated in **Tab. 1B**. When a backward variable selection was applied on the fitted model only PDA size and COI was statistically significant (p = 0.00268 and 0.00414 respectively, **Tab. 1C**).

CONCLUSIONS

There is evidence of an association between IVH and PDA size and COI. Furthermore, there is evidence that PDA affects cerebral oxygenation, cerebral electrical activity and cerebral blood flow but not in interaction with IVH severity. Overall, our analysis suggests that the components of our model have some validity, but the causal pathway we postulated is not supported by this data.

DECLARATION OF INTEREST

The study was funded by Neocirculation consortium (European FP7-Grant N:282533).

ABS 16

PRECISION ASSESSMENT OF A NOVEL CEREBRAL TISSUE OXIMETER AND EFFECTS OF FLUCTUATIONS IN SYSTEMIC AND CEREBRAL PHYSIOLOGICAL PARAMETERS

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INTRODUCTION

Monitoring cerebral tissue oxygen saturation (StO_2) by near-infrared spectroscopy (NIRS) enables clinicians to keep StO_2 within a predefined target range, which may prevent brain lesions in preterm neonates. However, precision of cerebral oximetry has been repeatedly reported to be ~5%, which is considered too high for clinical utility [1]. Our aims were to assess in preterm infants the precision of a new NIRS device optimized for precision, OxyPrem v1.3, and to investigate the influence which changes in physiological parameters (systemic and cerebral) have on this assessment.

METHODS

35 clinically stable, spontaneously breathing preterm infants with a median gestational age of $33^{2/7}$ week and a median postmenstrual age of $35^{5/7}$ weeks were included in the study. The sensor of our in-house developed OxyPrem v1.3 was placed 5 times on the same location on the left prefrontal cortex (temporal) for 1 minute each to test precision. Physiological parameters (heart rate and arterial oxygenation [SpO_2]) were measured with a pulse oximeter (Sensmart-X100, Nonin) on the right arm, and cerebral parameter [StO_2] was acquired with a second OxyPrem v1.3 sensor placed over the visual cortex (occipital) (**Fig. 1**). Within-subject variability (Sw) was determined by a linear mixed effects model ("lme" in R) with subject as factor over the median StO_2 values of each 1 minute measurement.

RESULTS

With all subjects included in the analysis we obtained a Sw of 2.64% for the temporal sensor. However, we obtained Sw = 3.06% for the occipital sensor and Sw = 2.35% for SpO_2. Sw of the temporal sensor is not higher than for the occipital one and

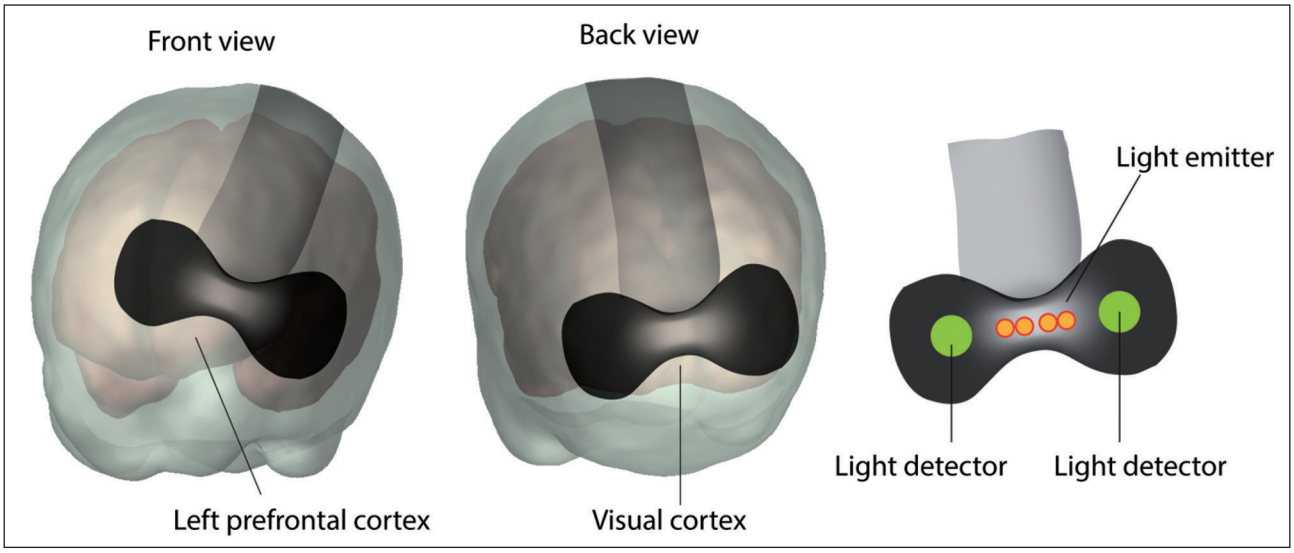

Figure 1 (ABS 16). Cerebral parameter [StO_2] was acquired with a second OxyPrem v1.3 sensor placed over the visual cortex (occipital).

Sw for SpO_2 is almost equally high. This shows that the observed variation is dominated by other factors than repeated placement of the temporal sensor. We thus performed a second analysis after exclusion of 11 subjects which met at least one the following criteria: (i) missing data or (ii) a standard deviation (SD) over the 1 minute median > 2% in SpO_2 or (iii) SD > 7.5% in occipital StO_2. An analysis of the remaining 24 subjects yielded significantly smaller Sw of 1.85% for the temporal, 2.08% for the occipital sensor, and 1.01% for SpO_2, showing that unstable subject physiology leads to systematic overestimation of Sw.

CONCLUSIONS

The optimization of OxyPrem v1.3 was successful. Indeed an excellent precision was achieved. Physiologically unstable subjects lead to a falsely high estimation of Sw. Precision estimation is only correct, if physiological parameters (systemic and cerebral) are stable. To ensure this in the future, systemic and cerebral physiological parameters have to be measured during precision assessments and subjects with pronounced fluctuations need to be excluded from analysis.

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ABS 17

ARGINASE UP-REGULATION AND ENOS UNCOUPLING CONTRIBUTE TO IMPAIRED ENDOTHELIUM-DEPENDENT VASODILATION IN A RAT MODEL OF INTRAUTERINE GROWTH RESTRICTION

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INTRODUCTION

Individuals born after intrauterine growth restriction (IUGR) are at increased risk of developing cardiovascular diseases later in life, notably hypertension (HTN). Besides decreased nephron endowment and hyperactivity of the hypothalamic-pituitary-adrenal axis, altered vascular functions, in particular impaired endothelium-dependent vasodilation, seem to play a key role in long-term effects of IUGR. Alterations in L-Arginine (L-Arg)-nitric oxide (NO) pathway have been found to be involved in endothelial dysfunction. However, the role of the main components of this signaling pathway in altered endothelium-dependent

vasodilation in individuals born after IUGR is still incompletely understood.

METHODS

Pregnant rats were fed with either a control diet (CTRL, 23% casein) or an isocaloric low-protein diet (LP, 9% casein) to induce IUGR. Systolic blood pressure (SBP) was measured by tail-cuff method in 5- and 8-week-old CTRL and LP male offspring (n = 7/group). Isolated aorta rings from 5-week-old rats were used to investigate: 1) ex-vivo endothelium-dependent relaxation induced by acetylcholine (Ach) ± L-Arg or the arginase inhibitor S-(2-boronoethyl)-L-cysteine (BEC); 2) arginase activity, measuring urea production by spectrophotometric method; 3) NO production ± Ach and ± L-Arg using a NO-specific fluorescent dye; 4) eNOS (total protein and dimer/monomer ratio) expression by western blot; 5) superoxide anion production using hydroethidine ± the NOS inhibitor N-nitro-L-Arginine (L-NNA).

RESULTS

SBP was significantly increased in LP vs. CTRL male offspring only in 8-week-old animals (mmHg ± SEM: 142.19 ± 2.42 vs. 129.74 ± 2.21, $p < 0.01$). In 5-week-old rats, endothelium-dependent relaxation of aorta was significantly impaired in LP males, but was completely restored to the CTRL level after pre-incubation with the eNOS substrate, L-Arg, or BEC. Arginase activity was significantly increased in LP vs. CTRL aorta. NO production was significantly reduced in LP vs. CTRL aorta both in basal conditions and after stimulation with Ach, but was completely restored by L-Arg pretreatment. Total eNOS protein expression, as well as the dimer/monomer ratio was significantly higher in LP vs. CTRL aorta. Superoxide anion production was significantly increased in LP aorta, and normalized to the CTRL level by pretreatment with L-NNA.

CONCLUSIONS

IUGR, induced by maternal exposure to LP diet during gestation in rats, leads to early impaired endothelium-dependent relaxation of aorta that may precede the development of HTN. Decreased NO production and enhanced superoxide anion generation, are involved, as consequences of arginase up-regulation and eNOS uncoupling. These early vascular defects could therefore pave the way to the development of HTN at adulthood observed in individuals born after IUGR.

ABS 18

ULTRASONOGRAPHIC MONITORING FOR POSTNATAL ADAPTATION IN PRETERM INFANTS

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INTRODUCTION

Failure of postnatal adaptation could lead to cerebral and organs injury. Superior vena cava flow (SVCf) measured using echocardiography and resistance index (RI) in anterior cerebral artery (ACA), basilar artery (BA), left and right internal carotid arteries (LICA, RICA) measured with cranial ultrasound could be markers of cerebral and systemic perfusion in high risk infants. Our aim was to compare changes in superior vena cava flow (SVCf) measured by echocardiography and in the resistance index (RI) of cerebral arteries measured by cranial ultrasound in preterm, compared with term infants. Furthermore we studied the association between SVCf and the development of intraventricular hemorrhage (IVH).

METHODS

A total of 46 neonates were eligible for our study: 13 patients with a gestational age (GA) < 32 weeks (group G1), 18 with 32 ≤ GA < 37 weeks (group G2) and 15 healthy term neonates (Group C). SVCf and cerebral artery RI in ACA, BA, LICA, RICA were measured at 6, 12, 24 hours after birth. Analyses were performed using IBM® SPSS® v. 21.0. A p-value < 0.05 was considered statistically significant.

RESULTS

SVCf was significantly lower in G1 and G2 compared with C ($p < 0.05$) but no differences were found between G1 and G2 at each time point. IR in ACA, BA, LICA and RICA were significantly ($p < 0.05$) higher in G1and G2 compared with C. No correlation was found between mean blood pressure (MAP) and SVCf in G1 and G2. Two patients in G1 and two in G2 developed IVH of low grade (Grade I and II). Low SVCf (< 40 ml/kg/min) was significantly associated with the development of IVH (any grade) in G1 and G2 ($p = 0.010$ and 0.006 at 6, 12 hours, respectively).

CONCLUSIONS

The transition phase from intra to extrauterine life is a complex process. The detection of SVCf can be a reliable marker of hypoperfusion and could give clinicians the possibility of an early intervention. SVCf is a more sensitive cardiocirculatory marker than MAP. Preterm infants showing low SVCf were at higher risk of IVH.

ABS 19

RETROSPECTIVE ANALYSIS OF CATHETER RELATED VEIN THROMBOSIS AMONG NEWBORNS IN THE NICU SETTINGS

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INTRODUCTION
Newborns treated in the Neonatal Intensive Care Units (NICU) are prone to occurrence of several complications linked to invasive procedures: among them is vein thrombosis. Although the rate of neonatal vein thrombosis is lower than in adults it happens mostly in the smallest patients and may lead to long sequelae. The goal of this study was to compare rates and risk factors of catheter related vein thrombosis in two different time periods.
METHODS
Retrospective analysis of vein thrombosis cases in Period 1 – years: 2013-2014 and Period 2 – 2015-June 2016. The cut off moment was chosen based on the increased number of reported vein thrombosis. Test U-Gauss was used for statistical analysis with Statistica 10 software.
RESULTS
Vein thrombosis was diagnosed in 16 newborns; 4 and 12 in Period 1 and 2 respectively. Due to significant increase in numbers of thrombotic events (TE) between analyzed periods, additional analysis of risk factors was performed. It was noted that major risk factor is presence of the central catheter, which was present in 84% of complicated cases. There was no difference in TEs between two periods ($p = 0.203$) and increased crude numbers of vein thrombosis was caused by increased number of catheter placement (294 vs. 435). Number of hospitalized newborns in both periods was also similar. Other risk factors statistically significant were identified as asphyxia, infection and duration of CVC use. In thrombosis group the time of CVC use was significantly longer than in control group. The majority of neonates had no clinical symptoms of thrombosis. Agitation, swelling of the extremities and painfulness were accounted for most common symptoms, although the majority (62.5%) was asymptomatic.
CONCLUSIONS
CVC together with asphyxia, infection and prolonged time of the CVC use are among the most important risk factors for TE in the neonatal period. Use and implementation of a thrombosis registry is a key point in improving management of these patients. Thus, bed site ultrasound exam should become routinely performed test, especially that majority of infants with thrombosis are asymptomatic.

ABS 20

NON-INVASIVE CARDIAC OUTPUT MONITORING BY ELECTRICAL CARDIOMETRY IN HEMODYNAMICALLY STABLE NEONATE INFANTS

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INTRODUCTION
The evaluation of hemodynamic is indispensable to the care of infants in the NICU. Functional echocardiography (Echo) has been used as a tool for periodic bedside measurements of cardiac output by the neonatologists. But, the limitations of Echo are the need for trained providers and the single point measurements of cardiac output. Electrical cardiometry (EC) is a new technique of continuous non-invasive cardiac output monitoring. Limited data are available about EC in neonates. We designed a prospective study with the aim to compare the results of EC-derived estimates of stroke volume (SV) and left ventricular output (LVO) with those obtained using Echo in hemodynamically stable neonates.
METHODS
Infants admitted to the NICU with a postnatal age less than 7 days were included. Hemodynamically stable 69 neonates underwent 451-paired EC and Echo measurements simultaneously, at least 2-hour interval. Infants with congenital heart disease, other than a patent ductus arteriosus or a patent foramen ovale were excluded. Echocardiographic evaluation of SV and LVO were performed with the Vivid q machine (GE healthcare, Wauwatosa, WI) and a 6-MHZ cardiac probe by a person trained in neonatal functional Echo. Continuous SV and LVO measurements were performed using the ICON

(Cardiotronic/Osypka Medical, Inc., La Jolla, CA, USA) system. Pearson correlation coefficients and linear regressions were performed between EC and echo measurements. And we used a Bland Altman graph to assess SV-EC and CO-EC bias and variability.

RESULTS

Sixty-nine neonates (mean GA: 35 ± 2.9 weeks, mean IBW: 2.29 ± 0.6 kg) were enrolled. There was a correlation between SV-EC and SV-Echo ($r = 0.294$; $p < 0.0001$; $R^2 = 0.086$) and between CO-EC and LVO-Echo ($r = 0.465$; $p < 0.0001$; $R^2 = 0.216$). Mean biases (and variabilities) were 0.12 (from -0.46 to 0.71) mL/kg and 14.2 (from -66.8 to 95.2) mL/min/kg for SV and CO, respectively. CO-EC correlated with LVO-Echo with or without a PDA ($r = 0.593$; $p < 0.0001$ and $r = 0.264$; $p < 0.001$, respectively). Infants ventilated with noninvasive or invasive ventilator had significant correlations between LVO-Echo with CO-EC ($r = 0.534$; $p < 0.001$ and $r = 0.242$; $p < 0.001$, respectively).

CONCLUSIONS

EC monitoring provides continuous trending of cardiac hemodynamics and there was a correlation between EC measurements (SV and CO) and Echo measurements (SV and LVO) regardless of the presence of PDA or ventilator. But there were wide level of variability on both SV and CO. Studies for detecting acute changes in hemodynamics would be needed to apply on routine clinical care.

ABS 21

MYOCARDIAL DEFORMATION AND ROTATIONAL MECHANICS IN INFANTS WITH DOWN SYNDROME IN THE EARLY NEONATAL PERIOD

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INTRODUCTION

There is a paucity of data on myocardial performance in infants with Down Syndrome (DS) in the immediate postnatal period using advanced echocardiography techniques, including deformation imaging and rotational mechanics. Furthermore, the impact of DS on the increased incidence of pulmonary hypertension (PH) in this period is not well described. We aimed to objectively assess the presence of PH and measure left (LV) and right (RV) ventricular function using deformation imaging and rotational mechanics in neonates with a confirmed diagnosis of DS over the first 5 days of age, and compare the findings with a group of healthy controls.

METHODS

Serial echocardiograms were performed on Days 1, 2 and 5 to measure LV and RV dimensions, LV global longitudinal strain (GLS) and systolic strain rate (SR), RV free wall (RVFw) longitudinal strain and systolic SR, and LV rotational mechanics (Basal and Apical rotation, Twist and Torsion). On Day 1, PH was assessed by examining the shunting pattern across the patent ductus arteriosus (PDA) and the presence of a tricuspid regurgitant jet (to estimate RV systolic pressure, RVSp). Values obtained in the DS infants were compared with a group of controls without a diagnosis of DS.

RESULTS

Twenty-three infants (13 infants with DS with structurally normal hearts and 10 Controls) with a mean ± SD gestation and birthweight of 38.4 ± 1.9 weeks and 3.2 ± 0.4 kg respectively were enrolled with no differences in demographics or clinical characteristics between groups. There was no difference in LV length (25 vs. 28 mm, $p = 0.08$) or RV length (27 vs. 26 mm, $p = 0.43$) between the groups. On Day 1, infants with DS had a higher proportion of bidirectional PDAs (80% vs. 20%, $p = 0.005$), a higher RVSp (34 vs. 17 mmHg, $p = 0.02$), wider RV mid cavity diameter (15 vs. 12 mm, $p = 0.02$) and a narrower LV diameter (14 vs. 18 mm, $p = 0.02$). There was no difference in LV GLS or LV systolic SR between the two groups over the study period (data not shown). Infants with DS had lower RVFw strain and strain rate over the three time points (**Fig. 1**). Infants with DS had impaired LV basal rotation on Day 1 with no improvement on Days 2 or 5 resulting in a significantly lower LV twist and torsion by Day 5 (**Fig. 1**).

CONCLUSIONS

Infants with DS demonstrate elevated pulmonary pressures during the early neonatal period, which translated into lower RV function measured using deformation imaging. In addition, they also demonstrate impaired rotational mechanics (twist/torsion) driven by a lack of adequate basal

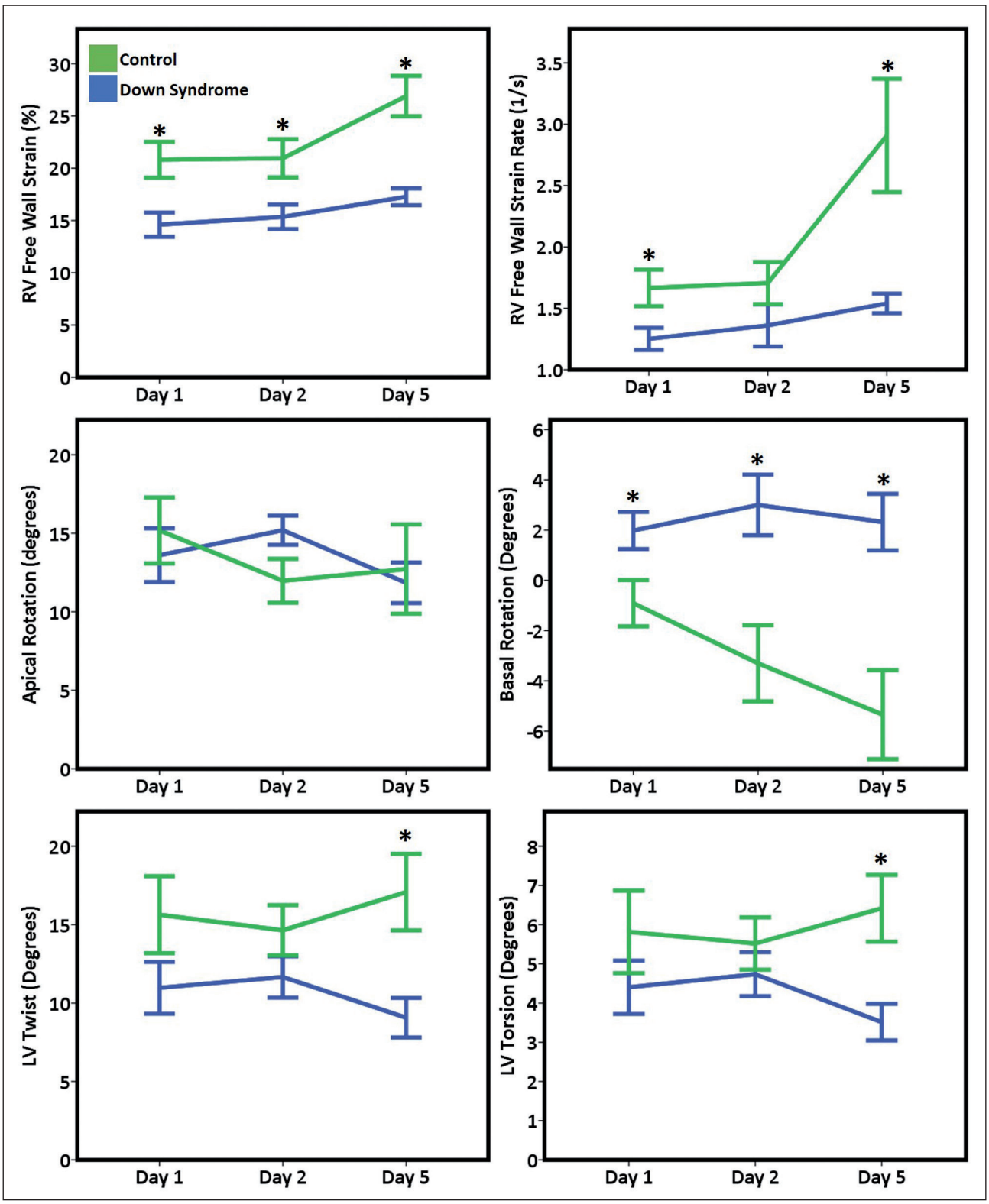

Figure 1 (ABS 21). RV deformation and LV rotational mechanics in the two groups over the study period.
*p-value < 0.05.

rotation. Basal rotation is known to be adversely affected by elevated pulmonary pressures. The clinical implications of those findings and their impact on the early neonatal course warrant further study.

ABS 22

THE EFFECTS OF DELAYED CORD CLAMPING ON 12-MONTHS BRAIN MYELIN CONTENT: A RANDOMIZED CONTROLLED TRIAL

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INTRODUCTION

At the time of birth, an infant receiving delayed cord clamping (DCC) can gain ~30% more blood volume and ~50% more iron-rich blood cells [RBCs] compared to an infant receiving immediate cord clamping (ICC) significantly boosting iron stores in infancy. Iron plays an essential role in early rapid brain growth. Iron deficiency can have a negative impact on neurodevelopment yet its impact on early white matter growth is not yet known. This 5-year study started in 2012 and assessed children at 4, 12, and 24-months of age. This report is on 12-month outcomes.

METHODS

Seventy-three women in term labor, with a singleton fetus, were randomized to either ICC (5 mins) at the time of birth. At 4 and 12-months, a serum ferritin was measured and each infant underwent non-sedated MRI scanning (McDespot technique) and neurodevelopmental testing using the Mullens Scales of Early Learning and the Brief Infant-Toddler Social and Emotional Assessment (BITSEA). Controlling for age, gender, and birthweight, myelin water fraction was calculated at each voxel throughout the brain imaging volume.

RESULTS

At 12-months, 56% of the children were successfully scanned. DCC (n = 22) and ICC (n = 19) are compared respectively: cord clamping time (319 ± 151 vs. 10 ± 6 secs, p = 0.001); 2-day hemoglobin (19.5 ± 1.9 vs. 17.5 ± 2 g/dL, p = 0.001); 4-month log ferritin was 1.9 ± 0.3 vs. 1.7 ± 0.2, p = 0.02). At 12-months there were no differences in blood values. There were no differences in the Mullens scores at 4 and 12-months of age. However, the BITSEA competence score was significantly higher at 12-months with DCC (16.6 ± 3 vs. 14.2 ± 3.3, p = 0.04). At 12-months, there were significant differences in brain myelin volume between the DCC and ICC groups (**Fig. 1**). The highlighted areas represent brain regions associated with motor, visual, and sensory processing and functioning.

CONCLUSIONS

At 12-months of age, infants who received DCC at birth, had significantly higher brain myelin volume in areas related to motor, visual, and sensory processing and functioning as well as higher social-emotional competence compared to infants who received ICC. This suggests that the endowment of iron-rich blood cells supplied by DCC at birth is beneficial for infant brain development.

ABS 23

NEONATOLOGIST-PERFORMED ECHOGRAPHY IN NEONATOLOGY: A TUNISIAN EXPERIENCE

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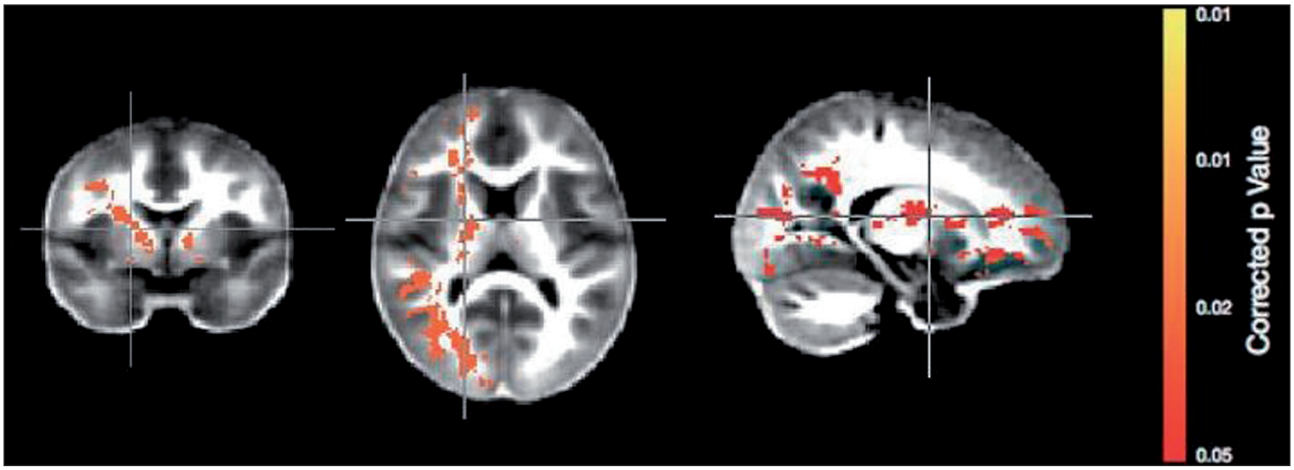

Figure 1 (ABS 22). Comparison between the DCC and ICC groups at 12-months.

INTRODUCTION
Echocardiography is an important tool for diagnosis of cardiac abnormalities that can impact the management and outcome of the sick newborn in the intensive care unit. A preliminary echocardiogram performed by the neonatologist under the supervision of a paediatric cardiologist for interpretation and review is an alternate when there is not a cardiologist on site. The aim of this study was to evaluate frequency of use, neonatal characteristics, and indications of neonatologist-performed echocardiography in a Tertiary Neonatal Care Centre in Tunisia.
METHODS
Prospective observational study in a tertiary Neonatal Intensive Care Unit (NICU) in Monastir (Tunisia) from April 2015 to February 2017. An echocardiography was indicated in these situations: cyanosis, signs of circulatory shock, clinical signs of heart failure, presence of a murmur, arrhythmia, and abnormal pulses in upper and/or lower extremities, suspected persistent pulmonary hypertension in neonates, clinically suspected patent ductus arteriosus, maternal diabetes mellitus and polymalformative syndrome. The echocardiographic findings were confirmed by a pediatric cardiologist in case of structural or functional cardiac abnormalities.
RESULTS
A total of 675 echocardiographic studies were performed by 2 neonatologists trained in paediatric echocardiography, 22% of them showed abnormalities and 8% required urgent care. Most frequent indications for this exam were the presence of a murmur followed by cyanosis. The most frequent diagnosis was atrial septal defect (n = 35) followed by ventricular septal defect (n = 29). Thirty other congenital heart diseases were diagnosed and managed (transposition of great arteries [n = 4], tetralogy of Fallot [n = 4], truncus arteriosus [n = 4], interrupted aortic arch [n = 4], atrioventricular septal defects [n = 3], double outlet right ventricle [n = 3]). Thirty patent ductus arteriosus were treated by ibuprofen (n = 17) or paracetamol (n = 13) with successful closure. Twelve neonates had persistent pulmonary hypertension; three of them required inhaled nitric oxide. Thirteen infants of diabetic mothers had hypertrophic cardiomyopathy without severe clinical impact. One cardiac rhabdomyoma was detected in a preterm infant and allowed for an early diagnosis of tuberous sclerosis complex.
CONCLUSIONS
Echocardiography is being utilized progressively on the neonatal unit, and has been indicated to have a high return for both structural and functional cardiac abnormalities. It is important to encourage collaboration with pediatric cardiologists to establish standards for training and maintenance of competency of neonatologists and to develop guidelines for clinical practice in order to improve neonatal care.

ABS 24

LOW SERUM CORTISOL LEVELS IN ASPHYXIATED INFANTS WITH HEMODYNAMIC INSTABILITY

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INTRODUCTION
Birth asphyxia is a leading cause of neonatal mortality and adverse neurological sequelae. In asphyxiated neonates, hemodynamic instability presenting with low systemic arterial blood pressure is common, theoretically partly due to relative adrenal insufficiency (RAI). To date, serum cortisol levels and its association to hemodynamic instability in neonates with perinatal asphyxia have not been studied in detail. Our aim was to describe serum cortisol levels in asphyxiated infants undergoing therapeutic hypothermia.
METHODS
In this retrospective cohort study, medical records of 79 term, asphyxiated neonates born between 2007 and 2016 were reviewed. Patients were cared for in the NICU of the 1st Department of Paediatrics Semmelweis University, Budapest, Hungary. Results of serum cortisol measurements between the 0-168th hours of life and clinical characteristics of patients were analysed.
RESULTS
Serum cortisol levels displayed an exponential decay characteristic after birth in the study population. During the first week of life 89% of all cortisol values were below 15 μg/dl, which is considered to be the threshold of RAI. Patients with more severe condition, as measured on the SNAP-II severity of illness score, had significantly higher serum cortisol, but values were still below 15 μg/dl, when compared to less severe cases (moderate-severe 4.97 [3.94; 10.90] μg/dl vs mild condition 2.75 [1.97; 4.60] μg/dl; p = 0.002). Eventually 57% of patients received low dose hydrocortisone

supplementation (HCS) at a median dose of 0.56 [0.48; 1.00] mg/kg due to hemodynamic instability and suspected RAI. Importantly, patients receiving HCS scored similarly on the Bayley-II test of infant development at 20 [19.0; 24.5] months when compared to the non-HCS group.

CONCLUSIONS

Our results suggest that low serum cortisol is a common finding in cooled asphyxiated infants with hemodynamic instability, and low dose HCS seemed to be safe in short term based on the results of neurological follow-up examinations at two years of age. Further studies are needed to evaluate the efficacy and long-term safety of HCS in treatment of hemodynamic instability in asphyxiated neonates.

ABS 25

INFLUENCE OF TYPE OF CONGENITAL HEART DEFECTS ON EPITHELIAL LINING FLUID COMPOSITION IN INFANTS UNDERGOING CARDIAC SURGERY WITH CARDIOPULMONARY-BYPASS

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INTRODUCTION

In children with congenital heart disease (CHD), altered pulmonary circulation could compromise oxygenation and gas exchange. Moreover, pulmonary dysfunction is a known complication of cardiac surgery with cardiopulmonary bypass (CPB). At present, no data is available on the effect of different CHDs on lung inflammation and pulmonary surfactant. The aim of this study was to analyze epithelial lining fluid (ELF) composition in children with CHDs before and after CPB.

METHODS

Tracheal aspirates (TAs) from 72 CHD children (age 2.9 [0.4-5.7] months) were obtained. ELF total phospholipids, surfactant proteins A and B (SP-A, SP-B), albumin, and myeloperoxidase activity were measured. TAs of 12 infants (age 1.0 [0.9-2.9] months) with normal heart/lung served as controls.

RESULTS

Heart defects were transposition of great arteries (TGA, 19), tetralogy of Fallot (TOF, 20), atrial or ventricular septal defect (ASD/VSD, 22) and hypoplastic left heart syndrome (HLHS, 11).

Table 1 (ABS 25). Epithelial lining fluid (ELF) composition in the preoperative and in the postoperative period.

Preoperative					
	TGA (n = 18)	**TOF (n = 20)**	**ASD/VSD (n = 19)**	**HLHS (n = 11)**	**Control (n = 12)**
PL (mg/ml)	7.6 (5.5; 20.7)[a]	3.2 (1.8; 5.9)[b]	6.3 (3.2; 7.3)[a,b]	4.4 (2.3; 11.5)[a,b]	5.5 (1.0; 9.5)
SP-A (µg/ml)	33.4 (26.8; 59.2)	25.5 (17.9; 57.8)	49.6 (34.7; 93.1)[d]	33.5 (20.0; 49.0)	29.0 (10.3; 35.1)
SP-B (µg /ml)	19.0 (10.9; 31.2)[d]	13.2 (6.8; 30.2)[d]	10.1 (6.6; 16.7)[d]	23.2 (6.6; 38.8)[d]	3.7 (2.5; 9.3)
MPO (mU/ml)	573 (123; 1,296)[d]	34 (1; 1,356)	343 (156; 1,042)[d]	695 (4; 1,115)[c]	10 (0; 194)
Albumin (mg/ml)	6.3 (4.4; 8.7)[a]	7.1 (2.4; 12.0)[a]	14.3 (10.9; 18.0)[b,d]	6.3 (1.7; 17.6)[a]	4.3 (1.4; 8.5)
Postoperative					
	TGA (n = 18)	**TOF (n = 18)**	**ASD/VSD (n = 19)**	**HLHS (n = 11)**	
PL (mg/ml)	7.8 (4.1; 17.7)[a]	4.4 (2.5; 6.3)[b]	5.7 (3.1; 6.4)[a,b]	9.2 (6.1; 10.8)[a,b]	
SP-A (µg /ml)	28.4 (14.5; 65.2)	29.3 (15.0; 65.3)	38.8 (29.0; 55.0)	35.9 (16.6, 75.0)	
SP-B (µg /ml)	20.2 (9.0; 31.3)	23.6 (7.4; 45.5)	11.4 (9.2; 18.5)	17.8 (12.0; 29.9)	
MPO (mU/ml)	888 (229; 1,948)	918 (164; 1,549)	964 (441; 3,462)	1,188 (215; 3,609)	
Albumin (mg/ml)	7.5 (5.7; 15.3)	7.7 (4.3; 12.9)	12.4 (9.4; 15.6)	6.4 (4.6; 11.5)	

PL: phospholipid; SP-A: surfactant protein A; SP-B: surfactant protein B; MPO: myeloperoxidase. TOF: tetralogy of Fallot; TGA: transposition of great arteries; ASD: atrial septal defect; VSD: ventricular septal defect; HLHS: hypoplastic left heart syndrome.
Values are median and interquartile range.
[a,b] Values in the same row that have different superscript letters are significantly different from each other ($p < 0.05$ by Kruskall Wallis and Dunn's Multiple Comparison Test); [c] $p < 0.05$ vs. control group by Mann Whitney test; [d] $p < 0.01$ vs. control group by Mann Whitney test.

Increased levels of ELF SP-B were found in all defects, increased myeloperoxidase activity in all except the TOF and increased levels of ELF albumin and SP-A only in ASD/VSD patients. Postoperatively, ELF findings remained unchanged except a further increase in myeloperoxidase activity (**Tab. 1**).

CONCLUSIONS

ELF composition has distinctive patterns in different CHD that could contribute to the onset of respiratory failure. We speculate that a better knowledge of the ELF biochemical changes may help to prevent respiratory complications.

ABS 26

GLIAL FIBRILLARY ACIDIC PROTEIN PLASMA LEVELS DURING CONGENITAL HEART DISEASES SURGERY INVERSELY CORRELATE WITH VINELAND ADAPTIVE BEHAVIOR SCALES COMMUNICATION SCORE

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INTRODUCTION

Congenital heart diseases (CHD) are the most common birth defect (4 to 10 ‰ of all live births) and they are the leading cause of death during infancy. Improvement in surgical and post-operative care techniques allowed the early mortality rate to drop under 5%, but neuro-cognitive deficits at the beginning of school age affect nearly 50% of children who underwent surgery for complex CHD. Newly acquired brain injury in CHD children affect 41% of patients preoperatively and 30% postoperatively. We analyzed glial fibrillary acidic protein (GFAP) plasma levels during cardiopulmonary bypass in CHD surgeries, to correlate the increase of GFAP with clinical parameters and neurological outcome.

METHODS

This is a prospective, single-center, observational study in children undergoing cardiac surgery. We studied 46 children with CHD: 6 univentricular physiology; 16 septal defects; and 24 canal defects. GFAP was measured by ELISA at different CPB stages. Vineland Adaptive Behavior Scales were administered to patients that were at least 18 months old. We recorded clinical and surgical parameters, applied multiple and logistic regressions to assess which parameters along with GFAP, were independent predictors of Vineland scores (IQ).

RESULTS

GFAP increased during CPB and peaked at the end of rewarming. Multiple regression showed GFAP maximum-reached value and neurological comorbidity (prior to surgery) as significant independent predictors of Vineland communication domain IQ, corrected for cerebral saturation during CPB, age at Vineland, univentricular heart, minimum temperature reached during CPB and occurrence of a period of neurological-risk time interval during CPB. Age, CHD group, cyanosis before surgery, and other surgical independent factors were also tested with a stepwise-backward regression, but were not included in the model because they were not significant. Receiver operating characteristic curve was calculated to verify the power of the model to predict a communication IQ < 70 and it was highly significant (**Fig. 1**, p = 0.001, Area = 0.9, 95% C.I. 0.8-1.0, S.E. = 0.053).

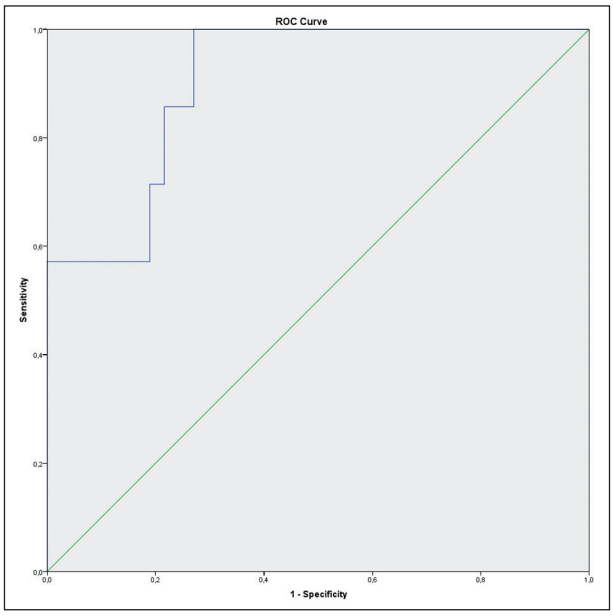

Figure 1 (ABS 26). Receiver operating characteristic curve (ROC) calculated to verify the power of the model to predict a communication IQ < 70.
P = 0.001, Area = 0.9, 95% C.I. 0.8-1.0, S.E. = 0.053.

CONCLUSIONS
Neurodevelopmental outcome of CHD children seems to be the result of an underlying disruption of cognitive function network. Newly acquired brain injuries could potentially be related to modifiable clinical risk factors especially during surgery. We found that GFAP is a potential plasma marker of brain injury that correlates with the neurological outcome. Further studies and deeper neuropsychological evaluation is needed to confirm these data.

ABS 27

DELAYED CORD CLAMPING IN PRETERM INFANTS WITH SUSPECTED INTRAUTERINE GROWTH RESTRICTION

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INTRODUCTION
Infants who have suspected intrauterine growth restriction (IUGR) may be at increased risk for polycythemia, hyperbilirubinemia, or respiratory symptoms including bronchopulmonary dysplasia (BPD). It has been suggested that delayed cord clamping (DCC) may be harmful in these circumstances. No studies have reported outcomes for a group of preterm infants with suspected IUGR who received DCC. This secondary analysis addresses safety and clinical outcomes for preterm infants with suspected IUGR who were included in a trial of DCC vs immediate cord clamping (ICC).
METHODS
Women admitted at less than 32 weeks gestation were enrolled and randomized to either DCC (30-45 seconds) or ICC (< 10 seconds). Mothers with suspected IUGR were not excluded. All placentas were sent for pathology examination. All major morbidities were examined (**Tab. 1**). Suspected necrotizing enterocolitis (NEC) was defined when an x-ray was ordered and an infant was made NPO for at least 24 hours.
RESULTS
Of the 211 mother/infant dyads randomized, 57 infants had either suspected IUGR and/or were small for gestational age (SGA) by pediatric evaluation. Twenty-five infants were randomized to DCC and 32 to ICC. Absent-end-diastolic-flow was present in 17 of the fetuses. Suspected IUGR was the primary reason for birth in 11 cases while severe preeclampsia was the reason in 61% of the mothers. Infants in the DCC and ICC groups weighed 1,020 and 925 g respectively and the mean gestation age was 29 weeks. There were no differences in safety outcomes (Apgar, temperature at NICU admission, peak bilirubin in the first week) or in hematocrit levels. There were no differences in most neonatal outcomes including death, IVH, LOS, NEC, BPD or Bayley III scores at 18 month corrected age < 85 or < 70. However, 53% of the infants in the ICC group experienced "suspected" NEC versus only 25% in

Table 1 (ABS 27). Neonatal and infant outcomes of infants with suspected intrauterine growth restriction (IUGR).

Outcomes	IUGR cohort		
	DCC (n = 25)	ICC (n = 32)	p-value
Initial hematocrit (%)	49.1 ± 7.1 (45.6-53.8)	49.4 ± 6.2 (46.8-53.0)	0.87
Peak bilirubin, first week (mg/dL)	6.4 ± 1.9 (4.5-7.7)	5.6 ± 2.6 (4.3-6.6)	0.21
Deaths	1 (4)	1 (3)	0.86
IVH	2 (8)	4 (13)	0.58
Suspected NEC	6 (25)	17 (53)	0.03[a]
Confirmed NEC	1 (4)	2 (6)	0.73
Confirmed LOS	3 (13)	4 (13)	0.94
BPD	7 (29)	6 (19)	0.58
Bayley III Motor Scores at 18 months[a]			
< 85	4 (21)	3 (12)	0.38
< 70	1 (5)	1 (4)	0.82

N (%) or mean ± SD (IQR).
IUGR: intrauterine growth restriction; DCC: delayed cord clamping; ICC: immediate cord clamping; NEC: necrotizing enterocolitis; BPD: bronchopulmonary dysplasia.
[a] Corrected age.

the DCC group (p = 0.03). In the sensitivity analysis including only infants diagnosed with SGA at birth, we observed similar levels of initial hematocrit, peak bilirubin in the first week, suspected NEC and BPD in the two groups. Placental examination revealed that 89% met the criteria of SGA. In addition, 48 placentas of the non-IUGR/SGA infants were also assessed to be SGA.

CONCLUSIONS

Our findings indicate no harm was found from DCC for infants with actual or suspected IUGR and suggest the benefit of less bowel disruption. The fact that nearly 50% of the entire preterm cohort had SGA placentas suggests that growth restriction is an ongoing process, beginning with the placenta, that starts early in pregnancy and puts the fetus at risk of preterm birth.

ABS 28

ELECTRICAL VELOCIMETRY IN PRETERM INFANTS: EFFECT OF TIME AND GESTATIONAL AGE

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INTRODUCTION

Cardiac output (CO) measurement has become the cornerstone of advanced hemodynamic monitoring in critical care circumstances. Electrical velocimetry (EV) measures electrical impedance changes as intrathoracic volume changes during systole and diastole, thereby representing left ventricular cardiac output (LVO). It allows for continuous, beat-to-beat cardiac output monitoring. Minimal technical proficiency is required, as compared to neonatal performed echocardiography (NPE). EV may therefore offer an alternative to NPE for cardiac output monitoring in preterm infants.

METHODS

This prospective, observational method-comparison study aimed to determine the accuracy of EV (NICOM Reliant®, Cheetah Medical, Israel), as compared to NPE, in determining cardiac output in preterm infants of various gestational ages (26-36 weeks) during the first 72 hours of life. All infants were managed via minimal invasive management strategies. NPE measurements of LVO were performed at specified time points (within 3 hours of delivery, thereafter 6-hourly) with EV performed continuously for 72 hours after birth. The ability of EV to accurately determine LVO was evaluated as well as the influence of measurement time (hours after birth, 6-hourly intervals) and gestational age on accuracy.

RESULTS

88 Infants between 26-36 weeks gestational age were recruited – 23 infants were excluded for a variety of reasons (discharge prior to 24 hours age, VSD on echo, severe hypotension requiring inotropes as well as infrastructure problems). Sixty-four stable preterm infants (mean GA 31.3 ± 2.6, mean birth weight 1,563 g ± 303 g) were available for evaluation, equating to 781 simultaneous, paired EV and NPE measurements. The limits of agreement, across all time points, were between 115 ml/kg/min and -74 ml/kg/min with a mean error of 20.5 ml/kg/min. EV consistently underestimated NPE LVO values. The error percentage was 25.6% (95th CI 23.8%; 27.8%). The accuracy was not influenced by gestational age (p = 0.431). Accuracy increased over time with an increased bias prior to 18 hours of age (p = 0.049) and decreased bias from 24-72 hours of age (p = 0.406).

CONCLUSIONS

The accuracy of LVO measurement by EV is not influenced by gestational age. Accuracy of EV improves over time.

DECLARATION OF INTEREST

Research supported by equipment donation (NICOM Reliant) from Amayezu Medical, Cape Town, South Africa. No monetary incentives were involved. The company had no influence on research design, performance, data analysis or result distribution.

ABS 29

COMPUTER ANALYSIS OF INFANT HEART SOUND RECORDINGS

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INTRODUCTION

Detection and interpretation of heart murmurs in infants and children may be dependent on skill and experience [1]. Objective assessment of heart sounds may help to improve detection. Electronic stethoscopes allow heart sounds to be recorded digitally thus enabling retrospective assessment and analysis. The aim of this study was to investigate waveforms of heart sounds from infants where murmurs were detected and compare with heart sounds with no discernible murmur.

METHODS

A Littmann Model 3200 Electronic Stethoscope (3M, USA) was used to acquire heart sound recordings from infants with murmurs as well as infants with no discernible murmur. Recordings were saved and exported as wav files. Software was written with MATLAB (The MathWorks Inc., USA) to segment the signals and display the waveform over the period chosen. In this study we selected segments of duration 2.5 to 3 seconds with little or no artifact. All heart sound recordings were reviewed by a Consultant Paediatrician and classified into one of 4 categories: no discernible murmur, grade 1, grade 2 or grade 3 and above murmur. The appearance of the waveforms was examined by assessing the frequency components and amplitudes in the signals corresponding to the first and second heart sounds.

RESULTS

Recordings on 6 infants had heart sounds with murmurs, one grade 1, two grade 2 and three at grade 3 and above. Of these recordings with murmurs, the median (range) age was 3 (0 to 8) months. Recordings on 2 infants had no discernible murmur and the ages of these infants were 3 months and 9 months. The waveforms from the infants with no discernible murmurs had a smooth appearance between heart sounds. In all 3 infants with grade 3 and above murmurs, there were clear high frequency components particularly following the first heart sound; the high frequency components could be seen as spikes in the signal. A similar pattern was seen in the grade two murmurs although the spikes were less apparent. In the grade 1 murmur the high frequency components seen in grade 3 and above murmurs were not present.

CONCLUSIONS

Heart sound recordings from two groups of children were successfully acquired and analysed. Clear differences were observed in the waveform appearance between grade 3 and above murmurs compared with recordings with no discernible murmur. This study suggests that assessment of waveform characteristics may enable objective classification of heart sounds in infants even from segments of only about 3 seconds duration.

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ABS 30

TREATMENT FOR PATENT DUCTUS ARTERIOSUS AND NEUROCOGNITIVE OUTCOME AT 6.5 YEARS OF AGE IN CHILDREN BORN EXTREMELY PRETERM

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INTRODUCTION

Patent ductus arteriosus (PDA) treatment is common after extremely preterm (EPT) birth, but the evidence-base is weak. PDA treatment has been associated with poor neurodevelopmental outcome at 2-3 years of age [1]. There is an association between surgical treatment for PDA and white-matter damage, smaller brain and cerebellar volumes in EPT children, but questions of confounding by indication have been raised [2, 3]. In a recent cohort study, no association between PDA-ligation and death or neurodevelopmental delay (NDI) at 18-24 months was found [4]. We aimed to study the neurocognitive outcome in EPT children at 6.5 years of age in relation to type of PDA treatment.

METHODS

The EXPRESS study includes all children born at < 27 weeks of gestational age in Sweden in 2004-2007. At 6.5 years age, 441/486 survivors, of whom 435 had PDA data registered, participated in a follow-up study [5]. The exposure, PDA treatment (pharmacological, surgical or both), was investigated in association to the outcomes:

Table 1 (ABS 30). PDA treatment and neurodevelopmental impairment (NDI).

	N	Risk of NDI Adj. IRR [a] (95% CI)	Total WISC-scores [a] (95% CI)
No PDA treatment	170	1.00 (ref)	Ref.
Pharmacological PDA treatment	139	1.21 (0.81-1.80)	-1.1 (-5.0 to 2.8)
Pharmacological PDA treatment + surgery	88	1.03 (0.71-1.49)	1.8 (-1.0 to 4.6)
Primary surgery	38	1.58 (1.25-1.99)	-6.9 (-11.3 to -2.4)

[a] Adjusted for gestational age, sex, birth weight Z-score, maternal education, postnatal steroid treatment, and intra-ventricular hemorrhage grades 3-4.

Wechsler Intelligence Scale for Children (WISC-IV) results, and the composite outcome of moderate to severe neurodevelopmental impairment (NDI), defined according to Moore et al. [6]. The association between PDA treatment and the outcomes were analyzed in multi-variable adjusted mixed effects regression models, with region as the random effects variable. A p-value of < 0.15 was chosen for inclusion of covariates in the final model.

RESULTS

The risk of moderate to severe NDI was 58% higher among infants treated with primary PDA surgery in the adjusted model (**Tab. 1**), than in EPT infants not needing PDA treatment. No increased risks of NDI were found among children treated pharmacologically for PDA, regardless of whether they later had surgical PDA closure or not. In analyses of the 366 children that had WISC-data available, EPT treated with primary PDA surgery had significantly lower total WISC-scores in the adjusted model, than EPT not treated for PDA. Pharmacological PDA treatment, with or without later PDA surgery, was not associated with lower WISC scores in EPT (**Tab. 1**).

CONCLUSIONS

We found no association between pharmacological PDA treatment or PDA surgery following prior pharmacological treatment, and later neurocognitive outcome. Our results indicate a risk of impaired neurodevelopment after primary PDA surgery; a finding that could not be explained by measured confounders. Further studies are needed to understand the mechanisms behind this finding and to optimize PDA management.

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ABS 31

SYSTEMIC HYPOPERFUSION AND REGIONAL OXYGENATION IN PDA: A CASE REPORT

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INTRODUCTION

Near-Infrared Spectroscopy (NIRS) represents an innovative method to monitor regional tissue oxygenation and perfusion, through the non-invasive measurements of the oxygen saturation (rSO_2) and the fractional oxygen extraction (FTOE) of different organs. NIRS can be used as a screening tool in ELBW neonates in the first weeks of life to identify signs of systemic hypoperfusion due to a hemodynamically significant Patent Ductus Arteriosus (PDA). In this case, in fact, a systemic to pulmonary shunting through the PDA occurs, causing pulmonary hyperperfusion and systemic hypoperfusion.

CASE REPORT

Baby S. was born at 24^{+4} weeks of gestational age by spontaneous delivery. He showed good adaption

to extra-uterine life and was easily stabilized with CPAP in delivery room. During the first 10 days of life he required non-invasive respiratory support and with low oxygen supplementation (max FiO_2 0.25). As per protocol in our unit, he received minimal inotropic support in the first 5 days of life and then remained clinically stable, showing normal ranges of arterial oxygen saturation, arterial pressure, cerebral and renal oxygen saturation ($rcSO_2$ and $rrSO_2$ 60-70%). At day 3 of life a screening echocardiography revealed a PDA, classified as not hemodynamically significant (size 2.3 mm, left-to-right shunting across the DA, LA:Ao ratio 1.3, no diastolic flow reversal in the descending aorta). However, a first-line treatment was carried out using two courses of paracetamol (15 mg/kg for 3 days), without any benefit on the echo findings. So, since the PDA was not implying a clinical deterioration, no further treatment was tempted. On 11th day of life, the baby showed a sudden episode of profound bradycardia and desaturation that required resuscitation with intubation and cardiac massage. A picture of increased pulmonary vascularity and an increase of RI (0.95) with reversed diastolic flow in the anterior cerebral artery were recognized respectively at chest X-ray and cranial ultrasound. The echo showed the persistence of PDA, this time hemodynamically significant (size 2 mm, LA:Ao ratio 1.6, diastolic flow reversal in the descending aorta). NIRS confirmed this clinical picture, displaying a reduction of the cerebral and renal oxygen saturation ($rcSO_2$ 44%, $rrSO_2$ 32%) and an increased FTOE (50-60%). As we started inotropic support, NIRS was also very useful at guiding the response. In fact, no changes of NIRS values were obtained until dopamine was increased first to 7.5 mcg/kg/min and then to 10 mgc/kg/min. At this point, an elevation of the regional saturations (both $rcSO_2$ and $rrSO_2$) to 70-80% was achieved, giving us an indirect assessment of the improved systemic perfusion.

CONCLUSIONS

NIRS is a non-invasive tool that can help to identify in ELBW a hemodynamically significant PDA through the evidence of reduced tissue perfusion. Moreover, NIRS may show the efficacy of inotrope treatment on systemic circulation and on pulmonary district, guiding on the need of different therapeutic strategies.

ABS 32

LONG-TERM OUTCOME AFTER PATENT DUCTUS ARTERIOSUS TREATMENT IN EXTREMELY PRETERM INFANTS

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INTRODUCTION

A hemodynamically significant patent ductus arteriosus (hsPDA) affects almost two third of the neonates born before 28 weeks of gestational age (GA). Although conservative management strategies are increasingly accepted, prolonged ductal patency could be harmful to the preterm brain. To date, studies on long-term outcome after hsPDA treatment are scarce and only reported up to 2 years of age. We hypothesized that a hsPDA negatively affects long-term outcome at an early school age.

METHODS

All infants (GA < 28 weeks) with serial echocardiography in the first week of life between 2008 and 2010 were included, and divided in 3 groups based on hsPDA treatment: indomethacin, surgical ligation, or control group. Near-infrared spectroscopy (NIRS) monitored regional cerebral oxygen saturation ($rScO_2$) before echocardiography. Neurodevelopmental outcome (NDO) was assessed at 2 years with the Dutch Bayley Scales of Infant and Toddler Development 3rd Edition (BSITD-III-NL) and 5 years with the Movement Assessment Battery for Children 2nd Edition (M-ABC-2) and Dutch Wechsler Preschool and Primary Scale of Intelligence 3rd Edition (WPPSI-III-NL). Multivariable logistic regression calculated (adjusted) odds ratios ([a]OR), corrected for peri- and postnatal confounders.

RESULTS

78 infants were included. NDO at 2 years of age was available for 70 (89.7%) infants. No differences were found in death or poor NDO (BSITD-III-NL < 1SD) between the 3 groups. At 5 years of age, motor performance was assessed in 65 (83.3%) infants. Poor motor outcome (M-ABC-2; PS < 5) occurred more often in hsPDA treated infants, but was not significant. Cognition was tested in 56 (71.8%) infants. hsPDA surgery was a significant risk factor for poor cognitive outcome (WPPSI-III-NL < 1SD) (aOR = 17.15, 95% CI: 1.21-242.17; p = 0.03). $rScO_2$ was significantly lower in infants with a poor cognitive outcome (mean ± SD: 54.2 ± 6) compared

to infants with a good cognitive outcome (61.6 ± 7; p = 0.003).

CONCLUSIONS

hsPDA surgery is significantly related to impaired cognitive function at early school age, potentially due to exposure to suboptimal cerebral oxygenation. NIRS-monitoring of cerebral oxygenation might identify infants at risk for poor NDO.

ABS 33

SIMULATION HEMODYNAMICS NEOCARDIO-SIM™ – PERINATAL AND CRITICAL CONGENITAL HEART SCENARIOS

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INTRODUCTION

We have already proposed updated 3D heart and regional circulations model of neonatal simulation hemodynamics in different intensive care situations NeoCardioSim TM as a clinical, educational and informative tool. Recently there is a great progress in both delivery room and perinatal critical congenital heart defects (CCHD) hemodynamic management. We hypothesized that this application could be successfully used in understanding of delivery room delayed umbilical cord clamping procedures as well as in perinatal CCHD hemodynamic interpretation.

METHODS

We have modeled different delivery room scenarios of resuscitation hemodynamics, early and delayed cord clamping and cord milking, influencing both heart and regional circulations. Moreover, selected CCHD models with particular focus on easily missed aortic coarctation and total anomalous pulmonary venous return as well as updated graphics enabling cardiomyopathies visualization have been uploaded. The latter models have been also interfaced with pulse oximetry saturation readings.

RESULTS

This model was effectively implemented in clinical setting, professional multidisciplinary and physician-parent communication platform as well as a teaching module.

CONCLUSIONS

This expanded simulation model of neonatal intensive care scenarios together with recently added delivery room and critical congenital heart hemodynamic management encompass broad range of perinatal cardiovascular diagnostic and therapeutic situations further increasing medical professionals' understanding of hemodynamics and clinical skills, enhancing educational applications and practical communication with obstetricians, cardiologists and parents about the newborn with perinatal cardiovascular problem. Implementation of artificial neural networks in this innovative simulation application is being planned.

ABS 34

PROGNOSTIC VALUE OF SUPERIOR VENA CAVA FLOW DURING THE FIRST DAY IN PRETERM INFANTS ≤ 32 WEEKS GESTATION

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INTRODUCTION

The relationship between the systemic blood flow and organ injuries especially cerebral lesions during the transition period remains a challenge in contemporary neonatology. Clinical markers used for the assessment of cardiac function are insufficient for a correct evaluation of the neonate during the transition period but superior vena cava flow (SVC) can be used as an indirect marker of systemic flow.

METHODS

A prospective study, in the preparation of NEO-CIRC trials, took place at 1st Neonatology Department, Emergency Hospital of Cluj-Napoca from July 2015 to April 2016, enrolling 51 preterm infants ≤ 32 weeks gestation. Every patient was examined during the first 24 hours, the following parameters being noted: anthropometric data, clinical data,

laboratory assessment and ultrasonography data (resistive index and SVC). Data were analyzed using IBM® SPSS® version 23.

RESULTS

Mean gestational age was 28.4 ± 2.6 weeks, birth weight of 1,141 ± 450 g. The ultrasound was performed at 16.69 ± 15.83 hours of live. SVC flow was not correlated to gestational age (p = 0.685), birth weight (p = 0.590) or by dimension of arteriosus duct (p = 0.930). SVC flows were lower in preterm infants from mothers with chorioamnionitis: 73.17 ± 36.50 vs. 140.32 ± 138.76 ml/kg/min (p = 0.046). SVC flow had no correlation to type of respiratory support. Instead significant correlation was found between SVC flow and intraventricular hemorrhage (p = 0.017) and periventricular leukomalacia (p = 0.043). SVC Flow was significant lower in the deceased group, p = 0.046.

CONCLUSIONS

1. SVC flow in the first day of life is independent of GA, weight, size of DA.
2. SVC flow is significantly lower in children from mothers with chorioamnionitis.
3. SVC flow can be considered as a prognostic factor for hemorrhagic and ischemic events.
4. SVC flow can be used as prognostic factor in death prediction.

ABS 35

COMPARISON OF CARDIAC OUTPUT MEASURED BY BIOREACTANCE WITH ECHOCARDIOGRAPHY MEASUREMENTS IN INFANTS WITH BIRTH WEIGHT BELOW 1,250 G

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INTRODUCTION

The diagnosis of haemodynamic impairment in preterm infants remains challenging area of neonatology. Currently, there is no device measuring cardiac output directly. Echocardiography can facilitate non-invasive cardiac output measurement in preterm neonates, however it is greatly influenced by pre-existing shunts and intra and inter observer variability. Recently, another method of continuous non-invasive cardiac output monitoring (NICOM®) using bioreactance became available. The aim of our study was to correlate echocardiographic measurements of left and right ventricular output and superior vena cava (SVC) flow with NICOM® measurements in preterm infants with birth weight below 1,250 g.

METHODS

Preterm neonates with birth weight less than 1,250 g were eligible for enrolment. Patients with major congenital abnormalities and patients with existing IVH ≥ grade II at six hours of age were excluded. Echocardiographic measurement of left and right ventricular output, SVC flow, ductus arteriosus flow and diameter were obtained at six, 18 and 36 hours of age. NICOM® monitor was applied at the start of the study and continued up to 48 hours of age. It consisted of four emitting and receiving electrodes placed bilaterally over mid-clavicles and in 6th-7th intercostal space. NICOM® cardiac output readings of 10 minutes prior to the start of the echocardiography and 20 minutes after the start of the echocardiography were averaged and used for the calculations.

RESULTS

Thirty-nine infants were enrolled following parental consent. Their mean weight and gestational age were 939 g (± 191) and 27.5 weeks of gestation (± 2.28) respectively. Cardiac output measured by NICOM® device correlated significantly with left ventricular output at six hours of age (correlation coefficient r = 0.78; p = 0.0004). However, this correlation became non-significant at 18 and 36 hours of age (correlation coefficient r = 0.16, p = 0.46 and r = 0.26, p = 0.27 respectively). There was no significant correlation between the cardiac output measured by bioreactance and right ventricular output at any predefined time point. There was a statistically significant correlation between SVC flow at 18 hours of age and NICOM® measurements (r = 0.44, p = 0.04).

CONCLUSIONS

Cardiac output measured by bioreactance correlated significantly with left ventricular output at six hours of age in infants with birth weight below 1,250 g.

ABS 36

SPONTANEOUS NEONATAL ARTERIAL THROMBOSIS: A REPORT OF 6 NEONATES

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INTRODUCTION

Arterial thromboses are rare in newborns, mostly caused by arterial catheters. Neonatal arterial thrombosis occurring in other contexts is much rare. We report arterial thrombosis, not caused by catheterization in 6 neonates (4 females and 2 males) hospitalized over a 15 year period in our neonatology department.

CASE REPORTS

Six neonates are eligible (4 females and 2 males). The diagnosis of arterial thrombosis was evident in three patients who had signs of ischemia affected by thrombosis of the iliac arteries in 2 of them and by thrombosis of distal portion of abdominal aorta in one of them. The symptoms were less clear in three of them: anuria associated with arterial high blood pressure in 2 patients affected by thrombosis of the abdominal aorta and by anuria with melena in a newborn with aortic and mesenteric thrombosis. Diagnosis was confirmed by arteriography in one patient, doppler sonography in 4 patients and autopsy data in one patient. Causes of thrombosis were sepsis in 3 neonates, dehydration in two patients and polycythemia in one patient. A delay to consultation was noted in 3 patients, whose outcome was fatal. The progression was favorable after thrombolysis and anticoagulation using heparin in two patients with major aortic thrombosis. The last patient had an amputation of the left leg (**Fig. 1**).

CONCLUSIONS

A multidisciplinary approach, thrombolysis and selective surgery achieved tissue preservation and function in the majority while minimizing complications. Early referral to centers with multidisciplinary teams is recommended.

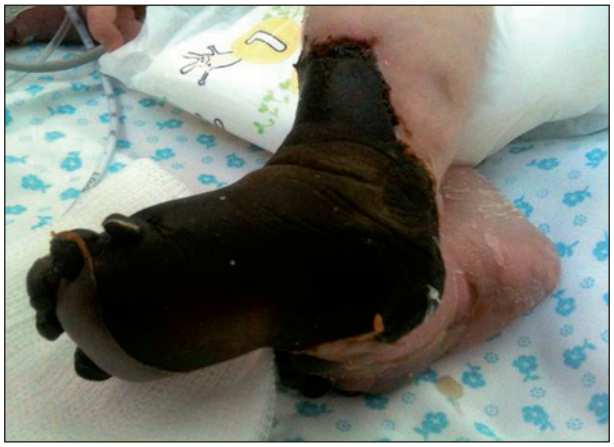

Figure 1 (ABS 36). A severe case of thrombosis, which required the amputation of the left leg.

ABS 37

COMPARISON OF TWO TECHNIQUES OF SUPERIOR VENA CAVA MEASUREMENT IN PRETERM NEONATES WITH BIRTH WEIGHT LESS THAN 1,250 G

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INTRODUCTION

Echocardiography can facilitate non-invasive cardiac output measurement in neonatal period, however it is greatly influenced by pre-existing shunts, namely ductus arteriosus and foramen ovale. To overcome these issues, measurement of Superior Vena Cava (SVC) flow has been used. Classically, abdominal approach to velocity time integral and modified parasternal long axis approach to SVC diameter has been used. Suprasternal/high parasternal approach to velocity time integral and axial approach to the area of SVC were described recently. Aim of our study was to compare two different methods of SVC flow measurement in preterm newborns with birth weight below 1,250 g.

METHODS

Preterm neonates with birth weight less than 1,250 g were eligible for enrolment. Patients with major congenital abnormalities and patients with existing IVH ≥ grade II at six hours of age were excluded. Echocardiographic measurement of SVC flow using both methods was performed at 6, 18 and 36 hours of age. Diameter was assessed from a modified parasternal long-axis view using M-mode. SVC cross-sectional area was measured directly from axial view. Velocity time integrals (VTI) were measured from abdominal and suprasternal/high parasternal approach. SVC flow was calculated using abdominal VTI and parasternal diameter and compared to the calculated values using suprasternal/high parasternal VTI and axial vessel area.

RESULTS

Thirty nine infants were enrolled following parental consent. Their mean weight and gestational age were 939 g (± 191) and 27.5 weeks (± 2.28) respectively. There was poor correlation between the two SVC measurement methods in the three predefined time periods with correlation coefficients r = 0.13 (p =

0.55) at 6 hours of age, r = 0.15 (p = 0.45) at 18 hours of age and r = 0.15 (p = 0.42) at 36 hours of age. At the secondary analysis, it seemed that the poor correlation was secondary to the VTI measurements.

CONCLUSIONS

The newly described SVC measurement technique correlated poorly with classic method in preterm neonates with birth weight below 1,250 g.