ID: 358
TITLE: CARDIAC PHENOTYPING IN PREMATURITY: COMPARISON OF LEFT VENTRICULAR ROTATIONAL MECHANICS IN TERM AND PRETERM INFANTS
AUTHORS: Aisling Smith1; Neidin Bussmann1; Phillip Levy2; Naomi McCallion1,3; Orla Franklin4; Afif EL-Khuffash1,3.
AFFILIATIONS: 1 Department of Neonatology, The Rotunda Hospital, Dublin, Ireland.
2 Department of Paediatric Cardiology, Our Lady’s Children’s Hospital Crumlin, Dublin, Ireland.
3 Division of Newborn Medicine, Boston Children’s Hospital, Boston, Massachusetts, USA.
4 Department of Paediatrics, School of Medicine, Royal College of Surgeons in Ireland. Dublin, Ireland.

CONTENT:

Developmental differences exist in left ventricular (LV) myofibre architecture between term and extremely premature infants. LV rotational mechanics add important information on myocardial structure and function, and describe the wringing motion that occurs due to the twisting of the apex and base of the heart in opposite directions during systole, and the return to the untwisted steady state in diastole. However, there remains a paucity of information comparing rotational mechanics in term and preterm infants. To test the hypothesis that prematurity alters LV twist and torsional physiology in the transitional period, we compared rotational mechanics between extreme preterm infants and term neonates over the first week of age.

We prospectively recruited a cohort of health term infants (37–42 weeks gestation) and compared it to a historical cohort of extremely preterm infants (<29 weeks gestation). Advanced quantitative speckle-tracking echocardiography was performed on Days 1, 2 and 5–7 to measure basal rotation, apical rotation, LV torsion (twist indexed to LV length), and LV untwist rate. Measurements were compared between the two groups and over time.

Thirty term infants (mean ± SD gestation: 39.7 ± 1.1 weeks, birthweight: 3667 ± 443 grams) and 51 preterm infants (gestation 26.7 ± 1.5 weeks, birthweight 1011 ± 233 grams) were included. In preterm infants, basal rotation was positive on Day 1, changing to negative by Day 5-7. Torsion was higher in preterm infants compared to term infants on Day 1 (P < 0.05) and continued to increase in preterm infants by Day 5-7 (P < 0.05). There was a significant increase in LV untwist in preterm infants over the study period (P < 0.05). Apical rotation was similar between the two groups and was persevered over the first week of age. There was no change in term rotational mechanics parameters over the study period with minimal twist (Figure).

Extremely preterm infants demonstrate increasing torsion over the first week of age. This is predominantly driven by an increasing negative basal twist. LV untwist is also altered in premature infants. There is no change in rotational parameters in term infants. An augmentation of torsion in premature infants may represent an adaptive response to compromised known longitudinal systolic and diastolic function in the preterm population.

IMAGES:
https://www.eiseverywhere.com/eselectv3/v3/events/351149/submission/files/download?fileID=cd789e747043dfe26d3d7524921add3f-MjAxOS0wNSM1Y2UyNyMjI2YzNhMWM2

COI: None declared
TITLE: INTRA AND INTER-OBSERVER VARIABILITY OF ADVANCED NEONATOLOGIST PERFORMED ECHOCARDIOGRAPHY IN PRETERM INFANTS BELOW 30 WEEKS

AUTHORS: Rebeca Sánchez Salmador 1; Ana Isabel Blanco 1; María Carmen Bravo 1; Jesús Díez 2; Adelina Pellicer 1

AFFILIATIONS: 1 Department of Neonatology, La Paz University Hospital, Madrid E-28046, Spain
2 Division of Statistics, La Paz University Hospital, Madrid E-28046, Spain

CONTENT:

Neonatologist Performed Echocardiography (NPE) is becoming a routine tool in neonatal intensive care as provides non-invasive and real time pathophysiological information on hemodynamics that can be used to guide treatment of sick newborn infants. The evolution of the technique has provided advanced methods to assess ventricular function. However, information regarding their reliability is scarce. We aim to describe the reliability of advanced echocardiographic measurements in preterm infants who underwent NPE for any reason.

Cardiac Strain using Wall Motion Tracking [Toshiba] and Tissular Doppler Imaging (TDI) were studied. Left ventricular global longitudinal strain (LS) and strain rate (SR) from four-chamber (4C) view, circumferential strain (circS) and circumferential SR (circSR) from basal short axis (SAX) view were assessed. All scans were performed by the same operator who did online first measurement. Intra-observer variability was established based on offline second analysis of the scans, at least one week apart. Inter-observer variability was evaluated by offline second analysis by a different investigator. Second reviews were blinded to the first measurements. Intraclass correlation coefficient with 95% confidence interval ICC (95% CI, p) and the repeatability index (RI) were used.

58 NPE studies were performed in 18 infants [27.9 (1.4) weeks of gestation, 1181 (309) g birth weight] during 4-months period, at day 7 (7.6) of life. Mean (SD), intra and inter-observer ICC and RI are displayed (Table 1).

The reliability of Cardiac Strain using Wall Motion Tracking (Toshiba) and Tissular Doppler Imaging is good or very good in preterm infants below 30 weeks of gestation. These new imaging techniques offer reliable information that can be used to guide treatment in the sick newborn infant.

COI: None declared
ID: 502

**TITLE:** DYNAMIC LIGHT SCATTERING: A NEW NONINVASIVE TECHNOLOGY FOR NEONATAL HEART RATE MONITORING

**AUTHORS:** Norani Gangaram-Panday 1; Tanja van Essen 1; Tom Goos 1,2; Rogier de Jonge 3; Irwin Reiss 1; Willem van Weteringen 4

**AFFILIATIONS:**
1 Division of Neonatology, Department of Pediatrics, Erasmus MC - Sophia Children’s Hospital, University Medical Center Rotterdam, Rotterdam, The Netherlands
2 Department of Biomechanical Engineering, Faculty of Mechanical Engineering, Delft University of Technology, Delft, The Netherlands
3 Pediatric Intensive Care Unit, Departments of Pediatrics and Pediatric Surgery, Erasmus MC - Sophia Children’s Hospital, University Medical Center Rotterdam, Rotterdam, The Netherlands
4 Department of Pediatric Surgery, Erasmus MC - Sophia Children’s Hospital, University Medical Center Rotterdam, Rotterdam, The Netherlands

**CONTENT:**

Heart rate (HR) detection in premature infants is challenging due to a low signal amplitude and fragility of the premature skin, necessitating the minimization of skin adhesives. This affects both the current standard of electrocardiography (ECG) and pulse oximetry. Recently the dynamic light scattering (DLS) technique has been miniaturized, allowing noninvasive HR measurements with a single sensor. Hemoglobin motion is detected with a laser diode emitting a small light beam which is scattered by hemoglobin. This creates a time-varying speckle pattern which translates to a pulsatile waveform (fig. 1a). This study evaluates DLS for HR measurement in neonates and compare agreement with ECG.

Stable infants with a gestational age (GA) of ≥ 26 weeks, monitored with ECG, were eligible for inclusion. HR was measured on 5 different sites (forehead, upper extremity, thorax, lower extremity and abdomen) with the DLS sensor (Elfi-Tech Ltd., Israel) for 15 minutes each. The DLS signal-to-noise ratio (SNR) indicates signal quality and was logged together with DLS HR at a 1 Hz rate. ECG-derived HR from standard of care monitoring was logged at a 1 Hz frequency. To match ECG averaging, every 10th second of DLS HR was compared to ECG HR. For analysis patients were randomly divided into two groups. To determine the optimal SNR value, bias and limits of agreement were calculated for every SNR in the first group. This value was used to assess agreement in the second dataset. Measurements of HR were performed in thirty-four patients, of which 31 were analyzed. Infants had a median (IQR) GA of 30 3/7 (27 4/7 – 31 6/7) weeks and median (IQR) weight at measurement of 1400 (1160 – 1825) grams. A total of 2490, 2477, 2504, 2497 and 2421 paired data points were available at the forehead, upper extremity, thorax, lower extremity and abdomen, respectively. For clinical use, international standards for heart rate detection demand a specified accuracy. In the first group (n=15), out of all sites the forehead showed the best compliance with the IEC 60601-2-27:2011 standard, reaching 100% at a SNR of 4.69 (68% of 1180 data pairs remaining). Application on the second group (n=16) showed an agreement between DLS HR and ECG HR with a bias (lower and upper limits of agreement) of -0.14 (-5.07 – 4.78) bpm on the forehead (1310 data pairs) (fig. 1b).

DLS is a new and promising technique for noninvasive heart rate detection in neonates, showing good agreement with ECG HR when measured at the forehead. Movement however has a notable influence on accuracy, which can be improved with future iterations of the technology. In addition, DLS has the potential for measuring other hemodynamic parameters such as blood flow, which is an important yet currently unavailable parameter in neonatal care.
Fig. 1 a) DLS waveform example in a neonate, showing a detailed sphygmogram and b) Bland-Altman plot of DLS measurement at the forehead, showing the agreement between ECG and DLS heart rate.

COI: None declared
ID: 596

TITLE: SPLANCHNIC OXYGENATION CHANGES ARE MORE PROFOUND COMPARED TO BRAIN FOLLOWING BLOOD TRANSFUSION

AUTHORS: Jayanta Banerjee 1; Ceri Murphy 2; Terence Leung 3; Narendra Aladangady 4

AFFILIATIONS: 1 Department of Neonatology, Imperial College Healthcare NHS Trust, London, England
2 Department of Neonatology, Homerton University Hospital NHS Trust, London, England
3 Department of Medical Physics and Bioengineering, University College, London, England
4 Department of Neonatology, Homerton University Hospital NHS Trust, London, England

CONTENT:

Blood transfusion improves cerebral (Banerjee et al. Early Human Dev 2016) and gut (Banerjee et al. Vox Sanguinis 2016) tissue perfusion in preterm infants; this has been demonstrated by increased tissue oxygenation index and reduced fractional tissue oxygen extraction. Retrospective and cohort observational studies have indicated that pre-existing anaemia as well as blood transfusion may lead to necrotising enterocolitis (Patel RM et al. JAMA 2016, Paul D. et al. Ped 2011). The objective of this study was to measure the relative changes in cerebral and splanchnic tissue oxygenation following blood transfusion using Near Infra-Red Spectroscopy (NIRS) in preterm infants.

Preterm infants who required blood transfusion for clinical indication were studied: babies with pre-existing Grade 3 or 4 IVH or gut abnormality such as NEC were excluded. Infants were recruited to three postnatal age groups: 1 to 7 (group 1), 8 to 28 (group 2) and ≥29 days of life (group 3). Simultaneous cerebral and gut oxygenation was measured using NIRS (NIRO 300, Hamamatsu Photonics KK Japan). Tissue Oxygenation Index (TOI) and Fractional Tissue Oxygen Extraction (FTOE) were measured 15-20 minutes before, during and 15-20 minutes post-transfusion. Descriptive analysis and t-tests were performed using SPSS 22.0. The study was approved by the regional Research Ethics Committee and written parental consent was obtained.

A total of 59 preterm infants receiving transfusion were recruited to the three postnatal age groups: Group 1; n=20, Group 2; n=21 and Group 3; n=18. The median (range) gestational age was 26 (23 - 27), 25 (23 - 30) and 26 (24 - 34) weeks and birth weight 763 (600 - 1180), 740 (600 - 1240) and 793 (520 - 1746) grams for the respective postnatal age groups. The cerebral TOI increased by 5%, 11% and 12% following transfusion in Group 1, Group 2 and Group 3 infants respectively; whilst splanchnic TOI increased by 42%, 29% and 30% in those postnatal age groups respectively. Both the cerebral and splanchnic FTOE decreased after blood transfusion but more so in the splanchnic tissue (Table 1).

The results indicate that the improvement of splanchnic tissue oxygenation following transfusion was more pronounced compared to cerebral oxygenation. We propose that this is likely due to an adaptive mechanism of splanchnic tissue in response to anaemia and sparing of brain perfusion.

IMAGES:
https://www.eiseverywhere.com/eselectv3/v3/events/351149/submission/files/download?fileID=66a52266983892ce0f055a873d006787-MjAxOS0wNSM1Y2UyNjY2YzI1YTE=

COI: None declared