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Acute Hemodynamic Effect Of Vasopressin On The Fontan Circulation

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Background: First-line therapies for Fontan patients presenting with hypotension during general anesthesia or sedation aim to augment preload and decrease pulmonary vascular resistance (PVR). Vasoactive-inotropic medications are often utilized for refractory hypotension, but there are limited data describing their impact on the Fontan circulation. We aimed to study the hemodynamic impact of vasopressin on Fontan patients in the catheterization laboratory. We hypothesized that the systemic vascular resistance (SVR) would increase without a change in PVR.

Methods: In this prospective, open-label, nonrandomized pilot study, 28 Fontan patients aged 3-50 years undergoing cardiac catheterization were enrolled. Fontan dysfunction was defined as moderate-or-worse ventricular dysfunction or atrioventricular valve regurgitation, lymphatic dysfunction, atrial pressure >12 mmHg, or PVR >3 mmHg/L/min/m². Following completion of the clinical catheterization, baseline hemodynamics were measured. A 0.03 U/kg IV vasopressin bolus was given over 5 minutes, followed by maintenance infusion of 0.3 mU/kg/min. Repeat hemodynamics were compared to pre-vasopressin data using paired t-tests or Wilcoxon signed-rank tests. The primary outcome variable was PVR:SVR, and secondary outcome variables were blood pressure, atrial pressure, and cardiac output.

Results: Patients were 13.5 (9.1, 17) years of age, majority (n=21, 79%) male, and majority (n=16, 57%) with a single or dominant right ventricle. There were 12 (57%) patients with Fontan dysfunction. Baseline aortic saturation was 94.0% (90.8%, 95.3%) with a hemoglobin of 14.4 +/- 1.5 g/dL. Following vasopressin administration, the systolic blood pressure increased from 86.5 (83.3, 92) to 104 (97.0, 114.3) mmHg, left atrial pressure increased from 7.0 (6.0, 10.3) to 8.5 (7.0, 11.0), PVRi decreased from 1.8 +/- 0.65 to 1.4 +/- 0.57 WU, and SVR increased from 17.1 (15.2, 20.4) to 22.0 (17.8, 27.4) WU (mean or median differences all p <0.001). There was no change in the Fontan pressure (12.5 (11.0, 14.3) vs. 12.5 (11.0, 14.0), p=0.69) or cardiac index (3.2 +/- 0.69 vs. 3.2 +/- 0.77, p=0.18) following vasopressin. There was no statistical difference in the direction or magnitude of response to vasopressin for studied variables between patients with and without Fontan dysfunction. There were no adverse events.

Conclusions: In Fontan patients referred for catheterization, vasopressin resulted in a significant increase in systemic blood pressure, SVR, and left atrial pressure, a decrease in PVR, and no change in the cardiac output. Our findings suggest vasopressin may be a useful agent for mitigating systemic hypotension in Fontan patients during sedation or general anesthesia.

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Congenital Heart Disease And The Risk Of Impaired Fertility: A Danish Nationwide Cohort Study Using Time To Pregnancy

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Background: The number of women with congenital heart disease (CHD) becoming pregnant are increasing. Although menstrual irregularities appear to occur more often in these patients, knowledge on their fertility is limited. In this nationwide cohort study, we evaluated the risk of impaired fertility in women with CHD compared with unaffected women using time to pregnancy (TTP).

Methods: The Danish National Birth Cohort (DNBC) of pregnant women constituted the study population. Information on TTP and use of medically assisted reproduction (MAR) treatment was reported at a first trimester interview. Women with CHD were identified by linkage to the Danish National Patient Registry. Two outcome variables were defined; TTP > 6 months or use of MAR treatment to conceive (i.e. subfertile) and TTP > 12 months or use of MAR treatment to conceive (i.e. infertile). Risk ratios for subfertility and infertility with 95% confidence intervals were estimated using binomial logistic regression.

Results: Among 93,832 pregnancies in 84,922 women, CHD was diagnosed in 333 women (0.4%), contributing with 360 pregnancies. The CHD was of simple complexity in 291 (87.4%) of the women. No association was found between a diagnosis of CHD and longer TTP. The same was observed when comparing women with simple CHD and unaffected women. The number of women with complex CHD were too low for evaluation.

Conclusions: Women with CHD had no increased risk of impaired fertility, assessed by TTP, when compared with unaffected women. A separate analysis of women with complex CHD was hampered by the low number included.

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Disparities In Hospital Length Of Stay And Morbidity In Acute Care Pediatric Cardiology Patients

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Background: Inequities in healthcare outcomes are well described among patients of different races and ethnicities. Despite improvement in patient survival, disparate outcomes exist in pediatric cardiology. Multicenter studies examining outcomes are lacking in pediatric acute care cardiology. The Pediatric Acute Care Cardiology Collaborative (PAC3) offers unique insight into cardiac specific outcomes. We hypothesized that Black and Hispanic patients admitted to pediatric acute care cardiology units (ACCU) have increased hospital length of stay (LOS) and complication rates compared to White and non-Hispanic peers. We also hypothesized these disparities will persist even when subdivided by United States (US) region.

Methods: Utilizing the PAC3 registry, we examined ACCU hospitalizations from 2/1/2019-7/30/2021 ending in discharge to home or death. Hospitalizations were categorized by race and ethnicity and sub-categorized by US region by hospital location (Northeast, Midwest, South, and West). In-hospital complications included healthcare acquired infections, iatrogenic incidents, pneumonia, sepsis, seizures, and stroke. Differences in hospital LOS and mean total number of complications were assessed using Student's t-test and ANOVA. Generalized linear models were constructed to evaluate differences in LOS and complications between regions and by race and ethnicity. We used Bonferroni correction to establish a significance threshold of 0.001.

Results: Analysis included 30,404 hospitalizations from 29 centers (23,314 with race data and 28,175 with ethnicity data). There were 16,233 White (70%), 4,533 Black (19%), 919 Asian (4%) and 1,629 other race (7%) hospitalizations. There were 23,592 (84%) non-Hispanic and 4,583 (16%) Hispanic hospitalizations. Non-Hispanic Black (14.9 days), and non-Hispanic other patients (15.6 days) had longer hospital LOS than non-Hispanic White patients (12.1 days; p-value $p < 0.0001$). Hispanic patients also had longer LOS than non-Hispanic patients (14.8 v 12.9 days; p-value $p < 0.0001$). The mean total number of complications per hospitalization were also significantly different between these groups. The gaps between LOS and complications persisted in all four US regions with some areas of greater difference: LOS for non-Hispanic Black patients was more pronounced than non-Hispanic White patients in the West compared to other regions (19.8 versus 11.9 days). Non-Hispanic Black patients in the West represented the smallest percentage of all Black patients within the study at 4.6%. The mean number of complications remained disparate across every region. For Hispanic patients in the south, LOS and mean number of complications were lower compared to all other regions. Hispanic patients in the South made up 32% of all Hispanic patients in this study.

Conclusions: Despite improved outcomes for patients with congenital and acquired heart disease, significant racial and ethnic disparities remain in both hospital length of stay and in-hospital complications. As demonstrated by these nationwide validated data, inequities persist across all regions of the US with some regions demonstrating greater disparities than others. Both institutional and department specific resources will be required to reduce inequities via quality improvement, medical education and continued political advocacy. US regions with less racial and ethnic diversity may require heightened attention to standardization of care and use of protocols to achieve equitable outcomes.

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Risk Factors For Electroencephalographic Seizures In Neonates Following Surgery With Cardiopulmonary Bypass

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Background: Seizures in neonates following surgery with cardiopulmonary bypass (CPB) have been associated with mortality, brain injury and neurodevelopmental impairment. Seizures in neonates are often subclinical and not detected without continuous electroencephalography (CEEG). We aimed to determine risk factors associated with seizures occurrence.

Methods: We hypothesized there are pre-operative, intra-operative, and post-operative factors associated with post-operative seizure risk. We performed an analysis of neonates undergoing surgery with CPB from June 2012 to May 2022. CEEG was initiated within 6 hours of surgery and continued for 48 hours post-operatively. The primary outcome was seizure occurrence. Univariable and backward stepwise multivariable logistic regression models were performed to determine factors associated with seizures.

Results: Of 1080 neonates, 102 (9.4%) had post-operative seizures on CEEG. The median age at surgery was 5 days (IQR 3, 7). The majority of operations (48%) were Society of Thoracic Surgeons-European Association for Cardio-Thoracic Surgery (STAT) category 4, followed by STAT 5 (29%), STAT 3 (16%), and STAT 1 and 2 (7%). Deep hypothermic circulatory arrest (DHCA) was used in 584 (54%) and regional cerebral perfusion (RCP) in 82 (8%) operations. In univariable analyses, pre-operative risk factors associated with seizure occurrence included: gestational age, birth head circumference, need for volume expansion at birth, need for urgent cardiac intervention at birth, single ventricle, and the presence of pre-operative seizures. Intra-operative risk factors included: STAT category, lowest temperature on bypass, DHCA duration, use of RCP, total support time, and ECMO onset in operating room. Post-operative risk factors included open sternum and use of inhaled nitric oxide (iNO) in the operating room. In multivariable analyses, gestational age [adjusted odds ratio (aOR): 0.85, 95% CI: 0.76-0.96], open sternum (aOR: 2.91, 95% CI: 1.82-4.72), and iNO (aOR: 1.92, 95% CI: 1.21-3.01) were predictors of seizures. Patients with seizures had longer ICU and hospital length of stay and were less likely to survive to discharge.

Conclusions: In this large 10-year single center experience, we found postoperative electrographic seizures occurred in 9.4% of neonates following surgery with CPB. Decreasing gestational age, open sternum, and iNO were associated with electrographic seizures