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Title: Outcomes of ELBW infants with congenital heart disease vs ELBW infants without congenital heart disease.

Background:

According to the CDC, CHDs are the most common type of birth defect, and affect nearly 40,000 births in the US each year.^{1,2} With improvements in technology, outcomes for these infants have improved dramatically over the past 30 years, with a significant increase in infants with CHD who survive their first year of life.^{1,3,4} However, most of what is known about outcomes of infants with CHD, has been studied in term infants, who tend to have fewer complications and are easier to treat than preterm infants and infants of low birthweight. Though our ability to treat premies and infants with CHD has improved,⁵ very few studies have looked at outcomes of VLBW infants with CHD, and fewer still have examined ELBW infants. This population is particularly vulnerable, not only because many co-morbid conditions affect this population specifically (such as ROP, NEC, and BPD), but also because the incidence of CHD is higher in preterm infants than term infants, and infants with CHD are more likely to be SGA than their counterparts without.⁶ These interactions produce a specific population that is at high risk and is as of yet understudied. In addition, advances in surgical technique have allowed for early intervention in infants of VLBW and ELBW, although standard of care is to allow the infants to grow before performing surgery.⁷ However recent studies have shown that the high risk of morbidity and mortality in VLBW infants with CHD may mean that earlier surgical intervention is warranted in some cases.^{8,9}

Because ELBW infants with CHD are understudied, it is very difficult to counsel parents as to possible outcomes and complications. It is also possible that there are unidentified risk factors to worse outcomes which could predict or direct appropriate treatment. Most of our understanding regarding outcomes of ELBW infants with CHD is drawn from studies of LBW or VLBW infants. Recent studies have differed in their conclusions regarding outcomes of these infants. All studies show an increase in mortality when compared with matched infants without CHD after a certain gestational age (25-27 weeks depending on the study)^{11,12,13,14}. However, while most studies showed no difference in common morbidities (NEC, IVH, ROP)¹⁵, some showed increases in all morbidities^{11,16}, and others showed that rates of ROP and IVH varied with birthweight. Most studies showed an increase in BPH in infants with CHD vs. those without. However, rates of these complications vary from institution to institution. For example, rates of chronic lung disease are much lower in the Columbia NICU than in the general preterm population.^{17,18}

Since 2017 Columbia has maintained a cardiac NICU, which employs neonatologists with cardiac training and is dedicated to the care of infants with CHD. Because of our unique focus on this population, the dearth of current research, and the evolving potential for interventions which can change outcomes in this population, we want to study outcomes of these infants who are cared for in our cardiac NICU specifically. We plan to look at the rates of mortality and morbidities such as ROP, IVH, NEC, and BPD in ELBW infants with CHD, and compare them to ELBW infants without CHD. Like previous studies, we expect that morbidity and mortality

will be increased in this population, but expect that the rates of these complications will be decreased at Columbia when compared with national registries. We also hope to identify risk factors which impact outcomes, so that we can better counsel families of these vulnerable infants.

Methods:

This is a retrospective cohort study. We have a database of ELBW infants with CHD from Columbia's cardiac NICU. We plan to match with ELBW infants in the NICU based on birth year, gender, gestational age, size for gestational age, method of delivery, and other neonatal risk factors. We will likely match 2:1 or 3:1. We plan to use Pearson Chi-square test to compare categorical variables and the Wilcoxon rank-sum test to compare any continuous variables. Primary outcomes include mortality, ROP, IVH, NEC, and BPH. If we don't have enough power to identify significant differences between the two groups, we will consider composite outcomes.

Inclusion Criteria:

ELBW infants (<1000g) with and without congenital heart disease.
Birth date in or after the year 2017

Study Drugs/ Medical Devices:

There are no drugs or medical devices used as part of this study.

Conflicts of Interest:

I have no conflicts of interest to report.

Location of Study:

This study will take place in the Morgan Stanley Children's Hospital Cardiac Neonatal ICU and Neonatal ICU.

Risks:

As a retrospective cohort study, there are no risks to participants of this study.

Benefits:

This study can help us better counsel parents of patients in our cardiac nicu as well as help us identify risk factors for poor outcomes, which may have an impact of future treatment of this population.

Future Directions:

If our hypothesis that we will shower lower rates of morbidities and mortality than national databases proves true, it would be valuable to do a follow-up study comparing outcomes of ELBW infants with CHD after the formation of the cardiac NICU, with infants who would have been treated in the cardiac NICU but were born before it existed.

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