Cardiac, renal and liver function in neonates with Hypoxic Ischemic Encephalopathy treated with Therapeutic Hypothermia

Gospodin Stefanov, MD, PhD**, Timothy Colombo*, Lorene Schweig, BSN, RN§, Preetha Prazad MD**, Ramona Donovan MS, RD§

Department of Pediatrics, Divisions of **Neonatology & Advocate Center for Pediatric Research†, Advocate Children’s Hospital – Park Ridge, IL, USA
†Rosalind Franklin University of Medicine & Science, North Chicago, IL, USA

Introduction

- Hypoxic-ischemic encephalopathy (HIE) is a condition in which perinatal asphyxia (PA)—prolonged hypoxia before, during, or after birth—leads to neuronal injury, causing extensive central nervous system (CNS) damage and possibly death.
- Up to 15-20% of infants diagnosed with HIE die in the postnatal period, and an additional 25% develop severe neurological deficits, including motor, auditory, or visual dysfunction, epilepsy, and cerebral palsy. Hypoxia secondary to perinatal asphyxia can lead to multiorgan dysfunction in addition to CNS damage.
- Therapeutic hypothermia (TH) has become a standard of care for asphyxiated neonates. It has been proven to be beneficial in minimizing the CNS damage that causes HIE. Cooling of an infant’s core temperature to 33-34°C for 72 hours improves neurological outcomes at 18 months of age in asphyxiated neonates.
- Cardiac dysfunction has been noted in 62% of neonates with HIE.
- Kidney and liver injury have also been shown to be a consequence of PA and may present in infants with HIE.
- Cardiac dysfunction alone has been noted in 62% of neonates with HIE.

Objective

- To evaluate cardiac, renal and liver function in neonates with HIE treated with TH and to determine whether various biochemical/functional parameters of cardiac, renal, and hepatic function are significant predictors of mortality.

Methods

Study Population: 47 neonates diagnosed with HIE and treated with TH in a level IV NICU, divided into groups based on:
- Gestational age (GA): Late Preterm (n=8) and Term (n=39)
- Size at Birth: Small-for-gestational age (SGA; n=12), appropriate-for-gestational age (AGA; n=30) and Large-for-gestational age (LGA; n=5)
- Outcome: Alive (n=40) and Deceased (n=7)

Cardiac function parameters: Ejection Fraction (EF), Shortening Fraction (%), and end-diastolic left ventricular internal diameter (LVIDd) were obtained from reports of echocardiograms. Blood pressure (BP) was also retrieved from EMR. EF (LVIDd) and blood pressure (BP) were obtained from the reports of echocardiograms. Blood pressure was also retrieved from EMR. EF (LVIDd) and blood pressure (BP) were obtained from the reports of echocardiograms.

Biochemical Parameters: The following parameters were extracted from EMR at 24, 48, 72, and 96 hours (±4 hours) after birth:
- Troponin I, CK-MB, AST, ALT, Alk Phos, Lactic Acid (LA), Creatinine
- Glomerular filtration rate (GFR)

Urine Output

- Mean urine output at 24, 48, 72, and 96h after birth.

Liver Function Parameters

- Mean serum ALT, AST, and Lactic Acid were significantly higher in the deceased group than the alive group at 24, 48, 72, and 96 (±4) hours after birth.

Results

Discussion

- Cardiac function parameters from echocardiograms (EF, SFx, LVIDd) did not significantly correlate with changes in biomarkers for renal and hepatic function.
- As a result, decreases in renal and hepatic function in neonates with HIE may be influenced more by the neonate’s inherent systemic response to hypoxia than cardiac dysfunction alone.

Conclusions

- There were disparities in the number of subjects in each group; for example, the Alive group had 40 subjects while the Deceased group had just 7.
- Approval will be requested to expand the study to include additional neonates treated for HIE up to 2020. This would improve the power of the study.

References