



# Electrical Cardiometry in the NICU, is it Feasible?

Mitch Rodriguez, M.D., Barbara Weaver, RN, Andrew P Boseman, M.D., Bao Ngoc T. Ho, B.S.,

Robert L. Vogel, Ph.D., Joseph M Van De Water, M.D.

The Medical Center of Central Georgia  
A subsidiary of Central Georgia Health System

ABSTRACT 450160

Department of Pediatrics and Surgery, Mercer University School of Medicine at the Medical Center of Central Georgia, Macon Georgia 31201

## Background



The evaluation of the hemodynamic state of the critically ill neonate remains a challenge in neonatal medicine. Clinical indicators of the circulatory pathophysiology of the neonate have not been shown to be effective measurement tools in evaluating cardiac output (CO). A non-invasive mean of obtaining an objective assessment of cardiac function in the neonatal population potentially could impact on the evaluation, management and trending of cardiovascular status in the neonate. An evaluation was begun of a new hemodynamic monitor; the Aesculon® (Cardiotronic, Inc. La Jolla, CA) designed to measure small stroke volumes (SV).

## Objectives



To adequately judge the role of SV and CO measured by Electrical Cardiometry on neonates in our Neonatal Intensive Care Unit.

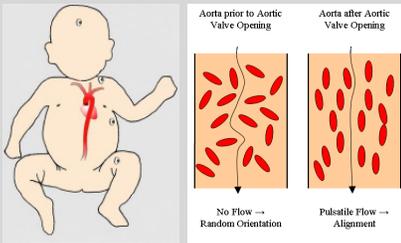
The first phase of our evaluation was an assessment of patient and operator acceptance, patient tolerance and ease of operation.

The second phase was an analysis of reproducibility both inter – and intra – operator.

Finally, stroke volume and cardiac output values from a series of 105 patients were correlated with weight, surface area (SA) and body mass index (BMI).

## Model of Electrical Velocimetry

is based on the fact that the electrical conductivity of the blood in the aorta changes during the cardiac cycle.



Just before aortic valve opening, the red cells in the blood of the aorta exhibit a random orientation (practically no blood flow). After aortic valve opening the red cells align in parallel with the pulsatile blood flow. An electrical current passing through the aorta has to circumfernce the red cells and faces a higher resistance (or decreased conductivity) prior to aortic valve opening (left) than in the period following aortic valve opening (right).

## Design/Methods

Institutional Review Board approval and parental informed consent for participation was obtained.

Inclusion criteria

Infants in the NICU during the period of October 2008- February 2009;

- Appgar score > 3 at 5 minutes.
- Weight greater than 500 grams.
- No congenital heart disease.
- Non- surgical neonates.
- Stable cardio-vascular status

The Electrical Cardiometry monitor, Aesculon® (Cardiotronics, Inc., La Jolla, CA 92307; Osypka Medical GmbH, Berlin, Germany) was used to estimate stroke volume and cardiac output.

Measurements were first determined by 5 different operators; each patient had a total of 5 measurements by operator, inter – and intra – operator user variability was determined by Type III Method of Moments.

Measurements were obtained for 105 neonates during the study period.

SV and CO values were correlated to weight, surface area and body mass index.

## AESCULON Research in Action



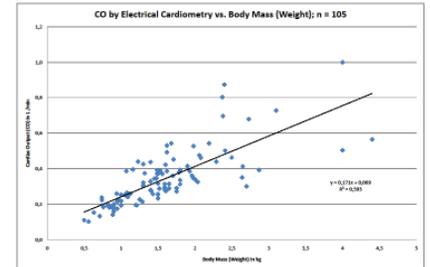
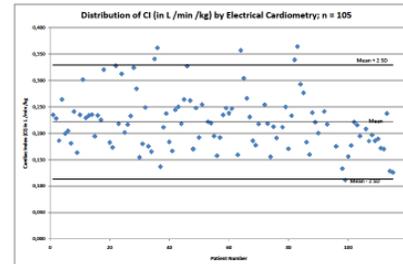
## Supporting Data



AESCULON® electrode placement on 590 gram, 23 week gestation infant



## Results



Our sample group had a mean gestational age of 32.6 weeks, and a mean birth weight of 1550 grams. Included 55 males and 50 females. There were no problems using single electrode placement along the left side of the body at scalp, base of neck, xyphoid and thigh levels. Babies' tolerance was good and device operation was easy, facilitating parental content.

Reproducibility was good with a variance < 1% and < 0.5% for inter- and intra-operator respectively.

Mean cardiac output measured was 339 ± 159 ml/kg.

Mean cardiac index measured was 222 ± 54 ml/kg/min.

Values for CO in this sample of neonates (n = 105) correlated well with weight, body mass index and body surface area. However, the best correlation was CO vs. weight R = 0.77, p < 0.0001.

## Conclusions

The placement of electrodes for performing Electrical Cardiometry in the neonatal patient differs little from the application of physiological monitoring system currently in place, making this process well tolerated by patients, family and staff.

No adverse complications were identified while measurements were obtained. In these same studies the cardiac output and stroke volume have provided some encouraging data as to the potential value of Electrical Cardiometry as a trending tool.

The measurement and trending of SV and CO in the NICU has the potential of providing the neonatal team with valuable information in assisting in the management of the cardiovascular status.