Title: Intra-operative High Frequency Jet Ventilation Does Not Significantly Affect Outcomes During Patent Ductus Arteriosus Ligation

Authors: Mackenzie Noonan[1], Joseph W Turek MD PhD[2,3], John M Dagle MD PhD[2], Steven J McElroy MD[2]

Institution: [1]Carver College of Medicine, University of Iowa, [2] Stead Family Department of Pediatrics, University of Iowa, [3]Department of Surgery, University of Iowa

Introduction: Persistence of a patent ductus arteriosus (PDA) is a common occurrence in premature infants. Symptomatic PDA has been associated with intraventricular hemorrhage, pulmonary hemorrhage, necrotizing enterocolitis, and bronchopulmonary dysplasia. If initial pharmacologic treatment fails or is contraindicated, surgical ligation is commonly performed to close the PDA. Premature infants requiring ductal ligation are commonly on high frequency jet ventilation (HFJV) in an attempt to decrease lung damage from high tidal volume ventilation. The standard procedure for neonates undergoing PDA ligation is to temporarily transfer them from HFJV to conventional ventilation (CV) to create a more motionless field. However, there is currently no evidence that this step is necessary. The goal of our study was to determine whether or not maintaining neonates on the HFJV throughout PDA ligation is as safe and effective as conversion to CV prior to and during surgery.

Methods: This study was completed using retrospective data of neonates that underwent PDA ligation by a single surgeon at the University of Iowa Children's Hospital from July 2014 to July 2016. All infants in the study were on HFJV prior to surgery. Control infants (n=25) were transferred to CV prior to surgery and returned to HFJV post-procedure. Experimental infants (n=16) remained on HFJV. Demographic data obtained from patient records included birth weight, gestational age, sex, maternal race, day of life at time of surgery, weight on day of surgery, and size of PDA. Outcome data was obtained for the 24-hour period prior to surgery, the 12-hour period following surgery, one day post-operation, and one week post-operation. Data obtained included change in diastolic pressure during surgery, time in OR, surgical mortality, incidence of pneumothorax, chylothorax or laryngeal nerve damage, average FiO_2, mean airway pressure (MAP), serum pH, serum CO_2, and serum base deficits. In addition, we collected weights at one week after the surgery, and number of chest x-rays and blood gases obtained during the 48 hours around surgery. One- and Two-tailed T tests were used to compare values of patients in the control group to patients in the experimental group, and statistical significance was determined to be <0.05.

Results: There were no significant demographic differences between the groups (birth weight, gestational age, sex, maternal race, day of life at time of surgery, and weight on the day of surgery). The only significant difference in the 12-hour period following surgery was the serum CO_2. The experimental group had significantly lower CO_2 on the day of surgery ($p=0.0014$). There were no significant differences observed in any outcome measures examined.

Discussion: These results support maintenance of HFJV throughout PDA ligation as it does not pose a threat to the safety or efficacy of the operation. They also show us that eliminating the step of transferring the neonates from the HFJV to CV may result in improved ventilation immediately following surgical ligation.