Comparison of hemodynamic effects assessed by Functional Echocardiography between patients on Conventional Mechanical Ventilation and High Frequency-Oscillatory Ventilation

Thesis

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By

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LIST OF CONTENTS

ABSTRACT

Background: Mechanical ventilation is an invasive life support procedure with many effects on the cardiopulmonary system. Hemodynamic evaluation in NICU is best assessed using Targeted Neonatal echocardiography which is a safe, non-invasive tool for better enhanced cardiovascular imaging and function. **Aim:** Utilization of Targeted neonatal echocardiopgraphy to compare the effect of both conventional mechanical ventilation (CMV) versus that of high frequency oscillatory ventilation (HFOV) at the same mean airway pressure on cardiovascular system and hemodynamic of ventilated neonates in NICU. **Patients and Methods:** This randomized control clinical study was conducted from January 2013 till May 2015 in the neonatal intensive care unit in Pediatric hospital Ain Shams University, Cairo, Egypt. Functional echocardiography measures were evaluated in 58 sick newborn infants needing assisted ventilation by different ventilator modes (29 on CMV and 29on HFOV) on the same mean airway pressure. The 2 groups were matched for gestational age, gender, postnatal age and birth weight. **Results:** There was no statistical significant difference as regards functional echocardiography parameters between the 2 modes of ventilation when using the same mean airway pressure. The comparison was done in terms of, Left ventricular end-diastolic diameter (LVEDD), Ejection fraction (EF), Fractional shortening (FS), ratio between left atrium to aorta (LA:Ao), pulmonary artery pressure (PAP), left ventricular output (LVO), right ventricular output (RVO), superior vena cava(SVC) flow , Pressure gradient across the PDA, Tricuspid lateral annulus TDI, Tricuspid septal annulus TDI. **Conclusion:** There was no significant hemodynamic effect of HFOV rather than CMV when used with the same mean airway pressure. The main problem was with the high mean airway pressures used which has adverse effects on the hemodynamics which is independent of the mode of ventilation.

LIST OF ABBREVIATIONS

- Δ: change in (delta)
- 2D : two-dimensional
- ALI: Acute Lung Injury
- Ao: Aorta
- ASE: American Society of Echocardiography
- BPD: Bronchopulmonary Dysplasia
- CBC: Complete Blood Count
- CBG: Capillary Blood Gases
- CDP: Continuous Distending Pressure
- CHD: Congenital Heart Disease
- CMV: Conventional Mechanical Ventilation
- CO: Cardiac Output
- CO_2 : Carbon dioxide
- CONS: Coagulase Negative Staph
- CPAP: Continuous Positive Airway Pressure
- CRP: c-Reactive Protein
- CT: Computed tomography
- CW Doppler: Continuous Wave Doppler
- Desc Ao: Descending Aorta
- ED vol: End Diastolic Volume
- Edi: Electrical activity of the Diaphragm
- EF : Ejection Fraction
- ESvol: End Systolic Volume
- ETT: Endotracheal tube
- *f:* Frequency
- FiO_2: Fraction of Inspired Oxygen
- FRC: Functional Residual Capacity
- GA: Gestational Age

- Hb: Hemoglobin
- HFOV : High Frequency Oscillatory Ventilation
- HIE: Hypoxic ischemic encephalopathy
- HR: Heart Rate
- ICP: Intracranial Pressure
- IMV: Intermittent Mandatory Ventilation
- ITP: Intrathoracic Pressure
- IV: Intravenous
- IVC: Inferior Vena Cava
- IVH : Intraventricular hemorrhage
- LA: Left Atrium
- LIP: Lower Inflection Point
- LV: Left Ventricle
- LVEDD: Left Ventricular End-Diastolic Diameter
- LVESD: Left Ventricular End-Systolic Diameter
- LVO: Left Ventricular Output
- Mv: Mitral Valve
- NAVA: Neurally Adjusted Ventilatory Assist
- NIRS: Near Infra Red Spectroscopy
- O_2: Oxygen
- OFC: Occipito-Frontal Circumference
- P: Pressure
- PA: Pulmonary Artery
- Pab: Intra-abdominal Pressure
- $PaCO_2$: Arterial Carbon dioxide Tension
- PaO_2: arterial oxygen tension
- $P_{AW:}$ Mean Airway Pressure
- PDA: Patent Ductus Arteriosus
- PEEP: Positive End Expiratory Pressure
- PFO: patent foramen ovale

- PIE: Pulmonary Interstitial Emphysema
- PIP : Peak Inspiratory/ Inflation Pressure
- *P*opt :Optimal Pressure
- P_{plat}: Plateau Pressure
- Pra: Right Atrial Pressure
- PSV: Pressure Support Ventilation
- PVH: Periventricular Hemorrhage
- PW Doppler: Pulsed Wave Doppler
- RA: Right atrium
- RDS: Respiratory Distress Syndrome
- ROP: Retinopathy Of Prematurity
- RPA: Right Pulmonary Artery
- RV: Right Ventricle
- RVO: Right Ventricular Output
- RVSp: Right Ventricular Systolic Pressure
- SD: Standard Deviation
- SF : Shortening Fraction
- SIMV: Synchronized Intermittent Mandatory Ventilation
- SVR: Systemic Vascular Resistance
- TCPL: Time-Cycled, Pressure-Limited
- Te: Expiratory Time
- Tei index: Myocardial Performance Index
- Ti: Inspiratory Time
- Tv: Tricuspid Valve
- UIP: Upper Inflection Point
- UOP: Urinary Output
- UTI: urinary tract infection
- V/Q: Ventilation-Perfusion
- V: Volume
- VILI: Ventilator Induced Lung Injury

- VLBW: Very Low Birth Weight
- VT: Tidal Volume
- VTi: Velocity Time Integral
- WBC: White Blood Cells
- wks: Weeks

LIST OF TABLES

LIST OF FIGURES