

Cardiovascular Effects of High Frequency Oscillatory Ventilation (HFOV) with Optimal Lung Volume Strategy in Term Neonates with Adult Respiratory Distress Syndrome (ARDS)

Ruben J. Acherman, Brian Siassi, Robert deLemos, Alan B. Lewis and Rangasamy Ramanathan. USC School of Medicine, LAC-USC Medical Center, Div of Neonatology, and Children's Hospital of Los Angeles, Div of Cardiology, Los Angeles, CA.

Cardiovascular effects of HFOV with optimal/high lung volume strategy and high mean airway pressure (MAP) in sick neonates is not well defined. We prospectively performed echocardiographic studies in 13 term neonates (BW 3463 ± 390 g; GA 39 ± 1 week) on HFOV and high MAP for the management of ARDS secondary to meconium aspiration syndrome. At the time of the study, infants had been on HFOV for 6-59 hours (mean 18 hours). Ventilatory parameters included: MAP 20 ± 4 cm H₂O; Frequency 10 ± 2 HZ; Amplitude 38 ± 12 cm H₂O.

All infants were paralyzed and sedated during HFOV. None of the infants had radiographic evidence of lung over-inflation. Total fluid intake was 152 ± 19 ml/k/day. Infants needed infusions of colloids and inotropes to maintain adequate blood pressure and perfusion. All infants were in positive fluid balance (mean + 368 ml/day) and generalized edema was noted in 11/13 patients after 24 hrs of HFOV.

LV and RV systolic functions were within the normal range in all patients. LV shortening fraction was $39 \pm 0.5\%$ with low normal LV diameters. Ejection fraction (Simpson's rule) in 10/13 patients $74 \pm 5\%$. Diastolic function estimated from doppler echo of the atrioventricular valves was normal in 8/13, in whom it was available; peak E/A ratios: mitral 0.9 ± 0.2 and tricuspid 0.8 ± 0.1 .

Cardiac output by aortic echo-doppler was severely reduced in 4/13 and moderately reduced in 3/13 patients. The inferior vena cava (IVC) was markedly dilated ($0.57 \pm .06$ cms; normal $0.13 \pm .04$) in all patients. Central venous pressure (CVP) was 9.2 ± 2 mm Hg.

The presence of a dilated IVC, high CVP and peripheral edema in association with normal systolic function and need for volume infusions to maintain cardiac output indicates that HFOV with high MAP causes impairment of systemic venous return at one or more sites. A tamponade-like effect similar to that reported with high positive end expiratory pressure ventilation may be involved.

Further studies are ongoing to delineate the site/mechanism of obstruction. Echocardiography is a valuable tool in assessing fluid status and cardiac function in these critically ill neonates.