Rescue of Term Infant with Refractory Airleak Using High-Frequency Jet Ventilation

Steve Greubel, RRT, St. Mary's Medical Center, Evansville IN.

Baby boy J was a term 3450 gram male born to a 35 year old who was gravida 5, para 2. He was born by C-section at an outlying hospital with APGARS of 9 and 10 at one and five minutes respectively. Baby J developed respiratory distress shortly after birth and his oxygen requirement increased to 70%. In spite of the increased oxygen he remained tachypneic and was transferred to St. Mary's Medical Center for evaluation and treatment.

Shortly after admission an echocardiogram revealed suprasystemic pulmonary artery pressures, evidence of moderate to sever pulmonary hypertension. Chest x-ray showed bilateral atelectasis and consolidation. The infant was intubated and placed on mechanical ventilation at a Rate of 60 bpm, PIP of 25 cm H2O, PEEP of 5 cm H2O, I-time of 0.37 sec. with a MAP of 15 cm H2O. While on conventional ventilation he was given 8 ml of Survanta®. At the end of one hour Baby J was still requiring 100% oxygen. The decision was made to switch him to HFOV (SensorMedics 3100A) at a frequency of 10 Hz, amplitude of 32 cm H2O, MAP of 16 cm H2O. He was started on Dopamine at 5 mcg/kg/min and transfused with fresh frozen plasma due to poor perfusion. He was also sedated with Morphine and Phenobarb due to prolonged irritability. The first ABG on HFOV at 40% oxygen was PO2 64, PCO2 36, pH 7.42 and HCO3 23.

By the afternoon of day two Baby J had been weaned to 25% oxygen on a MAP of 18 cm H2O and was reasonably stable. Then his oxygen saturation began to fall suddenly and the FiO2 had to be increased to 0.45. A stat chest x-ray revealed a right pneumothorax, which required the placement of a thoracotomy tube. Following the procedure the HFOV MAP was increased to 22 cm H2O and the amplitude was raised from 30 to 34 cm H2O. He also received another transfusion of plasma, at this time, to stabilize his blood pressure. Due to increasing oxygen requirements and growing difficulty managing his cardio respiratory status, Baby J received a second dose of Survanta and was paralyzed using Pavulon.

On the morning of day four, HFOV settings were frequency of 10 Hz, amplitude of 34 cm H2O, MAP of 16 cm H2O and oxygen of 46%. Capillary gases were PO2 60, PCO2 73, pH 7.28 and HCO3 33. A chest x-ray showed a re-accumulation of the right pneumothorax. After several unsuccessful attempts to reposition the thoracotomy tube, it was determined that it was occluded and it was replaced. Deep tracheal suctioning was also performed that produced a significant amount of clear mucus. Baby J remained on HFOV and attempts were made to optimize the settings in lieu of the pneumothorax and high PCO2. When the amplitude was increased to lower the PCO2 the chest tube activity would increase and when the amplitude was lowered to limit chest tube activity the PCO2 would increase. As a result, the decision was made to initiate a trial of high-frequency jet ventilation using the Bunnell Life Pulse™. Ventilating effectively at a lower peak and mean airway pressure, might give the pneumo a chance to resolve.

The Jet was started at 420 bpm, PIP 24 cm H2O, PEEP of 5 cm H2O, FiO2 of 0.50 with the conventional vent set on a background rate of 6 bpm. These settings produced a MAP of 9.8 cm H2O, significantly lower than the MAP of 16 cm H2O on HFOV. The first capillary blood gas results were PO2 55, PCO2 42, pH 7.49 and HCO3 32. The chest x-ray showed slight under-expansion so PEEP was increased to 6 cm H2O. Baby J slowly improved during the night and his oxygen was weaned to 30%. The AM chest film showed extensive clearing with even aeration and no free air. Capillary blood gases were PO2 48, PCO2 46, pH 7.44 and HCO3 31.

During the next several hours Baby J was weaned back to conventional ventilation, which he tolerated well. He continued to wean that day and by the morning of day six he was on CPAP. By mid-day he was extubated and that same evening his chest tube was removed. Baby J had no further cardio respiratory distress or other problems during the remainder of his hospitalization.