

Evaluation of a Double-Piston Configured Total Liquid Ventilator in an Adult Animal Model of Acute Respiratory Failure

DS Foley, MD; S Sawada, MD; DO Brandt, MS; RH Bartlett, MD; RB Hirschl, MD

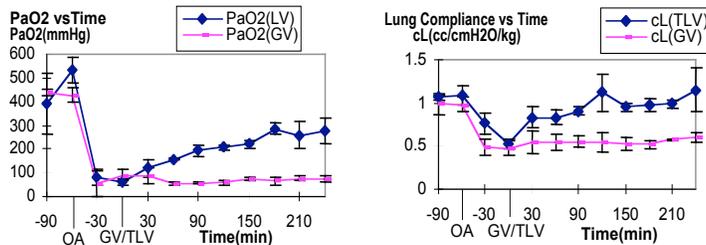
Objective: Total liquid ventilation(TLV) with perfluorocarbon liquid been associated with improved outcomes in animal models of acute respiratory failure. **EXAMPLE EXAMPLE EXAMPLE EXAMPLE EXAMPLE EXAMPLE EXAMPLE**

the size and complexity of the mechanical liquid ventilators which have been developed to assist with both the tidal flow and regeneration of the liquid. The efficacy of a recently developed double-piston configured liquid ventilator was tested in an adult animal model of the acute respiratory distress syndrome.

Methods: Following induction of anesthesia, tracheostomy and placement of hemodynamic monitoring lines, 6 young adult sheep(wt.19-25kg) underwent induction of lung injury with oleic acid (.07mg/kg) infusion to the right atrium. Adequate injury was defined by PaO₂ < 150mmHg and ≥ 50% reductions in pulmonary compliance over one hour while on pressure control ventilation with FiO₂=1.0. Animals were then randomized to receive four hours of either gas ventilation(GV,n=3) or total liquid ventilation(TLV,n=3) with perflubron(Liquivent®, Alliance Pharmaceutical Corp., San Diego, CA.), using an Alliance prototype double-piston liquid ventilator. Temperature, heart rate, systemic and pulmonary arterial pressure, cardiac output, pulmonary compliance and arterial and mixed venous blood gas measurements were obtained at thirty minute intervals during the treatment phase of the experiment. At the end of the protocol, each animal was euthanized, and its chest opened for gross inspection of the lungs.

Results: All six of the animals survived the four hour treatment period, and no significant temperature or hemodynamic differences were noted between GV and TLV groups. TLV animals demonstrated significantly higher arterial oxygen tensions(PaO₂) compared to GV controls at one hour after randomization (TLV=158±1.6 mmHg, GV=53.9±6.4mmHg; p=.001), and this difference was maintained for the rest of the experimental period. Static pulmonary compliance(cL) was significantly improved in the TLV group after one hour of therapy (TLV=.83±.08ml/cmH₂0/kg, GV=.54±.09ml/cmH₂0/kg;p=.002), and was consistent across most of the remaining time points. Gross examination of the lungs revealed less dependent atelectasis and hemorrhage in the TLV animals. The liquid ventilator was easily operated by one investigator.

Conclusions: The double-piston pump total liquid ventilator is both easily used and effective in improving pulmonary function in an adult animal model of the acute respiratory distress



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David S. Foley, MD, ECMO Research Laboratory B570 MSRBII/0686; 3-7420, pager 1234
Faculty mentor: RH Bartlett, MD