Category 1: Respiratory: ARDS - mechanical ventilation - other support C
A434 - Ultra-protective ventilation with coaxial endotracheal tube and moderately high respiratory rates reduces driving pressure

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Introduction:
Reduction of tidal volumes (TV) below 6 mL/kg associated with low driving pressure (ΔP) might improve lung protection in patients with acute respiratory distress syndrome (ARDS). The current study tests the combination of coaxial double lumen endotracheal tube (to reduce instrumental dead-space) and moderately respiratory rate (RR) (<80 bpm) to maintain CO2 at clinically acceptable levels while using ultraproductive TV. The objective is to considerably reduce ΔP, which has been premonized as an index more strongly associated with survival than TV, per se, in ARDS patients. The ultraproductive ventilation setup proposed here kept the original tracheal tube and require nothing else than standard ventilator circuit and monitoring.

Methods:
8 juvenile pigs were anesthetized, intubated and mechanically ventilated. Severe lung injury (P/F<100) was induced using a double-hit model: repeated surfactant wash-out followed by injurious mechanical ventilation using low positive end-expiratory pressure and high ΔP (~40 cmH2O) for 3 hours. Then VTs of 6, 4, and 3 mL/kg were used in random sequence for 30 min each, both using a standard and coaxial endotracheal tube. At each VT level, RR was adjusted to achieve PaCO2=60 mmHg but not exceeding 80 bpm. Lung functional parameters and blood gas analysis were measured at each VT level. Statistical analysis was performed using mixed linear model.

Results:
Coaxial endotracheal tube, but not the conventional tube, allowed decreasing VT to 4 and 3 mL/kg, while keeping PaCO2 at approximately 60 mmHg and RR<80 bpm, reducing ΔP of 4.0 cmH2O and 6.0 cmH2O, respectively, compared to the conventional VT of 6 mL/kg.

Conclusion:
In this ARDS model, coaxial tube ventilation associated with moderately high RR allowed ultraproductive ventilation (VT=3 mL/kg) and reduced ΔP levels, maintaining PaCO2 at acceptable levels. This strategy might have a significant impact on mortality of severe ARDS patients.

Image 1:

- Without coaxial ventilation
- With coaxial ventilation

Group effect: p=0.002
VT effect: p<0.001

 Aristocaric pressure of CO2 and respiratory rate at each studied tidal volume (6, 4, and 3 mL/kg) and group (with and without coaxial ventilation)