[GA2-61] Ventilation during adolescent robotic, laparoscopic-assisted bariatric surgery: volume-controlled, pressure-controlled or volume-guaranteed pressure-regulated modes?

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Background: Up to 4-7% of children in the United States are severely obese (BMI ≥ 40 kg/m2). Managing ventilation and oxygenation to avoid hypoxemia, hypercarbia, and barotrauma is challenging in this population. Pressure-regulated, volume-controlled (PRVC) ventilation is a dual-control mode of ventilation and an alternative to pressure (PC) or volume (VC) controlled ventilation. PRVC features a user-selected tidal volume target, that is auto-regulated and pressure controlled. The ventilator adjusts the pressure limit of the next breath based on the previous breath's measured exhaled tidal volume and has a pre-determined high pressure limit. PRVC may thus achieve the desired tidal volume with the lowest peak inspiratory pressure (PIP). We hypothesized that the PRVC mode of ventilation will provide improved oxygenation and ventilation during laparoscopic bariatric surgery with a lower PIP than either pressure or volume limited modes of ventilation.

Methods: This prospective, randomized, cross-over trial evaluated the effects of three modes of ventilation (PC, VC and PRVC) on PIP, ventilation and oxygenation during robotic laparoscopic vertical sleeve gastrectomy. Anesthetic monitoring (ASA specific monitors plus an arterial cannula), induction, and maintenance were standardized for each patient. In a randomized sequence, each patient received the 3 modes of ventilation for 30 minutes during the laparoscopic portion of the procedure. The patients were in the reverse Trendelenburg position during the study period. For all modes of ventilation, the inspired oxygen concentration was held at 0.5 with a positive end expiratory pressure of 5 cmH2O. The respiratory rate was adjusted to achieve normocarbia and the inspiratory time was set at 1.5 seconds. VC ventilation was provided with 6-8 mL/kg of tidal volume. PC ventilation was provided with the PIP adjusted to deliver a tidal volume of 6-8 mL/kg. PRVC was provided using a tidal volume of 6-8 mL/kg. During the 30 minute study period for each mode of ventilation, the PIP, exhaled tidal volume, respiratory rate, and oxygen saturation were recorded every 5 minutes. At the end of 30 minutes, an arterial blood gas was obtained. Data were analyzed using a paired t-test.

Results: PRVC and PC ventilation both resulted in significantly lower PIP (cmH2O) than VC ventilation (30.5 ± 3.0, 31.6 ± 4.9, and 36.3 ± 3.4 mmHg respectively; $p<0.01$ for PRVC vs. VC and PC vs. VC). No significant difference was found between the PIP for PRVC and PC ventilation. There was no difference in oxygenation (PaO2) or ventilation (PaCO2) using any of the three ventilation modes.

Conclusions: In the adolescent bariatric population undergoing laparoscopy, PRVC and PC ventilation appear to be superior to VC ventilation in the ability to mechanically ventilate with the lowest PIP. PRVC ventilation may require fewer adjustments than PC ventilation with variations in lung compliance and resistance.

References:
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