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Sigh in acute respiratory distress syndrome

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Keywords

Acute respiratory distress syndrome, ventilatory support

Comments

This paper eloquently tackles a number of unresolved issues surrounding the optimal method of ventilating ARDS patients. It provides a relatively simple addition to current best practice which warrants a larger clinical study to determine whether the observed benefits in ventilatory parameters translate into improvements in clinical outcome. It also stresses the increasingly observed phenomenon that patients with ARDS from a pulmonary origin appear to benefit less from clever ventilatory strategies, as unsurprisingly, the amount and type of lung damage in this group is more severe.

Introduction

There is much debate currently, regarding the optimal ventilation strategy in acute respiratory distress syndrome (ARDS). Several recent studies have promoted the open lung approach which involves: (1) the use of high levels of positive end-expiratory pressure (PEEP) to recruit and maintain lung units and hence prevent the deleterious effects of recruitment/derecruitment; (2) the limitation of plateau inspiratory pressure to 35 cmH_2O, in order to prevent the damaging effects of barotrauma, at the cost of relatively low tidal volumes (6-8 ml/kg), with consequent permissive hypercapnia. However, the authors of this paper raise the issue that this approach ignores the well documented phenomenon of progressive lung atelectasis seen in patients ventilated with low tidal volumes. The mechanism for this is deemed to be the progressive gas reabsorption seen in lung units whose gas uptake exceeds supply. As this occurs over seconds to minutes and not breath by breath, it can be overcome by intermittent high tidal volumes.

Aims

To test the following hypotheses: (1) that the open lung strategy (outlined above) maintains unresolved atelectasis; (2) that the addition of intermittent sighs leads to further lung unit recruitment and prevents derecruitment of these units, with a consequent improvement in gas exchange; (3) that the effects of adding sighs are different in patients with ARDS from pulmonary and extrapulmonary origins.

Methods

Ten sequential ARDS patients were studied, five each having pulmonary and extrapulmonary origin. ALL patients received identical treatment. They were ventilated using the open lung strategy for 2 h, during which time optimal PEEP was determined using both a static pressure volume curve and a PEEP trial. Patients were then switched to a ventilatory mode where, in addition to the above strategy with optimal PEEP, three consecutive sighs per minute were added for a period of 1 h. Sighs were breaths of longer duration and with a plateau pressure of 45 cmH_2O. The respiratory rate was decreased to maintain a constant minute volume. Patients were then returned to the original ventilatory settings for a period of 1 h. Measurements of gas exchange, hemodynamics, lung volumes and respiratory mechanics were made at set time intervals.

Results

During the sigh ventilation period PaO_2, $PaCO_2$ and shunt all improved. However, this effect was reversed within 30 min of returning the patients to baseline ventilation. A similar pattern of change was observed with hemodynamic variables, lung volumes and respiratory mechanics. These effects were much greater in the patients with ARDS of extrapulmonary origin.

Discussion

The authors made the following conclusions: (1) The open lung ventilatory strategy does not recruit and maintain all lung units; (2) the addition of sighs did recruit and maintain significantly more lung units with consequent benefits in all measured parameters; (3) that having achieved this further recruitment, return to baseline ventilation led to the loss of the observed benefit, despite optimal levels of PEEP; (4) that these effects were far greater in patients with ARDS of extrapulmonary origin. They argue that two types of atelectasis coexist in ARDS patients which they name compression and reabsorption. Optimal PEEP should prevent compression atelectasis but appears to fail in preventing reabsorption. Lung volume recruitment maneuvers overcome reabsorption atelectasis, but the effect is lost unless the maneuvers are repeated regularly, as demonstrated by the addition of regular sighs.

References

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