Mechanical ventilation with a lower tidal volume decreased mortality in the acute respiratory distress syndrome

Acute Respiratory Distress Syndrome Network. **Ventilation with lower tidal volumes as compared with traditional tidal volumes for acute lung injury and the acute respiratory distress syndrome.** N Engl J Med. 2000 May 4;342:1301-8.

QUESTION

In patients with acute lung injury or the acute respiratory distress syndrome (ARDS), does mechanical ventilation with lower tidal volumes improve clinical outcomes (death and ventilator-free days)?

DESIGN

Randomized (allocation concealed*), unblinded,* controlled trial with 180-day follow-up. The trial was stopped after 861 patients were enrolled.

SETTING

10 university centers in the United States.

PATIENTS

861 patients (mean age 51 y, 60% men) who were intubated and on mechanical ventilation with an acute decrease in the ratio of partial pressure of arterial oxygen to fraction of inspired oxygen ≤ 300, had bilateral pulmonary infiltrates on a chest radiograph consistent with edema, and had no evidence of left atrial hypertension for < 36 hours. Exclusion criteria included increased intracranial pressure, severe chronic respiratory or liver disease, and an estimated 6-month mortality rate of > 50%.

INTERVENTION

432 patients were assigned to lower tidal volumes (6 mL/kg of predicted body weight and an airway pressure measured after a 0.5-s pause at the end of inspiration [plateau pressure] of ≤ 30 cm of water), and 429 were assigned to traditional tidal volumes (12 mL/kg of predicted body weight and a plateau pressure of ≤ 50 cm of water).

MAIN OUTCOME MEASURES

The primary outcome measures were death and number of ventilator-free days before day 28.

MAIN RESULTS

Patients who were treated with lower tidal volumes had fewer deaths ($P = 0.007$) and a greater number of ventilator-free days during the first 28 days ($P = 0.007$) (Table).

CONCLUSION

In patients with acute lung injury or the acute respiratory distress syndrome, mechanical ventilation with a lower tidal volume decreased mortality and increased the number of ventilator-free days.

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*See Glossary.

Mechanical ventilation with lower tidal volumes (LTV) vs mechanical ventilation with traditional tidal volumes (TTV) in the acute respiratory distress syndrome†

Outcomes	LTV	TTV	RRR (95% CI)	NNT (CI)	Mean difference (CI)
Death by 180 days	31%	40%	22% (7 to 35)	12 (7 to 41)	—
Ventilator-free days (Mean from day 1 to 28)	12%	10%	—	—	2% (0.5 to 3.5)

†Abbreviations defined in Glossary; RRR, NNT, and CI calculated from data in article.

COMMENTARY

This important study by the Acute Respiratory Distress Syndrome Network confirms that a "lung-protective strategy" should be applied to patients with ARDS who are on a mechanical ventilator. This concept was based on studies, such as a randomized trial showing how mechanical ventilation could be harmful (1). Uncertainties persisted, however, because other clinical trials have not confirmed the influence of tidal volume on mortality in ARDS (2, 3).

This trial differs from previous negative studies in its larger size and its larger difference between the 2 tidal volumes used. The plateau pressure of the control group in this trial was in the high range after a few days, suggesting that a threshold pressure is necessary to cause harm. Regardless, this study reinforces the deleterious role of plateau pressures at ≥ 30 cm of water.

2 other key points should be made: Breathing frequency was increased in the lower tidal-volume group (from 16 to 29 breakthrough), and acidosis was prevented. In contrast with previous studies, maintaining arterial pH in the normal range may have prevented acidosis-induced side effects. Positive end-expiratory pressure (PEEP) was similar in both groups. It is conceivable, however, that increasing frequency in the lower tidal-volume group raised the real (not measured) total PEEP. A protective effect of PEEP cannot be excluded and needs to be investigated further.

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