Mechanical ventilation with a lower tidal volume resulted in decreased mortality in patients with acute lung injury and the acute respiratory distress syndrome

The 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?

Design
Randomised (allocation concealed), unblinded, controlled trial with 28 days of follow up. The trial was stopped after 861 patients were enrolled.

Setting
10 university centres in the US.

Patients
861 intubated patients (mean age 51 y, 60% men) receiving mechanical ventilation who had an acute decrease in the ratio of partial pressure of arterial oxygen to fraction of inspired oxygen (PaO_2:FiO_2 ratio) to ≤300 (indicating onset of hypoxemia), bilateral pulmonary infiltrates on a chest radiograph consistent with oedema, and no evidence of left atrial hypertension for <36 hours. Exclusion criteria included <18 years of age, increased intracranial pressure, neuromuscular disease that could impair spontaneous breathing, sickle cell disease, severe chronic respiratory or liver disease, pregnancy, weight >1 kg per cm of height, burns on >30% of body surface area, bone marrow or lung transplantation, 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 second 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
Mortality was lower in patients treated with lower tidal volumes (p=0.007) (table). The number of ventilator free days during the first 28 days was greater in patients in the lower tidal volumes group (p=0.007) (table).

Conclusion
In patients with acute lung injury and the acute respiratory distress syndrome, mechanical ventilation with a low tidal volume resulted in decreased mortality and increased number of ventilator free days.

Source of funding: National Heart, Lung, and Blood Institute.

For correspondence: Dr R G Brower, Division of Pulmonary and Critical Care Medicine, Johns Hopkins University, 600 N Wolfe Street, Baltimore, MD 21287, USA. Fax +1 410 955 0036.

A modified version of this abstract appears in ACP Journal Club and Evidence-Based Medicine.

*Mechanical ventilation with lower tidal volumes (LTV) v with traditional tidal volumes (TTV) in the acute respiratory distress syndrome**

Outcomes at 28 days	LTV	TTV	RRR (95% CI)	NNT (CI)
Death	31%	40%	22% (7 to 35)	12 (7 to 41)
	LTV	**TTV**	**Mean difference (CI)**	
Ventilator free days	12	10	2 (0.5 to 3.5)	

*Abbreviations defined in glossary; RRR, NNT, and CI calculated from data in article.

COMMENTARY

This study by the Acute Respiratory Distress Syndrome Network supports the use of low tidal volumes in acute lung injury and ARDS, and is consistent with a previous trial.[1] It differs from 3 previous negative trials[2–4] by having a larger difference in tidal volumes between groups, and by having a more aggressive approach to correcting acidosis. This study provides important information about tidal volume size; however, further research is still needed to determine the importance of concurrent strategies such as positive end expiratory pressure (PEEP).

In this study, an equation based on sex and height was used to calculate a predicted body weight, which was then used to set tidal volumes. Obesity is a common problem; the use of measured body weight can inadvertently lead to the use of high tidal volume ventilation. Tidal volumes should be based on ideal versus measured body weight.

This information is relevant to nurses who care for mechanically ventilated patients. Through continuous monitoring, the nurse is positioned to identify the need for treatment changes and to communicate findings with appropriate members of the team. Low tidal volume ventilation should be initiated when the PaO_2:FiO_2 ratio is ≤300 in the presence of non-cardiac pulmonary oedema.

High peak airway pressures and inspired oxygen concentrations may pose additional risks for harm. The benefits achieved with low tidal volumes may be lost if the level of PEEP used is insufficient to prevent end exhalation closure of alveoli, and some patients may find low tidal volumes uncomfortable. Consequently, monitoring to ensure that prescribed ventilation is maintained, to identify additional risks (eg, increasing airway pressures), and to recognise the need for additional interventions (eg, treatment of acidosis, sedation) is important.

Brenda Lynn Morgan, RN, BScN, CNCC(C)
Clinical Educator, Critical Care Trauma Centre
London Health Sciences Centre
London, Ontario, Canada

1 Amato MB, Barbas CS, Medeiros DM, *et al. N Engl J Med* 1998;**338**:347–54.
2 Brochard L, Roudot-Thoraval F, Roupie E, *et al. Am J Respir Crit Care Med* 1998;**158**:1831–8.
3 Stewart TE, Meade MO, Cook DJ, *et al. N Eng J Med* 1998;**338**:355–61.
4 Brower RG, Shanholtz CB, Fessler HE, *et al. Crit Care Med* 1999;**27**:1492–8.