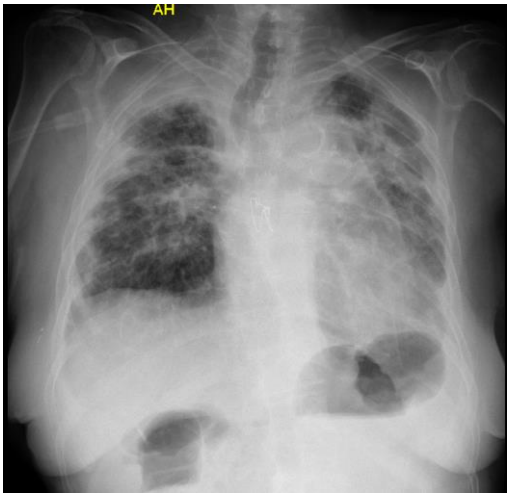
Clinical update no. 529
23 January 2018

Case: 58yr-F lung transplant patient presents with worsening dyspnoea and cough. She is hypoxic and tachypnoeic and requires ventilation. What ventilator strategies should be used? Is it ARDS?



Protective ventilator strategies are of proven benefit in ARDS. Any benefit for other groups of patients is not clear.

In essence, repetitive collapse and over distension of alveoli lead to lung damage and worse outcomes.

Protective ventilation strategies are outlined in the ARDSNET protocols. This involves PEEP to prevent alveolar collapse, and limiting TV to 6 ml/kg (predicted body weight based on height) and adjusting down to 4 ml/kg to keep plateau pressure <30 cm H2O.

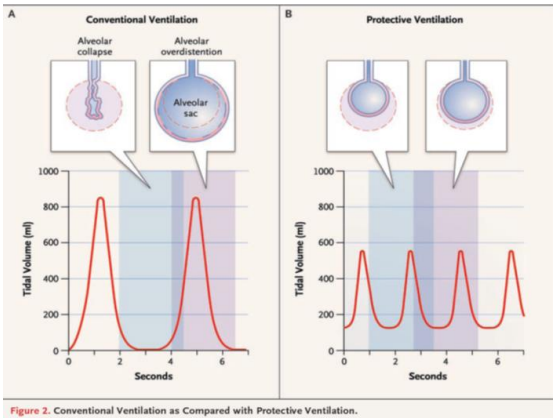
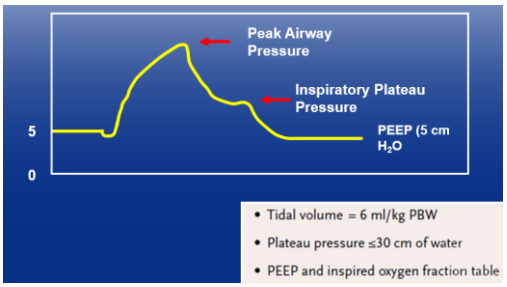


Figure 2. Conventional Ventilation as Compared with Protective Ventilation.



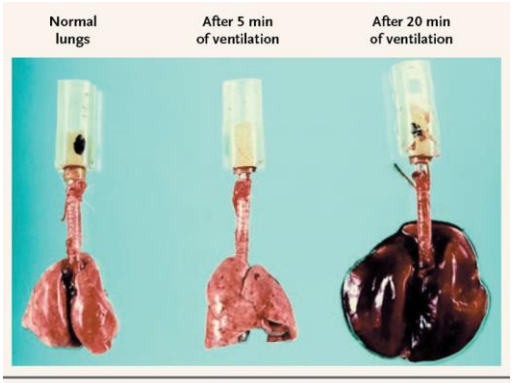


Figure 1. Normal Rat Lungs and Rat Lungs after Receiving High-Pressure Mechanical Ventilation at a Peak Airway Pressure of 45 cm of Water.

M. MECHANICAL VENTILATION

ARDSNET lung protective strategies

TV 6 ml/kg predicted body weight;

plateau pressure <30 cm H2O

higher PEEP if hypoxic

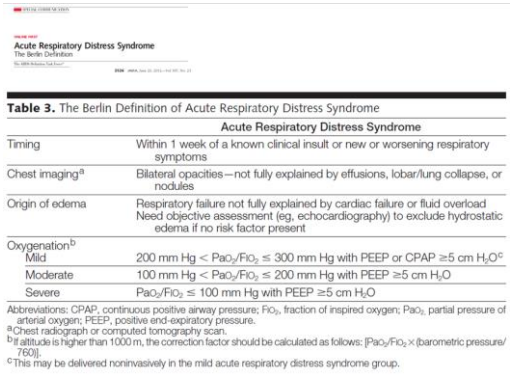
conservative fluid strategy

avoid β2-agonists if no bronchospasm

avoid routine use of pulmonary artery catheter

30-45 deg head elevation

There is no recommendation regarding the use of NIV in sepsis induced ARDS.



Acute Respiratory Distress Syndrome
The Berlin Definition

Table 3. The Berlin Definition of Acute Respiratory Distress Syndrome

	Acute Respiratory Distress Syndrome
Timing	Within 1 week of a known clinical insult or new or worsening respiratory symptoms
Chest imaging[a]	Bilateral opacities—not fully explained by effusions, lobar/lung collapse, or nodules
Origin of edema	Respiratory failure not fully explained by cardiac failure or fluid overload Need objective assessment (eg, echocardiography) to exclude hydrostatic edema if no risk factor present
Oxygenation[b]	
Mild	200 mm Hg < PaO_2/FiO_2 ≤ 300 mm Hg with PEEP or CPAP ≥5 cm H_2O[c]
Moderate	100 mm Hg < PaO_2/FiO_2 ≤ 200 mm Hg with PEEP ≥5 cm H_2O
Severe	PaO_2/FiO_2 ≤ 100 mm Hg with PEEP ≥5 cm H_2O

Abbreviations: CPAP, continuous positive airway pressure; FiO_2, fraction of inspired oxygen; PaO_2, partial pressure of arterial oxygen; PEEP, positive end-expiratory pressure.
[a] Chest radiograph or computed tomography scan.
[b] If altitude is higher than 1000 m, the correction factor should be calculated as follows: [PaO_2/FiO_2 × (barometric pressure/760)].
[c] This may be delivered noninvasively in the mild acute respiratory distress syndrome group.

In essence ARDS is non cardiogenic pulmonary oedema, i.e. bilateral opacities not explained by cardiac failure or fluid overload, nor effusions, lobar/lung collapse or nodules,

as outlined in the Berlin definition. Severity is defined by the PaO2 at a given FIO2.

Severe is a PaO2/FIO2 <100, i.e. FIO2 0.5 (50% O2) would give a PaO2 of <50 mm Hg, or 100% O2 would give PaO2 <100 mm Hg.

Moderate: PaO2/FIO2 100-200, i.e. FI O2 0.5 (50% O2) needed to give PaO2 >100 mmHg

Mild: PaO2/FIO2 200-300.

All include PEEP of at least 5 cm H2O. Therefore criteria essentially require the patient being intubated and ventilated with PEEP and a known FIO2.

However this patient is immunocompromised with severe pneumonia, and is not ARDS.

Research

JAMA | Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

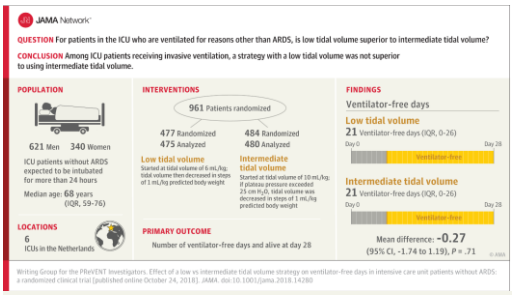
Effect of a Low vs Intermediate Tidal Volume Strategy on Ventilator-Free Days in Intensive Care Unit Patients Without ARDS

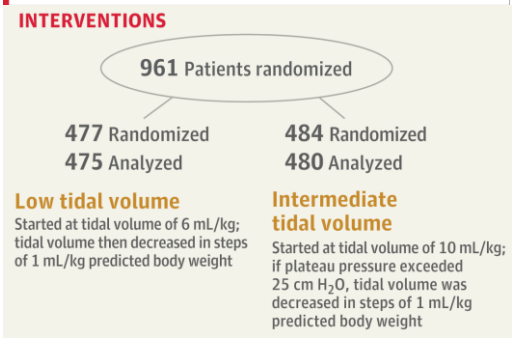
A Randomized Clinical Trial

Writing Group for the PReVENT Investigators

JAMA. 2018;320(18):1872-1880.

OBJECTIVE to determine whether a low tidal volume ventilation strategy is more effective than an intermediate tidal volume strategy.





TV of 6 ml/kg predicted body weight was compared to 10 ml /kg (reduced if plateau pressure >25 cm H2O).

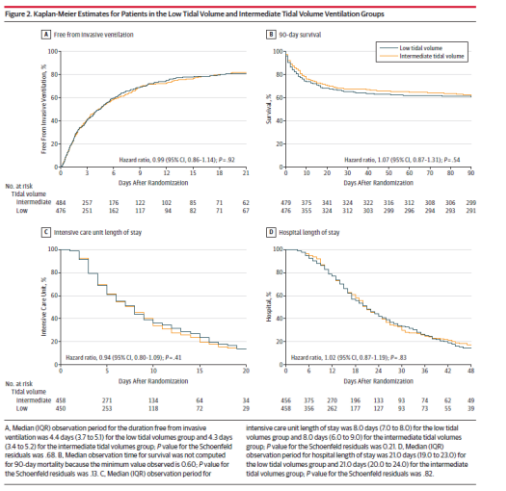
The study included patients ventilated for pneumonia or other lung pathology if they did not meet the definition of ARDS.

Over half were intubated for pneumonia, aspiration or sepsis, and a further quarter post cardiac arrest.

Table 1. Baseline Characteristics of the Patients

	Low Tidal Volume (n = 477)	Intermediate Tidal Volume (n = 484)
Reason for intubation, No. (%)		
Pneumonia	77 (16.1)	77 (15.9)
Sepsis	50 (10.5)	46 (9.5)
Aspiration	20 (4.2)	24 (5.0)
Cardiac arrest	110 (23.1)	120 (24.8)

There was no benefit in any outcome measure – ventilator free days, survival, and length of ICU or hospital stay.



Opinion

EDITORIAL

Lessons From ARDS for Non-ARDS Research

Remembrance of Trials Past

Benefit in previous trials has been more apparent when greater TV differences were compared, specifically <6 and >10 ml/kg predicted body weight (height based).

In this trial over 25% in the low TV group had TV >6.7 ml/kg, and <25% got down to 4 ml/kg, meaning the separation between groups was not as marked.

In practice most clinicians use a TV of around 8 ml/kg and ensure plateau pressures <30 cm H2O, avoiding higher volumes and pressures.

It is probably a reasonable approach.