Manual Ventilation

by Armstrong Medical

Manual ventilation

Mechanically ventilated patients are at risk of retained secretions and atelectasis contributing to pulmonary complications.

What is MHI?

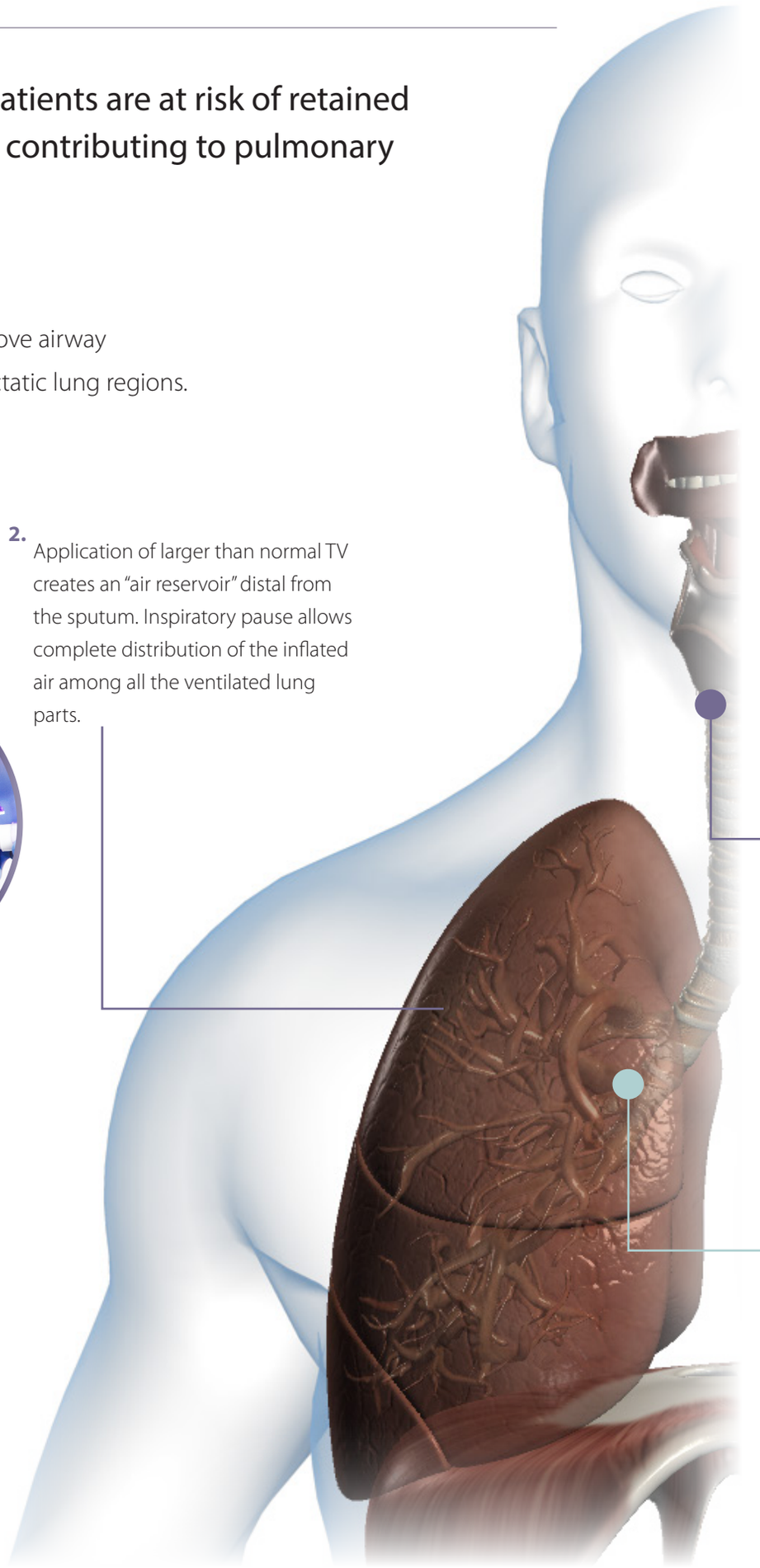
Manual hyperinflation aims to improve airway secretion removal and recruit atelectatic lung regions.

How does it work? [16]

1. Slow peak inspiratory flow (PIF) by controlled compression of the resuscitation bag.

2. Application of larger than normal TV creates an "air reservoir" distal from the sputum. Inspiratory pause allows complete distribution of the inflated air among all the ventilated lung parts.

3. Rapid release of the resuscitation bag obtains a fast peak expiratory flow (PEF) rate to help move secretions from distal to more proximal areas to be easily suctioned off. Studies have suggested that as PEF is increased, secretion removal is enhanced with optimal PEF of >0.41L/s (24.6L/min)



Clinical Evidence

Airway Resistance

Manual hyperinflation and suction has been shown to improve respiratory mechanics with a reduction in airway resistance and improved compliance by 20%. [17]

Secretion clearance

The Mapleson C circuit clears more secretions than a self-inflating resuscitation bag. (Laerdal) 3.51g v 2.61g. Peak expiratory flow rate (PEFR) was faster using rapid release with Mapleson C circuits compared with self-inflating resuscitation circuits. The Mapelson C generates lower PIF to PEF ratio than a self-inflating resuscitation circuit. [18]

Safety

A peak inspiratory pressure of 40 cmH_2O with manual hyperinflation is a good compromise between safety and effectiveness, the Mapleson achieved this pressure consistently while the Laerdal did not. [18]

Weaning

Patients receiving early manual hyperinflation in elective cardiac surgery spent less time on mechanical ventilation (295min v 372min time to extubation) and a shorter time to weaning. [19]

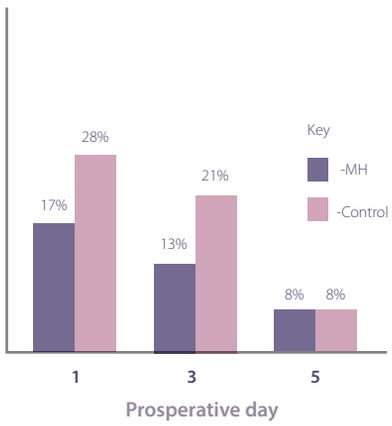
Secretion removal

By mimicking a cough, airway secretions are mobilised towards the upper airways for suctioning, preventing plugging of the smaller airways.

Reversal of atelectasis

Manual hyperinflation aims to improve lung volume, open collateral channels and recruitment of collapsed lung areas.

Manual hyperinflation was associated with less postoperative hypoxemia. [16]



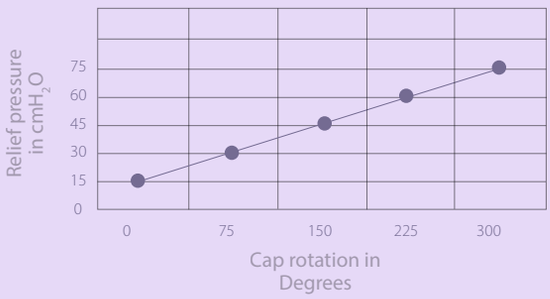
Lower incidence of atelectasis on post-operative chest radiographs. [16]

	MH (46)	Control (46)
No atelectasis	8%	0%
Plate/sub segmental atelectasis	20%	22%
Segmental atelectasis	18%	23%
Lobar atelectasis	0%	2%

Manual ventilation

Armstrong Medical's streamlined design incorporates a linear and proportional APL valve. Incremental pressure and adjustment enhances user feel and control.

Effect of cap rotation on relief pressure adjustment



The Ultra APL valve is utilised for a sensitive and accurate control of inspiratory pressures.

References

16. Paulus et al, Manual hyperinflation partly prevents reductions of functional residual capacity in cardiac surgical patients- a randomized controlled trial. Critical care (2011) 15 R187.

17. Choi J S et al, Effects of manual hyperinflation and suctioning on respiratory mechanics in mechanically ventilated patients with ventilator – associated pneumonia, Australian Journl of Physiotherapy, (2005) 51 25-30.

18. Hodgson C et al, The Mapleson c circuit clears more secretions that the Laerdal circuit during manual hyperinflation in Mechanically-ventilated patients: a randomized cross-over trial, Australian physiotherapy association 2007 (53) 33 -38

19. Blattner et al, Oxygenation and static compliance is improved immediately after early manual hyperinflation following myocardial revascularization: a randomized controlled trial. Australian journal of Physiotherapy (2008) (52) 173 – 178