

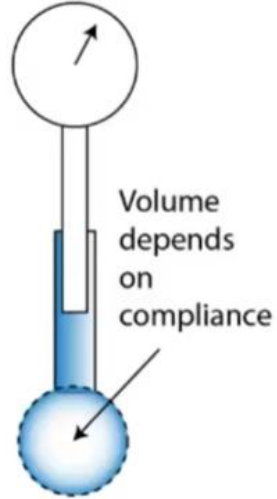
Volume-Targeted Ventilation

Volume control vs Pressure control ventilation

- In Pressure control ventilation, the primary control variable is the inflation pressure, while the tidal volume delivered to the lungs is the dependent variable.
- In Volume-Controlled ventilation, tidal volume delivery in to the ventilator circuit is controlled and pressure is the dependent variable

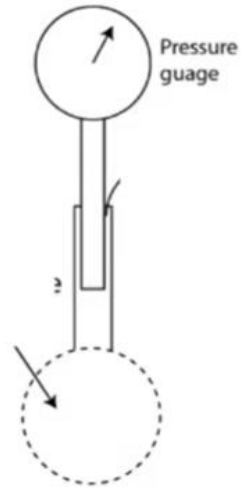
Working of pressure control ventilation

Poor compliance

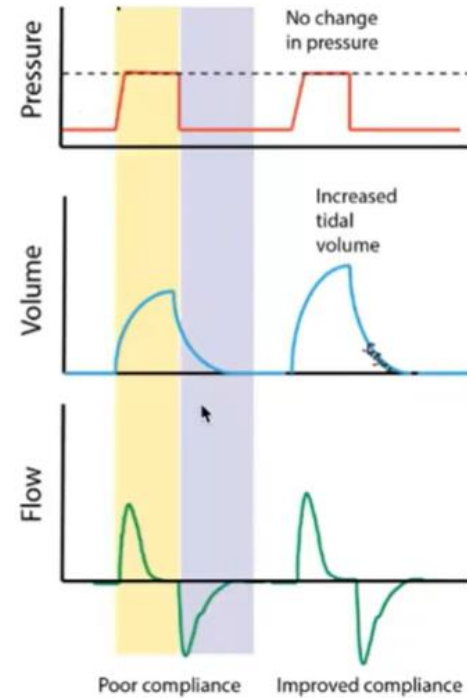


Poor compliance
(low tidal volume)

Improved compliance

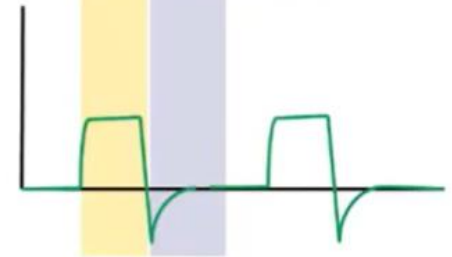
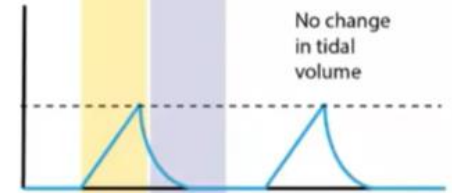
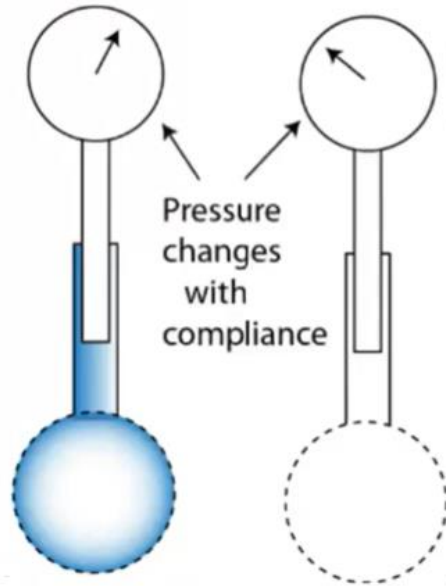


Improved compliance
(higher tidal volume)



Working of Volume controlled ventilation

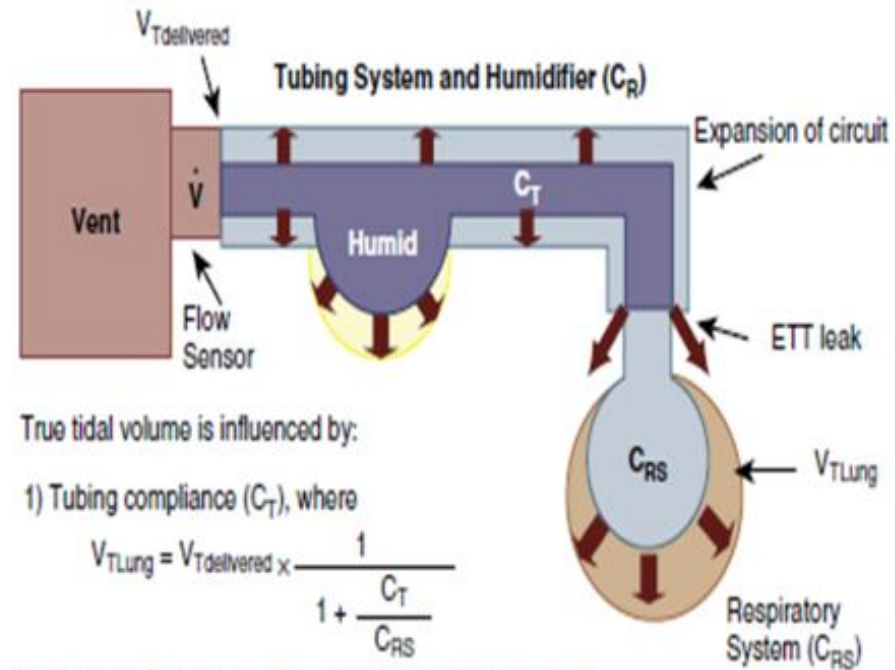
Low compliance Improved compliance



Poor compliance Improved compliance²³

- **VCV**- The major limitation of any VC ventilator is that- **what is controlled is the volume delivered into the ventilator circuit and NOT the tidal volume that enters the patient's lung.**
- This limitation is based on the fact that the **VT is measured at the ventilator end of the circuit.**

Parameters determining Tidal Volume



True tidal volume is influenced by:

1) Tubing compliance (C_T), where

$$V_{TLung} = V_{T\text{delivered}} \times \frac{1}{1 + \frac{C_T}{C_{RS}}}$$

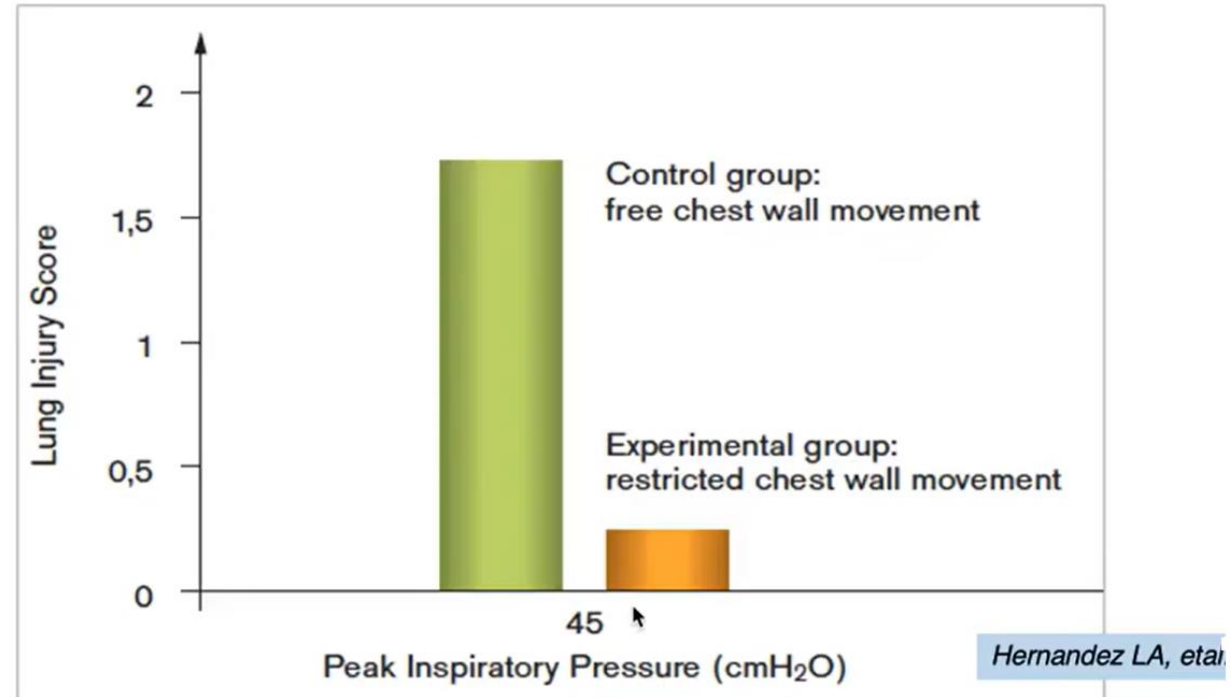
2) Compressible volume of the circuit, including humidifier

3) Magnitude of ETT leak

Rationale for Volume targeted ventilation

- Studies demonstrated that tidal volume is the critical determinant of ventilator induced lung injury
- When tidal volume is the primary control variable, inflation pressure will fall as the lung compliance and patient inspiratory effort improve, resulting in real time weaning of pressure, in contrast to manual lowering of pressure in response to blood gases
- There is a significant decrease in the combined outcome of death or BPD, lower rate of pneumothorax, decreased risk of intraventricular haemorrhage and shorter duration of mechanical ventilation

VILI - Volutrauma vs Barotrauma



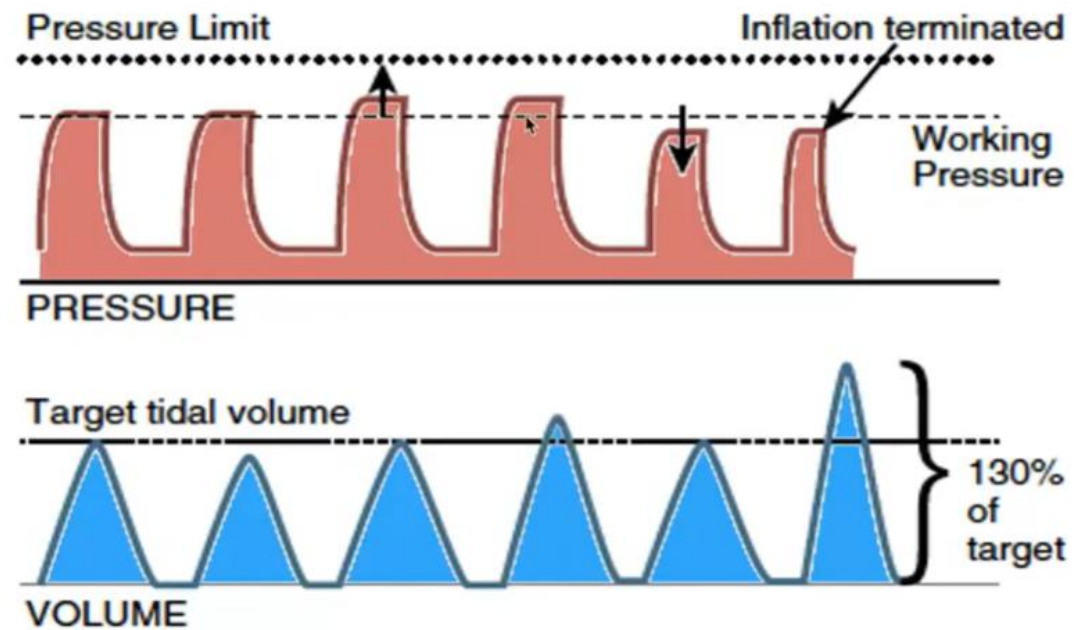
Volume-Controlled vs Guarantee

Variable	Volume controlled	Volume guarantee/targeting
TV	Set by clinician	Set by clinician
Determinant of TV reaching the baby	Circuit compliance, ET leaks	ET leaks
Flow rate	Set by clinician	Variable / determined by the ventilator
Ti	Depends on the set inspiratory volume and flow	Time/flow cycled
PIP	Peak at the end of inspiration	Peak early in inspiration
Determinant of PIP	Lung compliance	Breath-by-breath basis to target the set volume

Volume Guarantee ventilation

- It is a volume-targeted, time or flow cycled, pressure limited form of ventilation.
- The operator chooses a target tidal volume and a pressure limit up to which the ventilator operating pressure may be adjusted
- The microprocessor compares the exhaled tidal volume of previous inflation and adjusts the pressure up or down to target the set tidal volume
- The algorithm limits the pressure increment from one inflation to the next (maximum increase of 3cm H₂O)

Principles of operation of VG



Variants of Volume-Targeted ventilation

Pressure regulated volume control (maquet-servo i) :

- Time cycled, Pressure control, assist control mode
- Tidal volume measurement is done at the ventilator end and it can lead to overestimation of tidal volume
- servo-n and servo-u series: measures expiratory tidal volume

Volume targeted ventilation/ Adaptive pressure ventilation

-Volume targeted ventilation as implemented on the Hamilton-G5 ventilator is a modality that is functionally similar to VG

Targeted tidal volume(TTV):

-Present in SLE 4000 and SLE 5000 ventilators, functions similar to VG mode of ventilation

-In SLE-6000 ventilator this mode is now known as volume targeted ventilation

Volume-assured pressure support

- Hybrid mode that combines PSV with VCV
- Relies on the infant breathing spontaneously in order to trigger the ventilator to deliver breaths
- Flow accelerates rapidly at the start of inspiration and cycles in to expiration if the desired volume is reached. If it's not reached, the inspiratory flow continues until the desired volume is reached
- PIP is augmented if the volume is well below the target value

THANK YOU