Alternative Modes of Mechanical Ventilation

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Alternative Modes of Mechanical Ventilation

Dual-control ventilation modes

Advantages

volume-control (guaranteed minute ventilation) + pressure-control ventilation (limited peak airway pressure).

- Increase the safety and comfort of mechanical ventilation.
- No RCT indicate improved patient outcomes (including mortality).

Alternative Modes of Mechanical Ventilation

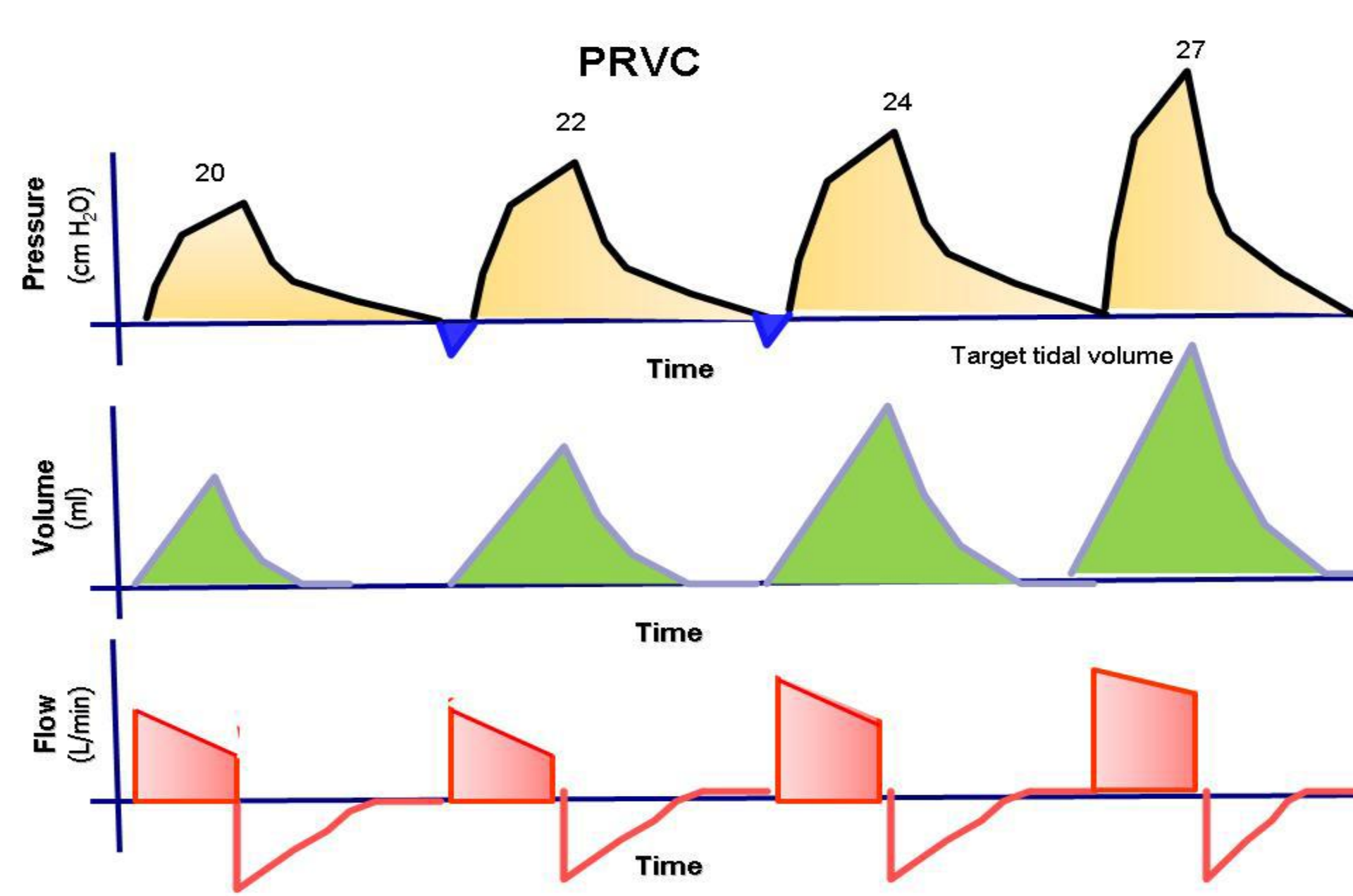
Pressure-**R**egulated **V**olume-**C**ontrol (PRVC)

- This mode is under the dual control of pressure and volume.
- The physician presets a desired TV, and the ventilator delivers a pressure-limited (controlled) breath until that preset TV is achieved.
- The breath is essentially like a conventional pressure-controlled ventilation breath, but the ventilator can guarantee a predetermined minute ventilation.

Alternative Modes of Mechanical Ventilation

Pressure-**R**egulated **V**olume-**C**ontrol (PRVC)

- Breath to breath, the inspiratory pressure is automatically adjusted down or up to deliver a preset TV.
- If the delivered volume is too low, it increases the inspiratory pressure on the next breath.
- If it is too high, it decreases the inspiratory pressure.
- This adjustment gives the patient the lowest peak inspiratory pressure needed to achieve a preset TV.
- Advantage…..deliver minimum minute ventilation at the lowest peak airway pressures possible



The pressure, volume, and flow to time waveforms for pressure-regulated volume-controlled ventilation

Alternative Modes of Mechanical Ventilation

Dual-control breath-to-breath, pressure-limited, flow-cycled ventilation

- volume-support ventilation (VSV) or variable-pressure-support.
- Combination of PSV and volume-control ventilation.
- Like PSV, the patient triggers every breath, controlling his or her own respiratory frequency and inspiratory time.
- This mode delivers a breath exactly like conventional PSV, but the machine can guarantee minute ventilation.
- The pressure support is automatically adjusted up or down to deliver a preset TV.

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Volume-support ventilation (VSV) or Variable-pressure-support

- it is flow cycled, which means that the patient determines the respiratory rate and inspiratory time.
- The mode cannot be used in a patient who lacks spontaneous breathing effort.

Volume support has also been marketed as a self-weaning mode.

Alternative Modes of Mechanical Ventilation

Volume-support ventilation (VSV) or Variable-pressure-support

Potential Problems

- If the patient's metabolic demand increases, raising the tidal volume, the pressure support decreases to provide less ventilatory support when the patient needs it most result in hypoxemia.
- TV must be correctly set to the patient's metabolic needs.
- If the tidal volume is set too high, weaning is delayed. If it is set too low, the work of breathing increase

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3--Automode and variable support or variable-pressure control

- This mode is basically the combination of the 2 modes described above.
- If the patient has no spontaneous breaths, the ventilator is set up in the PRVC mode.
- When the patient takes 2 consecutive breaths, the mode is switched to Volume-support ventilation VSV.

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3--Automode and variable support or variable-pressure control

- Designed for automatic weaning from pressure control to pressure support depending on the patient's effort.
- no randomized trials have been conducted to show this type of weaning is more effective than conventional weaning.

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Dual control within a breath

- This mode has been called volume-assured pressure support or pressure augmentation.

- This mode can switch from pressure control to volume control within a single specific breath cycle. After a breath is triggered, rapid and variable flow creates pressure to reach the set level of pressure support.

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Dual control within a breath

- TV is monitored.
- If it equals the minimum set TV, the patient receives a typical pressure-supported breath
- if the TV is less than the set one, the ventilator switches to a volume-controlled breath with constant flow rate until the set tidal volume is reached.

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Dual control within a breath

One study compared volume-assured pressure support with simple assist-control volume support and showed a 50% reduction in the work of breathing, lowered airway resistance, and lowered intrinsic PEEP.

Alternative Modes of Mechanical Ventilation

Automatic tube compensation

- Specifically for weaning
- Designed to overcome the resistance of the endotracheal tube by means of continuous calculations.
- These calculations allow the ventilator to supply the appropriate pressure needed to overcome this resistance
- no studies so fare

Alternative Modes of Mechanical Ventilation

Proportional assist ventilation

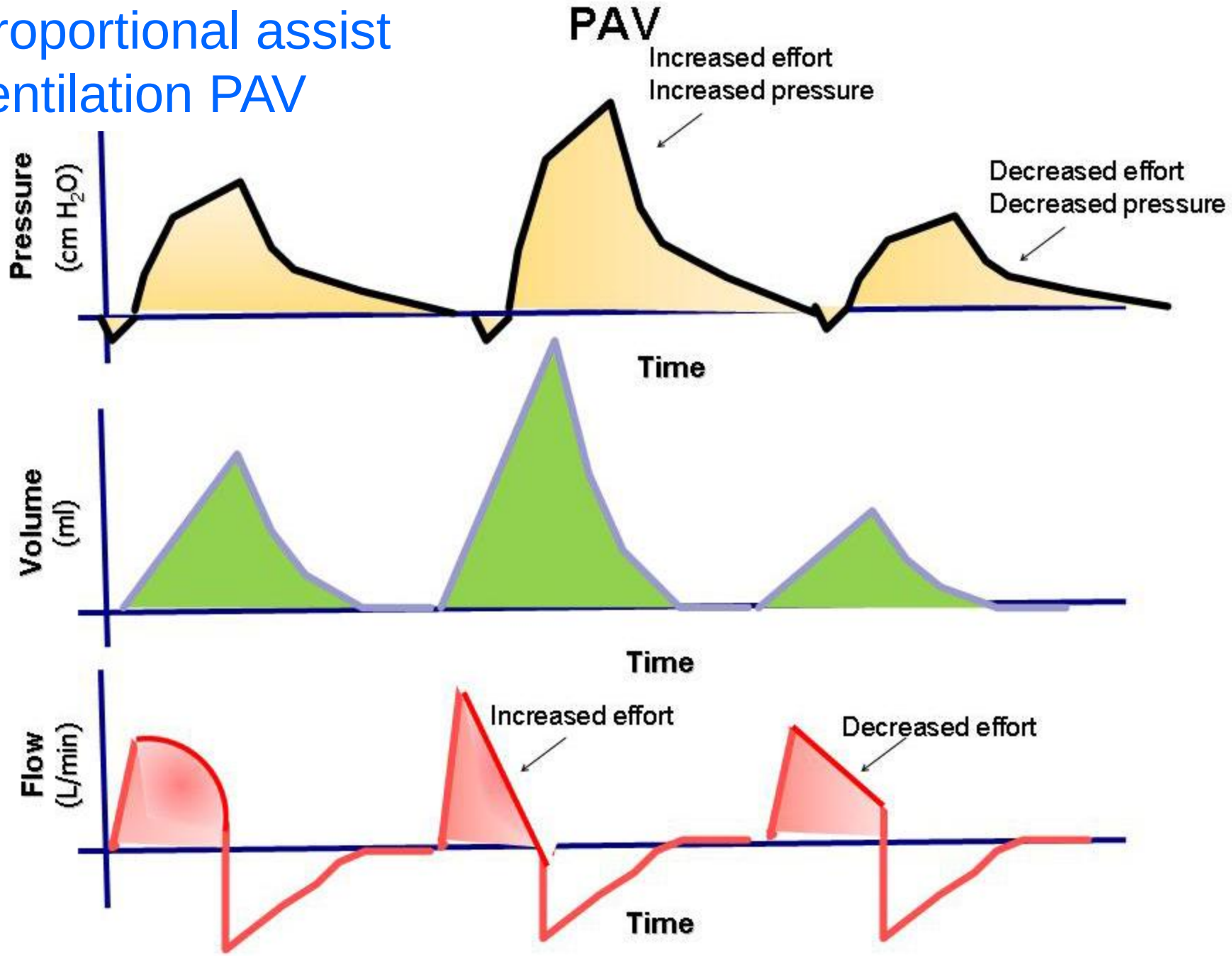
- Decrease the work of breathing.
- The mode adjusts airway pressure in proportion to the patient's effort.
- lets the patient determine the inspired volume and the flow rate.
- The support given is a proportion of the patient's effort and is normally set at 80%.

Alternative Modes of Mechanical Ventilation

Proportional assist ventilation

- This support is always changing according to patient's effort and lung dynamics.
- The patient's work of breathing remains constant regardless of his or her changing effort or demand
- This mode can be used only in patients with spontaneous respiratory efforts.
- Not approved by FDA

Proportional assist ventilation PAV



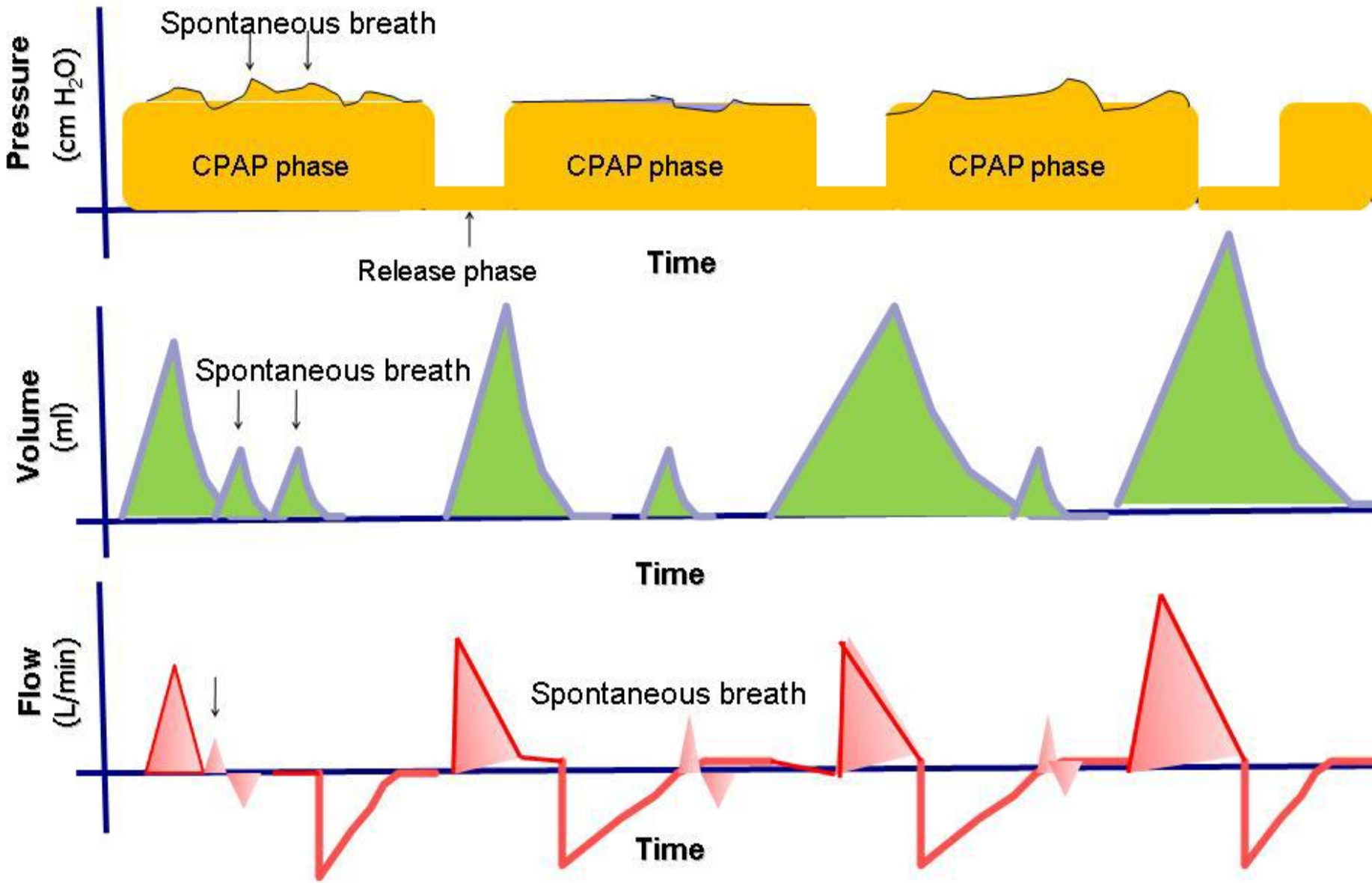
Alternative Modes of Mechanical Ventilation

Airway pressure–release ventilation

- Bilevel, or biphasic, ventilation
- new mode.
- The ventilator is set at 2 pressures

  high CPAP & low CPAP both levels are time cycled.

APRV


Pressure
(cm H_2O)
Spontaneous breath
CPAP phase
CPAP phase
CPAP phase
Release phase
Time
Volume
(ml)
Spontaneous breath
Time
Flow
(L/min)
Spontaneous breath
Time

Alternative Modes of Mechanical Ventilation

Airway pressure–release ventilation

- The high pressure is maintained for most of the time, while the low pressure is maintained for short intervals of usually less than 1 second to allow exhalation and gas exchange to occur.
- The patient can breathe spontaneously during high or low pressure

Alternative Modes of Mechanical Ventilation

Airway pressure–release ventilation

- Has benefit of alveolar recruitment.
- Its disadvantage is that the tidal volume is variable.
- The clinician must be constantly aware of the patient's minute ventilation to prevent severe hypercapnia or hypocapnia.