



Basics of Ventilator Management

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Disclosure

- + There are no financial disclaimers for this education program
- + Some of the products are not endorsed and simply used for this educational offering

Purpose of Education

- + Mechanical Ventilation Basic Overview
- + Application in Nursing Practice
- + Prevention of Ventilator Associated Pneumonia



Objectives

- The learner will be able to understand the reasons for placing a patient on mechanical ventilation
- The learner will understand the ventilator capabilities including various models, modes and ventilation options for the critically ill patient
- The learner will be able to engage resources for mechanical ventilation troubleshooting and alarm

Who Goes On Mechanical Ventilation?

Airway compromised

CHF

COPD

Respiratory Failure

End of Life

Sputum clearance

Surgical

Neurological Disease

Ventilator Settings

VT 6-8 ml/kg IBW

RR 16-20

EtCo₂ 35-45 mmHg

FIO₂ 21%-100%

PEEP 5-20 cmH₂O

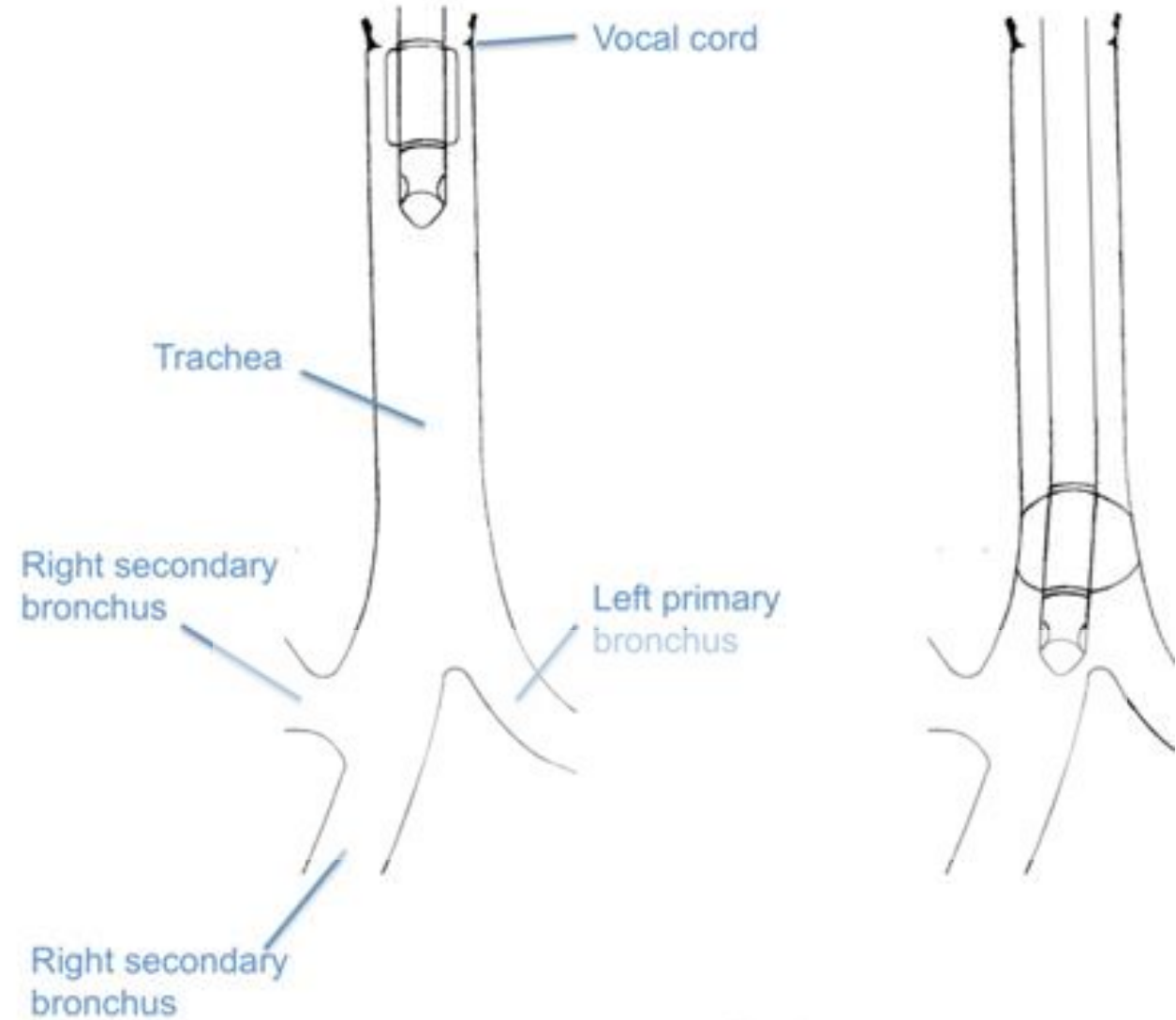
Plateau Pressures < 30 cmH₂O

Common Sizes of ETT

Endotracheal Tubes: Average Sizes (Inner diameter)

- **Adult female:** 7.0–8.0 mm
- **Adult male:** 8.0–8.5 mm

(Continued)



Some types Of Ventilators

ParaPac



Drager Evita Infinity V500



Advantages of Mechanical Ventilation

- + Complies with the patients flow demand
- + Automatic Tube Compensation (ATC)
- + SmartCare weaning mode
- + Continuous monitoring of various pulmonary parameters
- + A power supply unit
- + Reduces work of breathing, improves oxygen and CO₂ elimination, provides a stable airway



Some Modes of Ventilation

Volume-controlled ventilation:

- + VC-AC

Pressure-controlled ventilation:

- + PC-AC

- + PC-APRV

Support of spontaneous breathing:

- + SPN-CPAP/PS

- + SmartCare

VC-AC Volume Control-Assist Control

Delivers a mandatory pre-set volume and mandatory pre-set rate

Patient will receive mandatory rate minimally

Each of the patient's initiated breath over and above the set rate, is delivered at the set volume

PC- AC

Pressure Control-Assist Control Ventilation

- Pressure controlled
- Machine or patient triggered
- If the Resistance or Compliance changes during ventilation the VT will change



Figure 20: Possible ventilation settings



Set alarm limit VT_{high}
patient-specific



Free breathing ability during the complete
breathing cycle

PC-APRV

Pressure Control-Airway Pressure Release Ventilation

- + Spontaneous breathing under continuous positive breathing pressure with brief pressure relief times
- + To support CO₂ elimination, the pressure is reduced to P-low for the brief period T-low
- + APRV is an inverse ratio type of mode with intermittent mandatory ventilation and unrestricted spontaneous breathing that is typically used for refractory hypoxemia. Cautious use with hypercapnic patients, expect this to worsen



Figure 26: Possible ventilation settings

!	💡
Set alarm limit VT _{high} patient-specific ✓ [Ⓜ]	Free breathing ability during the complete breathing cycle
Set the alarm limit VT _{low} patient-specific ✓	
Set the alarm limit RR _{high} patient-specific ✓ [Ⓜ]	
Set alarm limit MV _{high} patient-specific ✓ [Ⓜ]	
Set alarm limit MV _{low} patient-specific ✓	

SPN-CPAP/PS

Spontaneous-Continuous Positive Airway Pressure/Pressure Support



Spontaneous breathing



Continuous positive pressure level with or without pressure support



If the patient is too weak to manage the complete breathing effort independently, there is the option of pressure support (PS).



If the lung mechanics of the patient change, the applied volume varies with fixed (PS)

SmartCare

- + Not all mechanical ventilators have this mode
- + These are proprietary settings
- + No mandatory rate
- + Vent operates in PS mode with PEEP
- + Patient breathes spontaneously
- + Ventilator monitors three parameters – Respiratory Rate, Tidal Volume, and End Tidal CO₂.
- + Special weaning mode that self adjusts to patient's needs
- + This common mode helps assist in the extubation of patients



Decrease ventilatory support gradually

- The safe and effective clinical protocol is patient controlled and includes a metabolic component.
- While weaning the patient, SmartCare®/PS aims to keep the patient in a comfortable zone of normal ventilation.
- Automatic reduction in ventilatory support frees up time for the caregiver.

Recommended Screening Criteria for Weaning

- $FiO_2 \leq .50$ with O_2 Sats $\geq 90\%$
- $PEEP \leq 8$ cm H₂O
- HR <130/min.
- RR <30/min.
- $EtCO_2 < 55$ mmHg
- No increase of Vasopressors in 2 hours
- Minimal sedation/Follows Commands
- Minimal secretions



Retrieved from [American Journal of Nursing pictures](#) 3.23.2020

Apnea Ventilation



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- + If a patient in a spontaneous mode is apneic
 - Mandatory ventilation occurs at a pre-set level automatically and continues until reset

Non-Invasive Ventilation (V60)



- + No invasive intubation; ventilation given via mask
- + Contraindicated on unconscious patients
- + Can put pt. on and off easily
- + Works well on:
 - CHF/fluid overload patients
 - No code patients
 - Severe COPD that may become vent dependent
 - Those who refuse to be intubated
- + Ok for RN to remove NPPV
- + **RT ONLY to resume NPPV!**

Alarm System



- + High and low minute volume
- + Volume not constant
- + High respiratory rate
- + Apnea
- + High and low pressure
- + O₂ and air loss
- + Power loss

Trouble Shooting



Anxious Patient

Patient may need to be suctioned
Frequently the patient needs medication for anxiety or sedation to help them relax



Can be due to a malfunction of the ventilator



Attempt to fix the problem



Call your RT

High and Low Pressure Alarms

- + Mucous plug
- + Patient coughing on their own, biting or gagging with their ETT
- + The ETT cuff is deflated
- + Disconnections in ventilator circuit
- + With High pressure alarms consider checking plateau pressure (via an inspiratory hold maneuver)

Accidental Extubation

Role of the Nurse

- + Ensure the Ambu bag is attached to the oxygen flow meter **and** it is on!
- + Attach the face mask to the Ambu bag and after ensuring a good seal on the patient's face; supply the patient with ventilation
- + Bag the patient and call for your RT

Consequences of Self-Extubation

- + Edema
- + Possible vocal cord damage

CONCERNS

- **Call for your RT**
- **Avoid the silence button!**



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Thank You

www.ihconline.org

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