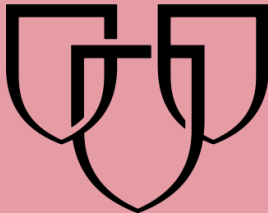

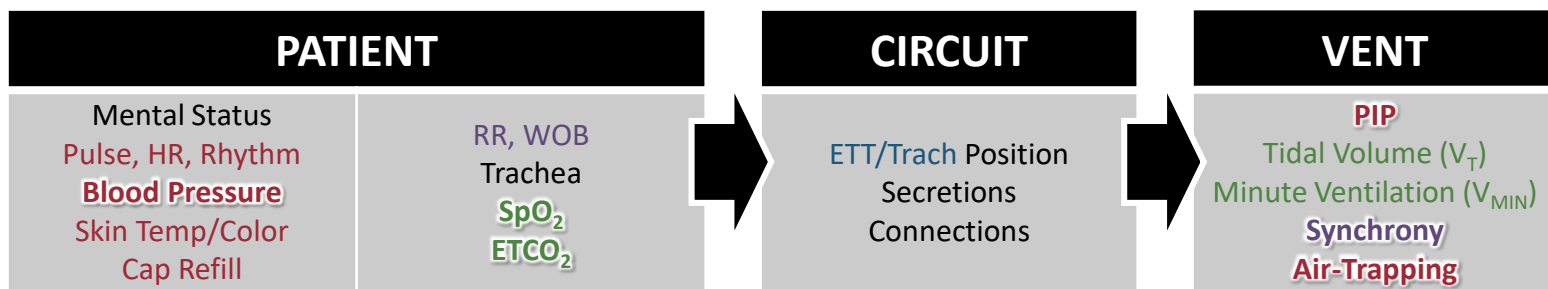


MAYO CLINIC MECHANICAL VENTILATION GUIDE

RESP FAILURE	GOALS	INITIAL SETTINGS		MONITORING	TARGETS
				6 P's	BASIC
	HEMODYNAMIC STABILITY	 <p>Start Here</p> 		SAFETY	1 BLOOD PRESSURE SBP > 90mmHg
	BAROTRAUMA PREVENTION				2 PEAK INSPIRATORY PRESSURE (PIP) < 35cmH ₂ O
	VOLUTRAUMA PREVENTION				3 AutoPEEP None
					TIDAL VOLUME (V _T) ~ 6-8cc/kg IBW
Loss of Airway	AIRWAY MAINTENANCE	Female ETT Male ETT	7.0-7.5 8.0-8.5	AIRWAY	AIRWAY / ETT / TRACH Patent
Hypoxia	OXYGENATION	F _I O ₂ PEEP	21 - 100% 5 [5-15]	GAS EXCHANGE	4 PULSE OXIMETRY (SpO ₂) > 90% pO ₂ > 60mmHg
Hypercapnia	VENTILATION	TIDAL VOLUME BPM (RR)	5'5" = 350cc [max 600] 6'0" = 450cc [max 750] 6'5" = 500cc [max 850] 14 [10-30]		5
High Work of Breathing (WOB)	SYNCHRONY	MODE	ASSIST CONTROL VOLUME or PRESSURE AC (V) / AC (P)	COMFORT	WORK OF BREATHING Decreased
	SUPPORT				6 PATIENT-VENTILATOR SYNCHRONY Comfortable Breaths

2° ASSESSMENT



1. Recognize **Signs of Shock** ➡ Work-up and Manage
2. **Assess 6Ps** ➡ If single problem ➡ *Troubleshoot Cause*
3. If **Multiple Problems** ➡ QUICK FIX ➡ *Troubleshoot Cause(s)*

PROBLEMS

HYPOTENSION

HYPOXIA
HYPOVENTILATION

BAROTRAUMA

DYSSYNCHRONY

autoPEEP



CAUSES

QUICK FIX

MANAGEMENT

HYPOTENSION (↓BP)

HYPOVOLEMIA
OBSTRUCTED BLOOD RETURN
CARDIAC FAILURE
VASODILATION

Bleeding
Dehydration
3 rd Spacing
Pneumothorax
Abdominal Compartment Syndrome
Air-Trapping (AutoPEEP)
PEEP
Cardiac Tamponade
Stun, Contusion, Chronic HF
Ischemia/Infarction
Arrhythmia
Diastolic or Valve Dysfunction
Right Heart Failure
Infection
Spinal Shock & Anaphylaxis
Medications

FLUID (if not hypoxic)
EPINEPHRINE (if not tachy)
↓ PEEP (if not hypoxic)

Hemostasis, Transfuse, Treat cause, Temperature control
Fluid Resuscitation (End points = hypoxia, ↑StO ₂ , ↓PVI)
Treat cause, Beware of hypoxia (3 rd spacing in lungs)
Needle D, Chest tube
Treat Cause, Paralyze, Surgery (Open Abdomen)
Pop off vent & SEE SEPARATE CHART
Reduce PEEP
Pericardiocentesis, Drain. Avoid mechanical ventilation if possible
Time, Rest (Sedate), Avoid cardiac stress
ASA (if no trauma), Maintain SBP >90, SpO ₂ > 90%, ?Transfuse
Treat cause (i.e. ischemia, electrolytes), Anti-arrhythmic, Cardiovert
Treatment dependent on cause
Treat cause (i.e. PE). Avoid high PEEP, hypoxia, acidosis
Treat infection, Source control, Consider Epi
Treat cause, ?Epi. Diphenhydramine
Avoid / Adjust precipitating meds (i.e. sedatives, narcotics, TIVA)

BAROTRAUMA (↑PIP)

LUNG DISEASE / INJURY
LUNG COMPRESSION
DYSSYNCHRONY
AIR-TRAPPING
VENTILATOR SETTINGS

Lung Injury / ARDS / Contusion
Pneumonia
Cardiogenic Pulmonary Edema
Alveolar Hemorrhage
Pneumothorax
Hemothorax / Effusion
Abdominal Compartment Syndrome
Atelectasis
SEE SEPARATE CHART
Incomplete Exhalation & Airway Obstruction
↑ PEEP
↑ Tidal Volumes

POP OFF VENT (if air-trapping)
SUCTION
BAG VENTILATE

Treat cause (i.e. Blast, Infection, Inhalation, Trauma)
Antibiotics, Pulmonary/Oral hygiene, Aspiration prevention
↑ PEEP (& ↓ Tidal Volume), Treat HF cause
Treat cause, Consider ↑ PEEP, Limit suctioning, Fix coags
Needle D, Chest tube
Thoracentesis, Chest tube, Fix injury/Surgery, Transfuse
Treat Cause, Sedate/Paralyze, Surgery
Bag w/ PEEP valve, Recruitment, Patient re-positioning
SEE SEPARATE CHART
SEE SEPARATE CHART
SEE SEPARATE CHART
Weigh risk & need for current PEEP
Weigh risk & need for current Tidal Volume

autoPEEP

DYSSYNCHRONY
AIRWAY DISEASE
VENTILATOR SETTINGS

SEE SEPARATE CHART
ETT Obstruction
Airway Secretions / Debris
Severe Bronchoconstriction
↑ I:E Ratio
↑ RR

SEDATE & PARALYZE

SEE SEPARATE CHART
Adjust ETT / Trach, Stop biting (Sedate), Bronchoscopy
Pulmonary Toilet, Oral hygiene, Bronchoscopy
Bronchodilator, ↑ Exhalation time (↓ i-Time)
↓ i-Time (Minimum is 0.6 seconds)
↓ RR

DYSSYNCHRONY

TACHYPNEA (↑RR)
BREATH-STACKING
DEMAND-SUPPORT MISMATCH
AIR-TRAPPING

Pain, Anxiety, Agitation
Metabolic Acidosis
Hypoxia
Low Set Tidal Volume / PIP
Inadequate Support (Mode)
CNS Injury
Thoracic/Lung Injury or Irritation
Auto-Cycling / Auto-Triggering
Gag / Cough / Hiccups
Short i-Time
Long i-Time
Inadequate flow
Low V _T
Incomplete Exhalation & Airway Obstruction

POP OFF VENT (if air-trapping)
SUCTION
SEDATE & PARALYZE (except w/ CNS injury)

Treat pain, anxiety, agitation
Treat cause, ?NaHCO ₃
SEE SEPARATE CHART
↑ Tidal Volume / PIP
Change mode (Consider AC), ↑ RR
Treat underlying cause
Treat cause (i.e. Pneumothorax, ARDS, Inhalation Injury)
Adjust trigger setting on vent
Sedate, Suction, Treat Hiccups
Lengthen i-Time
Shorten i-Time
Change Mode, Unlock flow
Increase Tidal Volume, PC, or PS
SEE SEPARATE CHART

HYPOXIA (↓SpO₂ / pO₂)

LOW OXYGEN SUPPLY
AIRWAY DISORDER
AIR SAC (ALVEOLAR) DISEASE (↓ Ventilation)
↓ BLOOD FLOW (Perfusion)

Low FiO ₂ (Supply, ↑ Altitude)
ETT / Trach Mal-position
Upper Airway Obstruction
Secretions / Debris
Severe Bronchoconstriction
Lung Disease (ARDS, ALI, ILD, Pneumonia, Pulmonary Edema, Contusion, Alveolar Hemorrhage)
Lung Compression (Pneumothorax, Hemothorax, Effusion, Abdominal Compartment Syndrome, Atelectasis)
Pulmonary Embolus

SUCTION
BAG VENTILATE (unless ETT/Trach in false passage)

↑ FiO ₂
Adjust, replace ETT / Trach, Ensure cuff inflation
Adjust ETT/Trach, Stop biting (Sedate)
Pulmonary Toilet, Oral hygiene
Bronchodilator, ↑ Exhalation time (↓ i-Time)
↑ PEEP & Treat Cause (SEE ↑ PIP CHART)
In severe cases, consider: Paralysis, iNO, Positional therapy, ECMO
Treat Cause (i.e. Needle D, Chest tube)
↑ PEEP if not in shock (i.e. w/ Tension Pneumothorax or Bleeding)
Anticoagulation, O ₂ , Monitor for RH failure, iNO, ?TPA if no bleeding

HYPOVENTILATION (↑ETCO₂ / pCO₂)

AIRWAY HYPOVENTILATION
AIR SAC (ALVEOLAR) HYPOVENTILATION (↓ Compliance)
VENTILATOR SETTINGS
↓ RESPIRATORY DRIVE
VENTILATOR SETTINGS

ETT / Trach Mal-position
Upper Airway Obstruction
Airway Secretions / Debris
Bronchoconstriction
Lung Disease (ARDS, ALI, Pneumonia, Pulmonary Edema, Contusion, Alveolar Hemorrhage)
Lung Compression (Pneumothorax, Hemothorax, Effusion, ACS, Atelectasis)
Air-Trapping (AutoPEEP)
Low Set Tidal Volume
Medications
CNS Injury
Low Set RR
High Trigger Set

POP OFF VENT
SUCTION
BAG VENTILATE (unless ETT/Trach in false passage)
↑ RR
BAG VENTILATE

Adjust, replace ETT / Trach, Ensure cuff inflation
Adjust ETT / Trach, Stop biting (Sedate), Bronchoscopy
Pulmonary Toilet, Oral hygiene, Bronchoscopy
Bronchodilator, ↑ Exhalation time (↓ i-Time)
↑ Tidal Volume, ↑ RR, ↑ PEEP (to recruit lung)
Treat Cause (SEE ↑ PIP CHART)
Maintain lung protective ventilation
Treat Cause (i.e. Needle D, Chest tube, Surgery, PEEP) (SEE ↑ PIP CHART)
SEE SEPARATE CHART
↑ Tidal Volume or PIP (goal 6-8cc/kg IBW)
Re-consider sedative need & dose
Treat cause/injury, Re-consider pCO ₂ , goal
↑ RR (if RR very high, monitor for AutoPEEP)
Adjust trigger settings