Ventilator Cheat Sheet

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Lung Physiology

Ventilation	• To **lower PaCO2, one must either** increase RR or increase tidal volume. • Minute ventilation = RR x VT**.
Oxygenation	• Monitored by O2 saturation and PaO2. • To increase PaO2 in the ventilated patient, one must either **increase FiO2 or PEEP**. • Can also **extend inspiratory time** fraction. • Can improve oxygen delivery by **increasing CO or hemoglobin**. • Can decrease oxygen requirements by **decreasing work of breathing, agitation or fever**. • Remove pulmonary vasodilators like nitroprusside.

Key Terms

Minute Ventilation	• **RRxVT**. Should be **adjusted to achieve baseline PaCO2**. • Initial VT of 8-10mL/kg is appropriate in most cases (lower in ARDS and COPD). • A **rate of 10-12 breaths/min** is appropriate.

Key Terms (cont)

FiO2	• Initially should be 100%. • Quickly titrate down and use the lowest possible level to **maintain a PaO2 of 50-60** or higher. • Avoid oxygen toxicity with FiO2<60% if possible. • If FiO2 of 0.5 does not result in adequate PaO2, **add PEEP or CPAP (allow reduction in FiO2)**.
Inspiratory/-expiratory ratio	• Duration of time allotted to inspiration compared to expiration in one delivered breath. Duarte of each breath is determined by set RR. Increased time in inspiration will proportionally decrease tie-in expiration. **1:2 is usually used**.

Key Terms (cont)

PEEP	• Positive pressure maintained at the end of passive exhalation to **keep alveoli open**. • 2.5-10cm H2O is the initial setting. • Can be added to any mode of ventilation and used mostly in hypoxic respiratory failure. • Increases lung compliance and oxygenation (**improves gas exchange**). • Prevents alveolar collapse and atelectasis. • Can cause barotrauma or **low CO (due to decreased venous return and increased PVR**, esp. with hypovolemia).

Mechanical Ventilation

Indications	• Significant respiratory distress or respiratory arrest. • Impaired or reduced level of consciousness with inability to protect the airway **(absent gag or cough reflex)**. • **Metabolic acidosis** without adequate compensation. • **Respiratory muscle fatigue**. • Significant **hypoxemia (PaO2<-70mmHg)** or **hypercapnia (PaCo2->50mmHg)**. • Respiratory acidosis (pH<7.2) with hypercapnia.

Complications

Complications	• Anxiety and discomfort treated with sedation. • Tracheal secretions need regular suction. • Nosocomial pneumonia (if >72 hours), accidental extubation, • **Barotrauma (high P)** • Oxygen toxicity (if FiO2>60% for >2 days). • Hypotension (high intrathoracic pressure decreases VR). • Tracheomalacia (softening of cartilage) due to prolonged ETT. Prevent with tracheostomy if >2weeks. • Laryngeal damage, GI effects (stress ulcers, cholestasis).

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Modes

Assisted Controlled Ventilation	• Initial mode used in respiratory failure. • Guarantees a **"backup" minute ventilation**. • The ventilator delivers a breath of **predetermined tidal volume** when the patient initiates a breath. • If the patient does not initiate a breath, the ventilator takes control and **delivers a breath at a predetermined rate**. • **All breaths are deviled by the ventilator**. • The patient can go over the determined rate but not under, and **every breath is a determined TV**.

Modes (cont)

Synchronous Intermittent Mandatory Ventilation	• Patients can breath above the mandatory rate without help from the ventilator. • The tidal volume of extra breaths is not determined by the ventilator. • When the patient breathes spontaneously, there is no preset volume, but the **patient has a guaranteed predetermined rate**. • Delivers the mandatory breath in synchrony with patient's initiated spontaneous breath (so they do not overlap). • Good for support of ventilation and weaning.
Continuous Positive Airway Pressure (CPAP)	• **Positive pressure (0-20cm H2O) is delivered** continuously during expiration and inspiration, but no volume breaths are delivered. • The patient breaths on their own. • The only **parameters to set are PEEP and pressure support**. • If the patient is being weaned, CPAP can be used to assess whether they can be extubated.

Modes (cont)

Pressure Support Ventilation	• Mostly during weaning trials. • Pressure is delivered with an initiated breath to assist breathing. • Pressure is not continuous and only responds to initiated breaths. • It **enhances respiratory efforts made by the patient**. • PEEP may be added.

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