Ventilator Modes

MODE	FUNCTION	CLINICAL USE & CONCERNS
(SIMV) Synchronous Intermittent Mandatory Ventilation	Delivers a synchronized preset volume or pressure while allowing the patient to breathe spontaneously in-between mandatory breaths	A primary mode as well as a weaning mode Patient uses own respiratory muscles
(IMV) Intermittent Mandatory Ventilation	Delivers a preset volume or pressure while allowing the patient to breathe spontaneously in-between mandatory breaths, mandatory breaths are not synchronized to the patient	The lack of synchronization may be uncomfortable and impair ventilation.
(PSV) Pressure Support Ventilation	Supports each spontaneous breath with supplemental flow to achieve a preset pressure Preset pressure augments the patient's inspiratory effort and decreases the work of breathing No set tidal volume or rate	Used for patients with a stable respiratory status and often used with SIMV during weaning Decreases the work of breathing in-between ventilator mandated breaths Used to overcome the resistance of breathing through ventilator circuits May be used for patients with high airway pressures
(A/C) Assist Control Ventilation	Delivers a preset volume or pressure in response to the patient's inspiratory effort, but will initiate the breath if the patient does not do so within the set amount of time	Used for patients who can initiate a breath but who have weakened respiratory muscles Allows synchrony with the patient while providing maximal support Rests ventilatory muscles May lead to Auto-PEEP
(PCV) Pressure Control Ventilation	Pressure ventilation set to a preset inspiratory time Similar to A/C; each inspiratory effort beyond the set sensitivity threshold delivers full pressure support maintained for a fixed inspiratory time and a set minimum respiratory rate	Used for patients with high airway pressures to avoid barotraumas or oxygenation problems by manipulating inspiratory time No guaranteed tidal volume, volumes are variable R/T compliance
(PRVC) Pressure Regulated Volume Controlled	Peak pressures are automatically adjusted by the ventilator to provide a set tidal volume Used in either assist/control, where every breath receives the set tidal volume; or SIMV, where the set tidal volume is delivered only at the rate of mandatory breaths	Use for patients with high airway pressures Gives a guaranteed tidal volume but minimizes barotrauma Adjusts for compliance automatically, compensates for ETT leaks with no need to correct for tubing

Ventilator Modes

MODE	FUNCTION	CLINICAL USE & CONCERNS
(PRVC SIMV) Pressure Regulated Volume Controlled with SIMV	Pressure Regulated Volume Controlled ventilation applied to the mechanical breaths	Only applied to ventilator breaths making weaning possible
(PRVC A/C) Pressure Regulated Volume Controlled with A/C	Pressure Regulated Volume Controlled ventilation applied to each breath	Mode not used for weaning
(CMV) Continuous Mandatory Ventilation	Delivers preset volume regardless of patient's own inspiratory efforts	Used for patients who are unable to initiate a breath
(ILV) Independent Lung Ventilation	Ventilates each lung separately; requires two ventilators, a double-lumen ETT tube and sedation/paralysis	Used for patients with unilateral lung disease or different disease process in each lung
(HFOV) High Frequency Oscillatory Ventilation	Delivers a small amount of gas at a rapid rate; requires sedation/paralysis	Used for hemodynamic instability, failure of conventional ventilation or if patient is high risk for pneumothorax Uses reduced peak and mean airway pressures Allows adequate ventilation with a disrupted airway or through narrow catheters
(CPAP) Continuous Positive Airway Pressure	Constant airway pressure used only with spontaneously breathing patients as patient initiates all breaths PEEP is the same as CPAP, but with PEEP the patient is on mechanical breaths	Maintains constant positive pressure in airways to decrease resistance Primarily used to maintain airway distending pressure and prevent airway collapse Used as a final mode prior to extubation Best technique for patients with obstructive sleep apnea
(BiPAP) Biphasic Bi-level Positive Airway Pressure	Noninvasive mode of ventilation that alternates between Inspiratory Positive Airway Pressure (IPAP) and a lower Expiratory Positive Airway Pressure (EPAP) Backup rates may be set on some devices that deliver IPAP pressures even if patients fail to initiate a breath	Usually delivered through a nasal mask, allowing exhalation through the mouth The term BiPAP is usually used with Obstructive Sleep Apnea patients
(NPPV) Intermittent Positive Pressure Ventilation	Delivers noninvasive BiPAP with respirations triggered by the patient A backup rate may be set in case patient fails to initiate a breath	Used for respiratory failure patients Usually delivered through full face mask The term NPPV is usually used with Respiratory Failure patients

Ventilator Terms

SETTING	FUNCTION	CLINICAL USE & CONCERNS
(FIO2) Fractional Inspired Oxygen	The fraction of inspired gas that is oxygen The percent of oxygen	Should always be used prior to and after suctioning Oxygen concentrations of greater than 0.50 (50%) increase the risk of oxygen toxicity if delivered for more than 24 hours
(PIP) (Ppeak) Peak Inspiratory Pressure	The maximum inspiratory pressure	Increases Peak Inspiratory Pressure may indicate secretions, obstruction, ventalatory resistance or kinked tubing
(PEEP) Positive End Expiratory Pressure	Constant airway pressure that stabilizes the alveoli during the expiration A PEEP setting of 5cm H_2O is equivalent to the effect of a closed glottis and is called physiologic PEEP	Used with CV, A/C, and SIMV to improve oxygenation by opening collapsed alveoli at the end of expiration Complications from the increased pressure can include decreased cardiac output, pneumothorax, and increased intracranial pressure
(V_T) (VT,TV) Tidal Volume	The volume of gas delivered with each breath Volume of gas delivered during each ventilator breath	Ventilator tidal volume usually 6-8 cc/kg A patient's spontaneous tidal volume should be at least 5 ml/kg
(Pmean) Mean Airway Pressure	Mean Airway Pressure	Increased Pmean may recruit additional alveoli
(Pplat) Plateau Pressure	Inspiratory hold pressure measured at end inspiration Pressure required to overcome tissue resistance and inflate alveoli	General measurement of lung stiffness
(V_E) Minute volume	The total volume of air inhaled and exhaled in one minute	Normal minute volume is 5-10 liters per minute RR X VT
(IRV) Inverse Ratio Ventilation	Inspiratory:Expiratory (I:E) ratio normally 1:2 but is reversed to 2:1 or greater; requires sedation/ paralysis A pressure control ventilation	Improves oxygenation in patients who are still hypoxic even with PEEP
(NIF) Negative inspiratory force	The negative inspiratory pressure generated with a deep inspiration	A patient's NIF should be at least –20 cm H_20.
(VC) Vital capacity	The maximal amount of air that can be exhaled after a normal inhalation	A patient's vital capacity should be at least 10cc/kg
(FVC) Forced Vital Capacity	The amount of forced exhaled volume following a deep inspiration	Pulmonary function test
(FRC) Functional Residual Capacity	The volume left in the lungs at end expiration	Increased with COPD patients
Auto-PEEP	When expiratory time is not sufficient for the lungs to empty before delivery of the next breath (air trapping), alveolar pressure will be greater than the baseline at end-expiration even if PEEP has not been set on the ventilator	If pressure continues to build in this manner, delivered tidal volumes will drop, work of breathing will increase, and the patient will experience acute discomfort until the extra volume producing the pressure is released. Patients with obstructive lung disease are prone to the development of auto-PEEP
(WOB) Work of Breathing	Measures the work required to breathe	Looks at respiratory rate and effort

Ventilator Alarms

HIGH PRESSURE	LOW PRESSURE	HIGH RESPIRATORY RATE	LOW EXHALED VOLUME
Secretions/obstructions in the ETT/airway or condensation in the tube Patient coughing, gagging or trying to talk Patient biting on ETT Kink in Ventilator tubing Increased airway pressure from bronchospasm or pneumothorax	Vent tubing disconnected Displaced ETT or trach Leak in cuff or inadequate cuff seal	Patient anxiety or pain Secretions in the ETT or airway Hypoxia Hypercapnia	Ventilator tubing disconnected Leak in cuff or inadequate cuff seal Occurrence of another alarm preventing full delivery of breath

Ventilator Management

1) Be aware of the ventilator settings on your patients
   - Know the PIP
   - Know the location of:
     - 100% FiO2
     - PIP
     - Alarm silence
     - Alarm reset
2) Monitor Lung Sounds, ABG's, O2 Sat, RR, WOB, and PIP
   - Suction prn
   - ABG's prn
   - Always call for help whenever needed

3) Always re-evaluate pressures and volumes following any intervention or change in status

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