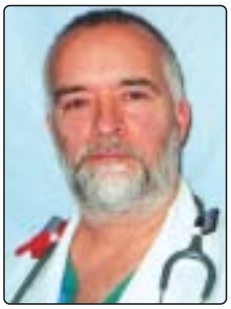
GLOSSARY OF TERMS AND ACRONYMS FOR MECHANICAL VENTILATION *by Dave Wheeler, RRT*



I have assembled a glossary of common terms for the clinician. Yes, I realize that there exist reliable texts that handle this task expertly, but, what I have attempted to do here is to simplify the most common terms or concepts utilized in the clinical application of respiratory care. For your review, they appear below.

Note: The language and syntactical use of terms in medicine is in constant flux. This guide is current as of February 2003.

Airway Pressure Release Ventilation (APRV) - A spontaneous mode of ventilation that employs a time cycled fluctuation in positive airway pressure. Continuous Positive Airway Pressure is periodically released to facilitate exhalation. The difference between CPAP and release pressure will be the net release pressure gradient. Tidal volumes will vary directly with lung compliance and inversely with changes in total resistance.

Assisted Ventilation - The continuous augmentation of the spontaneously triggered breathing effort with a mechanically generated breath. Can be either volume, pressure or flow.

Assist Control Ventilation (AC) - A mode of ventilation in which both spontaneous and mechanically triggered breaths are supported by the ventilator. The mandatory breath rate is the minimum amount of breaths the machine will deliver in a minute. The patient can trigger additional machine breaths above the set rate. AC breaths can be pressure, volume or flow cycled.

Auto-PEEP - Positive End Expiratory Pressure (PEEP) that is not set by the clinician. This PEEP represents a dynamic hyperinflation of the lung. PEEP that is present but not reflected by the monitoring systems of the mechanical ventilator.

BiPAP - A registered acronym of Respironics. A form of non-invasive full-face or nasal mask ventilation that employs a flow augmented, pressure limited, flow/time/pressure cycled form of ventilation. A level of inspiratory pressure limited flow augmentation, (IPAP) is clinician pre-set above a clinician pre-set end expiratory pressure, (EPAP). Essentially this time/pressure/flow triggered; pressure limited; flow/time/pressure cycled method of non-invasive ventilation is PSV with PEEP. Bear in mind that the pressures are cumulative and the PSV level will be the difference between the IPAP and EPAP levels.

Continuous Mechanical Ventilation (CMV) - a mode a ventilation either assisted or controlled where all breaths are mechanical. Note: CMV is more classically used to designate Controlled Mechanical Ventilation, a mode in which the patient is unable to reach a "locked out" triggering threshold.

Continuous Positive Airway Pressure (CPAP) - a spontaneous mode of ventilation. The mechanical ventilator administers a continuous supra-atmospheric pressure to the airway. The patient breathes spontaneously above this pressure.

Control variables - the variable the ventilator manipulates to cause inspiration. Specifically; pressure, time, flow and volume. Pressure controllers maintain pressure despite downstream changes in impedance. Volume controllers monitor volume delivery.

Inverse Ratio Ventilation (IRV) - method of ventilation engaging a prolonged inspiratory time. This inspiratory time inverts the normal I:E creating a situation where the inspiratory time is 2-4 times longer than the expiratory time. This maneuver attempts to enhance oxygenation with an increased mean airway pressure, gas-liquid inter-phase and greater alveolar recruitment. This pattern of I:E can be utilized in both pressure and volume limited modes of assisted ventilation.

Mandatory Breath - a breath that is machine triggered and/or cycled. A non-spontaneous breath.

Mandatory Minute Ventilation - (MMV) A method of ventilation that allows the patient to breathe spontaneously with a clinician pre-set minute volume target. If the patient satisfies the pre-set minute volume threshold the machine remains dormant and continues monitoring exhaled volume. Should the patient fail to reach the targeted minute ventilation the machine delivers clinician prescribed breaths until the pre-set minute volume is satisfied.

Mean Airway Pressure (MAP) - The average airway pressure during one complete ventilatory cycle. MAP is directly related to PEEP and influenced by PAP, inspiratory time and inspiratory flow. NOTE: Frequently expiratory airways resistance is greater than inspiratory airways resistance. This will cause most machines to underestimate true MAP which will usually be greater in reality than the instrumentation will indicate.

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Peak Airway Pressure - (PAP/PIP) The maximum airway pressure recorded during an inspiratory cycle. This maximum or extreme pressure is usually actualized at the end of inspiration. This pressure reflects the collective result of machine and patient variables and is dynamic in character.

Phase Variables - the aspects of the mechanically ventilated breath, (pressure, volume, flow and time) that affect the four phases of the mechanical breath. 1) the change from inspiration to exhalation, 2) inspiration, 3) the change from inspiration to exhalation and 4) exhalation.

Cycle variable - the variable that causes the change of phase from inspiration to exhalation. This variable can have a flow, time, pressure or volume threshold.

Trigger variable - the threshold of flow, time, pressure or volume that initiates mechanical inspiration. The trigger can be patient initiated or machine actuated.

Limit variable - the flow, pressure, time or pressure variable that frames the mechanical breath. The limit is a threshold that cannot be breached by the patient and remains constant.

Baseline variable - the mechanical parameter controlled during exhalation. (ZEEP and PEEP)

The PaO2/FiO2 index (P/F ratio) - quantifies the ratio of arterial oxygen tension to available oxygen concentration. It is a very useful formula in evaluating the degree of intrapulmonary shunt and subsequent compromise of cardiopulmonary function. The PaO2/FiO2 index is also a valuable indicie of diffusion capability and a primary tool in assessing the degree of injury to the lung. Low diffusion states will have a low ratio of arterial oxygen in relation to a given FiO2. The PaO2/FiO2 index acts to identify the severity of lung injury, If the PaO2/FiO2 index is < 300 strongly suspect Acute Lung Injury. (ALI) If the PaO2/FiO2 index is < 200 strongly suspect Acute Respiratory Distress Syndrome. (ARDS)

Plateau Pressure - (PPLAT) PPLAT is the pressure measured at the end of inspiration during an inflation hold. This inflation hold allows inspired gas to equilibrate in regions of the lung with incongruous time constants.PPLAT is the pressure required to counterbalance end inspiratory forces and is related to the static end inspiratory elastic recoil pressure of the total respiratory system. Airway pressure measured during an end inspiratory occlusion replicates the elastic threshold stress to the pulmonary system sans the inevitable resistive forces present during active inspiration. PPLAT faithfully approximates alveolar pressure and as such is a very useful clinical assessment tool.

Plateau pressure is needed to calculate total lung compliance as the relationship between PPLAT and delivered volume. This lung and chest wall compliance is derived in the following manner. Cl = Vt / (PPLAT– PEEPtot)

The difference between Peak Airway Pressure and PPLAT is a function of resistive forces in the patient ventilator system. Raw is calculated by looking at the pressure gradient between the peak airway pressure and the plateau divided by the flow.

Raw = PAP – PPLAT / Flow (L/sec.)

Positive End Expiratory Pressure - (PEEP) the application and maintenance of supra-atmospheric or positive airway pressure through the expiratory phase of a mechanical breath. The application of PEEP will increase both peak and mean airway pres-

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sures as well as the FRC. PEEP is primarily utilized to increase the PaO2, maintain alveolar integrity and facilitate patient triggering.

Pressure Controlled Ventilation - (PCV) A method of ventilation that is time cycled, pressure limited, pressure controlled and patient, (AC-PCV), or machine, (TC-PCV), triggered. Volume to the lung will be variable and related to pulmonary compliance, time constant, inspiratory time, pressure gradient and flow rate. PCV can be employed in the CMV, AC or SIMV modes.

Pressure Support Ventilation - (PSV) A method of augmented spontaneous ventilation that is flow, pressure or time cycled pressure limited and patient triggered. A form of spontaneous ventilation where flow is delivered to the airway up to a clinician pre-set pressure limit and continued until the machine senses either a drop in inspiratory flow beyond a preset threshold, excessive inspiratory pressure or prolonged inspiratory time. In PSV the patient determines the inspiratory rate, time, volume and flow. PSV can be employed as a mode of mechanical ventilation or in the SIMV mode.

Rapid Shallow Breathing Index (RSBI) - predictor of a patient's potential for success in the weaning process. The clinician evaluates the patient's breathing pattern by analyzing the relationship linking breathing frequency and average V_t. The RSBI is an accurate forecaster of the patient's ability to perform endurance related work and assume the work of breathing when extubated.

The RSBI is calculated as the spontaneous frequency divided by the average spontaneous tidal volume in Liters. The patient is evaluated wile breathing spontaneously without inspiratory adjuncts such as PSV. An index of < 100 is a predictor of weaning success. An index of > 100 suggests probable weaning failure.

Spontaneous Breath - a patient triggered and cycled breath.

Synchronized Intermittent Mechanical Ventilation - (SIMV) A mode of mechanical ventilation that delivers mandatory machine breathes as well as spontaneous breaths. The mechanical breaths are delivered in synchrony with the patient's spontaneous breathing pattern. The mechanical breath can be time or patient triggered, time or volume cycled and volume or pressure limited. The spontaneous breaths may have some level of PS.

Volume Assured Pressure Support - (VAPS) a form of pressure support ventilation that is flow-cycled, volume targeted. Inspiratory flow is augmented in the event the patient triggered breath fails to reach a clinician pre-set tidal volume. This form of ventilation delivers a pressure supported breath when patient demand is high and a constant-flow volume targeted breath is cases off low patient demand.

Volume Control - a method of mechanical ventilation in which volume is the control variable.

The current thinking in Critical Care literature calls for a deconstruction of manufacturer imposed terminology and a total re-naming of ventilator modes according to clinical performance. The prudent clinical manager will want to remain current in this endeavor. With this in mind I suggest that readers look at the work of Rob Chatburn, RRT, as he dominates contemporary thought in the deconstruction of mechanical ventilation terminology.