

Procedure: BiVent Clinical Practice Guidelines with the Servo i

DESCRIPTION

A Pressure Control mode with mandatory breaths utilizing 2 pressure levels, a modified form of CPAP, in which the patient is able to breath spontaneously unrestricted at both levels and if desired with the addition of Pressure Support. The Servo *i* allows this due to the floating/active exhalation valve.

GOAL

To provide the recognized strategy of lung protective ventilation supported by the ARDSnet research by delivering small distending volumes and reestablishing FRC through recruitment and maintained by creating intrinsic PEEP (PEEPi). The management of BiVent should be approached from this perspective.

BENEFITS

- Patients are able to breathe spontaneously throughout the ventilatory cycle. Since the activity of the diaphragm and intercostal muscles is not inhibited, there is a resultant improvement in matching of ventilation and lung perfusion. .
- Reduction in intrapulmonary shunting and dead space ventilation is associated with spontaneous breathing.
- Venous return and cardiac performance is improved
- Preserved diaphragmatic activity may recruit consolidated lung areas over time and thus improve oxygenation.
- Neuromuscular blockade may be eliminated, improvement in cardiac and renal function may be realized, lower ventilation pressures will protect the lungs while increasing oxygenation, and sedation may be reduced.
- BiVent should be a more comfortable mode of ventilation for the acutely ill patient.

TERMINONOLOGY (See graph on Page 4)

1. P High is the upper PEEP (CPAP) level. P High is analogous to MAP and thus affects oxygenation.
 - a. This establishes the upper pressure level and should be at or close to the patient's FRC. Patients can breath spontaneously at this level at any time.
 - b. Overdistension will occur when a P High set too high.
 - i. Assess the patient's spontaneous respiratory effort. If, during the release phase (T PEEP) they are actively exhaling, the

patient is struggling to get back down to FRC.

1. Decrease P High so FRC can reestablish
 2. Increase T PEEP so FRC can reestablish
 - c. At P High the patient may show abdominal and accessory muscle excursion with expiratory flow appearing in the graphics. At the same time, inspiratory efforts should be minimal, adjust Trigger. As recruitment takes place, the spontaneous tidal volumes will increase.
2. T High is the inspiratory time IT(s) phase for the ventilator control breaths.
 - a. This is your set rate control
 - b. The shorter the T High the more releases/minute.
 - i. It's during the release phase that PCO₂ is eliminated.
3. T PEEP (T Low) is the expiratory time ET(s) phase for the ventilator control breaths.
 - a. Changes in T PEEP will affect PEEP_i.
 - i. When T PEEP is increased it will decrease PEEP_i
 - ii. When T PEEP is decreased it will increase PEEP_i.
 1. PEEP_i should be measured. PEEP_i should be monitored to ensure there is no derecruitment or overdistention.
4. T High + T PEEP is the total cycle time for control breaths
 - a. Determines the I:E ratio
 - i. The clinician should note that through manipulation of the T High/T PEEP combination, extreme ranges in total MVE and I:E ratio are possible.
5. P Low is the level of mechanical PEEP (CPAP) at baseline.
 - a. Normally is set to zero. Due to the inverse ratios a high level of PEEP_i will be achieved.
 - i. The exceptions will be those patients whose compliance is decreased causing their respiratory time constants to be very short. In those cases, a set PEEP may prevent the faster lung units from completely collapsing. It will be necessary to balance such protection against CO₂ evacuation. MAP is minimally influenced but ventilation may be hindered as P Low is increased.
6. Pressure Support (P High/T PEEP)
 - a. PS may be added to augment the patient's tidal volume at P High and/or T PEEP.
 - i. Caution must be used when adding Pressure Support above the set P High, as patients may be at or near their inspiratory capacity and extra pressure may cause overdistention.

IMPORTANT POINTS

1. 75-25% PEF (peak expiratory flow) goal - The 75-25% PEF goal is primarily for oxygenation
 - a. The T PEEP should be titrated so the expiratory flow terminates inside the 75-25% PEF zone.
 - b. Allowing an expiratory flow to get closer to the 25% PEF end of the range, which may offer better CO2 evacuation, can augment elevated PaCO2.
 - i. It is important, however, that the lung not be derecruited. It is important the PEEPi be assessed during this decision process. Changes in the T PEEP will alter this value.

PROCEDURE

Prior to initiating BiVent, the RCP will...

1. Calculate the P/F ratio from the most recent ABG
2. Using the results of #1, choose the MAP from the following table:
(Steps 2, 3, 4, 5, & 6 are starting points only, adjust as necessary according to patient response, ABGs and other physiological parameters)

<u>If P/F is:</u>	<u>use MAP of:</u>
<300	10-15
<250	15-20
<200	20-25
<150	25-30

3. Set the P High at 3 cm above the MAP selected in step #2 but, **do not exceed a MAP of 30 cmH2O without the physician's approval.**
4. Set the PEEP (P Low) at zero
5. Set the T PEEP at 0.5s
6. Using the following table select a T High that results in a total frequency approximating the rate set on conventional ventilation.

<u>T High (s)</u>	<u>T PEEP (s)</u>	<u>Frequency</u>
3.0	0.5	17
4.0	0.5	13
5.0	0.5	11
6.0	0.5	9

7. Initiate BiVent
8. Review the total minute ventilation, oxygen saturations, and the expiratory flow curve.

MANAGEMENT OF PaO₂

1. To increase PaO₂
 - a. Increase MAP by increasing P High. in 2 cmH₂O increments.
 - b. Shorten T PEEP to increase PEEP_i in 0.1 cmH₂O increments

MANAGEMENT OF PaCO₂

1. To decrease PaCO₂

- a. Decrease T High.
 - i. This increases MVE by creating more airway releases/minute.
2. To increase PaCO₂
 - b. Increase T High
 - i. This decreases MVE by creating less airway releases/minute.

(In general, it is better to accept hypercapnia than sacrifice the MAP from which the oxygenation arises.)

WEANING

The overall weaning strategy shall be to reduce the most invasive parameter first. It is recommended that the physician establish these priorities.

1. As usual FiO₂ should be weaned first.
2. Reducing P High, by 2cmH₂O increments until the P High is below 20 cmH₂O.
3. Increasing T High by 5 releases/minute increments (which reduces the ventilator set rate) until the patient is essentially on CPAP with very few releases.
4. Patients should be increasing their spontaneous rate to compensate.
5. Add Pressure Support judiciously. When adding Pressure Support decrease P High, to avoid overdistention, yet try to maintain a consistent MAP.

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