

Proportional Assist™ Ventilation in a Patient with Respiratory Failure and Severe Anxiety

Case Study
PAV™+ software
option for the Puritan
Bennett 840™ ventilator

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Background

Proportional Assist™ ventilation (PAV) is generally perceived as a weaning mode that can be used in stable patients who were primarily ventilated with one form of assist control ventilation. Previous studies have shown that the PAV mode may be more comfortable for patients and better tolerated than other comparable

modes of ventilation^{1,2}. This case demonstrates how the PAV mode (using the PAV+ software option for the Puritan Bennett 840™ ventilator) can be used as a primary mode of ventilation with judicious use of sedation in a patient with hypercapnic respiratory failure and severe anxiety.

Profile

The patient is a 68 year-old female with a history of severe chronic obstructive pulmonary disease (COPD), bronchiectasis and emphysema. She is also known to suffer from severe anxiety and is dependent on sedatives and opiates. Her recent history included pseudomonas pneumonia and mechanical ventilation in the intensive care unit (ICU). At the time

of this case study, the patient was receiving treatment from a Respirationics BiPAP® Vision® ventilatory support system, using the BiPAP® mode and undergoing intensive pulmonary and physical rehabilitation while arrangements for placement in an extended care facility were being made.

Clinical Course

During her stay on the medical floor, the patient became lethargic while being treated with narcotics for chest pain. Initially she was placed on the Respirationics BiPAP Vision ventilatory support system, which was used nightly to treat chronic hypercapnic respiratory failure. With increasing hypercapnia and depressed mental status, the patient was brought to the ICU. The patient remained lethargic despite treatment with Naloxone, Flumazenil and the BiPAP Vision ventilatory support system. Arterial blood gas (ABG) results on the BiPAP Vision ventilatory support system with 50% FIO₂ revealed a pH of 7.2, a pCO₂ of 74 mm HG and pO₂ of 94 mm HG. Subsequently, the patient had to be intubated. Ventilation was initiated using the PAV+ software option for the Puritan Bennett 840 ventilator, and light sedation was maintained with a continuous Propofol infusion. The ICU nursing staff uses the Richmond Agitation Sedation Scale where "light sedation" is defined as: briefly awakens

with eye contact to voice (≥ 10 seconds). Further work-up confirmed the diagnosis of pericarditis. Analgesia including opiates were given as needed.

When the PAV+ software was initiated, the degree of breathing assist was set to 30% to 40% Support to keep the patient's work of breathing between 0.3-0.7 Joules per liter (J/L) (see table 1). Over the next two days, attempts to decrease support failed but the patient seemed to tolerate mechanical ventilation with PAV+ software well. On Day 3, however, the patient developed an increasing cough and agitation, so her support was increased to 60%. The patient was placed on pressure control ventilation (PCV) overnight due to increased sedation requirements. After her sedation was lightened in the morning, ventilation with PAV+ software was continued at 40% Support and later at 30% Support. On Days 4 and 5, the support was further decreased. On Day 6 the patient was extubated.

Table 1:

	General Floor	ICU Day 1	ICU Day 2	ICU Day 3	ICU Day 4	ICU Day 5	ICU Day 6
Vent Type	Respironics BiPap Vision	Puritan Bennett 840 ventilator					
Vent Status	BiPap/FiO ₂ 50%	PAV+ 40% Support	PAV+ 40% Support	PCV	PAV+ 40 then 30% Support	PAV+ 25% Support	PAV+ 25% Support
Clinical Observations	Lethargic, chest pain, hypercapnic Resp failure Transfer to ICU for intubation	PAV+ tolerated well	PAV+ tolerated well Stable Vital signs	Increased cough and patient becomes agitated, sedation increased	PAV+ tolerated well	PAV+ tolerated well	PAV+ tolerated well Extubated on Day 6
pH	7.2	7.34	7.43			7.4	7.4
pCO ₂	7.4	60	62			69	69
pO ₂	94	68	97			77	80
HCO ₃		29	39			39	38
SpO ₂		93	96			94	93

Discussion

The PAV+ software option permits and requires spontaneous breathing. As such, it is considered a weaning mode, often used after ventilation with conventional modes of ventilation. This case illustrates how the PAV+ option can be used as a primary mode of ventilation, combined with judicious use of sedation in a patient with severe anxiety. Recent guidelines and rec-

ommendations favor the use of light sedation, avoidance of over-sedation and daily sedation holidays as tolerated by the patient³. Proportional Assist ventilation has been shown in the past to provide better patient comfort compared to other modes of ventilation^{1,2}. This advantage may facilitate the rational use of sedation, even in patients at high risk for discomfort and stress.

References

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- 3 Jacobi J, Fraser GL, Coursin DB, et al. Clinical practice guidelines for the sustained use of sedatives and analgesics in the critically ill adult. *Crit Care Med.* 2002;30:119–141.

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