

PROLONGED MECHANICAL VENTILATION IN THE CHRONIC CRITICALLY ILL PATIENT



Prolonged mechanical ventilation (PMV) has been defined as the requirement OF at least six hours of mechanical ventilation per day for at least 21 consecutive days. (*Chest, 2005*)

The need for PMV is rarely, if ever, about management of the cardiopulmonary system. The need for PMV is a result of acute critical illness transitioning to **Chronic Critical Illness Syndrome (CCIS)**. There is evidence that this transition takes place between seven to 14 days post acute illness, if the patient does not fully recover from the acute episode. The complex pathophysiology of CCIS, which is an overwhelming and unchecked inflammatory response, is mediated by the neuro-endocrine system, the sympathetic nervous system and the immune system. The response of these systems, in the early phases of critical illness, are compensatory and adaptive. When the response is prolonged, it is no longer adaptive and diffuse organ and tissue damage result. The defining characteristics of CCIS include: severe nutritional deficits with the catabolization of muscles for energy, severe weakness from nerve and muscle dysfunction, endocrine dysfunction including loss of glycemic control and hypothyroidism, delirium and other mental health issues, bone loss, infections and immune dysfunction, wounds and a high burden of suffering. Managing the PMV patient requires careful consideration and management of each of these issues. Success is less about the manipulation of the ventilator and more about careful de-escalation of acute critical care strategies and an incremental movement toward restoration of “normalcy.”

PMV patients do well and recover in **long-term acute care (LTAC) hospitals** due to the specialized approach and care given to this group of patients who have failed weaning in the acute care setting. LTAC hospitals specialize in the care of these patients as they are placed in an environment with clinicians who are experienced with structured therapeutic processes and allow the patient time to regain strength and treat medical issues that are hampering the weaning process. The strategies for successful weaning of CCIS patients in an LTAC hospital setting are simple and straightforward. The execution of these strategies requires skill and expertise, diligence and hard work. The foundation for weaning the PMV patient includes: **MINIMIZING** sedation, **MAINTAINING** nutrition and **MAXIMIZING** Mobility. The “**3M approach**” of minimizing, maintaining and maximizing is a simple approach to treating a complex medical condition. The acute care

strategies for rapid liberation from the ventilator are no longer appropriate, as the patient has transitioned from acute to chronic critical illness. Every intervention needs to be carefully considered so that the underlying mechanism of rampant unchecked inflammation is reduced. In addition, RT driven weaning protocols that are consistently exercised as the patient is ready enhance the steady slow process of weaning in this patient population.

MINIMUM SEDATION is a significant part of ventilator liberation of CCIS patients with chronic respiratory failure. All sedating medications should be reviewed and discontinued if possible. Patients who are awake and alert and fully able to participate in therapy are ready to begin **Spontaneous Breathing Trials (SBT)**. Clinicians must develop alternative methods for patient safety as sedating medications are removed and patients become more alert. Patient safety devices that can be considered during this process are enclosure beds, freedom splints, low beds and wrist restraints. Discontinuing high dose narcotics and benzodiazepines are obvious but the clinician should also limit medications with sedative side effects. In addition, many medications have anticholinergic effects which contribute significantly to delirium. These should be evaluated as delirium contributes to the need to sedate a patient.



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(CONTINUED)

First Generation H₁ antagonists such as Benadryl (diphenhydramine), Vistaril (Atarax) and Tavist (chlorpheniramine) and antiemetics such as Phenergan (promethazine) and Compazine (prochlorperazine) are medications that should be stopped due to sedative side and/or anticholinergic effects. Alternative medications that can be used without sedation as a side effect are Claritin for H₁ antagonism and Zofran as an antiemetic. Further evaluation in medication reduction in the PMV patient is considering discontinuation of drugs that produce CNS depression such as clonidine and tricyclic antidepressants. Treatment of anxiety disorders not a result of insufficient ventilator support should be given oral dosing in the same manner used to treat the anxiety in the outpatient setting. Large doses and parenteral administration should be avoided as it may lead to confusion, delirium or respiratory instability.

MAINTAIN adequate nutrition support by a registered dietician or metabolic support staff. Malnutrition will significantly limit ventilator weaning and physical therapy outcomes. Weekly monitoring of protein, albumin and prealbumin levels should be part of the plan to make sure nutrition goals are met. Ensuring adequate nutrition in CCIS/PMV provides energy, enhances wound healing, prevents excess breakdown of lean body mass and boosts the immune system.

MAXIMIZING MOBILITY in CCIS patients is individualized to each patient due to the significance of muscle weakness and atrophy. Minimum requirements should be Passive Range of Motion and out of bed to chair twice a day with a goal of two hours total. Therapeutic modalities should be increased to Active Range of Motion, resistance exercise and ambulation. In addition to strengthening of muscles, weight bearing is anti-inflammatory and contributes to the resolution of delirium, turns off the catabolic stimuli of inflammation and helps restore glycemic control. During therapies, RT may support patients with full mechanical ventilation to maximize physical therapy if respirator fatigue limits therapeutic gains.

WEANING PROTOCOLS ARE NEEDED IN CONJUNCTION WITH THE “3MS.” THERE ARE DIFFERENT WEANING PROTOCOLS THAT ARE EMPLOYED IN THIS PATIENT POPULATION.

SUCCESSFUL WEANING PROTOCOLS REQUIRE :

- **Endorsement and support by the pulmonologists.**
- **Straightforward and simple criteria for a wean trial. There should be more than five pulmonary-related criteria and an evaluation of hemodynamic stability.**
- **Execution of the protocol in a competent and predictable manner by skilled RT staff.**

THE FOLLOWING REPRESENTS AN EXAMPLE OF A VERY SUCCESSFUL PROTOCOL :

Management of the mechanical ventilator should consist of the patient having a resting respiratory rate between 15 to 25 breaths per minute. The actual mode for resting ventilator support can be Assist Control, SIMV with PSV or Pressure Support only. A comfortable setting to ensure adequate patient rest on a resting mode of ventilation should be a priority. This can be assessed as the patient having a resting rate of less than 25 breaths per minute, Fio₂ less than 60% and awake, alert and cooperative.

Patients who meet the criteria to begin SBT are placed on PSV mode with 5 PS and 5 PEEP and observed for 10 minutes for signs of respiratory insufficiency. If respiratory distress is noted, the patient is returned to a resting mode of mechanical ventilation and is reassessed in 24 hours for another SBT attempt. If the patient passes SBT, the initial goal will be a trach collar trials (TCT) one hour BID with close supervision by the clinical team. Once the patient is able to tolerate one hour trach trials, the time off the ventilator is increased to two hours BID, three hours BID, four hours BID, 8 a.m. to 4 p.m. daily, 6 a.m. to 6 p.m. daily and then 6 a.m. to 10 p.m. daily. As the patient progresses to 16 hours per day consistently (6 a.m. to 10 p.m.) and appears comfortable, is mobilizing easily and has minimal secretions, the ventilator may be discontinued.

Care plans and therapeutic goals for the treatment of CCIS/PMV patients are distinctly different from acute critically ill patients. CCIS/PMV patients benefit from basic care involving minimum sedation, maximizing mobility and maintaining adequate nutrition allowing patients time to recover from their initial critical illness. The use of a structured, RT-driven weaning protocol supplements the care of these patients and supports success. Successful weaning of the PMV patient is a marathon as opposed to the sprint of ventilator liberation in the acute care ICU.

