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Weaning from mechanical ventilation – the team approach and beyond

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During the early 1980s I was caught up, as were many others, in the search for the answer to the decade old question "Is Intermitent Mandatory ventilation (IMV) and Synchronized IMV (SIMV) better than AMV/T-piece for weaning patients from the ventilator?" Vivid recollections remain of heated debates led by die hard advocates on either side of the controversy. Those in training during that period may still harbor the biases of their mentors who commonly disallowed, as a form of heresy, even the mention of "the other method".

Most good controversies contain both fact and fantasy on either side of the debate; the truth usually lies somehere in between. A patient's reaction to IMV, SIMV, T-piece and Pressure Support Ventilation (PSV) weaning will vary, depending on patient pathophysiology and ventilator circuitry. For example, T-piece has the advantage of requiring no demand valve – a potential benefit for a patient with marginal respiratory muscle reserve. On the other hand, a patient with auto-PEEP may benefit enough from the addition of CPAP through the IMV circuit to offset the imposed work of breathing from the ventilator demand valve [1]. A new development – flow triggered ventilatory support – reduces the work associated with a demand valve thereby allowing the potential for the combined advantages of T-piece and IMV. PSV is another successful and very popular modality for weaning, but it is not without the risk of the patient not synchronizing with the ventilator [2].

As editorial in *Chest* [3] by Petty entitled IMC vs CMC (intermittent mandatory cerebration versus continuous mandatory cerebration) seemed to be the first incisive commentary on the issue. Petty argued, in essence, that it was more important to understand the nuances of each ventilator mode so one could better select the modality best suited to the individual. He, by the way, preferred CMCI.

What then is the "best" way to wean a patient from mechanical ventilation? Clearly, no ventilator mode has yet been shown to be superior; as the technology continues to develop, however, there is increasing information indicating that what Milic-Emili termed the "art of weaning" [4] may have a larger component of science than appreciated previously.

Yang and Tobin recently demonstrated the statistical superiority (89% overall accuracy) of the rapid shallow breathing index (frequency/tidal volume ratio in breaths per min/l) over a number of other more sophisticated and cumbersome weaning predictors [5]. In their prospective controlled study an index of ≤ 105 was highly predictive of successful weaning while an index of ≥ 105 was associated with a high likelihood of weaning failure. The superiority of this simple index, requiring only a few minutes of bedside observation, deserves much reflection in light of rapidly advancing bedside monitoring technology.

What about the human element? Is it possible that the way we organize the weaning process may be more relevant than the mode used for weaning? In a 1980 editorial entitled "IMV and Weaning" Williams expressed his concern over the emerging reliance on IMV as a common cause of failure to wean [6]. He stated the following:

> *"When weaning is accomplished by discontinuing respiratory support, knowledge personnel must be present to observe the patient and reinstate mechanical ventilation at the first sign of distress. However, the substitution of technology for personnel can greatly prolong the length of time that many patients spend on a respirator."*

A small but growing number of recent studies document the importance of carefully designed multidisciplinary approaches to the care of ventilator dependent patients.

We developed a ventilator management team to oversee the care of all ICU patients requiring mechanical ventilation in a 20 bed medical-surgical ICU [7]. During the operation of the team the mean ventilator duration was decreased by 3.9 days which represented an estimated cost saving of $1300 per patient. The team was formed in response to perceived shortcomings in the weaning process such as poorly timed and coordinated orders, and a lack

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of face-to-face communication among the ordering physician, the bedside nurse, and the respiratory therapist. It consisted of a physician, therapist, and the individual bedside nurse. This group rounded formally three times a week for a total of 20–40 min perday and informally daily. The primary goal was to have a well organized weaning plan for every stable patient that was coordinated with the housestaff teaching team. IMV and T-piece methods were freely used at the discretion of the team and in concert with the housestaff. It was concluded that a multidisciplinary, ventilatory management team could expedite the process of weaning patients in the ICU. More importantly, however, this study demonstrates the impact of planning and organization on the process of weaning.

There are six other references to a team approach to weaning from mechanical ventilation that this author is aware of. Three of these appear in abstract form [8–10].

Munroe et al. reported on the use of a multidisciplinary consult service lead by a respiratory therapist with the help of a physician [8]. Similar to the study above these authors demonstrated a significant decrease in ventilator duration. Additionally, they showed a decrease in morbidity. Yupfer et al. developed a "Wean Team" to manage patients without the use of an ICU [9]. They have cared for over 900 patients in this manner with a successful weaning rate of approximately 70%.

A Comprehensive Support Care Team was developed in Detroit by Carlson et al. for the management of terminal critically ill patients with multiple organ failure [11, 12]. Their group was successful in reducing the stay in ICU by 50% over historic controls while maintaining comfort and dignity for the patient and family. In this novel and pragmatic application of the ethics committee at the bedside the team was able to act more assertively because of the knowledge base possessed by its multidisciplinary membership.

Though not exactly on the topic of weaning, East et al. have found a dramatic improvement in survival from ARDS by the use of computerized multidisciplinary management protocols [13]. This underscores the risks of a "play it by ear" approach to mechanical ventilation.

Finally Blondin et al. [10], using a multidisciplinary team and protocol approach to patients undergoing coronary artery byxpass surgery, have been successful in reducing ICU stay from a mean of 3,4 days to 2,3 days. They were able to achieve these results with a compliance rate of less than 50%. Noteworthy is that the efforts of these investigators were carefully designed based on principles of Total Quality Management (TQM) and Continuous Quality Improvement (CQI) [14]. Briefly, TQM is an approach to management which embraces the concepts that managers are leaders, and that those people involved with a process must be empowered to effect change in that process. CQI is a TQM technique by which explicity defined processes are examined in order to make improvements – thereby continuously striving for perfection. In contrast to conventional management techniques, under TQM solutions to problems are not handed down from the top, and the focus of change is the system or process, not the individual.

In the short span of a decade we have gone from pondering the "hard science" of ventilator circuitry as a solution for ventilator dependent patients to dabbling in the "soft science" of clinical observation, face-to-face team interaction, protocols, and process. It is reasonable to assert that organizational aspects of care have an important and measurable effect on outcome. Such precepts have not been widely applied or studied in medicine until recently. Advances in technology are continuing to provide us with increasingly sophisticated ventilators and monitoring devices. In order to optimize the use of these exciting new tools we need to fully explore and redefine the fundamentals of care. Personnel accounts for 60% or more of all the costs associated with ventilator care. It would seem rational to ensure that the human interaction at the bedside is at least as finely tuned as the instruments. To accomplish this goal more exploration and delineation of the "art of weaning" is needed. The team approach is a viable means in the quest.

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