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NEW PERSPECTIVES IN PULMONOLOGY

Long-term ventilator-dependent patients: New facilities and new models of care. The American perspective

Pacientes dependentes de ventilador a longo prazo: novas instalações e novos modelos de atendimento. A perspectiva Americana

The number of patients who receive mechanical ventilation as life support is rapidly increasing due to improvements in life saving medical therapy in critically ill patients, an aging population and the expanded use of aggressive surgical procedures. The historic annualized increase in prolonged mechanical ventilation use in the U.S. is approximately 5.5% compared with a 1% per annum increase in U.S. hospital admissions.[1] It is estimated that the population of patients who receive prolonged mechanical ventilation in the U.S. will more than double by the year 2020 and reach approximately 605,898 cases.[1] The increased number of patients who require prolonged mechanical ventilation strains the available resources of intensive care units (ICU) by requiring a greater degree of medical care and ICU hospitalization that exceeds the median length of stay. Mechanical ventilation is expensive therapy; patients who receive ventilation in the ICU disproportionately contribute to the high cost of ICU care.[2] Dasta and colleagues reported that ICU patients who require mechanical ventilation compared to ICU patients who do not receive mechanical ventilation have 50% higher costs and treatment with mechanical ventilation accounts for 51% of their total hospital costs.[3] Those who require prolonged ventilation consume an even greater percentage of heath care dollars. In an analysis of over 31 million hospital discharges for adults in 2003, Zilberberg reported a greater median length of stay (17 vs. 6 days) and hospital costs ($40,903 vs. $13,434) for those who received mechanical ventilation $\geq$96 h compared to those who received mechanical ventilation <96 h.[4] Patients who are ventilated for $\geq$21 days have even higher costs; the cost per one-year survival is $423,596, $266,105 and $165,075 for patients ventilated $\geq$21 days, $\geq$96 h with a tracheostomy and <96 h, respectively.[5] Carson reported on 126 patients ventilated $\geq$4 days with tracheostomy or $\geq$21 days without tracheostomy who were treated at one health care system and then followed prospectively for one year to determine the trajectories of their care and resource utilization.[6] One hundred and three survivors (82%) had 457 separate transitions in post discharge care location (median 4 transitions, including 68 patients who were readmitted at least once). Patients spent an average of 74% of all days either in a hospital or post acute care setting or received home health care. At one year, 11 patients (9%) had a good outcome – alive without functional dependency, 33 (24%) had a moderate outcome – alive with moderate dependency and 82 (65%) had a poor outcome, either alive with complete functional dependency (4 patients, 21%) or dead (56 patients, 44%). Those with poor outcomes were older, had more comorbid conditions and were more frequently discharged to a post acute care facility. The mean cost per patient was $306,135 and for the total cohort $38 million were spent for their medical care for an estimated $3.5 million per one independently functioning survivor at one year. These data suggest that some patients who receive prolonged ventilation consume considerable resources in their last year of life with low likelihood of any meaningful quality of life.

Some reports of patients who receive prolonged ventilation, however, show much better outcomes, both in terms of survival and quality of life. Gracey and colleagues reported a 65% survival at one year in patients treated in a multidisciplinary care unit.[7] Chatila showed an acceptable quality of life in patients receiving prolonged ventilation of >21 consecutive days with tracheostomy.[8] Mamary et al. recently reported in 182 consecutive patients receiving prolonged ventilation for >55 $\pm$ 42 days a 75% one-year and 59% three-year survival.[9] All of these studies were conducted in special Chronic Ventilator Dependent Demonstration Units of the Health Care Financing Administration (HCFA) that were geared to provide long-term ventilation outside of the ICU to selected patients expected to have high likelihood of benefitting from multidisciplinary treatment plans focused on restoring functional capacity via whole body rehabilitation.

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Besides the growing numbers of patients that require prolonged mechanical ventilation, geographic constraints on ICU bed capacity and the high cost of care, many other issues have been identified that adversely affect the plight of patients who require prolonged ventilation.[10] These include: the high mortality reported in patients receiving prolonged mechanical ventilation, the substantial number and severity of associated comorbidities (impaired cognition, decreased functional status, impaired swallowing), the quality of life following prolonged ventilation, the cost-effectiveness of care, the optimal treatment plan and the best location of care. Even more basic, the definition of what constitutes prolonged mechanical ventilation is still a matter of debate.

The definition of prolonged ventilation has ranged from $\geq$48 consecutive hours to $\geq$96 consecutive hours with tracheostomy to $\geq$21 consecutive days with at least 6 h of ventilation daily. The HCFA Chronic Ventilator Dependent Unit Demonstration Project that was conducted in the 1990s used the later definition.[2] The Chronic Ventilator Dependent Unit Demonstration Project purposely selected a patient cohort who was chronically ventilated but medically stable enough not to require ongoing aggressive non-pulmonary ICU care but continued to require mechanical ventilation and needed rehabilitation to restore their functional status. Patients who require mechanical ventilation for longer durations are usually older, sicker; receive mechanical ventilation longer before weaning attempts are begun and are more likely to have underlying COPD or pneumonia as the cause of respiratory failure. Moreover, they tend to have higher mortality and although fewer in number they incur longer lengths of stay and have much higher associated costs of care.[11]

The location of care for patients receiving prolonged ventilation in the U.S. migrated out of the acute care hospital in the mid 1990s due to adoption of the Prospective Payment System Designated Related Group (DRG) reimbursement scheme to specialized weaning centers, long-term acute care hospitals or skilled nursing facilities that accept ventilated patients. The Prospective Payment System utilized in the U.S. assigns payment scales to the care of patients who require mechanical ventilation with a tracheotomy operation performed except face, neck and mouth diagnosis (DRG 541, $89, 000) and mechanical ventilation $\geq$96 h without tracheotomy operation performed except face, neck and mouth diagnosis (DRG 542, $43,000) with the aim of bundling the cost of care and triaging differential payments for patients with higher care demands and resultant costs of care. The reported patient outcomes from these long-term acute care and skilled nursing facilities have been mixed; some reports show high one-year mortality with limited weaning success. Patients receiving mechanical ventilation who are transferred directly from the ICU to a lower acuity facility have been reported to have a high rate of readmission and mortality.[12] However, the selection criteria used to admit patients to these facilities and the description and intensity of the rehabilitative and pulmonary treatment plans that are utilized by these alternative locations of care are variable and limited.

Programs that utilize a comprehensive multidisciplinary rehabilitative approach to treat patients receiving prolonged ventilation have uniformly reported better survival and functional outcomes. The components of these programs that are considered essential for success, include strong medical respiratory specialist leadership, a multidisciplinary staff of nurses specialized in the care of ventilated patients, physical and respiratory therapists, speech therapists, psychologists and nutritional support.[13,14] In fact several studies have demonstrated that whole body and respiratory muscle training can facilitate an increase in functional performance, limb and respiratory muscle strengthening and liberation from mechanical ventilation.[14–16] Martin and colleagues have shown that an increase in upper extremity strength correlates better than any other spontaneous breathing variable in predicting weaning success.[14]

Because of the specialized needs of the patients receiving prolonged ventilation, it has been suggested that regional centers of excellence may not only be more cost effective, but also result in better outcomes. Lone et al. reviewed a database of admission to 3 UK ICUs and found that the incidence of patients requiring prolonged mechanical ventilation was 4.4 per 100 ICU admissions and 6.3 per ventilated ICU admission.[17] PMV patients used 29.15 of all general ICU bed days and spent a longer time in the hospital than non-PMV patients (median 17 vs. 7 days).They suggested that a three bed weaning unit could result in cost savings and unlock ICU beds for other patients.[17] In general, outcomes from mechanical ventilation have been reported to be better when conducted at high volume rather than low volume centers.[18] A cogent argument could be made that patients who receive prolonged ventilation need the most specialized care plan and their outcomes might be best served in regionalized centers of excellence that are dedicated to the evaluation and treatment of this patient group. That conclusion was also reached after analysis of the HCFA Chronic ventilator demonstration project, but limitations in funding prohibited their establishment.[2]

Patients who require prolonged mechanical ventilation place unique demands on the health care delivery system that impacts not only those who receive that therapy but other patients who receive care in the intensive care unit or compete for medical resources in a medical care delivery system currently under duress. Appropriate selection of patients receiving prolonged ventilation that may benefit from continued aggressive medical care, whole body rehabilitation and continued weaning efforts is required, however, the complete characterization of those patients most likely to benefit still awaits identification.[19] Future research is needed to identify those patients receiving prolonged mechanical ventilation who are most likely to benefit from comprehensive and aggressive medical care from those who are dying a protracted death to optimize patient outcome and alleviate unnecessary suffering.

Conflicts of interest

The authors have no conflicts of interest to declare.

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