

Chronic Ventilator Weaning Using Modified TIPS Protocol at a Long-Term Acute Care Unit (LTAC) On Patient With Multiple Comorbidities

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Abstract: Long-term acute care units (LTACs) are designed to meet the needs of patients who have ventilator-dependent respiratory failure, chronic pulmonary problems, complex and severe wounds, infections requiring long term antibiotic therapy, and conditions requiring continued life support, nutritional therapies, or pain control. The population of patients requiring prolonged mechanical ventilation (PMV) has been a rising area of research and study since the 1990s, when emerging economic pressures to maximize resource utilization have resulted in specialized centers for post intensive care unit (ICU) care. Optimal weaning strategies have been proposed and investigated. The objectives of this study are to: (1) Quantify weaning outcomes of ventilator-dependent patients admitted to Kindred Hospital, in terms of wean-off rate, time to weaning, and mortality; (2) Compare these rates to existing data; and (3) Describe the current chronic weaning strategy used in this LTAC. Methods entailed a chart review of 109 patients admitted on a ventilator in 2007. Outcomes measured were: wean rate, mortality, time to wean, length of stay and rate of ICU transfers. Our multidisciplinary team dynamics to chronic vent weaning management and the weaning protocol used was described. Our results demonstrated a 46% wean rate, 28.28% mortality rate and our median time to wean was 14.5 days. Our wean rates are numerically better than most reported data. However, controlled cohort studies should be undertaken to study this evolving segment of hospital care, to elucidate whether the use of a multi-disciplinary weaning team or the use of this modified-TIPS protocol indeed provides a statistical difference in wean outcomes or mortality.

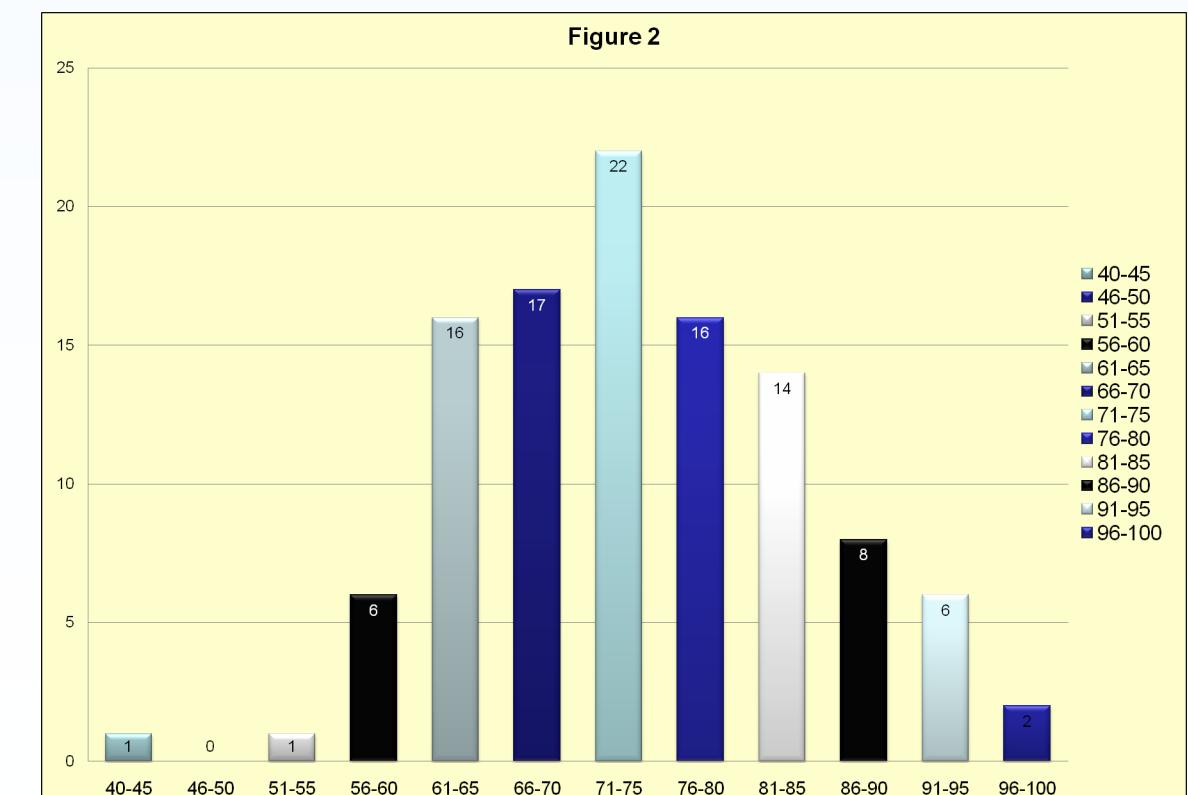
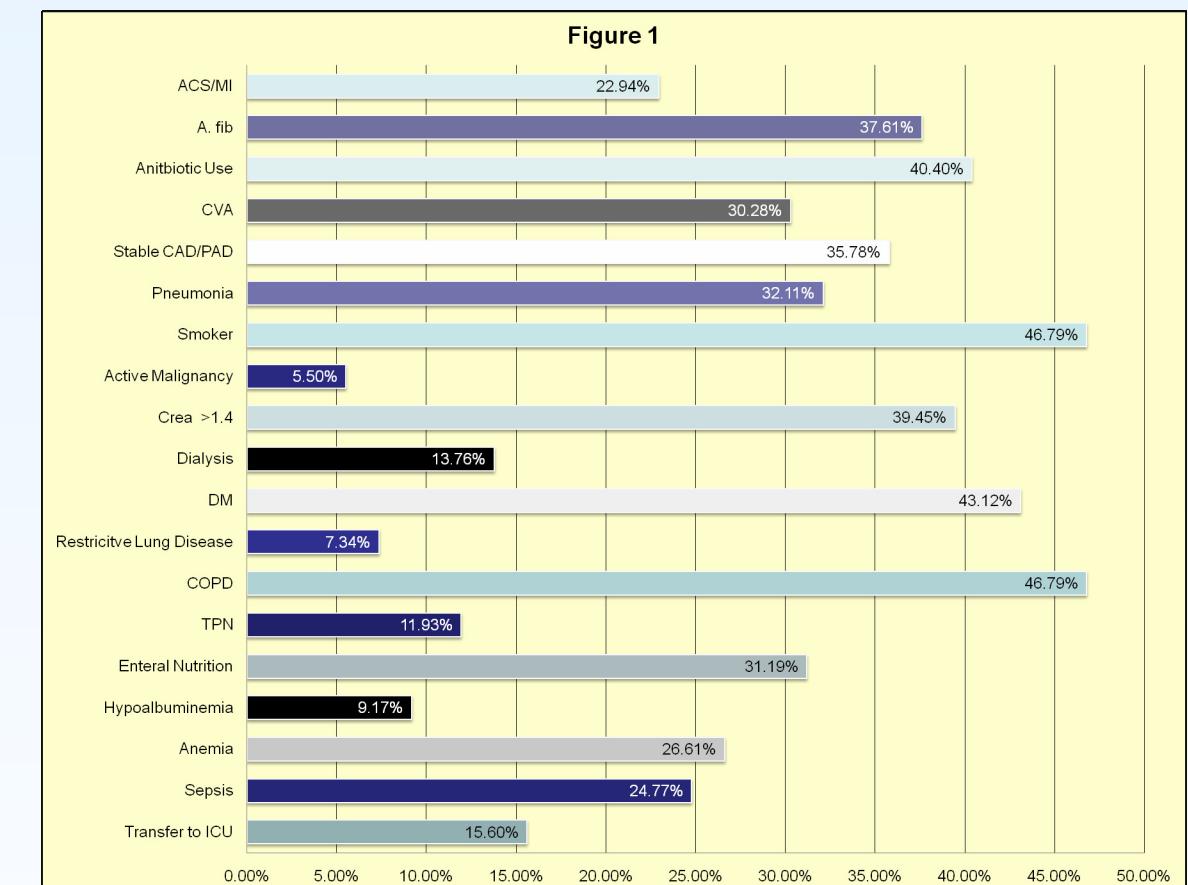
Introduction: The Long Term Acute Care or LTAC Hospital is a hybrid between the acute care hospital and the skilled nursing facility or sub-acute facility. LTACs are designed to meet the needs of patients who have ventilator-dependent respiratory failure, chronic pulmonary problems, complex and severe wounds, infections requiring long term antibiotic therapy, and conditions requiring continued life support, nutritional therapies, or pain control¹. Patients requiring prolonged mechanical ventilation (PMV) are rapidly increasing in number as improved ICU care has resulted in many patients surviving acute respiratory failure only to then require prolonged mechanical ventilator assistance during convalescence². The PMV population has been a rising area of research and study since the 1990s, when emerging economic pressures to maximize resource utilization have resulted in specialized centers for post intensive care unit (ICU) care. A retrospective record review (n=1123) of such patients at a regional weaning center from 1988 to 1994 reported no improvement in weaning outcomes through time. The numbers were as follows: 55.9% weaned, 15.6% failed to wean, 28.8% died, and median time to wean was 29 days. Although overall mortality rates have remained unchanged, survival of weaned patients 1-year after discharge to home has improved from 45% (1988-1992) to 59% (1992-1996)³. A latter analysis of a smaller population (n=133), reflected a 50% (n=66) mortality rate and 38% (n=51) wean rate. Significant predictors of poor outcomes were; age > 64 and not functionally independent before admission. Such subgroup of patients reflected a 95% (CI⁴ 84-99%) mortality rate⁴. Multicenter outcome studies of PMV patients admitted to long term care hospitals were later elucidated from a pool of 1,419 patients in 23 hospitals. Outcomes of all patients upon discharge were as follows: 54.1% weaned, 20.9% ventilator dependent, and 25% deceased. Median time to wean (n=766) was 15 days (range 7-30). Characteristically, most patients admitted were elderly, with acute on chronic illness, and continued to require prolonged and aggressive ICU interventions⁵. Apart from the epidemiologic characterization of such patients, much research has focused on which weaning strategy provides optimal outcomes. In the non-LTAC setting, a comparison of spontaneous breathing trials versus decreasing levels of pressure support ventilation (n=52), showed equal effectiveness in COPD patients requiring mechanical ventilation for more than 15 days⁶. In the LTAC setting, studies have felt a need to standardize weaning protocols for PMV. In 2001, Scheinhorn et al, used a therapist-implemented patient-specific (TIPS) protocol for PMV. The protocol is based on stepwise reductions in SIMV and PSV, followed by Spontaneous Breathing Treatments (SBT). Wean outcomes of patients subject to the TIPS protocol (n=252) were compared with patients treated under the same physician prior to protocol institution (n=238). The results demonstrated TIPS patients had shorter time to weaning (17 days) compared to historical controls (29 days). Nevertheless, TIPS group Vs Historic Control group were similar in the following respects: wean rate (54.7% Vs 58.4%), ventilator-dependence rate (17.9% Vs 10.9%), and death (27.4% Vs 30.7%)⁷. A follow-up study (n=191) of the TIPS protocol was thereafter designed to determine the optimal RSBI used to determine early entry into the SBT phase of weaning. Such RSBI threshold has since been changed to <100. Average time to weaning was 13.5 days⁸. Patients on PMV have clearly different needs and resource consumption compared to patients in acute ICUs. Specialized venues, management strategies and reimbursement schemes are rapidly developing. One challenging aspect of studying the PMV population is varying definitions of "weaning success". In the ICU setting (and in this LTAC), weaning success is typically defined as extubation without the need for the reinstitution of ventilatory support (invasive or non-invasive) within the subsequent 48-72 hours. A consensus panel has agreed that such definition may not apply in a PMV setting. The consensus recommendation was to change the time duration in the previous definition to 7 days.

Material and methods: Inclusion criteria of this study was, all patients admitted to Kindred on a ventilator. And there was no exclusion criteria. The multidisciplinary team consists of the Pulmonologist, Attending Physicians, Nurse Practitioners (NP), Respiratory Therapists (RT), and Nursing Staff (NS). The Nurse Practitioner role facilitates weaning in the LTAC setting through coordination of care. It is noteworthy that the patients each have an internist as a primary care physician with the pulmonary team in consultation. The day begins as the NPs assure that no acute problems necessitating immediate action are present. RTs report an account of overnight events, current ventilator settings, weaning parameters, as well as the RNs and RTs evaluation. The NP performs a physical examination of each patient ordered a pulmonary consultation. The laboratory values and progress notes are reviewed and analyzed. The evaluation of a new patient includes a history and physical, drawing of arterial blood gases, chest x-ray, and sputum culture. If the assessment warrants any immediate changes, they are made at this time. The NPs discuss any medical issues that may inhibit the weaning process with the attending physicians. Such concerns may include fluid and electrolyte imbalance, concurrent infection, acid base disorders, and the utilization of sedatives and narcotics. After the NPs conclude their assessment, they perform walking rounds with the Pulmonologist in order to collaborate on the plan of care. The NP rounds with the pulmonologist Monday through Friday. The pulmonologist rounds with Respiratory Therapists on weekends and holidays. The pulmonologists are on call on nights and weekends for sudden changes in patient condition.

Material and methods (continued): The weaning protocol is initiated if criteria are met (described in the next section). Following rounds, pertinent chest x-rays and/or CT's are reviewed with the pulmonologist and the radiologist. Decisions regarding the plan of care are then made according to findings. This model has been in place for the last three years. Constant communication between all members of the multidisciplinary team facilitates weaning and the ultimate objective of decannulation as applicable.

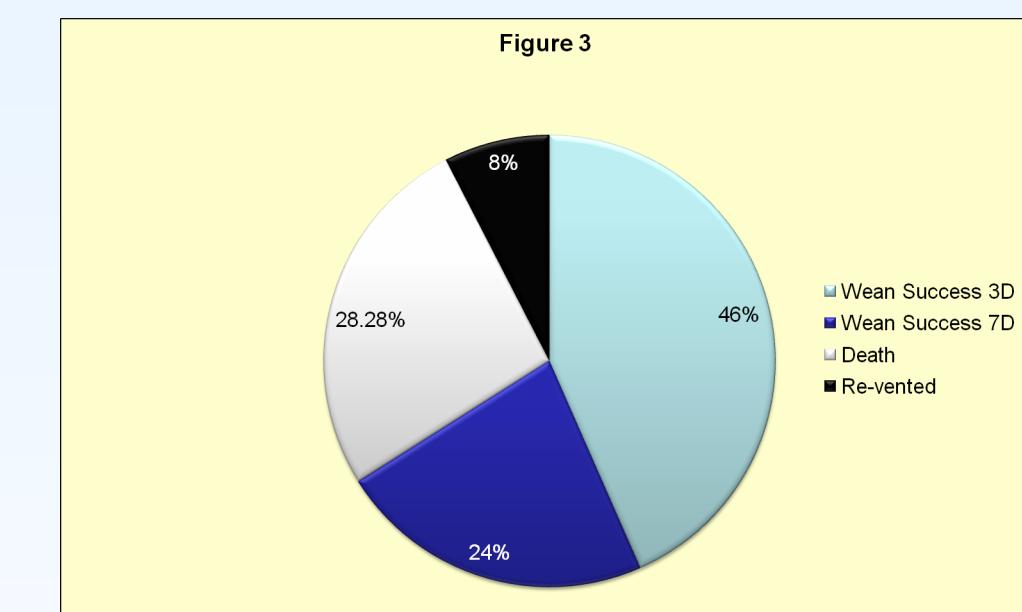
Weaning Protocol: The weaning protocol used in our setting is derived from that used by Scheinhorn and Chao. The main modifications are as follows (compare Appendices): (1) Initial Ventilator settings that specify low tidal volumes, 6-8 ml/kg IBW (consistent with ARDSNet trial data⁹) with PEEP set at 5 cm H₂O, (2) Included additional steps for initial assessment; portable chest x-ray, ABGs, weaning parameter (which include RSBI) daily; as described above.

Data Collection: In 2007, there were 109 ventilator-dependent patients admitted to Kindred. Charts and computerized records were reviewed retrospectively to determine patient characteristics, weaning rates, time to wean, transfers to acute ICU, lengths of stay and mortality. The following formula defined the wean rate: (Number of discharges for the month who were admitted on a vent and were weaned for >72 hours during admission X 100) / (Total number of patients discharged who were admitted on a ventilator). Admitted on a vent is defined as: all patients admitted on a ventilator or placed on a ventilator within 7 days of admission. By definition, only the first successful wean episode was counted. Patients who were transferred out of the hospital for <72 hours for a procedure/treatment at another hospital was not considered a discharge for the purposes of this indicator. Patients placed back on the ventilator at anytime during the admission were not included in the equation again.



Results: One hundred and nine with different comorbidities as shown in (figure 1). Patient age groups are shown in (figure 2). Forty six patients (46) admitted on a ventilator in 2007 were successfully weaned (n=109). This reflects a wean success rate of 46%. Mortality rate was 28.28%. As of this preliminary report, data on patient demographics, time to wean was 14.5 days, and rate of ICU transfer is 15.6%. These are being collected manually and will be incorporated into the final study results.

Discussion: Several factors influence weaning success rates. Clearly, the patient's age and functional status play a role.⁴ What is unclear is whether one approach to chronic weaning is superior to another. Scheinhorn et al. (1997) demonstrated that the TIPS protocol reduced the length of time to weaning. However, a statistically significant difference in mortality and overall wean rate was not demonstrated.⁷ The chronic weaning strategy used in this research is derived from, and is similar in many respects to the TIPS protocol. One difference is the inclusion of a nurse practitioner working within the context of a multidisciplinary team of pulmonologists, primary care physicians, respiratory therapists and nursing staff. Another difference was the inclusion of low tidal volumes for all ventilator settings.⁹ Our wean success rate of 46% is numerically better than most established data (see Introduction). Furthermore, it is noteworthy to recall that most previous studies have excluded Pts with neuromuscular disease and hemodynamic instability, whereas this study did not. In contrast, several study limitations also come to mind: (1) the degree of compliance to the multidisciplinary protocol were not measured, (2) the difference in outcomes could not be ascribed to any single aspect of our chronic weaning protocol, and (3) definitions of successful weaning may not exactly be the same from study to study. Although, from the consensus meeting of 2005, a patient that was ventilator-free for 3 days is what was generally accepted as a successful wean in the ICU setting.² The studies quoted in this paper where performed prior to the 2005. The proposal to re-define a successful wean as being ventilator-free for 7 days in the PMV setting, certainly makes more sense and should be used in future studies.



Conclusion: The weaning success rate of ventilated patients admitted to our LTAC is 46%. With median time to wean 14.5 days. This is numerically better than most reported data on wean-success rates. Due to its inherent weaknesses as outline above, these observational results are hypothesis generating, but worthy of further study. Controlled, cohort studies should be undertaken to study this evolving segment of hospital care, to elucidate whether the use of a multi-disciplinary weaning team or the use of this modified-TIPS protocol indeed provides a statistical difference in wean outcomes or mortality.

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