



## Summary of Ventilator Weaning: Quality of Life Research

### **Long-term Outcome and Functional Status of Patients Weaned from Prolonged Mechanical Ventilation**

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The goal of this prospective study was to assess the long-term survival and functional status of patients requiring prolonged mechanical ventilation (> 15 days) who were weaned and discharged from a long-term acute care hospital (LTACH). Of the 79 patients (age,  $70 \pm 13$  yrs) who were discharged from the LTACH, 40 (50.6%) were successfully weaned from mechanical ventilation, and 26 (65%) of these patients were still alive at  $10 \pm 5$  months after discharge. Of the 25 patients that were contacted, all but one was living at home.

To determine the long-term functional status, the patients were phoned and the Katz Activities of Daily Living (ADL) and Karnofsky Performance Index questionnaires were completed. Compared with pre-illness status, Karnofsky scores decreased from  $84 \pm 21$  at baseline (100=normal healthy individual) to  $67 \pm 20$  ( $p=0.01$ ) at time of contact; 19 of 25 patients (76%) maintained a score > 60 consistent with requiring occasional assistance, but were able to care for most of their personal needs. The ADL score (a scale of 0-18, 0 indicating complete independence) increased from  $0.3 \pm 0.7$  at baseline to  $4.0 \pm 6$  ( $p=0.007$ ) at long-term follow-up; 15 (62.5%) patients maintained independence in their activities of daily living.

In conclusion, most patients weaned from prolonged mechanical ventilation were still alive about one year after discharge from an LTACH hospital; of the contacted patients, 96% were living at home. Despite a decrease in Katz and Karnofsky scores, most contacted patients maintained their functional independence.



## **Effect of Prolonged Mechanical Ventilation on Quality of Life**

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The goal of this study is to prospectively determine the long-term, health-related, quality of life in patients who were weaned from prolonged mechanical ventilation ( $50.3 \pm 20.4$  days) and discharged from a long-term acute care hospital (LTACH). Short Form-36 (SF-36) and the Post-Traumatic Stress Syndrome (PTSS-10) questionnaires were mailed. Of 25 patients who were contacted at  $10.3 \pm 5.8$  months after discharge, 10 returned the questionnaires.

The SF-36 measures quality of life in eight distinct domains: physical functioning, role-physical, bodily pain, mental health, role-emotional, social functioning, vitality, and general health perceptions; these eight domain scores can be combined into two summary scores (a physical score and a mental score). Compared with national norms, standardized to a mean of  $50 \pm 10$  (SD), patients who had weaned from prolonged mechanical ventilation scored lower in the physical summary score (41.4,  $p < 0.007$ ), but not in the mental summary score (50.1,  $p=0.97$ ). Compared with outpatients who had serious, chronic medical conditions, the weaned patients had equivalent physical and mental scores.

The PTSS-10 is a self-reported scale for the diagnosis of post-traumatic stress disorder. Seven of the 10 patients reported at least two of four adverse experiences required for the development of post-traumatic stress disorder, although only one patient showed signs of the disorder. In conclusion, patients who were weaned from prolonged mechanical ventilation had equivalent physical and mental function, as did chronically ill outpatients and only one patient showed signs of post-traumatic stress disorder.



## **Handgrip Strength and Maximum Inspiratory Pressure in Patients Weaning from Prolonged Mechanical Ventilation**

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Patients receiving long-term mechanical ventilation suffer from multiple metabolic and nutritional deficiencies that decrease skeletal muscle bulk, which may contribute to difficulty with weaning. To determine whether the respiratory and limb muscles are equally affected we repeatedly measured maximum inspiratory pressure and handgrip strength in five patients referred to a specialized weaning facility. Mean age was  $78.2 \pm 7.6$  years and 60% were women. Patients had received mechanical ventilation for  $33.6 \pm 12.8$  days. Indications for mechanical ventilation were post-operative respiratory failure (four patients) and acute lung injury (one patient). Mean APACHE II scores on admission to the weaning facility were  $16.6 \pm 0.9$ . From the time of admission until a week after successful weaning, maximum inspiratory pressure increased by 19.5% ( $34.4 \pm 11.1$  to  $42 \pm 19.4$  mm H<sub>2</sub>O) whereas handgrip strength increased by only 4.2% ( $17.0 \pm 17.0$  to  $20 \pm 23.18$  kPa). The increase in the handgrip strength correlated with the increase in maximum inspiratory pressure ( $r=0.82$ ;  $p=0.08$ ).

In summary, increases in respiratory muscle and limb muscle strength in patients weaning from long-term mechanical ventilation were proportional to one another, although the increase in respiratory strength was much greater than that of limb strength. In conclusion, the relatively greater increase in respiratory over limb muscle strength suggests that the process of weaning may serve as a stimulus for ventilatory muscle training.



## **Determinants of Long-term Survival in Patients Weaned from Prolonged Mechanical Ventilation**

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Many long-term ventilated patients are being transferred to specialized weaning facilities, but there is little understanding of the determinants of long-term survival. To gain insight into this problem, we studied 65 consecutive patients (age  $68.1 \pm 12.6$  years, 36.9% women) who were transferred to a weaning facility; duration of mechanical ventilation before transfer was  $36.0 \pm 23.2$  days.

The indications for prolonged ventilation were acute hypoxic respiratory failure (43%), post-operative respiratory failure (40%), nervous system disorders (13%), and exacerbation of COPD (4%). Of the 65 patients, 55 (84.6%) survived the stay at the facility, 12 (22% of survivors) were discharged home, and the remaining 43 were transferred to a rehabilitation facility, a skilled nursing facility, or another hospital. At 12 months after discharge, 33 of the 65 patients (51%) were alive, and 31 of the patients (36% of survivors) were living at home. Weaning was accomplished in 88% of survivors and 19% of non-survivors ( $p=0.0001$ ). Five variables measured on arrival at the facility discriminated between patients who survived for 12 months after discharge from the facility and patients who died; age,  $64 \pm 13$  vs  $73 \pm 11$  years,  $p=0.002$ ; APACHE score,  $13.1 \pm 4.6$  vs  $17.0 \pm 5.1$ ,  $p=0.02$ ; SAPS score,  $24.7 \pm 8.8$  vs  $31.8 \pm 9.3$ ,  $p=0.002$ ; duration of mechanical ventilation before transfer to the facility,  $29 \pm 11$  vs  $43 \pm 30$  days,  $p=0.013$ , and maximal inspiratory pressure,  $48.5 \pm 14.8$  vs  $36.3 \pm 16.3$  cm H<sub>2</sub>O,  $p=0.002$ .

In conclusion, age, severity of illness, and respiratory muscle strength significantly influence 12-month survival of patients admitted to a facility for prolonged weaning from mechanical ventilation.



## **Is Quality of Life Worse After Weaning from Prolonged Mechanical Ventilation as Compared to Before?**

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Weaning from prolonged ventilation increases survival, but it can be offset by decreases in functional status and quality of life. To determine the effect of prolonged ventilation on muscle function, we measured maximum inspiratory pressure and handgrip strength, and to determine the effect on quality of life, we administered the Katz Activities Daily Living (ADL) and short form-36 (SF-36) questionnaires.

Measurements were obtained on admission and at six months after discharge (during a home visit). Of 24 discharged patients, 17 (71%) were alive at six months. Of these 17 patients, 11 were living at home. Home visits were made in eight of these patients, of whom mean age was  $60.5 \pm 16.5$  years and 25% were women. Mean APACHE II score at admission to the weaning facility was  $13.3 \pm 4.4$ . Between admission and six months after discharge, handgrip strength increased from  $32.5 \pm 19.2$  to  $92.6 \pm 21.4$  kPa ( $p=0.0004$ ), and maximum inspiratory pressure increased from  $49.5 \pm 11.4$  to  $60.1 \pm 20.4$  cm H<sub>2</sub>O, ( $p=0.05$ ). The SF-36 physical summary score was estimated at  $44.2 \pm 10.6$  before illness; it decreased to  $31.5 \pm 7.0$  ( $p=0.02$ ) at six months after discharge. The mental summary score did not change over time, and was comparable to national normal value. The ADL score (a scale of 0 to 18) increased from zero (indicating complete independence) at baseline to  $3.6 \pm 6.2$  ( $p=0.13$ ) at six months follow-up; four (50%) patients needed assistance in their activities of daily living.

In conclusion, patients weaned from prolonged mechanical ventilation show improvement in respiratory and limb muscle strength six months after discharge from a weaning facility, although their ratings of physical function were worse than before hospitalization.