Intensive Care Med (1999) 25: 581–587
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E. W. Ely
A. M. Baker
G. W. Evans
E. F. Haponik

The prognostic significance of passing a daily screen of weaning parameters

Received: 15 July 1998
Accepted: 9 March 1999

E. W. Ely (✉) · E. F. Haponik
Department of Internal Medicine, Section on Pulmonary/Critical Care Medicine, Wake Forest University School of Medicine, Winston-Salem, NC 27157, USA

A. M. Baker
Lynchburg Pulmonary Associates, Lynchburg, Virginia, USA

G. W. Evans
Department of Public Health Sciences, Wake Forest University School of Medicine, Winston-Salem, NC 27157, USA

Mailing address:
Section on Allergy/Pulmonary/Critical Care Medicine, Vanderbilt University Medical Center, 913 Oxford House, Nashville, TN 37232-4760, USA
email: wes.ely@mcmail.vanderbilt.edu
Tel. + 1 (615) 936-0393
Fax + 1 (615) 936-0396

Abstract *Objective:* While "weaning parameters" are commonly used to guide removal of mechanical ventilation devices, little information exists concerning their prognostic value. We evaluated whether passing weaning parameters was associated with survival.
Design: A prospectively followed cohort of mechanically ventilated patients.
Setting: Medical and coronary adult intensive care units of an 806-bed medical center.
Patients: 300 consecutively enrolled mechanically ventilated patients.
Measurements and results: 216 patients who passed a daily screen of weaning parameters were more likely to be extubated successfully (87 vs 30 %, $p = 0.0001$), less likely to require ventilation for > 21 days (3 vs 30 %, $p = 0.0001$), and had a higher survival to hospital discharge (74 vs 29 %, $p = 0.0001$) than 84 patients who never passed the screen. The overall accuracy of the daily screen for predicting successful extubation and in-hospital survival was 82 and 73 %, respectively. Multivariate proportional hazards analysis of time until hospital death confirmed the beneficial effect of passing the daily screen ($p = 0.01$) and of duration of mechanical ventilation ($p = 0.001$) even after adjustment for differences in severity of illness, age, race, gender, diagnosis, and treatment assignment. While liberation from mechanical ventilation was predictive of survival at any time during the hospital stay ($p = 0.001$), the prognostic significance of the daily screen for hospital survival was related to how early after intubation it was passed. The difference in survival between patients who had passed and those who had not passed the daily screen was significant for $1^1/_2$ weeks postintubation but progressively decreased over time. The average time to extubation after passing the daily screen increased from 3 days (range 0 to 56), for those passing within 5 days of intubation, to 8 days (0 to 35), for those passing after 10 days of intubation ($r = 0.26$, $p = 0.001$).
Conclusions: Passing a daily screen of weaning parameters is an independent predictor of successful extubation and survival, but its prognostic value decreases over time. Time spent on mechanical ventilation after passing the daily screen presents an important opportunity to optimize liberation from the ventilator.

Key words Ventilator weaning · Respiration · Artificial · Critical care · Outcomes

Introduction

Mechanical ventilation should be discontinued as soon as respiratory failure has resolved and patients are able to breathe spontaneously, but clinical judgment alone is a poor determinant of the optimal timing of removal of mechanical ventilation [1]. A systematic, objective approach using "weaning parameters" and breathing trials to decide when to extubate a patient is superior to empirical management [2–4]. Although numerous investigations have reported relationships between different weaning parameters and extubation success [5–15], these tools have not been reported to be an independent predictor of in-hospital mortality. We hypothesized that passing or failing the daily screen, which consisted of five simple weaning variables collected from day 1 of mechanical ventilation by respiratory care practitioners, might relate to the severity of illness, course of respiratory failure, and survival. We also questioned whether the number of days a patient spends on mechanical ventilation might be independently associated (i. e., after adjusting for severity of illness and other factors) with survival.

Methods

Patients

The study population included patients in the medical (MICU) and coronary (CCU) intensive care units of our 806-bed university medical center between June 1995 and February 1996 and has been described previously [2]. The hospital's institutional review board for human studies approved the protocol and informed consent was obtained from the subjects or their surrogates. All patients receiving mechanical ventilation were enrolled in the investigation unless they met the following exclusion criteria: age < 18 years, lack of informed consent, and the existence of an extubation order at the time of the evaluation. During the study period, 323 patients received mechanical ventilation and 300 were enrolled. Of the 23 patients not enrolled, 15 had no one avialable to grant informed consent and 8 declined to participate. All patients were enrolled on the day mechanical ventilation was begun.

Protocol

While the protocol [2] randomized patients into two groups (an intervention and a control group), all 300 patients were followed up similarly from the time of enrollment with the same screening tool, a set of five easily measured weaning parameters. The daily screen was performed between 6:30 and 7:00 a. m. by the respiratory care practitioner assigned to the unit each morning that the patient was on mechanical ventilation and required no equipment other than that already in use to monitor the patient. The screen was considered "passed" if at any time during the use of mechanical ventilation the patient met all of the following five criteria: (1) the ratio of partial pressure of arterial oxygen to the fractional inspired oxygen (PaO_2/FIO_2) had to exceed 200; (2) the positive end-expiratory pressure (PEEP) could not exceed 5 cm H_2O; (3) the ratio of respiratory frequency to the tidal volume (f/V_T) was less than 105 breaths/min per l; (4) the patient had an adequate cough during suctioning (i. e., airway reflexes had to the intact); (5) no vasopressor or sedative infusion drips were being used (dopamine could be used in doses not exceeding 5 μg/kg per min, and intermittent dosing of sedatives was allowed). The therapist was not allowed to change the FIO_2 or the level of PEEP without an order. To measure the f/V_T, a continuous positive airway pressure of 5 cm H_2O with no mandatory breaths from the ventilator was supplied and pressure support was removed for 1 min, criteria which differ from the original description of the test [5]. Minute ventilation and respiratory rate were measured using the Puritan-Bennett 7200 or Siemens 900 mechanical ventilator and the tidal volume was obtained by dividing the minute ventilation by the respiratory frequency.

Spontaneous breathing trial

Patients in the intervention group who successfully passed a daily screen underwent an spontaneous breathing trial later that morning. During the spontaneous breathing trial, ventilatory support was removed and the patient was allowed to breath through either a T-tube or ventilator circuit using "flow triggering" (rather than triggering by pressure) and continuous positive airway pressure of 5 cm H_2O. No changes were made in the FIO_2 or the level of PEEP. The spontaneous breathing trial was initiated and monitored by the respiratory care practioners and nurse caring for the patient, with cardiac monitoring and pulse oximetry throughout. The spontaneous breathing trial was terminated by the respiratory care practioners, nurse, or physician if any of the following criteria were met: a respiratory rate > 35 breaths/min for 5 min or longer, an arterial oxygen saturation < 90 % for more than 30 s, a heart rate > 140 beats/min, sustained changes in the heart rate of 20 % in either direction, a systolic blood pressure > 180 mm Hg or < 90 mm Hg, increased anxiety, or diaphoresis. A trial was considered successful when the patient could breathe without mechanical ventilation for 2 h, and both a verbal and written prompt were delivered to the managing physicians at that time. Successful extubation was defined as not requiring reinstitution of mechanical ventilation within 48 h of extubation. All patients were followed up until hospital discharge or death.

Statistical analysis

Proportions and ratios were compared using the chi-square test. Comparison of continuous variables was performed using Student's t-test for variables with normal distribution and the Mann-Whitney U test for variables not normally distributed. A p value ≤ 0.05 was considered to indicate statistical significance. Severity of illness was measured by the Acute Physiology and Chronic Health Evaluation (APACHE) II score [16] and the acute lung injury (ALI) score [17], although the latter has not been well enough validated to have prognostic value. Cox proportional hazards modeling [18] was used to assess differences in survival after adjusting for baseline variables such as APACHE II score, ALI score, age, gender, race, and diagnosis. In these analyses, passing the daily screen and duration of time on the mechanical ventilator were treated as time-dependent covariates and were allowed to assume different values over time and during the follow-up period. The variable for passing the daily screen was coded as 0 for each follow-up day after enrollment until the screen was passed, and coded as 1 thereafter. In contrast, the variable representing the number of days on mechanical ventilation was set to 0 on the day of enrollment into the investigation, and incremented by 1 for each additional day of follow-up until the patient was removed from the mechanical ventilator. For a patient who spent 4 days on the ventila-

Table 1 The causes of respiratory failure and their relationship to passing the daily screen[a] (*ARDS* acute respiratory distress syndrome, *CHF* congestive heart failure, *COPD* chronic obstructive pulmonary disease, *DKA* diabetic ketoacidosis, *GI* gastrointestinal, *MI* myocardial infarction, *MODS* multiorgan dysfunction syndrome, *OSA* obstructive sleep apnea)

Diagnosis	Passed ($n = 216$)	Failed ($n = 84$)	Percent passing	Accuracy in predicting survival (%)
CHF or MI	63	10	86	70
COPD or OSA	54	15	78	72
ARDS or MODS	49	37	57	76
GI bleed, cirrhosis	8	12	40	85
Malignancy	12	3	80	60
DKA, overdose	15	1	94	88
Neurologic disease	12	4	75	56
End-stage renal disease	3	2	60	80
Total	216	84	72	73 (mean accuracy)

[a] Accuracy of daily screen in predicting survival did not differ by disease category ($p = 0.394$)

tor, the covariate was set to 1 on the first day of follow-up, 2 on the second day, 3 on the third day, and 4 on the fourth day and every day thereafter. For all survival analyses, follow-up time was defined as the number of days from intubation until death or hospital discharge. The operating characteristics for the daily screen, which are presented in Table 4, were calculated using standard definitions. The cells of the 2 × 2 tables listed in Table 2 and 3 include the number of true positives (TP), false positives (FP), false negatives (FN), and true negatives (TN) by treatment assignment and in the population as a whole. Sensitivity = TP/(TP + FN); specificity = TN/(FP + TN); positive predictive value = TP/(TP + FP); negative predictive value = TN/(FN + TN); and accuracy = (TP + TN)/(TP + FP + FN + TN). All statistical analyses were performed with commercially available computer software (Stat View-Version 4.51, and SAS).

Results

Demographic variables

The study population comprised 300 patients enrolled from the MICU (79%) and the CCU (21%); 50% of the patients were male. The mean age of study participants was 61.1 years; 79% were Caucasian, 20% African American, and 1% Hispanic. The causes of respiratory failure for the 300 patients were diverse and included congestive heart failure (11%), valvular disease or myocardial infarction (13%), chronic obstructive pulmonary disease (15%), pneumonia (15%), acute respiratory distress syndrome on multiorgan dysfunction syndrome (14%), gastrointestinal or liver disease (7%), cancer or leukemia (5%), overdose or ketoacidosis (5%), neurologic emergencies (4%), or miscellaneous causes (11%). The accuracy rates of the daily screen in predicting survival were not statistically different between disease categories ($p = 0.394$; Table 1).

Admission variables

None of the 300 patients experienced significant hemoglobin oxygen desaturation, vital sign disturbance, or adverse outcome during their daily screens. Among these patients, 216 (72%) patients passed the daily screen at some point during their ventilator course and 84 never passed it. On enrollment into the investigation, static compliance was higher in those who eventually passed the daily screen (40 ± 17 cm H_2O/ml, mean ± SD) than those who never passed (32 ± 13) ($p = 0.0001$). Patients who passed the daily screen had lower APACHE II scores (18 ± 5.5 vs 21 ± 7.3, $p = 0.0003$) and ALI scores (1.6 ± 0.7 vs 2.1 ± 0.8, $p = 0.0001$) than those who never passed the daily screen. (The latter would be expected because the daily screen and ALI score both contain PEEP and the PaO_2/FIO_2 ratio.) These differences in severity of illness were adjusted for using multivariate analysis (see below) to assess independently the importance of passing or failing the daily screen.

Successful extubation and survival

The relationships between treatment assignment, passing the daily screen, and successful extubation are shown in Table 2. Overall, 216 of these 300 patients

Table 2 Relationship between passing the daily screen and successful extubation[a,b]. Values are numbers with percentages in parentheses

Daily screen	Control patients ($n = 151$)		Intervention patients ($n = 149$)		All patients ($n = 300$)	
	Off ventilator	Never off ventilator	Off ventilator	Never off ventilator	Off ventilator	Never off ventilator
Passed	86	17	101	12	187 (88)	29 (33)
Never passed	12	36	13	23	25 (12)	59 (67)
Total	98	53	114	35	212 (100)	88 (100)

[a] $p = 0.001$ by Cochran-Mantel-Haenszel test for independence; even after stratifying by intervention, a relationship exists between passing the daily screen and successful extubation

[b] $p = 0.976$ by Breslow-Day test for homogeneity of odds ratios; the relationship of the daily screen to successful extubation was not different by treatment group

Table 3 Relationship between passing the daily screen and survival[a,b]. Values are numbers with percentages in parentheses

Daily screen	Control patients ($n = 151$)		Intervention patients ($n = 149$)		All patients ($n = 300$)	
	Discharged alive	In-hospital death	Discharged alive	In-hospital death	Discharged alive	In-hospital death
Passed	78	25	81	32	159 (87)	57 (49)
Never passed	12	36	12	24	24 (13)	60 (51)
Total	90	61	93	56	183 (100)	117 (100)

[a] $p = 0.001$ by Cochran-Mantel-Haenszel test for independence; even after stratifying by intervention, a relationship exists between passing the daily screen and survival

[b] $p = 0.386$ by Breslow-Day test for homogeneity of odds ratios; the relationship of the daily screen to survival was not different by treatment group

Table 4 Operating characteristics of daily screen data in 300 patients. Values are percentages

Test characteristics	Successful extubation			Survival		
	Control	Intervention	All	Control	Intervention	All
Sensitivity	88	89	88	87	87	87
Specificity	68	66	67	59	43	51
Positive predictive value	83	89	87	76	72	74
Negative predictive value	75	66	70	75	67	71
Accuracy	81	84	82	75	70	73

passed the daily screen, and 212 were successfully extubated. As previously reported [2], patients in the intervention group were more likely to be successfully extubated (114 of 149 patients, 77 %) than were patients in the control group (98 of 151 patients, 65 %, $p = 0.027$). Patients who passed the daily screen were also more likely to be successfully extubated (187 of 216 patients, 87 %) than were patients who failed to pass the daily screen (25 of 84 patients, 30 %, $p = 0.001$), and this was true regardless of treatment assignment (Breslow-Day test for homogeneity of odds ratio: $p = 0.976$). In the intervention group, passing the daily screen predicted whether or not a patient would successfully pass a spontaneous breathing trial: 89 (79 %) of the 113 patients who passed the daily screen also passed a spontaneous breathing trial within 48 h.

Among patients who passed the daily screen and were successfully extubated, there was a weak, but significant, positive correlation between the number of days required to recover enough respiratory function to pass the daily screen and the subsequent amount of time it took to be successfully extubated ($r = 0.26$, $p = 0.001$). Patients who passed the daily screen during the first 5 post-intubation days required an average of 3 days between passing the screen and successful extubation (range 0–56), while patients who passed the daily screen from 6–10 days' post-intubation required an average of 4 additional days before extubation (range 0–17), and patients who passed the daily screen more than 10 days post-intubation required an average of 8 additional days before extubation (range 0–35). The time from intubation to passing the daily screen also correlated weakly, but significantly, with durations of ICU stay ($r = 0.22$, $p = 0.001$) and hospitalization ($r = 0.36$, $p = 0.001$).

The relationships between treatment assignment, passing the daily screen, and hospital survival are shown in Table 3. Overall, 183 of these 300 patients (61 %) survived until hospital discharge. There was little difference in survival rates between the treatment groups [93 of 149 (63 %) patients in the intervention group survived vs 90 of 151 (60 %) patients in the control group, $p = 0.62$]. In contrast, there was a significant relationship between passing the daily screen and survival [159 of 216 (74 %) passing the daily screen survived vs 24 of 84 (29 %) patients who never passed the screen, $p = 0.001$], with no significant evidence that the effect of passing the daily screen differed by treatment group (Breslow-Day test of homogeneity: $p = 0.386$).

The operating characteristics of the daily screen for predicting both successful extubation and survival until discharge are shown in Table 4. Generally, these characteristics were similar for the two treatment groups and the combined sample. The overall accuracy of the daily screen for predicting successful extubation was 82 % (81 % in the control arm and 84 % in the intervention arm), and that for predicting survival until discharge was 73 % (75 % in the control arm and 70 % in the intervention arm).

False negative daily screens

Of the 25 patients who never passed the daily screen yet were successfully extubated (i. e., those who had false-negative daily screens), 15 failed because of inadequate

Table 5 The temporal relationship of passing the daily screen and successful extubation to hospital survival. Values are numbers (or percentages)

	Days post-intubation						
	3	6	9	12	15	18	21
Status							
Discharged	2	18	34	61	86	104	115
Deceased	18	37	56	70	82	89	96
Remaining[a]	280	245	210	169	132	107	89
Daily screen							
Passed (at any time)	104	133	137	114	93	78	66
Surviving until discharge (%)	78	80	77	75	76	76	77
Failed (not yet passed)	176	112	73	55	39	29	23
Surviving until discharge (%)	50	47	60	65	67	69	74
p-value[b]	0.001	0.001	0.013	0.18	0.25	0.48	0.74
Extubation							
Successful extubation	51	95	110	102	82	66	53
Surviving until discharge (%)	84	89	89	88	88	89	88
Still on ventilator	229	150	100	67	50	41	33
Surviving until discharge (%)	60	47	49	48	50	49	59
p-value[b]	0.001	0.001	0.001	0.001	0.001	0.001	0.001

[a] The number of patients ramaining at any given time (i. e., not discharged or deceased) will be used to determine relationships between hospital survival and passing/failing the daily screen or successful extubation

[b] For null hypothesis that % surviving until discharge is the same for those passing vs failing daily screen, or successfully extubated vs still on ventilator. Passing the daily screen is associated with a higher hospital survival for the first 9 to 10 days, while successful extubation is associated with a higher hospital survival through day 21

oxygenation and 10 because of an elevated f/V_T. When compared to patients with true positive daily screens, patients with false-negative daily screens had lower median admission (PaO_2/FIO_2 ratios (183 vs 257, $p = 0.0007$); (2) lower median static lung compliance (26 vs 38 cm H_2O/ml, $p = 0.0006$); (3) and higher median ALI scores (1.87 vs 1.50, $p = 0.02$). The likelihood of a false-negative screen did not relate to gender (14 women vs 11 men), the etiology of respiratory failure, or duration of ventilatory support prior to extubation.

Prognosis over time post-intubation

Patient status (discharged, deceased, or still hospitalized) is presented in Table 5 as a function of time (3,6, 9, 12, 15, 18, and 21 days post-intubation). In addition, daily screen (pass vs fail) and extubation (successfully extubated vs. on ventilator) results are presented for those patients still hospitalized on each day, along with the percentage of patients in each category who survived until discharge. For example, at 3 days' post-intubation, 2 patients had been discharged, 18 patients were deceased, and 280 patients were still hospitalized. Of the 280 patients still hospitalized, 104 had passed the daily screen while 176 hat not yet passed, and 51 had been successfully extubated while 229 still required mechanical ventilation. The percentage of patients who survived until discharge was significantly higher both for those who had passed the daily screen compared to those who had not yet passed (78 vs 50 %, $p = 0.001$) and for those who had been successfully extubated compared to those who still required mechanical ventilation (84 vs 60 %, $p = 0.001$).

Also from Table 5, it is apparent that the difference in survival between patients who were successfully extubated and those who required continued mechanical ventilation remained relatively constant over time, and this difference was statistically significant for each of the seven time periods examined. In contrast, while the difference in survival between patients who had passed the daily screen and those who had not passed the daily screen was significant ($p = 0.001$) at 3 days post-intubation, it decreased over time and was no longer statistically significant by 12 days post-intubation ($p = 0.18$). Proportional hazards analysis of time until in-hospital death confirmed the beneficial effect of passing the daily screen ($p = 0.01$) after adjustment for differences in severity of illness, age, race, gender, diagnosis, and treatment assignment.

The relationship between duration of mechanical ventilation and survival was significant ($p = 0.02$) with mortality increasing steadily throughout the first 3 weeks as follows: mortality was 33 % [95 % confidence interval (CI) of 26 to 40 %] for those on mechanical ventilation for 1 to 7 days, those on mechanical ventilation for 8 to 14 days had a mortality of 48 % (CI 35 to 59 %), and for those on mechanical ventilation, 15- to

21-day mortality was 62% (CI 39 to 78%). Those on mechanical ventilation for more than 21 days had a drop in mortality to 41% (CI 24 to 57%). Proportional hazards analysis of time until in-hospital death confirmed this relationship between survival and duration of mechanical ventilation even after adjustment for differences in severity of illness, age race, gender, diagnosis, and treatment assignment ($p = 0.001$).

Discussion

Reducing the length of time that patients spend on mechanical ventilation is essential, but neither the predictors of liberation from the ventilator (i.e., use of weaning parameters) nor the number of days on mechanical ventilation have been associated independently with survival. The current analysis of previously unreported data provides additional new information regarding the prognostic value of the daily screening of ventilated patients by respiratory care practitioners and/or physicians. The daily screen predicted the likelihood of successful extubation with an accuracy of 82% and its sensitivity and positive predictive values both approached 90%. Moreover, passing the daily screen during the first $1^1/_2$ weeks of mechanical ventilation also predicted hospital survival. Because there was variable "lag time" between passing the daily screen and successful extubation, these data could help physicians to prognosticate during the use of mechanical ventilation and also support rigorous attempts at withdrawal from the ventilator.

It is not the purpose of this report to separate the effects of the daily screen from those of spontaneous breathing trials and/or physician prompts. All of these components are best considered as complementary in assessing patients' readiness to be liberated from mechanical ventilation. Nevertheless, the information derived from the daily screen had important prognostic value not only for patients who received spontaneous breathing trials and prompts, but equally for those in the original control group (Tables 2 and 3, $p > 0.3$).

Passing the screen was associated with lower APACHE and ALI scores, and more importantly was an independent predictor of survival. When one considers that this information is very easily and noninvasively obtained, requires no additional equipment, and takes only a few minutes at the bedside once daily, this clinical tool is especially appealing. Among patients who passed the daily screen at any time during mechanical ventilation, 75% were extubated and survived until hospital discharge versus only 29% of those who never passed the daily screen. That the daily screen was not associated with survival after the initial $1^1/_2$ weeks of mechanical ventilation, and that nearly 30% of patients who never passed the screen will eventually survive, indicate that this tool (like most others in clinical use) is not perfect. During the initial period of mechanical ventilation, a positive daily screen may help clinicians gain some insight into a patient's prognosis, but this information should not be used rigidly as a sole criterion. Rather, it should be applied in the context of each patient's clinical circumstances and preferences for ongoing life support.

On the other hand, a negative daily screen should not dissuade a weaning effort, since 25 patients with a variety of diagnoses had false-negative daily screens and were successfully extubated despite never passing these weaning parameters. These patients did not pass their daily screens because of inadequate oxygenation and/or an elevated ratio of f/V_T. Interestingly, they had lower PaO_2/FIO_2 ratios and static lung compliance on admission. It will be important to identify under what circumstances (and in which patients) individual components of the daily screen may be disregarded, allowing the patient to progress to spontaneous breathing trials and/or extubation without delay. For example, female gender, smaller endotracheal tube size (≤ 7 mm), and age have been associated with an elevated f/V_T ratio [19, 20], and it may be appropriate to adjust the "passing" threshold for this measurement in these instances.

This investigation provides several other important insights. Because passing the daily screen was associated with a reduced incidence of prolonged mechanical ventilation (3 vs 30%, $p = 0.0001$); this monitoring technique may have useful triage implications for patients being considered for regional weaning centers or for timing of tracheostomy in anticipation of a need for chronic airway support [21–23]. For example, if the daily screen becomes positive, a physician may delay tracheostomy and/or triage to a chronic ventilator facility. Although a negative screen identifies the majority of those who will require prolonged mechanical ventilation, the information is of little use because 70% will still be extubated prior to the fourth week.

It is sometimes questioned whether a patient who has been on mechanical ventilation for a prolonged period of time needs to be "slowly weaned" from mechanical ventilation after having recovered from respiratory failure. Although not designed to address this issue, the current data show an inconsistent relationship between these two times. Some patients who passed the daily screen early developed complications (e.g., nosocomial pneumonia) which delayed their successful extubation, while others who were on mechanical ventilation for over 3 weeks were able to be removed from the ventilator quickly after finally passing the daily screen. Further investigations, which focus only on long-term mechanically ventilated patients, should prospectively evaluate this observation and its relevance to the pace of weaning.

Although intuitive, there are few data to support the common assumption that time on the mechanical ventilator is an independent predictor of mortality. As previously stated, our proportional hazards analysis indicated a relationship between survival and duration of mechanical ventilation even after adjustment for differences in severity of illness and other factors ($p = 0.001$). However, this finding is tempered by the fact that patients who remained on mechanical ventilation over 21 days had a 59 % chance of surviving the hospitalization. This observation supports that of a previous report of a multicenter registry of acute respiratory distress syndrome patients in which 85 % of the nonsurvivors had died by the 4th week, and subsequent mortality was much lower than that of the population as a whole [24]. In another report of 36 patients with severe respiratory failure, an association was found between mortality and the duration of mechanical ventilation prior to the initiation of extracorporeal life support [25]. It was not clear whether adjustments were made for severity of illness, and the total duration of mechanical ventilation was not used to examine the relationship with mortality. We believe that the independent relationship between mechanical ventilation and survival requires further prospective study.

In conclusion, successfully removing the mechanical ventilator at any time is associated with higher survival rates, which may be independent of severity of illness. During the first week and a half of mechanical ventilation, passing the daily screen also offers a predictor of survival and supports attempts at optimizing liberation from mechanical ventilation. Failure to pass the screen of weaning parameters is of little value prognostically, since up to 29 % of such patients will survive their hospital stay. While physicians should always be motivated to remove ventilators as early as possible, time spent on mechanical ventilation after passing the daily screen presents a particular opportunity during which to optimize liberation from the ventilator.

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