Effect of Spontaneous Breathing Trial Duration on Outcome of Attempts to Discontinue Mechanical Ventilation

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The duration of spontaneous breathing trials before extubation has been set at 2 h in research studies, but the optimal duration is not known. We conducted a prospective, multicenter study involving 526 ventilator-supported patients considered ready for weaning, to compare clinical outcomes for trials of spontaneous breathing with target durations of 30 and 120 min. Of the 270 and 256 patients in the 30- and 120-min trial groups, respectively, 237 (87.8%) and 216 (84.8%), respectively, completed the trial without distress and were extubated ($p = 0.32$); 32 (13.5%) and 29 (13.4%), respectively, of these patients required reintubation within 48 h. The percentage of patients who remained extubated for 48 h after a spontaneous breathing trial did not differ in the 30- and 120-min trial groups (75.9% versus 73.0%, respectively, $p = 0.43$). The 30- and 120-min trial groups had similar within-unit mortality rates (13 and 9%, respectively) and in-hospital mortality rates (19 and 18%, respectively). Reintubation was required in 61 (13.5%) patients, and these patients had a higher mortality (20 of 61, 32.8%) than did patients who tolerated extubation (18 of 392, 4.6%) ($p < 0.001$). Neither measurements of respiratory frequency, heart rate, systolic blood pressure, and oxygen saturation during the trial, nor other functional measurements before the trial discriminated between patients who required reintubation from those who tolerated extubation. In conclusion, after a first trial of spontaneous breathing, successful extubation was achieved equally effectively with trials targeted to last 30 and 120 min. Esteban A, Alía I, Tobin MJ, Gil A, Gordo F, Vallverdú I, Blanch L, Bonet A, Vázquez A, de Pablo R, Torres A, de la Cal MA, Macías S, for the Spanish Lung Failure Collaborative Group. Effect of spontaneous breathing trial duration on outcome of attempts to discontinue mechanical ventilation. AM J RESPIR CRIT CARE MED 1999;159:512–518.

Mechanical ventilation is associated with numerous life-threatening complications (1), and should be discontinued at the earliest possible time in the course of a patient's illness. Weaning patients from a ventilator is one of the most challenging problems faced by physicians working in an intensive care unit (ICU), and accounts for a huge portion of the clinical workload in this setting (2). Management of the weaning process has fallen within the realm of clinical judgement, but studies now indicate that an empirical approach can prolong the duration of mechanical ventilation (3–5). Fortunately, recent prospective studies have identified many of the issues of importance for improved clinical decision making (5–8). We (8) recently demonstrated that a once-daily trial of spontaneous breathing was the most effective method of weaning. These findings were extended by Ely and coworkers (5), who compared a two-step active approach versus conventional, empirical management. Each day, a set of weaning predictors were measured and patients who met five criteria proceeded to a 2-h trial of spontaneous breathing. As compared with patients managed in an empirical manner, the active management group experienced a significant decrease in the number of days of mechanical ventilation, a lower rate of reintubation, and lower ICU costs.

Although a 2-h trial of spontaneous breathing expedites the weaning process (4, 5, 8), close observation of a critically ill patient over a 2-h period is demanding for staff members. The duration of spontaneous breathing trials in research studies has been set at 2 h (5, 7–9), but patients who fail a trial tend to declare themselves at a much earlier time (7–12). This led us to hypothesize that clinical outcomes would be equivalent

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for trials of spontaneous breathing lasting 30 and 120 min. Unsuccessful weaning attempts are usually defined as the development of significant distress when ventilator support is withdrawn, or as the need for reintubation within a fixed period following extubation. In many studies, a distinction between these unfavorable outcomes has not been made, and both have been lumped together. However, the pathophysiologic basis of clinical deterioration following extubation may be quite different from that occurring while an endotracheal tube is in place. Accordingly, we also prospectively investigated the reasons for reintubation and its effect on patient outcome.

METHODS

Patients

The study was conducted between November 1995 and May 1996 in 30 medical-surgical ICUs in 30 tertiary-care hospitals (25 in Spain and five in South America). The study population consisted of 526 critically ill patients older than 18 yr who received mechanical ventilation until a first attempt was made to discontinue ventilator support. Patients with a tracheostomy were excluded.

To be enrolled in the study, patients had to have an improvement or resolution of the underlying cause of acute respiratory failure; adequate gas exchange as indicated by a Pa_{O_2} above 60 mm Hg while breathing with an $F_{I_{O_2}}$ of 0.40 or less with a positive end-expiratory pressure (PEEP) of 5 cm H_2O or less; a Glasgow Coma Scale score above 13; a core temperature below 38° C; a hemoglobin level above 10 g/dl; and no further need for vasoactive or sedative agents. In addition, the attending physician had to agree that the patient was in stable condition and ready to be weaned from the ventilator. The study was approved by the ethics committees of the participating hospitals. The study was explained to the patient, who gave consent to it.

Protocol

When a patient was enrolled in the study, mechanical ventilation was stopped and the patient breathed spontaneously for 3 min through a T-tube circuit with the $F_{I_{O_2}}$ set at the same level as that used during mechanical ventilation. Tidal volume (V_T) and respiratory frequency were measured with a spirometer during this period. Maximal inspiratory pressure ($P_{I_{max}}$) was measured, and the most negative value of three efforts was selected. Patients underwent a trial of spontaneous breathing when respiratory frequency was less than 35 breaths/min and when either maximal $P_{I_{max}}$ was more negative than -20 cm H_2O or V_T was greater than 5 ml/kg of body weight. Patients who did not meet these criteria when first tested were reevaluated on a daily basis.

Through the use of a random number table, patients were randomly assigned to undergo a trial of spontaneous breathing with a T-tube circuit for up to 30 min or up to 120 min. Patients were allocated to the two groups in a blinded fashion through the use of opaque, sealed, numbered envelopes, which were opened only when a patient fulfilled all of the inclusion criteria. Randomization was done through the permuted block method according to study center.

Respiratory frequency, heart rate (HR), systolic blood pressure, and oxygen saturation (Sa_{O_2}) measured by pulse oximetry were recorded every 15 min during the trial of spontaneous breathing. The primary physician terminated the trial if the patient had any of the following signs of poor tolerance: a respiratory frequency of more than 35 breaths/min, Sa_{O_2} below 90%, HR above 140 beats/min or a sustained increase or decrease in the HR of more than 20%, systolic blood pressure above 200 mm Hg or below 80 mm Hg, and agitation, diaphoresis, or anxiety (8). If a patient had any of the signs of poor tolerance at any time during the trial, mechanical ventilation was reinstituted. From this point forward, the methods for mechanical ventilation and/or weaning were freely chosen by the primary physician, and neither was specified by protocol. A patient who had no signs of poor tolerance at the end of the trial was immediately extubated and received supplemental oxygen by face mask.

A follow-up of all patients was done until discharge from the hospital or death. In the cases of patients who underwent a successful trial and were extubated but required reintubation within 48 h, the reason for reintubation was prospectively recorded as: (*1*) upper-airway obstruction (episode of acute respiratory distress with stridor); (*2*) hypoxemia (Sa_{O_2} below 90% with pulse oximetry or $Pa_{O_2} < 60$ mm Hg during breathing with an $F_{I_{O_2}} \geq 0.50$); (*3*) respiratory acidosis (pH < 7.30, with $Pa_{CO_2} > 50$ mm Hg); (*4*) clinical signs of increased respiratory work (at least one of the following: recession of the suprasternal notch, retraction of the intercostal spaces, accessory muscle recruitment, paradoxical motion of the abdomen); (*5*) impaired clearance of secretions; (*6*) cardiac failure; (*7*) atelectasis; and (*8*) decreased consciousness; and if another cause was responsible, this was listed. Complications that occurred during or after reintubation were noted at that time. Pneumonia was defined as a new and persistent infiltration on a chest X-ray, fever or hypothermia, purulent sputum, and a change in $F_{I_{O_2}}$ requirements.

Statistical Analysis

We have previously reported that 62% of ventilated patients can be successfully extubated after a 2-h trial of spontaneous breathing (8). We calculated that 220 patients were needed in each group to detect a 20% difference in the percentage of successfully extubated patients (from the expected 62% to 75%) at a power of 80% with a two-tailed, type I error of 0.05.

Data are presented as medians with 25th and 75th centile range, or as percentages, as appropriate. All categorical variables were analyzed with chi-square tests, except where small size required the use of Fisher's exact test. Comparison of continuous variables among the two groups was done with Student's *t* test for variables with normal distribution, and with the Mann–Whitney U test for variables with nonnormal distribution. Comparisons among the following three groups: (*1*) patients who failed the spontaneous breathing trial (trial failure group); (*2*) patients successfully extubated (successful extubation group); and (*3*) patients reintubated within 48 h (reintubation group) were made through one-way analysis of variance (ANOVA) for continuous variables with normal distribution, and through the Kruskall–Wallis test for variables with nonnormal distribution. The incremental area under the curve was used as a summary statistic (13) for comparing each patient's measurements for respiratory frequency, HR, systolic blood pressure, and Sa_{O_2} during the trial of spontaneous breathing among the trial failure group, the successful extubation group, and the reintubation group.

RESULTS

Of 526 patients included in the study, 256 were randomly assigned to a spontaneous breathing trial for up to 120 min, and 270 were assigned to a spontaneous breathing trial for up to 30 min. The two groups were similar with respect to patient characteristics, indications for mechanical ventilation, and respiratory functional parameters measured before the trial of spontaneous breathing (Tables 1 and 2).

Of 270 patients in the 30-min group, 237 (87.8%) successfully completed the trial of spontaneous breathing and were immediately extubated; 32 of the 237 (13.5%) required reintubation within 48 h. The remaining 33 patients had signs of poor tolerance during the trial of spontaneous breathing, which lasted a median of 15 min (25th and 75th centiles: 15 and 29 min, respectively), and were reconnected to the ventilator (Figure 1).

Of 256 patients in the 120-min group, 216 (84.4%) successfully completed the trial of spontaneous breathing and were immediately extubated; 29 of them (13.4%) required reintubation within 48 h. The remaining 40 patients were reconnected to the ventilator because of poor tolerance of the trial after a median duration of 30 min (25th and 75th centiles: 15 and 60 min, respectively).

The within-unit and in-hospital mortality rates for the two study groups did not differ (Table 3). The lengths of stay in the ICU and hospital were longer in the 120-min group (Table 3).

The percentage of patients who remained extubated for 48 h after a trial of spontaneous breathing did not differ in the 30- and 120-min groups (75.9% versus 73.0%, respectively, p =

TABLE 1

CHARACTERISTICS OF THE STUDY POPULATION AT BASELINE ACCORDING TO DURATION OF SPONTANEOUS BREATHING TRIAL

Characteristic	30 min (*n = 270*)	120 min (*n = 256*)	p Value
Sex/number (%)			
Males	189 (70)	191 (75)	0.28
Females	81 (30)	65 (25)	
Median age, yr (25th, 75th centiles)	65 (50, 72)	63 (51, 72)	0.68
Median SAPS II score (25th, 75th centiles)	37 (29, 47)	37 (29, 49)	0.44
Median length of stay in ICU before trial of spontaneous breathing, d (25th, 75th centiles)	6 (3, 9)	6 (3, 10)	0.31
Median time of ventilator support before trial of spontaneous breathing, d (25th, 75th centiles)	6 (3, 9)	5 (3, 10)	0.51
Reason for mechanical ventilation, n (%)			
Neuromuscular disease	3 (1)	2 (1)	1.00
Coma	38 (14)	29 (11)	0.43
COPD	52 (19)	63 (25)	0.15
Acute respiratory failure	177 (65)	162 (63)	0.74
Cause of acute respiratory failure, n (%)			
Postoperative state	54 (30)	44 (27)	0.47
Pneumonia	31 (17)	25 (15)	0.62
Multiple trauma	19 (11)	18 (11)	0.87
ARDS	4 (2)	5 (3)	0.75
Heart failure	28 (16)	29 (18)	0.83
Sepsis	17 (10)	24 (15)	0.25
Others	24 (13)	17 (10)	0.42

Definition of abbreviations: ARDS = acute respiratory distress syndrome; COPD = chronic obstructive pulmonary disease; ICU = intensive care unit; SAPS = Simplified Acute Physiology Score.

0.43). In the 30- and 120-min groups, neither the reintubation rates (13.5% versus 13.4%, respectively, p = 0.91) nor the trial failure rates (12.2% versus 15.6%, respectively, p = 0.32) were different (Figure 1).

Among all 61 patients who required it, reintubation was necessary in nine (14.7%) patients solely because of signs of upper-airway obstruction, and in the remaining 52 patients because of a variety of factors (Table 4). The most common reasons for reintubation were clinical signs of increased respiratory work, hypoxemia, and impaired clearance of secretions. A single factor precipitated the need for reintubation in some patients, but two or more clinical problems existed in most patients. Eleven of the reintubated patients (18%) had some complications associated with reintubation. Six patients developed pneumonia within the subsequent 72 h, and one patient each developed ventricular fibrillation, bradyarrhythmia requiring pharmacologic treatment, cardiac arrest with successful resuscitation, aspiration of gastric contents, and atelectasis.

In neither of the study groups did the rates of successful extubation, trial failure, or reintubation differ according to whether mechanical ventilation was instituted because of coma, chronic obstructive pulmonary disease (COPD), or acute respiratory failure (Table 5). In a *post hoc* analysis of subgroups based on the criteria of more severe disease (viz., more than 10 d of mechanical ventilation, a score above either 35 or 40 points on the Simplified Acute Physiology Score [SAPS II], or a breathing frequency/V_T ratio of more than 100 breaths/min/L), neither the rate of successful spontaneous breathing trial nor the rate of reintubation differed in the 30- and 120-min trial groups.

Changes in respiratory frequency, HR, systolic blood pressure, and Sa_{O_2} during the spontaneous breathing trial are shown in Figure 2. When compared with each of the other two groups, the group that failed the trial had significantly greater incremental areas under the curves for respiratory frequency, HR, and systolic blood pressure, and a smaller area for Sa_{O_2}

TABLE 2

RESPIRATORY FUNCTIONAL INDICES MEASURED DURING THE FIRST 3 min AFTER DISCONTINUATION OF VENTILATOR SUPPORT AND BEFORE RANDOMIZATION TO THE TWO STUDY GROUPS

Functional Indices	30 min (*n = 270*)	120 min (*n = 256*)	p Value
Ratio of Pa_{O_2} to $F_{I_{O_2}}$	263 (220, 335)	262 (225, 323)	0.69
V_T, ml	450 (360, 575)	420 (350, 528)	0.08
Respiratory frequency, breaths/min	23 (18, 28)	24 (20, 28)	0.34
f/V_T ratio*	51 (36, 69)	55 (37, 74)	0.12
$P_{I_{max}}$, cm H_2O	−28 (−22, −38)	−28 (−24, −39)	0.94

Definition of abbreviation: f/V_T = respiratory frequency divided by V_T expressed in breaths per minute per liter.

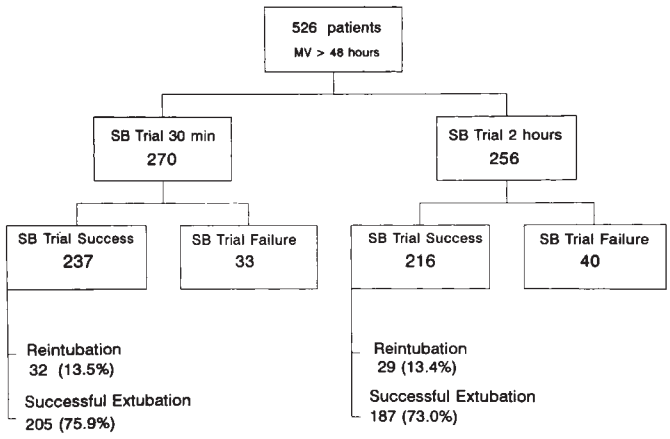

Figure 1. Distribution of the studied population according to the duration of spontaneous breathing trials.

TABLE 3

MORTALITY AND LENGTHS OF STAY IN STUDY GROUPS ACCORDING TO TRIAL DURATION

	30 min (*n* = 270)	120 min (*n* = 256)	p Value
Within-unit mortality, n (%)	34 (13)	22 (9)	0.18
In-hospital Mortality, n (%)	51 (19)	47 (18)	0.96
Length of stay in ICU, d, median (25th, 75th centiles)	10 (6, 18)	12 (7, 21)	0.005
Length of stay in hospital, d, median (25th, 75th centiles)	22 (15, 33)	27 (17, 43)	0.02

($p < 0.01$ in each instance). However, these four variables did not differ between the patients who were reintubated and those who were successfully extubated.

The within-unit mortality rate among patients who required reintubation (20 of 61, 32.8%) was higher than in the successfully extubated patients (18 of 392, 4.6%) ($p < 0.001$). The in-hospital mortality rate among patients who required reintubation (25 of 61, 41.0%) was also higher than in the successfully extubated patients (49 of 392, 12.5%) ($p < 0.001$). Patients requiring reintubation because of upper-airway obstruction had a within-unit mortality rate of 11% (one of nine), as compared with a mortality rate of 36% (19 of 52) among patients requiring reintubation for all other causes ($p = 0.25$).

The within-unit mortality rate among patients who failed the trial of spontaneous breathing was 24.7% (18 of 73). Of the 73 patients who failed the initial trial of spontaneous breathing, 54 were extubated after subsequent attempts. Forty of these 54 patients were successfully extubated, and 12 were reintubated within 48 h; thus, the reintubation rate was 23.1% (data relating to this issue were missing for two patients). The median value of the length of stay in the ICU for the patients successfully extubated was 15 d (25th and 75th centiles: 9 and 23, respectively), and was 22 d (25th and 75th centiles: 18 and 34, respectively) for the patients who were reintubated. The within-unit mortality rate was 2.5% (one of 40) in the group of patients successfully extubated, and 25% (three of 12) in the group of reintubated patients. Of the 73 patients who failed the initial trial, 14 died in the ICU without being weaned.

Of 61 patients who were reintubated after a successful initial trial of spontaneous breathing, 23 (36%) underwent tracheostomy. Of the 73 patients who failed the initial trial of spontaneous breathing, 18 (24.7%) underwent tracheostomy without prior extubation. The remaining nine patients who underwent tracheostomy came from the group of 392 patients who tolerated a trial of spontaneous breathing, were extubated, and did not require reintubation over the initial 48 h after extubation.

DISCUSSION

The main finding of the present study was that a trial of spontaneous breathing targeted to last 30 min was as effective as a trial targeted to last 120 min in achieving successful extubation, with no differences in the rate of reintubation or mortality. This study also confirmed that mortality is markedly higher in patients who require reintubation within 48 h after extubation than in patients who tolerate extubation.

In our previous study of 546 patients, we found that two thirds were extubated after their first trial of spontaneous breathing (8). It is axiomatic that any attempt at weaning in the literal sense (i.e., gradual reduction in the level of ventilator support) could only have prolonged the duration of mechanical ventilation in these patients. In another study of 484 patients, we found no difference in the rate of successful extubation when patients were managed with a trial of spontaneous breathing and with a trial of pressure support of 7 cm H_2O, with each trial lasting 2 h (12). In the subgroup of 130 difficult-to-wean patients in our earlier study (8), a once-daily trial of spontaneous breathing led to extubation about three times more quickly than did intermittent mandatory ventilation, and about twice as quickly as did pressure support. However, the optimal duration of trials of spontaneous breathing has not been defined, and they range from fewer than 5 min (14) to as long as 24 h (15). In the first prospective, randomized study of weaning methods, Brochard and colleagues (7) set the trial duration at 2 h. We used the same duration (8, 12), as did Ely and associates (5).

We have extended our earlier observations by showing that the rate of successful extubation did not change when the target duration of a spontaneous breathing trial was reduced from 120 min to 30 min. Likewise, the rates of reintubation and mortality did not differ for patients managed with trials having target durations of 30 min and those having durations of 120 min. The efficacy of trials with target durations of 30 min and 120 min was also equivalent when patients were separated into subgroups according to their underlying disease (Table 5). Although our study was not designed to focus on outcome in specific categories, the relatively large number of patients in

TABLE 4

REASONS FOR REINTUBATION IN 61 PATIENTS*

Reason for Reintubation	Number of Patients
Upper-airway obstruction	9
Hypoxemia	20
Respiratory acidosis	7
Signs of increased respiratory work	23
Impaired clearance of secretions	17
Cardiac failure	4
Atelectasis	5
Decreased consciousness	11
Other causes	5†
Unknown causes	3

* More than one condition could be present in a single patient.

† Two patients were reintubated because of cardiac arrest, and one patient each for tracheal granuloma, pneumonia, and upper gastrointestinal hemorrhage requiring endoscopy.

TABLE 5

RATES OF SUCCESSFUL EXTUBATION, REINTUBATION, AND TRIAL FAILURE ACCORDING TO DISEASE CATEGORY

Outcomes	Coma n (%)	COPD n (%)	Acute Respiratory Failure n (%)
Successful extubation			
30-min group	30 (79)	37 (71)	137 (77)
120-min group	24 (83)	46 (73)	116 (72)
Reintubation			
30-min group	5 (14)	8 (18)	18 (12)
120-min group	2 (8)	8 (15)	18 (13)
Trial failure			
30-min group	3 (8)	7 (13)	22 (12)
120-min group	3 (10)	9 (14)	28 (17)

Definition of abbreviation: COPD = chronic obstructive pulmonary disease.

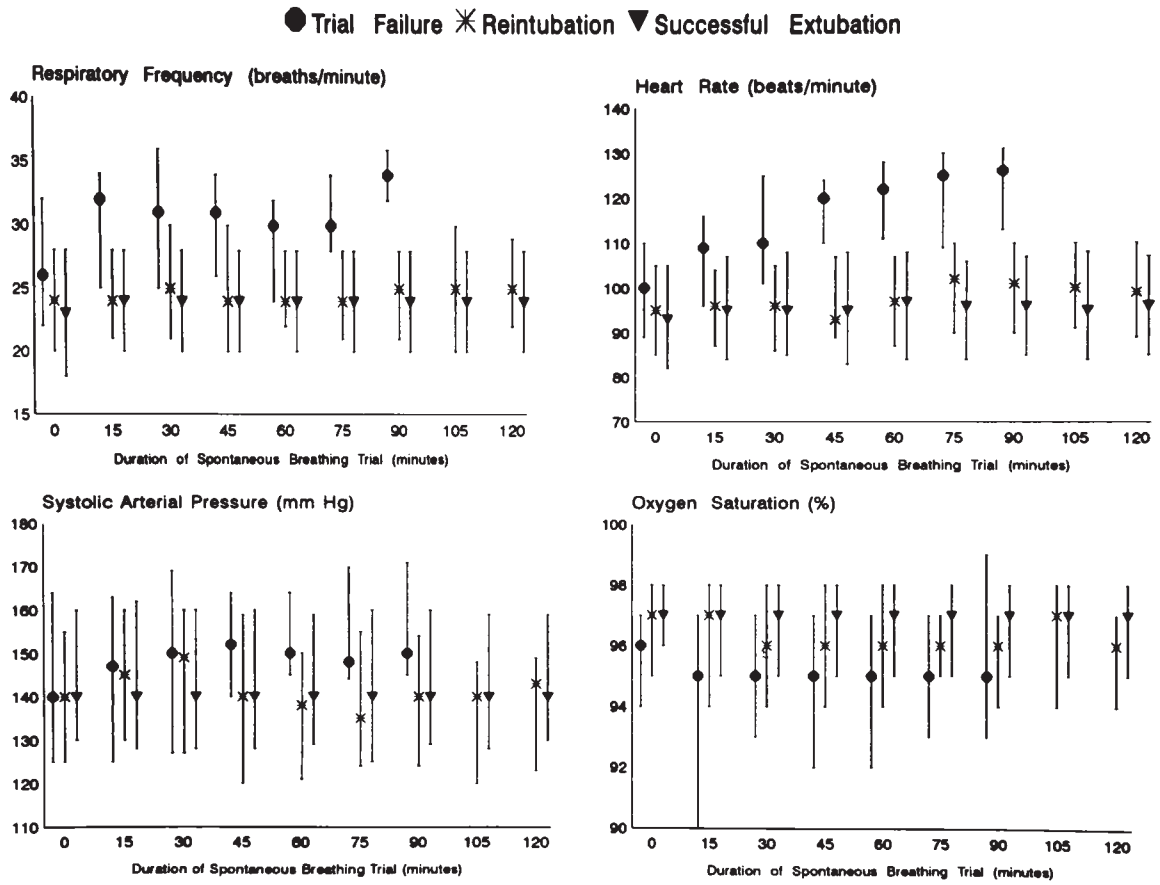

Figure 2. Median (25th and 75th percentiles) respiratory frequency, HR, systolic blood pressure, and Sa_{O_2} in successfully extubated patients, reintubated patients, and patients who failed the trial of spontaneous breathing according to the time elapsed from the onset of the trial. In the group that failed the trial, the incremental areas under the curves for respiratory frequency, HR, and systolic blood pressure were greater, and that of Sa_{O_2} was smaller for both trial times ($p < 0.01$ in each instance). The number of patients was 526 from time 0 to 30 min, and 256 patients from 45 to 120 min.

the different categories lend credence to the notion that a 30-min trial of spontaneous breathing is effective regardless of the indication for mechanical ventilation. The ability to safely achieve a 4-fold decrease in the time required for a trial of spontaneous breathing further simplifies and clarifies weaning management, and frees time for staff members to perform other tasks. It should be borne in mind that the present study pertains only to the initial attempt at weaning. In patients who fail an initial trial of spontaneous breathing, the duration of subsequent trials may have to be longer than 30 min, especially if the goal is to achieve reconditioning of the respiratory muscles; this issue requires additional investigation.

Patients who failed the spontaneous breathing trial did so at median durations of 15 and 30 min in the 30- and 120-min trial groups, respectively. Among patients who met the criteria for failure in the first 30 min of a spontaneous breathing trial, the mean duration of the trials were equivalent in the 30- and 120-min trial groups, at 19 ± 9 (mean ± SD) and 21 ± 10 min, respectively ($p = 0.42$).

The lengths of stay in both the ICU and in the hospital were longer in the 120-min group. Since the two groups had resided in the ICU for similar periods at the point at which the spontaneous breathing trials were undertaken, the longer lengths of stay of the 120-min group were related to the period after the spontaneous breathing trials. The differences in lengths of stay of the 30- and 120-min groups were confined to the subgroup of patients who were successfully extubated; among patients who failed the trials and among those who required reintubation, the lengths of stay were similar for the 30- and 120-min groups. The differences in the lengths of stay probably relate to the development of more adverse events in the 120-min group than in the 30-min group; since no difference was observed between the two groups in the first 48 h after extubation, a difference in the rate of adverse effects may have occurred in the period thereafter. A causal, rather than fortuitous, relationship between the rate of adverse effect and prolonged length of stay in the 120-min group is suggested by the trend toward a higher reintubation rate after 48 h in the 120- than in the 30-min group (12.3% versus 7.3%, $p = 0.13$).

Published rates of reintubation have varied from under 5% to almost 20% (7, 8, 12, 16–18), probably reflecting differences in patient populations and criteria used to determine the appropriateness of both extubation and reintubation. A lower rate of reintubation is often assumed to reflect superior care, and is used for monitoring quality assurance. A low extubation rate, however, could equally signal an overly cautious style of practice, placing a patient at increased risk of ventilator-associated complications by postponing extubation (19). The influence of reintubation on patient outcome was recently evaluated by Epstein and colleagues (20). Using multiple logistic regression analysis, they found that patients who required reintubation were approximately seven times more likely to die

in the hospital than patients who were successfully extubated (adjusted odds ratio [OR]: 7.3; 95% confidence interval [CI]: 4.6 to 11.7; $p < 0.0001$). We also found that the mortality rate in reintubated patients (20 of 61, 32.8%) was markedly higher than in patients who tolerated extubation (18 of 392, 4.6%).

Three factors could have been responsible for the higher mortality among patients who required reintubation. One of these factors is the relatively invasive nature of the procedure *per se*. This seems unlikely, since mortality was not increased in patients who were reintubated because of upper-airway obstruction. Moreover, Schwartz and associates (21) observed a mortality of only 3% (seven of 270 patients) at the time of or within 30 min after intubation. Furthermore, mortality was not greater among the 11 patients in our study who developed complications at the time of reintubation than in the remaining 50 patients (45.4% and 30.0%, respectively, $p = 0.53$). A second possible factor is that between the time of extubation and reintubation, patients may have developed a new problem, unrelated to the disease that initially precipitated their need for mechanical ventilation. A third factor could have been that the need for reintubation simply serves as a marker of a poor prognosis.

Indices that guide the weaning process (6) are evaluated for accuracy by their ability to predict outcome. A successful outcome is almost invariably defined as the toleration of extubation for 24 h or longer. An unsuccessful outcome has been defined as either the development of distress when ventilator support is withdrawn or the need for reintubation. Several studies have not made a distinction between these two outcomes. Respiratory frequency, an index commonly used to predict weaning outcome, did not discriminate between patients who required reintubation and those who were successfully extubated. Thus, a distinction needs to be made between the ability of indices to indicate the time at which a ventilator can be safely withdrawn and whether a patient is likely to tolerate extubation, as recently pointed out by Epstein and Ciubotaru (22).

After completion of the present study, a new test was proposed for predicting the likelihood of stridor following extubation (18). When the cuff of an endotracheal tube was deflated, the leak around the tube was smaller in patients who developed stridor following extubation. However, upper-airway obstruction following extubation occurred in only 2% (nine of 453) of our patients who tolerated a trial of spontaneous breathing, and it was the reason for reintubation in only 14.7% of our patients. Thus, although the cuff-leak test represents an attractive addition to the prognostic armamentarium, its overall impact on patient outcome is likely to be quite limited. Instead, indices need to be developed to identify patients who can sustain spontaneous breathing without distress but who will require reintubation after extubation.

In summary, the study reported here is the fifth prospective study to show that most patients receiving mechanical ventilation tolerate the first trial of spontaneous breathing and can be safely extubated (5, 7, 8, 12). Among patients with a high rate of weaning success, a trial of spontaneous breathing with a target duration of 30 min was as effective in identifying patients who could be safely extubated as a trial with a target duration of 120 min.

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APPENDIX

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When country is not stated, the hospital is in Spain.