Tracheostomy Tube in Place at Intensive Care Unit Discharge Is Associated With Increased Ward Mortality

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OBJECTIVE: To determine the relationship between tracheostomy tube in place after intensive-care-unit (ICU) discharge and hospital mortality. METHODS: We conducted a prospective observational cohort study in a medical-surgical ICU in a tertiary-care hospital that does not have a step-down unit. We recorded clinical and epidemiologic variables, indication and timing of tracheostomy, time to decannulation, characteristics of respiratory secretions, need for suctioning, and Glasgow coma score at ICU discharge. We excluded patients who had do-not-resuscitate orders, tracheostomy for long-term airway control, neuromuscular disease, or neurological damage. RESULTS: A total of 118 patients were tracheostomized in the ICU, and 73 were discharged to the ward without neurological damage. Of these, 35 had been decannulated. Ward mortality was 19% overall, 11% in decannulated patients, and 26% in patients with the tracheostomy tube in place; that difference was not statistically significant in the univariate analysis ($P = .10$). However, the multivariate analysis, which adjusted for lack of decannulation, age, sex, body mass index, severity of illness, diagnosis at ICU admission, duration of mechanical ventilation, Glasgow coma score, characteristics of respiratory secretions, and need for suctioning at ICU discharge, found 3 factors associated with ward mortality: lack of decannulation at ICU discharge (odds ratio 6.76, 95% confidence interval 1.21–38.46, $P = .03$), body mass index > 30 kg/m^2 (odds ratio 5.81, 95% confidence interval 1.24–27.24, $P = .03$), and tenacious sputum at ICU discharge (odds ratio 7.27, 95% confidence interval 1–55.46, $P = .05$). CONCLUSIONS: In our critical-care setting, lack of decannulation of conscious tracheostomized patients before ICU discharge to the general ward was associated with higher mortality. *Key words: decannulation, mechanical ventilation, outcome, tracheostomy, weaning.* [Respir Care 2009;54(12):1644–1652. © 2009 Daedalus Enterprises]

Introduction

About 10% of patients requiring mechanical ventilation undergo tracheostomy before mechanical ventilation discontinuation. Most efforts to elucidate the prognosis associated with this technique have focused on the outcome at intensive care unit (ICU) discharge, depending on the specific technique employed and the timing of the procedure.[1-3] Early tracheostomy seems to decrease the duration of mechanical ventilation and ICU stay in certain critically ill populations, such as trauma and general ICU populations.[4,5] However, clinical protocols for tracheostomy are far from being standardized.[6]

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Furthermore, the possible impact of tracheostomy on survival remains controversial. It has been suggested that tracheostomy might increase post-ICU mortality,[7,8] although others have questioned these findings.[9] Recently, Clec'h et al[10] reported the association of a tracheostomy

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tube left in place after ICU discharge with higher risk of post-ICU mortality; however, the observational design of their study necessitated a complex propensity analysis to control for treatment selection bias.

Specific protocols and predictors of successful decannulation have been developed only in patients requiring prolonged tracheostomy[11] or as decisional flowcharts based on clinical expertise.[12] Most studies have not reported weaning or decannulating procedures, and this makes the results difficult to interpret.

Ward prognosis after ICU discharge has been related to scores based on subjective clinical outcome or physiologic variables,[13-15] but other variables not measured in these scores probably affect the hospital outcome of these patients. Objective measurement of cough strength, together with a semi-quantitative measurement of the characteristics of respiratory secretions and the need for suctioning in clinical decision making, has improved decannulation success rates.[16]

We hypothesized that tracheostomy tube in the ward may be a risk factor for morbidity or mortality, with a varying impact based on patients' vulnerability. We studied the relationship between the presence of a tracheostomy tube following ICU discharge and in-hospital mortality in patients without severe neurological disease at the time of ICU discharge or inability to manage airway secretions.

Methods

The study protocol was approved by the healthcare service of Castilla-La Mancha, with which the tertiary-care hospital Virgen de la Salud is affiliated.

Patients

We screened all patients admitted to our 26-bed closed medical-surgical ICU over an 18-month period, in a 700-bed tertiary hospital without a step-down unit. The study was approved by the institutional review board of our institution, and informed consent was waived because this observational study did not change the standard practice in our ICU.

We included tracheostomized patients without exclusion criteria. The categorized indications for tracheostomy were: prolonged mechanical ventilation ($>$ 7 d); inability to clear respiratory secretions, defined as $\geq$ 2 failed extubations (re-intubation in the first 72 h after planned extubation) due to retained secretions, based on the physician opinion, or lack of extubation in patients with a high frequency of needed aspiration who tolerate a weaning trial, neurological status (motor component of Glasgow coma score $<$ 5), and prolonged weaning.[17] Patients requiring partial ventilatory support at ICU discharge were discharged to specific difficult-to-wean units and excluded from the study.

Patients meeting any of the following criteria were excluded from the study: age $<$ 18 years; tracheostomy before ICU admission; motor component of the Glasgow coma score $<$ 6 at the attempts to discontinue mechanical ventilation; tracheostomy for long-term airway control; severe neuromuscular disease (eg, amyotrophic lateral sclerosis, Guillain-Barré syndrome); and do-not-resuscitate order. Early tracheostomy ($<$ 7 d under mechanical ventilation) was performed only in patients with severe neurological damage on admission.

Weaning and Decannulation Protocol

Attempts to discontinue mechanical ventilation were initiated when the tracheostomized patient fulfilled the criteria.[18] Patients were screened daily for these criteria.

A clinical algorithm for progressive weaning from mechanical ventilation was followed at the discretion of the attending physician.[19] Patients were weaned following one of 2 methods: progressive withdrawal of pressure-support ventilation, and spontaneous breathing trials on T-piece. Patients who tolerated spontaneous breathing for 12 hours on 2 consecutive days remained connected to the T-piece continuously.

When the patient had remained disconnected from mechanical ventilation for at least 24 hours, we assessed the patient's preparedness for decannulation. We performed the tracheostomy tube occlusion test[20] to exclude tracheal obstruction to air flow. The next step in the decannulation protocol evaluated the patient's ability to protect the airway, and the risk of aspiration (see below). The attending physician clinically evaluated the patient's capacity to clear respiratory secretions, mainly based on the frequency of the need for suctioning and the characteristics of the respiratory secretions (see below).

The nurse suctioned subglottic secretions while deflating the tracheostomy tube cuff, to avoid the risk of aspiration.

The patient was decannulated if the respiratory secretions management was considered adequate ($\leq$ 2 suctionings every 8 hours) and the risk of aspiration was low (water swallowing did not induce cough reflex or aspiration); otherwise, the tracheal cannula was replaced with a cuffless "speaking" cannula with an inner cannula, unless there was high risk of aspiration. In patients with high risk of aspiration secondary to severe swallowing dysfunction (saliva and pharyngeal secretions aspiration), the cuff was reinflated.

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Conditions at ICU Discharge

An additional attempt at decannulation was made every 24 hours, using the same clinical criteria. If decannulation was not feasible within 10 days in the ICU, the patient was discharged to the ward with an uncapped cuffless cannula, unless intensive nursing care (> 2 suctionings every 8 hour) was needed, there was a high risk of aspiration, the cuff needed to be inflated, or there was persistent improvement in the clinical or neurological status.

Patients were discharged from the ICU with a ≥ 7-mm inner diameter, uncapped, fenestrated cannula.[21]

Ward Management

Patients with tracheostomy tubes were discharged only to wards with specific tracheostomy care protocols and skilled nurses, a nurse-to-patient ratio of 1:10–15, 24-hour presence of an ear, nose, and throat physician, and daytime presence of physiotherapy staff. The ward decannulation protocol matched that previously reported by Ceriana et al.[12]

Data Collection

We prospectively recorded: age; sex; Acute Physiology and Chronic Health Evaluation (APACHE II) score at ICU admission, at tracheostomy, and at ICU discharge; primary diagnosis, comorbidities; need for re-intubation (failed extubation within 72 hours); transfusion during the first 24 hours of ICU stay; duration of mechanical ventilation; and ICU and hospital stay. With respect to the tracheostomy we recorded indication, timing, technique, complications, and related adverse events during the ICU and ward stay (eg, malposition, occlusion). At ICU discharge we measured: Glasgow coma score; a collaboration scale[22] based on the patient's ability to complete 4 tasks (ie, open eyes, follow with eyes, grasp hand, stick out tongue); forced vital capacity and spontaneous peak flow with deflated cuff; frequency of suctioning needed; and volume of secretions during the preceding 8 hours.

Risk of aspiration was assessed after deflating the cuff, by checking the patient's ability to speak and oral tolerance of nutrition by assessing the patient's gag reflex (pharyngeal stimulus) and ability to swallow.[23] These variables were classified with a 3-point subjective semi-quantitative scale. The ability to swallow was classified in 3 categories: (1) Normal drink test (≤ 5 swallows in < 10 seconds to drink 50 mL water); (2) abnormal drink test or clinical evidence of aspiration during the drink test; (3) no swallowing test because of spontaneous aspiration of saliva and pharyngeal secretions. To exclude occult minor aspiration of enteral nutrition and pharyngeal secretions, we performed a glucose oxidase test strip or the blue dye test if the attending physician considered it indicated.[24]

In addition to the semi-quantitative clinical rating of respiratory secretions as tenacious, thick, frothy, or watery,[25] the need for airway care was assessed using quantitative variables, such as the volume and viscosity of expectorated and suctioned secretions.

Statistical Analysis

Continuous normal variables are described with means and standard deviations, whereas non-normally distributed variables are described with medians and interquartile ranges (25th–75th percentiles).

Continuous variables were compared using Student's *t* test; however, the Kruskal-Wallis and Mann-Whitney U tests were used for samples of < 30 individuals. Categorical data were compared using chi-square tests with Yates's correction, or the 2-tailed Fisher's exact test.

A multiple-variable model was designed to assess ward mortality, using forward stepwise logistic regression of variables that were significant in the univariate analysis ($P < .05$) or that could act as confounding factors, and the results are expressed as odds ratios (ORs). The Hosmer-Lemeshow test was used to estimate the model's goodness of fit.

To exclude other variables influencing clinical decision making, we used a second multiple-variable model to compare the clinical characteristics of the patients discharged from the ICU after decannulation to those of patients discharged with the cuffless cannula in place.

Results

Figure 1 shows the study participant flowchart. During the 18-month study period, 1,638 patients (385 neurocritical patients, 574 medical patients, 327 coronary patients, and 352 surgical patients) were admitted to the ICU.

We compared the clinical characteristics of ICU-decannulated patients to those of patients who were not decannulated before ICU discharge, to check for bias in the decision to decannulate (Table 1). Factors associated with ICU-decannulation on the multivariate analysis (Table 2) were age (OR 0.93 per year, 95% confidence interval [CI] 0.89–0.98, $P = .003$), ventilator-associated pneumonia prior to tracheostomy (OR 0.14, 95% CI 1.02–0.83, $P = .03$), suctioning frequency (OR 0.42 per suctioning, 95% CI 0.22–0.80, $P = .009$), and adequate swallowing function (OR 13.52, 95% CI 2.09–87.17, $P = .006$).

Ward mortality was 19% overall, 11% in decannulated patients, and 26% in patients with the tracheostomy tube in place; that difference was not statistically significant in the univariate analysis ($P = .10$). Table 3 reports the clinical characteristics of the 2 groups. Only age was significantly different: lower in survivors. Only lack of decannulation

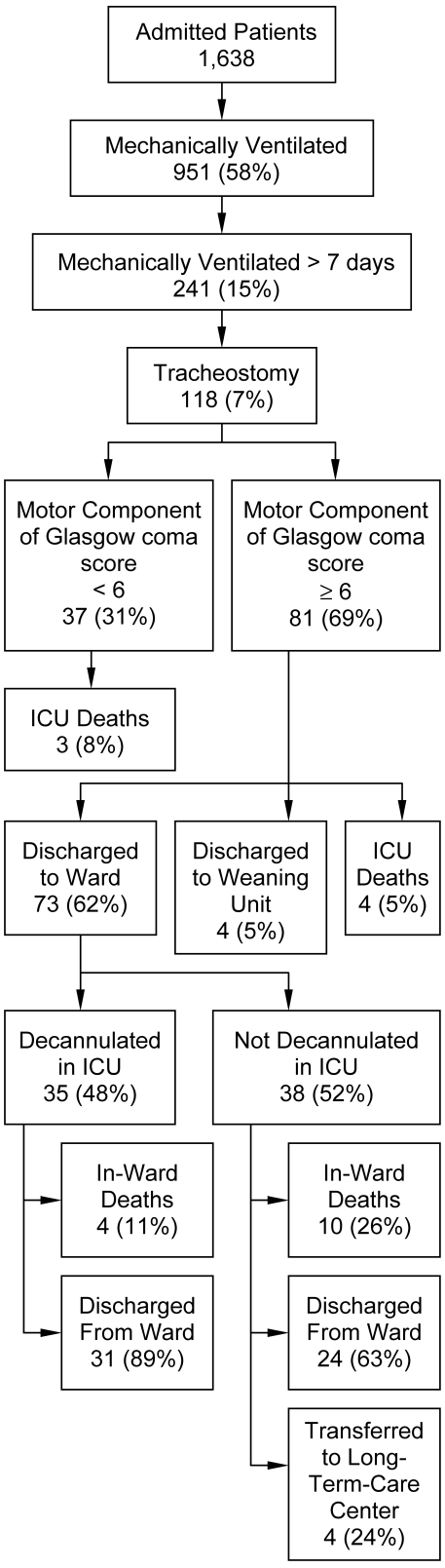

Fig. 1. Flowchart of the patients.

before ICU discharge and cannula-related complications in the ward were more common in non-survivors.

In the multivariate analysis (Table 4), after adjusting for age, sex, body mass index (BMI), severity of illness, diagnosis at ICU admission, duration of mechanical ventilation, Glasgow coma score, characteristics of respiratory secretions, and need for suctioning at ICU discharge, only decannulation before ICU discharge (OR 0.14, 95% CI 0.03–0.83, $P = .03$), BMI > 30 kg/m^2 (OR 5.81, 95% CI 1.24–27.24, $P = .03$), and tenacious sputum at ICU discharge (vs thick, frothy, or watery) (OR 7.27, 95% CI 0.99–55.46, $P = .05$) were significantly associated with ward mortality.

The cause of in-ward deaths was cardiorespiratory arrest in 33% of ICU-decannulated patients, versus 90% of those discharged with a cannula in place ($P = .08$). In addition, the median ward stay of non-survivors was 3 days (range 1–10 d) for patients discharged from the ICU with a cannula in place, and 16 days (range 5–60 d) for ICU-decannulated patients ($P = .03$). All patients who were discharged from the ICU with a cannula in place who died in the ward were still cannulated at the time of death. Median time from ICU discharge to decannulation in survivors was 9 days (range 2–39 d).

Discussion

The major finding of this study is that when decannulation of the specific subset of tracheostomized patients without severe neurological damage at ICU discharge is not feasible, patients have an increased ward mortality rate, in our critical care setting.

Some peculiarities of the population studied deserve mention. The ICU and ward mortality rates of our tracheostomized patients (5% and 17.8%, respectively) were lower than those reported by Clec'h et al[10] (27.6% and 37.1%, respectively) and by Frutos-Vivar et al[7] (20% and 39%, respectively). The main reason for this difference is probably the exclusion of patients with severe neurological disease in our study; however, it is also likely that our more restrictive indication for tracheostomies, reflected by the longer time needed to perform the tracheostomy and the exclusion of early tracheostomies, also contributed to this difference.

Most protocols for tracheostomy decannulation[11,12] apply only to long-term tracheostomy patients. Under these circumstances, a patient is considered independent from mechanical ventilation only after 5 days of complete disconnection from mechanical ventilation. In our clinical experience, most patients no longer need mechanical ventilation after 24 hours of total disconnection. In our study only 3 patients required reinstitution of mechanical ventilation, and in all cases this was due to an airway complication that was solved within 12 hours.

Table 1. Clinical Characteristics of Patients Decannulated and Patients Not Decannulated Before ICU Discharge, Via Univariate Analysis

	Patients Decannulated at ICU Discharge (n = 35)	Patients Not Decannulated at ICU Discharge (n = 38)	P
Demographics			
Age (mean ± SD y)	48.3 ± 18.5	62.2 ± 16.3	.008
Male (n, %)	27 (77)	25 (65)	.10
Body mass index (mean ± SD kg/m^2)	28.8 ± 8.5	27.3 ± 5.7	.50
APACHE II score (mean ± SD)			
At ICU admission	19.7 ± 5.9	19.9 ± 4.9	.30
On tracheostomy day	7.2 ± 3.2	7 ± 4	.60
At ICU discharge	5 ± 3.7	5 ± 3	.80
Glasgow coma score at ICU discharge (mean ± SD)	14.3 ± 1.3	13 ± 1.7	.13
Cooperation score* < 4 items at ICU discharge (n, %)	30 (87)	25 (66)	.07
VAP prior to tracheostomy (n, %)	14 (40)	25 (66)	.05
Failed extubation (n, %)	10 (29)	11 (29)	.58
Variables Related to Airway Protection			
Spontaneous peak flow at ICU discharge (mean ± SD L/min)	123.2 ± 65.2	73.3 ± 41.6	.09
Forced vital capacity at ICU discharge (mean ± SD mL)	852.7 ± 305.9	493.3 ± 167.7	.01
Tenacious sputum at ICU discharge (n, %)	12 (34)	25 (66)	.05
Suctioning frequency at ICU discharge (mean ± SD suctionings/last 8 h)	0.4 ± 0.9	1.6 ± 1.2	.21
Sputum volume at ICU discharge (mean ± SD mL/last 8 h)	20.7 ± 22.7	5.3 ± 2.3	.03
Suctioned volume at ICU discharge (mean ± SD mL/last 8 h)	1.3 ± 3.7	1.3 ± 2.3	.90
Adequate swallowing function at ICU discharge (n, %)	24 (68)	12 (32)	.004
Time-Related Variables (median and IQR d)			
ICU stay	35 (21–56)	37 (25–52)	.40
Hospital stay	58 (36–77)	62 (40–94)	.54
Total time on mechanical ventilation	27 (16–39)	22 (15–36)	.34
Time on mechanical ventilation before tracheostomy	16 (11–26)	17 (10–22)	.20
Comorbidities (n, %)			
Respiratory disease	8 (23)	7 (19)	.60†
COPD (FEV_1 < 80% predicted)	7 (20)	6 (16)	
Restrictive lung disease	1 (3)	1 (3)	
Neurological disease	11 (31)	15 (39)	
Cardiac disease (LVEF < 45%)	8 (23)	4 (10)	
Diabetes mellitus	9 (26)	9 (24)	
Arterial hypertension	14 (40)	18 (47)	
Cancer	0 (0)	2 (5)	
Chronic renal failure	2 (6)	1 (3)	
Chronic hepatic disease	3 (9)	1 (3)	
Diagnosis at Admission (n, %)‡			.09†
Pulmonary injury	8 (23)	4 (11)	
Cardiac injury	2 (6)	1 (3)	
Abdominal injury	4 (11)	1 (3)	
Sepsis (other sources)	2 (6)	0 (0)	
Multiple trauma	8 (23)	15 (39)	
Trauma brain injury	7 (20)	11 (29)	
Scheduled surgery	5 (14)	8 (21)	
Urgent surgery	6 (17)	9 (24)	
Indication for Tracheostomy (n, %)			
Prolonged mechanical ventilation	10 (28)	12 (31)	.11†
Low level of consciousness	6 (17)	13 (35)	
Inability to clear respiratory secretions	3 (8)	3 (8)	
Prolonged weaning	16 (47)	10 (26)	
Surgical tracheostomy (n, %)	13 (37)	23 (61)	.03

* Cooperation score of Salam et al[22] at ICU discharge.

† This is the combined P value for all the rows in this subheading.

‡ Pulmonary injury included pneumonia (6), aspiration (1), asthma exacerbation (1), pulmonary embolism (1), and COPD exacerbation (3). Cardiac injury included endocarditis (2) and myocarditis (1). Abdominal injury included pancreatitis (3), cholangitis (1), and ischemic bowel (1). Sepsis included other infection sources not included previously: urologic sepsis (1) and soft-tissue infection (1). The scheduled surgery included neurosurgery (7), thoracic surgery (2), abdominal surgery (3), and other surgeries (1). The urgent surgery included neurosurgery (10), thoracic surgery (2), and abdominal surgery (3).

APACHE = acute physiology and chronic health evaluation

COPD = chronic obstructive pulmonary disease

LVEF = left-ventricle ejection fraction

VAP = ventilator-associated pneumonia

Table 2. Factors Significantly Associated With Decannulation Before ICU Discharge, Via Multivariate Analysis*

Variable	Coefficient	Odds Ratio	95% Confidence Interval	*P*
Age	–0.07	0.93	0.89–.98	.003
Higher suctioning frequency	–0.88	0.42	0.22–.80	.008
Ventilator-associated pneumonia prior to tracheostomy	–1.96	0.14	1.02–.83	.03
Adequate swallowing at ICU discharge	2.60	13.52	2.09–87.17	< .001
Constant	4.29	NA	NA	< .001

* The effect of age and suctioning frequency on the dependent variable is per unit (year and number of suctionings, respectively).
NA = not applicable because the constant value is not associated with an odds ratio or confidence interval.

Clec'h et al[10] used the propensity technique to study potential baseline confounding factors and treatment selection bias in tracheostomized patients. However, one of the variables related to the probability of being tracheostomized was a neurological disease as the reason for mechanical ventilation. The prognosis after ICU discharge and the probability of being decannulated in this subset of patients are mostly related to their ability to clear respiratory secretions, which is mainly related to the recovery of neurological status.[25,26] None of the previously mentioned studies report measurement of this variable, the rate of decannulated patients during the ICU stay, or the decannulation protocol.

Higher BMI was an additional risk factor for ward mortality in our tracheostomized patients. This finding agrees with the results of some studies[27,28]; in contrast, other investigators found only undernutrition as a morbidity and mortality risk, both in the ICU and in the ward after ICU discharge.[29] After excluding differences in processes of care in obese patients, O'Brien et al[30] reported no association between hospital mortality and BMI in tracheostomized patients. There are some possible explanations for the difference from our results. First, their rate of tracheostomized patients was somewhat higher than in our series (20.5% vs 12.4%); this difference is even greater considering that they included only patients with acute lung injury. Second, our patients with a BMI > 30 kg/m^2 were morbidly obese (BMI 43.6 ± 7.6 kg/m^2), with an increased risk of dying.[27] There were no underweight patients in our study.

Some limitations of our study merit consideration. First, the size of our sample (< 100 patients) may have induced overfitting of the results in the multivariate analysis. On the other hand, it is possible that the small sample size may underestimate real differences in ventilatory function as measured by peak flow and spontaneous forced vital capacity. Second, our single-center design allows direct application of our results only to hospitals with similar approaches to the treatment of tracheostomized patients in the ward. Third, the lack of evidence-based decannulation protocols can lead to clinical bias in the decision to decannulate,[31] and factors not assessed in the study may have influenced this decision, also limiting a propensity analysis to exclude a selection bias in the decannulation process. Our multivariate analysis detected 2 variables unrelated to the airways: age and pre-tracheostomy pneumonia, which seem to influence clinicians against decannulation. This implicit clinical approach was not supported by our analysis of the factors associated with ward mortality, and it remains to be determined whether this approach is due to medical prejudice or implicit medical knowledge about the likelihood of successful decannulation. Fourth, the accuracy of the cause of death reported in the medical charts is a matter of debate. Although it has been reported previously,[32] some indirect data strongly suggest that deaths were caused by respiratory arrest in our study: 8 of 9 arrest episodes in the group with tracheostomy tube in place occurred between 22:00 and 08:00 hours, while arrest in decannulated patients was in the morning hours. Furthermore, no clinical deterioration was reported in previous days, as deaths occurred early in the course of the ward stay.

In terms of patient safety, our selection of dedicated wards for these patients is an intermediate position between step-down units and general wards. Nevertheless, despite the low incidence of cannula-related problems reported in the charts, the shorter interval between ICU discharge and death in non-decannulated patients, and the fact that cardiorespiratory arrest was the most common cause of death in this group, suggest suboptimal care or monitoring, which suggests that the next step in improving the management of these patients is the implementation of a step-down unit. These results would need to be confirmed in wider prospective randomized multicenter trials.

Conclusions

We conclude that, in the conditions of our ICU and ward environments, and in patients with good neurological function, maintaining the tracheostomy tube in place at

Table 3. Characteristics of Survivors and Non-Survivors in the Ward*

	Ward Deaths (n = 14)	Ward Survivors (n = 59)	P
Demographics			
Age (mean ± SD y)	66.1 ± 11.9	52.9 ± 19	.006
Male (n, %)	7 (50)	45 (76)	.10
Body mass index > 30 kg/m^2 (%)	50	22	.04
APACHE II score (mean ± SD)			
At ICU admission	20 ± 5.7	18 ± 3.9	.20
On tracheostomy day	7 ± 3.9	7 ± 4.4	.60
At ICU discharge	5 ± 4.2	5 ± 2.9	.80
Transfusion during first 24 h of ICU stay (mean ± SD units)	1.2 ± 4	0.6 ± 1.7	.40
Glasgow coma score at ICU discharge (mean ± SD)	13.1 ± 1.7	14.4 ± 1.2	.10
Cooperation score† at ICU discharge (< 4 items) (n, %)	3 (21)	0 (0)	.60
VAP prior to tracheostomy (n, %)	8 (57)	30 (51)	.90
Failed extubation (n, %)	3 (21)	18 (30)	.40
Decannulated before ICU discharge (n, %)	3 (21.4)	32 (54)	.04
Variables Related to Airway Protection			
Cannula inner diameter (mean ± SD mm)	8.3 ± 0.4	8.1 ± 0.3	.60
Long cannula (> 70 mm) (n, %)	0 (0)	5 (8)	.53
Spontaneous peak flow at ICU discharge (mean ± SD SD L/min)	82 ± 30.3	125.1 ± 67.2	.17
Forced vital capacity at ICU discharge (mean ± SD mL)	646 ± 227.9	851.07 ± 318.3	.18
Tenacious sputum at ICU discharge (n, %)	13 (93)	24 (41)	.005
Suctioning frequency at ICU discharge (mean ± SD suctionings/last 8 h)	0.4 ± 0.9	0.8 ± 1.1	.33
Sputum volume at ICU discharge (mean ± SD mL/last 8 h)	25.6 ± 16.6	21.8 ± 23	.13
Suctioned volume at ICU discharge (mean ± SD mL/last 8 h)	2.4 ± 3.5	1.1 ± 3.6	.46
Cannula-related complications in ward (n, %)	1 (7)	0 (0)	.03
Adequate swallowing function at ICU discharge (n, %)	9 (64)	27 (46)	.70
Time-Related Variables (median and IQR d)			
ICU stay	40 (29–48)	37 (22–56)	.70
Hospital stay	55 (39–72)	62 (38–91)	.20
Total time on mechanical ventilation	26 (17–33)	22 (15–38)	.72
Time on mechanical ventilation before tracheostomy	17 (15–24)	17 (10–25)	.51
Time to decannulation	15 (10–27)	14 (10–23)	.96
Comorbidities (n, %)			.44‡
Respiratory disease	5 (36)	10 (17)	
COPD (FEV_1 < 80% predicted)	4 (29)	9 (15)	
Restrictive lung disease	1 (7)	1 (1.7)	
Neurological disease	3 (21)	23 (39)	
Cardiac disease (LVEF < 45%)	3 (21)	9 (15)	
Diabetes mellitus	8 (57)	10 (17)	
Arterial hypertension	10 (71)	22 (37)	
Cancer	1 (7)	1 (1.7)	
Chronic renal failure	1 (7)	2 (3)	
Chronic hepatic failure	2 (14)	2 (3)	
Diagnosis at Admission (n, %)			.03‡
Pulmonary injury	6 (43)	6 (10)	
Cardiac injury	1 (7)	2 (3)	
Abdominal injury	1 (7)	4 (7)	
Sepsis (other sources)	0 (0)	2 (3)	
Multiple trauma	4 (29)	19 (32)	
Trauma brain injury	4 (29)	14 (24)	
Scheduled surgery	0 (0)	13 (22)	
Urgent surgery	2 (14)	13 (22)	
Indication for Tracheostomy (n, %)			.11‡
Prolonged mechanical ventilation	3 (23)	19 (32)	
Low level of consciousness	2 (15)	17 (29)	
Inability to clear respiratory secretions	1 (8)	5 (8)	
Prolonged weaning	8 (54)	18 (31)	
Early tracheostomy (n, %)	2 (14)	14 (24)	.53
Surgical tracheostomy (n, %)	9 (64)	34 (58)	.83

* Medical and surgical diagnoses co-existed in some patients.
† Cooperation score of Salam et al[22] at ICU discharge.
‡ This is the combined P value is for is all the rows in this subheading.
APACHE = Acute Physiology and Chronic Health Evaluation
COPD = chronic obstructive pulmonary disease
LVEF = left-ventricle ejection fraction
VAP = ventilator-associated pneumonia

Table 4. Factors Significantly Associated With Ward Mortality on Multivariate Analysis

Variable	Coefficient	Odds Ratio	95% Confidence Interval	*P*
Presence of cannula after ICU discharge	–1.91	6.76	1.21–38.46	.03
Body mass index (> 30)	1.76	5.81	1.24–27.24	.03
Tenacious sputum at ICU discharge	1.98	7.27	1–55.46	.05
Constant	–1.77			< .001

ICU discharge is associated with an increased risk of death in the ward. This was even greater in obese patients and in those with tenacious sputum at ICU discharge.

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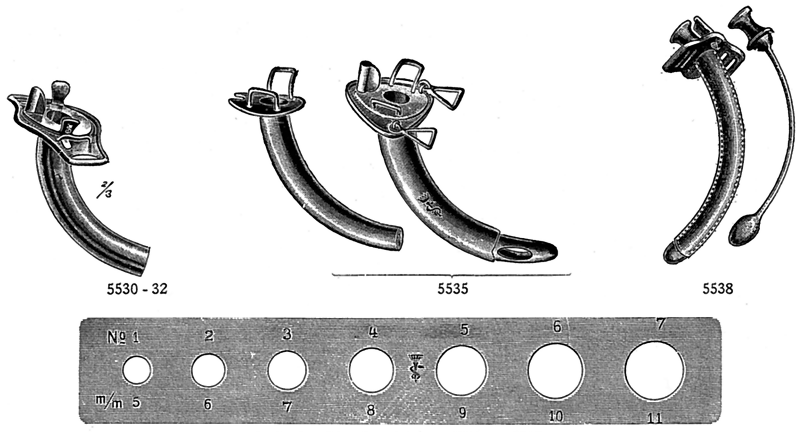

Tracheostomy tubes, obturators, and sizing scale.
Catalogue of Surgical Instruments of Superior Quality, 24th edition.
Seattle Washington: Biddle & Crowther Inc, 1935.
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