A North American Survey of Respiratory Therapist and Physician Tracheostomy Decannulation Practices

Henry Thomas Stelfox MD PhD, Dean R Hess PhD RRT, and Ulrich H Schmidt MD PhD

BACKGROUND: Tracheostomy is a common surgical procedure performed on critically ill patients. However, little is known about how clinicians make decisions to decannulate patients, and whether similar decisions are made by respiratory therapists (RTs) and physicians. METHODS: We performed a cross-sectional survey of RTs ($n = 52$) and physicians ($n = 102$) at 54 medical centers in North America, to characterize contemporary decannulation practices. RESULTS: RTs and physicians rated ability to tolerate capping, secretions, cough effectiveness, and level of consciousness as the most important factors in the decannulation decision, with RTs placing greater emphasis on ability to tolerate capping and physicians on level of consciousness. In the clinical scenarios, RTs and physicians recommended decannulation with similar frequency (52% vs 55%, $P = .54$). Patients were most likely to be recommended for decannulation if they had a strong cough, scant thin secretions, required minimal supplemental oxygen, and were alert and interactive. In addition, RTs were more likely to recommend decannulation for patients who demonstrated an ability to tolerate tracheostomy tube capping for 72 hours and whose etiology of respiratory failure was chronic obstructive pulmonary disease. RTs preferred shorter time frames for defining decannulation failure than did physicians (median response 48 h vs 96 h, $P = .02$ for test of proportions). Both groups identified 2–5% (median response) as an acceptable rate of decannulation failure ($P = .48$ for test of proportions). CONCLUSIONS: Important differences exist in the decannulation practices of North American RTs and physicians. Evidence-based tracheostomy guidelines are needed to facilitate the safe and effective management of patients with tracheostomies. *Key words: tracheostomy; tracheotomy; critical care; intensive care; ventilators, mechanical; respiration, artificial; decannulation; survey.* [Respir Care 2009;54(12):1658–1664. © 2009 Daedalus Enterprises]

Introduction

Tracheostomy is a common surgical procedure performed to facilitate prolonged airway and ventilatory support in critically ill patients.[1-5] The recent development of percutaneous dilational tracheostomy techniques has made tracheostomy a routine bedside procedure in the intensive care unit (ICU).[6] The frequency of tracheostomy in the management of patients receiving mechanical ventilation contrasts with the lack of evidence as to when a tracheostomy tube should be removed.

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Since little is known about how clinicians make decisions to decannulate tracheostomized patients, we recently conducted a survey to examine decannulation practices at major medical centers in North America, Europe, Australia, and Japan.[7] Our results identified one clinician factor (principal work facility) and 5 patient factors (oxygenation, level of consciousness, ability to tolerate tracheos-

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tomy tube capping, cough effectiveness, and secretions) to be important determinants in the decision to decannulate a tracheostomized patient.[7] In North America, respiratory therapists (RTs) are intricately involved in the management of tracheostomized patients, yet little is known about whether their opinions regarding tracheostomy decannulation differ from that of physicians. Therefore, as a first step toward defining current decannulation practices, we performed a re-analysis of a subset of respondents from our recent international survey, so as to identify and compare those factors that influence the perceptions of RTs and physicians in recommending decannulation, and to ascertain their opinions regarding the definition of decannulation failure.

Methods

Survey

Our original survey was targeted at physicians and RTs around the world to determine their opinions regarding decannulation of tracheostomized patients.[7] In developing our survey instrument, we conducted semi-structured interviews with RTs, physicians, nurse practitioners, and speech therapists. We determined that, although tracheostomized patients are frequently cared for by a multidisciplinary team, RTs and physicians were the 2 groups of clinicians most directly involved in the decision to decannulate a tracheostomized patient. Therefore the questions being asked in our survey were best addressed to these 2 groups. For purposes of this study, we restricted our analysis to physicians and RTs from North America, because RTs play an integral role in the care of patients with artificial airways in Canada and the United States. Conversely, in many European countries, the function of the RT is provided by physicians, respiratory physiotherapists, and nurses. Surveys were sent via e-mail to RTs and physicians identified through an initial search of the medical literature.[7] A cover letter explaining the purpose of the study and a unique username and password that provided access to a secure Web-based questionnaire (SQL Server 2005, Microsoft, Redmond, Washington) were included in the e-mail. Reminders were sent to those clinicians who did not respond to the first mailing within 8 weeks. Each questionnaire asked respondents to provide recommendations for additional clinical experts to survey, whether local, national, or international.[8] A snowball sampling technique was employed to capture these additional experts.[9]

The survey instrument contained 5 domains of questions[7]:

1. Respondents were asked to provide basic demographic and professional data, including their experience in managing patients with tracheostomies and decannulations.

2. Respondents were asked to rate the importance of 11 potential determinants of decannulation in their decision-making process, using a 7-point Likert scale ranging from 1 (irrelevant) to 7 (very important). The determinants included in the survey were selected using a computerized search of the MEDLINE databases and semi-structured interviews with RTs, physicians, nurse practitioners, and speech therapists.[7] These determinants included patient age, comorbidities, etiology of respiratory failure, difficulty of intubation, ability to tolerate capping, cough effectiveness, secretions, swallowing function, level of consciousness, respiratory rate, and oxygenation.

3. Respondents were asked to provide a decannulation recommendation (yes or no) for each of 3 patient scenarios. Based on our interviews and clinical experience, we constructed 2 medical and 2 surgical clinical case scenarios considered to be representative of the types of patients commonly treated in ICUs. Three scenarios were randomly selected to be included with each survey. Each scenario included the 11 common determinants of tracheostomy decannulation the respondents had previously been asked to rate, which were randomly varied as follows: age (45 y vs 75 y); co-morbidities (no significant prior comorbidities vs end-stage renal disease); etiology of respiratory failure (pneumonia vs chronic obstructive pulmonary disease); difficulty of intubation (easy vs difficult); level of consciousness (alert and interactive vs drowsy, but arousable); ability to tolerate capping (tracheostomy tube capped for 24 h vs 72 h); cough effectiveness (strong vs weak cough); secretions (scant thin vs moderate thick secretions); swallowing function (enteral nutrition via gastric tube and nothing per mouth vs enteral nutrition via gastric tube and is eating Jell-O and pudding); respiratory rate (18 breaths/min vs 28 breaths/min); and oxygenation (oxygenation is 95% with a fraction of inspired oxygen of 0.3 vs 0.5).

4. Respondents were asked what they considered a time frame for decannulation failure.

5. Respondents were asked what they considered an acceptable rate of decannulation failure.

The instrument was tested before implementation on 5 RTs and 6 physicians, and was found to have good test-retest reliability (kappa statistic 0.79), discriminability

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Table 1. Characteristics of Respiratory Therapist and Physician Respondents*

Characteristic	Respiratory Therapists (n = 52)	Physicians (n = 102)	P
Time since graduation (mean ± SD y)	20.3 (9.7)	17.7 (8.1)	.08
Principal work facility (n, %)			< .001
Acute care	25 (48)	86 (84)	
Weaning	16 (31)	11 (11)	
Rehabilitation	3 (6)	4 (6)	
Long-term care	8 (15)	1 (1)	
Experience with tracheostomized patients (n, %)			.003
1–5 y	5 (10)	15 (15)	
6–10 y	9 (17)	24 (23)	
11–20 y	12 (23)	42 (41)	
> 20 y	26 (50)	21 (21)	
Tracheostomized patients cared for per year (n, %)			< .001
< 10	1 (2)	0 (0)	
11–20	3 (6)	16 (16)	
21–50	11 (21)	39 (38)	
51–100	18 (35)	36 (35)	
> 100	19 (36)	11 (11)	
Tracheostomized patients decannulated per year (n, %)			.15
0–1	5 (10)	19 (19)	
2–5	7 (13)	20 (20)	
6–10	8 (15)	22 (22)	
11–20	10 (19)	15 (15)	
> 20	22 (42)	26 (25)	

* Percentages may not sum to 100 because of rounding.

(8/11), clarity (11/11), utility (9/11), face validity (10/11), content validity (9/11) and minimal redundancy (1/11).[7]

Statistical Analysis

Survey responses were summarized using proportions, means, medians, standard deviations, and interquartile ranges. The strategy for the primary analysis was to compare RT and physician responses for the 5 survey domains. RT and physician responses were compared using t tests, chi-square tests, and Fisher's exact test for outcomes with rare events. Nonparametric comparisons were performed using the Mann-Whitney and nonparametric trend tests. Logistic regression was performed to examine associations between RT, physician, patient factors, and decannulation recommendations. RT and physician and patient factors were first examined using univariate analyses. Variables that were significant at a $P \leq .10$ were included in the multivariable analyses. Variables were selected by means of backward stepwise regression and comparison of the regression sum of squares. To account for the interdependence of our patient scenario data (3 scenario responses per respondent), we used robust estimates of variance (generalized estimating equation).[10] Statistical analyses were performed (Stata version 10.0, StataCorp, College Station, Texas) with 2-tailed significance levels of .05. The survey was approved by the local institutional review board.

Results

The survey was sent to 217 clinicians (71 RTs and 146 physicians) at 54 medical centers in the United States and Canada, between May and December 2006. Of the 217 clinicians who were sent the survey, 154 (71%) responded. The response rate for RTs (52/71 [73%]) and physicians (102/146 [70%]) was similar ($P = .61$).

Respiratory Therapists and Physicians

The demographic characteristics of the respondents are summarized in Table 1. The primary specialties of practice of the physician respondents were intensive care medicine (46 [45%]), pulmonary medicine (28 [27%]), surgery (18 [18%]), and anesthesia (10 [10%]). The majority of clinicians worked in acute care facilities, had more than 10 years of experience caring for tracheostomized patients, managed more than 50 patients with tracheostomies a year, and participated in multiple tracheostomy decannulations annually. There were significant differences between the RTs and physicians surveyed. Compared to physicians, RTs

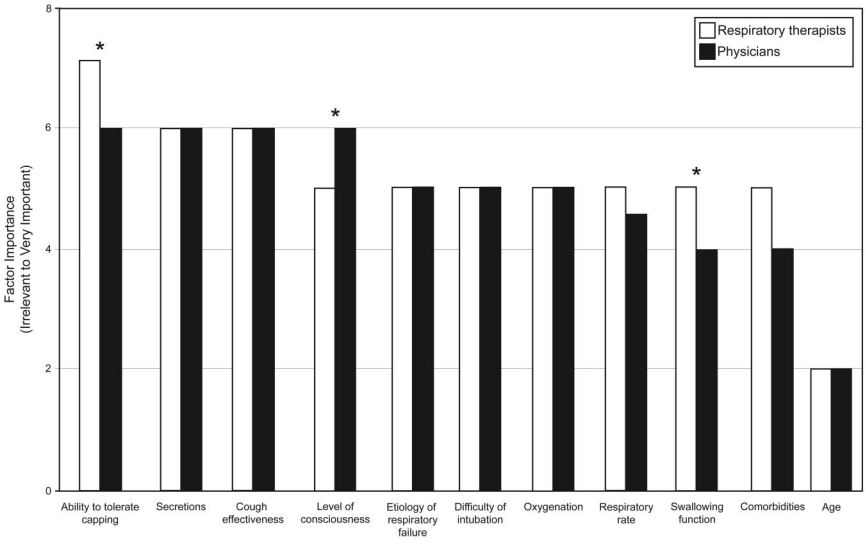

Fig. 1. Respiratory therapist and physician ratings of determinants of tracheostomy decannulation. The values are median scores. * $P < .05$

tended to have more years of work experience, were more likely to work in weaning and long-term care facilities, and on average cared for more tracheostomized patients each year. Both groups reported decannulating similar numbers of patients per year.

Ratings of Tracheostomy Decannulation Factors

RTs and physicians rated ability to tolerate tracheostomy tube capping, secretions, cough effectiveness, and level of consciousness as the 4 most important determinants in the decision to decannulate a tracheostomized patient (Fig. 1). Etiology of respiratory failure, difficulty of intubation, patient oxygenation, respiratory rate, swallowing function, and comorbidities were judged to be of intermediate importance. Patient age was the single factor that was rated as being of low importance. RTs rated ability to tolerate capping (median score 7 vs 6, $P = .02$) and swallowing function (median score 5 vs 4, $P = .02$) as significantly more important determinants of decannulation than physicians. Conversely, RTs rated level of consciousness (median score 5 vs 6, $P = .02$) as significantly less important than physicians.

Patient Scenarios

RTs (52% [81/156]) and physicians (55% [168/306]) ($P = .54$) were equally likely to recommend decannulation in the patient scenarios. After constructing multivariable models, we identified 7 independent factors to be associated with RTs' decannulation recommendations, and 4 independent factors with physicians' recommendations (Table 2). RTs who worked in rehabilitation ($P = .09$) and long-term care ($P < .01$) facilities were less likely to recommend decannulation. Both RTs and physicians were more likely to recommend decannulation if patients had a strong cough, scant thin secretions, required minimal oxygen, and were alert and interactive. RTs were also more likely to recommend decannulation if patients could tolerate a trial of tracheostomy tube capping for 72 hours and if their etiology of respiratory failure was chronic obstructive pulmonary disease, as opposed to pneumonia.

We tested for interactions between the type of clinician (RT/physician) evaluating the patient and the 4 patient factors that were independently associated with decannulation recommendations for both RTs and physicians. There was no evidence of an interaction between RTs/physicians and cough effectiveness ($P = .82$), secretions ($P = .36$), or oxygenation ($P = .55$). However, there was a significant interaction between RTs/physicians and level of consciousness ($P = .02$), suggesting that a patient's level of consciousness is a significantly less important factor for RTs than physicians in the recommendation to decannulate a patient.

Decannulation Failure

The distribution of RTs' and physicians' responses for describing a decannulation failure is summarized in Figure 2. RTs preferred shorter time frames for defining decannulation failure than physicians (median response 48 h vs 96 h, $P = .02$ for test of proportions). Both groups identified 2% to 5% (median response) as an acceptable rate of decannulation failure ($P = .48$ for test of proportions).

Table 2. Multivariate Logistic Regression Analysis of Decannulation Factors, Stratified According to Respiratory Therapists and Physicians*

	Respiratory Therapists			Physicians		
	Odds Ratio	95% CI	*P*	Odds Ratio	95% CI	*P*
Clinician's Principal Work Facility						
Acute care†	1.00	NA	NA	NA	NA	NA
Weaning	0.41	0.13–1.27	.122	NA	NA	NA
Rehabilitation	0.36	0.11–1.18	.092	NA	NA	NA
Long-term care	0.12	0.03–0.54	.006	NA	NA	NA
Patient Scenario Characteristics						
Cough effectiveness: strong vs weak†	4.46	1.93–10.30	< .001	4.16	2.39–7.23	< .001
Secretions: scant thin vs moderate thick†	3.58	1.58–8.15	.002	2.39	1.34–4.27	.003
F_{IO_2}: 0.30 vs 0.50†	2.45	1.16–5.19	.012	2.13	1.28–3.57	.004
Consciousness: alert vs drowsy†	2.30	1.00–5.27	.049	6.39	3.59–11.40	< .001
Ability to tolerate capping: 72 h vs 24 h†	2.08	1.03–4.17	.040	NA	NA	NA
Etiology of respiratory failure:						
COPD vs pneumonia‡	2.01	0.97–4.15	.059	NA	NA	NA

* The odds ratios and 95% confidence intervals (CIs) were calculated via multivariate logistic regression analysis, and are for the comparison of clinical scenarios where decannulation was recommended and those where it was not. Odds ratios greater than 1.0 favor clinicians recommending tracheostomy decannulation. Odds ratios less than 1.0 favor clinicians recommending against tracheostomy decannulation.
† Clinical scenarios with this factor served as the reference group.
NA = not applicable

Discussion

To our knowledge, our study is the first survey of contemporary tracheostomy decannulation practices of North American RTs and physicians. The results demonstrate 3 important findings. First, RTs and physicians agree on the majority of patient factors that they believe are important in the decision to decannulate a tracheostomized patient. Second, RTs and physicians appear to have differing opinions on 2 important patient factors in the decision to decannulate a patient: ability to tolerate capping, and level of consciousness. Third, RTs and physicians have different opinions of what constitutes a decannulation failure.

Our study highlights that RTs and physicians agree more than they disagree in contemporary decannulation practice. However, important differences between RTs and physicians exist and may have practical implications for patient care. Why did we observe these differences? Several possible explanations exist.

First, important training differences exist between the 2 groups. RTs are trained in airway management, including suctioning requirements. Conversely, most North American physicians receive general medical training but little instruction in management of airway issues, including management of secretions and swallowing dysfunction.

Second, the work environments of the RTs and physicians in our study were quite different and may have conditioned the respondents to provide different answers, despite the fact that the case scenarios were standardized to the acute care hospital environment. For example, mental status may be considered a less important determinant of decannulation in patients with chronic decreased level of consciousness, as compared to those with recent change.

Third, work experience could potentially explain the observed differences. Compared to the physicians, the RTs had both more years of experience and cared for more tracheostomized patients each year. This increased experience may have translated into greater confidence in managing tracheostomized patients and a different approach to decannulation.

Fourth, it is possible that RTs and physicians spent different amounts of time with their tracheostomized patients and consequently emphasized different determinants of decannulation. For example, it is possible that an RT may evaluate a patient several times daily for suctioning and respiratory treatments. Conversely, a physician may see a patient only once daily on rounds. The difference in time spent evaluating the patient and in repeat evaluations may emphasize the importance of a tracheostomy for airway protection.

Fifth, perceptions of ultimate responsibility may also influence decision making. If the physician and not the RT is perceived as being ultimately responsible for the patient's care, including the success or failure of tracheostomy decannulation, then this responsibility itself may influence decision making. The physician may want to be more conservative, wanting there to be little or no chance of a failure. Conversely, RTs might have responded differently if we had specified in our survey that the individ-

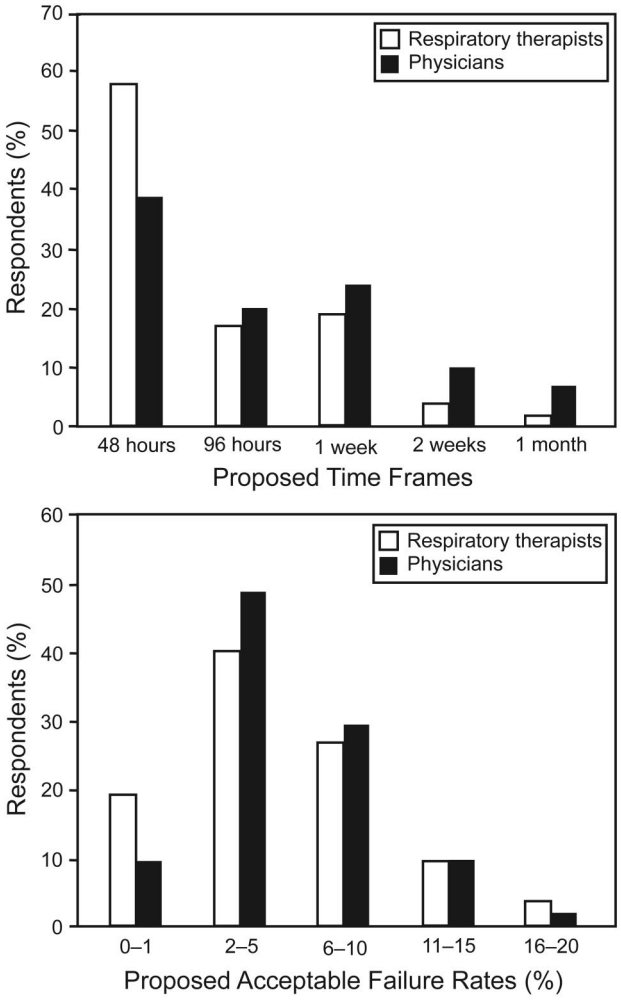

Fig. 2. Respiratory therapist and physician impressions of tracheostomy decannulation failure.

ual providing the decannulation recommendation was ultimately responsible for the consequences.

The observed differences in decannulation practices between North American RTs and physicians highlight the need for the development of evidence-based tracheostomy guidelines. Veelo et al have demonstrated in a survey of Dutch ICU physician medical directors that significant practice variation exists between centers.[11] Pending clinical trials that can inform clinical practice, institutions can develop local algorithms to guide clinical practice. For example, Ceriana et al demonstrated that a clinical decision aid aimed at assessing a patient's swallowing function, ability to manage secretions and breathe spontaneously, dead space, and psychiatric status could guide decannulation decisions.[12]

At the Massachusetts General Hospital we developed a decannulation guideline, based on the results of our survey, that incorporates evaluations of a patient's level of consciousness, cough effectiveness, secretions, oxygenation, swallowing function, and ability to tolerate capping. In addition, practice variation can be addressed by having tracheostomy care provided by a dedicated multidisciplinary team. Although tracheostomy is probably the most common surgical procedure performed on critically ill patients, very few clinicians outside of the ICU have extensive experience with tracheostomy care and decannulation.[5] Establishing standards for RTs or physicians who manage very few tracheostomized patients may simply not be practical. Another option is limiting the number of health-care providers within each center who can manage tracheostomized patients. For example, implementation of a dedicated tracheostomy service may reduce decannulation times and complication rates for tracheostomized patients.[13,14] Tobin et al, in a before-and-after case series, demonstrated that an intensivist-led tracheostomy team reduced the time to decannulation from ICU discharge from a medium of 14 days to 7 days.[13]

Our study has limitations. First, the survey instrument we used was simple. To ensure that our instrument was not too burdensome for clinicians, we were unable to explore all important aspects of tracheostomy decannulation, including the influence of patient prognosis on the decision to decannulate. Second, we measured what health-care workers stated they would do, but did not observe how they practice. Finally, our analyses represent a secondary analysis of North American centers from an international survey[7] and therefore should be considered hypothesis-generating.

Conclusions

Our study provides the first survey of contemporary tracheostomy decannulation practices of North American RTs and physicians. Our data indicate that both RTs and physicians consider a patient's cough effectiveness, secretions, oxygenation, and level of consciousness when determining whether to recommend tracheostomy removal. However, RTs also consider the etiology of respiratory failure and a patient's ability to tolerate capping, while physicians place greater emphasis on level of consciousness. RTs and physicians disagree on the definition of decannulation failure, but are willing to accept a 2% to 5% failure rate. Evidence-based tracheostomy guidelines are needed to facilitate the safe and effective management of patients with tracheostomies.

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