

# Management of Tracheostomy: A Survey of Dutch Intensive Care Units

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**OBJECTIVE:** To determine tracheostomy-management practices in Dutch intensive care units (ICUs) and post-ICU step-down facilities. **METHODS:** We surveyed the physician medical directors of all Dutch nonpediatric ICUs that have  $\geq 5$  beds suitable for mechanical ventilation. The survey asked for demographic information about the hospital and ICU setting, and for information and opinions about tracheostomy management in the ICU and step-down facilities, and the use of tracheostomy-management guidelines. **RESULTS:** Forty-four of the 69 ICUs responded. Sixty-four percent of the respondent ICUs only deflate the cuff when the patient is breathing spontaneously, without assistance from the ventilator. Fifty-nine percent do not routinely change the tracheostomy tube. Almost half use inner cannulas in tracheostomy tubes. Overall, intensivists were most often involved in the follow-up of discharged tracheostomized patients. In the nonacademic hospitals, specialized ICU nurses were more often involved ( $P = .05$ ). Sixty-four percent indicated they have no guideline for managing discharged tracheostomized patients. There was a diversity of opinion (median visual-analog-scale score 5.0, 95% confidence interval 3.0 to 8.0) on whether the tracheostomy tube should be removed “at once” or after “down-sizing.” **CONCLUSIONS:** There were large differences in tracheostomy management among Dutch ICUs. ICU and post-ICU tracheostomy-management guidelines are lacking and needed. *Key words:* tracheostomy, mechanical ventilation, tracheostomy tube, inner cannula, cuff, decannulation, survey, Netherlands. [Respir Care 2008; 53(12):1709–1715. © 2008 Daedalus Enterprises]

## Introduction

Tracheostomy is performed in about 11% of intensive care unit (ICU) patients.<sup>1,2</sup> It may benefit patients who

need prolonged mechanical ventilation, because tracheostomy allows the patient to speak, facilitates oral feeding, provides a more secure airway than a translaryngeal tube, and increases the patients' mobility.<sup>3-5</sup> A tracheostomy may also speed weaning from respiratory support.<sup>6-9</sup>

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Tracheostomy risks include blocking of the tube by debris, and dislocation of the tracheostomy cannula.<sup>10</sup> Managing a patient with a tracheostomy requires expertise in tracheostomy care. The use of a multidisciplinary team and a tracheostomy-care protocol can improve outcomes.<sup>11-16</sup> Hospitals differ in their tracheostomy management and follow-up practices because of differences in available technology, teaching activities, and because different personnel may be involved in the decision to remove the tracheostomy. It is important to understand differences in tracheostomy-management practice.

Several surveys on tracheostomy indications, timing, and techniques have been performed over the last decade.<sup>7,17-21</sup> However, until now, no survey has investigated practice in tracheostomy management in patients in ICUs

and post-ICU step-down facilities. We surveyed tracheostomy-management practice in Dutch hospitals. We asked about the use of speech valves and inner cannulas, cuff management, and tracheostomy removal. We also compare the practice differences between the academic and nonacademic hospitals.

## Methods

### Survey

We surveyed the physician medical directors of all Dutch ICUs that have  $\geq 5$  beds suitable for mechanical ventilation. We excluded pediatric ICUs. The survey was sent a second time to ICUs that did not respond to the first mailing.

The survey (Appendix) asked for demographic information about the hospital and ICU setting, and for information and opinions about tracheostomy management in the ICU and step-down facilities, and the use of tracheostomy-management guidelines. The questions on tracheostomy management were based on a literature review and expert opinion of 3 ICU physicians experienced in both clinics and research, two of whom work in an academic hospital, and one in a general hospital. The format and phrasing of the survey questions were based on earlier surveys about tracheostomy. We also thoroughly reviewed the literature for important elements of tracheostomy management that have not been surveyed or on which we found a lack of data or a lack of uniform results. Our rationale for survey-topic selection was to seek insight into (evidence-based) practice and evaluate the need for additional studies or the formulation of tracheostomy-management guidelines. We chose to use closed-ended questions. Questions on attitudes about selected tracheostomy-management issues were presented in the visual-analog-scale format (ie, mark the visual analog scale to indicate agreement/disagreement with the statement [see Appendix]).

All data were collected, analyzed, and presented anonymously, by assigning a number to each ICU. Only one of us (DPV, who sent out the survey) knew which number corresponded to which ICU, which was necessary for a second mailing.

### Statistical Analysis

We used descriptive statistics to summarize respondent characteristics. If normally distributed, continuous values are expressed as mean  $\pm$  SD; non-normally distributed data are reported as median and interquartile range. Differences between percentages are expressed with their 95% confidence intervals and calculated with confidence-interval analysis, with Wilson's method.<sup>22</sup> The effect of small sample sizes is reflected in the width of the confidence

intervals. Statistical significance ( $P < .05$ ) can be derived from confidence intervals that do not include a zero value. We analyzed the data with statistics software (SPSS 11.0, SPSS, Chicago, Illinois).

## Results

### Demographic Data

Responses were obtained from 44 (64%) of 69 ICUs, located in 39 (64%) of 59 hospitals. Fourteen (36%) hospitals had 200–500 beds, 15 (38%) had 500–800 beds, and 10 (26%) had  $> 800$  beds. Seven ICUs had  $> 20$  beds available for mechanical ventilation, 6 had 15–20 beds, 29 had 5–15 beds, and 2 had  $< 5$  beds. The 2 ICUs that had  $< 5$  beds suitable for mechanical ventilation were officially registered to have  $> 5$  such beds by the Dutch Intensive Care Society. We decided not to discard those data.

Thirty-two (73%) of the 44 respondent ICUs were in nonacademic hospitals; 31 (71%) had no ICU fellows, 2 (5%) had 1–4 fellows, and 11 (25%) had  $> 4$  fellows. Forty-three (98%) of the 44 ICUs were “closed-format” departments (ie, ICU clinicians treat their own patients and consult specialists when needed; this is the case in the majority of Dutch ICUs). Nine (23%) of the 39 respondent hospitals had more than one ICU. Twenty-six (59%) ICUs were specialized in the treatment of medical and surgical patients; in 4 (9%) and 10 (23%) ICUs they also treated cardiothoracic surgery patients and neurosurgery patients. Sixteen ICUs (37%) treated all patient categories.

### Local Guidelines

Sixty-four percent of respondents indicated their ICU had no guideline for managing (discharged) tracheostomized patients. Nine (21%) had a guideline for nurses only. Three (7%) had a guideline for nurses and physicians.

### Cuff-Deflation, Inner Cannulas, and Speech Valves

Most respondents stated that they deflate the cuff only when the patient is breathing spontaneously, without assistance from the ventilator (Table 1). Twenty-six (59%) of the ICUs do not routinely change the tracheostomy tube. Mentioned reasons to routinely change the tube were: to insert a smaller tube (16 ICUs, 36%); to switch to another type of cannula (15 ICUs, 34%); and to clear debris (12 ICUs, 27%). Almost half of the respondents use inner cannulas in tracheostomy tubes, whereas 6 (14%) respondents stated they never use an inner cannula. The use of an inner cannula was nonsignificantly less frequent in the nonacademic hospitals than in the academic hospi-

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Table 1. Tracheostomy-Management Practice in Dutch Intensive Care Units

|                                     | Academic Hospitals<br><i>n</i> = 12 (%) | Nonacademic Hospitals<br><i>n</i> = 32 (%) | % Difference<br>(95% CI) | <i>P</i> |
|-------------------------------------|---|--|--------------------------|----------|
| Use un-cuffed tracheostomy tube     |   |  |                          |          |
| During mechanical ventilation       | 2 (16.7)                                | 6 (18.8)                                   | 2 (-22 to 3)             | .87      |
| Only during weaning                 | 7 (58.3)                                | 21 (65.6)                                  | -7 (-37 to 2)            | .66      |
| Only when fully weaned              | 3 (25.0)                                | 3 (9.4)                                    | 16 (-6 to 45)            | .18      |
| Never                               | 0 (0)                                   | 1 (3.1)                                    | NA                       | NA       |
| Change tracheostomy tube            |   |  |                          |          |
| Never                               | 10 (83.3)                               | 16 (50.0)                                  | 33 (0.8 to 54)           | .048     |
| Once every 14 d                     | 0 (0)                                   | 9 (28.1)                                   | NA                       | NA       |
| Once every 7 d                      | 2 (16.7)                                | 6 (18.8)                                   | -2 (-22 to 28)           | .87      |
| Use inner cannula                   |   |  |                          |          |
| Always                              | 8 (66.7)                                | 12 (37.5)                                  | 29 (-3 to 54)            | .09      |
| Only during weaning                 | 1 (8.3)                                 | 10 (31.3)                                  | -23 (-42 to 7)           | .12      |
| Only when fully weaned              | 0 (0)                                   | 1 (3.1)                                    | NA                       | NA       |
| When discharged to ward/medium care | 3 (25.0)                                | 0 (0)                                      | NA                       | NA       |
| Never                               | 0 (0)                                   | 6 (18.8)                                   | NA                       | NA       |

CI = confidence interval

NA = not applicable because one of the values is zero

tals; the difference was 9% (95% confidence interval -16 to -24%). Thirty-five (80%) of the ICUs that use inner cannulas remove and clean the inner cannula several times a day. Most respondents agreed with the statement that patients on non-ICU wards should always have an inner cannula (median visual-analog-scale score 8.9, 95% confidence interval 7.0 to 10.0). Thirty-four of all respondents (77%) use speech valves when patients were discharged to a step-down facility.

### Follow-up

The frequency of post-discharge visits ranged widely; 48% visit their post-discharge patients every day; 10% visit them twice a week; 7% visit them once a week; and 37% visit them only on request. Overall (Table 2), intensivists were most often involved (eg, routine or indicated visits, decision making regarding cannula removal) in the follow-up of discharged tracheostomized patients (22 ICUs, 54%), followed by ear, nose, and throat physicians (19 ICUs, 46%) and consultative ICU nurses (18 ICUs, 44%). Ear, nose, and throat physicians were significantly more involved in follow-up in the academic hospitals than in the nonacademic hospitals ( $P = .01$ ), whereas specialized ICU nurses were more often involved in the nonacademic hospitals ( $P = .05$ ). In 26 (63%) ICUs, follow-up was performed by more than one specialist. In 3 ICUs (all of which were academic hospitals), tracheostomized patients remained in the ICU until the tracheostomy cannula was definitively removed.

### Decannulation

The following criteria were mentioned to influence the decannulation decision: ability to cough, frequency of airway suctioning; patient condition; and ability to breathe without the tube (Table 3). There was diversity of opinions (median visual-analog-scale score 5.0, 95% confidence interval 3.0 to 8.0) on whether the tube should be removed "at once" or "after down-sizing." Most respondents thought that after removing the tube the wound should be sealed airtight immediately (median visual-analog-scale score 7.0, 95% confidence interval 5.0 to 8.8).

### Discussion

This is the first survey of tracheostomy management in patients in the ICU and post-ICU step-down facilities. We found wide variability in daily tracheostomy management in such patients in the Netherlands. In addition, our results show that, although follow-up is usually multidisciplinary, the intensivists are most often involved. The specialized ICU nurses are especially active in the nonacademic hospitals. There was a surprising lack of tracheostomy-management guidelines in use in the respondent ICUs and step-down facilities.

Most respondents stated that they deflate the cuff only when the patient is completely weaned from mechanical ventilation. A recent study, however, found that early deflation during T-piece weaning trials reduces diaphragmatic effort and increases tidal volume in patients who

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Table 2. Clinician Involvement in Follow-up of Patients With Tracheostomy (n = 41)\*

| Clinician Type                  | Academic Hospitals<br>n = 12 (%) | Nonacademic Hospitals<br>n = 32 (%) | % Difference<br>(95% CI) | P   | Total Frequency†<br>(n and %) |
|---------------------------------|----------------------------------|-------------------------------------|--------------------------|-----|-------------------------------|
| Intensivist                     | 4 (33.3)                         | 18 (56.3)                           | -23 (-48 to 9)           | .18 | 7 (17.1)                      |
| Intensivist fellow              | 2 (16.7)                         | 2 (6.3)                             | 10 (-8 to 39)            | .29 | 3 (7.3)                       |
| Surgeon                         | 3 (25.0)                         | 7 (21.9)                            | 3 (-20 to 33)            | .83 | 1 (2.4)                       |
| Ear, nose, and throat physician | 9 (75.0)                         | 10 (31.3)                           | 44 (10 to 65)            | .01 | 6 (14.6)                      |
| Consultative ICU nurse          | 2 (16.7)                         | 16 (50.0)                           | -33 (-54 to -0.8)        | .05 | 8 (19.5)                      |
| Pulmonary physician             | 0                                | 2 (6.3)                             | -6 (-20 to 18)           | NA  | 1 (2.4)                       |

\* Three intensive care units (ICUs) would not discharge a patient with tracheostomy (rather, only after decannulation).

† Total frequency of solitary involvement in academic and nonacademic hospitals combined

NA = not applicable because one of the values is zero

have difficulty weaning.<sup>23</sup> In addition, there is evidence that continuous-positive-airway-pressure ventilation can be safe in a patient with a deflated or partially deflated cuff, although a small decrease in intratracheal pressure may occur.<sup>24,25</sup> We prefer early cuff deflation in patients in whom small changes in airway load can make the difference between success and failure of a weaning trial, and in conscious patients on continuous-positive-airway-pressure ventilation, who consequently benefit from the ability to speak and swallow, provided that the adequacy of swallowing is carefully assessed and secretion-pooling above the cuff is limited, to prevent aspiration.

In more than a third of the respondent ICUs, tracheostomy tubes are routinely changed, usually to insert a smaller tube or change the type of tube. It has been suggested that there are fewer complications when tracheostomy tubes are regularly changed, because less granulation tissue may be formed.<sup>26</sup> However, we recommend caution when considering (early) changing of tracheostomy tubes because of the risk that the tube cannot be replaced or that a false route is created.<sup>10</sup>

All the ICUs that use inner cannulas clean the inner cannulas several times per day. Most ICUs even consider an inner cannula mandatory before the patient is discharged to a step-down facility. Cleaning the inner cannula might

prevent infection, and although the inner cannula increases the imposed work of breathing, it helps keep a clear artificial airway.<sup>27,28</sup> The decision to use an inner cannula requires individualization, but guidelines are needed to specify which patients might benefit from an inner cannula.

An important part of follow-up is the decision on when to decannulate.<sup>29</sup> Ceriana et al were the first to standardize the process of tracheostomy weaning, and they achieved a re-intubation rate of only 3%.<sup>30</sup> Although that trial was performed in a respiratory ICU, their protocol might also be applicable to patients in non-ICU wards. Our respondents indicated that their most important criteria regarding the decision to decannulate are ability to cough, frequency of airway suctioning, and the patient's condition, which concurs with previous reports and a recent international survey.<sup>30-33</sup> Although a substantial percentage of our respondents prefer "down-sizing" to "at once" decannulation, studies are needed to compare those strategies.

Tracheostomy management requires specific knowledge that might not be available to nurses in step-down facilities.<sup>34</sup> In England and Australia specialized critical care outreach teams provided follow-up for patients with tracheostomies, and tracheostomy-related complications decreased.<sup>16</sup> In the Netherlands there are no national guide-

Table 3. Decannulation Criteria

| Decannulation Criteria                     | Always<br>n (%) | Frequently<br>n (%) | Sometimes<br>n (%) | Never<br>n (%) |
|--|-----------------|---------------------|--------------------|----------------|
| Ability to cough properly                  | 37 (84.1)       | 5 (11.4)            | 0 (0)              | 0 (0)          |
| Frequency of airway suctioning             | 28 (63.6)       | 10 (22.7)           | 4 (9.1)            | 0 (0)          |
| Patient condition                          | 27 (61.4)       | 13 (29.5)           | 4 (9.1)            | 0 (0)          |
| Possibility of breathing past the cannula* | 17 (38.6)       | 9 (20.5)            | 13 (29.5)          | 3 (6.8)        |
| Opinion of attending nurse                 | 14 (31.8)       | 14 (31.8)           | 14 (31.8)          | 2 (4.5)        |
| Wound inflammation                         | 2 (4.5)         | 0 (0)               | 29 (65.9)          | 11 (25.0)      |

\* With the cuff deflated

lines or standardization in regulation of health care or health-care-delivery systems on managing tracheostomized patients. Physicians provide this care, often in combination with consultative ICU nurses. A possible advantage of follow-up by consultative ICU nurses is that they probably have more time for post-discharge patient visits and therefore might be able to earlier identify patients who no longer need a tracheostomy. In addition to the use of multidisciplinary teams, a specific tracheostomy-follow-up protocol might improve outcomes.<sup>11-16</sup> Our survey indicates that few Dutch hospitals use such protocols and that the need for such guidelines is high.

The observed practice variation is not desirable and might negatively impact care. Standardization of care and use of protocols in sedation, weaning, and multidisciplinary follow-up may improve outcomes of ICU patients.<sup>11-16,35</sup> Our survey did not address outcomes, so we do not draw any conclusions on outcomes. Especially on the topics of early cuff deflation, cannula changes, the use of an inner cannula, and standardization of tracheostomy management, studies are needed to compare outcomes, weaning duration, and the incidence of airway infection.

### Limitations

Our survey-response rate was only 64%. Although both academic and nonacademic teaching hospitals were adequately represented, our sample size is relatively small to be able to reliably compare tracheostomy practice differences between academic and nonacademic hospitals.

In the Netherlands, ICU clinicians often are internists, anesthesiologists, or surgeons trained in intensive care medicine. Most Dutch ICUs have medical, surgical, and neurosurgical patients. Thus, our survey results may not be applicable to other countries or settings.

Finally, our survey was not formally tested for reliability and validity.

### Conclusions

There are large differences in tracheostomy management, especially in cuff-management, tracheostomy tube change, and decannulation. This survey indicates the need for tracheostomy-management guidelines.

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Appendix

Survey of Dutch Intensive Care Units' Tracheostomy-Management Practices

**Demographics**

- 1. What size is your hospital (number of beds)?
  - < 200 beds
  - 200-500 beds
  - 500-800 beds
  - > 800 beds
- 2. What size is your ICU (beds suitable for mechanical ventilation)?
  - < 5 beds
  - 5-15 beds
  - 15-20 beds
  - > 20 beds
- 3. What kind of hospital ?
  - academic
  - nonacademic
- 4. Does your hospital train fellow intensivists?
  - No fellows
  - 1-4 fellows
  - > 4 fellows
- 5. What sort of patients are admitted at your ICU (more than 1 answer possible)?
  - All specialisms
  - Medical
  - General surgery
  - Cardiopulmonary surgery
  - Neurosurgery
- 6. What is the character of your ICU?
  - Closed format (the intensivist treats his/her patients and consults specialists only on indication)
  - Open format (each specialist treats his own patients)
- 7. Are there other ICUs in your hospital (only adults)?
  - No
  - Yes, namely: \_\_\_\_\_

**Management of Tracheostomy and Follow-up**

- 8. When is the cuff of a patient deflated?
  - While still on mechanical ventilation
  - Only on the moments that the patients is breathing without ventilator
  - Only when the patient is completely weaned from mechanical ventilation
  - Only when the patient is transferred to the ward
  - Never
- 9. How often is the trachea cannula changed on your ICU?
  - Once every 14 days
  - Once every 7 days
  - Never, or only when the cannula is obstructed

- 10. What is the reason for changing the cannula routinely?
  - For cleaning purposes
  - For down-sizing purposes
  - To change the cannula for another type
  - Not relevant, we never change the cannula routinely
- 11. Is there a protocol on weaning from mechanical ventilation with a tracheostomy?
  - No
  - Yes, we always apply this protocol
  - Yes, although this protocol is not often applied
- 12. An inner cannula is used
  - Always, even during mechanical ventilation
  - Only on the moments that the patients is breathing without ventilator
  - Only when the patient is completely weaned from mechanical ventilation
  - Only when the patient is transferred to the ward
  - Never
- 13. An inner cannula is
  - Cleaned daily once or more than once
  - Cleaned only on indication
  - Not relevant, we never use inner cannulas
- 14. Which specialists provide follow-up after transfer to the ward (more than 1 answer possible)? Please indicate the frequency for each specialist
  - We never discharge patients with tracheostomies
  - Intensivist \_\_\_%
  - Fellow-intensivist \_\_\_%
  - Surgeon \_\_\_%
  - Ear, nose, and throat physician \_\_\_%
  - Consultative ICU nurse \_\_\_%

- 15. Is there a protocol for management of patients on the wards?
  - Yes
    - Nurse
    - Medical
  - No

- 16. Do you use speech valves?
  - Yes
    - What type? \_\_\_\_\_
    - Which patients? \_\_\_\_\_
  - No

- 17. What items are deemed important in the decision to remove the tracheostomy?

- A) Frequency of bronchial toilet
  - Always
  - Usually
  - Sometimes
  - Never

- B) Ability to breathe past the cannula
  - Always
  - Usually
  - Sometimes
  - Never

- C) Ability to cough
  - Always
  - Usually
  - Sometimes
  - Never

- D) Inflammation around the tracheostomy wound
  - Always
  - Usually
  - Sometimes
  - Never

- E) Opinion of the attending nurse
  - Always
  - Usually
  - Sometimes
  - Never

- F) Condition of the patient
  - Always
  - Usually
  - Sometimes
  - Never

- 18. How often does one visit the patients with a tracheostomy in situ?
  - Every day
  - Twice a week
  - Once a week
  - Only on request

- 19. Are speech therapists involved with tracheotomized patients (more than 1 answer possible)
  - Always
  - Only those who have difficulties with swallowing
  - Only those who have speech problems possibly related to the tracheostomy
  - We don't have speech therapists

**Please indicate whether you agree with the following statements:**

- 1. "On the wards an inner cannula should always be used."
 

Totally disagree 0 1 2 3 4 5 6 7 8 9 10 agree
- 2. "It is better to remove a cannula at once than applying down-sizing first."
 

Totally disagree 0 1 2 3 4 5 6 7 8 9 10 agree
- 3. "After removing the cannula the wound should be sealed airtight (for example, plaster with vaseline)."
 

Totally disagree 0 1 2 3 4 5 6 7 8 9 10 agree