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Clinical investigations in critical care

Indications, Timing, and Techniques of Tracheostomy in 152 French ICUs*

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Study objectives: To investigate the current practice of tracheostomy in French ICUs, focusing on the frequency, timing, indications, and techniques.

Design: A retrospective study.

Setting: A questionnaire was sent to all ICUs included in the national registry of the Société de Réanimation de Langue Française.

Patients: All ICU patients receiving mechanical ventilation (MV) during the year preceding the survey (excluding noninvasive ventilation) were covered by the questionnaire.

Intervention: None.

Measurements and results: Of the 708 ICUs invited to participate, 152 (21.5%) answered the questionnaire. Overall, 35,322 patients (median, 212 patients per unit; interquartile range [IQR], 148 to 329 patients) had received MV, including one fourth of patients for > 7 days. A median of 7.2% of patients (IQR, 2.9 to 11.1%) had undergone a tracheostomy. The most frequently reported indications for tracheostomy were prolonged MV (95%, after a median of 20 days) and failure of extubation (48%). An indication for "early" tracheostomy (*ie*, < 3 weeks) was considered in 68% of the ICUs, after a median time of 7 days. Physicians thought that performing tracheostomy would facilitate weaning from MV and early oral nutrition, and would improve overall patient comfort. The main disadvantages listed were tracheal complications, the aggressiveness of the procedure, and the risk of infection. Surgical techniques largely remained preferred compared to percutaneous techniques.

Conclusions: There is much heterogeneity in the reported practices of tracheostomy in French ICUs. Three fourths of physicians considered that a randomized study comparing prolonged translaryngeal intubation and early tracheostomy in patients expected to receive prolonged MV would be necessary to clarify those issues. (CHEST 2005; 127:1347-1352)

Key words: ICU; mechanical ventilation; tracheostomy

Abbreviations: ENT = ear, nose, and throat; IQR = interquartile range; MV = mechanical ventilation

In patients requiring mechanical ventilation (MV), a tracheostomy may be proposed to facilitate airway management. The main indications for tracheostomy can be divided into two categories.¹ First,

tracheostomy could avoid complications of translaryngeal intubation, such as laryngeal injury (*eg*, edema and stenosis).^{2,3} Second, several advantages have been suggested for tracheostomy, including weaning from MV in patients receiving long-term

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†A list of members of Commission d'Epidémiologie et de Recherche Clinique is located in the Appendix.

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For editorial comment see page 1083

MV, facilitated nursing care, decreased risk of cannula displacement, and improved patient comfort (including the ability to speak and to feed orally).^{4,5} Although these advantages remain theoretical, many physicians have adopted tracheostomy in their routine clinical practice, while others use tracheostomy

only in specific and rare instances. There is considerable discrepancy of opinion among ICU physicians regarding the usefulness of tracheostomy in patients receiving MV, and surprisingly few data are available on current practices in this area. An international utilization review⁶ showed that MV was delivered via a tracheostomy in 24% of 1,638 patients. A nationwide survey⁷ in Switzerland showed that the prevalence of tracheostomy was 10% in patients receiving MV for > 24 h. In the latter study, the technique was far from being standardized with regard to indications for, timing of, and choice of the technique.

The aim of this descriptive study was to investigate the current practice of tracheostomy in French ICUs through a nationwide survey. The frequency, timing, indications, and techniques of tracheostomy were recorded.

MATERIALS AND METHODS

A questionnaire was designed by the Commission d'Epidémiologie et de Recherche Clinique of the Société de Réanimation de Langue Française. The questionnaire was first tested in the ICU of one of the investigators. Then, the questionnaire was sent to one senior physician at each ICU included in the registry of the national society as of early 2001.

The following items were recorded: hospital category (teaching hospital or not); the number of beds in the hospital and in the ICU; ICU category (*ie*, medical, surgical, or medical-surgical ICU); the number of patients who had received MV (excluding noninvasive ventilation) in the preceding year, with the distinction made between medical and surgical patients; the number of patients receiving MV for > 7 days; the number of patients undergoing a tracheostomy during their ICU stay; the techniques used to perform the tracheostomy (*ie*, surgical or percutaneous); the operator and location (*ie*, surgeon or intensivist, in the operating room or the ICU); indications (no specific indication; failure of extubation followed by reintubation; prolonged MV, and if so, after how long; timing of tracheostomy after the initiation of MV and whether tracheostomy was performed early [*ie*, before receiving MV for 3 weeks] in specific indications).

In addition, senior physicians were asked to provide their opinions on the potential advantages and disadvantages of tracheostomy. For each item, a score between 1 (minor advantage or disadvantage) and 4 (major advantage or disadvantage) was given.

Finally, physicians were asked whether they considered that a prospective randomized trial comparing early tracheostomy vs prolonged intubation would be justified. The results are reported as the percentage or median and interquartile range (IQR).

RESULTS

The data reported in the first part of this section (*ie*, type and size of ICUs, and MV and tracheostomy rates) are those actually recorded in ICUs, based on the prospectively collected database of the Medical Information System used in French hospitals. Conversely, results relative to the practices of tracheos-

tomy are based on self-reporting by physicians responding to the questionnaire.

Type and Size of Participating ICUs

Of 708 ICUs that were invited to participate, 152 (21.5%) answered the questionnaire. The majority of participating ICUs were medical-surgical ICUs (77%), 15.8% were medical ICUs, and 7.2% were surgical ICUs. Approximately one third of ICUs (38%) were located in teaching hospitals. The median number of beds in participating ICUs was 12 (IQR, 8 to 15 beds).

The nonresponding ICUs, which were included in the registry of the national society, were compared to the 152 ICUs who answered the questionnaire. The number of beds per ICU was comparable between the ICU groups (median, 10 beds; IQR, 8 to 12 beds), as was the percentage of medical ICUs (17.2%). However, a lesser proportion of nonresponding ICUs was located in teaching hospitals (25%; $p < .05$ [χ^2 test]).

Patients Receiving MV During the Previous Year

The median number of patients receiving MV per unit (excluding noninvasive MV) during the year preceding the study was 212 (IQR, 148 to 329 patients; total, 35,322 patients). A majority of patients had received MV for a medical indication (median, 125 patients; IQR, 82 to 200 patients; total, 16,594 patients). Overall, 9,059 patients (median, 54 patients per unit; IQR, 35 to 108 patients per unit) received MV for > 7 days. The number of patients receiving MV per year was slightly higher in teaching hospitals and in surgical ICUs than in other units. Otherwise, there was no significant difference between teaching hospitals and others, or among medical-surgical ICUs, surgical ICUs, and medical ICUs (Table 1).

Overall, 2,738 patients had a tracheostomy performed (median, 7.2% [2.9–11.1%]).

Physicians' Opinion Survey on Indications and Timing of Tracheostomy

The most frequently reported indications for tracheostomy (multiple answers were allowed, and ear, nose, and throat [ENT] emergencies were excluded) were failure of extubation (as reported by 48% of responding physicians) and prolonged MV (as reported by 95% of physicians) after a median period of 20 days (IQR, 14 to 30 days). The absence of any specific indication was notified by 3% of responding physicians. The failure of extubation was more often considered as an indication for tracheostomy in

Table 1—Number of Patients Receiving MV or Tracheostomy According to the Type of ICU

Variables	Teaching Hospital	Nonteaching Hospital	ICU		
			Medical	Surgical	Medical-Surgical
ICUs, No.	58	94	24	11	117
Patients with MV/unit/yr*	260 (197–421)	200 (127–282)	232 (173–315)	254 (200–450)	206 (137–315)
Patients with tracheostomy*	10 (5–30)	16 (8–26)	17 (10–28)	10 (6–20)	16 (7–27)

*Values given as median No. of patients per ICU per year (IQR).

nonteaching hospitals (54%, after a median time of 15 days) than in teaching hospitals (38%, after a median time of 21 days).

Early tracheostomy (before 3 weeks of MV) was considered by 68% of the respondents, after a median time of 7 days (IQR, 3 to 8 days). Early tracheostomy was considered more often in nonteaching hospitals (76.5%) than in teaching hospitals (54.5%; $p < 0.01$ [χ^2 test]) after a median time of 7 days in both types of hospitals. Only 58% of medical ICU physicians considered performing an early tracheostomy, compared to 70 to 72% of physicians in other ICUs.

The potential advantages and disadvantages of tracheostomy listed by physicians are shown Table 2. Briefly, the main advantages listed were as follows: (1) facilitation of weaning, (2) overall comfort of patients, and (3) earlier oral nutrition. The main disadvantages were as follows: (1) tracheal complications, (2) aggressiveness of the procedure, and (3)

risk of stomal infections. A prospective randomized study comparing prolonged translaryngeal intubation and early tracheostomy in patients receiving long-term MV was considered to be justified by 73% of physicians.

Techniques of Tracheostomy From Survey of Opinion

Operators, hospital location, and techniques used for performing tracheostomies are shown in Table 3. Briefly, tracheostomies were indifferently performed by a surgeon/ENT specialist or by an intensivist, in the operating room or in the ICU. In surgical ICUs, tracheostomies were less frequently performed in the ICU by intensivists than in medical or medical-surgical ICUs.

Surgical techniques were largely preferred to percutaneous techniques, without significant differences between teaching and nonteaching hospitals.

Table 2—Physicians' Opinions on the Potential Advantages and Disadvantages of Tracheostomy*

Advantages	Answers (Overall Score)	Disadvantages	Answers (Overall Score)
Facilitation of weaning	94 (287)	Tracheal complications	56 (131)
Better comfort of patients	75 (221)	Aggressive procedure	42 (113)
Earlier oral nutrition	38 (103)	Risk of stomal infections	35 (80)
Easier tracheal suctioning	36 (99)	Esthetic sequelae	31 (51)
ENT nursing	33 (101)	Bleeding	27 (57)
Overall safety	27 (88)	Psychological trauma	19 (40)
Easier care of mouth	24 (70)	Delayed ICU discharge	11 (34)
Reduced risk of sinusitis	17 (47)	Risk of catheter-related infection	10 (28)
Mobility of patient	15 (50)	Organizational difficulties	9 (26)
Earlier ICU discharge	15 (42)	Stomal care difficulties	6 (13)
Reduced laryngeal complications	14 (44)	Risk of cannula displacement	5 (12)
Easy changes of cannula	12 (36)	Increased risk in ward	3 (11)
Reduction of sedation needs	9 (33)	Risk for prone positioning	3 (6)
Earlier speech	8 (20)	Delay for cannula removal	3 (4)
Airway protection	5 (14)	Tracheal hypersecretion	2 (7)
Reduced risk of obstruction	3 (10)	Risk of pneumothorax	2 (4)
Reduced risk of VAP	3 (9)	Liability	1 (4)
Cost	1 (3)		
Physical appearance	1 (1)		
Total score	1278		623

*Overall score = No. of physician's opinions multiplied by the score attributed to each item, ranging from 1 (minor advantage or disadvantage) to 4 (major advantage or disadvantage) [eg, 94 responding physicians considered that tracheostomy facilitated weaning, with scores ranging from 1 to 4 (overall score, 287)]. VAP = ventilator-associated pneumonia.

Table 3—How Tracheostomies Are Declared to be Performed in French ICUs*

Variables	Always	Often	Rarely	Never
Operator				
Surgeon/ENT	42	16	32.5	9.5
Intensivist	19.5	52.5	11	17
Hospital location				
Operating room	35.5	24.5	26.5	13.5
ICU	24	39	15	22
Technique				
Surgical	73.5	10.5	13	3
Percutaneous	6.5	14	17	64.5

*Data are presented as %.

Medical ICUs were twice as prone as others to adopt a percutaneous technique. Among percutaneous tracheostomies, anterograde dilatational techniques were used four times more often than retrograde techniques.

DISCUSSION

Despite decades of experience in ICUs, there is still controversy over the specific indications, techniques, and timing of tracheostomy.¹ Not only the optimal timing (*ie*, early vs delayed) and the most appropriate technique remain subjects of debate, but also the actual clinical value (benefit/risk ratio) of tracheostomy is unknown. In most studies, the level of evidence remains poor. In addition, the duration of MV is not easy to predict, making the decision to perform an early tracheostomy difficult. For these reasons, physicians' attitudes regarding tracheostomy are heterogeneous across different types of ICUs, and the reasons for using or withholding tracheostomy are often based solely on a physician's opinion.

Despite the frequent use of tracheostomy in ICUs, there is little epidemiologic information on this intervention. In this multicenter survey, French ICU senior physicians were queried on their practices concerning the performance of tracheostomy in patients receiving MV. The first limitation of this work is that only one fifth of ICUs invited to participate actually answered the questionnaire. Although the participating ICUs were roughly comparable to the nonresponding ones, the generalization of our results is questionable. Specifically, physicians answering the questionnaire could be those having a greater interest in the practice of tracheostomy. A second limitation is that the study is based in part on self-reporting by physicians, in addition to objectively recorded data. Finally, the role of tracheostomy within a strategy of weaning from MV, and, more specifically, with regard to the use of noninva-

sive MV after extubation, has not been investigated in the present study, although its role might be growing, as some studies^{8,9} have suggested that postextubation noninvasive ventilation in patients who are at risk for respiratory failure does not prevent reintubation.

About one fourth of patients receiving MV underwent MV for >7 days, and about one third of them were reported to have received a tracheostomy (7.7% of all patients receiving MV). In a 1-day international point-prevalence study,⁶ 24% of patients receiving MV via a tracheostomy. In Swiss ICUs, 1.3% of all patients and 10% of those receiving MV for > 24 h eventually received a tracheostomy.⁷ In three North-American studies,^{10–12} 8.3 to 10% of about 6,500 patients receiving MV required a tracheostomy. Although these other studies used different designs and methods, which does not allow direct comparisons among them, physicians' practices appear to vary considerably from one country to another. In particular, the prevalence of tracheostomy seems to be higher in France compared with that in other European countries.

The opinions of French physicians about the indications for tracheostomy were similar to those reported in the Swiss study.⁷ The need for long-term MV was the major indication, followed by failed weaning and reintubation. Overall, tracheostomies were said to be performed after a median time of 20 days, a duration that is longer than that reported in the international survey by Esteban et al⁶ (median, 11 days), in the Swiss study⁷ (second week of MV), or in the recent study by Engoren et al¹² (median, 13 to 17 days).

However, an early tracheostomy appears to be considered in two thirds of the ICUs, after a mean of 7 days. Recently, the VIII Consensus Conference of the French Society of Intensive Care Medicine, which focused on artificial airways, suggested¹³ that a decision on performing tracheostomy could be made without delay after 5 to 7 days of MV, if at that time the foreseeable duration of MV exceeds 15 additional days. In 1989, the North-American Consensus Conference recommended¹⁴ that translaryngeal intubation should be preferred in the first 10 days of MV, while tracheostomy should be performed when MV exceeds 3 weeks. Both recommendations therefore suggest performing a tracheostomy when the expected duration of MV is \geq 3 weeks. However, the major difficulty in applying a recommendation for early tracheostomy is to predict the duration of MV. Criteria predictive of prolonged MV or of extubation failure have been described in several patient populations.^{10,15–18} However, most of these criteria lack predictive value at the individual level. Although the ideal timing of tracheostomy remains undeter-

mined,¹⁹ early tracheostomy could be more particularly recommended for some indications, such as cervical spinal cord injury or infratentorial lesions.¹⁷

Physicians responding to this survey identified several advantages and disadvantages of tracheostomy (Table 2). The potential advantages recorded (*eg*, facilitation of weaning, better patient comfort, earlier oral nutrition and speech, easier care of airways, and safety) have been widely discussed in the literature.^{20–28} In an international multicenter study,²⁹ 373 patients with tracheostomy were compared to a matched control group. Although the mortality rate in the ICU was lower in tracheostomized patients (24.4% vs 37.3%, respectively; $p < 0.001$), the hospital mortality rate did not differ between the two groups (38.6% vs 41.6%, respectively; $p = 0.41$). Tracheostomy can substantially reduce the mechanical workload of ventilator-dependent patients.⁴ Except for the recent study by Rumbak et al,⁵ other studies^{29,30} have not documented the other potential advantages of the procedure, such as a reduced rate of sinusitis or ventilator-associated pneumonia, or a reduced duration of MV or ICU and hospital stays, and better comfort for the patient.

Similarly, the main disadvantages that have classically been advocated (*eg*, tracheal complications, catheter-related infections, and psychological consequences) cannot be specifically attributed to tracheostomy. Interestingly, the hospital policy to accept or refuse tracheostomized patients on regular wards or the availability of beds for long-term tracheostomized and ventilator-dependent patients has opposite consequences on ICU practices. Fifteen physicians considered that performing a tracheostomy may facilitate ICU discharge, while 11 others considered that tracheostomy was a potential barrier to ICU discharge. Finally, absolute contraindications for tracheostomy are altogether infrequent. Anatomic defects or soft tissue infection of the neck, or very severe respiratory distress with refractory hypoxemia and hypercapnia may be considered as contraindications. Conversely, although hematologic disorders are often considered to be contraindications for the procedure, previous studies^{31,32} have shown that a tracheostomy can be safely performed in patients with severe neutropenia or thrombocytopenia.

Whereas the indications and potential benefits of tracheostomy remain highly controversial, an extensive number of studies on the techniques and procedures of tracheostomy has been published during the past 20 years. Despite the low rates of complications associated with tracheostomy that have been reported over the past few years in the literature,^{33,34} most physicians responding to this survey still con-

sider the procedure to be aggressive. Most probably, they simply bear in mind that it is an invasive surgical procedure, which may expose patients to the risk of cosmetic sequelae. The development of percutaneous techniques could change the approach of intensivists regarding the use and timing of tracheostomy. In our survey, tracheostomies were indifferently performed by a surgeon/ENT specialist or by the intensivist, in the operating room or in the ICU. Surprisingly, despite a promising increase in the number of studies in the literature on percutaneous techniques,^{33,34} surgical techniques remain largely preferred in France (always used, 84%; often used, 20.5%). Unfortunately, ICU physicians were not queried about the reasons for their reluctance to use percutaneous techniques. Similarly to Swiss ICUs, organizational aspects and lack of adequate training in the use of these techniques could, in part, explain this finding.

We conclude that in the 152 French ICUs that answered the questionnaire, there is a great heterogeneity regarding the reported routine practice of tracheostomy in patients receiving MV. The need for long-term MV and the failure of extubation/reintubation remain the major indications for performing tracheostomy in the opinions of French intensivists. In this setting, tracheostomy is most often considered after a mean time of 3 weeks (*ie*, later than recommended by several consensus conferences).^{13,14} As suggested by three fourths of the physicians answering the questionnaire, a randomized study comparing prolonged translaryngeal intubation and early tracheostomy in patients who are expected to receive prolonged MV would be necessary to clarify those issues.

APPENDIX

Members and Locations of the Commission d'Epidémiologie et de Recherche Clinique

D. Annane (Garches); J. Bohé (Lyon); P. E. Bollaert (Nancy); C. Brun-Buisson (Créteil); Y. Cohen (Bobigny); R. Cremer (Lille); B. De Jonghe (Poissy); F. Feihl (Lausanne); M. Garrouste-Orgeas (Paris); L. Holzappel (Bourg en Bresse); M. Jourdain (Lille); C. Melot (Bruxelles); H. Mentec (Argenteuil); J. P. Quenot (Dijon); and M. D. Schaller (Lausanne).

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