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BRIEF REPORT

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Safety of tracheotomy in neutropenic patients: a retrospective study of 26 consecutive cases

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Abstract *Objective:* To evaluate the safety of tracheotomy in neutropenic ventilated cancer patients, in terms of infectious and haemorrhagic complications.
Design: Retrospective study.
Setting: A medical-surgical intensive care unit in a Cancer-hospital.
Patients and participants: 26 consecutive patients undergoing a tracheotomy in neutropenic period, from 1987 to 1990.
Interventions: Tracheotomy, performed at the bedside or in operating room.
Measurements and results: In all neutropenic patients undergoing a tracheotomy, the characteristics and duration of both neutropenia and mechanical ventilation have been recorded. Stomal bleeding and infection, and infectious pneumonias and alveolar haemorrhage have been carefully reviewed. Platelets were transfused in 23 of the 26 patients at the time of the procedure; no local haemorrhage was observed. Neither stomal nor pulmonary infections secondary to tracheotomy were noted. No respiratory worsening was attributable to the tracheotomy. Nineteen patients (73%) died in ICU, without direct link between tracheotomy and death.
Conclusions: These findings suggest that a tracheotomy can be safely performed in neutropenic patients requiring mechanical ventilation.

Key words Tracheotomy · Endotracheal intubation · Mechanical ventilation · Neutropenia · Cancer

Introduction

Despite substantial improvements in the management of critically ill patients, the prognosis of neutropenic patients undergoing mechanical ventilation (MV) remains very poor, with a mortality rate of 80 to 100% [1–4]. The main factors in this high mortality rate appear to be the duration of neutropenia, of MV during neutropenic period, and of stay in intensive care unit (ICU) [1, 2]. The prognosis is also related to other factors such as the onset of nosocomial pneumonia and the indication for MV [4–6].

It has been reported that tracheotomy reduces the duration of MV and ICU stay [9, 10], and early tracheotomy (within 48 h of MV) could be associated with a lower incidence of nosocomial pneumonia, as suggested in multiple-trauma patients [5]. However, there are no data on the safety of this procedure in neutropenic (and usually thrombocytopenic) patients. We therefore assessed the safety of tracheotomy in neutropenic patients requiring mechanical ventilation, in terms of infectious and haemorrhagic complications.

Materials and methods

We reviewed the charts of all patients with chemotherapy-induced neutropenia referred to our ICU from 1987 to 1990. During this period, 125 neutropenic patients (WBC count $< 1000/mm^3$ and/or neutrophil count $< 500/mm^3$) were admitted, and 80 required MV. Of these 80 patients 26 were tracheotomized. Tracheotomy was per-

formed either at the bedside or in the operating room, in surgical conditions and with general anesthesia. The tracheotomy protocol was standardized, as follows: small horizontal skin incision, separation of the strap muscles, separation and, when necessary, suture ligation of the thyroid isthmus. Hemostasis was obtained prior to incising the trachea, and the tracheostomy tube was inserted immediately to prevent air entry and emphysema. Skin closure, when necessary, was done with loose sutures.

The following characteristics were analyzed in each case: duration of neutropenia and MV, number of platelet units transfused immediately before the operative procedure, incidence of bleeding or local infection at the site of the tracheotomy, and indication for MV and tracheotomy. Lung infections were investigated endoscopically each time suspected by clinical or radiological findings. Bacterial pneumonia was defined by the isolation of 10^3 or more colony-forming units (CFU)/ml on a protected specimen brush. Fungi were considered to be responsible for pneumonia if isolated from the respiratory tract for *Aspergillus*, and if evidence of systemic fungal dissemination was obtained by organ biopsy or post-mortem examination for *Candida*. Viral pneumonia was diagnosed when a virus isolated from the respiratory tract had a cytopathic effect, e.g. the presence of Herpes simplex virus intranuclear inclusion bodies in bronchoalveolar lavage fluid. Alveolar haemorrhage was defined by the presence of more than 20% siderophages among cells recovered by bronchoalveolar lavage.

Results

Twenty-six neutropenic patients underwent tracheotomy (Table 1). The indications for MV were a respiratory ($n = 20$) or a neurological failure ($n = 4$), a cardio-vascular arrest ($n = 1$) or a post-operative MV ($n = 1$); tracheotomies were performed 3.4 ± 6.3 days after onset of MV (median: 1 day), because of long presumed durations of neutropenia and/or MV (early tracheotomies) or because unsuccessful weaning of MV (late procedures).

The mean duration of neutropenia was 24.2 ± 23.6 days (mean $\pm$ SD), and the duration of MV was 14.5 ± 11.2 days, 8.1 ± 7.1 days of which were during the neutropenic period. The WBC count on the day of tracheotomy was $264 \pm 225/mm^3$, and the platelet count was $43 \pm 32 \times 10^3/mm^3$. Twenty-three patients received platelet transfusions before tracheotomy, in order to achieve a count of more than $50 \times 10^3/mm^3$ at the time of the procedure.

No local bleeding was observed in the peri-operative period. Alveolar haemorrhage was diagnosed in two patients before tracheotomy, and did not worsen after the procedure. One patient who remained severely thrombocytopenic despite daily platelet transfusions (platelet count $< 20000/mm^3$) developed interstitial pneumonia after 3 days after tracheotomy; bronchoalveolar lavage at day 6 revealed alveolar bleeding but no evidence of bleeding around the tracheotomy.

No stomal infections occurred. The five patients who developed documented infectious pneumonia (non-haemolytic Streptococci, $n = 2$; *Staphylococcus aureus*, $n = 1$; *Aspergillus fumigatus*, $n = 1$; *Candida albicans*, $n = 1$; *Herpes simplex* virus, $n = 1$; one patient had two bacterias) did so before the tracheotomy procedure (Table 2). Radiographic pulmonary infiltrates extended after tracheotomy in two cases; the first patient (#24) developed ARDS after cardiac arrest, requiring MV and early tracheotomy (day 1); in the other case (#17), pulmonary infiltrates appeared on day 5 following tracheotomy and were associated with *Streptococcus sanguis* and *Staphylococcus epidermidis* bacteremia; both organisms were also recovered from the proximal aspirate, while plugged telescopic catheter specimens remained sterile. Since most of the patients were on antibiotics, a threshold lower than 10^3 CFU/ml on the protected specimen brush was also considered, without incidence on our results.

Two consecutive blood cultures yielded *Bacteroides fragilis* 3 days after tracheotomy in one patient, but the organism was not recovered from the respiratory tract. Three consecutive blood cultures yielded an *Acinetobacter* spp. on the day of tracheotomy in another patient; the only other specimen from which this organism was recovered, despite a full bacteriologic work-up, was the feces.

The incidence of late tracheal complications such as granuloma and stenosis was not assessed systematically, but the 5 patients who left the hospital had no clinically symptomatic laryngo-tracheal complications several months later (two of them underwent a bronchoscopy for another reason, which did not reveal any laryngo-tracheal complication).

Nineteen patients (73%) died in the ICU from refractory hypoxia ($n = 7$), septic shock ($n = 9$), multiple organ failure ($n = 2$) or brain haemorrhage ($n = 1$). No direct link between tracheotomy and death was found.

Discussion

The mortality in neutropenic patients requiring MV is more than 80% in most series [1–3]. In Schuster's series, all patients who remained neutropenic for more than 5 days after the beginning of MV died [1]. Among the approaches used to reduce the mortality rate in this setting are the administration of growth factors to shorten neutropenia, and selective decontamination of the digestive tract to prevent nosocomial pneumonia, but the efficacy of both has been called into doubt [7, 8].

Tracheotomy is usually recommended when prolonged ventilation is necessary [9, 10]; moreover, tracheotomy has been claimed to reduce acquired pneumonia by improving airway suctioning and mouth care [9]. On the other hand, tracheotomy may cause haemorrhaging and stomal infection [11, 12].

Since 1987 we have tracheotomized neutropenic patients when local conditions permit, if it is likely to be beneficial given three main criterias of decision: the presumed durations of neutropenia, of MV during neutropenic period, or the inability to obtain the weaning of MV or efficient airway suctioning (particularly because of

persistent tracheal haemorrhage in thrombocytopenic patients). Our results suggest that tracheotomy is safe when adequate platelet transfusion are given prior to the procedure, including patients with refractory thrombocytopenia (because of anti-platelets antibodies). No local bleeding or infection was observed in this series, and deaths never appeared to be related to the procedure. Moreover, there were no cases of acquired pneumonia directly due to the tracheotomy, in contrast to other reports [12]. Only one patient had a positive blood culture (*Acinetobacter* spp.) within 2 days after tracheotomy, and the only other specimen positive for this organism was the feces. Finally, there were no late symptomatic tracheal stenoses, although this lack of late complications must be confirmed in a prospective study.

In conclusion, tracheotomy appears to be safe in neutropenic patients requiring MV. The usefulness of early tracheotomy, which has been suggested to reduce the incidence of acquired pneumonia in multiple-trauma patients, warrants a randomized trial in this setting.

Table 1 Characteristics of the 26 patients undergoing tracheotomy during neutropenia (*ALL* Acute lymphocytic leukemia, *NSTC* non seminomatous testis cancer, (+) yes, (−) no, *NHL* non-Hodgkin's lymphoma, *ECC* endocrine cells cancer, *A* alive, *D* dead, *AML* acute myelogenous cancer, *Fibr.* fibrosarcoma)

No. of patient	Underlying malignancy	BMT	Duration (days) of			Days of tracheotomy			Days of MV after tracheotomy	Outcome
			Neutropenia	MV	MV in aplasia	WBC count	Platelet count	Platelet infusion		
1	ALL	−	27	26	9	100	36000	+	25	A
2	NHL	+	61	34	23	60	35000	+	32	A
3	NSTC	−	11	43	4	200	16000	+	42	A
4	ALL	−	16	11	10	0	55000	+	10	A
5	NHL	−	6	25	4	300	48000	+	10	A
6	NSTC	−	7	16	3	900	22000	+	13	A
7	Cerebellum cancer	+	21	13	13	600	17000	+	1	A
8	Multiple myeloma	+	19	2	2	200	26000	+	2	D
9	ALL	−	100	1	1	400	47000	+	1	D
10	Osteogenous fibr.	−	3	2	2	200	42000	+	2	D
11	NHL	+	9	1	1	100	10000	+	1	D
12	ECC	−	11	16	11	200	31000	+	13	D
13	Ewing's sarcoma	+	14	23	13	800	7000	+	20	D
14	ECC	−	5	8	5	300	40000	+	3	D
15	NHL	+	82	5	5	400	132000	−	1	D
16	NHL	−	22	11	11	300	23000	+	10	D
17	NHL	−	28	12	12	400	140000	+	12	D
18	ALL	+	25	3	3	600	51000	+	2	D
19	NHL	−	10	12	3	200	36000	+	11	D
20	NHL	+	26	27	4	200	27000	+	26	D
21	Lung cancer	−	7	14	6	200	24000	−	13	D
22	NHL	+	49	30	30	100	70000	+	1	D
23	NHL	+	30	20	18	0	43000	+	20	D
24	NHL	−	4	4	4	200	71000	−	2	D
25	AML	−	17	19	7	100	35000	+	18	D
26	NSTC	−	9	6	3	400	36000	+	4	D

Table 2 Infectious pneumonia in tracheotomized patients (*SNH* Streptococcus non hemolyticus, *SA* Staphylococcus aureus, *BAL* bronchoalveolar lavage, *PSB* protected specimen brush)

No. of patient	Organism isolated	Type of prelevement	Blood cultures	Outcome	Autopsy
1	Herpes simplex virus	BAL[a]		Alive	
6	SNH	PSB (10.000 CFU/mL)	Negative	Alive	
12	SA	PSB (10.000 CFU/mL)	Positive	Dead	No
	SNH	PSB (100.000 CFU/mL)	Negative		
18	*Candida albicans*	Biopsy post-mortem		Dead	Yes[b]
21	*Aspergillus fumigatus*	Biopsy post-mortem		Dead	Yes[c]

[a] Presence of intranuclear viral inclusion bodies
[b] Infection of lungs, kidneys, heart and spleen
[c] Infection of lungs, kidneys, heart, spleen and liver

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ANNOUNCEMENTS

1996

6th International Symposium on Clinical Intensive Care Medicine – Rational Concepts in Intensive Care Medicine: Presence and Future

15–17 February, Bremen, Germany
Information: Prof. Dr. W. Kuckelt, Zentrum für Anaesthesiologie, Klinik für Operative und Allgemeine Intensivmedizin, Zentralkrankenhaus Links der Weser, Senator-Wessling-Strasse 1, D-28277 Bremen, Germany.
Tel.: +49-421-879-731
Fax: +49-421-879-605

16th International Symposium on Intensive Care and Emergency Medicine

19–22 March, Brussels, Belgium
Information: Prof. J.-L. Vincent, Department of Intensive Care, Erasme University Hospital, Route de Lennik 808, B-1070 Brussels, Belgium.
Tel.: +32-2-555-3215
Fax: +32-2-555-4555

2nd World Congress on Pediatric Intensive Care 1996

23–26 June, Rotterdam, The Netherlands
Information: Holland Organizing Centre, Parkstraat 29, NL-2514 JD The Hague, The Netherlands
Tel.: +31-703657850
Fax: +31-703614846

MIE 96 – Medical Informatics Europe, 13th International Congress

19–22 August, Copenhagen, Denmark
Information: MIE 96, c/o DIS Congress Service Copenhagen A/S, Herlev Ringvej 2c, DK-2730 Herlev, Denmark.
Tel.: +45-44-924-492
Fax: +45-44-925-050
Email: mie96@ risoe.dk. Alternatively, subscribe the list mie96-1 with a message to maiser@ risoe.dk. In the body of the message write "subscribe mie96-1". Our Web Server is
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Emergency Management and Critical Care of Stroke

5–7 September, Heidelberg, Germany
This conference is sponsored by the Research Group of Neurological Intensive Care of the World Federation of Neurology (WFN).
Information: Werner Hacke, MD, Professor and Chairman, Department of Neurology, Im Neuenheimer Feld 400, D-69120 Heidelberg, Germany
Tel.: +49-6221-568211
Fax: +49-6221-565348

4th International Symposium on Central Nervous System Monitoring

5–7 September, Gmunden, Austria
Deadline for submission of abstracts for poster presentation and/or free papers: *1 July 1996.*
Information: W. H. Loeffler, MD, Department of Anaesthesiology and Critical Care, LNK Wagner-Jauregg, A-4020 Linz, Austria
Tel.: +43-732-6921-2501/2152
Fax: +43-732-6921-39

9th European Congress on Intensive Care Medicine

23–27 September, Glasgow, UK
Information: Secretariat: Castle House Conferences, 28–30 Church Road, Turnbridge Wells, Kent TN1 1JP, UK
Tel.: +44-1892-539606
Fax: +44-1892-517005