Hanna Mackiewicz-Nartowicz[1], Magdalena Mackiewicz-Milewska[2], Sabina Lach[2], Anna Szymańska-Skrzypek[1], Arkadiusz Owczarek[1], Anna Sinkiewicz[3]

[1]Department of Otolaryngology Head and Neck Surgery Nicolaus Copernicus University *Collegium Medicum* in Bydgoszcz
[2]Department of Rehabilitation Nicolaus Copernicus University *Collegium Medicum* in Bydgoszcz
[3]Department of Phoniatry in Jan Biziel Hospital in Bydgoszcz

Decannulation factors in patients after serious brain injuries

Abstract

Background. Patients with a long term tracheotomy (longer than 4 weeks) are quite frequent patients in the Neurorehabilitation Wards. These are especially patients after serious traumatic brain injuries, ischemic or hemorrhagic strokes, ischemic brain injuries and others. A correct multidisciplinary treatment requires a very close cooperation of: physiotherapists, neurologists, laryngologists and speech therapists.
The aim of our study was to analyze factors that may influence positive decanulation in patients with tracheotomy performed because of the traumatic brain injury, stroke or cardiac arrest.
Methods. Our material includes 127 patients hospitalized in our Department of Rehabilitation between 2002 and 2005. All of them had tracheotomy performed after the brain injury. We analyzed factors like: age, sex, cause of tracheotomy, GCS scale, duration of tracheotomy, concomitant diseases, microbiology examination of the bronchial secretion and the influence of these factors on decanulation.
Results. We confirmed that young age (less than 40), traumatic brain injury and short time of tracheotomy are the positive decannulation factors.

Key words: tracheotomy, brain injury, decannulation

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Introduction

Patients with a long term tracheotomy (longer than 4 weeks) are frequent patients in the Neurorehabilitation Wards. These are especially patients after severe traumatic brain injuries, ischemic or hemorrhagic strokes, ischemic brain injuries. According to several sources, 10–43% of patients hospitalized because of a major brain trauma require tracheotomy. The number of tracheotomies increases to 50–70% with the low Glasgow Coma Scale [1–3]. Hammon recommends tracheotomy in all the cases with the score of 7 and below in GCS confirmed on the 7th day after the trauma [4]. Tracheotomy performed in such patients provides a secure airway, facilitates airway suctioning and prevents laryngeal and tracheal decubitus. Simultaneously, tracheotomy is recommended in the literature because of reduced Intensive Care Unit stay, shortens duration of mechanical ventilation and reduces hospitalization costs [5, 6, 7]. Similarly, in patients with acute stroke requiring long mechanical ventilation tracheotomy should be performed [8]. Rabinstein at all confirmed less pulmonary complications and shorter hospital stays in the tracheotomy group [9].

Address for correspondence: Hanna Mackiewicz-Nartowicz
ul. Stroma 12a/22, 85–158 Bydgoszcz
Tel. 0600091861
Fax: (+48 52) 585 40 35
e-mail: hamack@wp.pl

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When the emergency situation stops the patient after severe brain damage is transferred to Neurorehabilitation Ward. A hard and long work to restore the psychophysical efficiency begins. A multidisciplinary treatment requiring a cooperation of neurologists, specialists of rehabilitation and laryngologists is necessary. Special attention must be paid to laryngological consultations in the management of patients with tracheotomy and dysphagia [10, 11].

Methods

Our analysis was a retrospective study of 127 patients hospitalized between 2002 and 2005 in the Rehabilitation Department of the University Hospital in Bydgoszcz because of the brain trauma, ischemic or hemorrhagic stroke and cardiac arrest consequences. All the analyzed patients had tracheotomy performed before admission to the Rehabilitation Department. Our investigation included 30 women and 97 men at the age from 2 and a half to 72 years. All of them were divided into three age groups:

I — below 20 years of age (31 subjects);
II — 21–40 years (54 subjects);
III — 41–72 years (42 subjects).

The effect of several factors on success of decanulation was analyzed. We estimated age, sex, cause of hospitalization (stroke, brain injury or cardiac arrest), Glasgow Coma Scale in case of trauma, duration of tracheotomy, tracheotomy complications, concomitant diseases and bacterial colonization of the respiratory tract. Laryngological examination was conducted to qualify patients for decanulation. They should have a cough reflex preserved, pharyngeal reflex preserved or diminished, with absence of respiratory tract infection. Laryngeal examination was often very difficult to conduct because of lack of cooperation with the patient. These patients were qualified for endoscopic examination of the larynx and trachea. Endoscopy was performed in the operation theatre of the Otolaryngology Department under the local anaesthesia preceded by premedication or under the general intravenous anaesthesia. Mucosal membrane of the larynx, glottis volume, respiratory mobility of the larynx and upper trachea were estimated. In case of laryngeal and tracheal pathology absence, a special tracheostomy tube with an opening and closed by a cork was placed. The physiological respiratory passage was observed for minimum three days. The tracheotomy tube was removed if there were no respiratory disorders. Patients with profuse respiratory tract secretion, without laryngeal reflex and with pathological lesions present in the larynx or trachea (stenosis, fistula or granulation) were disqualificated on endoscopic examination.

To analyze our data, a χ^2 test and, in case of small groups, χ^2 test in Yates modification were used. The analysis involved the comparison of decannulation and the factors.

Results

A successful decannulation was performed in 40 out of 127 patients, *i.e.* 31.5 %. There were 7 women and 33 men among them. We did not find any statistical positive correlation between sex and decannulation. Analyzing the relationship between age and decannulation, we found a statistically positive correlation at $p = 0.0009$ (Table 1). There were 85 patients below 40years of age group and we successfully decannulated 36 of them (47%).

Analyzing the decannulation ratio and an indication for tracheotomy, we confirmed that, among 50 patients hospitalized because of stroke, 6 patients were successfully decannulated (5 after the ischemic and 1 after the hemorrhagic stroke). 26 subjects were after the cardiac arrest and only 3 of them had the tracheostomy tube removed. 74 patients were hospitalized for the traumatic brain injury and 33 of them were decannulated. This was a statistically positive corelation at $p = 0.0002$.

Analyzing age distributtion in the above groups we found statistically positive dependences. 64 (87%) out of 74 patients after the traumatic brain injury, were below 40 years of age. The finds up for

Table 1. Age and decannulation

Age	Decannulation		Total
	0	1	
Below 20 years	18	13	31
21–40 years	31	23	54
41–72 years	38	4	42
Total	87	40	127

the other groups were as follows: 31 (62%) patients after stroke and 16 (61%) patients after the cardiac arrest were older than 41 years. The correlations were statistically positive at p = 0.0001.

All the traumatic patients were below 6 in GCS at the time of injury. This is the reason why we have not observed any positive correlations between the severity of trauma and decannulation. The duration of tracheotomy was from 1 week to 389 weeks. We confirmed that long term tracheotomy results in decannulation difficulties. The relationship was statistically positive at p = 0,0001. The concomitant diseases were present in 26 patients. These were: diabetes mellitus in 7, renal diseases in 6 and chronic respiratory tract disorders in 11 cases. The concomitant diseases did not influence decannulation. All patients admitted to the Rehabilitation Department had the microbiological examination of the respiratory tract secretion in preparation for decannulation. Only 26 out of 127 patients had the sterile culture. The rest of them, 101 subjects had positive microbiological cultures. The most frequent bacteria present were: Pseudomonas aeruginosa and Staphylococcus aureus. We also found the fungal colonization of Candida albicans. We did not confirm any statistical correlations between microbiological investigation and decannulation.

Discussion

Each patient after a severe brain injury regardless of the cause of the admission to the Rehabilitation Department requires a special care, especially if tracheotomy was earlier performed. Tracheotomy significantly limits the possibilities of rehabilitation. Important exercises in water can not be conducted, respiratory and speech exercises and a therapy for dysphagia are difficult. A personal contact with a physiotherapist during the daily Bobas exercises is also very limited. These exercises require a close patient-therapist contact during the body position changing and during head or trunk supporting. These exercises provoke a cough and bronchial secretion with expectoration. This results in droplet infections spread from the patient to the therapist. The psychological factor also plays an important role. The patient as well as his family do not often accept the need for breathing through the tracheostomy tube. Furthermore, tracheotomy makes entry for respiratory tract infections especially in bed ridden patients. This leads to the increase of treatment costs. Rello at al observed a colonization with typical and atypical bacterial strains in 98 % of patients [12]. Our findings were similar. The necessity of decannulation should not be questioned, however, but it is not easy. Szmeja at al emphasize the difficulties with decannulation due to a subjective impression of dyspnea after the tracheostomy tube has been removed. The authors weaned their subjects away from tracheotomy by gradual reduction in the tube size [13]. The same method was advocated by Citta-Pietrolungo at al in decannulation performed in injured children [14]. We did not encounter such problems among our patients. A few days observation after plugging the tracheostomy tube was sufficient to make an attempt to dacannulate our subject. We were not forced to perform retracheotomy in any case. This was a result of a very accurate selection of patients for decannulation. Each subject had an endoscopic examination of the larynx and trachea to exclude the respiratory tract mechanical obstruction. This is a necessary examination to avoid late tracheotomy complications and it was also emphasized by Szmeja [13], Donnelly [15] and Chintamani [16]. We successfully decannulated 31.5% of patients that had tracheotomy performed because of a serious brain injury.

A number of decannulated patients presented in our material considerably differs from the other authors. Wiel decannulated 80% of treated patients [17], Donnelly 78% of patients [15], but those data originate from the Otolaryngology Wards where tracheotomy was performed mainly due to upper respiratory tract obstruction. Citta-Pietrolungo describes 26 young patients after a brain injury and after tracheotomy. He successfully decannulated 10 of these patients [14]. We did not find any articles in the available literature which would analyze such an extensive material including more than 100 subjects after tracheotomy performed due to serious brain injuries. In the above study, we wanted to share our experience in decannulation of patients of our Neurorehabilitation Ward.

Conclusions

1. In the analyzed group, the most successful decannulations were observed in patients below 40 years of age after a traumatic brain injury.
2. Time interval from tracheotomy until decannulation has a significant influence on decannulation.

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