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Emergency replacement of an obstructed tracheotomy tube in patients receiving palliative or ventilatory care by paramedics — a proper conduct or overstepping of competencies?

Abstract

This article describes the consequences of a situation when paramedics did not attempt to replace an obstructed tracheotomy tube in a patient with respiratory failure treated at home. It also indicates the possible reasons for paramedics' misconduct and actions that should be taken to ensure that paramedics know the scope of their competencies and are capable of replacing a tracheotomy tube at a patient's home. If no adequate action is taken, it may result in additional suffering stemming from the necessity to transport the patient to the hospital.

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Introduction

Patients receiving invasive mechanical ventilation at home are usually patients transferred from intensive care units (ICU), where mechanical ventilation was provided via an artificial airway, in whom weaning from the ventilator was not possible in the course of the underlying disease [1]. Patients whose general condition is stable are frequently hospitalized at the ICU

only due to the need of mechanical ventilation, which may constitute an additional burden for them. Due to the possibility of at-home mechanical ventilation, patients can be discharged from the hospital, which reduces treatment costs associated with hospitalization at the ICU and improves their quality of life [1, 2].

In order to provide care to a patient who is mechanically ventilated via tracheostomy at home, caregivers must be trained by the physician qualifying the patient

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for ventilatory care and the staff of the unit in which the patient is staying prior to their discharge from the hospital. The family or caregiver undergo the training to acquire the skills necessary to ensure that the mechanically ventilated patient is safe at home. The first training concerning the replacement of the tracheotomy tube should be conducted at the hospital, in an environment that provides the caregivers with complete psychological comfort, which increases the safety of patients from the very first day spent at home, when the caregivers are left on their own, without the help of the medical staff. To increase the safety of patients and improve the effectiveness of the training, caregivers should actively participate in the replacement of the first and next tube, i.e. replace the tube under the supervision of a physician [1]. After the patient is discharged from the hospital, caregivers should receive education from the physician and the nurse during each home visit. Even after a thorough training, caregivers' skills may be insufficient, especially during the first period of providing care for mechanically ventilated patients.

In practice, caregivers are often afraid to replace the tracheotomy tube. The first replacement of the tracheotomy tube at the patient's home should be performed between the 7th and the 14th day after its insertion, and it should be replaced every 14 days afterwards [3]. As mentioned above, caregivers should actively participate in the scheduled replacement of the tracheotomy tube in under the supervision of a physician so that in a life-threatening situation, such as an obstruction of the artificial airway, they are able to perform the procedure on their own. Tracheotomy tube obstruction can cause death if caregivers do not take appropriate action within a short period of time [4]. Although the procedure in the case of tracheotomy tube obstruction is repeatedly and thoroughly discussed, in case of sudden deterioration of the patient's condition, caregivers are unable to recognize the cause thereof, and, as recommended by the ventilation center, call the Emergency Medical Services (EMS) Team without replacing the tracheotomy tube.

Case presentation

In March 2018, amyotrophy lateral sclerosis (ALS) was diagnosed at a neurology unit in a 66-years-old female patient. She was referred by her attending physician to a ventilation centre for at-home non-invasive ventilation (NIV). After examining the patient, the anaesthesiologist confirmed the need to urgently implement NIV due to significant hypercapnia. It was planned to apply NIV the next day, but due to incre-

asing dyspnoea the patient was transferred to the ICU at night, where she was intubated and connected to a ventilator. After several days, a tracheostomy was conducted, and, subsequently, the patient was connected to the ventilator at home. The family received training on caring for a mechanically ventilated patient, and the patient was discharged home, to a town 20 km away from a large city.

On the day of the patient's discharge, the attending physician and a nurse from the ventilation centre conducted another training, which covered essential elements ensuring the patient's safety, including: emergency replacement of emergency tracheotomy tube in case of tube obstruction, cleansing of the bronchial tree, operation of the ventilator (including interpretation of basic alarms), pulse oximeter, electric and foot suction pump, and self-expanding bag. Caregivers received education during each subsequent visit of the physician and nurse. After spending 14 days at home, the patient reported increasing dyspnoea in the morning. Her husband noticed significant weakness — the patient was unable to go to the bathroom on her own, which had not been a problem before. Vital parameters measured by pulse oximeter: heart rate 114/minute, blood oxygen saturation (SpO₂) 89%. The patient's husband attempted to suck secretions out of the bronchial tree, but was not able to insert the catheter into the tracheotomy tube to a depth of approximately 6 cm, because of considerable resistance. Concerned about his wife's condition, he called an ambulance due to increasing dyspnoea. The emergency team performed the following actions:

- an assessment of the patient's vital signs: heart rate 123/minute, SpO₂ 83%, blood pressure 160/90 mm Hg;
- electrocardiogram — normal;
- an attempt of suction was made by a paramedic who could not insert the catheter, self-expanding bag was connected — it was found that free ventilation was not possible, which indicated that there was a significant resistance in the airways.

A decision was made to transport the patient to the hospital, which took 25 minutes. Upon the arrival at the Hospital Emergency Department (ED), the patient was unresponsive, SpO₂ 62%; after the replacement of the tracheotomy tube it was found that dried secretions almost completely blocked its lumen. After the replacement of the tracheotomy tube, the patient was connected to the ventilator and 100% oxygen was administered. After 30 minutes, the patient became verbally responsive, the hospital ventilator was changed to the at-home ventilator, and the patient was transported home in stable condition.

Discussion

Insertion of tracheostomy is indicated when it is necessary to perform mechanical ventilation and/or cleansing of the bronchial tree to maintain airway patency [4]; both situations often concern patients diagnosed with ALS. Many of these patients are staying at home under the care of their families or professional caregivers. Assisted by the carers, physicians working at ventilation centres perform scheduled replacements of tracheotomy tubes at home, at intervals of approx. 14 days; if these periods are extended, it increases the risk of tracheotomy tube obstruction, especially in patients receiving oral nutrition. Priorities include educating families and caregivers about tracheotomy tube replacement in the case of a sudden obstruction, as in such circumstances time is critical to patients' survival. Sometimes, however, the family or the caregiver do not attempt to replace the tracheotomy tube even though it is a life-threatening condition, in which case, as recommended by ventilation centres, the emergency medical team should be called immediately.

The Regulation of the Minister of Health of 16 December 2019 lists non-instrumental and instrumental restoration and securing of the patient's airway among medical emergency actions that can be performed by a paramedic, without the order and consent of a physician. In addition, under the above-mentioned regulation, paramedics are obliged to have basic skills related to the cleansing of the bronchial tree, respiratory support, non-instrumental and instrumental artificial lung ventilation with the use of oxygen and air, also using a ventilator, and passive and active oxygen therapy [5]. Based on the above document, it can be concluded that paramedics of the State Emergency Medical Service (SEMS) system have the right to perform all actions related to clearing the artificial airway at the home of the patient.

By properly identifying the problem, i.e. obstruction of the tracheotomy tube (the lack of possibility to insert the catheter into the tube to suck out secretions as well as the lack of possibility to ventilate with the self-expanding bag), and subsequently performing a simple procedure, i.e. its replacement, eliminates the need to transport the patient to a hospital. Transport of patients with impaired ventilation as well as their stay at the ED constitute a threat to their life. Due to their many responsibilities, ED staff may not be able to provide such patients with the attention that they require, especially when their family members and caregivers are absent, due to such circumstances as the COVID-19 pandemic and the restrictions related thereto. The optimal place for such patients is their

home, provided that their families and caregivers receive adequate support from professionals.

SEMS paramedics should know their rights specified in the Regulation of the Minister of Health of 16 December 2019 on medical rescue actions and medical services other than medical rescue actions that can be performed by a paramedic, as well as in the Public Notice of the Speaker of the Sejm of the Republic of Poland of 4 May 2020 on the publication of the consolidated text of the Medical Rescue Act. A paramedic should also be certain that the unblocking of the tracheotomy tube at home will make it possible to avoid the necessity of transporting the patient to hospital; such actions are within his/her competence [5, 6]. Doubts regarding emergency replacement of the tracheotomy tube among paramedics may result in failure to implement an adequate procedure, which may stem from a lack of or insufficient education in the field of artificial airway care during the 3-year undergraduate programme authorizing to practice the profession of a paramedic.

Tracheotomy is a surgical procedure that lies within the domain of a physician whose goal is to create a tracheostomy with a tracheostomy tube [7]. Paramedics are not expected to perform a tracheostomy, but only clear the airways by replacing an obstructed tube in a previously created stoma. A medical rescue student is only taught the technique of performing conicopuncture for urgent indications, so it seems important to make curriculum changes. Since many patients who are mechanically ventilated at home are provided with a tracheotomy tube, medical rescue teams are frequently called to such patients.

The profession of a paramedic requires constant learning and reinforcing professional competencies, including postgraduate education. The Regional Ambulance Station notices the problem of an appropriate approach to patients with advanced diseases, therefore, for several years, the Training and Medical Services Department has been providing education within the field of management of patients requiring palliative care, collaborating with doctors and nurses specializing in palliative medicine and palliative care nursing, respectively. The „Rescue after Hours” series (RAH), i.e. expert meetings organized by a paramedic, an emergency physician and a nurse practitioner, also address topics related to patients receiving palliative care. RAH was the idea of paramedics from Kraków, Grzegorz Nowak and Jerzy Jaskuła, who initiated meetings at which medical topics were discussed. The idea gained approval of the medical community — similar conventions were held in 17 cities in Poland [8–12]. The aim of postgraduate courses and meetings is to change the misconception that paramedics can-

not help patients receiving palliative care. In many patients, certain procedures are not performed due to severity of their diseases and clinical condition, however, it is essential to ensure that pain and other distressing symptoms are adequately treated and that the artificial airway is clear. It is important to ensure that the above knowledge is transferred among medical rescue students, which will better prepare future paramedics to provide help to patients, also those receiving palliative care. Training equipment available at Medical Simulation Centres is useful in practical teaching concerning tracheotomy tube replacement.

Conclusions

Training programmes for future paramedics at undergraduate level, as well as programmes for professionally active paramedics within the framework of postgraduate education, should include emergency replacement of the tracheotomy tube in patients' homes, which makes it possible to avoid patient discomfort caused by hypoxia, transport to the hospital, and their stay at the ED.

Declaration of a conflict of interest

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