

CRITICAL CARE

Assessment of healthcare professionals' knowledge of managing emergency complications in patients with a tracheostomy[†]

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Background. Ear, nose, and throat (ENT) surgeons perform the majority of surgical tracheostomies. Intensive care anaesthetists are increasingly performing bedside percutaneous tracheostomy. The objectives of this study were to characterize emergency complications of tracheostomy and to ascertain healthcare professionals' knowledge of life-saving strategies for the patient with a tracheostomy.

Methods. Seventy staff members in two large teaching hospitals completed an interview questionnaire, comprising a simple clinical scenario and unambiguous questions regarding the emergency management of patients with a tracheostomy.

Results. There were significant gaps in knowledge among healthcare professionals regarding the management of specific tracheostomy-related emergencies.

Conclusions. Knowledge of tracheostomy-related emergencies appears to be insufficient among non-ENT healthcare professionals. This needs to be addressed in order to maximize patient safety.

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Tracheostomy is among the most commonly conducted procedures in critically ill patients. It is performed predominantly in patients who require prolonged mechanical ventilation, frequent suctioning for broncho-pulmonary toilet, or have obstruction of the upper airway. The indications for the procedure have evolved with the ability to keep critically ill patients alive, such that two-thirds of tracheostomies are performed on patients who are in the intensive care unit (ICU).^{1–3}

There are two approaches to tracheostomy: open surgical tracheotomy (ST) and percutaneous dilatational tracheostomy (PT). ST has traditionally been undertaken by ear, nose, and throat (ENT) (otorhinolaryngeology) surgeons. With the increasing use of PT, a wider range of healthcare providers are now directly involved in the care of patients with a tracheostomy and need to be familiar not only with tracheostomy care, but also with the techniques of decannulation and management of acute and life-threatening complications.

Tracheostomy tube displacement, regardless of the operative technique used, may occur at any time. Although

uncommon, such displacement is potentially serious and can be life threatening.⁴ When replacement is required under emergency conditions, the procedure can be difficult, particularly if this occurs early before a tract has had time to form. Multiple factors including obesity, short neck, abnormal anatomy, copious respiratory tract secretions, and excessive granulation tissue can complicate the replacement of a stable airway.⁴ Blind, forceful attempts at tracheostomy tube re-insertion in the early postoperative period can result in the creation of a false passage and possible respiratory arrest. If accidental decannulation occurs before the tract has time to form, then oral tracheal intubation should be performed if possible.^{4,5}

The use of stay sutures placed circumferentially around the tracheal rings has been proposed.⁶ In our centres, stay sutures are routinely used for ST. These sutures are cut long and left out of the wound and then taped to the anterior chest wall. They can be of help

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Questionnaire

Department:

Job Title:

Experience (yr):

Number of tracheostomies/yr in department:

Case Study:

An ICU patient is day 2 post-surgical tracheostomy for prolonged intubation following a head injury. The patient is ventilated. GCS is 6. Forceful coughing causes accidental dislodgement of tracheostomy tube. The photograph represents the clinical picture at the bedside before the tube is dislodged.

Question 1: Have you dealt with this emergency?

Question 2: What is the first thing you do?

Question 3: Do you know what the stay sutures are for?

Question 4: How are they used in the emergency setting?

Question 5: Do you know what to do with the introducer/obturator?

Fig 1 Clinical scenario and questionnaire used in interviews.

during the operation and can be of benefit after it. If the tube is displaced from the trachea in the early postoperative period, traction on these sutures can permit rapid re-intubation.

With a wider range of healthcare professionals now directly involved in managing patients with a tracheostomy, we sought to evaluate their knowledge regarding life-threatening emergencies and to identify key areas in which appropriate management strategies are inadequate.

Methods

A descriptive, exploratory design was used to determine knowledge levels concerning emergency management strategies for tracheostomy patients. A sample of healthcare professionals ($n=70$) from two centres was used to describe this knowledge and identify any differences in knowledge among subgroups of the sample. All interviews were conducted by two investigators (P.C. and E.L.). A pilot questionnaire was tested on a small representative group before the main survey began. Phrases or questions considered to be ambiguous were adjusted. The response deemed most appropriate for each question was based on the opinions of six ICU and ENT consultants from four different centres. The questionnaire (Fig. 1) was based on a short illustrative case history and photograph

showing a tracheostomy *in situ* with clearly labelled stay sutures.

Seventy healthcare workers from two teaching hospitals were recruited. Subgroups comprised ENT specialist registrars (SpRs) and senior registrars (SRs), 1–4 and 5–6 yr on the ENT higher training scheme, respectively; ENT senior house officers (SHOs); anaesthetic registrars (Regs) and specialist registrars; anaesthetic SHOs; ICU nurses and ENT ward nurses. Interviewees were asked to complete a questionnaire regarding the management of early, accidental, dislodgement of a tracheostomy tube. The questionnaire was designed with a very simple formula. We wanted to establish the immediate response of healthcare workers to an acute complication and to ascertain if respondents were aware of the potential hazards associated with attempted tracheostomy tube re-insertion. It was made clear that the patient had no upper airway obstruction and that a surgical tracheostomy had been performed. No time constraint was placed on the participant to complete the questionnaire, and anonymity was assured. Participants were fully informed regarding the nature and objectives of the survey.

As most questionnaire studies examine categorical data, comparison across studies is difficult. In the absence of a comparable questionnaire, we sought to obtain the largest sample size available. Data were analysed using χ^2 test and Fisher's exact test.

Table 1 Number of participants in each group and experience in specialty (yr)

Group	<i>n</i>	Mean years	SD	Range	Experienced this emergency (<i>n</i>)
ENT SpR/SRs	11	5.7	3.7	2–15	4
ENT SHOs	5	1.2	0.4	0.6–2	0
Anaesthetic Reg/SpRs	21	7.4	4.4	3–20	4
Anaesthetic SHOs	5	1.8	0.8	1–3	1
ICU nurses	15	10	7.6	2–25	3
ENT ward nurses	13	10	6.4	2–25	1

Results

The 70 participants included 11 ENT SpR/SRs, 5 ENT SHOs, 21 anaesthetic Reg/SpRs, 5 anaesthetic SHOs, 15 ICU nurses, and 13 ENT ward nurses (Table 1). Experience ranged from less than 6 months to over 10 yr.

Question 1: have you dealt with this emergency before?

Participants were asked whether they had first-hand experience in dealing with ST tube dislodgement in the first 48 h after operation. Less than half of any group had directly experienced this emergency (Table 1). This emphasizes the potential unfamiliarity with early tube displacement among healthcare workers directly involved in caring for post-ST patients.

Question 2: what is the first measure to take?

To establish the immediate action to be taken to protect the patient's airway, we asked for the first action taken by the participants (Fig. 2). Seventy-three per cent ($n=8$) of the ENT SpR/SR group answered that they would use a bag-valve device with jaw-thrust and chin lift or re-establish an oro-tracheal airway. In the equivalent anaesthetic group (Reg/SpR), 52% opted for a bag-valve device or oro-tracheal manoeuvres. Among SHOs, 20 and 100% in ENT and anaesthetics, respectively, opted for tracheostomy tube re-insertion. Seventy-four per cent of ICU nurses and 100% of ENT ward nurses felt re-introduction of the tracheostomy tube was the appropriate action to take. Most ENT trainees stated that re-establishing an oral airway, using a bag-valve device for intubating the patient via the oral tracheal route, was the correct procedure, acknowledging that re-inserting the tube might prove difficult. Twenty per cent of the anaesthetic SpR/Reg group felt that re-establishing the airway via the stoma might be difficult and would orally intubate the patient after one failed attempt. Ninety per cent of ENT ward nurses and 60% of ICU nurses specifically mentioned the tracheal dilator as an aid to re-establishing an airway.

Question 3: do you know what the stay sutures are for? and Question 4: how are they used in the emergency setting?

The number, position, and securing tapes for stay sutures have inter-operator variability, so it is essential that healthcare workers are aware of the concept of stay sutures and how to use them to their advantage in case of emergency. Among the participants interviewed, 100% of the

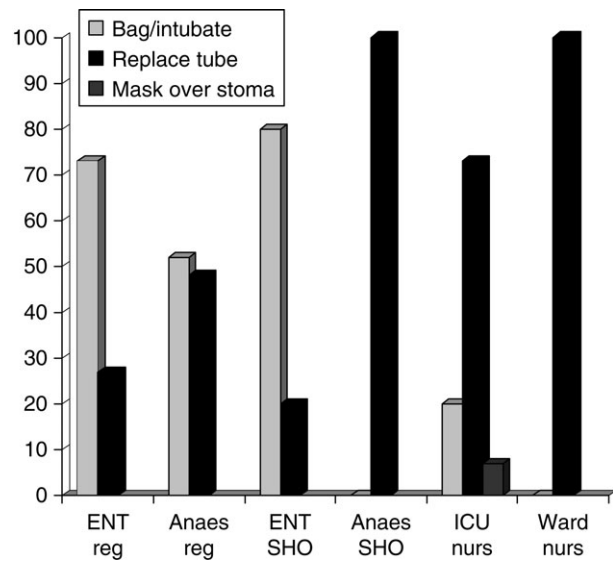


Fig 2 What is the first measure to take to maintain an airway? First-line management to re-establish an airway following accidental decannulation of tracheostomy tube among participant subgroups. ENT reg, ENT SpR/SRs; Anaes reg, anaesthetic Reg/SpRs; Anaes SHO, anaesthetic SHOs; ICU nurs, ICU nurses; WARD nurs, ENT ward nurses.

ENT subgroup was familiar with the concept of stay sutures compared with 23% of the anaesthetic group, 37% of the ICU nurses group, and 31% of the ENT ward nurses group. Four per cent of the anaesthetic group knew what the stay sutures were for but did not know how to use this to their advantage in case of emergency tube dislodgement.

Question 5: do you know what to do with the introducer/obturator?

As discussed subsequently, the introducer is used to avoid creating a false passage upon re-inserting the tracheostomy tube. The tracheostomy tube in this example is a Shiley tube which has a removable inner tube. The introducer that accompanies this tube enables straightforward introduction of the tracheostomy tube. It is inevitably left close to the patient's bedside and is often found secured to the wall above the bed to facilitate accessibility. The interviewees were asked if they knew what the function of the introducer was and it was made clear what specifically was meant by the introducer. One hundred per cent of the ENT group was familiar with the principle of the introducer compared with 81% in the anaesthetic group, 20% in the ICU nurses group, and 31% in the ENT ward nurses group.

Of those who opted for immediate re-insertion of the tracheostomy tube in Question 2, analysis by subgroups showed that 46% of anaesthetists, 63% of ICU nurses, and 69% of ENT ward nurses in this group did not know what the stay sutures were for, and 6, 81, and 16%, respectively, did not know what the introducer was for.

Discussion

Besides being one of the most frequently performed surgical procedures, tracheostomy is also one of the oldest described. Previously the domain of the ENT surgeon, the increasing practice of PT has broadened the spectrum of clinicians performing the procedure. This applies particularly to anaesthetists in the intensive care setting because as many as one-third of critically ill patients will require a tracheostomy. Performance of bedside PT by ICU physicians has positive implications for the ENT service in terms of distribution of workload and for the hospital in terms of cost and resources. However, it is important that all healthcare workers directly involved in the postoperative care of tracheostomy patients can provide proper tracheostomy care, are aware of the potential tracheostomy-related complications, and can manage these complications, particularly in an immediate life-threatening situation. In our centres, percutaneous tracheostomies are performed by the anaesthetists in a large proportion of cases. Surgical tracheostomies are performed by the ENT service in situations where difficulty is anticipated or there are no suitably trained personnel to perform a PT. There is no in-house ENT service on-call in any Dublin hospital. ENT SpR/SRs cover from two to four hospitals at night and as such will rarely be first to the scene in the case of a dislodged tracheostomy tube.

We used the case of an ICU patient 2 days after tracheostomy to highlight the absence of tract formation. After tracheostomy, a tract usually forms by day 5 after the procedure. Before tract formation, careless or forceful tracheostomy tube re-insertion may easily result in the formation of a false passage and initiate a respiratory arrest.

The answer deemed most appropriate by the consultant panel interviewed was to re-establish an oral airway. Although re-inserting the tube is a valid response in this setting, it is often much simpler and safer for an anaesthetic trainee to consider an oral airway. In particular, this should be considered by personnel unfamiliar with features such as the introducer or stay sutures. Although the clinical scenario in this study is very basic, it does highlight that once a tracheostomy tube has been placed, re-intubating or using an oro-pharyngeal method can be overlooked as a means of re-establishing an airway.

This is particularly pertinent among the subgroup that elected to re-insert the tracheostomy tube. Our results accentuate a lack of understanding among these groups regarding the potential pitfalls of attempted re-insertion and suggest that attempts among these subgroups are more likely to result in an adverse event. Our results do not reflect participants' knowledge regarding the general management of patients with a tracheostomy. This scenario was developed specifically to examine knowledge levels

regarding a life-threatening tracheostomy emergency. Myers and Sharp⁷ assessed healthcare professionals' knowledge regarding the emergency ventilation of a tracheostomy patient. In an attempt to establish a comparable knowledge level, we directed the same three-point questionnaire at our participants. Our results compared favourably with Myers' study. Ninety per cent of participants answered correctly. We included this questionnaire to highlight the general understanding among the participants regarding patients with a tracheostomy.

ENT surgeons work within a team of physicians and nurses and must rely on and communicate with others to ensure patient safety and well-being. In addition to direct postoperative communication between ENT surgeons performing ST and physicians and nurses providing postoperative care, we feel that this study emphasizes the need for more tracheostomy-related education to be provided as routine to healthcare workers directly involved in the care of these patients.

It is important to remember that the presence of a tracheostomy tube does not necessarily denote an upper airway obstruction. Attempted re-insertion of a tracheostomy tube should only be undertaken by personnel familiar with the procedure and complications. This study suggests gaps in knowledge among healthcare workers in managing tracheostomy-related complications, specifically pertaining to the purpose of stay sutures and the introducer. This prompts the question whether a questionnaire needs to be administered on a more systematic basis or whether the survey should be repeated after appropriate education. It outlines the need for an information sheet and emergency-based management algorithm to be available at the bedside of every tracheostomy patient.

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