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Emergency tracheostomy management cognitive aid

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Tracheostomies may be inserted to assist weaning from ventilation or to aid airway management.[1] Complications occur in up to 40% of patients, with tube displacement, tube obstruction, pneumothorax and haemorrhage most common.[1–3] Prevention and management of tracheostomy emergencies requires multidisciplinary teamwork, a standardised approach, education, equipment, patient and carer involvement, and effective clinical governance.[1,3,4] The use of clinical decision supports such as cognitive aids also improves performance, supports education, and guides quality improvement.[1,5] The British National Tracheostomy Safety Project has developed extensive resources including emergency algorithms and bedhead signs.[6] We report on the development of an emergency tracheostomy management (ETM) cognitive aid at our institution (Figure 1). The aid is not intended to be used in laryngectomy emergencies.

Austin Health is a tertiary referral hospital with multiple different services involved in tracheostomy care. The intensive care unit (ICU), Department of Anaesthesia, and several surgical units including maxillofacial, thoracic, and ear nose and throat (ENT) provide care for patients with tracheostomies. Two state services, the Victorian Respiratory Support Service (VRSS) and the Victorian Spinal Cord Service (VSCS), also based at Austin Health, provide care to tracheostomy patients with complex ventilation needs and spinal injuries, respectively. The Austin Tracheostomy Review and Management Service (TRAMS) was established in 2002 as a multidisciplinary consultative service.[1] TRAMS coordinates tracheostomy care, management guidelines and education across all disciplines at Austin Health and is a founding member of the Global Tracheostomy Collaborative (GTC).[1] In addition, the departments of anaesthesia and intensive care undertake specific airway education and co-ordination of airway emergencies.

Cognitive aids are tools that enable an experienced individual or team to perform reliably, avoiding both fixation and key omissions.[7,8] They have been described as implementation tools intended to be used in real time and should be distinguished from foundation tools which contain more detailed background information targeting novices.[8] Cognitive aids must be aligned with current best practice and introduced with an education and training campaign so that they are familiar and useable in emergency situations.[8,9] By developing a shared mental model, cognitive aids support team communication and facilitate transfer of leadership when required.[10] The key steps of cognitive aid development include staff familiarisation, implementation and long-term cultural change.[7,8] Developing a cognitive aid for tracheostomy emergencies is particularly complex (see Table 1).[5]

The Austin Health code blue team responds to all airway emergencies and includes an intensive care trainee, an anaesthetic trainee, a medical trainee and a senior ICU nurse. The amount of direct experience in managing tracheostomy emergencies may vary and while code blue team members are expected to have

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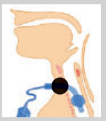
EMERGENCY TRACHEOSTOMY MANAGEMENT

PRIMARY RESPONDERS

Not to be used for laryngectomy patients

Blocked tracheostomy

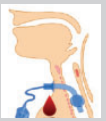


1	Initiate Respond Blue	■ Call code blue ext xxxx
2	Remove	■ Inner cannula (if present) ■ Speaking Valve ■ HME
3	Deflate the cuff	
4	Instill/ Suction/ Nebulise	■ Instill 5ml saline lavage ■ Suction ■ Apply saline nebuliser and suction PRN
5	Oxygen	■ Apply oxygen via nose/ mouth and tracheostomy If tracheostomy remains blocked: > 7 days post initial insertion, consider tracheostomy change by experienced staff < 7 days post initial insertion, do NOT change the tracheostomy. Wait for CODE BLUE team

Accidental decannulation

1	Initiate Respond Blue	■ Call code blue ext xxxx
2	Oxygen	■ Apply oxygen via nose/mouth and tracheostomy stoma if required Consider: > 7 days post initial insertion, experienced staff can reinsert the tracheostomy < 7 days post initial insertion, do NOT reinsert tube. If long blue stay sutures present, pull anteriorly to keep stoma open while waiting for CODE BLUE team

Bleeding from tracheostomy



1	Initiate Respond Blue	■ Call code blue ext xxxx
2	Protect airway	■ Inflate cuff ■ Sit patient up Note: Hyperinflation of tracheostomy cuff +/- direct digital compression may help in the event of catastrophic bleeding
3	Oxygen	■ Apply oxygen via tracheostomy if required
4	IV access	■ Establish wide bore IV access Note: <10mls bright blood activate Urgent Clinical Review Notify surgeon responsible for inserting tracheostomy A CT angiogram neck is recommended to exclude possibility of a tracheo-arterial fistula

FRONT – this side to be displayed

To be completed by airway specialist at time of insertion (Anaesthetist or ICU Doctor). If not completed please contact: TRAMS (ext XXXX – Mon-Fri 8:30 to 5pm) / Anaesthetics (ext XXXX) / ICU Doctor (ext XXXX)

PATIENT

UR

Name

DOB

TRACHEOSTOMY INFORMATION

Insertion method

☐ Surgical ☐ Percutaneous

Insertion date ⁄ ⁄

Size ☐ 6 ☐ 7 ☐ 8 ☐ 9

Cuff ☐ Yes – Air / Water ☐ No

Last tracheostomy change ⁄ ⁄

UPPER AIRWAY INFORMATION

Date ⁄ ⁄

Difficult upper airway

☐ Yes ☐ No ☐ Unknown

Laryngoscopy grade

Laryngoscopy device

Mask ventilation (BMV)

☐ 2 hands ☐ Guedel

LMA type / size

COMPLETED BY

Name

Designation

THIS COGNITIVE AID TO REMAIN WITH THE PATIENT AT ALL TIMES

Images in pathway title boxes adapted with permission (NTSP Manual 2013. www.tracheostomy.org.uk) Version 2.0 / Date: 31/07/2020

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Figure 1. Emergency tracheostomy management cognitive aid.

EMERGENCY TRACHEOSTOMY MANAGEMENT

ADVANCED RESPONDERS

Not to be used for laryngectomy patients

Difficulty breathing or ventilating via tracheostomy tube

Stop when patient is stable

1	Remove attachments and inner cannula	**Remove / disconnect** ■ Ventilation circuit and filter ■ Speaking valve or heat moisture exchanger ■ Inner cannula
2	Suction	**Pass suction catheter through entire length of tracheostomy tube** ■ If suction catheter does not pass: **DO NOT VENTILATE VIA TRACHEOSTOMY TUBE** and proceed to Step 3 ■ If suction catheter passes easily, look listen and feel at tracheostomy – If breathing, apply oxygen via tracheostomy, consider partial obstruction – If not breathing, ventilate tracheostomy with air viva. **STOP IF HIGH RESISTANCE**
3	Deflate tracheostomy tube cuff	**Look, listen and feel at mouth** ■ If breathing via upper airway, apply oxygen to face ■ If not breathing, manage upper airway – mask ventilate/LMA/ intubate **Consider partial obstruction whether or not breathing**
4	Patient causes	■ Rapidly consider patient causes e.g. large pneumothorax, anaphylaxis, sputum plugging
5	Consider immediate bronchoscopy	**Consider immediate bronchoscopy of tracheostomy tube if scope available and the following apply** ■ New tracheostomy (<10 days old) and ■ Obstructed upper airway
6	Remove tube	■ **Remove tracheostomy tube and proceed to the next emergency pathway (Completely removed tracheostomy tube)**

Completely removed tracheostomy tube

Stop when patient is stable

1	Assess breathing	■ Patient may be breathing adequately via the tracheostomy stoma or upper airway, no immediate action may be required
2	Consider replacing tracheostomy tube	■ If greater than 7 days post initial insertion, experienced staff can reinsert tracheostomy tube
3	Upper airway	■ Manage upper airway - mask ventilate/ LMA / intubate
4	Upper airway and tracheostomy at same time	■ **Airway team** – manage upper airway ■ **Neck team** – via tracheostomy 1. Primary measures: LMA or paediatric mask over stoma 2. Secondary measures: endotracheal or tracheostomy tube in stoma **Consider:** **– traction on stay sutures** **– tracheal dilators** **– endotracheal tube on bronchoscope** **– bougie / exchange catheter** **– guidewire and Melker**
5	New surgical airway	

Bleeding from tracheostomy

Complete all steps

1	Protect airway	■ Sit upright ■ Hyperinflate tracheostomy cuff ■ Consider pushing finger on bleeding point ■ Pass large bore suction catheter if required
2	Oxygen and IV access	■ Oxygen via tracheostomy ■ Establish wide bore IV access
3	Urgent contact	■ ENT and/or Thoracic surgery ■ Charge Anaesthetist ext xxxx ■ Theatre ANUM ext xxxx
4	Go to theatre or interventional radiology	**Note:** **– a small bleed may precede a life threatening bleed from a tracheo-arterial fistula**

IN ALL CASES

1. Confirm tracheostomy not laryngectomy
2. Confirm airway information on opposite side
3. Apply oxygen via tracheostomy and face mask
4. Call Code Blue ext xxxx and assess ABC
5. Use capnography as soon as possible
6. Call surgeon if required

THIS COGNITIVE AID TO REMAIN WITH THE PATIENT AT ALL TIMES

An advanced responder is a trainee or consultant doctor with specialist airway skills eg Anaesthetist, Intensivist, ENT/Thoracic/Maxillofacial surgeon.

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Figure 1. Continued.

Table 1. Considerations in the design of a tracheostomy emergency cognitive aid.

Logistical	• Patients may be located in critical care (intensive care, operating suite, emergency department), hospital ward or community/home-based care. Different equipment and expertise available in these settings.[1, 5] • Team dealing with emergency comprises bedside primary responders and then successive advanced responders. • Emergency team personnel almost always different. • Multiple clinical groups responsible for patients with tracheostomy. All need to be involved in cognitive aid development.[1, 5]
Nature of tracheostomy emergencies	• Four primary emergencies with some similarity in how they present.[2] • Bleeding may be associated with decannulation and tube obstruction and can result in significant hypoxia, therefore airway should be immediate focus.[2] • Blocked tube may mimic displaced tube, misaligned tube and pneumothorax.
Incorporation of important principles	• ABC approach.[5] • Oxygenation immediate priority, rather than a secured airway.[5] • Key questions to be considered to assist decision-making in a tracheostomy emergency: (1) Confirm tracheostomy not laryngectomy. (2) Upper airway easy or difficult to manage (if upper airway is not difficult, which is likely in 70% of patients, then it is a sensible rescue route).[1] (3) When was tracheostomy performed. (4) Surgical or percutaneous insertion (may be difficult to reinsert tracheostomy tube for 7–10 days post percutaneous tracheostomy procedure but may be able to access surgical tracheostomy stoma earlier).[5] • Positive pressure ventilation via tracheostomy tube displaced from trachea can result in subcutaneous emphysema and bad outcome.[5]
Cognitive aid design	• Focus of cognitive aid: bedside, intermediate or expert responders or all groups. • Single emergency pathway or three or more problem-specific pathways which require clinician decision-making about which pathway to follow.[5] • Including both ventilated and spontaneously breathing patients presents design challenges. • Whether advanced technical skills and equipment (e.g. bronchoscope) required in crisis circumstances should be included.[5] • Titles of emergency pathways may be technical (e.g. decannulation), or suggest a diagnosis (e.g. blocked tube).

ABC: airway, breathing, circulation.

more advanced critical care skills than bedside staff, they are not necessarily tracheostomy experts.[5] A group was therefore formed to develop a cognitive aid for use by the code blue team in such situations. The task group decided to include three different emergency pathways in contrast to the single generic algorithm approach used in the British guideline.[5] The use of three emergency pathways was already successfully established in the hospital in the TRAMS cognitive aid and existing education and training. A bleeding pathway was felt to be important due to its potential catastrophic significance.[1,11] The task group also thought consideration of alternative causes for an apparently blocked tracheostomy tube was important. The use of a bronchoscope is advocated in tracheostomy emergency[5] and it was considered valuable to provide guidance on its appropriate use. A linear rather than a branched algorithm approach was used to try and more simply reproduce real-life workflow of the expert clinicians on the task group.[8,10] A displaced or blocked tube may require removal, therefore it was considered logical for it to be placed prior to decannulation/completely removed tube. Bleeding may present as difficulty breathing or ventilating or a blocked tube so appropriate for it to follow the first two pathways. There was a determination to include only important and not excessive information;[8] however, this was challenging given the variable experience of the code blue responders. Use of a title (e.g. suction) for each step with an accompanying description of the implications or further actions required in that step was chosen as a method to address this expertise gradient. An academic communication designer (TGS) worked with an intensivist (CMF), an anaesthetist (JMG) and TRAMS to develop the overall appearance and to maximise clarity and impact with the aid of end-user feedback.[8,9] The ETM cognitive aid is printed in A3 size. The development and implementation of this cognitive aid will allow us to continue to monitor the incidence and outcomes of tracheostomy emergencies and modify its design and tailor educational activities to optimise patient safety.

The ETM cognitive aid is placed at the bedhead of every patient with a tracheostomy alongside emergency equipment. While tracheostomy emergencies are infrequent,

they are challenging to manage and have a high risk of poor outcomes. Multidisciplinary training and a cognitive aid such as we describe may improve patient outcomes.

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