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National Tracheostomy Safety Project

The Faculty of Intensive Care Medicine

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50 YEARS

Guidance For:

Tracheostomy Care

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Tracheostomy Care

Prepared on behalf of the Council of the Intensive Care Society by:

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Our patients assume safe care and expect high-quality care.

1. Executive summary, key standards and recommendations

The patient population in NHS hospitals that are managed with a tracheostomy has evolved significantly over the last 20 years. The majority are performed percutaneously by intensivists, in the Intensive Care Unit, on critically ill patients or those recovering from critical illness. Most tracheostomies are temporary.

The vast majority of patients with 'surgical' and 'non-surgical' tracheostomies experience critical care at some stage of their journey. The multidisciplinary nature of tracheostomy care is a familiar working environment for our speciality, with tracheostomy care being perhaps one of the best examples truly multidisciplinary care.

There is increasing evidence from national and international quality improvement programs that a multidisciplinary tracheostomy team that reviews and coordinates the management of tracheostomy patients can bring benefits for the quality and safety of care, including organisational efficiencies and significant cost savings.

All patients with tracheostomies admitted to critical care units should expect safe care to be delivered by appropriately trained, equipped and supported staff. Patient-centred high-quality care also focusses on communication, vocalisation, mobilisation, information and a prompt return to oral intake. Improving the quality and safety of patients with tracheostomies and laryngectomies is a hospital-wide issue, and our speciality is well placed to lead and to contribute to the safe management of this vulnerable patient group.

International quality improvement efforts should be supported. The key drivers of the Global Tracheostomy Collaborative (GTC) are examples of the hospital-wide changes that are required, which will involve and impact the ICU. The GTC key drivers are:

1. **Multidisciplinary team-based care:** Multidisciplinary tracheostomy team replacing siloed care, meeting face-to-face to coordinate and plan care, overcoming barriers to effective communication between providers. Such team-based care has been shown to reduce adverse events, length of stay, time to decannulation, increase speaking valve use and facilitate patient communication.
2. **Standardisation of care:** Standardised care protocols provide consistency in care, environment, equipment, and patient and provider expectations. Instituting such pathways and procedures promotes coordinated care, increases efficiency, and improves outcomes in airway emergencies.
3. **Broad staff education:** All patient encounters must involve healthcare staff who have been appropriately trained in tracheostomy care. Educational interventions have demonstrated marked improvement in objective knowledge and confidence with providing tracheostomy care, translating into safer patient care.
4. **Patient and family involvement:** Patients, their family and their carers are engaged in QI. Prioritising patient-centred care identifies key clinical outcomes, performance measures, and improvement areas that may otherwise not have been recognised.
5. **Patient-level data:** Hospitals track outcomes using a prospective database with detailed patient-level data captured each tracheostomy admission. Analytics allow the multidisciplinary team to benchmark over time and anonymously with peers within the Collaborative to assess the impact of initiatives.

This is a standards document. Reference to external resources such as those provided by the ICS, FICM, RCoA, NTSP, GTC and individual hospitals (amongst others) are signposted throughout. Key evidence-based standards and recommendations are made at the end of each chapter. Key standards and recommendations are summarised in the table overleaf.

Table: Key standards in this document linked to key drivers to improve the quality and safety of tracheostomy care.

Key driver	Key standards
Multidisciplinary (MDT) team-based care	**All in-patients with a tracheostomy are seen at least weekly by a tracheostomy MDT.** **Appointment of an institutional lead (Champion) for tracheostomy care.** All patients considered for tracheostomy as part of their critical illness will have a multidisciplinary discussion about the benefits and burdens of elective tracheostomy as part of ICU management. If a patient is discharged from an ICU with a tracheostomy in situ, the ICU has a responsibility to ensure that receiving locations are adequately prepared to receive and manage the patient.
Standardisation of care	**Institutional multidisciplinary tracheostomy group with oversight of tracheostomy care.** **Institutional tracheostomy policy in place.** All patients under the care of an ICU team will have an appropriate consent form completed prior to elective tracheostomy, whether occurring in the ICU or the operating theatre. All ICU tracheostomy insertion procedures must include a checklist and LocSSIP. Appropriate equipment to safely perform tracheostomy will be immediately available on the ICU. Tube selection should be a multidisciplinary discussion, especially for patients with abnormal anatomy. Sub-glottic suction tracheostomy tubes should be used as standard for new tracheostomy. Weaning from ventilatory support and decannulation should be conducted in a consistent manner.
Broad staff education	**Bedside staff caring for tracheostomy patients will have received training in tracheostomy care as per local policy.** New or existing staff who might be called upon to respond to a tracheostomy emergency must be appropriately trained, equipped and supported. All staff involved in insertion of a tracheostomy in ICU or in managing the upper airway and/or performing bronchoscopy to facilitate tracheostomy will be sufficiently trained and considered competent. All patients with a tracheostomy must have communication and swallowing needs assessed by an SLT with referral when the decision to wean from the ventilator has been made and the sedation hold started. Staff must have the knowledge and equipment to facilitate safe vocalisation, through the use of comprehensive cuff deflation strategies aligned to weaning plans, one-way/speaking valves, and alternative methods of vocalisation such as ACV. All tracheostomy and laryngectomee patients must have a bedhead airway sign. All bedside staff caring for a laryngectomee must understand the airway implications.

Patient and family involvement	**Institutional Patient Champion engaged in QI program.** All patients and/or their family/carers will be involved in insertion discussions if appropriate. Verbal and non-verbal communication methods must be made available to patients with a tracheostomy. Bedside staff must be familiar with their use. Information will be made available to patients and/or their family/carers regarding tracheostomy.
Patient-level data	**Aggregate patient level data is collected, analysed and reviewed to benchmark and assess the impact of QI measures.**

2. Tracheostomy in light of COVID-19

The publication of this document was delayed by the global COVID-19 pandemic. The pandemic resulted in a surge of patients requiring relatively prolonged intubation and ventilation, with around 10% of this patient group requiring a tracheostomy. The highly infectious nature of the SARS-CoV-2 virus meant that usual considerations for tracheostomy and usual care for patients with a tracheostomy were adjusted. As the community learns more about how best to manage this disease, some of the guidance will evolve. Detailed discussion of care of the COVID-19 tracheostomy patient is beyond the scope of this document, but the principles are outlined below, with signposting to appropriate resources.

Concerns about the protection of healthcare staff who will be undertaking airway management procedures in patients with confirmed (or suspected) COVID-19 initially led to changes in the timing of tracheostomy for those patients requiring prolonged ventilation. This was primarily to avoid exposing the patient and insertion team to the risks of insertion if a tracheostomy was not going to impact on patient care. A generally more conservative approach to tracheostomy was adopted.

Tracheostomy may have some advantages in protecting staff by delivering ventilatory support via a closed system (cuff inflated positive pressure ventilation) in preference to a trial of extubation and possible non-invasive respiratory support and/or re-intubation. However, whilst a closed system protects staff, it likely disadvantages patients, who will not be able to experience cuff deflation strategies early in their tracheostomy journey. International expert consensus statements suggested limiting tracheostomy interventions to the minimum necessary to provide safe care. This meant reductions in the frequency of routine care such as inner cannula changes, stoma care and suction, and limiting endoscopy and FEES. ‘Dry’ circuits using a HME filter instead of active humidification were also recommended. There are limited outcome data emerging that suggest these strategies did not increase harm for patients and they seemed to have protected staff. However, as we learn more about this disease, considering when the risk of infection becomes low enough in a given patient to adopt more ‘usual’ care and interventions will be important in engagement and rehabilitation.

At the time of publication, the guidance for tracheostomy management in the COVID-19 era is limited to expert consensus statements and opinion. The changes in practice were supported by an NHS England Safer Tracheostomy Care initiative which will evolve into a comprehensive quality improvement programme via the Adoption & Spread workstream. With further data collection and analysis, best practice recommendations are likely to evolve. Current guidance for the UK and internationally are detailed below.

NTSP COVID-19 information

http://www.tracheostomy.org.uk/healthcare-staff/improving-tracheostomy-care/covid-19

NHS England Safer Tracheostomy Care Toolkit

http://www.tracheostomy.org.uk/storage/files/Safe%20TrachyCareToolkit%20V9b.pdf

McGrath et al. Tracheostomy in the COVID-19 era: global and multidisciplinary guidance

Lancet Respiratory Medicine (HEALTH-CARE DEVELOPMENT) VOLUME 8, ISSUE 7, P717-725, JULY 01, 2020

https://www.thelancet.com/journals/lanres/article/PIIS2213-2600(20)30230-7/fulltext

McGrath et al. Multidisciplinary guidance for safe tracheostomy care during the COVID-19 pandemic: the NHS National Patient Safety Improvement Programme (NatPatSIP). Ananesthesia…

https://onlinelibrary.wiley.com/doi/full/10.1111/anae.15120

3. Introduction

This is the third revised standards document on tracheostomy care and the first developed by the joint standards committees of the Intensive Care Society (ICS) and Faculty of Intensive Care Medicine (FICM).

Since the widespread adoption of bedside percutaneous tracheostomy in the critically ill, there has been a change in the patient population who are managed with temporary or permanent tracheostomy in the NHS. Whilst indications for surgical tracheostomies have also evolved, increasing numbers of complex patients recovering from critical illness have been managed with tracheostomy, bringing a responsibility for critical care staff, units and their national bodies to provide guidance and standards for this vulnerable group. Around two-thirds of all new tracheostomies are now performed in Intensive Care Units (ICUs) on 'ICU' patients, who have predominantly 'medical' problems. Alongside this critical care activity, there is also a wider responsibility to ensure that our tracheostomy patients are discharged from critical care units into safe locations, with appropriate equipment, training and standards provided in all locations where patients with tracheostomies are managed.

The first standards document was prompted by an appreciation of a national need to improve the care of patients with tracheostomies in both critical care units and on general wards. Such concerns were raised in part by reports to (and from) the NPSA, MHRA, Coroners and other bodies. The NAP4 audit 2011, NCEPOD study 2014, and other reports highlight continuing issues: namely obstruction, dislodgement, bleeding, hypoxaemia and cardiac arrest. These problems are significantly more serious in the critically ill and/or ventilator-dependent patient, with critical care units consistently highlighted as a high-risk environment for airway management, including tracheostomy.

There is rightly an increasing awareness and focus on the needs of patients and families who experience tracheostomy care, with groups such as the National Tracheostomy Safety Project (NTSP) and the Global Tracheostomy Collaborative (GTC) emerging over the last 10 years. Their work, amongst others, challenges organisations to provide not just safer care, but the highest possible quality of care. Recent qualitative research in the UK could be summarised by stating that **our patients *assume* safe care and *expect* high quality care**. High quality care focusses on the things that are important to patients; eating, drinking, vocalisation, mobilisation, decannulation and information for patients and their families before, during and after tracheostomy.

Advances in the non-invasive management of respiratory failure, increased tolerance of trials of extubation and increased awareness of the potential problems associated with temporary or permanent tracheostomy have led to a likely stabilisation in the number of new procedures performed in our ICUs over recent years. However, tracheostomy continues to be an important procedure available to the multidisciplinary healthcare team and is likely to remain a relevant intervention as increasingly frail and complex patients are admitted to our units. A typical UK ICU can expect between 10-20% of their level 3 admissions will undergo tracheostomy, depending on their case mix, and these patients will spend longer on the ICU and in hospital, occupying a disproportionately high number of ICU bed days and ventilator days. The NTSP's Improving Tracheostomy Care program identified that around 80% of 'typical' patients with a new or existing tracheostomy are admitted to ICU or HDU at some point in their hospital stay where they spend a median of 23 days, mostly receiving some sort of invasive respiratory support. Tracheostomies remain in situ for a median of 28 days and hospital stays are typically 50 days, with wide variations between patients, units and hospitals.

The major indication for tracheostomy remains facilitating anticipated weaning from artificial mechanical ventilation for patients with significant comorbidities, although actual or threatened airway compromise and invasive respiratory physiotherapy are common indications. Many surgical tracheostomies are also admitted to the ICU, with over 90% of all new tracheostomy patients spending at least some time on the ICU.

Since the original ICS Standards, there have been a number of detailed national guidelines, which are referred to in this document. This document provides a reasonably concise overview, referring to more detail available elsewhere. The main focus of this document is on the care of adult patients with a temporary tracheostomy in the critical care unit, although many elements are applicable elsewhere. We must ensure that our own medical, nursing and allied health staff are prepared and supported in caring for patients and their families with tracheostomies, but also recognise the role that intensive care medicine can play outside of our units in supporting and troubleshooting problems and in ensuring high quality, safe care is provided. This is increasingly relevant out of regular working hours, where often by default, the multidisciplinary skills of the critical care team are called upon.

The multidisciplinary nature of tracheostomy care is a familiar working environment for our speciality, with tracheostomy care being perhaps one of the best examples of bringing expertise from different clinical backgrounds together for patient benefit. There is increasing evidence from national and international quality improvement programs that a multidisciplinary tracheostomy team that reviews and coordinates the management of tracheostomy patients can bring benefits, including reductions in time spent receiving ventilatory support, time in ICU, time with the tracheostomy in situ and time in hospital. As well as improving the quality and safety of care, these tracheostomy teams have also demonstrated a significant impact on the cost of care, mostly through organisational efficiencies and reductions in patient safety incidents.

With the vast majority of patients with tracheostomies experiencing critical care at some stage of their journey, our speciality is well placed to lead and to contribute to the safe management of this vulnerable patient group.

4. Indications for tracheostomy and patient selection

Historical procedures were usually undertaken to provide emergency 'surgical airways' to relieve obstruction to the upper airway, caused by trauma or tumour. Whilst this indication remains, the advent of modern intensive care has seen a demand for prolonged mechanical ventilation. This is usually best achieved via a tracheostomy if the patient requires ventilation for more than around 7-10 days, although timing should be considered on an individual basis.

In modern medical practice, the indications have widened both for temporary and permanent tracheostomy. Indications for tracheostomy can be considered as:

- to facilitate weaning from artificial ventilation in acute respiratory failure and prolonged ventilation
- to enable long-term mechanical ventilation of patients, either in an acute ICU setting or sometimes chronically in hospitals or in the community
- to secure and maintain a patent (clear) airway in actual or potential upper airway obstruction
- to secure and maintain a safe airway in patients with injuries to the face, head or neck and following certain types of surgery to the head and neck
- to facilitate the removal of bronchial secretions where there is poor cough effort with sputum retention: direct suctioning of the trachea can be performed by introducing a catheter via the tracheostomy
- in an attempt to protect the airway of patients who are at high risk of aspiration, that is patients with incompetent laryngeal, pharyngeal or tongue movements, absent or impaired swallow function e.g. neuromuscular disorders, Prolonged Disorders of Consciousness (PDOC), unconsciousness, head injuries, stroke, etc. A tube with a cuff can keep some secretions or aspirated material out of the airways that would otherwise enter the lungs.

There is no convincing data that can guide clinicians as to the timing of tracheostomy. Prolonged use of a trans-laryngeal tracheal tube can cause functional problems with the larynx and the upper airway, and the tube is unpleasant to tolerate, almost always necessitating sedation. Balancing the risks of managing an airway with prolonged trans-laryngeal tracheal tube, versus the risks of tracheostomy (procedural and post-placement) is usually difficult. For specific circumstances, such as extensive elective head and neck surgery or a patient with a clear and prolonged indication for tracheostomy, the decision can be straightforward.

Risks of prolonged trans-laryngeal intubation:

- Unpleasant to tolerate
- Prolonged sedation required
- Difficult to re-institute respiratory support without re-intubation
- Upper airway trauma
- Damage to vocal cords
- Breaches larynx, aspiration risks
- Blockage and displacement
- Post-extubation dysphagia
- Post-extubation dysphonia

Risks of tracheostomy:

- Invasive procedure
- Bleeding and airway loss during procedure
- Blockage and displacement risks after procedure
- Stoma infection or breakdown
- Scarring, tracheomalacia, glottic and subglottic stenosis
- Damage to adjacent structures e.g. oesophagus, recurrent laryngeal nerve

The 2014 NCEPOD report highlighted a significant proportion of critically ill patients underwent tracheostomy without an attempt at primary extubation. Whilst it may be clear that an individual patient requires a tracheostomy from early in their journey, advances in sedation and ventilation strategies in recent years mean that the majority of ventilated patients can undergo a spontaneous breathing trial. The early use of non-invasive ventilation following extubation may also avoid re-intubation in some circumstances.

Tracheostomy insertion often commits the patient to prolonged supportive care which can lead to long-term placement in healthcare or nursing facilities. Whilst this may be entirely appropriate and desirable by the patient and their family, a permanent or long-term tracheostomy is a significant lifestyle consideration with burdens for both the patient and their family or carers. All reasonable efforts to establish the patient's wishes for long-term support following critical illness should be explored by the critical care team. This may involve multidisciplinary input or formal best interests meetings. The indications, burdens and benefits of tracheostomy at the time of insertion should be clearly documented in the patient's clinical record by a senior clinician. This information must be communicated to the patient where possible and appropriate and to their family or carers.

Units are encouraged to offer printed information to patients and their families. Examples can be obtained and adapted from the NTSP website.

Indications for tracheostomy summary

Standards:

- All patients considered for tracheostomy as part of their critical illness will have a multidisciplinary discussion about the benefits and burdens of elective tracheostomy as part of ICU management.
- All patients and/or their family/carers will be involved in discussions if appropriate.
- Information will be made available to patients and/or their family/carers regarding tracheostomy.

Recommendations:

- Multidisciplinary discussion within the ICU team is documented.
- Discussion with the patient and/or their family/carers is documented.
- Printed or multimedia information is offered to the family/carers and to the patient when appropriate.

Information is available from www.tracheostomy.org.uk

5. Insertion

Percutaneous tracheostomy is the highest risk elective procedure that occurs on an ICU. As such, units must prepare, rehearse and train all staff involved to perform the procedure as safely as possible.

National Safety Standards for Invasive Procedures (NatSSIP) have been in place since 2015. These detail the standards and considerations for safe performance of procedures, the principles of which can be adapted to Local Safety Standards for Invasive Procedures (LocSSIP). The FICM and ICS have produced WHO-style checklists for percutaneous tracheostomy that can be adapted into LocSSIPs and the NTSP has co-produced a more detailed checklist (see further resources).

Around two-thirds of tracheostomy procedures are now performed by intensivists in ICUs rather than by surgeons in operating theatres, with over 90% of ICU tracheostomies performed percutaneously at the bedside. A tracheostomy may be fashioned by an open surgical or percutaneous dilatational technique (PDT), either as an emergency, emergent or elective procedure.

Consent and preparation

Tracheostomy in the critically ill should almost always be a planned procedure, with the benefits and burdens weighed up by the MDT over a period of days prior to insertion. This should allow ample time to explain the procedure to the patient's relatives and the patient (if appropriate). Appropriate consent has been considered good practice since the last ICS standards document. In light of the NCEPOD report and several Coronial reports into peri-procedural adverse events, consent must be considered mandatory. It is anticipated that the majority of consent forms will be for patients who lack capacity, necessitating discussion with the patient's family. Where appropriate, attempts should be made to utilise communication aids and support to determine patient capacity and facilitate consent.

Standards and best practices that apply if the patient was transferred to the operating theatre for tracheostomy must apply if the procedure is performed on the ICU. Many of the adverse events reported to NAP4, NCEPOD or incident reporting systems (such as the NRLS or the GTC) around tracheostomy are predictable and can be prevented by appropriate planning and preparation. Appropriate preparation includes that of the equipment, the patient, the team and planning for difficulty.

Although perhaps unfamiliar to some staff in ICU, human factors are increasingly acknowledged as perhaps the most important element of managing procedures, procedural complications and emergencies. Human factors include environmental influences, team behaviours and individual performance, each of which have been comprehensively addressed in the DAS guidelines for airway management in the critically ill. Cognitive aids such as checklists and algorithms can improve performance in stressful situations and must be employed prior to undertaking potentially high-risk invasive procedures such as tracheostomy insertion.

Equipment preparation

- Airway management kit
- Endoscopic kit for visualising the trachea
- Tracheostomy insertion kit
  - Percutaneous insertion set
  - Limited surgical set if appropriate
- Monitoring
  - End-tidal CO_2
  - Visible timer
  - Vital signs, including SpO_2 with audible sound

Critically ill patients have a higher incidence of potentially difficult airways than found in routine anaesthetic practice. This is compounded by the extended neck position and limited access that can occur during tracheostomy. The person managing the airway must be competent to do so, with all relevant equipment immediately available. Videolaryngoscopy with a screen visible to all can make manipulations of trans-laryngeal tracheal tubes easier. Similarly, an endoscope with a screen visible to all will help teamwork and communication. Supraglottic airways may be used for airway management and are particularly suited to patients with relatively low airway pressures.

End-tidal CO_2 is mandatory for any airway manipulation. Particular care must be given to which breathing circuit the capnograph is attached to as confusion can occur if, for example, an additional circuit is used to connect to the new tracheostomy tube whilst the capnograph remains attached to the ventilator circuit connected to the tracheal tube.

A visible timer is a useful addition and is present on most modern bedside vital signs monitors.

Patient preparation

- Positioning
- Ultrasound of the neck to identify vessels and depth from skin to trachea
- Stopping and aspirating enteral feeding
- Appropriate ventilation settings
  - 100% oxygen
  - Consider a volume controlled/guaranteed mode
  - Consider a 1:1 I:E ratio
- Identify team member who will monitor vital signs
- Set haemodynamic and oxygen saturation parameters and agree actions
- Check clotting, anticoagulants, antiplatelet agents
- Agree sedation strategy

Patient positioning is important. The neck should be extended by placing a pillow or similar device under the shoulders. Tilting the bed or torso 30 degrees or so head up will reduce venous pressure and may reduce bleeding. The patient should be moved laterally towards the side of the bed that the operator will stand.

Ultrasound is recommended prior to the procedure to identify significant vessels and the depth to the trachea. The use of peri-procedural ultrasound is limited at present by the footprint of commonly available probes.

Stopping and starting enteral feed can cause problems with glycaemic control in the critically ill. Prolonged fasting prior to tracheostomy is probably unnecessary, especially as gastric mobility may be impaired. Aspiration of gastric contents prior to airway management is a sensible precaution.

Use of an endoscope will impair ventilation and appropriate adjustments to ensure adequate oxygenation should be made prior to the procedure. Patients will often deteriorate during a tracheostomy due to suboptimal positioning for ventilation and interruption/inadequate ventilation. There are no defined parameters that make a tracheostomy safer to perform, but typically a patient should be receiving less than around 50% inspired oxygen and requiring less than around 10cmH_2O PEEP prior to tracheostomy. For patients with raised intracranial pressure, the position required for tracheostomy insertion may be a relative contraindication.

An identified team member must be responsible for monitoring vital signs and responding to changes with agreed actions. Appropriate sedation and adequate neuromuscular blockade should be used. Airway manipulation can be very stimulating, requiring an increase in opiate and sedative medication. A vasopressor may be required to manage periods when direct airway manipulation is not occurring.

Local anaesthesia with an additional vasoconstrictor such as adrenaline may help to reduce bleeding from the superior tissues. Before administering any drugs, allergies or intolerances must be checked.

Staff preparation

Staff should introduce themselves by name and role, identifying an airway operator, airway assistant, tracheostomy operator and a runner. A team leader should be identified who ideally does not have another role. It is prudent to know how and where additional anaesthetic and surgical assistance can be summoned. For higher risk cases (for example with clotting or anatomical problems) the procedure should be timed following discussion with surgical colleagues so that they are on site and available to assist if required.

Prepare for difficulty

Critically ill patients may have known or anticipated difficulty in managing the airway, compounded by prolonged oral intubation, laryngeal and oral cavity trauma or secretions, nasogastric tubes, patient positioning and physiological instability. A clear plan must be verbalised for managing the upper airway.

Similarly, a clear plan of the key steps of tracheostomy tube insertion must be verbalised, including the number of attempts at tracheal puncture and the planned order of endoscopic confirmation of tracheostomy tube position, suction and then ventilation. It is important to identify who will be summoned to help, what the plan is for unexpected bleeding and what will occur of the tracheostomy tube cannot be inserted.

Sign out

Clear instructions must be given to bedside staff regarding the care required following tracheostomy insertion. The same standards must be applied as if the patient had left an operating theatre.

The position and orientation of the tracheostomy tube must be checked and documented, with the patient in the position that they will be nursed in (rather than the insertion position). This should include the distance from the carina, which is especially important for adjustable flanged tubes. A tube that is considered inadequately positioned must be changed whilst the team and airway equipment are all available. This usually requires a larger or longer tube.

The tube must be secured, and the purpose of any sutures identified, with instructions for removal documented. There is no clear evidence that suturing a tube in place reduces displacement, but the commonest and most significant problem that occurs with a new percutaneously inserted tracheostomy tube is displacement, requiring the tube to be secured adequately.

Chest X-rays are not routinely required unless complications are suspected.

The sedation and ventilation plan should be reviewed and confirmed, along with thromboprophylaxis or anticoagulation plans. Simple analgesia is usually required for patients whose sedation will be reduced.

A bedhead sign is an effective method of communicating key facts about a tracheostomy in an emergency and must be completed by the operator as part of the sign out process. The bedhead sign must include details of any difficulties managing the upper airway. Signs can be downloaded (and adapted if necessary) from the NTSP website.

Staff competence

The competencies required to participate in tracheostomy insertion are not just limited to technical skills, but include human factors, situational awareness, teamworking and communication.

Competencies in airway management are defined by the FICM and RCoA. Typically, staff managing the upper airway will have completed an Initial Assessment of Competency (IAC) in airway management (or a recognised equivalent level of competence) and have completed a minimum of 3 months of training in Anaesthesia.

Additionally, staff managing the upper airway will be required to use an endoscope during the procedure, although this could conceivably be performed by an additional person. The FICM syllabus describes basic competency for endoscopy and bronchoscopy.

Competencies for percutaneous tracheostomy insertion are defined by the FICM and RCoA Step 3 (Advanced) training requirements for ICM. Consultants and senior staff must reflect on their own competency and frequency of tracheostomy insertion; annual appraisal is an appropriate opportunity. There are currently no standards around the frequency of training or the frequency of performing tracheostomy to be considered competent.

For some units, it may be preferable to have a limited group of consultants or senior staff who are considered competent to insert tracheostomies. This group would be expected to be able to maintain their competencies by more frequent exposure to the procedure.

Similarly, training opportunities for trainees and skills maintenance opportunities for senior staff may be limited. It may not always be appropriate to expose non-ICM or junior trainees to the tracheostomy procedure on the ICU in order to preserve opportunities for regular or senior staff for whom tracheostomy insertion remains an important skill to develop or maintain.

In considering the required responses to this standards document, it may be useful to work back from the perspective of considering a death on the ICU due to a major complication of tracheostomy insertion (e.g. major haemorrhage or loss of the airway). Is the ICU able to defend the environment, equipment, procedure and competency or level of supervision of those staff involved?

Surgical or percutaneous?

There is no conclusive evidence to justify recommending surgical or percutaneous dilatational tracheostomy (PDT) over each other. The main advantages of PDT at the bedside of the critically

ill patient are logistical; transfer to the operating theatre is not required and the procedure can be performed in a timely manner, without waiting for an appropriate window in the patient's ongoing critical care for the procedure to coincide with theatre and surgical availability. The choice will be affected by available expertise, local practices, and individual patient characteristics. Surgical techniques are beyond the scope of this document, but situations in which they may be required are discussed below.

There are no comprehensive datasets that can directly compare the risks and benefits of each approach and the guidance below is based on consensus opinion. Analysis of large datasets may help to clarify some of these guidelines in the future.

Percutaneous insertion can be considered as a purely 'needle through skin' technique, or as a hybrid surgical technique with varying degrees of tracheal exposure prior to puncture of the trachea. Similarly, a surgical technique may involve surgical exposure of the trachea, but entry into the trachea could be achieved with a percutaneous set, or by opening the trachea with a scalpel.

As a principle, an operator undertaking any surgical exposure of the trachea or using a percutaneous insertion kit must be appropriately trained and/or supervised.

Surgical techniques have the advantage of a wider exposure of the structures of the neck which may allow easier haemostasis, especially if significant blood vessels or the thyroid isthmus overlay the trachea. Surgical techniques also allow the insertion of 'stay' or 'maturation' sutures, which may be beneficial if tracheal access for later tube changes could be difficult. However, these techniques require additional skills, training and equipment that is not readily available at the bedside. The larger incision and wound associated with a surgical approach may also take longer to heal than a purely percutaneous approach in the critically ill and may not provide such a tight seal against stomal air leaks for patients ventilated with relatively high airway pressures. Surgical tracheostomies may be more suitable for patients with burns, recent neck surgery or cervical spine injuries.

Percutaneous procedures involve a much smaller incision and potentially less tissue trauma, with the tamponading effect of the percutaneously inserted tube at least partly effective in reducing post-procedural bleeding. However, significant bleeding can still occur and should be anticipated and planned for. Percutaneous procedures are not necessarily contraindicated in patients receiving anticoagulants or antiplatelet agents and discussion with surgical colleagues is recommended. Factors influencing the risk/benefits include the anatomy, the experience of the operator, the chosen technique, the anticoagulant strategy and clotting results. Percutaneous procedures are safest when the trachea can be identified and easily palpated, with sufficient space between the cricoid cartilage and the sternal notch to puncture the trachea between the second and third tracheal rings. Surgical techniques are usually more appropriate when bleeding is anticipated (especially from an identified vessel) or when anatomical landmarks are difficult to identify. Patients with known or suspected head and neck cancer may benefit from a more precise surgical exploration.

A surgical tracheostomy can usually be changed safely after 2 or 3 days, although this depends on the surgical technique, anatomy, stay sutures and often, surgical preference. After 7-10 days, most tracheostomy stomas will have healed adequately to be considered 'established' enough that the stoma will remain patent if a tube is temporarily removed. It doesn't matter too much at this point how a stoma was initially created. This period of time elapsing does not guarantee that tube reinsertion is straightforward, however. If a tube change is required within 7 days of percutaneous tracheostomy, it may be safer to actively manage the upper airway (sedation and re-intubation) and electively re-insert or change the tube.

A bedhead sign must be completed whatever the method of insertion so that responders to an airway emergency can clearly identify the nature of the tracheostomy stoma.

Surgical tracheostomy

Surgical technique is described comprehensively in surgical texts and although usually confined to the operating theatre, there may be situations where surgical expertise or assistance is required at the bedside of a critically ill patient requiring tracheostomy, either electively or in an emergency. All units should have close links with their head and neck surgical colleagues and agree what equipment must be immediately available on the ICU for surgical tracheostomy. Discussions should be held well in advance of any urgent or emergency procedures, and provision of staff and equipment reviewed following surgical intervention in a tracheostomy procedure on the ICU.

Whilst the precise nature of surgical equipment will be influenced by local considerations, if an ICU is performing tracheostomies at the bedside, then the location of the following equipment should be agreed:

- Surgical tracheostomy instrument set, typically containing
  - Tissue tweezers, mosquito forceps, scissors, muscle and skin retractors, and Mayo needle holder, scalpels, tracheal dilating forceps, tracheal hooks
- Adequate overhead light source
  - Headlight may be preferred by surgical teams
- Diathermy

Elective or emergency tracheostomy?

Almost all tracheostomies performed on the ICU should be planned. There are occasions however when an emergency tracheostomy could be required. These are discussed in the 2018 Difficult Airway Society guidelines for the management of intubation in the critically ill.

Following a failed intubation and attempts to oxygenate via the upper airway, emergency airway access is recommended to occur via surgical approaches to the cricothyroid membrane. This is the default strategy for ‘Plan D’ in these difficult situations. However, the DAS guidance recognises that many intensivists are skilled in percutaneous tracheostomy insertion and provision is made for this in the guidelines. There may be advantages in securing an airway with a tracheostomy, principally to provide more effective ventilation than with a smaller calibre cricothyroidotomy tube (especially in acute lung injury) and to facilitate long-term ventilation. However, insertion of a percutaneous or surgical tracheostomy takes significantly longer than an emergency surgical cricothyroidotomy and should only be undertaken if the situation demands it and by those trained to do so. A patient who has had been recently decannulated is an example of a special circumstance where emergency tracheostomy may be safer and quicker than a cricothyroidotomy.

All units should adopt the DAS guidelines and the principle of providing emergency surgical airway access via the cricothyroid membrane is commended to staff working in intensive care. Medical staff providing airway management to critically ill patients must be trained in emergency surgical cricothyroidotomy and undergo regular rehearsal of airway management scenarios with the multidisciplinary ICU team. The requirement for emergency tracheostomy should be considered and planned by the unit management and multidisciplinary team.

Tracheostomy insertion summary

Standards:

- All patients under the care of an ICU team will have an appropriate consent form completed prior to elective tracheostomy, whether occurring in the ICU or the operating theatre.
- All staff involved in managing the upper airway and/or performing bronchoscopy will be sufficiently trained and considered competent.
- All staff involved in insertion of a tracheostomy in ICU will be sufficiently trained and considered competent.
- Appropriate equipment to safely perform tracheostomy will be immediately available on the ICU.
- All ICU tracheostomy insertion procedures must include a checklist and LocSSIP. Standard templates are available from the FICM/ICS and the NTSP (see below).

Recommendations:

- Medical leadership on the ICU must consider the skill mix of the consultant and senior team with respect to tracheostomy insertion. It may be appropriate to limit the number of staff who insert tracheostomies.
- Competency to manage an airway and insert a tracheostomy must be considered for all permanent medical staff. Annual appraisal is a good opportunity to review this.
- Competency to manage an airway (and insert a tracheostomy for more senior trainees) must be considered for all new trainees as part of induction medical staff.

Further resources

www.ficm.ac.uk/safety-and-clinical-quality/safety-checklists-invasive-procedures

www.tracheostomy.org.uk

6. Tracheostomy tube types and choice

There are a variety of different tracheostomy tubes available from a number of manufacturers, each with their own characteristics. It is advisable to use an initial tracheostomy tube that is compatible with the insertion kit (usually from the same manufacturer), although it is possible to insert different tubes with different kits. The tube required by an individual patient may change with time and should be reviewed regularly, ideally by the tracheostomy multidisciplinary team.

There may be advantages in stocking only a limited range of tubes from specific manufacturers. This approach may aid familiarity for staff and make education easier. This needs to be balanced against the requirements for the variety of patients managed at the institution. An informed decision by those involved in tracheostomy care is advised.

Tubes may be classified by material, internal diameter, proximal and distal length, angle, presence of a cuff, presence of fenestrations, presence of subglottic suction port and presence of an inner cannula.
The clinical factors to be considered when selecting a tracheostomy tube for a patient are listed below.

Respiratory function: Most temporary tracheostomies will be inserted whilst a patient is on an ICU and still requiring some positive pressure ventilation. Typically, this will require the use of a non-fenestrated cuffed tracheostomy tube. However, it is recognised that long term mechanical ventilation can be delivered through an uncuffed tube.

Secretion management: Sub-glottic suction is likely to reduce the incidence of ventilator-associated pneumonia as part of a bundle of interventions. Standard tracheostomy tubes are available with sub-glottic suction ports. These ports can also be used for above cuff vocalisation (see later).

Abnormal airway anatomy: Upper airway endoscopy following percutaneous insertion suggests that a standard tracheostomy tube may be anatomically unsuitable in as many as a third of adult patients. Obese patients, or those with local neck swelling or oedema, may require a tube with an extended proximal length, whilst patients with fixed flexion abnormalities may not easily accommodate tubes with a fixed angulation.

Airway pathology: Localised airway pathology such as tracheomalacia, granuloma formation etc, may on occasion necessitate the use of a tracheostomy tube that has a longer distal length than standard.

Weaning: Many patients can be ‘weaned’ from mechanical ventilation to decannulation without any need to change from the cuffed tracheostomy tube initially inserted. In some cases, it may be useful to consider options such as downsizing or an uncuffed which promote greater gas flow out via the upper airways, allowing vocalisation and promoting laryngeal rehabilitation. Fenestrated tubes may also promote vocalisation, but there are associated risks of surgical emphysema (when used with positive pressure ventilation) and risks of developing granulation tissue, tracheomalacia and stenosis. Other options for vocalisation should be explored first.

Clinical environment: Tubes with an inner cannula that is able to be easily removed and cleaned have a lower incidence of obstruction. For patients who are attached to a warmed and humidified closed ventilator circuit the benefits of a tube with an inner cannula may not be so marked. For patients receiving high inspired oxygen concentrations or high airway pressures, the risks and benefits of circuit disconnection and loss of PEEP associated with cleaning an inner cannula should be balanced against the potential risks of blockage. For patients on open breathing circuits

or on less respiratory support (typically 50% inspired oxygen concentration) inner cannula are recommended. Inner cannulae will also narrow the effective internal diameter of the tracheostomy tube, potentially increasing airflow resistance and the work of breathing.

Patient preference is important for alert patients or those with long term tracheostomies.

Some tubes have specialist features such as foam-filled or fluid-filled cuffs, tight-to-shaft cuffs, materials and coatings to reduce biofilm formation or systems to continuously inflate or irrigate the cuff and subglottic space. At present there is no evidence to clearly recommend one tube type over another.

Selecting the correct tube is important, especially if the patient has it inserted percutaneously, as it may take 7 days or more for the stoma to mature to more safely allow tube changes. The choice of the size and type of tube for initial insertion may be clinically obvious from the factors detailed above. However, tube size often comes down to experience and the multidisciplinary team can be invaluable. There may be a role for pre-procedural ultrasound or imaging in tube selection, although at present, there are no clear guidelines for tube selection. There is ongoing research into this important area.

Videos and information describing tube types in detail are available from the NTSP website and the e-learning in Anaesthesia e-learning modules.

Tube types summary

Standards:

- Tube selection must be a multidisciplinary discussion, especially for patients with abnormal anatomy.
- Sub-glottic suction tracheostomy tubes should be used as standard for new tracheostomy. These tubes can reduce the incidence of pneumonia (as part of a bundle of care) and can allow Above Cuff Vocalisation (ACV) without needing to change the tube.

Recommendations:

- ICUs must consider the range of tubes they stock and use. There is a balance of limiting stock to improve familiarly, but also of providing an adequate range of devices to cater for patient mix.
- Staff must be familiar with the variety of tubes available within the ICU.
- Consider patient preference for long term tracheostomy patients.

7. Routine care of the established tracheostomy

Many potential complications of tracheostomy care can be prevented by basic care, done well. In the ICU, many of these roles will fall to nursing staff, but all multidisciplinary staff managing patients with tracheostomies should be aware of the principles of routine care. These should be considered when reviewing a patient with a tracheostomy.

Cleaning of the tube

Tracheostomy tubes are artificial airways and may become blocked with secretions or blood. To reduce the chance of blockage, inspired gases must be warmed and humidified where possible and secretions regularly suctioned.

Inner cannula must be removed and checked at least once per nursing shift (every 8-12 hours), although the frequency of checking will depend on patient factors. If a patient has a lot of secretions for example, the frequency should increase. The inner cannula can be cleaned and replaced in many instances, although some cannulae are disposable. It is advisable to keep a spare inner cannula at the bedside so that circuit disconnections to change inner cannulae are kept to a minimum.

The outer part of the tube can be cleaned simply with saline solution. The whole tracheostomy tube should be changed in line with the manufacturer's recommendations; typically, every 28 days.

Stoma care

Tracheostomy stomas need to be kept clean and dry. This is usually achieved by applying a specific absorbent dressing around the tube which will also reduce the chance of direct pressure from the wings of the tube itself. The stoma should be inspected at least once per day.

If infection is suspected, then the stoma must be swabbed. Barrier creams are sometimes necessary if there are lots of secretions. Specialist tracheostomy nurses, head and neck surgical colleagues and tissue viability nurses are a good source of advice if there are problems with the stoma. Granulation tissue may be treated with topical steroid creams.

The purpose of any sutures in or around the stoma must be clarified at the time of insertion and documented on the bedhead sign, with a clear plan for removal.

Cuff deflation and cuff management

The tracheal mucosa has a capillary blood supply which will be compromised by the presence of a tracheostomy tube cuff at high pressure, a problem compounded by critical illness. The cuff pressure should be maintained as low as possible to prevent air leaks from the upper airways and ideally below 25cmH_2O. Some systems can continually monitor and adjust cuff pressure within set parameters and these systems likely control cuff pressures more accurately and more safely than intermittent manual checks.

For manual checks, the cuff pressure should be checked at least once per nursing shift (typically 8-12 hours).

If the ventilator peak inspiratory pressure exceeds the cuff pressure, then leakage of inspired gas past the cuff can be anticipated. This does not mean that the cuff has failed necessarily. However, leakage of gas from the upper airways during ventilation, the patient being able to vocalise, the requirement for high cuff pressures or repeated addition of gas to the cuff may indicate that the

tube is malpositioned or of an inappropriate size, or defective. The patient must be reviewed by a healthcare practitioner competent in tracheostomy care.

Cuff deflation should be a goal of routine care of patients with tracheostomies. This can be a complex decision and is best taken following multidisciplinary review by the ICU team and Speech & Language Therapists (SLT) and physiotherapists. The risks of aspiration may be mitigated by a constant upwards flow of gas under positive pressure past the deflated cuff, although an individual assessment is warranted. Fibreoptic Endoscopic Evaluation of Swallow (FEES) by a trained SLT is invaluable in informing a risk assessment for cuff deflation trials and attempts at oral intake.

Clearance of subglottic secretions from above the cuff should occur prior to cuff deflation. This is best achieved by using a tube with a subglottic suction port. Oral secretions may need to be addressed prior to deflation (see below).

Cuff deflation increases the work of breathing as a variable proportion of inspired gas 'escapes' via the upper airways and does not ventilate the lungs. Cuff deflation should normally start as a short trial under direct supervision, extending the frequency and duration of deflation guided by weaning parameters (such as respiratory rate or evidence of fatigue).

A ventilator that can tolerate significant leakage of gas needs to be employed for cuff deflation trials. The inspiratory pressure may need to be increased to allow for leakage and reduced ventilatory effectiveness. Patients often require rest after periods of cuff deflation and cuff deflation should form part of an overall weaning strategy, including clear parameters for success and failure, and clear plans for the ventilator setting.

Patients should be reassured that any discomfort or unpleasant tastes or smells will usually resolve. Vocalisation is usually possible and is of significant emotional and practical benefit to the patient, their family and to staff. There are likely additional beneficial effects on laryngeal sensory and motor function by promoting trans-laryngeal airflow.

If a significant leakage of gas via the upper airways does not occur when the cuff is deflated, then downsizing to a smaller tracheostomy tube should be considered. If problems persist, it may also be prudent to rule out laryngeal pathology such as oedema or vocal cord immobility using visualisation such as laryngoscopy, FEES or laryngeal ultrasound.

If cuff deflation becomes established and tolerated, an uncuffed tube should be considered.

Secretion management

To reduce the chance of blockage, inspired gases must be warmed and humidified where possible. Dehydration will increase sputum thickness.

Suction can be 'open' (insertion of a separate single-use suction catheter) or 'closed' (suction catheter is part of the breathing circuit). A closed system reduces the number of times a breathing circuit is interrupted and may be advantageous if the patient is continually ventilated. Suction catheters are of different lengths and diameters. Specific tracheostomy closed suction catheters are shorter than the endotracheal equivalents. This may not be long enough if a long or adjustable tracheostomy tube is used. Care should be taken to avoid airway trauma when using longer suction catheters.

Inability to pass a suction catheter is a 'red flag' and may indicate that the tube is badly positioned within the airway. A prompt review by an experienced professional is warranted. Fenestrated inner cannula can cause partial obstruction of the passage of a suction catheter and should be replaced by a non-fenestrated inner cannula prior to suctioning.

Humidification is important for patients with tracheostomies and laryngectomies, especially if the cuff is inflated and therefore the natural warmth and humidification of the nose bypassed. Humidification requirements and effectiveness should be regularly reviewed with multidisciplinary input, especially from respiratory physiotherapists. Mucolytics may be of benefit in some circumstances.

Secretions may be from below or above the glottis. Oral secretions may be significant, especially if the swallow is affected. Controlling oral secretions is beneficial for mouth care, for reducing aspiration risk and associated pulmonary infections, and may help progress a patient towards cuff deflation.

Copious secretions require multidisciplinary input respiratory physiotherapy assessment and SLT swallowing assessments are important. Strategies for managing oral secretions include:

- Good oral hygiene
- Regular sub-glottic suctioning
- Treat any lower respiratory tract infection
- Anti-sialagogues
  - Sub-lingual atropine (eye drops work well)
  - Systemic anticholinergics (hyoscine, glycopyrrolate)
  - Salivary gland Botox injections (under image guidance)
- Improving laryngeal function
  - ACV
  - Pharyngeal Electrical Stimulation
  - Trials of cuff deflation
  - one-way valves e.g. Passy Muir

Mobilisation

It can seem quite daunting to mobilise an invasively ventilated patient, but this has benefits for physiological and psychological wellbeing for the patient. Many long-term tracheostomy patients in the ICU are awake enough to appreciate being mobilised, either out of bed our out of the ICU if possible. Careful planning with physiotherapy, nursing and medical teams is important, and the patient and their family should be involved if appropriate. Essential equipment must accompany the patient if they are moved, along with monitoring.

Units should consider access for ventilator-dependent tracheostomy patients who could be mobilised away from their bed space, accounting for associated equipment and staff, and identify possible safe locations for visits. A risk assessment should occur prior to moving a patient from the ICU.

Monitoring

Routine monitoring should be used whilst a patient is invasively ventilated. Monitoring for tracheostomy insertion on the ICU must be to the same standard as if the procedure occurred in theatre.

Capnography is mandatory for invasively ventilated patients. However, there are some situations when the benefits of continuous capnography may not be as marked, although this is an individual risk assessment for that moment in the patient journey. When a tracheostomy cuff is deflated, a capnograph waveform is not always detectable by side stream analysis due to the escape of

expired gas via the (unmonitored) upper airways. Continuously connected capnography may not be of benefit in this situation. Similarly, a mobile patient may find closed suction and capnography add weight to the circuit and may contribute to inadvertent decannulation risks.

If capnography is not used in these circumstances, it must be immediately available at the bed space.

Some longer-term patients with tracheostomies will not require full monitoring all of the time – again, this is an individual decision that should be risk assessed, and the decision may alter over time.

Changing tubes electively

Tracheostomy tubes should only be changed by trained and competent staff. Tube changes are an opportunity to assess and clean the stoma. Time may be limited if the patient is ventilator-dependent. A surgically inserted tracheostomy tube does not necessarily need to be changed by a surgeon, although the timing and circumstances of the first tube change should be agreed and communicated at the time of insertion.

Patients should be monitored at levels appropriate to their condition, and the predicted ease or difficulty of replacement. Technologies to confirm correct placement should be immediately available (capnography and endoscopy).

The first tube change should necessitate a high degree of preparation and planning, as the ease of re-insertion of the new tracheostomy tube is unknown. It may be safer to perform the first tube change over a bougie or similar device (expert opinion). The ease (or otherwise) of the first tube change should be clearly documented in the patient record and/or the tracheostomy passport. This should include recommendations for subsequent tube changes.

It is essential that a plan is made prior to removal of the existing tube that covers:

- Pre-oxygenation
- Ventilation if appropriate
- The agreed procedure if the tube cannot be inserted
  - Calling for help – who/how/where
  - Additional equipment
  - Additional drugs

Lubricating gel with local anaesthetic may be of benefit.

A sufficiently experienced staff member may wish to use adjunctive sedation for tube changes. This strategy risks a reduction in spontaneous ventilation and means that the operator must be confident and competent to deliver adequate ventilatory support. There is also a risk that patients may expect sedation for tube changes in the future which may create logistical problems for long-term patients.

Locations (cohorting)

Critical care units must be safe locations to manage patients with tracheostomies. Bedside staff must be trained, equipped and supported in providing safe, high quality care.

Depending on the case mix of the hospital site, one or more additional locations should be identified within the hospital that can adequately care for tracheostomy patients. The designation of such

locations should be taken at high level within the organisation with input from the tracheostomy team. These additional locations may require the support of the ICU team and associated services (such as outreach nursing), especially out of hours, and especially for non-head and neck wards. This is a local decision, but one in which the support of the ICU will be important.

The potential flow of a new patient with a tracheostomy or laryngectomy arriving in the hospital via a planned or unplanned route should be considered by those responsible for managing the locations that could be impacted, including the ICU. Creating safe locations within the hospital other than the ICU may help to relieve bed pressures for these complex patients and the support of the ICU staff and expertise in establishing and maintaining appropriate standards in these locations may be beneficial to the ICU, and to patient flow.

Equipment

Comprehensive details of equipment that must be present at the bedside of a tracheostomy patient and equipment that must be immediately available within the unit are available from the NTSP.

Local infection control practices may limit the amount of equipment immediately at the bedside but as a guide, any equipment that may be required for routine care must be available. Equipment should include a spare tube, spare inner cannulae, cleaning equipment, suction and a system or device to measure or monitor cuff pressure. Scissors or a stitch cutter to remove sutures must also be available.

Appropriate humidification must be used at all times. Details of the 'humidification ladder' are provided by the NTSP but anyone admitted to a critical care are with a tracheostomy is likely to benefit from active humidification with a closed or open system.

A suitably stocked airway trolley must be available with a range of basic and advanced equipment to manage the upper airways and the tracheostomy. This must include immediate access to an endoscope, with NICE recognising the benefit of disposable endoscopes in their immediate potential availability.

Appropriately skilled staff with airway expertise must also be available to attend the unit immediately.

The tracheostomy multidisciplinary team

Comprehensive management of the tracheostomised patient requires input from a wide range of staff from a variety of backgrounds, which may cross traditional working boundaries. The Global Tracheostomy Collaborative has evaluated a multidisciplinary team-based model of care which has been demonstrated to have a significant impact on the safety and quality of care, translating into significant improvements in organisational efficiency.

The composition of a team will vary depending on local circumstances and expertise, but should typically include:

- A tracheostomy specialist nurse
- An Intensivist or Anaesthetist with an interest in tracheostomy care
- A Head and Neck Surgeon
- A Speech & language Therapist
- A Respiratory Physiotherapist
- A Dietician

The team should meet together and review all relevant patients regularly (most published models are weekly) in conjunction with the bedside care team. Involving the patient and their family/carers is important.

When it is not possible to physically meet and round together, the team must have arrangements in place for rapid consultation. For example, mechanisms to involve an airway surgeon if laryngeal pathology is identified.

A regular tracheostomy multidisciplinary ward round is an opportunity for data-collection, audit and education.

Routine care summary

Standards:

- Local hospital-wide tracheostomy policy should be developed with input from the Critical Care leadership team.
- Local policy should cover standards for routine tracheostomy care as outlined above, including the roles of the multidisciplinary team in secretion management, vocalisation, swallowing and mobilisation.
- All in-patients with a tracheostomy should be seen at least weekly by a tracheostomy multidisciplinary team. The Critical Care team should be an integral part of the multidisciplinary tracheostomy team.
- All bedside staff caring for tracheostomy patients will have received training in tracheostomy care as per local policy.

Recommendations:

- All ICUs consider the education needs of medical, nursing and Allied Healthcare Professional staff in planning local and hospital tracheostomy education. The frequency and content of refresher training should be determined locally.
- Patient-level data is collected for tracheostomy patients who are managed in the ICU as part of comprehensive hospital-wide data collection. These data can benchmark safety, quality and duration of care metrics over time and against similar units and hospitals.
- Consideration of cuff deflation should be a goal of routine care of patients with tracheostomies.

Further resources

Advanced Life Support Group (www.alsg.org) provides half day training courses and templates for in-house tracheostomy training.

Suggested competencies for staff are provides at www.tracheostomy.org.uk

Guidance around tracheostomy multidisciplinary team working is available at www.globaltrach.org

8. Vocalisation, communication and oral intake

There is rightly a focus on delivering safe care to patients with tracheostomies and laryngectomies in our hospitals and ICUs. However, our patients *assume* safe care and *expect* high quality care. For the patient and their families, this means a focus on vocalisation, communication and a return to oral intake as soon as possible. Inability to communicate effectively is a significant source of anxiety for patients and a lack of oral intake can lead to frustration and depression. Recent UK Quality Improvement projects have shown a significant reduction in times to vocalisation and first oral intake in critically ill tracheostomised patients. The role of dedicated critical care Speech & Language Therapists as part of the multidisciplinary team cannot be underestimated.

For many patients managed with a tracheostomy in ICU, the tube has been inserted in order to allow a reduction in sedation and wean from mechanical ventilation. This often means that in the first few days following tracheostomy the patient may be awake and able to communicate but with the cuff still inflated, preventing vocalisation.

Communication can be verbal or non-verbal, both of which may be compromised by the tracheostomy and critical illness.

Non-verbal communication

Non-verbal communication may be facilitated by a range of aids from a pen/paper through to digital communication boards and tablet device applications. Lip reading can be challenging for all involved, although there are some software and hardware developments in this area that may help in the future. An electrolarynx may be of benefit to some patients. The most important aspect of facilitating non-verbal communication is attentive and patient bedside staff reducing distractions, environmental noise and the communication burden of the patient. SLTs can also advise staff, patients and families on strategies and on how to manage specific communication impairments such as dysphonia, dysarthria, aphasia or cognitive communication deficit.

Verbal Communication

In order to vocalise, gas must flow via the larynx and out through the mouth. This is most effectively achieved by deflating the tracheostomy tube cuff or using an uncuffed tube.

One-way speech and swallow valves ("speaking valves") can increase the amount of gas exhaled via the upper airways significantly. These valves are attached to the tracheostomy tube directly or into the ventilator circuit. They are open during inspiration but close during expiration, meaning that gas cannot be exhaled via the lumen of the tracheostomy tube. Instead this gas is forced around the tube and out through the upper airways. This does add resistance to expiration and increases the work of breathing, and so valves may need to be gradually introduced.

One-way valves do not guarantee vocalisation, but even without speech, there may be additional benefits to the patient. These include:

- the addition of a degree of continuous positive airways pressure (CPAP)
- restoration of subglottic pressures
- better laryngeal function and sensation through the upper airway (which may benefit swallowing and secretion management)
- stronger voice
- better ability to generate a Valsalva-type manoeuvre (which may help with posture or going to the toilet)
- improved smell and taste

The biggest potential problem with one-way valves is that they need to be used with an uncuffed or deflated cuff tracheostomy tube. Any obstruction to expiration will effectively cause asphyxiation. The safest way to use these valves is with an uncuffed tube. For any patient with a cuffed tube in situ, the cuff must be fully deflated. All staff must be aware that a speaking valve is in use and in place, which is especially important at handovers or when bedside staff take a break. Some valves may be used in the ventilator circuits which may decrease visibility and detection of problems. If a unit chooses to stock and use such in-line valves, then all new and existing staff must be made aware of them and given training in their use and a protocol may be helpful.
One-way valves may be contraindicated for some patients:

- airway obstruction
- absent cuff leak when deflated (as a result of laryngeal oedema, subglottic /glottic stenosis, vocal fold palsy narrowing the glottis)
- severe COPD with gas trapping
- laryngectomy
- foam-filled cuff tracheostomy tube

Digital occlusion or 'capping' (obstruction) of the tracheostomy tube are other potential methods to promote glottic airflow.

Above cuff vocalisation (ACV) is a strategy that may be useful for patients who cannot tolerate cuff deflation. It involves connection of an additional, external flow of gas to the subglottic port of certain tracheostomy tubes. Gas flow is therefore directed in a retrograde manner, exiting above the cuff and flowing up through the larynx and out of the mouth, independent of the ventilator gas flows. ACV may have the additional benefits on laryngeal function beyond vocalisation that are associated with cuff deflation.

ACV should be used with caution by practitioners trained in its use. Prolonged use of unregulated flows of cold, dry gas have unknown effects on laryngeal function, although research is continuing to derive guidelines, systems and strategies for the safe use of ACV.

Tracheostomy patients are at risk of vocal fold impairment and laryngeal injury e.g. post intubation, and any signs of dysphonia should be assessed by SLT with referral to ENT as needed. Oral intake
For many patients, one of the most frustrating things about having a tracheostomy is a delay or absence of oral intake. This can include liquids and solids.

All patients with a tracheostomy must have communication and swallowing needs assessed by an SLT when the decision to wean from the ventilator has been made and the sedation hold started.

There is increasing evidence of the benefits of early referral of all tracheostomised patients to SLT services for the detection and management of dysphagia. Intubation trauma, prolonged intubation and sedation and the presence of a tracheostomy (with or without a cuff) can all cause overt or occult dysphagia. Fiberoptic Endoscopic Evaluation of Swallow (FEES) can result in earlier introduction of oral intake, can influence tracheostomy/ventilator weaning decisions and, by detecting silent aspiration, may prevent respiratory complications delaying weaning. The ability to evaluate the impact of laryngeal injury, supraglottic airway and glottic closure abnormalities, excess secretions, intubation trauma and critical illness myopathy on swallowing are particularly useful in critical care patients. SLT assessment of the impact of ACV, cuff deflation and one-way valves on laryngeal function, secretions and swallow function is important for successful introduction of oral intake and swallow rehabilitation in these patients.

'Risk feeding' may occur in situations where the aspiration risk is known or suspected to be high but the psychological benefits to the patient of commencing oral intake justify aspiration risks (for example in palliative care settings). FEES and multidisciplinary input can help to quantify these risks and make appropriate quality of life decisions with patients and their families.

Vocalisation, communication and oral intake summary

Standards:

- Verbal and non-verbal communication methods must be made available to patients with a tracheostomy. Bedside staff should be familiar with their use.
- All patients with a tracheostomy must have communication and swallowing needs assessed by an SLT with referral when the decision to wean from the ventilator has been made and the sedation hold started.
- Staff must have the knowledge and equipment to facilitate safe vocalisation, through the use of comprehensive cuff deflation strategies aligned to weaning plans, speech and swallow valves, and alternative methods of vocalisation such as ACV.

Recommendations:

- Units should work closely with SLT departments to ensure that GPICS standards (duplicated here) are maintained. For many departments, this may require additional resources. However, the likely benefits of increasing SLT involvement in ICU patient care are significant, from a safety, quality and organisational efficiency perspective.
- Vocalisation should be a daily goal of care for alert tracheostomised patients. If this is not possible, a multidisciplinary strategy towards vocalisation should be developed.
- A return to oral nutrition should similarly be a daily goal of care, with a multidisciplinary strategy towards oral intake developed if this is not possible.
- FEES performed by SLTs should be available, either routinely or on request.

Further resources

The NTSP website has links to resources and videos that explain the importance of communication, vocalisation and oral intake.

9. Emergency management

Most tracheostomy problems can be predicted and prevented, but emergencies still occur. All staff who manage patients with a tracheostomy must be trained in detecting tracheostomy 'red flags' and initial emergency management. UK studies have shown benefits in reducing the frequency, nature and severity of incidents following comprehensive staff training.

For ventilator-dependant patients or the critically ill, airway emergencies are compounded by a lack of physiological reserve and often, a difficult airway. Trained staff with airway expertise must be immediately available to attend, review and manage a patient with a tracheostomy on an ICU.

Complications can occur at any time, but can be considered as:

- At the time of insertion
  - Bleeding
  - Misplacement
  - Damage to head and neck structures
  - Loss of the airway during manipulations of the existing tube
- Post-insertion
  - Displacement
  - Blockage
  - Bleeding
  - Skin breakdown
  - Infection
  - Fistulae

Displacement and blockage are the commonest complications. Some long-term complications (granulomata, stenosis and tracheomalacia) are discussed in the decannulation section.

Key principles

The principles of emergency management have been described by the NTSP, with paired bedhead signs and universal emergency algorithms. Detailed guidance is available via the website and e-learning resources.

The bedhead sign will detail important features of the patient's tracheostomy and native upper airway. Although the airway may be 'difficult' in some patients, for the vast majority of ICU patients, the upper airway provides a familiar route to provide oxygenation and/or ventilation in an emergency.

The NTSP algorithms detail guided interventions for the multidisciplinary team. The algorithms move through basic assessment of the airway and actions that are likely to address common problems with tracheostomies.

Oxygenation of the patient takes priority (not necessarily securing the airway immediately and definitively, unless required for oxygenation). For the majority of critically ill patients, a definitive airway will need to be reinserted to continue respiratory support.

The best assistance must be sought early, and units should plan in advance who they will call and how this will occur. Bedhead signs can be adapted to include contact details.

Training

All staff who will manage patients with tracheostomies in the critical care unit must receive training in emergency tracheostomy management. National courses are available with resources to support local courses provided on the NTSP website and via the Advanced Life Support Group (www.alsg.org).

Tracheostomy emergency management training should form part of the mandatory training requirements for critical care multidisciplinary staff and records should be kept.

Refresher training will be required and the frequency of this will depend on the case mix and workload of the unit.

Nationally agreed competencies for staff and e-learning resources from the NHS e-learning for healthcare program are provided on the NTSP website.

Emergency management summary

Standards:

- All bedside staff caring for tracheostomy patients will have received training in tracheostomy care as per local policy.

Recommendations:

- All ICUs consider the education needs of medical, nursing and Allied Healthcare Professional staff in planning local and hospital tracheostomy education. The frequency and content of refresher training should be determined locally.
- Competency to detect and manage a tracheostomy emergency should be considered for all permanent medical staff. Annual appraisal is a good opportunity to review this.
- Competency to detect and manage a tracheostomy emergency should be considered for all new trainees as part of induction medical staff.

10. Decannulation and discharge from ICU

Decannulation

The majority of patients managed with a tracheostomy in the ICU will be require temporary tracheostomies, although this depends on local case mix and services. Around 6-10% of patients will require a prolonged wean from mechanical ventilation (of at least 3 weeks) and some will require long term tracheostomy for respiratory failure or airway problems.

The process of weaning from full mechanical ventilatory support via a tracheostomy involves reductions in the pressures delivered and the frequency of support; increased spontaneous breathing; deflation of the cuff; and proactive management of cough and swallow. A consistent approach and a recognisable weaning strategy for the unit is likely to be of benefit. Involvement of the multidisciplinary team is important.

In general, when a patient is able to tolerate cuff deflation and is ventilator free for over 24 hours, then consideration may be given to a trial decannulation. This may be preceded by changing to a smaller or uncuffed tube ("downsizing"). The upper airway must be patent. If there are doubts or concerns, then endoscopy must be undertaken prior to decannulation.

Tracheostomies should be removed as soon as they are no longer required. This requires regular, coordinated multidisciplinary input and these reviews should continue if the patient is discharged from a critical care unit with a tube in situ.

Prior to the removal of a temporary tracheostomy tube, there must be multidisciplinary agreement that the indication for the tracheostomy has resolved sufficiently. This same team should remain the main point of contact for at least 48 hours post-decannulation. If patient location prevents this being a viable option, care should be formally handed over to a team able to provide adequate advice and interventions.

Decannulation should be considered as a trial, with the same provisions of observation and intervention (respiratory support, re-intubation or re-insertion of the tracheostomy tube) as a trial of extubation.
Example decannulation protocols and checklists are provided by the NTSP.

Discharge from ICU and follow up

Some patients will be discharged from ICU with a tracheostomy tube still in situ. Critical care units have a responsibility to ensure that receiving locations are adequately prepared to receive and manage these patients, especially if their primary team has no particular tracheostomy expertise (medical wards for example).

A tracheostomy passport is an increasingly useful method of communicating essential details about a patient's tracheostomy and its history to other healthcare providers. Essential information should include:

- The reason for insertion
- Type and size of tracheostomy tube
- Any problems with the native upper airway
- The schedule for tube changing, including who will do this
- Plans for future reviews of the tracheostomy (when, who)
- Criteria for re-assessment for tube removal

For patients who have been recently decannulated and discharged, follow up by critical care outreach services is recommended to ensure that the patient has adequate cough, swallow and respiratory function.

Long-term complications following tracheostomy include:

- Failure of the stoma to heal (often complicated by critical illness)
- Granuloma formation
- Tracheal stenosis
- Tracheomalacia

Whilst many of these problems are apparent on decannulation, many remain unrecognised, as problems such as breathlessness may be attributed to respiratory issues rather than airway problems.

All patients who have undergone tracheostomy should be followed up. Their GP must be informed that the patient had a tracheostomy and be provided with a contact if they have concerns about longer term problems.

The majority of patients who require a tracheostomy in critical care will be invited to ICU follow up clinics. This is an opportunity to assess for tracheostomy-related problems and arrange further investigations if appropriate.

Problems with swallowing or communication should be identified and referred to SLT services as appropriate.

Surgical tracheostomies for surgical pathologies are usually followed up by the surgical teams. Where a surgical tracheostomy has been inserted to manage a non-surgical condition (typically prolonged respiratory failure but unsuitable for percutaneous tracheostomy) an agreement should be in place as to who will follow up such patients following discharge.

Pathways should be agreed with head and neck surgical colleagues for referral and review if a potential problem is identified with a tracheostomy, either during its use or after removal. This includes problems detected at FEES, airway endoscopy, videofluoroscopy or clinically.

Decannulation & discharge summary

Standards:

- Weaning from ventilatory support and decannulation must be conducted in a consistent manner. The tracheostomy multidisciplinary team has a key role.
- If a patient is discharged with a tracheostomy in situ, the ICU has a responsibility to ensure that receiving locations are adequately prepared to receive and manage the patient. This is especially important if their primary team has no particular tracheostomy expertise (medical wards for example).
- The safe and effective flow of patients with tracheostomies must be ensured as part of a hospital-wide tracheostomy policy.

Recommendations:

- Pathways should be agreed with head and neck surgical colleagues for referral and review if a potential problem is identified with a tracheostomy, either during its use or after removal.
- ICU leadership should engage with multidisciplinary colleagues as part of a hospital-wide tracheostomy policy to ensure the safe and effective flow of patients with tracheostomies.

11. Patients with laryngectomies

Patients with laryngectomies will occasionally be admitted to critical care services, depending on case mix and local ward facilities. This may be planned or un-planned.

A laryngectomee is a **neck-only breather**, in that ventilation can only occur via the neck. There is no anatomical connection between the upper airways and the lungs. (Patient's with tracheostomies are often referred to as 'neck breathers' but the distinction is that they have a potentially patent upper airway; i.e. an anatomical connection from the trachea to the upper airways remains. The reason for the tracheostomy may of course be partial or complete obstruction of this upper airway, which must be recorded clearly on the bedhead sign). Bedhead signs can clearly identify neck-only breathing laryngectomy patients (red bed head sign) and those with a potentially patient upper airway (green bedhead sign).

Laryngectomees who are hospitalised for non-head and neck surgical problems or procedures may be most safely managed in critical care units. This is a local decision for the hospital but should involve critical care representation due to the potential impact on beds.

Communication needs

Whilst surgical removal of the larynx clearly impacts on communication, voice-reconstruction procedures are increasingly used, allowing patients to vocalise following laryngectomy. Such procedures include tracheo-oesophageal puncture (TOP or TEP) valves and a range of stoma covers and one-way valves.

Patients will have usually adapted to communicate using a variety of verbal and non-verbal techniques. Examples are provided on the NTSP website. These should be explored with the patient and their families and made available. Specialist head and neck staff are a valuable source of advice.

All patients with a tracheostomy must have communication and swallowing needs assessed by an SLT with referral when the decision to wean from the ventilator has been made and the sedation hold started

Routine care

Humidification is as important for patients with a laryngectomy as those with a tracheostomy. A variety of stomal covers are available, some of which offer a degree of humidification. Active humidification is usually required for the critically ill.

Stoma care should continue as close to the patient's normal routine as possible. Advice should be sought from the patient, their family and head and neck specialist nursing staff.

Ventilation

The stoma of a laryngectomee is the patient's airway. Ventilation can be delivered using paediatric facemasks or supraglottic airways. Intubation of the stoma is possible with standard or specialised (e.g. Montadon) tracheal tubes or with standard tracheostomy tubes. Confusion can arise if a neck-only breathing laryngectomee patient has a tracheostomy tube inserted, surrounded by a dressing. Clear communication between staff and teams, supported by accurate bed head signs, are critical in ensuring that avoidable incidents with confusion around the airway do not occur.

Existing TEP valves provide a controlled fistula between the trachea and pharynx for vocalisation. These do not require removal for airway management and significant damage can occur if non-expert attempts at removal take place. Following extubation of a laryngectomy stoma, specialist head and neck staff should check the position and orientation of any existing TEP valve.

Laryngectomy summary

Standards:

- All bedside staff caring for a laryngectomee must understand the airway implications.
- All laryngectomee patients must have a bedhead sign detailing their airway anatomy.

Recommendations:

- All bedside staff who could care for a laryngectomee must receive education in the basic anatomy and routine care required to keep these patients safe.
- Early involvement of SLTs and Head and Neck Specialist Nursing staff in the care of laryngectomee's admitted to a Critical Care environment.

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Notes

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