National Tracheostomy Safety Project

Multidisciplinary COVID-19 tracheostomy guidance

Updated 30-4-20

The COVID-19 pandemic is causing a significant increase in the number of patients requiring relatively prolonged invasive mechanical ventilation and an associated growth in patients who need a tracheostomy to facilitate weaning from respiratory support. There has been a lot of work in the UK and beyond to produce guidance for tracheostomy during the pandemic. Key stakeholders have been working with international and UK groups to develop consensus statements and guidelines which will be published in early May. NHS England will also launch their National Patient Safety Improvement Programme (NatPatSIP) *Safer Tracheostomy Care* imminently. Key stakeholders involved in the consensus work include (alphabetically):

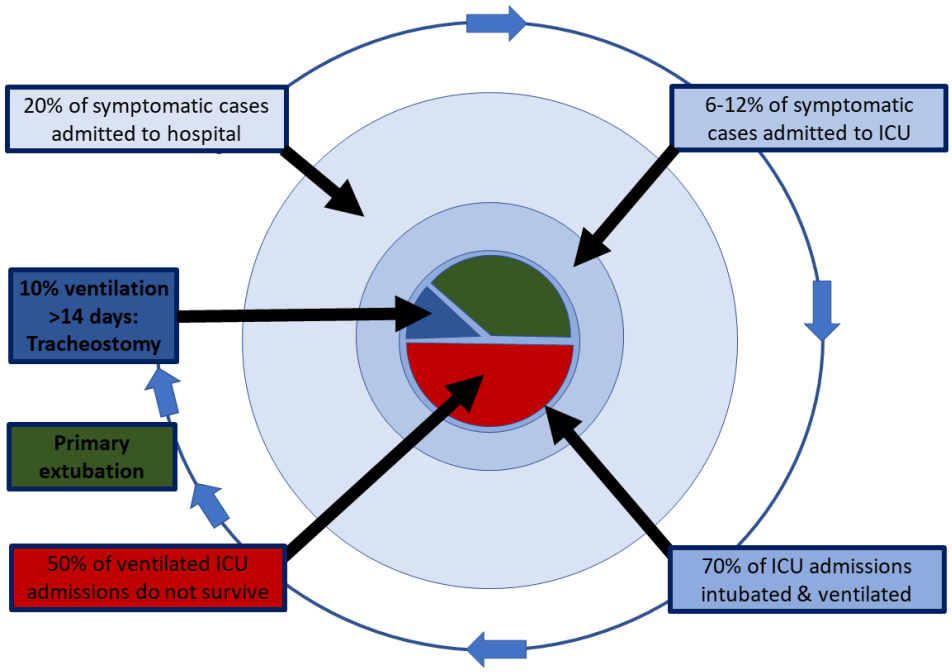
- Association of Anaesthetists
- Association of Chartered Physiotherapists in Respiratory Care
- British Association of Head & Neck Oncologists
- British Association of Oral and Maxillofacial Surgeons
- British Laryngological Association
- Difficult Airway Society
- ENT-UK
- Faculty of Intensive Care Medicine
- Intensive Care Society
- National Tracheostomy Safety Project
- NHS England & NHS Improvement
- Patient representation
- Royal College of Anaesthetists
- Royal College of Nursing
- Royal College of Speech & Language Therapists

Key recommendations from the UK consensus document are listed below, along with key points for each of the sections are highlighted below. The academic papers that underpin these papers will be published shortly. Further information about tracheostomy care can be found on the websites of these organisations and at www.tracheostomy.org.uk.

Introduction

Whilst practice is variable around the UK, around 10% of all those admitted to ICU will be ventilated for more than 14 days and a tracheostomy is a well-established strategy to help wean these patients from ventilation.

Figure. Schematic flow of symptomatic COVID-19 patient admitted to UK hospitals.



Whereas the SARS-CoV-2 coronavirus responsible for COVID-19 has lower case fatality rates than coronaviruses which cause Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS), it has significantly higher infectivity and levels of transmission. The virus is transmitted directly through surface spread from respiratory droplets, with later mucosal contact, and also via direct respiratory droplet inhalation. Transmission to healthcare staff is also possible during aerosol generating procedures (AGP), which include tracheostomy insertion and subsequent management.

Modifications to usual tracheostomy care are therefore required. This guidance considers balancing the risks of infection control regarding aerosol spread of the virus versus the best management for the patient with a tracheostomy. This guidance is written for UK hospitals but is applicable elsewhere. The guidance may change as data on tracheostomy in the COVID-19 pandemic becomes available.

Key topics include patient selection, timing of tracheostomy, conduct of the procedure and subsequent routine management. These are considered in detail below, along with the need to protect staff undertaking aerosol-generating procedures.

Indications for tracheostomy in the COVID pandemic

- Tracheostomy is indicated to facilitate weaning from prolonged ventilation when a primary extubation has failed or is anticipated to have a high likelihood of failure.
- A tracheostomy may provide a more controlled situation for weaning than a high-risk primary extubation, particularly if the use of rescue therapies is a concern or restricted.
- Laryngeal oedema may be an additional problem in COVID-19.

The predominant indication for tracheostomy remains facilitating, and weaning from, prolonged mechanical ventilation. The primary 'surgical' indication remains actual or anticipated airway obstruction. Attempted primary extubation should be based on established practices. However, failed primary extubation associated with urgent rescue oxygenation and re-intubation risks exposing patients to potential morbidity and mortality, and exposes clinical staff to potential infection risks.

A conservative approach to attempted primary extubation is suggested, restricted to those predicted to have a high chance of success. Elective tracheostomy offers a 'closed' system (cuff inflated, ventilator circuit) for controlled weaning of respiratory support which may be preferable to a high-risk primary extubation strategy.

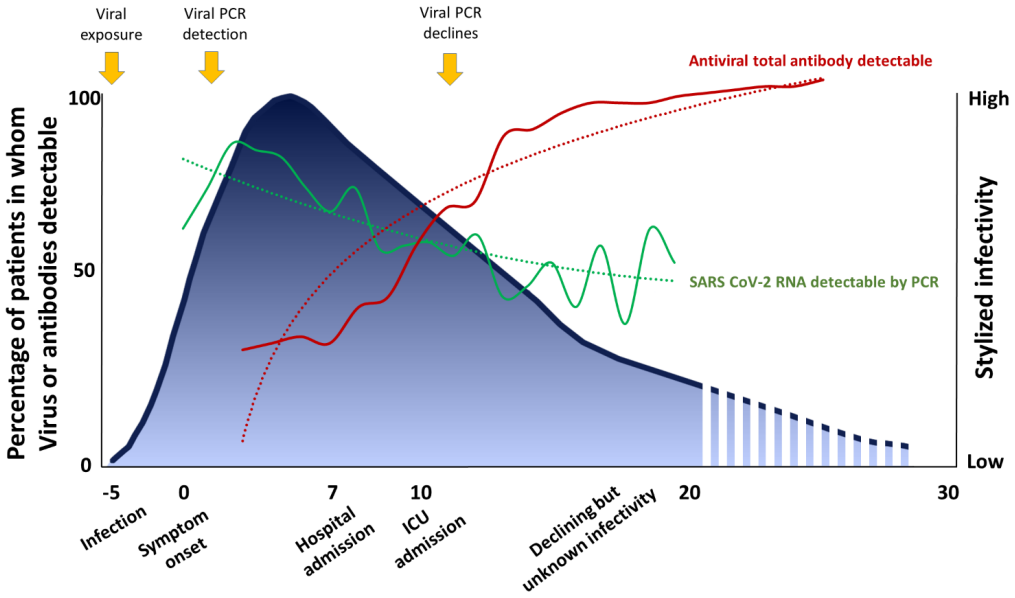
Laryngeal oedema and laryngeal ulceration may be a problem in COVID-19 patients. Whilst post-intubation laryngeal oedema is not uncommon in the critically ill, coronaviruses are known to cause laryngitis and it is plausible that the SARS-CoV-2 virus has additional direct laryngeal effects in some. A pre-extubation tracheal tube cuff deflation 'leak test' should be considered as a screening surrogate of upper airway patency, with laryngoscopy indicated if there is doubt. Tracheostomy may be indicated if airway oedema does not improve over time.

Timing of tracheostomy and 'infectivity'

- Infectivity is difficult to quantify, and adequate tests are not routinely available.
- Delaying tracheostomy reduces risks for healthcare workers involved at insertion but exposes patients to the risks of prolonged intubation and associated critical care.
- Infectivity is likely to be low around the time of tracheostomy and significantly lower than the time of initial intubation.
- The role of PCR and antibody testing to determine optimal timing for tracheostomy is unclear, but a 'negative' SARS-CoV-2 RNA PCR is not necessary prior to undertaking tracheostomy.

The "infectivity" of a particular person relates to their ability to transmit live virus to another and can only be assessed by culture of detected virus. The amount of virus required to infect another is currently unknown, but the highest risk is associated with respiratory secretions. The detection of viral RNA by PCR (viral shedding) does not necessarily indicate infectivity, as non-viable virus can be detected. The anatomical source and the performance of the PCR test also influence detection.

In critically ill patients (those more likely to require tracheostomy), viral RNA load has been shown to be significantly higher and it declines more slowly. The figure below describes the typical clinical course of severe COVID-19 disease, based on published case series. By pooling data from two studies of 181 (combined) patients, which included 32 (17.7%) 'critical' and 72 (40%) 'severe' cases, the viral profile can be characterized. Whilst the true level of infectivity is unknown, it is likely to be low around the time that tracheostomy is considered, some 10-14 days after intubation; approximately 20-24 days after the onset of symptoms. This is especially the case in the presence of antiviral antibody or if a patient is showing signs of physiological improvement, associated with a reduction in inflammatory markers.



Timeline (days) not to scale. Time zero is symptom onset

Tracheostomy insertion procedure for COVID-19 patients

- Tracheostomy insertion and subsequent care are aerosol-generating procedures.
- Positive-pressure ventilation increases the aerosolisation risk.
- Optimal location for tracheostomy insertion should be discussed and agreed locally.
- Modification to tracheostomy insertion techniques are required to minimise aerosol generation.
- Open surgical procedures are preferred, but percutaneous procedures are not contra-indicated.
- A pre-procedural apnoea test can ensure physiological stability prior to embarking on a tracheostomy.
- Neuromuscular blockade should be monitored and maintained throughout the procedure.
- Planning, rehearsal and communication is critical.

Because of the high infectivity of SARS-CoV-2, modifications to the insertion technique have been proposed by both surgical and intensive care groups. There are additional human factors and logistical challenges to working in unfamiliar circumstances, wearing PPE, and undertaking cases which can invoke significant concern amongst health care providers. Successful percutaneous, open surgical or hybrid approaches have been described in the current pandemic, all of which can be used in operating theatres or appropriate ICU locations. The choice of technique is determined by local expertise and resources, with confidence and experience essential.

Percutaneous techniques involve airway manipulations that leave the tracheal tube cuff at the level of the larynx. This risks leakage of exhaled gas during ventilation. Packing of the hypopharynx and continuous suction from the mouth have been proposed to mitigate leaks. Endoscopic guidance of the tracheal puncture likely improves the safety of the procedure, but makes aerosol generation more likely. The choice of using endoscopy during percutaneous tracheostomy in a COVID-19 patient should reside with the operative team. If used, single-use endoscopes with a sealed ventilator circuit are recommended.

During surgical tracheostomy, strategies to mitigate aerosol generation include; advancing the tracheal tube distal to the operative site prior to opening the trachea, hyperinflation of the tracheal tube cuff, pausing ventilation at key points and covering the operative site with gauze swabs when ventilation recommences. Detailed descriptions of the surgical technique have been proved by ENT-UK (www.entuk.org), the British Laryngological Society (www.laryngology.uk), and the British Association of Oral and Maxillofacial Surgeons (www.baoms.org.uk) amongst others. Clamping of the tracheal tube prior to manipulation should not be necessary during apnoea and may damage the tube (especially subglottic suction tubes).

Pausing ventilation at key points during the procedure will minimise aerosolisation. Key points include during initial manipulation of the tracheal tube below the tracheostomy site for surgical procedures, above it during percutaneous approaches, and when the trachea is opened/punctured. As apnoea can rapidly cause life-threatening hypoxia in ventilator-dependant critically ill patients, in order to demonstrate physiological readiness for tracheostomy, it is a wise precaution to perform an apnoea trial in the supine position in the ICU prior to committing to the procedure. Rapid desaturation predicts a similar response during tracheostomy. For spontaneously breathing patients, a reduction in pressure support may suffice. The ability to conduct or tolerate an apnoea trial should not replace multidisciplinary clinical judgement regarding the risks and benefits of a tracheostomy. This technique of 'apnoeic tracheostomy' should only be performed by experienced operators who have agreed a detailed plan of how critical desaturation will be managed.

Many patients in whom a tracheostomy is indicated will be anticoagulated. There is no definitive evidence to guide the best technique to minimise complications, including those receiving extra-corporeal membrane oxygenation (ECMO). Regardless of technique, complete paralysis is essential and eliminates patient movement and coughing. For patients receiving infusions of neuromuscular blocking drugs, tachyphylaxis can occur and neuromuscular monitoring is recommended

Whichever technique is chosen, personnel should be kept to an absolute minimum with the most senior operator and anaesthetist involved. The team should prepare, rehearse, communicate effectively (including non-verbal communication) and use LocSIPPs to standardise the procedure. Use of dedicated surgical, anaesthetic and theatre teams is likely to improve performance.

Management following tracheostomy

- Care should be initially adapted to minimise airway procedures and especially AGPs.
- Review the frequency of routine procedures such as suction and inner tube care daily.
- Review humidification needs daily.
- Suspend ventilation if possible during disconnection from a ventilator circuit.
- Safe cohort locations should be appropriately equipped and supported, with care led by experienced multidisciplinary teams.
- PPE is only one part of a systematic approach to reduce risks of HCW contamination and infection.
- Standard or enhanced PPE is required depending on the location, intervention planned and the ventilation status of the patient.
- Modifications to standard care help to protect staff.

The care of tracheostomised COVID-19 patients follows established principles of high-quality multi-disciplinary tracheostomy care. However, because of the risk of viral transmission to healthcare workers, it must be adapted. Whilst infectivity reduces with time, it is currently unclear when a patient with COVID-19 ceases to be an infection risk to healthcare staff and others. This is particularly the case for patients recovering from critical illness. Until such time that a test, or combination of tests, can clarify this situation, tracheostomised patients recovering from SARS-CoV-2 infection should be considered to be potentially hazardous to staff, although a tailored individual approach to evaluating infection risks may be possible with appropriate local expertise.

Several modifications to standard care should be considered during the pandemic. Key principles include infection prevention and control, a focus on essential care and the avoidance of unnecessary interventions (especially those that generate aerosols), early recognition of deterioration, and timely responses to emergencies.

Humidification and removable inner cannulae are routinely used during ventilated and non-ventilated tracheostomy care to prevent tube occlusion from respiratory secretions and reduce the need for suction. Commencing immediate post-operative care with 'dry' circuit containing a simple Heat-Moisture-Exchange (HME) filter (which can be changed every 7 days) combined with inner tube inspection/change every 24 hours appears safe. However, experience suggests that secretions may become thicker over time and active, water-based 'wet' humidification may become necessary. Mucolytic drugs may be a useful alternative or adjunct, as can saline or hypertonic saline nebulizers. The addition of humidification or saline significantly reduces HME efficiency. HMEs should be inspected daily and at any time when there is a deterioration in a patient's ventilation. Whilst patients are considered infectious, ventilation should be paused (following pre-oxygenation) prior to circuit breaks to change inner tubes or HMEs.

Cuff deflation, ventilator-adjusted leak facilitated speech, one-way speaking valves, above-cuff vocalisation strategies and induced coughing risk aerosolisation, especially when positive-pressure ventilation is on-going. A cautious approach to weaning with the cuff remaining inflated must be balanced against delaying recovery and restricting communication. Early involvement of Speech and Language Therapists using creative methods of augmentative and alternative communication will reduce patient anxiety and facilitate communication. Potentially infectious patients, who are clinically ready to commence cuff deflation trials, should be managed in dedicated COVID-19 locations by experienced staff protected by appropriate PPE. Different ventilators generate variable peak flows which staff must

appreciate prior to cuff deflation. Minimum or no positive pressure delivered during trials, used alongside facemasks or tracheostomy shields for patients, will reduce aerosolisation. Bedside assessment of laryngeal function or oedema should initially rely on clinical skills rather than endoscopy or laryngoscopy if possible and a multidisciplinary approach is recommended. Visualization of the larynx may be required if upper airway pathology is suspected (absence of vocalisation or an inability to manage oral secretions or swallow safety). If endoscopy is essential to guide care, it should be undertaken by experienced staff, recorded to minimise duplication, abbreviated to reduce exposure time, reviewed by a multidisciplinary team and undertaken with the minimal positive pressure possible if cuff deflation is used as part of the assessment.

Decannulation should be considered as soon as is safely possible, managed by a multidisciplinary tracheostomy team. Most patients will be suitable for decannulation during their hospital admission, but some will require ongoing care and rehabilitation. Clear plans for daily care, PPE requirements, review and decannulation should be communicated to the patient, their family and the community care teams when planning discharge. Multidisciplinary follow up clinics are recommended.

Patients with existing tracheostomies

In-patients are at an unknown risk of COVID-19 form visitors and staff. Plan where a patient would go if they developed symptoms. If an out-patient with a tracheostomy needs ventilator support, then they will need a cuffed tracheostomy inserting and management in a critical care location. A suspected or confirmed COVID-19 patient who does not need ventilatory support will need managing in a cohort area. These locations will need staff who are trained and competent to manage tracheostomies and their potential complications.

Existing patients with laryngectomies

Patients who have neck-only-breathing laryngectomees don't have the nasal 'filters' and intuitively they are at greater risk of viral infection. Some sensible, practical advice may also be relevant for hospitalised laryngectomy patients:

- Wear a stomal HME filter (not all HMEs perform equally).
- Hands-free valves minimize touching of the stoma.
- Ask the patient to manage as much of their stoma care as possible.
- See http://dribrook.blogspot.com/

Summary

The recommendations made in this multidisciplinary, multi-specialty guidance are based on reports from previous epidemics, early experience of countries affected by the current pandemic before the UK and on expert consensus opinion.

The effectiveness of these recommendation will only be realised through comprehensive data collection and analysis. The Global Tracheostomy Collaborative (GTC) database (www.globaltrach.org) is freely available for sites to collect comprehensive patient-level data, harm metrics and surrogates for the quality of care (for example, time to vocalisation, oral intake and decannulation). Implementation of the GTC Quality Improvement programme has recently demonstrated rapid improvements in the quality and safety of clinical care, using the GTC database to benchmark against the 7,000 global cases currently in the dataset. Recognising the urgency of data collection, the surgical stakeholders have collaborated to develop a registry of patients undergoing tracheostomy during the pandemic. Information about this project can be found on the relevant societies' websites (BAOMS, BLA, ENT-UK).

Resources for training staff can be found at www.tracheostomy.org.uk including updated e-learning for healthcare modules and links to the NHS England and NHS Wales safety programs as they are published.

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