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The Royal College of surgeons multidisciplinary guidelines on elective tracheostomy insertion in COVID-19 ventilated patients



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ABSTRACT

Background: The current COVID-19 pandemic has placed enormous strain on healthcare systems worldwide. Understanding of COVID-19 is rapidly evolving. Pneumonia associated with COVID-19 may lead to respiratory failure requiring mechanical ventilation. The rise in patients requiring mechanical ventilation may lead to an increase in tracheostomies being performed in patients with COVID-19. Performing tracheostomy in patients with active SARS-CoV-2 infection poses a number of challenges.

Methods: These guidelines were written following multidisciplinary agreement between Otolaryngology, Head and Neck Surgery, Respiratory Medicine and the Department of Anaesthetics and Critical Care Medicine in the Royal College of Surgeons in Ireland. A literature review was performed and a guideline for elective tracheostomy insertion in patients with COVID-19 proposed.

Conclusion: The decision to perform tracheostomy in patients with COVID-19 should be undertaken by senior members of the multidisciplinary team. Steps should be taken to minimise risks to healthcare workers.

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Introduction

The global pandemic of Coronavirus disease 2019 (COVID-19) is caused by a new strain of Coronavirus (SARS-CoV-2) discovered in 2019 and not previously identified in humans.¹ The worldwide impact of the disease - 33.7 million cases in 213 countries - indicates the highly contagious nature of the virus. Direct person-to-person transmission occurring during close contact mainly via respiratory droplets is the main mode of transmission. Healthcare workers are particularly at risk of contracting COVID-19 due to their exposure to infected

patients, their inability to maintain social distancing while working in teams and the limited availability of personal protective equipment (PPE).²

Acute Respiratory Distress Syndrome (ARDS), a syndrome of hypoxia and loss of lung compliance resulting from alveolar-capillary barrier disruption and an inflammatory pulmonary edema, occurs in 10–17% of patients with COVID-19.^{3,4} Approximately 5–10% of hospitalised patients require invasive mechanical ventilation, the majority of whom fulfill criteria for ARDS.⁵ Data on duration of ventilation indicates a requirement for prolonged advanced respiratory support (median of 13 days, ICNARC report Sept 25th 2020), while a rise

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in patients requiring invasive mechanical ventilation will lead to an increase in tracheostomies performed.⁶

Discussion

Tracheostomy is a common procedure performed in patients requiring prolonged mechanical ventilation. In this group, tracheostomy improves patient comfort, reduces trauma to the larynx, leads to a reduced need for sedation and improves patient communication. Prolonged translaryngeal intubation increases the risk of tracheal stenosis over time. Adequate endotracheal cuff pressures are required to minimise aerosolisation in ventilated patients, with care taken to avoid unnecessarily high pressures leading to tracheal pressure injury.^{7,8} Prior to the onset of the SARS-CoV-2 pandemic, there was no agreed optimal timing of tracheostomy tube insertion to facilitate weaning from mechanical ventilation.⁹

The landmark TracMan trial found no advantage of early (<4 days) tracheostomy in relation to 30-day mortality, duration of mechanical ventilation, or length of time in critical care.¹⁰ In addition, over half of the subjects randomised to the late tracheostomy arm did not receive the intervention. This suggests that postponing tracheostomy beyond 4 days allows a subset of patients to avoid the intervention. Thus, there is no clear benefit to early tracheostomy for mechanically ventilated patients in the ICU. However, a lower incidence of pneumonia with early tracheostomy was suggested by a recent meta-analysis.¹¹ Tracheostomy decreases sedation requirements, avoids pressure induced trauma (both to the trachea and oral cavity), and may reduce the severe physical deconditioning associated with prolonged mechanical ventilation.¹² COVID-19 complicates matters further in terms of timing and choice of technique, with important considerations of risk to staff as well as patients. The viral load of patients infected with SARS-CoV2 decreases over time leading to a reduction in the risk of transmission during tracheostomy.^{13,14} As such, the later timing of tracheostomy during the COVID-19 pandemic may be a justifiable consideration in the current circumstances. Delaying tracheostomy insertion in these patients until 14 or even 21 days of ventilation if feasible has been recommended.^{15,16}

Both open and percutaneous methods for tracheostomy tube insertion can be used in patients with COVID-19. Although data are limited, the percutaneous dilational method may lead to less risk of procedural transmission of SARS-CoV2 given that it does not involve opening the airway.^{17,18} This method must be used without airway manipulation such as bronchoscopy with cuff deflation to have benefit over open techniques. If the patient's anatomy is favourable and there are no contraindications to percutaneous tube insertion, then this method may be preferred in patients with COVID-19 infection. The mortality rate for patients requiring ICU admission with confirmed COVID-19 is high at 51.6%.¹⁹ Therefore, the selection of patients for tracheostomy insertion requires careful consideration. Patients should be haemodynamically stable with low vasopressor requirements. They should not require a PEEP >8cmH₂O, FiO₂ >0.5 or a pressure support >12cmH₂O. Patients with tracheostomy can be nursed in the prone position but the airway

cannot be visualised, risking displacement and pressure damage, therefore tracheostomy is not recommended in those still requiring prone ventilation. The decision to perform tracheostomy should be deferred in patients who are deemed to have a low chance of recovery or a high chance of mortality in the near future. These decisions should be made on a case-by-case basis by senior team members.

The upper aerodigestive tract, trachea and nasopharynx contain a high viral load during the early stages of infection with COVID-19.^{20,21} In patients with severe infection the viral RNA load is significantly higher and decreases more slowly than those with mild infection.⁴ Any airway procedure, including endotracheal intubation and tracheostomy, markedly increases the risk of exposure and transmission from patient to healthcare worker.²² Aerosol-generating procedures should be avoided where possible during this time. Infection control to limit the transmission of COVID-19 is an integral part of the care of patients with suspected or confirmed infection. For patients with suspected or confirmed COVID-19 infection, who undergo aerosol-generating procedures, PPE requirements for healthcare workers include a gown, eye protection, gloves, shoe covers and a suitable respirator offering a high level of protection.^{23,24} Any uncovered skin, hair or shoes worn by the worker is at risk of contamination with aerosols.²⁵ Healthcare workers should undergo training for the donning and doffing of PPE.

During tracheostomy tube insertion, deep neuromuscular blockage should be used to minimise patient movement and coughing. Pausing ventilation and placing the endotracheal tube cuff distal to the tracheostomy insertion point also minimises aerosol generation. Where possible, tracheostomy tube insertion should take place in a neutral pressure suite or Airborne Isolation and Infection Room (AIIRS). The next preferable location is a negative pressure airborne isolation room. This is a single-patient room in which a minimum of six air exchanges per hour takes place at a negative pressure when compared with surrounding areas. An operating theatre with laminar air flow stopped and doors sealed during and after the procedure for 30 min is also an acceptable option. A cuffed non-fenestrated tube should be used with the cuff adequately inflated to minimise aerosol risks to staff.

Tracheostomy management in patients with COVID-19 should be modified. A number of recommendations have been made to minimise aerosol generation during the care of these patients. Early management should include keeping the cuff inflated, closed-suction system, an in-line viral filter and avoidance of nebulisation. These measures should be put in place until the is considered non-infectious. Tracheostomy tube changes and decannulation protocols can then be considered.²⁶ Protocols should be established for patients discharged to ward level from ICU for management of tracheostomy not connected to a closed ventilatory circuit. Simple heat moisture exchanger (HME) devices may act as droplet barriers. In-line suctioning can be attached to the tracheostomy tube prior to the HME. Humidification and nebulisation should be limited. The use of disposable inner cannulas is preferred to avoid brush cleaning of reusable inner cannulas at risk of aerosolisation.²⁷

Effective communication between all team members is essential during tracheostomy tube insertion to minimise risk

of procedural viral transmission. Teams that perform tracheostomy regularly are bound to do so in a more efficient manner. Tracheostomy guidelines from ENT-UK suggest the creation of a “COVID Airway Team” to concentrate experience and coordinate training locally.²⁸ This improves safety and leads to familiarity with the new infection control measures needed to protect healthcare workers.

Recommendations

The following are recommendations from our combined departments, in the Royal College of Surgeons in Ireland, based on our expertise managing this emergent public health threat. We acknowledge these recommendations may require individualization based on region, facility, resources, clinical expertise, and patient-specific factors. The major objective of tracheostomy guidelines in the context of a COVID-19 pandemic is to promote safety and encourage excellent communication between Intensive Care Medicine/Anaesthesia, Respiratory, Surgical, and Nursing staff.

1. A multidisciplinary team composing of Consultant Surgical and Intensive Care Medicine/Anaesthesia physicians should review all cases considering the risk versus benefit for the patients, operating clinician and the entire healthcare team. Communication and collegial support is essential.
2. Patient selection is very important. Anatomy, history, comorbidities, clinical course (current and projected) may result in increased complications and procedures being postponed or indeed cancelled.
3. In the context of this COVID-19 pandemic most tracheostomy procedures should be avoided or delayed until 14 days after symptom onset because of the high risk of viral aerosolization during the acute phase of the infection. The anticipated timing for viral clearance cannot be predicted currently. Furthermore, critically ill patients demonstrate longer periods of viral shedding.⁴ The higher the viral load during the

acute phase of the illness, the higher the aerosolization risk. An Evidence Summary for COVID-19 viral load over course of infection compiled by the Health Information and Quality Authority in Ireland reports that viral loads are highest at the time of symptom onset and remain high for the first few days followed by a decrease over the next 1–3 weeks (15 studies) The median duration of virus detection based upon RT PCR is 13 days (16 studies).²⁹

4. The patient considered for tracheostomy should be haemodynamically stable (minimal vasopressor requirement) and not require prone ventilation, high levels of Positive End Expiratory Pressure (PEEP) (>8cmH₂O), Fraction of inspired oxygen (FiO₂) (>0.5), or pressure support (>12cmH₂O).
5. Avoid tracheostomy in COVID-19 positive or suspected patients (at any time) during periods of respiratory instability or heightened ventilator dependence.
6. We acknowledge that resource constraints during a surge in Intensive Care Unit demand may necessitate tracheostomy formation to facilitate patient transfer from an ICU to a COVID High Dependency Unit (HDU) or stepdown facility, thereby freeing the ICU for patients deemed in greater immediate clinical need.
7. The optimal location for tracheostomy placement in order of preference is:
 - a. Neutral pressure suite, comprising a HEPA filtered ante-room (+10% atmospheric for donning), all air flowing to the patient care area (+5% above atmospheric) air flowing to the Doffing area and sluice (atmospheric pressure).
 - b. Negative pressure Room.
 - c. Theatre environment which has had laminar flow system stopped and all doors sealed for the duration and 30 min after the procedure in line with anaesthesia guidelines.
8. Consideration should be given to percutaneous dilational tracheostomy if the patient's anatomy and proceduralist expertise allow it to be done safely with bronchoscopy performed during pauses at end

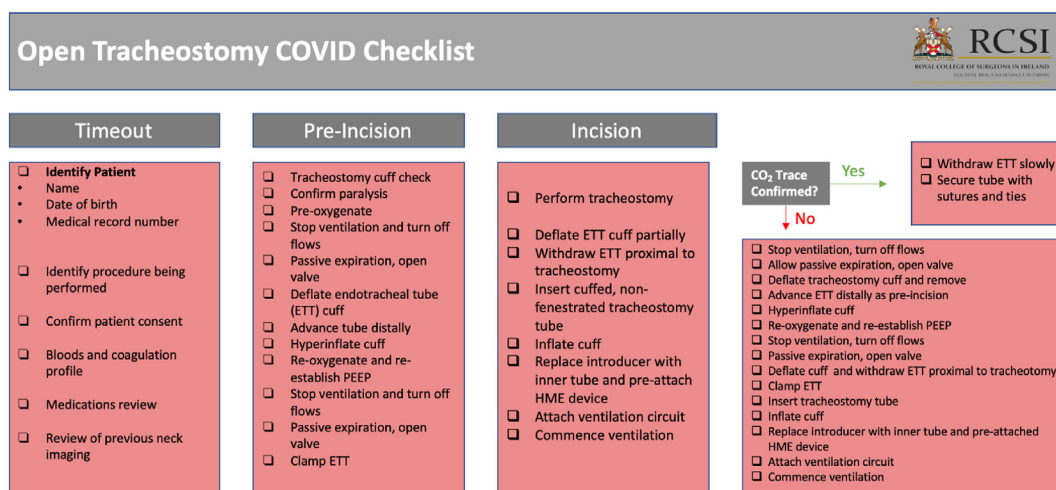


Fig. 1 – Open tracheostomy COVID checklist.

Percutaneous Tracheostomy COVID Checklist		
Timeout	Pre-Procedure	Procedure
<ul style="list-style-type: none"> <input type="checkbox"/> Identify Patient <ul style="list-style-type: none"> • Name • Date of birth • Medical record number <input type="checkbox"/> Identify procedure being performed <input type="checkbox"/> Confirm patient consent <input type="checkbox"/> Bloods and coagulation profile <input type="checkbox"/> Medications review <input type="checkbox"/> Review of previous neck imaging 	<p>Anaesthesia</p> <ul style="list-style-type: none"> <input type="checkbox"/> Infusions: Propofol, Midazolam, Fentanyl & Deep Muscle Relaxation <input type="checkbox"/> Lignocaine 2% with Adrenaline 1/200 000 <input type="checkbox"/> Emergency meds: Phenylephrine, Ephedrine, Atropine <p>Equipment</p> <ul style="list-style-type: none"> <input type="checkbox"/> Flexible fiberoptic bronchoscope (mandatory) <input type="checkbox"/> Full intubation equipment <input type="checkbox"/> Roberts forceps or similar curved tip <input type="checkbox"/> Tracheal dilators <input type="checkbox"/> Ultrasound (Operator dependant: goitre, aberrant vessels) 	<ul style="list-style-type: none"> <input type="checkbox"/> Perform bronchoscopy during tracheal puncture, dilation and placement <input type="checkbox"/> Ensure the tracheal puncture is at the appropriate level, between the 1st & 3rd, but not below the 4th tracheal ring <input type="checkbox"/> Stop Ventilation and ensure zero airflow during bronchoscopy and tracheal dilation <input type="checkbox"/> Stitch tracheostomy in place to prevent displacement
<p>Tracheostomy Insertion Kit: Ciaglia Blue Rhino (CBR; Cook Critical Care, Bloomington, IL), Portex Blue Line Tracheostomy (Smiths Medical, Minneapolis, USA) Both comprise of a one-step curved dilator with a hydrophilic coating</p>		

Fig. 2 – Percutaneous tracheostomy COVID checklist.

expiration only to minimise aerosolisation, endotracheal suctioning, and disruption of the ventilator circuit. Open procedures generate more aerosolization and should be avoided if possible.

9. Choose a non-fenestrated, cuffed, tracheostomy tube. Standard size 8 for males and 6 for females. The cuff should remain adequately inflated to limit viral dispersion and transmission through the upper airway during ventilation.
10. When performing the tracheostomy procedure provide adequate sedation and paralysis to eliminate the risk of coughing during the procedure. Ventilation should be paused (apnoea) at end-expiration when the trachea is accessed and any time the ventilation circuit is disconnected.
11. Perform tracheostomy suctioning using a closed suction system, use circuits with viral filters or HMEs which exhibit high viral filtration efficiencies. Use a HME device attached to a non-vented tracheal adaptor or closed suction system instead of a tracheostomy collar during weaning to humidify the inhaled gases and minimize droplet dispersion and aerosolization during coughing and tracheal suctioning.
12. Adhere to strict donning and doffing procedures in full Personal Protective Equipment (PPE) based on institutional protocol. Limit the number of providers participating in tracheostomy procedure and post-procedure management. Rely on cold instrumentation and avoid monopolar electrocautery.

13. Tracheostomy downsizing should be avoided, and decannulation decisions should be clinician led and be commenced at the earliest opportunity.

In the event of a tracheostomy we advise the following checklists for open (Fig. 1) and percutaneous (Fig. 2) methods.

Conclusion

Tracheostomy insertion in patients with COVID-19 presents a set of new challenges and risks. The importance of training and planning during this time cannot be overstated.

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Declaration of competing interest

None.

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