

## **Paediatric Tracheostomy and Tracheostomy Long-Term Ventilated Care during the COVID Pandemic**

### **1. Introduction**

The global pandemic with coronavirus SARS-CoV-2 and associated disease COVID-19 has led to a significant health care crisis. The disease profile is recognised to predominantly cause severe illness in the adult population and the focus of evidence and treatment guidance reflects this adult preponderance.

The paediatric population, whilst known to be at risk of COVID-19, can be asymptomatic or mildly symptomatic carriers of the SARS-CoV-2 infection. Those patients with underlying co-morbidity, including those with a tracheostomy or long-term ventilation (LTV) support (invasive by tracheostomy, or non-invasive by facial interface), are in need of protection from this virus and may be included in the 'extremely vulnerable' group outlined by Public Health England (PHE). This patient group often has a complicated care regime which has taken time to develop in response to individualised needs.

It is important to recognise that a child with tracheostomy-LTV often has a number of co-morbidities as compared to the non-ventilated child with a tracheostomy, who may have no or very few other co-morbidities.

Both these patient groups, when unwell, are more likely to need acute hospital admission with provision of high dependency or intensive care. In the current situation, where resources are being monitored closely and some areas are having to respond to demand which exceeds capacity, it is in everyone's best interests to avoid preventable admissions.

The exposure of healthcare staff to the SARS-CoV-2 coronavirus is to be prevented. This is to protect the workforce from COVID-19 disease and to prevent the onward transmission to further members of the population. It is acknowledged that without an active, well, healthcare workforce, the pandemic outcomes would be greatly worse.

The National Tracheostomy Safety Project (Paediatric Working Group) is a group of health care professionals who have been working to improve the safety of tracheostomy care in the UK and Ireland. The group includes representatives from specialist areas of ENT surgery, Paediatric Intensive Care, Respiratory Care, Speech and Language therapy, Physiotherapy, Anaesthetics and Paediatric specialist nurses.

The group propose to interpret the latest PHE guidance for those involved in delivering care to these patients with tracheostomy or long-term ventilation by tracheostomy.

<https://www.gov.uk/government/publications/wuhan-novel-coronavirus-infection-prevention-and-control/covid-19-personal-protective-equipment-ppe>

*Certain work environments and procedures convey higher risk of transmission and aerosol generating procedures (AGPs) present risk of aerosolised transmission. This guidance therefore seeks to set out clear and actionable recommendations on the use of PPE, as part of safe systems of working, for health and social care workers relative to their day-to-day work. Incidence of COVID-19 varies across the UK and risk is not uniform and so elements of the updated guidance are intended for interpretation and application dependent on local assessment of risk.*

### **PHE 03/04/2020**

The main aims of this guidance are to use PHE guidance in a risk assessed method to:

- **Protect** the NHS workforce
- **Reduce transmission** of SARS-CoV-2 to patients, public and staff
- **Reduce preventable admission** to hospital or HDU/ICU to maximise available resources

## 2. Delivery of Established Care

It is proposed that, for children who require Tracheostomy or Tracheostomy Long-Term Ventilation (Tracheostomy-LTV) care, the best approach is **to leave their care unchanged as much as possible**. This will hopefully mean a continued stability in their health, and that the parent or community-led care can continue with social distancing techniques providing a level of protection for them.

Emergency Healthcare Plans should be provided by the responsible hospital specialists to people receiving Tracheostomy-LTV. They should provide information about what to do and who to contact in an emergency situation. They should form part of hand-held records that are fully accessible to the person receiving LTV, parents, carers and the health and social care teams. These plans should include reference to any agreed ceilings of care or advanced care plans for these children.

In the current climate where COVID-19 is an active pandemic affecting our community, the use of precautions for the care of all patients with a tracheostomy or tracheostomy-LTV apply. Care should be modified to:



- Protect staff
- Protect patients
- Reduce the frequency of airway, tracheostomy and ventilator interventions which may have viral aerosol-generating potential

### Protecting staff

In order to minimise the risk of healthcare staff bringing SARS-CoV-2 into the patient environment, the use of appropriate PHE personal protective equipment (PPE) by staff is recommended alongside good handwashing practices.

**General contact** (with a patient confirmed or suspected to have COVID-19) or entry into a designated cohort area should involve the PPE demonstrated. Eye protection is based on risk assessment, but we recommend that due to the nature of the patient group this guidance is aimed at, that eye protection is worn at all times.

Note that this 'general contact' PPE should also be used when cleaning equipment.

The most common way that the virus is spread is from contaminated surface or hand contact, which is then transferred to the mucus membranes (eyes, nose or mouth). Hand washing is therefore essential.

'Sessional' PPE is permitted. That means you don't have to change all of your equipment after every contact if you are in an area with more than one patient. Doffing (removal) of PPE is important. Rehearse and ask a colleague ('buddy') to watch you.

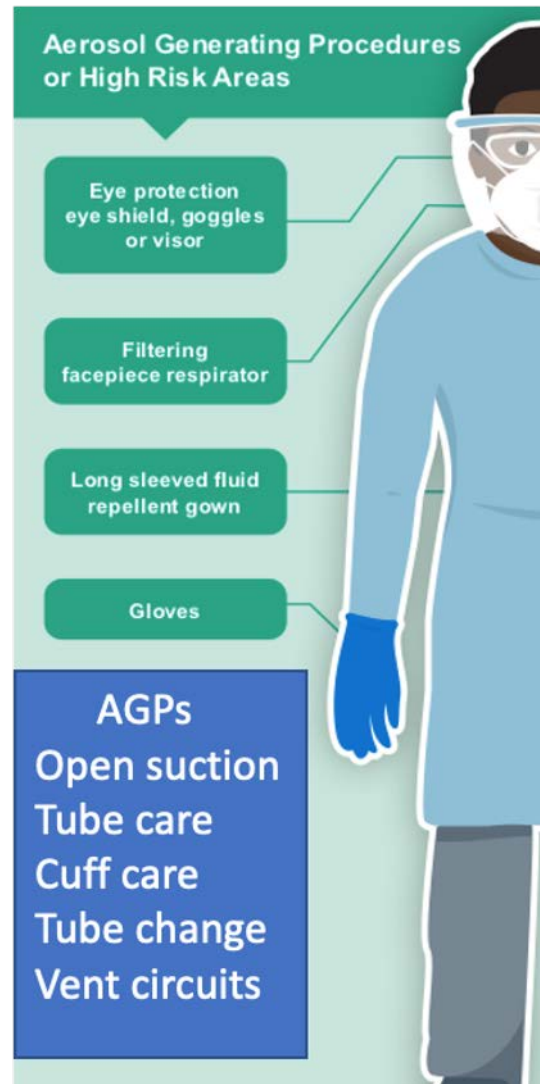
**Aerosol Generating Procedures (AGPs)** pose additional risks for staff. If you work in a high-risk area where AGPs are occurring (in an ICU/HDU where there is ventilation with a positive pressure gas flow occurring) then the risks of exposure to virus-containing aerosols are increased. This is particularly the case if you are providing care specifically related to the tracheostomy tube. Some procedures can cause coughing, and some involve circuit disconnection.

Tracheostomy procedures include:

- Open suction
- Tube care (cleaning, dressings, ties/tapes)
- Cuff care
- Tube changes
- Changes of ventilator circuits

Sessional PPE can be used in a cohort area. This includes a 'filtering facepiece respirator (FFP3/N95 masks recommended by NHS England), long sleeved gown and visor and single use apron with either a double glove layer or change of gloves and apron after an AGP.

Closed suction systems should be used where possible.



Tracheostomy tubes with inflated cuffs are ideal to reduce the aerosol risks to staff, but an individual assessment must be made for each patient. Cuffed tubes stop laryngeal airflow, prevent vocalisation and communication and increase the risks if the tube becomes blocked as the patient cannot breathe around the tube. In children they also carry morbidity due to tracheal wall damage and injury.

Patients should be cohorted into designated areas where possible. This allows the delivery of care to be clear and consistent and may conserve the supply of PPE by allowing sessional use (the PPE may be worn between different patients, with appropriate cleaning/changing of outer gloves/gown or apron between patients).

**High Risk Areas** include:

- Areas where COVID positive patients are managed
- Areas where patients with an unknown but suspected COVID status are managed
- Areas where Aerosol Generating Procedures occur frequently (ventilated children, including children with tracheostomies and tracheostomy-LTV)

**General Areas** include:

- COVID negative asymptomatic patients (following an appropriate screen or diagnostic test)
- Non-ventilated children with tracheostomies (although you will need enhanced PPE if you are performing AGPs such as tube care or suction)
- Based on patient population and local practice it may be useful to have one staff member in AGP-appropriate PPE at all times to respond in a timely manner to a tracheostomy emergency such as a blocked tube so there is no delay.

**Protection of patients**

Staff should ensure that they maintain the highest possible standards of infection control, especially when entering and leaving a cohort area, or when working between patients. With appropriate PPE and practices, the risks to staff of healthcare-associated SARS-CoV-2 infection are low. However, due to the nature of transmission of this virus, healthcare workers can transmit it between patient

Hand washing, alcohol gel and outer glove/gown or apron changes between patient contacts remain important.

**Recommendations for parents or legal guardians**

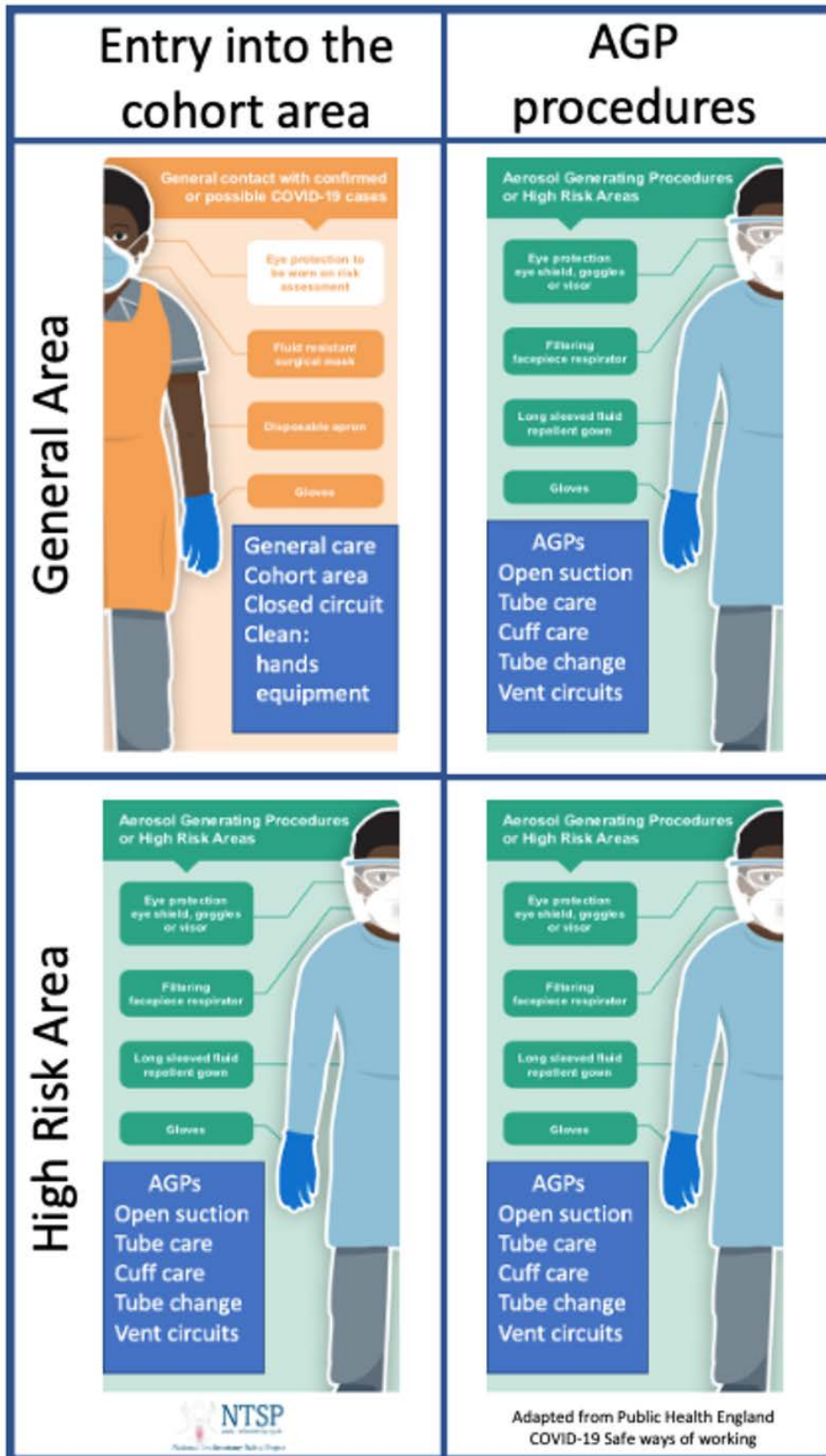
For parents or legal guardians who are acting as carers for a child with a tracheostomy or tracheostomy-LTV, the infection control measures both with the child and with the supporting staff/community are important. The protective measures (handwashing and social distancing) are in place to prevent infection or limit the spread of an infection in either a hospital or community setting. It may be beneficial to offer training and provision of PPE to these parents or guardians who are performing tracheostomy care in situations where they are not able to socially distance and are therefore at greater risk of spreading infection. Decisions about these recommendations should be made at a local level.

In the hospital setting, visitors should be limited where possible to one named parent or guardian for the duration of the child's admission. If this person has to self-isolate due to PHE guidance then this will have to be addressed with local teams.

Hospitals are likely to close communal areas such as coffee rooms and play rooms in order to avoid social gathering, maintain social distancing, and to prevent the spread of SAR-CoV-2 infection. For these reasons it is also important that parents or guardians should only interact with their own child. We acknowledge that this will be difficult given the friendships which often form between the families and carers of these patients, particularly in prolonged or repeat hospital admission episodes.

For those children admitted to critical care units due to suspected or confirmed COVID-19, PICS/ NHS England have issued guidance that only one parent/ carer be allowed to visit the child, and that this parent/ carer should stay inside the dedicated isolation area until discharge. For COVID-19 –positive patients, parents should wear appropriate PPE equipment.

Summary PPE requirements with respect to children with tracheostomy



### **Modifications to care regimes during the COVID-19 pandemic**

The principles are that established care should continue, but that airway and tracheostomy interventions should be reduced to a minimum. This minimum frequency of interventions will change from patient to patient and over time, depending on the patient's condition.

It is not considered appropriate in the **asymptomatic patient** to make changes to their ventilation, equipment or tracheostomy care regime at this time, but rather for those healthcare staff involved in delivering care to take additional PPE precautions as outlined for AGP above.

Where possible, at the next planned tube change, consider changing all children to an equivalent tracheostomy tube which may allow less frequent changes (e.g. Bivona®, dependent on local availability and patient-suitability).

### 3. Suspected or Confirmed COVID-19

When patients with Tracheostomy or Tracheostomy-LTV **develop symptoms or signs consistent with COVID-19 or have suspected infection**, the need for patient isolation and PPE is essential and should be guided by local Infection Prevention & Control teams.

Some children will be able to remain in the community during these times, others may require hospital admission. Some patients will have rising carbon dioxide levels and falling pulse oximetry saturations due to their respiratory infection, and require additional respiratory support (ventilation pressures or oxygen delivery). This may necessitate admission to a hospital specialist area, high-dependency or intensive care unit in order to optimise care.

In these patients it is important to consider additional actions to minimise the risk of transmission by **reducing aerosol generation**. It is not possible to remove the need for AGPs entirely and isolation, PPE and decontamination practices remain essential.

Modifications to reduce the exposure of staff to AGPs could include:

- Reduce the frequency of suction to 'as indicated' by the clinical condition
  - E.g. patients may not need suction every 4 hours regardless of secretion load
  - Suction frequency should be reviewed regularly
- Reduce the frequency of inner cannula cleaning/changing (if used)
- Consider the use of a 'dry' ventilator circuit, using a Heat and Moisture Exchange (HME) filter rather than an active heated/water-based system; 'anti-viral' HME filters are available
- Reduce the frequency and use of nebulised therapies and move to an 'as indicated' regime
- Consider changing from open suction to a modified closed suction system
  - E.g. the Kelley circuit.  
[http://www.tracheostomy.org.uk/storage/files/The\\_Kelley\\_Circuit\\_For\\_Tracheostomy.pdf.pdf](http://www.tracheostomy.org.uk/storage/files/The_Kelley_Circuit_For_Tracheostomy.pdf.pdf)



Any modifications to care to reduce aerosol generation and viral spread in the Tracheostomy-LTV or Tracheostomy patient group must be considered in the context of potential risks or side-effects:

Action	Risk or Side-effect
<ul style="list-style-type: none"> <li>Viral filter with heat-moisture exchange attached to the patient tracheostomy in place of simple heat-moisture exchange filter</li> </ul>	<ul style="list-style-type: none"> <li>None identified</li> </ul>
<ul style="list-style-type: none"> <li>Consider conversion from heated humidified system to inline viral heat-moisture exchange filter ('dry circuit' rather than 'wet circuit')</li> </ul>	<ul style="list-style-type: none"> <li>Increased secretion viscosity and mucus plugging which may lead to deterioration and requirement for increased nebulisation/suction or change in ventilation</li> </ul>
<ul style="list-style-type: none"> <li>Closed in-line suction catheter to avoid disconnections</li> </ul>	<ul style="list-style-type: none"> <li>Dead-space with CO<sub>2</sub> retention and requirement for increased ventilation</li> </ul>
<ul style="list-style-type: none"> <li>Conversion to a dual limb ventilator circuit to avoid environmental expiration</li> </ul>	<ul style="list-style-type: none"> <li>Lack of care team familiarity with these circuits; not compatible with all portable ventilators</li> </ul>
<ul style="list-style-type: none"> <li>Viral filter to protect the ventilator on expiratory limb</li> </ul>	<ul style="list-style-type: none"> <li>None identified; not always applicable</li> </ul>
<ul style="list-style-type: none"> <li>Cuffed tracheostomy tube: <b>only</b> consider if large leak and other efforts to reduce aerosol generation has been implemented (Viral HME, closed inline suction etc)</li> </ul>	<ul style="list-style-type: none"> <li>Traumatic tracheostomy change; impaired management of oro-pharyngeal secretions/swallowing; loss of vocalisation and communication; smaller internal diameter tube may be required; lack of care team familiarity and care requirements for cuffed tracheostomy; may require hospital admission in some patients; cuff pressure related tracheal injury; a blocked or displaced cuffed tube is a more dangerous situation than a blocked or displaced uncuffed tube.</li> </ul>

Not all these actions will be appropriate for all patients or in every patient setting. Changes made in order to prevent viral spread may lead to worsening of patient respiratory status, escalation of care requirements, prolonged admission to hospital and additional AGPs. The changes should therefore be made in balance of these risks to the patient, staff and resources.

National work is being undertaken to develop a single limb wet circuit that can incorporate a viral HMEF without affecting ventilation and functionality. We will disseminate any updates as they occur. This system is being trialled at Alder Hey currently.

**Appendices:**

**Appendix 1: Overview of existing inpatient and admission from community**

**1. For asymptomatic tracheostomy-LTV or tracheostomy only**

Tracheostomy-LTV children will be in a high-risk area and should be looked after in “sessional” FFP3 PPE. If an AGP is performed then PPE should be changed after that episode. For tracheostomy only children basic PPE plus enhanced PPE for AGP only. Consider having one person in FFP3 PPE in the area. Patients should be tested for COVID-19 if they develop symptoms or anything changes in their clinical picture. These children could be nursed in a bay together with the agreement of the local Infection Control and Prevention team .

**2. For suspected or Covid positive tracheostomy-LTV or tracheostomy only**

Tracheostomy-LTV children will be in a high-risk area and should be looked after in “sessional” FFP3 PPE. If an AGP is performed then PPE should be changed after that episode. For non-LTV children basic PPE plus enhanced PPE for AGP only. Consider having one person in FFP3 PPE in the area. If an AGP is performed then PPE should be changed after that episode. They should be tested for COVID-19. Isolate in a cubicle if possible.

**3. For all outpatients requiring admission assume all SARS-CoV-2 infection.**

Discuss the role of admission COVID testing and isolation with your local Infection Control and Prevention team. It is recommended to consider isolation in a cubicle initially and apply PPE as per PHE guidance.

## **Appendix 2: Care Modification Summary**

### **1. Tracheostomy Long-Term Ventilated (Tracheostomy-LTV) patients**

#### **A. Tracheostomy-LTV patient asymptomatic / not suspected**

- FP3 PPE “sessional” and change apron and gloves after an AGP procedure e.g.: suction or tube change
- Isolate or cohort
- Closed in-line suction system if available in hospital and staff trained
- Continue with established care ventilation regime
- Consider local policy for COVID testing

#### **B. Tracheostomy-LTV patient suspected or COVID positive**

- FP3 PPE “sessional” and change apron and gloves after an AGP procedure e.g.: suction or tube change
- Isolate or cohort
- Closed in-line suction system
- Tracheostomy tube changes only if problems
- Consider suitability for change to cuffed tracheostomy tube if large leak only
- Send COVID test
- Consider placing viral HME onto the tracheostomy with a dry circuit (note that at present it has not been demonstrated that adding a HMEF to a single limb wet circuit is clinically possible)
- Consider change to a dual-limb ventilator set-up if LTV-ventilator allows
- Consider escalation to a dual-limb ventilator circuit with heated humidified circuit and viral filter to protect the ventilator if dry circuit with HME not tolerated

### **2. Tracheostomy-only patients**

#### **A. Tracheostomy-only patient asymptomatic / not suspected**

- Basic “sessional” and enhanced PPE if AGP then change apron and gloves after an AGP procedure e.g.: suction or tube change
- Additional oxygen maybe needed via a trache mask
- Use routine HME
- Isolate or cohort
- Consider local policy for COVID testing

#### **B. Tracheostomy-only patient suspected or COVID positive**

- FP3 PPE “sessional” and change apron and gloves after an AGP procedure e.g.: suction or tube change
- Isolate or cohort
- Tracheostomy tube changes only if problems
- Send COVID test
- Place viral HME at the tracheostomy in place of usual HME
- Closed suction if possible in hospital setting if trained staff

For all suspected or confirmed COVID positive patients, monitor respiratory function and ventilation parameters and escalate to paediatric intensive care team if concerns as the patient may need specialist intensive care ventilation.

**Appendix 3: Emergency Management of Tracheostomy Emergency COVID positive or Suspected Patient**

**Safety checks**

<b>1</b>	PPE available outside cubicle
<b>2</b>	Emergency Paediatric Tracheostomy Algorithm' available INSIDE and OUTSIDE ROOM
<b>3</b>	End Tidal CO <sub>2</sub> monitoring used (in all critical care areas)
<b>4</b>	Closed in-line suction system (if Tracheostomy-LTV)
<b>5</b>	Viral HME filter attached to the rescue breathing circuit: BVM or T-piece

**Hot Zone/Dirty** = cubicle or patient bed side

**Warm Zone 'Anteroom'/Clean** = outside cubicle door

1. Care should follow the NTSP Guidelines using the bed head and algorithm at the bedside. A second algorithm will be on the COVID airway trolley which will be brought to the anteroom/clean zone in an emergency.
2. Plan ahead! E.g. elective tracheostomy tube changes or airway interventions with appropriate support whenever possible to avoid emergencies
3. In the event of an Emergency –

Nurse in the cohorted area or at the patient's bedside should be in FFP3 PPE at the time of an emergency.

**Call for help – pull emergency buzzer in hot zone**

4. Tell responder:
  - What the problem is
  - Help required
  - Who to contact (2222 COVID Cardiac arrest team)
5. **First Responder (in PPE) Follows Emergency Tracheostomy Algorithm**

Changes below:

- Closed in-line suction system for Tracheostomy-LTV patients
- Viral HME filter between tracheostomy/stoma/face mask and the BVM or breathing circuit
- **DO NOT** listen and feel at the mouth and tracheostomy/ stoma

6. **Runner** outside cubicle:
  - Collect Covid-19 Intubation Trolley and Arrest Trolley
  - Read-out Tracheostomy emergency algorithm
  - Ensure arriving team wear **PPE appropriate for AGP**

7. **Expert help:**
  - if **Airway Intervention** is needed to use COVID Airway intubation local guidance which should be available on the COVID airway trolley.

**Appendix 4: Circuit or Tracheostomy suction modifications**

**1. The Kelley circuit**

Closed in-line suction with a tracheostomy

[http://www.tracheostomy.org.uk/storage/files/The Kelley Circuit For Tracheostomy.pdf.pdf](http://www.tracheostomy.org.uk/storage/files/The%20Kelley%20Circuit%20For%20Tracheostomy.pdf.pdf)

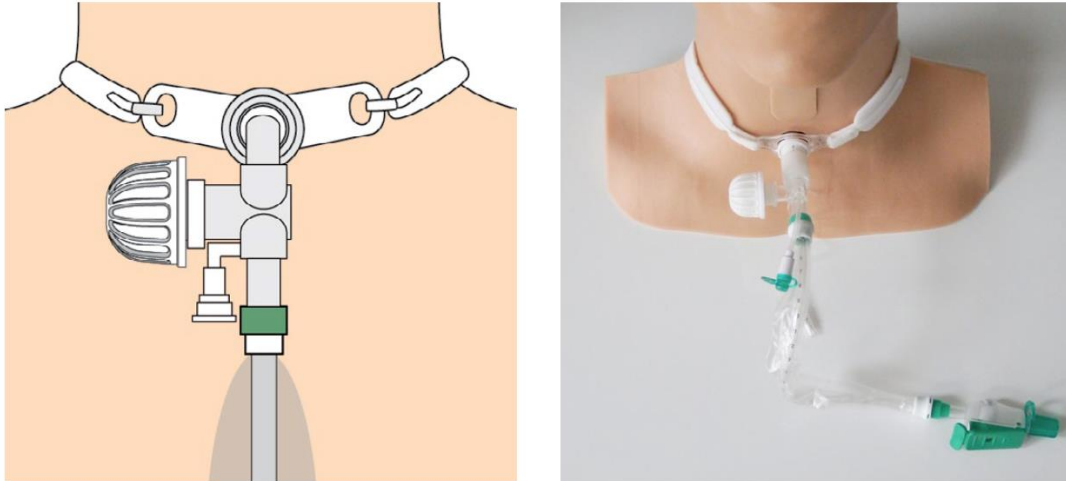
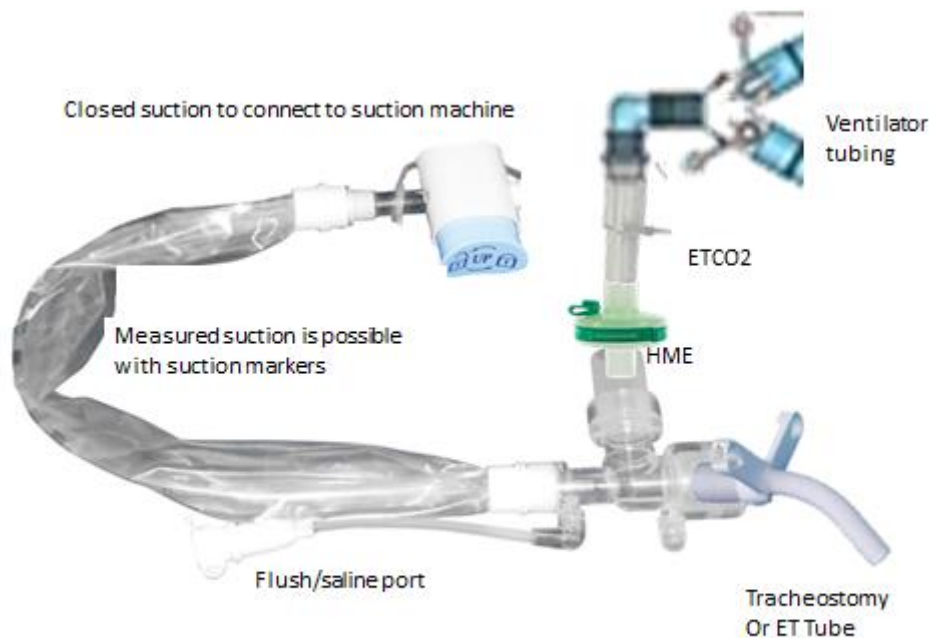


Figure 1. The Kelley Circuit with a closed circuit suction system attached to the ISO 15 hub of the tracheostomy tube and the ProTrach XtraCare attached to the ventilator hub on the side.

**2. Dual limb ventilator set up for COVID Positive or Suspected Patient**

Proposed example of ventilator dual limb 'dry circuit' with viral HME in place.



### 3. Alder Hey single limb wet circuit with viral HMEF: Trial



Appendix 5: **References and definitions**

**Personal Protective Equipment**

- <https://www.gov.uk/government/publications/wuhan-novel-coronavirus-infection-prevention-and-control>

Please keep updated through your government public health department.  
Current information (accessed 05/04/2020):

- [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/877728/T1\\_Recommended\\_PPE\\_for\\_healthcare\\_workers\\_by\\_secondary\\_care\\_clinical\\_context\\_poster.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/877728/T1_Recommended_PPE_for_healthcare_workers_by_secondary_care_clinical_context_poster.pdf)
- [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/877603/T4\\_Additional\\_considerations\\_of\\_COVID-19\\_poster.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/877603/T4_Additional_considerations_of_COVID-19_poster.pdf)
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- <https://www.gov.uk/government/publications/guidance-on-shielding-and-protecting-extremely-vulnerable-persons-from-covid-19/guidance-on-shielding-and-protecting-extremely-vulnerable-persons-from-covid-19>

**Extremely vulnerable:**

***What do we mean by extremely vulnerable?***

*People falling into this extremely vulnerable group include:*

1. *Solid organ transplant recipients.*
2. *People with specific cancers:*
  - *people with cancer who are undergoing active chemotherapy*
  - *people with lung cancer who are undergoing radical radiotherapy*
  - *people with cancers of the blood or bone marrow such as leukaemia, lymphoma or myeloma who are at any stage of treatment*
  - *people having immunotherapy or other continuing antibody treatments for cancer*
  - *people having other targeted cancer treatments which can affect the immune system, such as protein kinase inhibitors or PARP inhibitors*
  - *people who have had bone marrow or stem cell transplants in the last 6 months, or who are still taking immunosuppression drugs*
3. *People with severe respiratory conditions including all cystic fibrosis, severe asthma and severe COPD.*
4. *People with rare diseases and inborn errors of metabolism that significantly increase the risk of infections (such as SCID, homozygous sickle cell).*
5. *People on immunosuppression therapies sufficient to significantly increase risk of infection.*
6. *Women who are pregnant with significant heart disease, congenital or acquired.*

**PHE 30/03/2020**

<https://www.gov.uk/government/publications/wuhan-novel-coronavirus-infection-prevention-and-control/covid-19-personal-protective-equipment-ppe>

## **Aerosol Generating Procedures:**

### **8.1 Aerosol Generating Procedures**

*The following procedures are currently considered to be potentially infectious AGPs for COVID-19:*

- *intubation, extubation and related procedures, for example manual ventilation and open suctioning of the respiratory tract (including the upper respiratory tract)*
- *tracheotomy or tracheostomy procedures (insertion or open suctioning or removal)*
- *bronchoscopy and upper ENT airway procedures that involve suctioning*
- *upper gastro-intestinal endoscopy where there is open suctioning of the upper respiratory tract*
- *surgery and post mortem procedures involving high-speed devices*
- *some dental procedures (for example, high-speed drilling)*
- *non-invasive ventilation (NIV); Bi-level Positive Airway Pressure Ventilation (BiPAP) and Continuous Positive Airway Pressure Ventilation (CPAP)*
- *High Frequency Oscillatory Ventilation (HFOV)*
- *induction of sputum (cough)*
- *High flow oxygen*
- *Videofluoroscopic swallow study (VFSS)*
- *Cough reflex testing*

*For patients with possible or confirmed COVID-19, any of these potentially infectious AGPs should only be carried out when essential. Where possible, these procedures should be carried out in a single room with the doors shut. Only those healthcare staff who are needed to undertake the procedure should be present.*

**PHE 03/03/2020**

### **Sessional PPE:**

*A single session refers to a period of time where a health and social care worker is undertaking duties in a specific clinical care setting or exposure environment. For example, a session might comprise a ward round, or taking observations of several patients in a cohort bay or ward. A session ends when the health and social care worker leaves the clinical care setting or exposure environment. Once the PPE has been removed it should be disposed of safely. The duration of a single session will vary depending on the clinical activity being undertaken.*

**PHE 05/04/2020**

### **Higher risk areas:**

#### **8.2 Higher risk acute inpatient care areas**

*Long sleeved disposable fluid repellent gowns, FFP3 respirators, eye protection, and gloves must be worn in higher risk areas containing possible or confirmed cases, or as indicated by local risk assessment. If non-fluid-resistant gowns are used, a disposable plastic apron should be worn underneath. Gloves and aprons are subject to single use as per Standard Infection Control Precautions (SICPs) with disposal after each patient contact. Gowns, respirators and eye protection may be subject to single session use [Section 6](#).*

*A higher risk acute inpatient care area is defined as a clinical environment where AGPs are regularly performed.*

*Higher risk acute care areas include:*

- *intensive care and high dependency care units (ICU or HDU)*
- *emergency department resuscitation areas*
- ***wards or clinical areas where AGPs are regularly performed*** (such as wards with NIV or CPAP)
- *operating theatres, where AGPs are performed*
- *endoscopy units, where bronchoscopy, upper gastrointestinal or nasendoscopy are performed*

**PHE 05/04/2020**