**Western Health COVID-19 intubation guideline**

**Aim**

The aim of this document is to provide clear guidance regarding Western Health’s approach to intubating COVID-19 patients.

**Intubation Guideline**

The Safe Airway Society have produced a consensus document outlining the principles of airway management and tracheal intubation in COVID-19 patients. It is recommended that all airway clinicians read the document. Large parts of this document are reproduced with permission and modified for Western Health below

**General comments**

1. Generic guidelines already exist for intubation of the critically ill patient and other patient groups. The appropriate guidelines should be followed where they do not contradict specific recommendations for the COVID-19 patient group, outlined below.
2. Generic resources already exist to facilitate airway rescue and transition to the ‘Can’t Intubate Can’t Oxygenate’ (CICO) scenario. Many of these algorithms are similar in content. These should be followed where they do not contradict the specific recommendations for the COVID-19 patient group, outlined below.
3. Generic checklists already exist for intubation of the critically unwell patient. These should still be used as a minimum, but consideration should be given to using the SAS checklist which has been specifically modified for the COVID-19 patient group.
4. Early intubation during daytime hours should be considered to prevent the additional risk to staff of emergency intubation during severe hypoxia or cardiac/respiratory arrest, and to avoid prolonged use of high flow nasal oxygen or non-invasive ventilation.
5. The safety of medical personnel is paramount. Significant preparation is required to optimise staff and patient safety in preparing for the airway management of the COVID-19 patient group. Meticulous attention to PPE donning and doffing is required (as described in the PPE guideline). In addition to clinical and support staff in intensive care, operating theatres and the emergency department, extensive liaison will be required with multiple other stakeholders, including but not limited to administration, infection control, engineering, sterilisation and equipment disposal services, procurement and education units.
6. The principles for airway management outlined below should be the same for both the COVID-19 patient group with mild or asymptomatic disease requiring urgent surgery and for critically unwell patients with ARDS.

**Guiding principles**

These recommendations have been developed according to the following general principles with the goal of maintaining staff safety while providing timely, efficient and effective airway management:

“Standardised practice” satisfies the following criteria:

* *Safe*: choose options that will not expose patient or staff to unnecessary risk;
* *Simple*: straightforward solutions that can be executed efficiently;
* *Familiar*: where possible rely on existing techniques that are familiar to the relevant clinicians;
* *Reliable*: choose options that are known to be successful in the hands of the relevant clinicians;
* *Robust*: choose options that will continue to fulfil the above criteria in the face of foreseeable variations in patient characteristics, environment and the availability of personnel and resources.

**WH RECOMMENDATIONS FOR AIRWAY MANAGEMENT IN THE COVID-19 PATIENT GROUP**

**Environment for airway management**

* Negative pressure ventilation rooms with an adjacent room (antechamber) are ideal to minimise exposure to aerosol and droplet particles. Where this is not feasible, normal pressure rooms with closed doors are recommended.
* Dedicated spaces should be used for planned airway management of the COVID-19 patient group (e.g. airborne infection isolation rooms). The potential resource and ergonomic advantages of this approach need to be balanced against the implications of transporting potentially infective patients around the hospital and room cleaning between patients.
* The decision to move a clinically stable patient between two clinical areas prior to airway management should primarily be based on whether the destination environment will provide a more controlled situation, better equipment and/or more experienced staff to make the process of airway management safer (including less likely to generate aerosolised virus).

**Sunshine Hospital**

* Patients already on ICU who require intubation should be moved to the ICU negative pressure isolation room for intubation
* Patients from the ward may be brought to Sunshine DPU for intubation in the procedure room where the patient’s clinical condition allows for transfer.
* Emergency intubations that take place on the ward or ED should ideally be performed in a negative pressure environment, or if not possible, in a room with a closed door.

**Footscray Hospital**

* Patients already on ICU who require intubation should be moved to the ICU negative pressure isolation room for intubation
* Patients from the ward may be brought to Footscray DPU for intubation in the bronchoscopy procedure room.
* Emergency intubations that take place on the ward or in ED should ideally be performed in a negative pressure environment, or if not possible, in a room with a closed door.

Any other aerosol generating procedures (AGPs) that might be necessary should be considered post intubation, including nasogastric tube insertion.

**Equipment, Monitoring and Medications**

*General Principles*

* Where an equivalent disposable item of equipment is available, this is always preferred over reusable equipment. Where disposable items are not considered equivalent, the time, resource and infection risk implications of sterilising reusable equipment should be considered on a case-by-case basis. Utmost care should be taken to avoid unnecessarily contaminating equipment, and the use of wipe-clean boxes for airway Plans A to D should be considered.
* Allocation of dedicated items of reusable equipment for use in the COVID-19 patient group is preferred where feasible.

*Oxygen delivery and ventilation equipment – prior to intubation*

* Oxygen can be administered via nasal cannulae, (standard or HFNO), simple facemask or non-rebreather mask, with the general principle that the higher the flow rate, the greater risk of virus aerosolisation.
* NIV should generally be avoided due to its unproven utility in ARDS and the risk of virus aerosolisation.

*Oxygen delivery and ventilation equipment – during pre-oxygenation*

* Pre-oxygenation should be performed using a well-fitting occlusive face mask attached to a manual ventilation device with an oxygen source, or an anaesthetic machine.
* A viral filter **MUST** be inserted between the face mask and manual ventilation device to minimise aerosolisation. The viral filter should be applied directly to the face mask as an increased number of connections between the face mask and filter increase the opportunity for disconnection on the patient side, with subsequent aerosolisation of the virus.
* An anaesthetic machine with a circle system, a hand-held circuit (e.g. Mapleson circuit) or a self-inflating bag-valve-mask (BVM) attached to an occlusive face mask can be used as the manual ventilation device. While bag collapse when using Mapleson and circle systems provides a sensitive indication of face mask leaks (alerting to potential aerosolisation of the virus), this should only be a consideration in clinicians already familiar with these devices. For anaesthetists, manometry and ETO2 monitoring are further advantages of using an anaesthetic machine for this purpose.
* Note that the rebreathing/non-rebreathing nature of the ventilation device should not be a consideration for any clinician group in choosing between these alternatives as once the viral filter is applied, no virus should enter the ventilation device. As such, the most important factor in choosing between these devices is prior familiarity.
* Non-rebreather masks provide sub-optimal pre-oxygenation and promote aerosolisation and are not recommended for this purpose.
* Nasal oxygen therapy (via standard or high flow nasal cannulae) should not be used during pre-oxygenation or for apnoeic oxygenation due to the risk of virus aerosolisation to the intubation team.

*Oxygen delivery and ventilation equipment – post intubation*

* Oxygenation and mechanical ventilation can be delivered using operating theatre (OT) anaesthetic machines or mechanical ventilators (in ICU or ED). While there are advantages and disadvantages of both, the choice will likely depend more on their availability and the location of patient care rather than their individual characteristics.

*Airway Equipment*

A pre-prepared ‘COVID-19 airway trolley’ along with a CMAC videolaryngoscope will be available at Footscray, Sunshine, Joan Kirner and Williamstown Hospitals in the operating department.

This trolley will contain airway equipment for airway Plans A to D. To minimise contamination, the equipment for each of these plans will be in separate boxes on the trolley. All airway personnel should be familiar with the contents of these boxes. All equipment that may be necessary should be brought into the room.

*Supraglottic Airways*

* Where a supraglottic airway is indicated, use of a second-generation device (i-gel) is recommended as its higher seal pressure during positive pressure ventilation decreases the risk of aerosolisation of the virus.

*Videolaryngoscopy*

* CMAC videolaryngoscopes are a limited resource.
* A CMAC should be used as the default laryngoscope for tracheal intubation;
* A CMAC should be dedicated for use in the COVID-19 patient group;
* Both Macintosh and hyperangulated CMAC blades should be available;
* Hyperangulated D blades should only be used by airway operators who are proficient in their use.

*Suction*

* Once the patient is intubated, closed suction systems should be used to minimise aerosolisation of the virus.

*Miscellaneous*

* A cuff manometer is unnecessary peri-intubation. It is recommended to deliberately err on the side of over-inflation of the tracheal cuff.

*Equipment available without delay nearby*

* Cardiac arrest trolley;
* Difficult airway trolley;
* Fibreoptic scope

**Team**

The following principles are considered for team assembly:

* Limit numbers: only those directly involved in the process of airway management should be in the room;
* Use the most experienced available as per the daily rostering
* Consider excluding staff who are vulnerable to infection from the airway team. This includes staff who are older (> 60yrs), immunosuppressed or have serious co-morbidities. Although there is limited evidence base for risk in pregnancy at present, consider minimizing high risk contact situations for pregnant healthcare workers.
* Allocate clearly defined roles

At WH we recommend the following team:

1. **Airway Operator.** Most experienced/skilled anaesthetist to perform upper airway interventions.
2. **Airway Assistant.** This should be an experienced clinician or nurse (at least an airway-trained registrar, or anaesthetic nurse), to pass airway equipment to the Airway Operator, and help with bougie use and in bag-valve-mask (BVM) ventilation.
3. **Team Leader.** A second anaesthetist to coordinate the team, manage drugs, observe monitoring, operate the anaesthetic machine/ventilator and provide airway help if emergency front-of-neck airway (eFONA) is required. This member will also be responsible for communication to team members outside the room.
4. **Door Runner** (just outside the room) to pass in any further equipment or drugs that may be needed in an emergency. This team member can also act as the PPE “Spotter” (see below), and be responsible for documentation.
5. **Outside Room Runner.**To pass equipment into ante room (dirty side), or directly to Door Runner if no ante room.

At WH we plan to use in-hours ‘intubation teams’, although this will be dependent on the number of cases and staff resources. This may improve familiarity, compliance and efficiency of processes around airway management in the COVID-19 patient group, including proper donning/doffing of PPE use amongst the staff. These teams also allow cognitive off-loading of the intensive care and and emergency department teams, and may also concurrently assist with other invasive procedures such as CVC insertion while under PPE. Evidence for the benefit of this strategy is not yet available.

**Planning**

* Meticulous airway assessment to be performed early by senior airway clinician and clearly documented;
* An individualised airway management strategy should be formed, based on patient assessment and the skill-mix of the team. This should include plans for intubation and airway rescue via face mask, supraglottic airway and emergency front of neck access (eFONA), with defined triggers for moving between each;
* The ventilation plan should be discussed prior to intubation. This may involve protective lung ventilation, use of high PEEP, proning, and other strategies for refractory hypoxaemia including consideration of extracorporeal membrane oxygenation.

**Communication**

Clear communication is vital while managing the COVID-19 patient group due to the risk of staff contamination. At the same time, PPE may impede clear communication.

* Pre-briefing should occur, to share a mental model with the whole team prior to intubation. This should include (but is not limited to) verbalising role allocation, checking equipment, discussing any anticipated challenges, the airway management strategy, post intubation plans and PPE donning and doffing processes.
* Clear, simple, concise language should be used.
* Voices need to be raised to be heard through PPE.
* It may be hard for the Outside Room Runner to hear requests from inside the room. At WH we advocate an audio communication system, such as leaving your mobile phone on speakerphone, EarPods or a walkie-talkie. Alternatively a whiteboard and marker pen can be used.
* Standardised language should be consistently employed; that is precisely defined, mutually understood and used to communicate key moments of situation awareness (critical language)
* Closed-loop communication should be encouraged.
* Speaking up should be encouraged.

**Cognitive Aids**

The incidence of errors during airway management is known to increase under stress, even when experienced clinicians are involved. Task fixation, loss of situation awareness and impaired judgement may arise. The use of resources to support implementation of the airway strategy is particularly important in the COVID-19 patient group, where the challenges involved may consume significant cognitive bandwidth, even before airway management becomes difficult.

* Use of a ‘kit dump’ mat may facilitate preparation of equipment. Ideally this should be specifically modified for the COVID-19 patient group.
* The SAS intubation checklist specifically modified for the COVID-19 patient group is recommended.
* Familiarity, availability and use of a simple cognitive aid for airway rescue, that is designed to be referred to in real-time during an evolving airway crisis, is recommended.

**Personal Protective Equipment (PPE)**

There is a separate WH guideline for PPE. The following may be a duplication.

* ‘Buddy system’: all staff should ideally have donning and doffing of PPE individually guided by a specially trained and designated staff member acting as a ‘Spotter’ before entering room. This may help protect task-focused staff from PPE breaches and may help mitigate the stress experienced by the intubating team.
* PPE for **Airway Operator, Airway Assistant**and **Team Leader**(who may need to perform eFONA):

Impervious gown, theatre hat, N95 mask, consider face shield rather than goggles for eye protection, consider double gloves.

* Outer gloves should be removed carefully after airway management is completed/ the ETT is secured
* This level of PPE should also be worn for endotracheal tube repositioning/replacement, bronchoscopy and percutaneous dilatational tracheostomy.
* PPE for other team members.
* Gown, gloves, N95 facemask, eye protection.
* Infection control and staff safety to remain top priority. Hand hygiene processes need to be vigilantly followed.
* Follow hospital and/or WHO guidelines for both donning AND doffing of PPE.
* Recognise that doffing is a high-risk step for virus transmission to healthcare workers.

**Process for Airway Management**

Familiar, reliable techniques should be used to maximise first pass success, secure the airway rapidly and minimize risks to staff.

*Pre-oxygenation*

* Pre-oxygenation is particularly important as these patients will often desaturate quickly.
* In the period before the team enters the room to perform intubation, the patient’s oxygen delivery should be maximised by placing patient in 45° head up position, and they should remain in this position for pre-oxygenation
* Prior to the team entering, a critically unwell COVID-19 patient may be receiving high flow oxygen via nasal cannulae, simple facemask or a non-rebreather mask. These devices should not be used for pre-oxygenation when the team is in position, due to the risks of virus aerosolisation.
* If the patient is receiving high flow oxygen, it should be turned off prior to removal of the face mask or nasal cannulae to minimise aerosolisation.
* Pre-oxygenation should then be commenced immediately, using the best available facemask device, with a viral filter applied directly to the mask and ETCO2 in the system. NB: added connections increase the opportunity for disconnection.
* A 2-handed vice grip is recommended to maximize the facemask seal and minimise gas leak after induction.
* Manual ventilation (which may cause aerosolisation of the virus) should be minimised unless required for rescue oxygenation.
* Continuous waveform capnography should be used. A triangular rather than square ETCO2 trace or a low numerical ETCO2 value during preoxygenation may indicate a leak around the face mask with aerosolisation of virus and should prompt interventions to improve the seal.
* Fully pre-oxygenate the patient. **A minimum of five minutes of pre-oxygenation is recommended if ETO2 is not available**.
* The use of high flow nasal oxygen for apnoeic oxygenation during intubation is not recommended given the risk to staff due to aerosolisation of the virus.

*Induction*

* Use rapid sequence intubation (RSI) as the default technique unless concerns with airway difficulty make this inappropriate.
* Intubating conditions should be achieved with rocuronium (>1.5mg/kg IBW) OR suxamethonium (1.5mg/kg TBW). Generous dosing promotes rapid onset of deep neuromuscular blockade and minimises the risk of the patient coughing during airway instrumentation.
* The time between administration of neuromuscular blocking agent (NMBA) and laryngoscopy should be closely monitored to minimise apnoea time while ensuring adequate time is given for the NMBA to take effect to avoid precipitating coughing. The extended duration of action of rocuronium potentially provides an advantage over suxamethonium in the COVID-19 patient group, by preventing coughing and potential aerosolisation of virus should attempts at airway management be prolonged.

*Intubation*

* The CMAC videolaryngoscope is recommended for the first attempt at intubation.
* In addition to VL potentially contributing to first-pass success, visualising the larynx using the indirect (video screen) view, with the operator standing upright and elbow straight, maximises the distance between the Airway Operator’s face and the patient. This should reduce the risk of viral transmission*.*
* The choice between a Macintosh geometry and a hyperangulated videolaryngoscope blade should be made according to the skill set and clinical judgement of the airway operator.
* Care should be taken to place tube to correct depth first time, to minimise the need for subsequent cuff deflations.
* Once the tube is placed, the cuff should be generously inflated before positive pressure ventilation is attempted.
* The viral filter should be applied directly to the end of the tracheal tube. Increasing the number of connections between the filter and the tracheal tube increases opportunities for disconnection and aerosolisation of virus.
* Cuff pressure does not require monitoring with a cuff manometer. Generous cuff inflation is recommended.

*Face Mask Ventilation:*

If rescue face mask ventilation is required, the following precautions should be taken:

* A 2-handed vice grip is recommended (the Airway Assistant is therefore required to squeeze the bag).
* Ventilation pressure should be minimised through ramping and/or early use of an oropharyngeal airway with low gas flows.

*Emergency Front of Neck Access (eFONA)*

* In a CICO situation, use of a scalpel-bougie eFONA technique is advocated to minimise the viral aerosolisation risk of high-pressure oxygen insufflation via a small-bore cannula.

*Post intubation*

* A nasogastric tube should be placed at the time of intubation to avoid further close contact with the airway
* Unless single use, the laryngoscope blade should be placed in a tray, bagged and sealed for sterilisation immediately after intubation according to ASNZ4187 standards.
* PPE should be removed as per WH guidelines, using a ‘Spotter’ and noting that there is more risk of contamination during doffing than donning. PPE should be disposed of as per WH policy.
* In the ICU, a chest X-ray should usually be performed to confirm tube position but should be delayed until after central line insertion to minimise staff entries into the room.
* A debrief should occur after every episode or airway management in this patient group to discuss lessons learned.

*Extubation practices*

This is one of the highest risk times for aerosolisation.

Generic guidelines exist for extubation. These should be followed where they don’t conflict with the special considerations for extubation of the COVID-19 patient group outlined below. Patients should ideally be non-infective prior to extubation but this may not be feasible as resources become limited. Where this is achievable, however, standard extubation procedures apply. In order to minimize the risk of viral transmission the following recommendations apply:

* Staff members in full PPE; non-essential staff out of room
* The same level of PPE should be worn as for intubation
* Runner in clean anaesthetic bay with means of communicating
* Ensure all necessary equipment prepared and immediately available in room
* Extubation should occur on the patient’s bed
* Patient should ideally be ready for extubation onto facemask
* Non-invasive ventilation and high flow nasal oxygenation should be avoided if possible
* Optimise airway and oxygenation through positioning and recruitment manoeuvre
* Have patient sitting up with no theatre staff in front of patient
* Extubate under plastic drape/sheet
* Avoid positive pressure on bag as endotracheal tube removed
* Extubate on to facemask immediately. Use 2 handed grip and maintain seal until able to breathe on room air or low flow oxygen via Hudson mask or nasal prongs with a surgical mask on top
* Immediately dispose of single use equipment in a yellow clinical waste bin
* Patient should be encouraged not to cough
* Oral suctioning may be performed, with care taken not to precipitate coughing. Ensure no contamination of self or others.
* If familiar with technique, consider the following strategies to minimize coughing on extubation:
  + Opioids
  + Lignocaine
  + Dexmedetomidine
  + Spontaneously breathing deep extubation
  + LMA exchange

**Education**

* Early, department-based, interprofessional education is vital for ALL staff involved in the airway management of patients with COVID-19.
* Regular and repeated education is strongly recommended.
* Simulation-based education is strongly recommended.
* Staff education on donning and doffing of PPE, accompanied by multimedia visual aids and supervised practice is strongly recommended.

**Special Contexts**

*Immediate ICU care after intubation*

* If using a humidified ventilator circuit, the viral filter used for intubation will need to be removed in a timely fashion as it may soon become waterlogged.
* In a dry circuit, a combined heat-moisture-exchanger (HME) and viral filter can be left in place, but this means that nebulisers cannot be administered without breaking the circuit (to place a nebuliser between the patient and the HME).
* If the viral filter has been removed, the ventilator should be placed on standby for all circuit disconnections (to minimise the risks of aerosolisation). Great care should be taken that ventilation is recommenced after the circuit is reconnected.

*Urgent surgery in the COVID-19 patient group*

These patients will have COVID-19 as an incidental comorbidity, unrelated to their need for airway management, and may have only mild/asymptomatic COVID-19 disease. There is a separate WH guideline for patient flow in this situation.

* If surgery is non-urgent it should be deferred until the patient is non-infective.
* Airway management in the COVID-19 patient group presenting for urgent surgery should follow the same principles outlined above with particular attention to the following issues.
* Use a dedicated “COVID-19 theatre”.
* As there is little evidence to inform best practice, choice of anaesthetic technique and a particular airway type (face mask, supraglottic airway, tracheal tube) should primarily be based on the same principles as for non-COVID patients, with attention to the following considerations:
  + Regional anaesthesia avoids airway management but leaves the airway open to the room for the duration of the procedure. Minimise supplementary oxygen unless required, minimise sedation (to decrease the risk of precipitating unplanned airway management) and maintain a safe minimum distance from the patient’s airway.
  + Where general anaesthesia is required, use of neuromuscular blocking agents (according to the principles outlined above) ensures apnoea and prevention of coughing during airway interventions, thereby minimizing the risk of aerosol generation while the airway management team is in close proximity to the patient’s airway.
  + Intubation maximises the seal around the airway, limiting aerosolisation with positive pressure ventilation but creates the issue of potential coughing with extubation. Prevention of this may require deep extubation, use of opioids, lidocaine or dexmedetomidine.
  + Use of a supraglottic airway avoids the need for neuromuscular blockers and positive pressure ventilation, as well as decreasing the risk of coughing during emergence but may not create as good a seal around the airway as a tracheal tube. Conversely, the absence of neuromuscular blockade may increase the risk of coughing during airway management or during a case.
  + Avoid positive pressure ventilation with a face mask or supraglottic airway due to the risk of aerosol generation with a suboptimal seal.
* As discussed above, staff not immediately involved with airway management should not enter the operating theatre until after the airway has been secured. This includes surgical staff.
* Recover the patient in the operating theatre to avoid exposure to other patients and staff.

*Unplanned Airway Management (this includes Prehospital Airway Management)*

These scenarios present great risk to staff, especially during cardiac arrest. The Safe Airway Society recommend:

* Appropriate PPE is rapidly allocated to staff at inpatient cardiac arrest calls (and prehospital sites). Processes must be put in place to ensure this is available.
* Early tracheal intubation by a skilled airway operator.
* Prior to intubation, first responders should only use the airway techniques they are experienced in performing. Positive pressure ventilation should be avoided wherever possible.
* Supraglottic airway placement is likely a better option than face mask ventilation (due to less aerosolisation of the virus) if immediate intubation is not possible.
* At any time, we recommend clinicians to avoid close contact with the patient’s mouth (e.g. do not listen for breathing.)

**Acknowledgements**

The Safe Airway Society for allowing WH to use their guidelines and infographics

Western Health Specialist Anaesthetists:

Dr Ashley Hague

Dr Ying Chen

Dr Candida Marane

Dr John Ozcan

Dr Jonathan Galtieri

Dr Madeline Lim

Dr Liz Hessian

Dr David Bramley

Dr Richard Horton