Evidence check

1 May 2020

Rapid evidence checks are based on a simplified review method and may not be entirely exhaustive, but aim to provide a balanced assessment of what is already known about a specific problem or issue. This brief has not been peer-reviewed and should not be a substitute for individual clinical judgement, nor is it an endorsed position of NSW Health.

Intubation in the emergency department during COVID-19

Rapid review question

What is the evidence for the safe practice of intubation in the emergency department during the COVID-19 pandemic?

In brief

- Australian and New Zealand medical societies and colleges have endorsed a consensus statement from the Safe Airway Society on the principles of airway management and tracheal intubation specific to COVID-19. Guidance currently suggests early intubation and that principles of airway management are the same for patients with mild or asymptomatic disease requiring urgent surgery or critically unwell patients with acute respiratory distress syndrome. The statement suggests negative pressure ventilation rooms with an anteroom are ideal to minimise exposure to aerosol and droplet particles. Where this is not feasible, normal pressure rooms with closed doors are recommended.
- Consensus guidelines from the UK suggest if critical care is expanded to areas outside of the intensive care unit, airway management may take place in rooms with positive pressure with reduced air exchanges. The guidelines suggest this may have implications for transmission risks and there needs to be consideration of what constitutes appropriate personal protective equipment (PPE).
- Expert recommendations are for a rapid sequence induction technique (or a modified version) for emergency intubation. The use of video laryngoscopy is suggested to improve first-attempt success. Video laryngoscopy enables a reduction in the proximity of intubator and patient airway.
- Clinical data on 202 patients on emergency tracheal intubation by anaesthetists from two hospitals in Wuhan China with COVID-19 showed that using rapid sequence induction resulted in first-attempt intubation in 89% of cases and 100% overall.
- Guidance consistently suggests that airway management needs to be performed quickly and the number of healthcare workers at the bedside kept to a minimum, and adherence to airborne precautions, hand hygiene and donning of PPE.
- Most guidance features a recommendation that airway management plans, including backup techniques, are to be agreed upon before starting the procedure.
- The evidence and guidance reflects a range of PPE recommended and used.

Limitations

The guidance available is based upon relatively limited data. Recommendations are copied from source material and no attempt has been made to integrate the different guidance. Most of the guidance is from international sources and it may not be generalisable to the Australian context and/or different response phases to the COVID-19 pandemic.

Background

Intubation may create localised aerosol generation and result in airborne transmission to those closely involved in the procedure. (1) Evidence shows that intubation of critically ill patients with COVID-19 can be associated with episodes of COVID-19 transmission to other healthcare workers. The reasons for this are likely multifactorial, including high-level viral shedding due to severity of patient illness, procedures associated with intubation that may generate aerosols, and healthcare worker use of PPE.

Australian guidelines such as those from the Australasian College for Emergency Medicine (2) and the Emergency Care Institute NSW provide guidance for emergency department management including intubation. (3) The Clinical Excellence Commission has a quick reference guide for PPE in the ED, including for intubation (4) and the Australian Commission on Safety and Quality in Health Care has inflection control guidelines. (5) The latter guidelines include a practice statement identifying that it is good practice to place patients on airborne precautions in a negative pressure room (Class N / Type 5) with bathroom facilities or in a room which air does not circulate to other areas. (5)

The Emergency Care Institute states ‘During the pandemic, departments should regularly reassess whether all patients are intubated with a COVID specific model or only those with symptoms suspicious for COVID infection.’ (3)

Methods

PubMed and Google were searched on 1 May 2020. The PubMed searched retrieved articles with empirical data and guidance published in peer reviewed journals. Google was searched specific to find any additional publications with empirical data that may not have been retrieved in the PubMed search. We acknowledge the large amount of guidance that exists in the grey literature from individual organisations on safe practice of intubation in the emergency departments, which we have not included in the tables below.

Results (Table 1)

Table 1: Safe practice of intubation in the emergency departments

Reference	Summary guidance (aims to summarise components of the guidance, it is not a complete summary of the full guidance)	Source
Emergency tracheal intubation in 202 patients with COVID-19 in Wuhan, China: lessons learnt and international expert recommendations Yao et al., 2020 (6)	• Rapid sequence induction (RSI) or modified RSI was used with an intubation success rate of 89.1% on the first attempt and 100% overall. • Hypoxaemia (SaO_2 <90%) was common during intubation (*n*=148; 73.3%). Hypotension (arterial pressure <90/60 mm Hg) occurred in 36 (17.8%) patients during and 45 (22.3%) after intubation with cardiac arrest in four (2.0%). Pneumothorax occurred in 12 (5.9%) patients and death within 24 h in 21 (10.4%). • All intubations were undertaken by two trained operators. The clinical context for the intubations was an emergency. • For PPE, all intubating clinicians wore N95 respirators, surgical masks (covering the N95 respirator), eye protection goggles, and a protective coverall with hood and foot covers as inner layer protection. The outer layer of protection comprised a water-resistant full gown and either a face shield or a full hood, either without a powered air-purifying respirator (PAPR) or with a PAPR, with double pairs of gloves used in all intubations. Donning and doffing were checked by a nurse, and the two clinicians checked each other. • Before tracheal intubation, most patients showed gross physiological abnormalities, including hypoxaemia, tachypnoea, hypotension, tachycardia, and unconsciousness. Supplemental oxygen or ventilation therapy was administered to all patients, most commonly by non-invasive (NIV) mask ventilation. • Before induction of general anaesthesia, preoxygenation was performed for 5 min in all patients either using a face mask supplying 100% oxygen (47%) or by continuing the previous oxygen therapy (53%). Propofol was used for induction in 194 (96%) cases with rocuronium for neuromuscular block in 200 (99%). • Mask ventilation after induction and before intubation was undertaken in 93% of intubations. • Laryngoscopy was performed. • All personnel for tracheal intubations were anaesthesiologists. • The airway plan, including backup techniques, should be agreed upon before starting the procedure.	Article

Reference	Summary guidance (aims to summarise components of the guidance, it is not a complete summary of the full guidance)	Source
	• Where tracheal intubation is undertaken by a non-anaesthesiologist, these individuals should be previously well trained before attempting airway management in a COVID-19 patient, and whenever feasible, an anaesthesiologist or ear, nose, and throat surgeon should be immediately available to assist in the event of unexpected difficulty in airway management.	
Practical recommendations for critical care and anaesthesiology teams caring for novel coronavirus (2019-nCoV) patients Wax et al., 2020 (1)	• Intubation of critically ill patients with COVID-19 was associated with episodes of healthcare worker transmission. Reasons: multifactorial, including high-level viral shedding due to severity of patient illness, procedures associated with resuscitation or intubation that may generate aerosols, and healthcare worker use of PPE. • Management of patients requiring intubation should be undertaken in an airborne isolation room. All personnel in the room must be using appropriate airborne and droplet PPE. • In some cases, entire ICUs were converted to negative pressure or airflow wards rather than individual patient rooms. In such cases, full airborne, contact and droplet PPE would be worn in the patient room without independent airborne isolation ('hot zone') that can be removed on exit. Clean N95 masks, gowns, and gloves should be worn in the makeshift negative pressure ICU outside of patient rooms ('warm zone') because of potential airborne spread of the virus into adjacent common areas from patient rooms that did not have airborne isolation capacity. • Careful planning of this intervention is required. The procedure should be attempted by the most skilled person at intubation using a rapid sequence intubation technique, to optimise first attempt success. • Recurrent traffic of people bringing equipment into the room may increase the risk of viral transmission. All necessary equipment and medications should be available in the room at the time of intubation attempt. • The number of personnel in the room at the time of intubation should be minimised to essential team members only. • Bag-mask ventilation prior to intubation can generate aerosols, as can the patient coughing during laryngoscopy. An exhalation filter should also be present attached to the resuscitation bag, typically between the mask or endotracheal tube and the bag. • Once intubated, lung protective mechanical ventilation strategies should be used (target tidal volume 6 mLkg-1 predicted body weight, plateau pressure B30cm H_20, target SaO_2 88-95% and pH C 7.25). • Video laryngoscopy should be used, ideally with a display separate from the blade, to avoid placing the face of the intubator close to the patient. • All exhaled gas from the ventilator should be filtered.	Article

Reference	**Summary guidance** (aims to summarise components of the guidance, it is not a complete summary of the full guidance)	**Source**
	• Consider pneumothorax in any ventilated patient with sudden respiratory deterioration.	
Consensus guidelines for managing the airway in patients with COVID-19: guidelines from the Difficult Airway Society, the Association of Anaesthetists the Intensive Care Society, the Faculty of Intensive Care Medicine and the Royal College of Anaesthetists Cook et al., 2020	• Ideally patients are managed in a single, negative pressure rooms with good rates of air exchange (>12 exchanges per hour) to minimise the risk of airborne exposure. • Many ICU side rooms do not meet this standard and, when critical care is expanded to area outside of ICU, airway management may take place in rooms with positive pressure (e.g. operating theatres) or those with reduced air exchanges. These factors may have implications for transmission risk, retention of aerosols and therefore what constitutes appropriate PPE.	Article

Reference	Summary guidance (aims to summarise components of the guidance, it is not a complete summary of the full guidance)	Source
	A SUMMARY FOR EMERGENCY TRACHEAL INTUBATION OF THE ADULT COVID-19 PATIENT ☐ Tracheal intubation of the patient with COVID-19 is a high-risk procedure for staff, irrespective of the clinical severity of disease. ☐ In severe COVID-19 it is also a high-risk procedure for the patient. ☐ Limit staff present at tracheal intubation: one intubator; one assistant; and one to administer drugs and monitor the patient. A runner should be outside the room. ☐ Create a COVID-19 tracheal intubation trolley or pack that can be used in ICU or elsewhere. ☐ Wear full personal protective equipment (PPE) at all times. Consider double gloving. Defog goggles and/or eye wear if possible. Touch as little as possible in the room to avoid fomites. ☐ Intubate in a negative pressure room with > 12 air changes per hour whenever possible. ☐ Know and communicate the plan before entering the room; use a checklist to achieve this. ☐ Take the algorithm or cognitive aid you plan to use into the room or display it there. ☐ Prepare airway equipment and drugs outside the room as much as possible. Use a kit dump mat if available. ☐ Plan how to communicate before entering the room. ☐ The best skilled airway manager present should manage the airway to maximise first-pass success. ☐ Be safe, accurate and swift. Aim to succeed at the first attempt because multiple attempts increase risk to sick patients and staff. Do not rush but make each attempt the best it can be. ☐ Use reliable techniques that work, including when difficulty is encountered. The chosen technique may differ according to local practices and equipment. With prior training and availability this is likely to include: o Pre-oxygenation with a well-fitting mask and a Mapleson C ('Waters') or anaesthetic circuit, for 3–5 minutes. o Videolaryngoscopy for tracheal intubation; o 2-person, 2-handed mask ventilation with a VE-grip to improve seal; o A second generation supraglottic airway device for airway rescue, also to improve seal. ☐ Place a HME filter between the catheter mount and the circuit at all times. Keep it dry to avoid blocking. ☐ Avoid aerosol-generating procedures, including high-flow nasal oxygen, non-invasive ventilation, bronchoscopy and tracheal suction without an in-line suction system in place. ☐ Establish full monitoring: including continuous waveform capnography before, during and after tracheal intubation. ☐ Use RSI with cricoid force where a trained assistant can apply it. Take it off if it causes difficulty. ☐ To avoid cardiovascular collapse consider ketamine 1–2 $mg.kg^{-1}$ ☐ Paralyse early with rocuronium 1.2 $mg.kg^{-1}$ or suxamethonium 1.5 $mg.kg^{-1}$. Ensure full neuromuscular blockade before attempting tracheal intubation ☐ Have a vasopressor for bolus or infusion immediately available for managing hypotension. ☐ Do not face mask ventilate unless needed, and use a 2-person, low flow, low pressure technique if needed. ☐ Intubate with a 7.0–8.0 mm ID (women) or 8.0–9.0 mm ID (men) tracheal tube with a subglottic suction port. ☐ Pass the cuff 1–2 cm below the cords to avoid bronchial placement. Confirming position is difficult wearing PPE. ☐ Inflate the tracheal tube cuff to seal the airway before starting ventilation. Note and record depth. ☐ Confirm tracheal intubation with continuous waveform capnography – which is present even during cardiac arrest. ☐ Avoid circuit disconnection - push twist all connections. ☐ Clamp tube and pause ventilator for airway manoeuvres or disconnections. ☐ Use a standard failed tracheal intubation algorithm with a cognitive aid if difficulty arises. ☐ Communicate clearly: simple instructions; closed-loop communication (repeat instructions back); adequate volume without shouting. ☐ Place a nasogastric tube after tracheal intubation is completed and ventilation established safely. ☐ If COVID-19 status not already confirmed take a deep tracheal aspirate for virology using closed suction. ☐ Discard disposable equipment safely after use. Decontaminate reusable equipment fully and according to manufacturer's instructions. ☐ After leaving the room ensure doffing of PPE is meticulous. ☐ Clean the room 20 minutes after tracheal intubation (or last aerosol-generating procedure). ☐ A visual record of ease of tracheal intubation should be prominently visible in the patient's room. ☐ If airway difficulty occurs the subsequent plan should be displayed in the room and communicated between shifts.	

Reference	**Summary guidance** (aims to summarise components of the guidance, it is not a complete summary of the full guidance)	**Source**

Novel 2019 coronavirus SARS-CoV-2 (COVID-19): an updated overview for emergency clinicians
 	
Giwa et al., 2020 (7)
	• In the event a patient presents in severe respiratory distress or fails prior use of NIV, the clinician must prepare for invasive ventilation and endotracheal tube intubation. RSI steps:
	  ○ Viral filter on exhalation port of ventilator, to create sterile closed circuit
	• Procedure
	  ○ Performed by most experienced staff
	  ○ Limit the number of people in the room
	  ○ During episodes of apnea
	  ■ If using BiPAP, continue with backup rate
	  ■ If using BVM, hold mask (with PEEP valve attached) with jaw thrust to prevent collapse of alveoli), but avoid bagging the patient, if possible, as this may potentially aerosolize viral particles
	  ○ Inflate endotracheal tube (ETT) cuff prior to ventilation
	  ○ Secure ETT at precalculated depth
	• Post-Procedure:
	  ○ Doff PPE using meticulous doffing procedure described in **Table 2**.
	• Recommendation is to expand availability of negative pressure rooms where possible, with priority given to COVID-19 patients to occupy these spaces.
		Article

Staff safety during emergency airway management for COVID-19 in Hong Kong Cheung et al., 2020 (8)	• All medical personnel involved in the management of patients with suspected COVID-19 must adhere to airborne precautions, hand hygiene, and donning of PPE. • All aerosol-generating procedures should be done in an airborne infection isolation room. Double-gloving, as a standard practice at our unit, might provide extra protection and minimise spreading via fomite contamination to the surrounding equipment after intubation. • Airway devices providing 6L/min or more of oxygen are considered high-flow and we discourage their use if an airborne infection isolation room is unavailable. • Endotracheal intubation is done by an expert specialised in the procedure, and early intubation should be considered in a patient with deteriorating respiratory condition. For all cases, backup airway plans should be ready. • Avoid bag mask ventilation for as long as possible and optimise preoxygenation with nonaerosol-generating means. • Rapid sequence induction is the technique of choice for emergency intubation. • Some operators prefer rocuronium over suxamethonium for its longer half-life, which effectively prevents coughing or vomiting that might occur when the shorter acting muscle relaxant subsides after an unsuccessful first attempt.	Correspondence

Reference	Summary guidance (aims to summarise components of the guidance, it is not a complete summary of the full guidance)	Source
	• Once an endotracheal tube is inserted, its cuff should be inflated immediately to avoid leakage. The endotracheal tube should be connected to the ventilator via a filter and a waveform capnography monitoring device, with ventilation only started after pilot balloon inflation is confirmed.	
German recommendations for critically ill patients with COVID-19 Kluge et al., 2020	• Early intubation and repeated prone positioning are key elements in treating hypoxemic COVID-19 patients. • Be restrictive with HFNC and NIV in the context of COVID-19. In patients with severe hypoxemia ($PaO_2/FiO_2 \leq 200$mmHg) we suggest performing early intubation and invasive mechanical ventilation. • In any case, continuous monitoring and preparedness for urgent intubation are cornerstones in the treatment of COVID-19 patients with respiratory failure. A delay of intubation in patients failing NIV worsens outcome, and any emergency intubation in this cohort puts medical professionals at risk and should be avoided. • Airway procedures (intubation, bronchoscopy, open suction, bag ventilation, tracheostomy) should only be performed with appropriate airborne precautions PPE (including FFP2/FFP3 masks and goggles) if absolutely necessary due to the risk of aerosol formation. • Intubation should be performed by the most experienced physician with a broad expertise in airway management. • If possible, a rapid sequence induction without intermittent bag mask ventilation should be preferred to minimise aerosol formation. • With using a video-laryngoscope for intubation the distance between physician and patient during intubation can be increased. • To verify correct tube placement avoid using the stethoscope and use direct visualisation and CO_2 indicators or capnography.	Review
Consensus statement: Safe Airway Society principles of airway management and tracheal intubation specific to the COVID-19 adult patient group Brewstar et al., 2020 (9)	• Generic guidelines exist for the intubation of different patient groups, and should be followed where they do not contradict our specific recommendations for the COVID-19 patient group. • Consideration should be given to using a checklist which has been specifically modified for the COVID-19 patient group. • Early intubation should be considered to prevent the additional risk to staff of emergency intubation and to avoid prolonged use of high flow nasal oxygen or NIV. • Significant institutional preparation is required to optimise staff and patient safety in preparing for the airway management of the COVID-19 patient group.	Article and Consensus statement and resources

Reference	Summary guidance (aims to summarise components of the guidance, it is not a complete summary of the full guidance)	Source
	• The principles for airway management should be the same for all patients with COVID-19 (asymptomatic, mild or critically unwell). • Negative pressure ventilation rooms with an anteroom are ideal to minimise exposure to aerosol and droplet particles. Where this is not feasible, normal pressure rooms with closed doors are recommended. Furthermore, positive pressure ventilation areas, which are common in operating theatres, should ideally be avoided. • The decision to move a clinically stable patient between two clinical areas before 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. • Safe, simple, familiar, reliable and robust practices should be adopted for all episodes of airway management for patients with COVID-19 • Resources to accompany the consensus statement here	
Swivel-HEPA-ETT (SHE) bougie and HEPA-ETT (HE) methods for safe intubation while managing patients with COVID-19 (10)	• Use a closed system with the high-efficiency particulate air (HEPA) filter already attached to the endotracheal tube (ETT) via either the HEPA-ETT ('HE') or 'Swivel-HEPA-ETT (SHE)-bougie' method. • The ETT combination with HEPA filter in advance can potentially reduce aerosolisation of the viral droplets from the larynx and trachea during intubation, and the ventilator can then be connected directly to the HEPA filter after intubation. • The 'HE' and 'SHE' methods have not been rigorously tested; they are suggestions for potentially safer intubation.	Letter
The COVID-19 intubation and ventilation pathway (CiVP); a commentary Baig, 2020 (11)	• It is essential to contain a crashing suspected or confirmed COVID-19 patient within the confines of a negative isolation chamber due to a high risk of aerosolisation, with strict adherence to PPE, exclusively comprising of N95 or preferably a powered air purifying respirator. • Pre-oxygenation can be performed with a bag valve mask device with positive end expiratory valve and a viral filter, if available. • Induction and relaxant medications should be administered at a maximum dose in order to prevent cough or gag reflex during the procedure. • Most experienced staff should look after the patient, in order to minimize contamination to few personnel only. • A video laryngoscope should be used so as to avoid having the operator position their face close to the patient.	Commentary

Reference	**Summary guidance** (aims to summarise components of the guidance, it is not a complete summary of the full guidance)	**Source**
	• The endotracheal tube should be positioned at a predetermined depth and secured properly. • A plastic transparent sheet can be placed over the patient's head and chest to prevent droplet spread. • All contaminated instruments should be placed in a transparent bag for immediate disposal and/or decontamination.	

Appendices

Appendix 1

PubMed: ((emergency) AND (intubation)) AND (((2019-nCoV[title/abstract] or nCoV*[title/abstract] or covid-19[title/abstract] or covid19[title/abstract] OR "covid 19"[title/abstract] OR "coronavirus"[MeSH Terms] OR "coronavirus"[title/abstract] OR sars-cov-2[title/abstract] OR “severe acute respiratory syndrome coronavirus 2”[Supplementary Concept]))

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