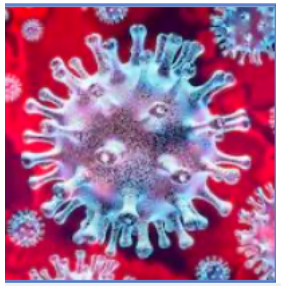
Special Consideration for Airway Management in Patient with COVID-19



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Airway Management:

Respiratory Precautions

(For use during COVID-19 Pandemic)

INTUBATION and AIRWAY MANAGEMENT are Aerosol Generating Procedures (AGPs), with a higher risk of respiratory pathogen transmission.[1,*]

NSW GOVERNMENT | CLINICAL EXCELLENCE COMMISSION

Adapted from the Dept of Anaesthesia & Pain Management. Royal North Shore Hospital

 doi:10.1111/anae.15054

Guidelines

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

T. M. Cook,[1] K. El-Boghdadly,[2] B. McGuire,[3] A. F. McNarry,[4] A. Patel[5] and A. Higgs[6]

COVID-19: the need for airway interventions and risks to airway managers

Severe acute respiratory syndrome-corona virus-2 (SARS-CoV-2), which causes COVID-19, is a single-stranded ribonucleic acid -encapsulated corona virus and is highly contagious. Transmission is thought to be predominantly by droplet spread (i.e. relatively large particles that settle from the air), and direct contact with the patient or contaminated surfaces (fomites) rather than airborne spread in which smaller particles remain in the air longer [1, 2]. Procedures during initial airway management and in the intensive care unit (ICU) may generate aerosols which will increase risk of transmission [1]. Healthcare workers (HCW) treating patients with COVID-19 are at increased risk of contracting the illness [3–6].

The predominant COVID-19 illness is a viral pneumonia. Airway interventions are mainly required for tracheal intubation and establishing controlled ventilation. However, as the epidemic increases, there will be many

descending order of risk as: (1), tracheal intubation; (2), tracheostomy (and presumed for emergency front-of-neck

The process of airway management is an increased risk period for aerosol-based transmission for the following reasons:

- The patient may become agitated or combative due to hypoxia.
- The patient's mask must be removed.
- Clinicians are near the patient's airway.
- Laryngoscopy and intubation are vulnerable to aerosol generation.
- Aerosol generating events are more likely.

nasal oxygen in a situation of mass illness and mass mechanical ventilation. First, it may simply delay tracheal

Table 1: Sources of potential aerosol generation during airway management

Aerosol generating events (AGEs)
• Coughing/sneezing/expectorating • NIV or positive pressure ventilation with inadequate seal* • High flow nasal oxygen (HFNO) • Jet ventilation • Delivery of nebulised/atomised medications via simple face mask • Cardiopulmonary resuscitation (prior to tracheal intubation) • Tracheal extubation
Procedures vulnerable to aerosol generation (increased risk of association with AGEs)
• Tracheal suction (without a closed system) • Laryngoscopy • Tracheal intubation • Bronchoscopy/gastroscopy • Front-of-neck airway (FONA) procedures (including tracheostomy, cricothyroidotomy)

*The reliability of seal is greatest with tracheal tube>supraglottic airway>face mask

Brewster DJ, Chrismas NC, Do Thy BT, Fraser K, Groombridge CJ, et al. Consensus Statement: Safe Airway Society Principles of airway management and tracheal intubation specific to the COVID-19 adult patients group. The Medical Journal of Australia, update 1 April 2020

ASA
Australian Society of Anaesthetists

Anaesthesia and caring for patients during the COVID-19 outbreak

AVOIDING AEROSOLISATION

The principles of managing the airway are to keep droplet spread to a minimum and avoid aerosolisation as far as possible. Aerosolisation is the production of small particles of water which, rather than falling to the ground (as droplets do), can flow through the air and spread more widely.

Reduction of aerosolisation includes avoidance of aerosolising procedures in the operating theatre such as:

- High flow nasal cannula (above 6 litres per minute).*
- Nebulisers. Others may regard nebulisers as a non-aerosol generating procedure. We have included it here as nebuliser treatment may induce coughing.
- Awake fibreoptic intubation.
- Entonox/ inhalational sedation.
- Non-invasive ventilation.
- Bag masking.
- Use of a t-piece or any other open circu
- Open suction.

AIRWAY MANAGEMENT

It is suggested that individual departments establish and mandate a standardised approach to airway management. Airway management should be performed by the most senior clinician available in the team, with full PPE precautions.

The airway management is aimed at minimising disconnection, aerosolisation and exposure of staff to viral transmission. Intubation is recommended rather than use of supraglottic airways unless required for airway 'rescue'.

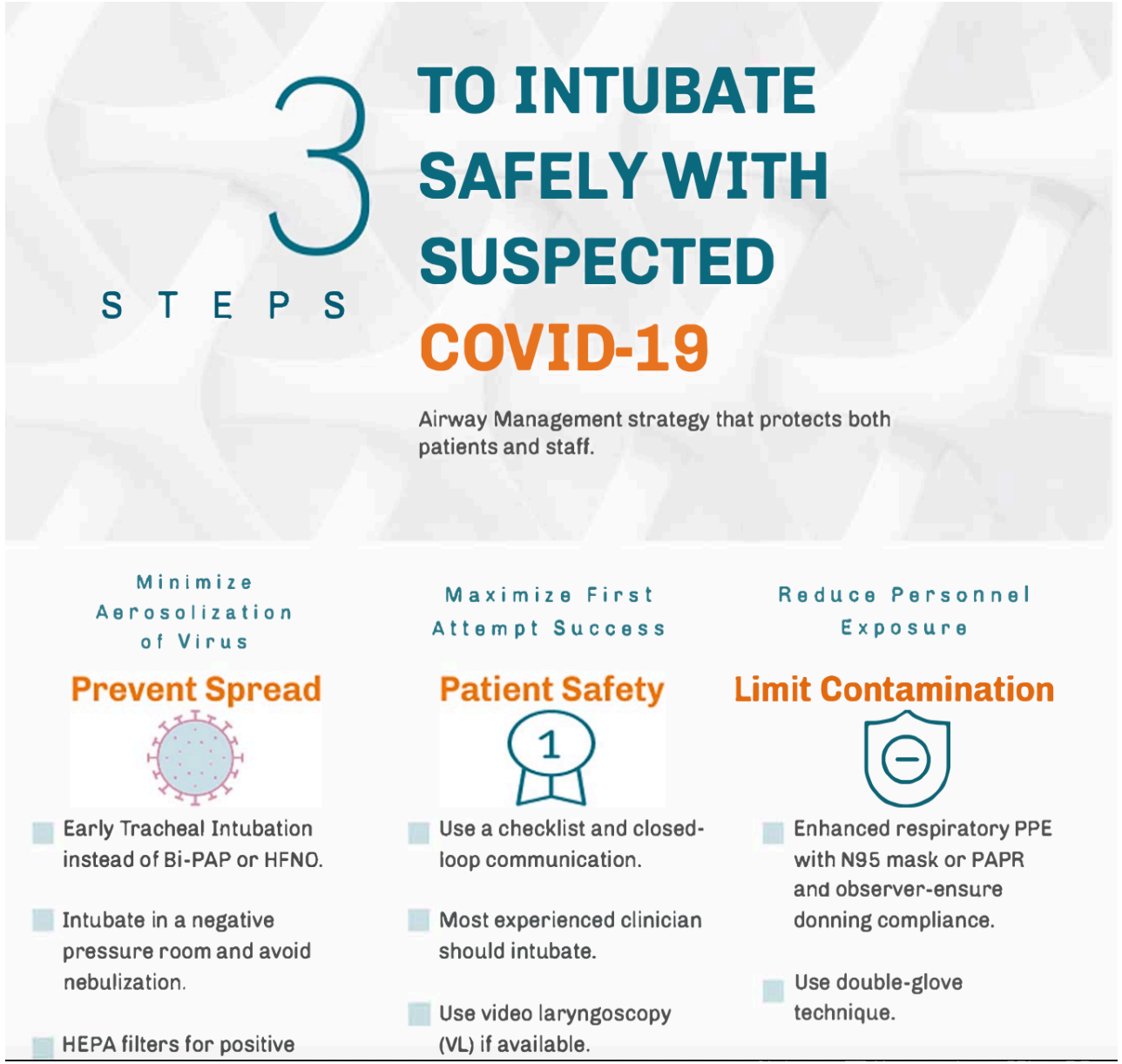
Clinical management of severe acute respiratory infection (SARI) when COVID-19 disease is suspected

Interim guidance
13 March 2020

World Health Organization

Endotracheal intubation should be performed by a trained and experienced provider using airborne precautions.

Remarks: Patients with ARDS, especially young children or those who are obese or pregnant, may desaturate quickly during intubation. Pre-oxygenate with 100% FiO_2 for 5 minutes, via a face mask with reservoir bag, bag-valve mask, HFNO or NIV. Rapid-sequence intubation is appropriate after an airway assessment that identifies no signs of difficult intubation *(28, 29, 30)*.



COVID-19 airway management: SAS

Safe	for staff and patient
Accurate	avoiding unreliable, unfamiliar, or repeated techniques
Swift	timely, without rush or delay

Figure 2 Principles of coronavirus disease 2019 airway management.

Fundamentals of airway management for a patient with suspected or confirmed COVID-19

Airway management for patients who are suspected or confirmed to have COVID-19 follows similar principles in both emergency and non-emergency settings (Fig. 1).

1 ***Prepare.***

a Institutional preparation (equipment for routine management and for managing difficulty; adequate numbers of appropriately trained staff; availability of tracheal intubation checklists; PPE etc.) should be in place well before airway management occurs. If this does not already exist, it is strongly recommended it is put in place urgently. Resources from this guideline may form part of that preparation.

b Team and individual preparation require knowledge of the institutional preparation, the skills required, how to use PPE correctly and assessment of the patient's airway to predict difficulty and prepare the airway strategy (Fig. 3). It is accepted that MACOCHA (Malampatti, obstructive sleep apnoea, c-spine movement, mouth opening, coma, hypoxaemia, non-anaesthetist intubator [25]) is not widely used but it is validated and recommended.

2 ***Create a COVID-19 tracheal intubation trolley or pack.*** Critically ill patients may need to be intubated in a location other than ICU. On ICU, tracheal intubation will likely take place in single rooms. Prepare a tracheal intubation trolley or pack that can be taken to the patient and decontaminated after use. The Supporting Information (Appendix S1) in the online supplementary material illustrates and provides some guidance on its contents.

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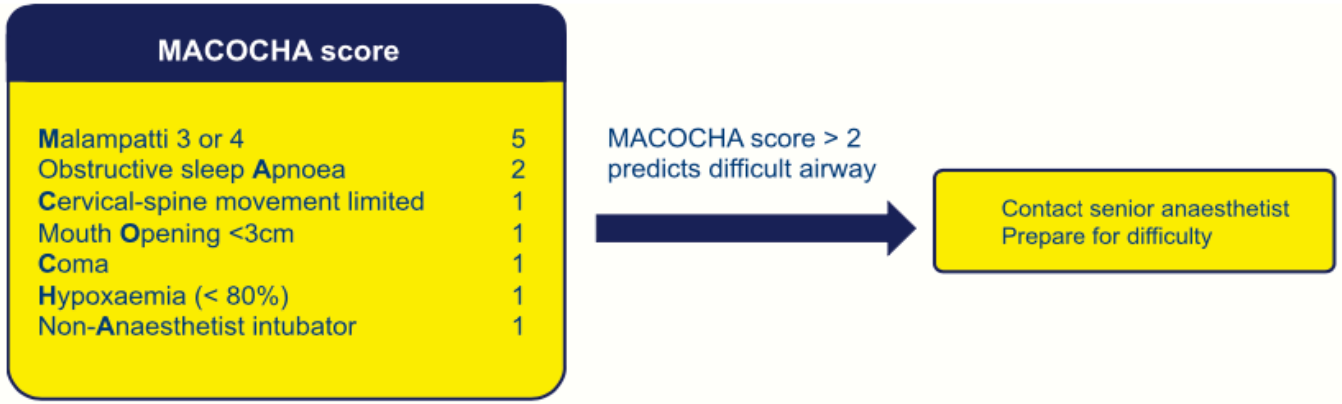

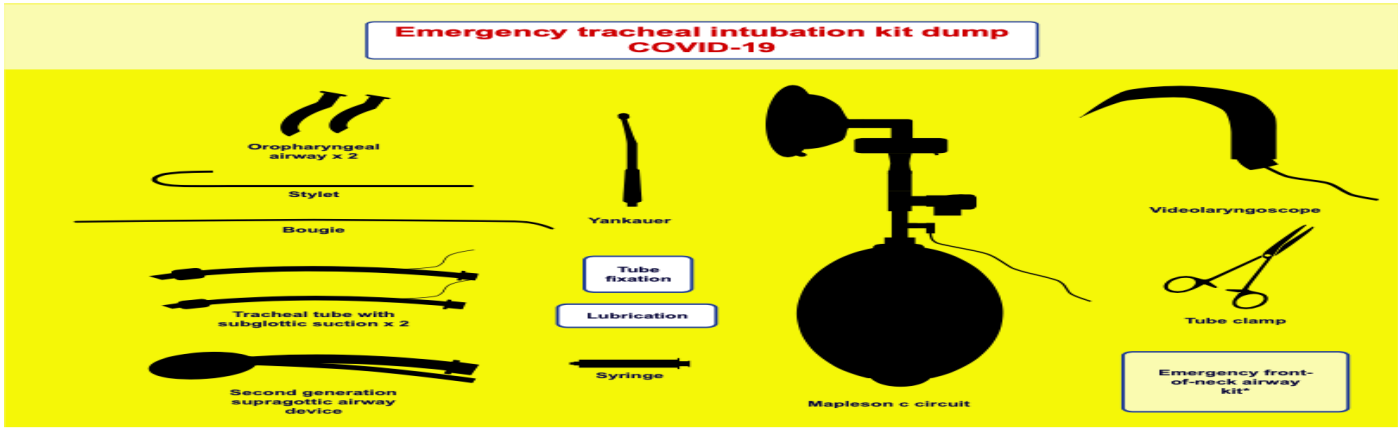

4 ***Involve the smallest number of staff necessary.*** This is not an argument for solo operators but staff who have no direct role in the airway procedure should not unnecessarily be in the room where airway management is taking pace. Three individuals are likely required: an intubator; an assistant; and a third person to give drugs and watch monitors. A runner should be watching from outside and be able to summon help rapidly if needed (Fig. 4).

5 ***Wear appropriate, checked PPE* (see above).** Even in an emergency and including cardiac arrest, PPE should be in worn and checked before all airway management and staff should not expose themselves to risk in any circumstance.

6 ***Avoid aerosol-generating procedures wherever possible.*** If a suitable alternative is available, use it. If aerosol generation takes place, the room is considered contaminated, airborne precaution PPE should be used and the room should be deep cleaned after 20 min [24].

7 ***Focus on promptness and reliability.*** The aim is to achieve airway management successfully at the first attempt. Do not rush but make each attempt the best it can be. Multiple attempts are likely to increase risk to multiple staff and to patients.

8 ***Use techniques that are known to work reliably across a range of patients, including when difficulty is encountered.*** The actual technique may differ according to local practices and equipment. Where training and availability is in place this is likely to include:

- **a** Use of a kit dump mat (Fig. 5);
- **b** Videolaryngoscopy for tracheal intubation;
- **c** A 2-person 2-handed mask ventilation with a VE-grip (Fig. 6);
- **d** A second-generation supraglottic airway device (SGA)

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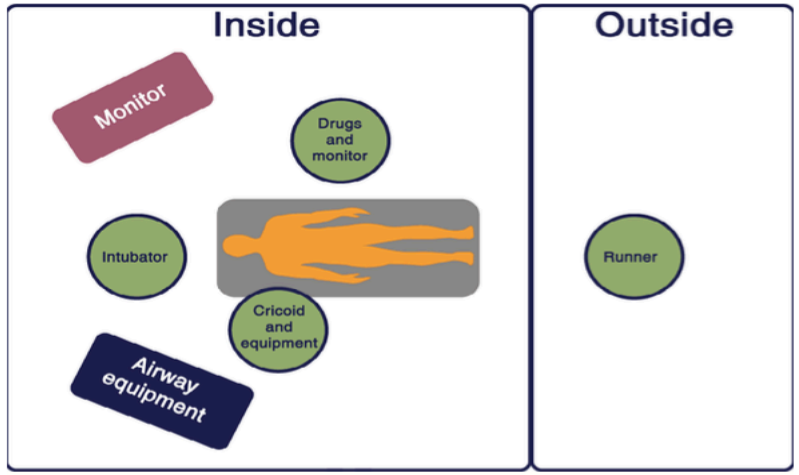

Figure 4 Personnel plan for tracheal intubation of a patient with coronavirus disease 2019. Adapted from [20].

DoD COVID-19 PRACTICE MANAGEMENT GUIDE

Clinical Management of COVID-19

Intubation.

1. If a negative pressure OR is unavailable, consider intubating the patient in a negative pressure room and transporting to the OR after intubation.
2. Consider video laryngoscopy.
3. Rapid Sequence Intubation should be performed when at all possible to avoid mask ventilation due to increased aerosolization of secretions.
4. Ensure HME/HEPA filter is on the exhalation limb or at the Y-piece (sampling line should be post filter).
5. Double glove and immediately remove outer glove after the airway is confirmed secure. Outer gloves may be used to wrap disposable portions of airway equipment after use. Consider, at a minimum, using hand sanitizer on inner gloves or exchange with new gloves.
6. Intubation and extubation generate a transient, significant droplet load for the room. Ensure all non-essential personnel are given the chance to leave the room if possible before performing the procedures.
7. Any external equipment (US machine, GlideScope, etc) needed for the case should be draped to the greatest extent possible and NOT REMOVED until the room is terminally cleaned.
8. ICU patients will recover in the ICU and floor patients should be taken to a negative pressure room in the PACU. If a negative pressure PACU room isn't available, use the ICU as a recovery room if bed space allows. Extubating in a PACU negative pressure or ICU room if necessary. If extubating in the OR, place a regular OR mask on the patient prior to transport to the PACU or ICU. If you elect to extubate a patient in the ICU rather than the OR, the anesthesia team should maintain responsibility for the patient until stable for routine handoff.
9. The ASA continues to update its website and has relevant links: https://www.asahq.org/in-the-spotlight/coronavirus-covid-19-information

Leads: Lt Col Renee I. Matos and COL Kevin K. Chung
3-23-2020

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Anaesthetic and airway technique for emergency tracheal intubation

1 A rapid sequence induction (RSI) approach is likely to be adopted. Use of cricoid force is controversial [28], so use it where a trained assistant can apply it but promptly remove it if it contributes to tracheal intubation difficulty.

2 Meticulous pre-oxygenation should be with a well-fitting mask for 3–5 min. A closed circuit is optimal (e.g. anaesthetic circle breathing circuit) and a rebreathing circuit (e.g. Mapleson's C ('Waters') circuit is preferable to a bag-mask which expels virus-containing exhaled gas into the room.

3 Place a heat and moisture exchange (HME) filter between the catheter mount and the circuit. Non-invasive ventilation should be avoided. High-flow nasal oxygen is not recommended.

4 Patient positioning, including ramping in the obese and reverse Trendelenburg positioning, should be adopted to maximise safe apnoea time.

5 In agitated patients, a delayed sequence tracheal intubation technique may be appropriate.

6 If there is increased risk of cardiovascular instability, ketamine 1–2 $mg.kg^{-1}$ is recommended for induction of anaesthesia. Rocuronium 1.2 $mg.kg^{-1}$ for neuromuscular blockade, should be given as early as practical. These measures minimise apnoea time and risk of patient coughing. If suxamethonium is used the dose should be 1.5 $mg.kg^{-1}$.

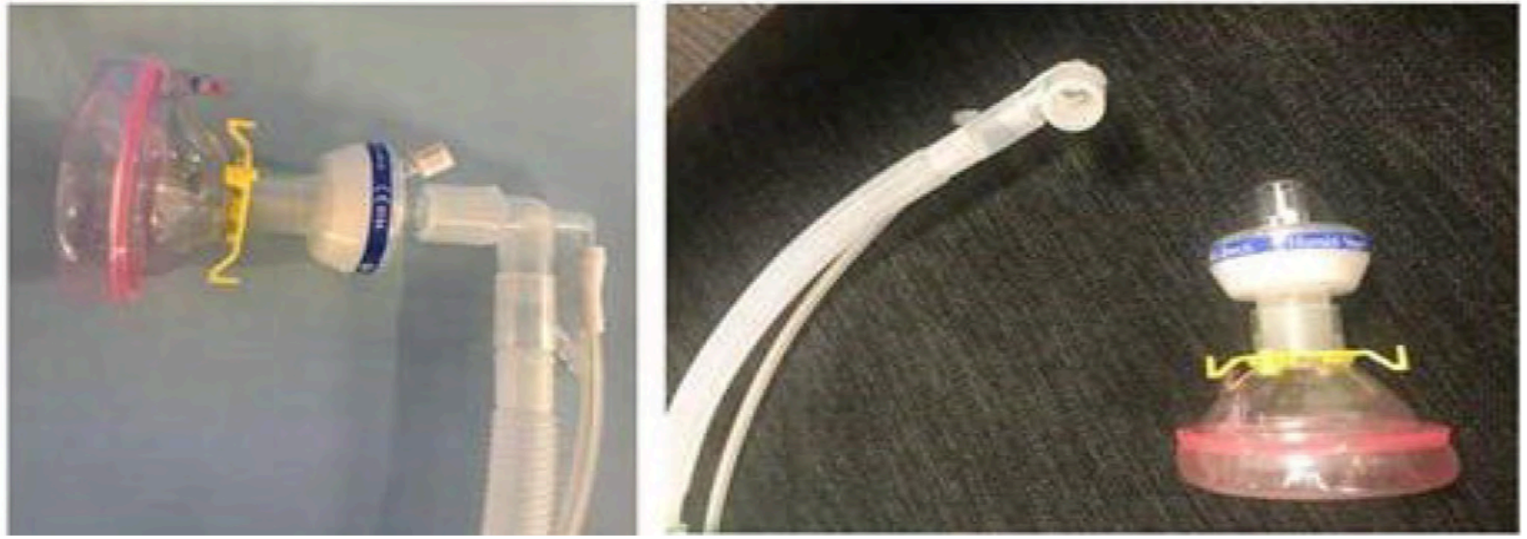


Figure 1. Disconnection of the facemask and filter from the breathing circuit when not in use. Disconnecting in this manner risks contamination of the ventilator if the circuit is inadvertently reconnected without the filter in place. A second HME filter placed on the expiratory limb near the machine is recommended.

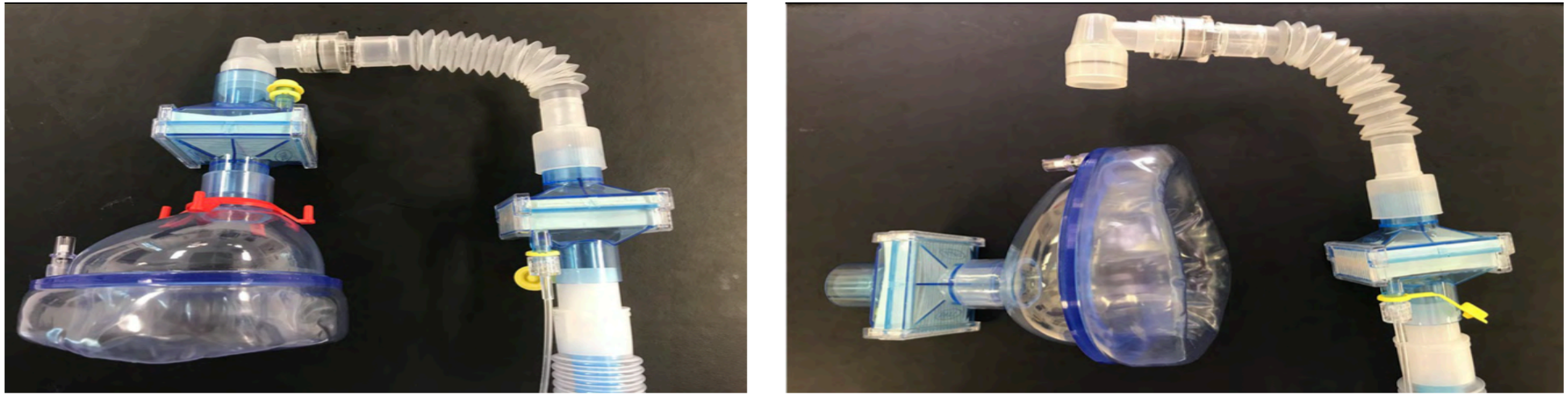
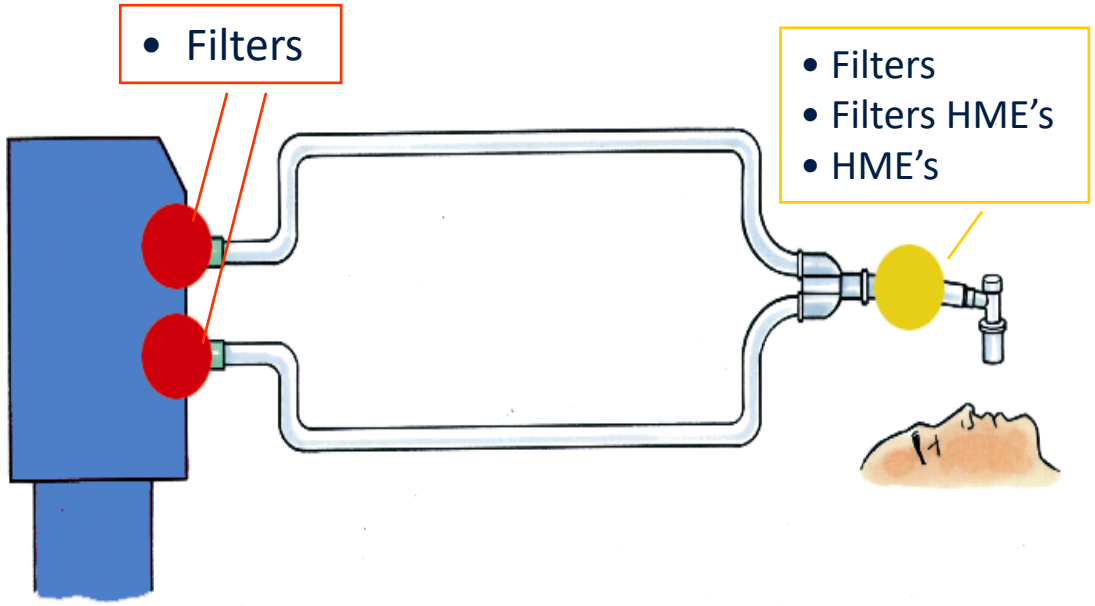


Figure 2. An alternative method of disconnection involving the use of two HME filters. After pre-oxygenation the catheter mount is disconnected from the mask/filter. The circuit is then reconnected as normal with a filter still in place. This method is quicker, requires fewer disconnections/reconnections and avoids entangling of the CO2 line. However it uses 2 filters per case, creates a larger deadspace and increases resistance.

Where to place a filter or FHME

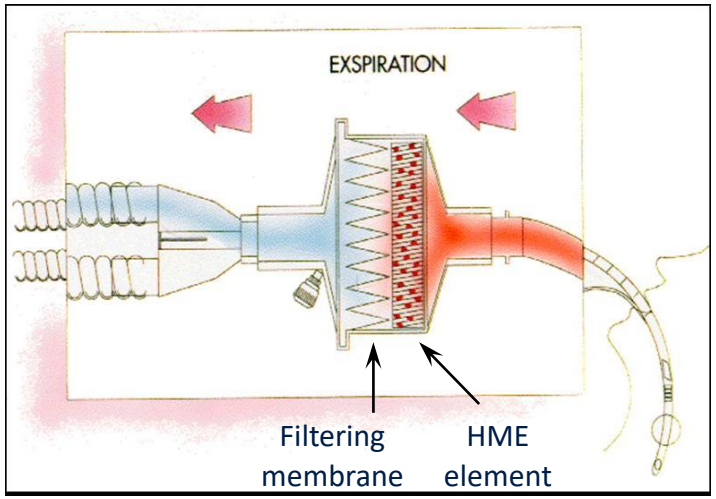
EXCHANGE of HEAT & MOISTURE
by means of a HYDROPHOBIC FILTER
equipped with HYGROSCOPIC CELLULOSE ELEMENT



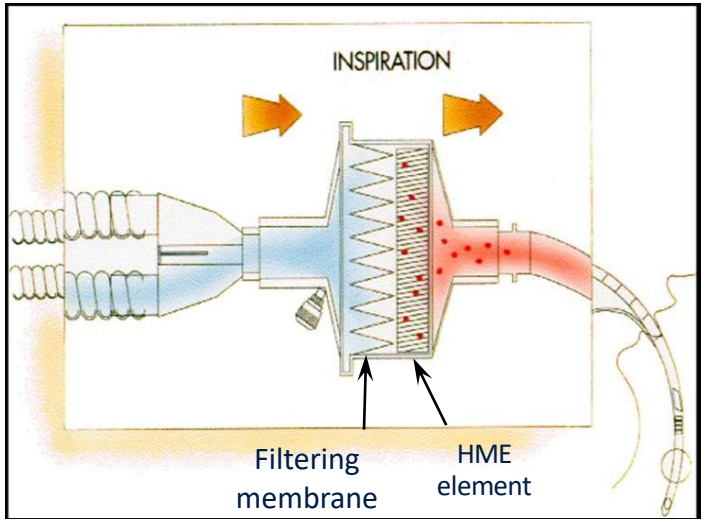
Machine side

Patient side

During expiration, the HME element retains heat and water vapour coming from the patient



During inspiration, heat and water are available to warm and humidify the inspired gases



DAR FILTER

ELECTROSTATIC FILTERS

Reference name	Barrierbac	Barrierbac S
Product name	Electrostatic Filter, Large	Electrostatic Filter, Small
Tidal volume range	300 - 1500 ml	150 - 1200 ml
Internal volume*	99 ml	36 ml
Weight*	35 g	19 g
Moisture loss* (Vt 500 ml)	17 mg H_2O/l	18 mg H_2O/l
Moisture output[1] (Vt 500 ml)	16 mg H2O/l	9 mg H_2O/l
Resistance to flow*		
2.5 l/min	-	-
5 l/min	-	-
15 l/min	-	-
30 l/min	0.6 cm H_2O	0.8 cm H_2O
60 l/min	1.5 cm H_2O	2.1 cm H_2O
90 l/min	2.6 cm H_2O	3.7 cm H_2O
Filtration efficiency		
NaCl[2]	≥99.592%*	≥98.096
Bacterial	≥99.9999%[3]	≥99.9999%[4]
Viral	≥99.9999%[5]	≥99.9999%[6]
CFN	• 350/5422	• 350/5879 • 350/5845

ELECTROSTATIC FILTER-HMES

Hygrobac S
Adult-Paediatric Electrostatic Filter HME, Small
150 - 1200 ml
51 ml
28 g
6 mg H_2O/l[14]
33 mg H_2O/l
1.2 cm H_2O
2.7 cm H_2O
4.8 cm H_2O
≥98.352%[15]
≥99.9998%[3]
> 99.999%[5]
• 352/5877

HMES ONLY

Reference name	Tracheolife™ II
Product name	HME for Tracheostomised Patients
Tidal volume range	>15 kg body weight
Internal volume	16 ml
Weight	8.5 g
Moisture loss (Vt 500 ml)	11 mg H_2O/l
Moisture output (Vt 500 ml)	28.5 mg H_2O/l
Resistance to flow	
30 l/min	0.8 cm H_2O
60 l/min	1.8 cm H_2O
90 l/min	3.2 cm H_2O
CFN	• 353/19004

7 Ensure full neuromuscular blockade before tracheal intubation is attempted. A peripheral nerve stimulator maybe used or wait 1 minute.

8 Ensure a vasopressor for bolus or infusion is immediately available for managing hypotension.

9 Only after reliable loss of consciousness – to avoid coughing – gentle continuous positive airway pressure (CPAP) may be applied, if the seal is good, to minimise the need for mask ventilation. Bag-mask ventilation may be used to assist ventilation and prevent hypoxia if indicated. Use a Guedel airway to maintain airway patency. Use the 2-handed, 2-person technique with a VE-grip to improve seal particularly in the obese patient [29]. When bag-mask ventilation is applied, minimal oxygen flows and airway pressures consistent with achieving this goal should be used.

10 Alternatively, a second-generation SGA may be inserted, after loss of consciousness and before tracheal intubation, to replace the role of bag-mask ventilation or if this is difficult [7, 30].

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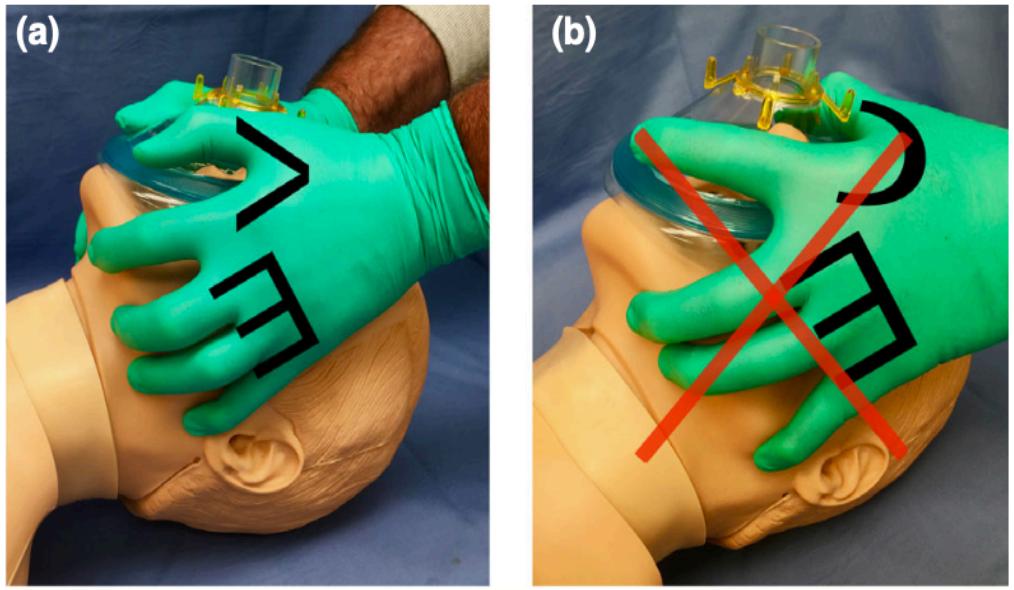

Figure 6 (a). Two-handed two-person bag-mask technique with the VE hand position; the second person squeezes the bag. (b). The C hand position, which should be avoided. Reproduced with permission of Dr A. Matioc.

11 Laryngoscopy should be undertaken with the device most likely to achieve prompt first-pass tracheal intubation in all circumstances in that operator's hands – in most fully trained airway managers this is likely to be a videolaryngoscope.

- **a** Stay as distant from the airway as is practical to enable optimal technique, whatever device is used
- **b** Using a videolaryngoscope with a separate screen enables the operator to stay further from the airway and this technique is recommended for those trained in their use.
- **c** If using a videolaryngoscope with a Macintosh blade, a bougie may be used.
- **d** If using a videolaryngoscope with a hyperangulated blade, a stylet is required.
- **e** Where a videolaryngoscope is not used, a standard MacIntosh blade and a bougie (either pre-loaded within the tracheal tube or immediately available) is likely the best option
- **f** If using a bougie or stylet, be careful when removing it so as not to spray secretions on the intubating team

12 Intubate with a tracheal tube size 7.0–8.0 mm internal diameter (ID) in women or 8.0–9.0 mm ID in mens, in line with local practice. Use a tracheal tube with a subglottic suction port where possible.

13 At tracheal intubation, place the tracheal tube without losing sight of it on the screen and pass the cuff 1–2 cm below the cords, to avoid bronchial intubation.

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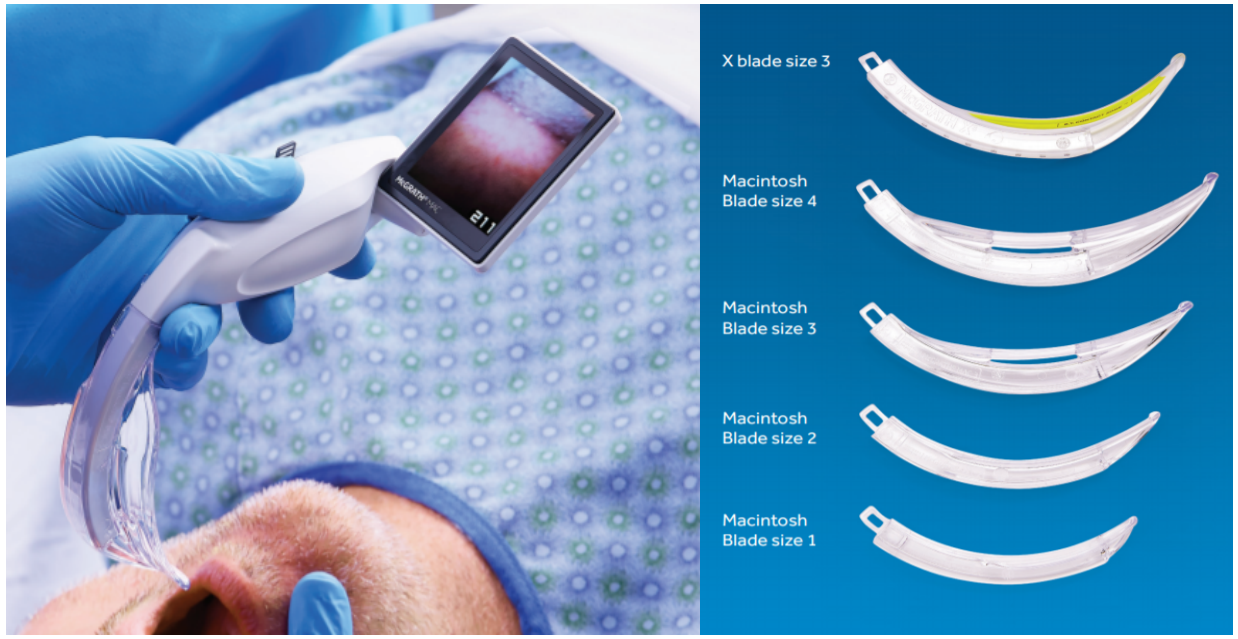
To stay further from the patient airway

MCGRATH MAC VIDEOLARYNGOSCOPE
INTUBATION

- Better glottic visualization than traditional Macintosh laryngoscopy
- Higher intubation success rates than many other video laryngoscopes *(reff : M Kleine, right table)*
- Disposable blade



EVALUATION OF SIX VIDEO LARYNGOSCOPES IN 720 PATIENTS WITH A SIMULATED DIFFICULT AIRWAY: A MULTICENTER RANDOMIZED CONTROLLED TRIAL

M. KLEINE-BRUEGGENEY1,2,*, R. GREIF1, P. SCHOETTKER3, G. L. SAVOLDELLI4, S. NABECKER1 AND L. G. THEILER1

Table 2 First intubation attempt, presented as number, as percentage, or as median (25th; 75th percentile). No reason for failure was reported for one C-MAC™ D-blade, one GlideScope™, three Airtraq™, 13 A.P. Advance™, and three KingVision™ patients. No Cormack–Lehane grade was reported for one C-MAC™ D-blade, three GlideScope™, one McGrath™, nine Airtraq™, 24 A.P. Advance™, and four KingVision™ patients. *χ^2 test. *Post hoc* logistic regression and pairwise comparison with Bonferroni–Holm corrections: $P<0.01$ for A.P. Advance™ *vs* all other videolaryngoscopes, and $P<0.05$ for McGrath™ *vs* GlideScope™, Airtraq™, and King Vision™. †Kruskal–Wallis test. *Post hoc* ordered logistic regression and pairwise comparison with Bonferroni–Holm corrections: $P<0.01$ for A.P. Advance™ *vs* all other videolaryngoscopes. ‡Fisher's exact test

	Devices without a guiding channel			Devices with a guiding channel			
	C-MAC™ D-blade (*n*=120)	GlideScope™ (*n*=120)	McGrath™ (*n*=120)	Airtraq™ (*n*=120)	A.P. Advance™ (*n*=120)	KingVision™ (*n*=120)	P-value
First-attempt success (*n* (%); [95% CI])	114 (95); [89–98]	102 (85); [77–90]	117 (98); [92–99]	102 (85); [77–90]	44 (37); [28–46]	104 (87); [79–92]	<0.01*
Cormack–Lehane grade I/IIa/IIb/III/IV (*n*)	76/36/7/0/0	80/29/3/2/3	64/45/9/1/0	74/30/4/0/3	19/28/22/8/19	63/41/7/1/4	<0.01†
Percentage of glottic opening [median (percentiles)]	90 (80; 100)	100 (83; 100)	90 (80; 100)	90 (80; 100)	60 (10; 80)	90 (80; 100)	<0.01†
Failure because of technical problems/poor view/intubation difficulty (*n*)	0/0/5	0/5/12	0/1/2	3/7/5	2/34/27	0/6/7	0.05‡

14 Inflate the cuff with air to a measured cuff pressure of 20–30 cmH_2O immediately after tracheal intubation.

15 Secure the tracheal tube as normal.

16 Start mechanical ventilation only after cuff inflation. Ensure there is no leak.

17 Confirm tracheal intubation with continuous waveform capnography.

18 Confirming correct depth of insertion may be difficult.

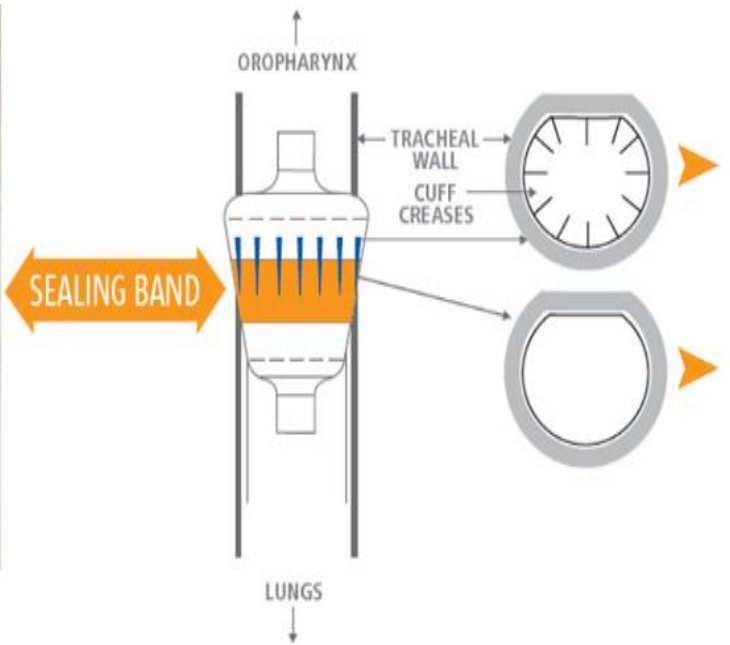
- **a** Auscultation of the chest is difficult when wearing airborne precaution PPE and is likely to risk contamination of the stethoscope and staff, so is not recommended.
- **b** Watching for equal bilateral chest wall expansion with ventilation is recommended.
- **c** Lung ultrasound or chest x-ray may be needed if there is doubt about bilateral lung ventilation.

19 Once correct position is established record depth of tracheal tube insertion prominently.

20 Pass a nasogastric tube after tracheal intubation is complete and ventilation established to minimise the need for later interventions.

21 If the patient has not yet been confirmed as COVID-19 positive collect a deep tracheal sample using closed suction for COVID-19 testing. Some upper airway samples are false negatives.

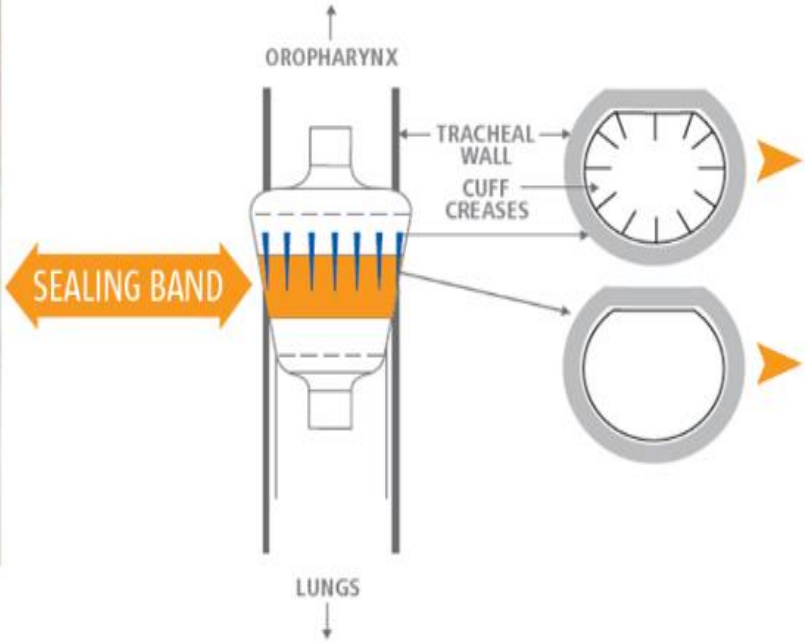
22 A visual record of tracheal intubation should be prominently visible on the patient's room (see also Supporting Information, Appendix S3).



TAPERGUARD ETT ™

CUFF TAPER DESIGN

- **HVLP**
- + Low pressure prevents trachea damage
- - Microaspiration



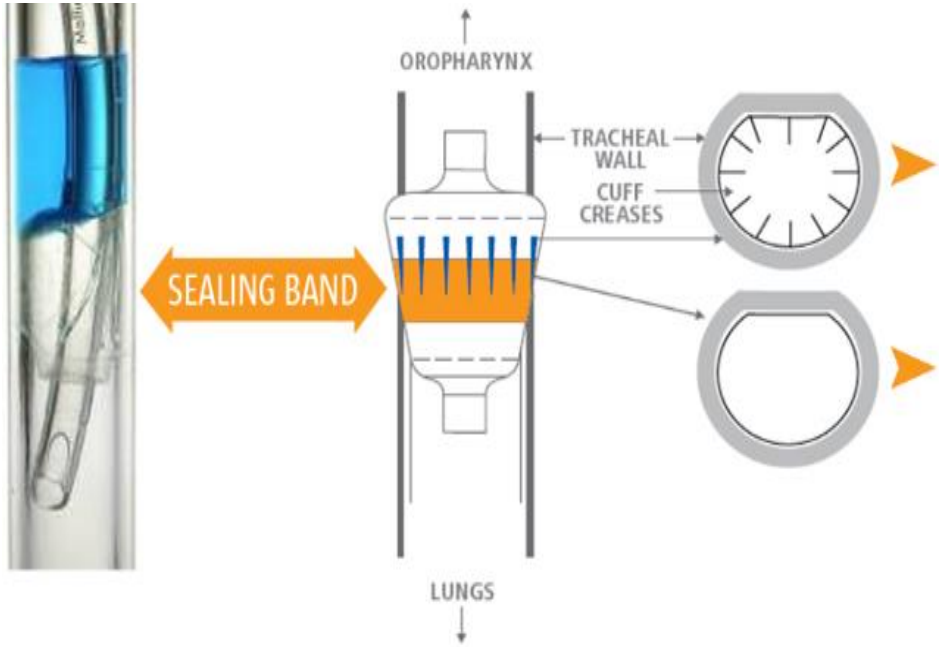
Proximal cuff:
Cuff diameter > Tracheal diameter

Sealing band:
Cuff diameter = Tracheal diameter eliminating excess cuff material locally

LVLP
- + Low pressure prevents trachea damage
- - Reduce Micro aspiration by 90%

SHILEY TAPERGUARD™ EVAC

CUFF TAPER DESIGN + SUCTION

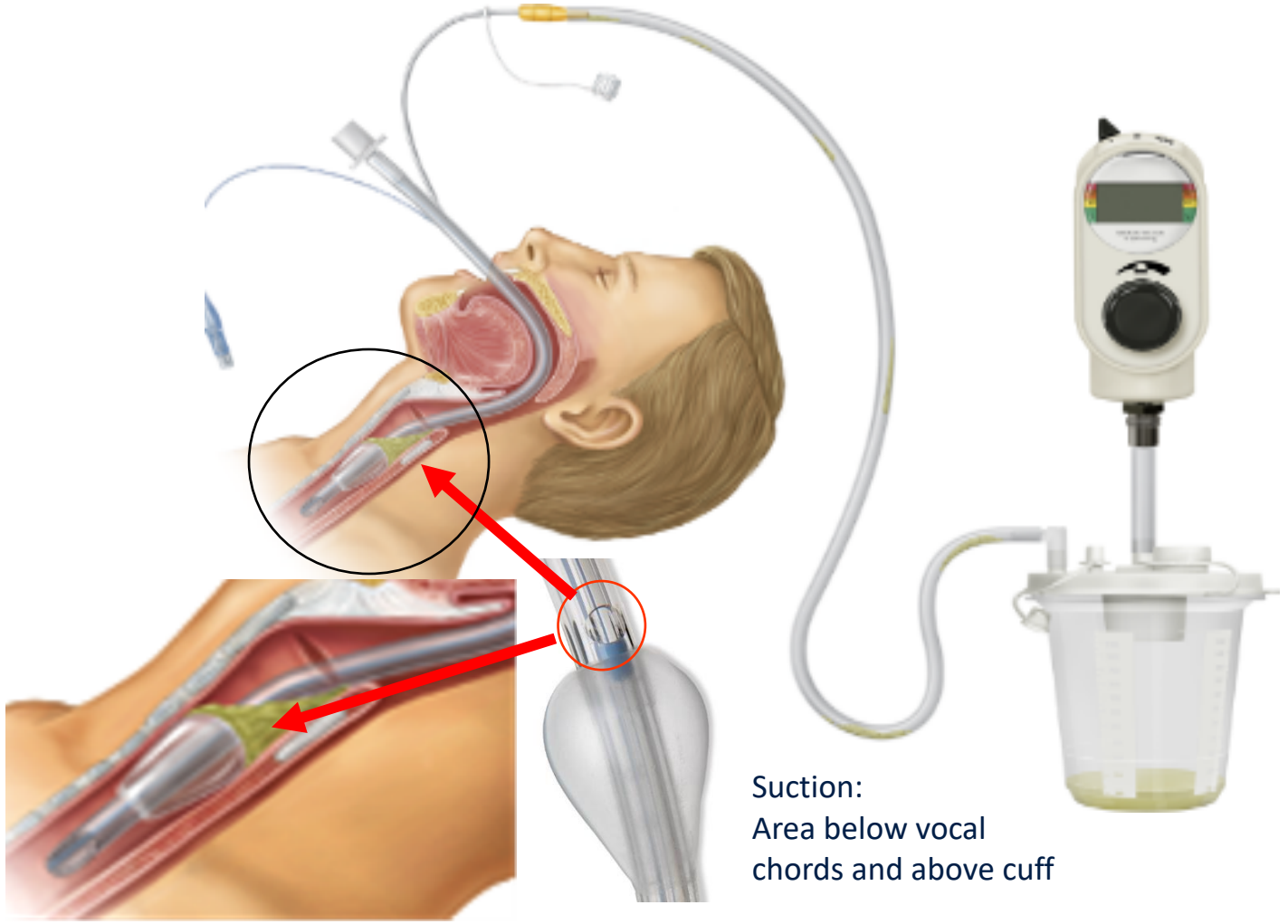


LVLP

- \+ Low pressure prevents trachea damage
- \- Reduce Micro aspiration by 90%

Lichtenthal PR,Borg UB. Endotracheal cuff pressure: role of tracheal size and cuff volume. Crit Care. 2011;15:P147.

TaperGuard ™ cuff and Evac technology has been shown to significantly reduce the incidence of VAP by an average of 50%.[2]



Suction:
Area below vocal chords and above cuff

Unexpected difficulty

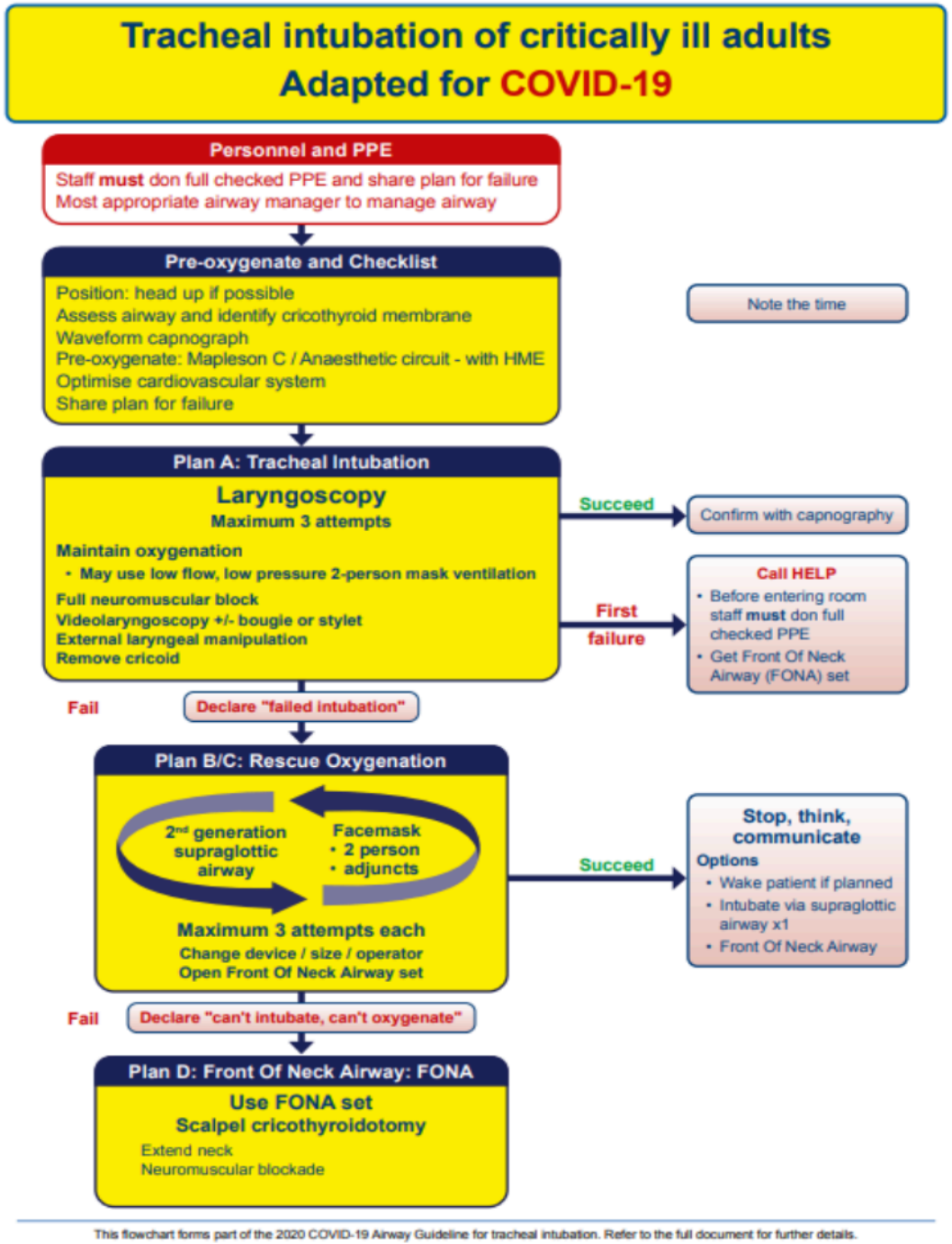
- The basic algorithm for tracheal intubation can usefully adhere to the simplified DAS 2018 guideline for tracheal intubation of the critically ill patient (Figs. 8a and 8b) or the Vortex approach (Fig. 8c). If there is difficulty with tracheal intubation this should be managed according to standard rescue algorithms with attention to the following:

a Transition through the algorithm promptly, consider minimising number of attempts at each technique.

b Declare difficulty or failure to the team at each stage.

c Mask ventilation may be deferred initially and a second-generation SGA used as an alternative between attempts at laryngoscopy. This may reduce aerosol generation due to improved airway seal

d If an emergency FONA is required, the simplified DAS 2018 guidance should be followed (Fig. 8b). The scalpel-bougie-tube technique is particularly preferred in COVID-19 patients due to the risk of aerosolisation with the oxygen insufflation associated with cannula techniques.



Can't Intubate, Can't Oxygenate (CICO) in critically ill adults

Adapted for COVID-19

CALL FOR HELP

↓ Declare "Can't Intubate, Can't Oxygenate"

Plan D: Front Of Neck Airway: FONA

Extend neck

Ensure neuromuscular blockade

Exclude oxygen failure and blocked circuit

Personnel and PPE

New staff **must** don full checked PPE

Most appropriate airway manager to perform FONA

Scalpel cricothyroidotomy

Equipment: 1. Scalpel (wide blade e.g. number 10 or 20)
2. Bougie (≤ 14 French gauge)
3. Tube (cuffed 5.0-6.0mm ID)

Laryngeal handshake to identify cricothyroid membrane

Palpable cricothyroid membrane

Transverse stab incision through cricothyroid membrane

Turn blade through 90° (sharp edge towards the feet)

Slide Coudé tip of bougie along blade into trachea

Railroad lubricated cuffed tube into trachea

Inflate cuff, ventilate and confirm position with capnography

Secure tube

Impalpable cricothyroid membrane

Make a large midline vertical incision

Blunt dissection with fingers to separate tissues

Identify and stabilise the larynx

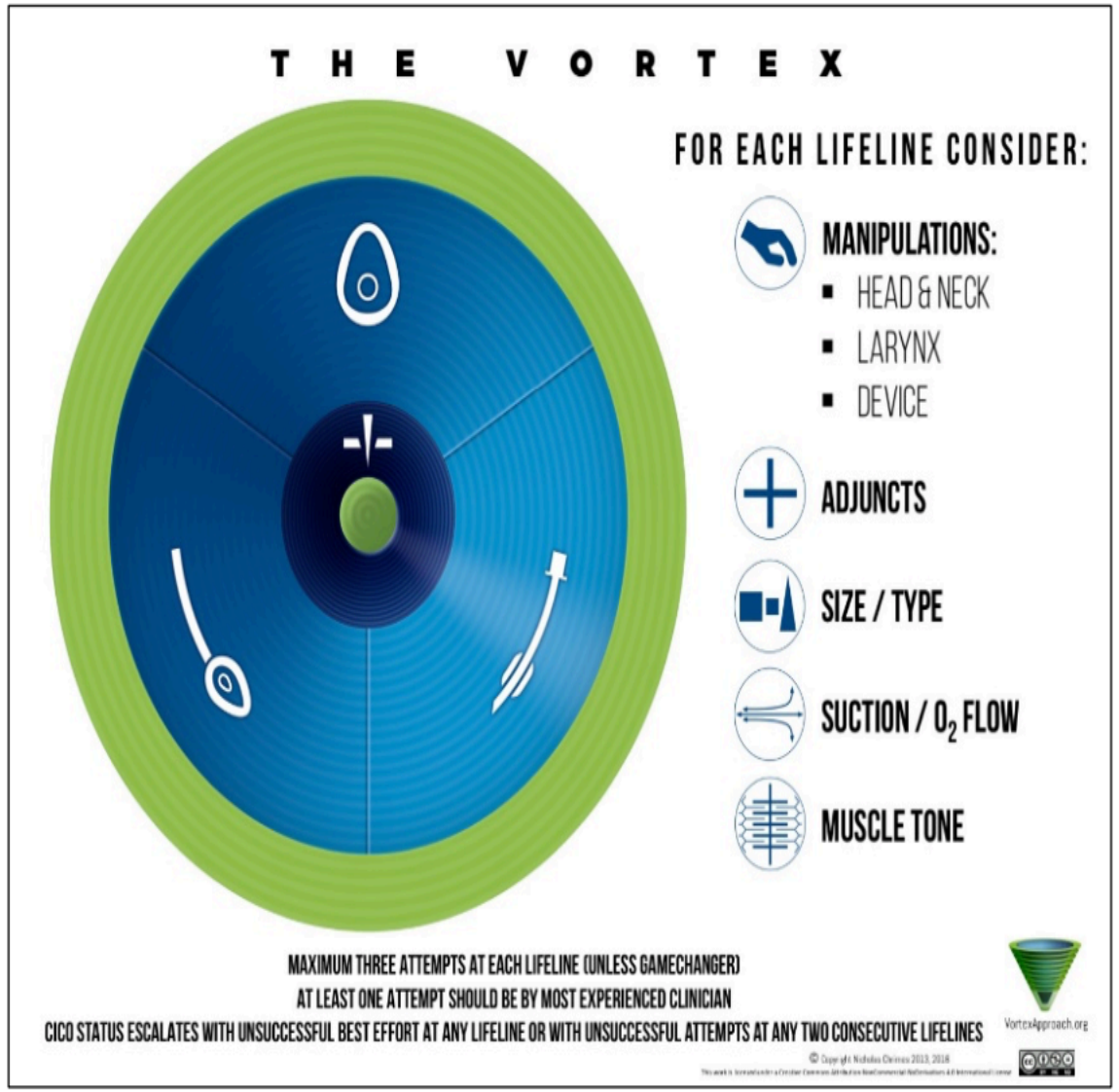
Proceed with technique for palpable cricothyroid membrane as above

Post-FONA care and follow up

- Closed tracheal suction
- Recruitment manoeuvre (if haemodynamically stable)
- Chest X-ray
- Monitor for complications
- Surgical review of FONA site
- Agree airway plan with senior clinicians
- Document and complete airway alert

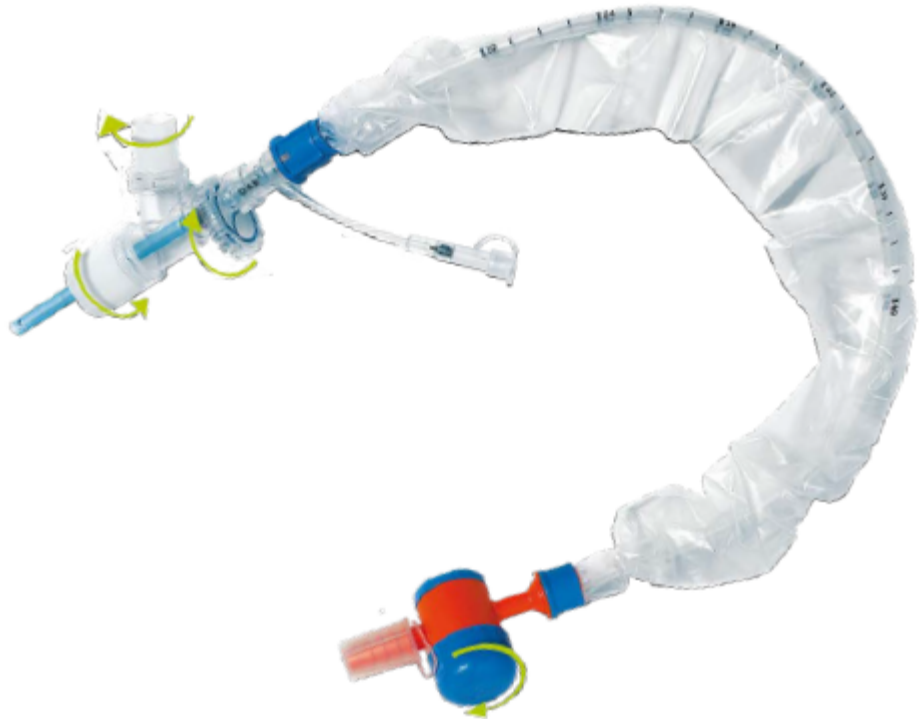
This flowchart forms part of the 2020 COVID-19 Airway Guideline for tracheal intubation. Refer to the full document for further details.

c



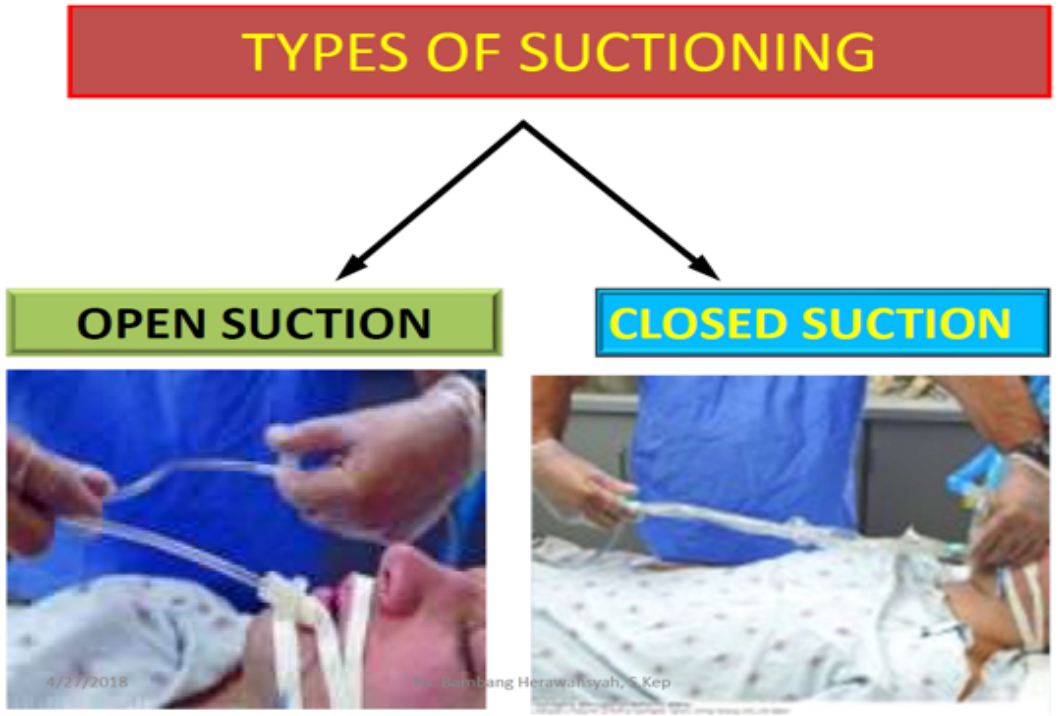
Airway management after tracheal intubation and trouble shooting

- *Use an HME filter close to the patient*, instead of a heated humidified circuit (wet circuit) but take care this does not become wet and blocked.
- *Monitor airway cuff pressure carefully to avoid airway leak*. If using high airway pressures, ensure the tracheal tube cuff pressure is at least 5 cmH_2O above peak inspiratory pressure. Cuff pressure may need to be increased before any recruitment manoeuvres to ensure there is no cuff leak.
- *Monitor and record tracheal tube depth* at every shift to minimise risk of displacement.
- *Managing risk of tracheal tube displacement*. This is a risk during patient repositioning including: prone positioning; turning patients; nasogastric tube aspiration or positioning; tracheal suction; and oral toilet. Cuff pressure and tracheal tube depth should be checked and corrected both before and after these procedures. There is a risk of tracheal tube displacement during sedation holds and this should be considered when planning these (e.g. timing, nursing presence etc.).
- *Suction*. Closed tracheal suction is mandatory wherever available.
- *Tracheal tube cuff leak*. If a cuff leak develops to avoid aerosol-generation pack the pharynx while administering 100% oxygen and setting up for re-intubation. Immediately before re-intubation, pause the ventilator.



Importance of closed suction

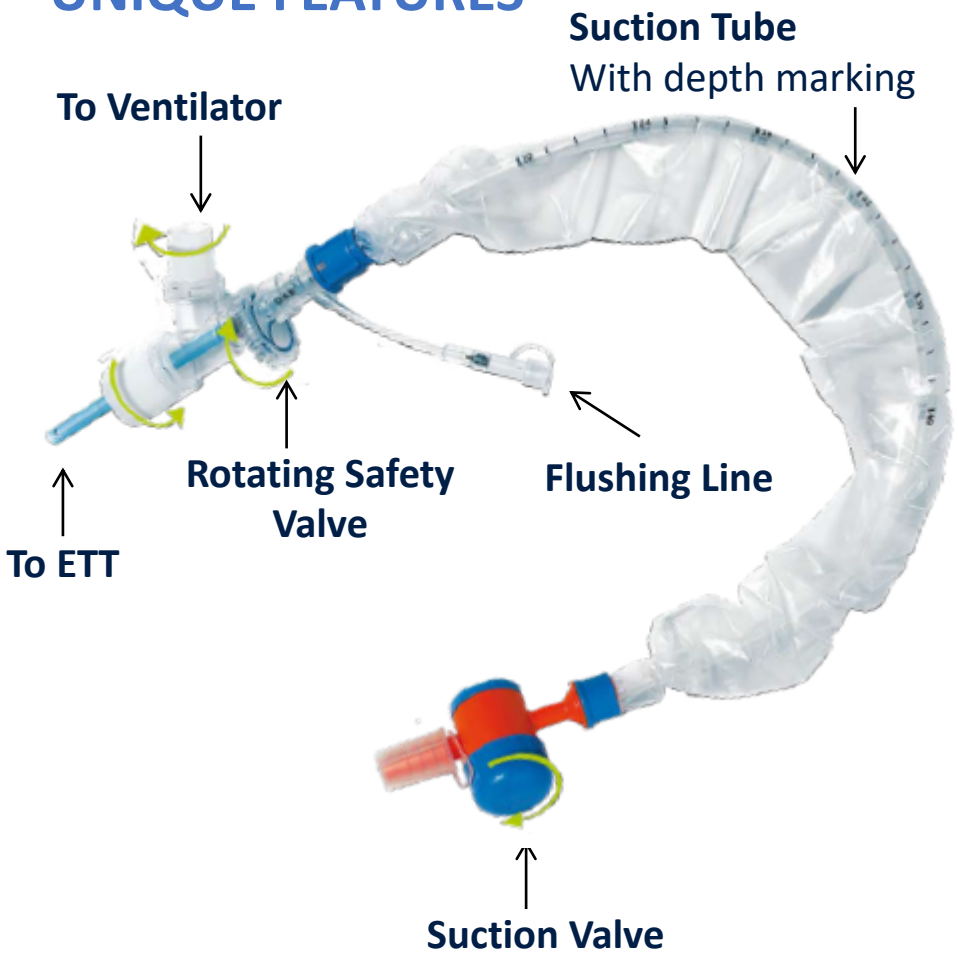
- Closed suction systems ensure patient's security:
- Prevents lung volume loss and drop in oxygenation during suctioning (this is very important in hypoxemic and ARDS patients)



OPEN SUCTION	FAKTOR PEMBANDING	CLOSE SUCTION
2 ORANG	PENOLONG	1 ORANG
DISPOSIBLE	PENGGUNAAN CATHETER	NON DISPOSIBLE
YA	LEPAS VENTILATOR	TIDAK
YA	PENURUNAN SATURASI	TIDAK
YA	RESIKO VAP	TIDAK
BESAR	INOK	KECIL
YA	HILANGNYA VOLUME PARU	TIDAK
YA	MENGGUNAKAN BAGGING	TIDAK

DAR CLOSED SUCTION

UNIQUE FEATURES



MDI port = Metered Dose Inhaler
Function is to deliver medication to lungs

Key Features

1) Atraumatic tip
2) Sealing cap for Brochoscopy
3) Rotating patient access valve to isolate patient's airways

Benefits

1) Reduced trauma to Patient's trachea contributing to a faster outcome
2) Bronchoscopy performed in a closed circuit to reduce exposure of patient airways to the environment. Reduction of cross contamination.
3) Vital parameters are not altered while cleaning the catheter and no saline solution can inadvertently reach patient's airways. The cleaning can take as long as required in full safety for the patient.

- *Airway interventions*. Physiotherapy and bagging, transfers, prone positioning, turning the patient, tube repositioning. If the intervention requires a disconnection of the ventilator from the tracheal tube before the airway intervention:

a Ensure adequate sedation.
b Consider administering neuromuscular blockade.
c Pause the ventilator so that both ventilation and gas flows stop
d Clamp the tracheal tube
e Separate the circuit with the HME still attached to the patient
f Reverse this procedure after reconnection

- *Avoid disconnections*. push-twist all connections to avoid risk of accidental disconnections.
- *Accidental disconnection*. Pause the ventilator. Clamp the tracheal tube. Reconnect promptly and unclamp the tracheal tube.
- *Accidental extubation*. This should be managed as usual, but management should be preceded by full careful donning of PPE before attending to the patient, irrespective of clinical urgency.
- *Tracheostomy*. This is a high-risk procedure due to aerosol-generation, and this should be taken into account if it is considered. It may be prudent to delay tracheostomy until active COVID-19 disease is resolved.

- Pause the ventilator, so that both ventilation and gas flow stop
- Clamp the tracheal tube
- Separate the circuit with the HME still attached to the patient

Anaesthesia 2020 doi:10.1111/anae.15054

Guidelines

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

T. M. Cook,[1] K. El-Boghdadly,[2] B. McGuire,[3] A. F. McNarry,[4] A. Patel[5] and A. Higgs[6]

Tracheal extubation

- Many ICUs routinely extubate patients' tracheas and then use high-flow nasal oxygen immediately for up to 24 h. This is unlikely to be desirable or feasible in patients with COVID-19. Consequently, tracheal extubation may be delayed, unless the pressure of bleeds demands otherwise.
- Efforts should be made to minimise coughing and exposure to infected secretions at this time.

a Undertake appropriate physiotherapy and tracheal and oral suction as normal before extubation.

b Prepare and check all necessary equipment for mask or low flow (< 5 l.min^{-1}) nasal cannula oxygen delivery before extubation.

c After extubation, ensure the patient immediately wears a facemask as well as their oxygen mask or nasal cannulae where this is practical.

d During anaesthesia, drugs to minimise coughing at emergence include dexmedetomidine, lidocaine and opioids [32]. The value of these is unproven in critical care and needs to be balanced against adverse impact on respiratory drive, neuromuscular function and blood pressure. For these reasons, routine use is currently unlikely.

e While an SGA may be considered as a bridge to extubation to minimise coughing this involves a second procedure and the possibility of airway difficulty after SGA placement so is unlikely to be a first-line procedure [33, 34].

f Likewise, the use of an airway exchange catheter is relatively contra-indicated in a patient with COVID-19 due to potential coughing etc.

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CORRESPONDENCE

Lidocaine during intubation and extubation in patients with coronavirus disease (COVID-19)

Reza Aminnejad, MD · Alireza Salimi, MD · Mohammad Saeidi, MD

To the Editor,

In the months that have followed the initial outbreak of sever acute respiratory syndrome coronavirus-2 (SARS-CoV-2) i Wuhan, a similar critical situation has developed in Iran Anesthesiologists are at the forefront of this fight, particularly a the time of airway management. We have implemented into ou daily practice the valuable points from the recently publishe review article by Wax and Christian "Practical recom mendations for critical care and anesthesiology teams carin for novel coronavirus (2019-nCoV) patients".[1] We would like t add two additional points to the others raised in their review.

Cough is one of the major ways of human-to-human viral spread, and is one of the prevalent features of this infectious disease[2]; any airway instrumentation can also exacerbate it. Cough is a common event following premedication with an opioid such as fentanyl (given prior to induction of anesthesia) and can be prevented by a single intravenous dose of lidocaine.[3] One of the reasons complete muscle relaxation during endotracheal intubation in coronavirus disease (COVID-19) patients is recommended is to reduce coughing.[4] In addition, coughing and bucking are also prevalent events during extubation. Emergence coughing is a challenging issue and a variety of medications have been proposed to prevent it. Again, administration of intravenous lidocaine (which is readily available) prior to tracheal extubation can effectively reduce emergence coughing without any other significant side-effects.[5] Consideration should be given to injections of lidocaine at the beginning and the end of any procedure requiring intubation and/or extubation in patients with COVID-19.

Funding statement None.

Editorial responsibility This submission was handled by Dr. Hilary P. Grocott, Editor-in-Chief, *Canadian Journal of Anesthesia.*

References

1. *Wax RS, Christian MD.* Practical recommendations for critical care and anesthesiology teams caring for novel coronavirus (2019-nCoV) patients. Can J Anesth 2020. DOI: https://doi.org/10.1007/

summary

- Airway management is challenging situation in patient with COVID-19 and increase risk for aerosolization and transmission to the healthcare workers
- Preparation, team briefing, skillfull intubator, tray kit, PPE, HME filter, closed suction, video laryngoskop are important part to intubate patient with COVID-19
- The aim of airway management patient with COVID-19 are to minimize disconnection, avoid aerosolization and transmission of the viral to the healthcare workers

THANK YOU