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Expert Recommendations for Tracheal Intubation in Critically ill Patients with Noval Coronavirus Disease 2019

Mingzhang Zuo[1], Yuguang Huang[2*],* Wuhua Ma[3], Zhanggang Xue[4], Jiaqiang Zhang[5], Yahong Gong[2], Lu Che[2], Chinese Society of Anesthesiology Task Force on Airway Management

1 Department of Anesthesiology, Beijing Hospital, National Center of Gerontology; Institute of Geriatric Medicine, Chinese Academy of Medical Sciences, Beijing, 100730 China
2 Department of Anesthesiology, Peking Union Medical College Hospital, Chinese Academy of Medical Sciences, Beijing, 100730 China
3 Department of Anesthesiology, First Affiliated Hospital, Guangzhou University of Chinese Medicine, Guangzhou, 510405 China
4. Department of Anesthesiology, Zhongshan Hospital Fudan University, Shanghai, 200032 China
5. Department of Anesthesiology, Henan Provincial People's Hospital, Zhengzhou, 450003 China

Abstract

Coronavirus Disease 2019 (COVID-19), caused by a novel coronavirus (SARS-CoV-2), is a highly contagious disease. It firstly appeared in Wuhan, Hubei province of China in December 2019. During the next two months, it moved rapidly throughout China and spread to multiple countries through infected persons travelling by air. Most of the infected patients have mild symptoms including fever, fatigue and cough. But in severe cases, patients can progress rapidly and develop to the acute respiratory distress syndrome, septic shock, metabolic acidosis and coagulopathy. The new coronavirus was reported to spread via droplets, contact and natural aerosols from human-to-human. Therefore, high-risk aerosol-producing procedures such as endotracheal intubation may put the anesthesiologists at high risk of nosocomial infections. In fact, SARS-CoV-2 infection of anesthesiologists after endotracheal intubation for confirmed COVID-19 patients have been reported in hospitals in Wuhan. The expert panel of airway management in Chinese Society of Anaesthesiology has deliberated and drafted this recommendation, by which we hope to guide the performance of endotracheal intubation by frontline anesthesiologists and critical care physicians. During the airway management, enhanced droplet/airborne PPE should be applied to the health care providers. A good airway assessment

* Corresponding author: Mingzhang Zou, zuomz@163.com; Yuguang Huang, garybeijing@163.com. The non-author contributors are listed at the end of article.
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before airway intervention is of vital importance. For patients with normal airway, awake intubation should be avoided and modified rapid sequence induction is strongly recommended. Sufficient muscle relaxant should be assured before intubation. For patients with difficult airway, good preparation of airway devices and detailed intubation plans should be made.

Key words: COVID-19; SARS-CoV-2; endotracheal intubation; difficult airway; infection control precaution

Coronavirus Disease 2019 (COVID-19) is a disease caused by a novel coronavirus outbreak in 2019. It firstly appeared in Wuhan, Hubei province of China at the end of 2019, and has spread to the whole country. COVID-19 is defined as the Class B infectious diseases according to the *Law of the People's Republic of China on the Prevention and Control of Infectious Diseases*, and is determined to be managed as the Class A infectious disease.[1] The virus infection can cause a new type of coronavirus pneumonia (COVID-19 illness). Main manifestations include fever, fatigue, and dry cough. Severe patients often experience dyspnea and/or hypoxemia one week after the onset of illness. In severe cases, the disease can progress rapidly and develop to the acute respiratory distress syndrome, septic shock, metabolic acidosis and coagulopathy, which is difficult to correct. As the fact that endotracheal intubation is needed in critically ill patients with novel coronavirus infection, the expert panel of airway management in Chinese Society of Anaesthesiology has deliberated and drafted recommendations on proper practice of tracheal intubation in critically ill patients with Noval Coronavirus Disease 2019. We hope the recommendations can provide guidance for the frontline anesthesiologists and critical care physicians on performance of endotracheal intubation.

1. Indications

Endotracheal intubation should be performed timely when:

(1) Severe patients, no symptom relief（persisting respiratory distress and / or hypoxemia）after standard oxygen therapy;

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(2) Symptoms (respiratory distress, respiratory rate > 30 / min, oxygenation index <150 mmHg) persist or exacerbate after high-flow nasal oxygenation (HFNO) or non-invasive ventilation for 2 hours. [2]

2. Infection control precaution is of top priority!

Endotracheal intubation is a high-risk procedure, during which secretions, blood, droplets and aerosols can shed widely. Therefore the management warrant specific caution, and intubation should be undertaken in an airborne isolation room. All the associated health care workers (HCWs) should be applied with appropriate airborne/droplet Personal Protective Equipment（PPE). [3]

(1) Apply enhanced droplet/airborne PPE to the anesthesiologist who are managing the airway, including fit-tested N95 masks, hair cover, protective covercall, gown, gloves, face shields and goggles, shoe covers.[3-5] If available, medical protective head hood or powered air purifying respirator (PAPR) should be used. Goggles and glasses need to be prepared for anti-fog.

(2) Put on PPEs: strictly follow the “PPE Donning Process for High Risk Level of Exposure” and in the following order: disposable hair cover, fit-tested N95 respirator, fluid-resistant gown, two layers of gloves, goggle and face shield, fluid-resistant shoe covers. Do an overall check by an experienced assistant before entering the isolation area.[3-6] Make sure that PPEs have been properly dressed and would not interfere with intubation.

(3) Remove PPEs: strictly follow the “PPE Doffing Process for High Risk Level of Exposure” and in the following order: hand hygiene, remove face shield and goggle, remove fluid-resistant gown, remove outer gloves, remove shoe covers, remove inner gloves, hand hygiene, remove N95 respirator, remove hair cover. Doffing process should be supervised by an inspector. Inadvertent contamination of the skin or mucosa should be reported to hospital infection office to assess the necessity of quarantine. A thorough shower is also highly recommended after removing PPE, including oral, nasal and external auditory canal disinfection.[3-6]

3. When possible, intubation should be performed by an experienced anesthesiologist and with assistance of another doctor (anesthesiologist or intensive care physician).

4. Prepare airway devices, anesthetics, vasoactive drugs, suction device, ventilators, and establish standard monitoring and venous access (electrocardiogram, blood pressure and pulse oximetry).

5. Perform a rapid airway assessment:

(1) past history of difficult airway;

(2) mouth opening test (distance between incisors < 3cm);

(3) thyromental distance (< 6cm);

(4) mobility of head and neck;

(5) circumference of neck;

(6) modified Malampati test (Not recommended).

A good airway assessment before airway intervention is of vital importance, because recognition of patients at particular risk of difficult airway may aid pre-intubation planning.

6. Choose the airway devices that you are most familiar with. Recommend disposable airway management tools, including but not limited to the following:

(1) Video laryngoscope with disposable blades.

(2) Disposable seeing optical stylet or disposable video endotracheal tube.

(3) Disposable second-generation intubating laryngeal mask.

(4) Prepare devices for needle or scalpel cricothyroidotomy.

(5) If available, prepare disposable flexible video bronchoscope.

(6) If available, prepare supraglottic & subglottic injectable ETT. Periodical injection of 2% lidocaine 2ml -3ml or 1% lidocaine 4ml - 6ml through the working channel can reduce the irritation caused by ETT, thereby reduce the sedation drugs and muscle relaxant needed.

7. For anticipated difficult airway, the following suggestions should be followed:

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(1) For an anticipated difficult airway, awake bronchoscopic trans-nasal intubation with reserved self-respiration is recommended with proper sedation and sufficient topical anesthesia.[7-9] If available, the endoscopic mask is highly recommended with advantages of potential prevention of desaturation and spread of droplet and/or aerosol. If transnasal intubation fails, oral intubation can be adopted. Enhanced PPE should be applied and measures should be taken to inhibit cough reflexes. Lidocaine spray can be used for topical anesthesia with cautions for that it may generate contagious aerosol and droplets.

(2) If all the available intubating airway devices, including video laryngoscope and flexible video bronchoscope, carry a high risk of intubation failure, and a difficult ventilation is also highly anticipated, proceed to tracheotomy directly by ENT doctors or other surgeons.[7-9] Performing intubation or tracheotomy with the support of extracorporeal membrane oxygenation can also be considered.[10]

8. For patients with normal airway, awake intubation should be avoided and modified rapid sequence induction is recommended. Sufficient muscle relaxant should be given immediately after loss of consciousness to abolish cough reflexes, facilitate early intubation with better conditions, reduce apnea time and avoid severe hypoxemia. Complete neuromuscular blockade should be ensured to avoid cough reflex during intubation.[7-9, 11]

(1) Optimize patient's position. Generally patients should be placed at the “sniffing” position. For obese patients, the ‘ramped’ position should be used routinely.

(2) Preoxygenate with 100% FiO_2 for 5 minutes. For patients already on HFNO, bag-mask ventilator should be prepared in case of severe hypoxemia. Cover patient’s mouth and nose with two layers of wet gauze (the gauge should not block the airway patency or fall into the mouth), and ventilate the patient with bag-mask if necessary. For patients already on non-invasive mechanical ventilation, ventilate the patients with 100% oxygen for 5 minutes before induction, and prepare bag-mask ventilator.

(3) The choice of induction drug is dictated by haemodynamic considerations. Midazolam 2mg to 5mg with a small dose of etomidate (patients with hemodynamic

instability) or propofol (patients with stable hemodynamic state) can be used for induction. Appropriate amount of fentanyl or remifentanil can be given to suppress laryngeal reflexes and provide better conditions for intubation. Rocuronium 1mg/kg (the first choice) or succinylcholine 1mg/kg should be administered immediately after loss of consciousness and intubation can be carried out 1 minute later. Succinylcholine is contraindicated among patients with hyperkalemia. Rocuronium has a rapid onset and can be antagonized immediately with sugammadex. Keep sugammadex at hand if available.

(4) After induction, ventilation with low tidal volume and high frequency is recommended if bag-mask ventilation is necessary to maintain satisfactory oxygenation.

(5) Cricoid pressure by an experienced assistant can be applied to prevent gastroesophageal reflux and aspiration.

(6) Video laryngoscope with disposable blades is recommended for tracheal intubation orally. If difficult intubation is encountered, using external laryngeal manipulation or bougie or disposable seeing optical stylet may improve the chance of success.

(7) HFNO is recommended during intubation to avoid aggravating hypoxemia if necessary. But cautions should be taken in that use of HFNO may generate droplets and aerosol.

(8) Closed airway suction is recommended to reduce viral aerosol.

9. Make preparations for unanticipated difficult tracheal intubation.[7-9]

(1) If tracheal intubation fails, a second-generation laryngeal mask should be placed immediately. If the second-generation laryngeal mask is placed properly and satisfactory ventilation is achieved, then tracheal intubation can be achieved through the laryngeal mask with the guidance of fibreoptic bronchoscope.

(2) If tracheal intubation, face-mask ventilation, and second-generation laryngeal mask airway (LMA) all have failed, proceed to invasive cricothyroidotomy immediately to ensure ventilation.

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(3) A cricothyroidotomy may be performed using either a needle technique (a 4mm cricothyroidotomy kit) or a scalpel technique (a scalpel with number 10 blade, a bougie and a size 5.0mm - 6.0 mm cuffed tracheal tube).

10. During the induction of anesthesia, hemodynamic instability is common. Monitor the blood pressure, heart rate and pulse oxygen saturation closely with helps of infectious disease physician and intensive care doctors. Proper fluid administration and implementation of vasopressors should be applied to maintain hemodynamic stability.

11. One high efficiency particulate air (HEPA) filter should be installed between the mask and the breathing circuit or the respiratory bag, and one at the expiratory end of the breathing circuit.[11]

12. After intubation, proper positioning of ETT can be confirmed by direct view of ETT passage through the vocal cord, detection of trachea ring or bulge by bronchoscopy, proper waveform of end tidal CO_2 and thoracic respiratory movement. ETT should be placed at the optimal level to avoid single lung ventilation or accidental extubation. Appropriate depth of ETT can be determined by the insertion markers (23 cm and 21 cm from the upper incisors in adult males and females, respectively) and suprasternal palpation of the ETT tip or cuff. Chest radiography should be performed if possible.

13. Secure the endotracheal tube properly and put the patients on mechanical ventilation.

14. All the airway devices must be collected in double-sealed bags and implement proper disinfection during disposal.

15. Appropriate cleaning and disinfection of equipment and environment surfaces is mandatory to reduce transmission by the indirect contact route.

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Members of the expert group apart from authors (sorted alphabetically by the last name):

Xiangdong Chen, Union Hospital of Tongji Medical College, HuaZhong University of Science and Technology, Wuhan, China

Ping Chi, Beijing Youan Hospital, Capital Medical University, Beijing, China

Xiaoming Deng, Changhai Hospital, Naval Military Medical University, Shanghai, China

Tianzuo Li, Beijing Shijitan Hospital, Capital Medical University, Beijing, China

Ailin Luo, Tongji Hospital, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, China

Weidong Mi, Chinese PLA General Hospital, Beijing, China

Lingzhong Meng, Yale University School of Medicine, New Haven, Connecticut, USA

Huafeng Wei, Perelman School of Medicine, University of Pennsylvania, Philadelphia, Pennsylvania, USA

Lize Xiong, Shanghai Fourth People's Hospital Affiliated to Tongji University School of Medicine, Shanghai, China

Zhongyuan Xia, Renmin Hospital of Wuhan University, Wuhan University, Wuhan, China

Zongze Zhang, Zhongnan Hospital, Wuhan University, Wuhan, China

Liming Zhang, University of Pittsburgh School of Medicine (UPSOM) and University of Pittsburgh Medical Center (UPMC), USA

Hongfei Zhang, Zhujiang Hospital of Southern Medical University, Guangzhou, China

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