



Use of Plastic Bag to Reduce Risks in Operators During Endotracheal Intubation of Patients With Coronavirus Disease 2019

Yu-Jie Yuan¹, Yu-Chi Tseng², Chan-Peng Hsu¹, Cho-Chao Feng¹, Chaou-Shune Lin¹, Yang-Tse Lin^{1,*}

¹Department of Emergency Medicine, Hsinchu Cathay General Hospital, Hsinchu, Taiwan

²Department of Emergency Medicine, Hsinchu MacKay Memorial Hospital, Hsinchu, Taiwan

The rapid spread of coronavirus disease 2019 (COVID-19) has led to a large number of patients being admitted to hospitals, resulting in a near collapse of the medical system. The shortage of negative pressure isolation rooms and personal protective equipment is a potential problem. It is a pressing challenge to prevent the risk of infection in emergency physicians (EPs) during the endotracheal intubation of patients with COVID-19. We used a large clear plastic bag, cut an opening that covered the patient's head, and created a negative pressure environment inside the plastic bag using the hospital's medical gas pipeline system; thus reducing the amount of virus-containing aerosols leaked out and the risk of infection in the operators performing intubation. The video (<http://www.caregiver.com.tw/Article.asp?ID=1258#article>) about the detailed preparation of the plastic bag intubation kit (PBIK) has been posted on the website. This technique for safe endotracheal intubation in patients with COVID-19 is being used not only by EPs in Taiwan, but also by physicians and paramedics from other countries. Regarding designing the PBIK, our original intention was to use readily available materials to make tools that can improve the safety of the operators performing the intubations in situations where medical resources are exhausted. However, due to limited time and patients, further research is needed for validation.

Key words: *intubation, coronavirus, COVID-19, plastic bag intubation kit (PBIK), healthcare workers*

Introduction

The rapidly spreading coronavirus disease 2019 (COVID-19) has led to many patients being admitted to hospitals, resulting in a near collapse of the medical system.¹ Because the disease testing is time-consuming, it is impossible to identify it immediately to those severe dyspneic patients. Healthcare workers (HCWs), such as emergency physicians (EPs), are at a high risk of being infected when caring for these patients, especially when performing endotracheal intubations.² Therefore, it is critical for the operators

to be equipped with complete personal protective equipment (PPE) when these operators perform endotracheal intubations.^{3,4} However, with the current exhaustion of medical resources, lack of PPE has become an urgent problem in all countries.⁵ Moreover, emergency departments are experiencing a shortage of negative pressure isolation rooms. Therefore, preventing the risk of infection is a pressing challenge for EPs. The aim of this letter is to share the experiences of using a plastic bag to reduce infected risks in HCWs during endotracheal intubation of patients with suspected COVID-19.

Received: May 21, 2020; Revised: August 6, 2020; Accepted: September 8, 2020.

*Corresponding author: Yang-Tse Lin, MD, Department of Emergency Medicine, Hsinchu Cathay General Hospital, No. 678, Sec. 2, Zhonghua Rd., East Dist., Hsinchu City 300003, Taiwan. E-mail: qqyyog@gmail.com

Experiences of Using a Plastic Bag

The plastic bag intubation kit (PBIK) (Fig. 1), made from the readily available clear plastic bag as physical barriers to reduce exposure to COVID-19 virus, was designed by YCT and KCT. The endotracheal intubation equipment was placed in the plastic bag, and the hospital's medical gas pipeline system (MGPS) and wall-mounted suction unit were used to create a negative pressure inside the plastic bag. This negative pressure prevents excessive expansion of the plastic bag caused by the air flowing out of the non-re-breathing mask and simultaneously draws the virus-containing aerosol into the suction bottle. The preparation steps are as follows:⁶

- (1) Choose a $100 \times 100 \text{ cm}^2$ clear plastic bag, preferably with 0.06 mm thickness. Apply double-sided tape to the edge of the open end of the plastic bag.
- (2) Measure the length of the patient's head and neck, and cut an appropriate slit in the middle of one side of the plastic bag to allow the head and neck to pass through and to be covered by the bag. Double-sided tape can be applied to the inside of this slit to attach the bag to the bed and avoid the leakage of virus-containing aerosol.
- (3) Extend both arms from the open end to the two bottom corners of the plastic bag and grasp them

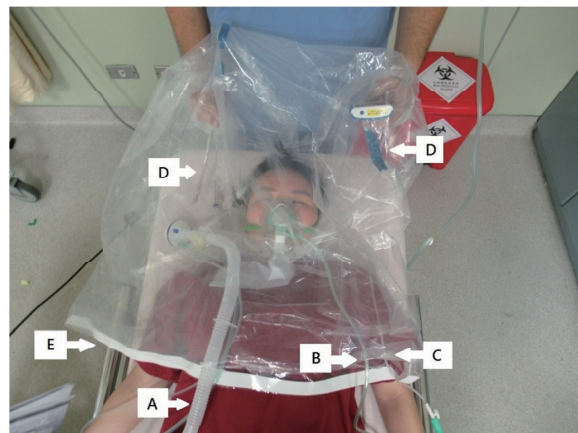


Fig. 1. Plastic bag intubation kit equipment. (A) Ventilator circuit with high-efficiency particulate air filter used to connect the ventilator. (B) Oxygen tube of non-re-breathing mask. (C) Suction tube used to connect the wall-mounted suction unit. (D) Endotracheal tube and video assisted laryngoscope. (E) Double-sided tape used to seal the opening of the bag.

with both hands. Ask the assistant to fasten rubber bands on both wrists from outside the bag. The assistant must then hold the open end of the plastic bag, pull it in the opposite direction, and turn it inside out, forming two pockets that will allow both hands to reach in and perform the intubation (Fig. 2).

- (4) Cover the patient's head and neck through the slit and secure the bag on the bed with double-sided tape.
- (5) Place the endotracheal tube, video assisted laryngoscope, 10 mL empty syringe, suction tube, and ventilator circuit into the plastic bag from the open end (Fig. 1). After placing the equipment, connect the tube to the hospital's MGPS and wall-mounted suction unit or a ventilator with a high-efficiency particulate air filter. Finally, seal with the double-sided tape applied to the edge of the open end of the bag.
- (6) Reach both hands into the pockets and perform endotracheal intubation following the standard procedure. After the intubation is completed, use the same plastic bag to wrap the used equipment for sterilization/disposal.

The video detailing the PBIK preparation is on the website.⁶ Besides the EPs in Taiwan, physicians and paramedics, from Italy, the USA, Middle-Eastern

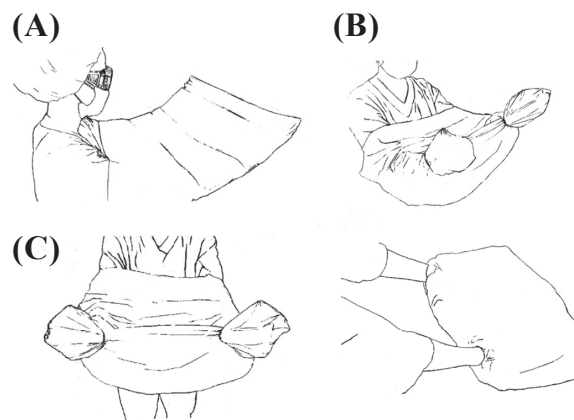


Fig. 2. Procedure to create two pockets to allow both hands to perform intubation. (A) Extend both hands to the two bottom corners of the plastic bag. (B) Fasten rubber bands on both wrists. (C) Hold the edge of the open end of the plastic bag, pull the bag in the opposite direction, and turn it inside out to form two pockets.

countries, etc., have used this kit to perform endotracheal intubation in COVID-19 patients in the emergency room or pre-hospital environment. As no large-scale community infection had broken out in Taiwan, we only used about 10 cases. However, in our experience, intubation is much easier when we use a PBIK compared to an aerosol box,⁷ as it facilitates fluid hand movement. Some physicians have also used PBIK during endotracheal tube removal, wherein the used equipment is enclosed in the plastic bag, thus preventing infection caused by exposure of the equipment to the environment.

The intention for the PBIK design is not to replace PPE or change the current intubation guidelines but to use a simple plastic bag to protect HCWs from exposure to large amounts of the virus during intubation, especially in situations with scarce medical resources, lack of negative pressure environment, or no other reliable methods. Because the negative pressure environment is created by sealing the bag opening with double-sided tape and connecting the suction tube to the wall-mounted suction unit, it is uncertain whether this negative pressure environment can effectively prevent infection. Due to limited time and patients, further research is required to validate its effectiveness.

Conclusions

In the end, we notice four points that require close attention during PBIK preparation. First, it takes about 5 minutes to make a PBIK. Therefore, we recommend making the kit in advance so that it is immediately available during an emergency. Second, the size of the plastic bag should be appropriate. If it is too big, the intubation equipment will slide inside when the bag is covering the patient, which makes it inconvenient for both hands to operate in the pockets. If it is too small, there will not be enough space for

performing the intubation, and the plastic bag could be easily pulled away from the bed. Third, after the suction tube is inserted into the plastic bag, the aerosol may contain viruses. Usually, the suction tube is connected to the pipeline system of the wall-mounted suction unit, and whether this will cause contamination in the hospital depends on the hospital's design. Thus, close attention must be paid to its usage. Finally, if the plastic bag is too thin, the two sides of the plastic bag will come together when the negative pressure is activated, failing to form an appropriate space for the performance of intubation.

References

1. Leonardi Vinci D, Polidori C, Polidori P. The healthcare and pharmaceutical vulnerability emerging from the new coronavirus outbreak. *Eur J Hosp Pharm* 2020;27:129-130. doi:10.1136/ejhpharm-2020-002278
2. Ng K, Poon BH, Kiat Puar TH, et al. COVID-19 and the risk to health care workers: a case report. *Ann Intern Med* 2020;172:766-767. doi:10.7326/L20-0175
3. Meng L, Qiu H, Wan L, et al. Intubation and ventilation amid the COVID-19 outbreak: Wuhan's experience. *Anesthesiology* 2020;132:1317-1332. doi:10.1097/ALN.0000000000003296
4. Zuo MZ, Huang YG, Ma WH, et al. Expert recommendations for tracheal intubation in critically ill patients with novel coronavirus disease 2019. *Chin Med Sci J* 2020;35:105-109. doi:10.24920/003724
5. Kamerow D. Covid-19: the crisis of personal protective equipment in the US. *BMJ* 2020;369:m1367. doi:10.1136/bmj.m1367
6. Tseng Y. Using plastic bag to reduce risks in performing endotracheal intubation for patients with COVID-19. Available at: <http://www.caregiver.com.tw/Article.aspx?ID=1258#article>. Accessed August 7, 2020.
7. Canelli R, Connor CW, Gonzalez M, Nozari A, Ortega R. Barrier enclosure during endotracheal intubation. *N Engl J Med* 2020;382:1957-1958. doi:10.1056/nejmc2007589