

## Pre-hospital methods of oxygen therapy and airway management in patients with suspected or confirmed COVID-19.



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### ABSTRACT

There are many treatment suggestions for patients infected with SARS-CoV-2 virus during the coronavirus epidemic. The most common patterns of practice, which are publicly available on social media and medical portals, mainly concern mechanical ventilation methods, but these are examples used in intensive care units. After a retrospective analysis of most recommendations, good practices, guidelines, and primarily based on our experience, the authors of this article prepared a short compendium on safe oxygen therapy in patients suspected or confirmed with the SARS-CoV-2 virus and safe methods of instrumental airway management, minimizing production aerosol.

The methods of conducting passive oxygen therapy, controlling breathing, clear upper airway with use of supraglottic devices and modified endotracheal intubation will allow medical personnel to increase their safety in supplying airway management in patients with suspected or confirmed COVID-19. This is extremely important in times of epidemic, where medical personnel in prehospital care is at high risk of being infected with SARS-CoV-2 virus.

**KEY WORDS:** COVID-19, SARS-CoV-2, 2019-nCoV, coronavirus, oxygen therapy, ventilation, airway patency methods, intubation, supraglottic devices

## INTRODUCTION

There are many treatment suggestions for patients infected with SARS-CoV-2 virus during the coronavirus epidemic. The most common patterns of practice, which are publicly available on social media and medical portals, mainly concern mechanical ventilation methods, but these are examples used in intensive care units. After a retrospective analysis of most recommendations, good practices, guidelines and primarily based on our experience, the authors of this article prepared a short compendium on safe oxygen therapy in patients suspected or confirmed with the SARS-CoV-2 virus and safe methods of instrumental airway management, minimizing production aerosol [1-5].

In this article authors will not presented methods for choosing size of tubes or use appropriate analgesic, sedative or muscle relaxant drugs. This is not the essence subject of airways management protection recommendations in the face of the prevailing COVID-19 epidemic and the coping scheme will be described as an alternative or even dedicated to airways management in the broadly understood pre-hospital emergency medicine, especially for less experienced practitioners intubation.

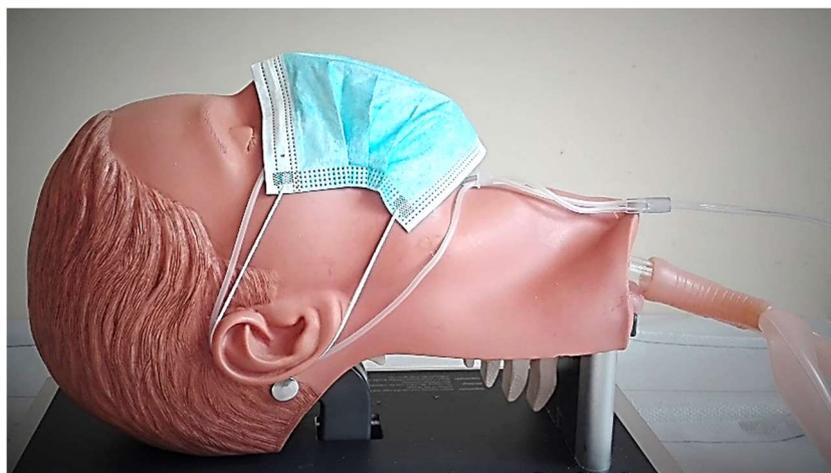
## PREPARATION BEFORE DEPARTURE AND EXAM

When we receiving departure to go to a patient with suspected or confirmed case of COVID-19, we suggest that you call the person who calling Emergency Medical Services (EMS) and collect an epidemiological interview and ask the family (if present at the place of the event) to ventilate the room in which patient is located [6,7]. Unfortunately, not all information is included in an interview collected by the medical dispatcher. If the patient is in good condition and does not require intensive medical activities, one may be tempted to collect part of SAMPLE interview by phone from the patient or family to reduce the time spent in the same room with patient. After reaching the place of incident, team protects themselves with Personal Protective Equipment (PPE), i.e. protective suit, protective gloves, protective half mask, e.g., FFP2 or FFP3, goggles or visor [5-7]. After arriving at the place of the incident, we suggest that you put on a surgical mask before taking the body temperature measurement, gathering the interview according to the SAMPLE scheme (unless you have previously ordered it by phone), or before performing the necessary Emergency Medical Services. The patient's family can be used to put on a surgical mask if present at the scene.

Additionally, you can consider ordering a patient's temperature by one family member after instructing how to do it correctly with the device that EMS has. If it is possible, remember to limit contact with other household members, in order to do so, ask them to leave the room, but that the witnesses of the event / family be within reach, in order to possibly complete the interview. We suggest that only the person in charge EMS should go to the patient at the beginning, who after the initial assessment will decide whether he needs the help of other team members at the moment..

### PASSIVE OXYGEN THERAPY

Passive oxygen therapy is highly undesirable in patients infected with SARS-CoV-2 virus [5,8]. However, if there are indications for its use, the existing methods should be modified. In the case of mild dyspnoea, use a nasal cannula, which is placed on the patient's face, and then a surgical mask is put on top. Maximum oxygen flow using a nasal cannula is a 3 litres / minute (figure 1).



**Figure 1.** Passive oxygen therapy with nasal cannula

If dyspnoea is moderate, passive oxygen therapy should be implemented with an oxygen mask with reservoir at a maximum flow of 6 litres / minute after prior filling of the oxygen reservoir and constant monitoring of its filling during oxygen supplementation. The supply of oxygen in this flow for this type of mask is a borderline flow, but if the dyspnoea is of a heavier nature, the oxygen flow should be adapted to the patient's needs, without excluding the maximum possible flow for this type of mask. The modification of oxygen therapy in this situation involves putting a surgical mask on the patient's face, covering the mouth and nose, after which an oxygen mask with a filled oxygen reservoir is put on (figure 2) [5,9].

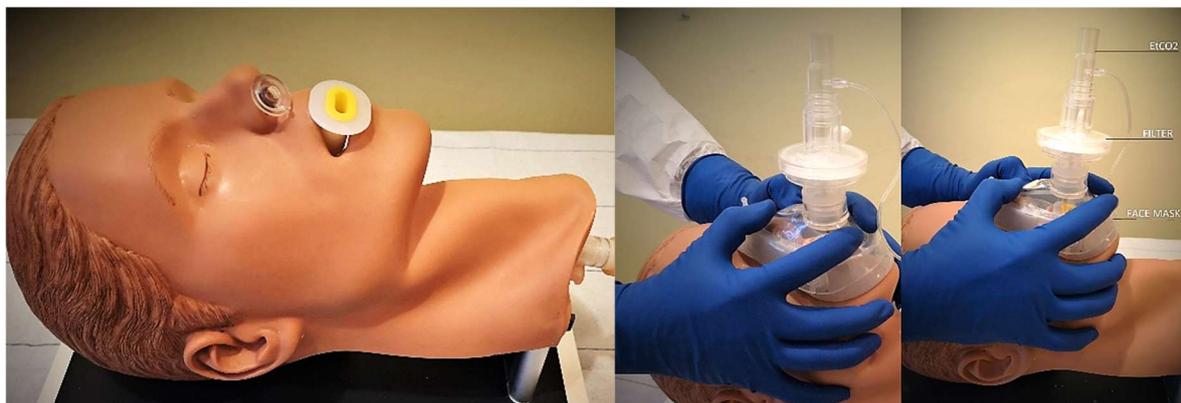


**Figure 2.** Passive oxygen therapy with oxygen mask and reservoir

In patients with suspected or confirmed COVID-19, nebulization, which carries increased aerosol production and transmission, should be avoided [5,9,10].

### BREATH CONTROL METHODS

The breath evaluation method should be carried out by means of "scanning" - observation of the chest (lifting and falling) within 10 seconds. There is no need to bend over the patient and assess breathing by hearing and feeling the breath [5,11,12]. An indicative method for assessing breath quality can be obtained with the etCO<sub>2</sub> sensor. To do this, if the patient is unconscious, open the airway using the oropharyngeal or nasopharyngeal airway or both, at the same time, and then tightly cover the lower part of the face with a face mask with a filter attached and etCO<sub>2</sub> sensor (figure 3). The problem can be men with significant lower body hair. In order for the mask to adhere tightly to the face, use food foil for "chin hair reduction". After correctly placing the face mask with filter and etCO<sub>2</sub> sensor, the capnometry value should be monitored, and it is best to observe the capnography chart with an unambiguous assessment of respiratory rate and observation of the patient's breathing muscles. Non-invasive etCO<sub>2</sub> measurement can be obtained using "capno-cannula" - is a suitably modified nasal cannula containing ports for "collected CO<sub>2</sub>" and "delivered O<sub>2</sub>" [13]. Depending on the type of cannula, in some it is possible to connect an oxygen source, which also includes passive oxygen therapy (figure 4).



**Figure 3.** Breath control method with face mask, oropharyngeal and nasopharyngeal airway

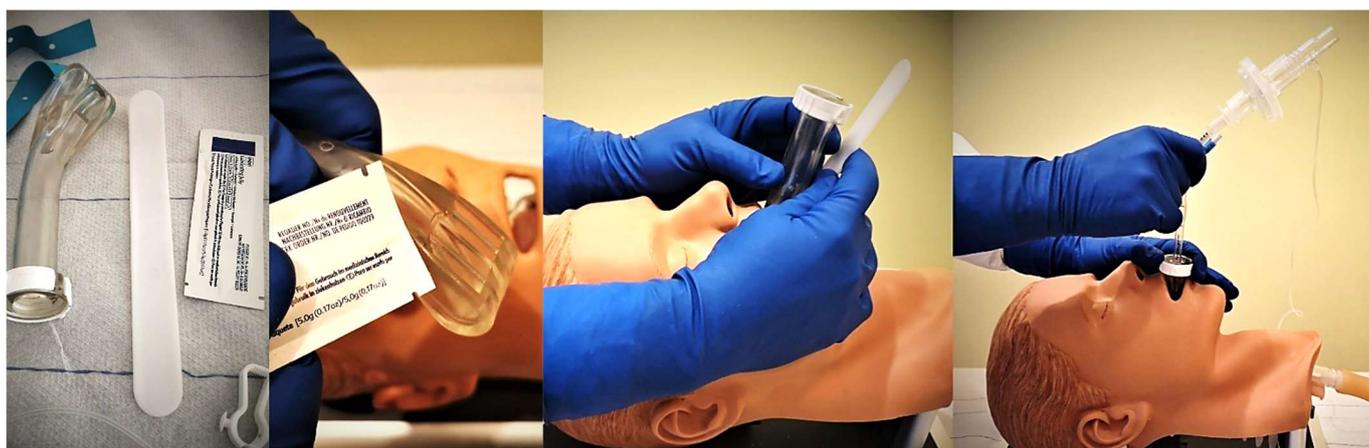


**Figure 4.** Capno-cannula (Smart CapnoLine Plus) with O<sub>2</sub> connector

### S.A.L.T. AIRWAY

Respiratory protection using a S.A.L.T. airway seems to be the most preferred method that can be used in pre-hospital care. The problem is the availability of this equipment in some countries and its price around \$ 40 or £ 28. Construction of this device and the method of putting it on is minimizing the "look" in the respiratory tract during clearing compared to intubation in direct laryngoscopy. S.A.L.T. airway when introduced into the oral cavity, it functions not only as an oropharyngeal tube, but also as a guide for the endotracheal tube. After intubation, the patient can be used to immobilize the endotracheal tube and to protect against possible biting.

The manufacturer of this equipment provides on the efficiency of introducing the endotracheal tube into the trachea on the first attempt up to 90% [14]. S.A.L.T. airway as a guide, it is designed for intubation tubes with a diameter of 6 to 9 mm in diameter. The kit includes: S.A.L.T. airway, spatula with bent tip, gel, clamp / stop, fastening tape (figure 5). The intubation procedure using S.A.L.T. airway can be done by one person with outstretched arms (you can use an assistant to prepare the equipment). After inserting the spatula into the mouth, the operator slides down the gelled S.A.L.T. airway, which is inserted until the collar rests on the lips of the patient's mouth. In S.A.L.T.'s canal applied a gelled endotracheal tube with a breathing filter and etCO2 sensor. After placing the endotracheal tube at the recommended depth (according to the principle of tube size three times), we seal the balloon. We put a stop on the endotracheal tube, which is additionally attached with a ribbon. The patient is prepared for ventilation after confirming the correct position of the endotracheal tube (figure 6) [15-17]. In the event of sudden cardiac arrest, we stop or postpone during chest compressions until S.A.L.T. airway is inserted and sealing the endotracheal tube [5,11].



**Figure 5.** Preparation for insertion S.A.L.T. airway



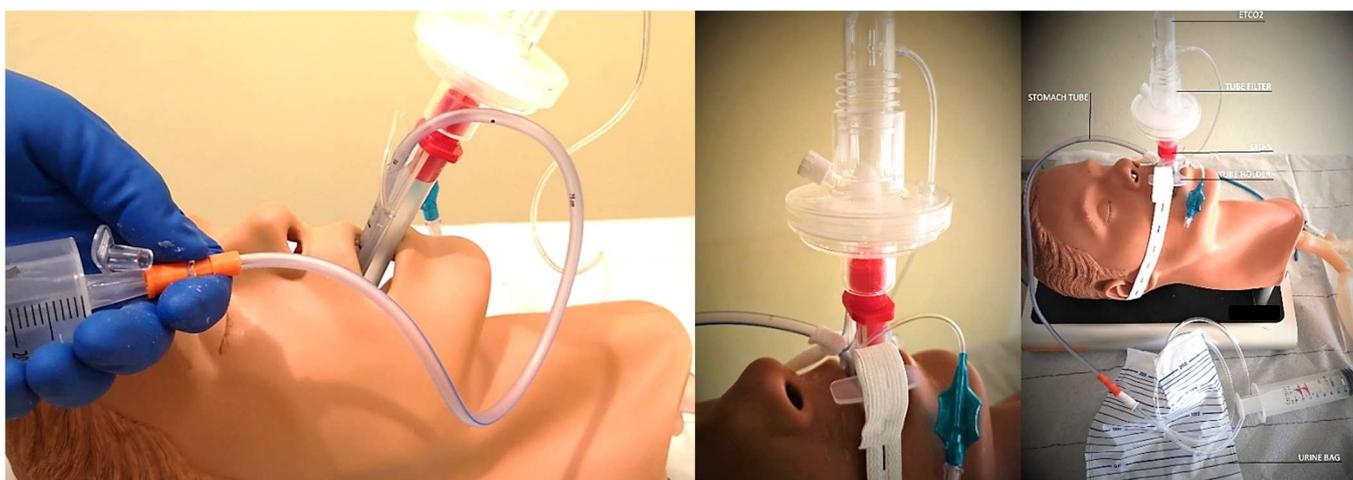
**Figure 6.** Insertion of S.A.L.T. airway

## LTS-D AIRWAY

One of the most important advantages of this method of securing airway management is the relative easy to use, LTS-D airway is inserted blindly. This laryngeal airway has a two ports: oesophageal port that can be easily used for an alternative method of controlling outflow of gastric contents, as well as the supply of drugs that are available in form of tablets; we are talking mainly about clopidogrel, ticagrelor and acetylsalicylic acid, which are used in the treatment of acute coronary syndrome [12,18,19]. The methods of airway management with this device, known worldwide, is recommended primarily by American Heart Association (AHA) or European Resuscitation Council (ERC) Guidelines in prehospital emergency department [12,18]. The laryngeal airway is also used by rescuers, let's call them conventionally for the purposes of the article "non-medical" (eg. firefighters), which proves easy to use after proper training. The recommended method is best presented in the illustrations (figure 7, figure 8), however, to describe it, we present a simple, schematic guide.



**Figure 7.** Insertion of LTS-D



**Figure 8.** Insertion of LTS-D and stomach probe with urine bag

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## Procedure instructions

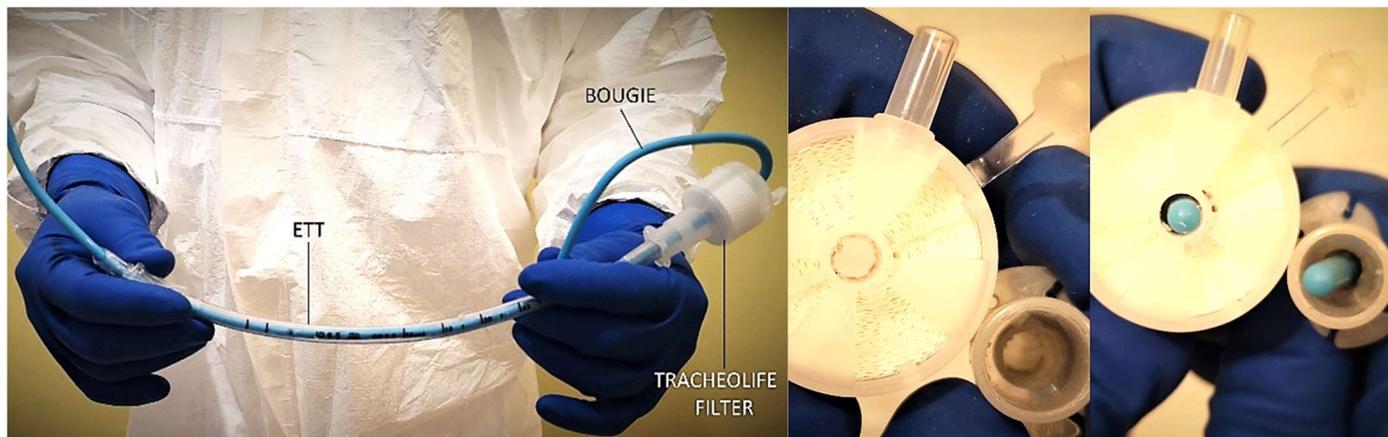
Required equipment: LTS-D airway, tape holder, syringe for refilling balloons, lubricant, breathing filter, etCO<sub>2</sub> sensor, stomach probe, catheter syringe, a bag (can be used to monitor diuresis). This ready set to use is LTS-D airway + breathing filter + etCO<sub>2</sub> sensor after checking for leaks and applying a lubricant - an assistant prepares if available.

Action (recommended alone): We clear upper airway by known methods and insert a prepared set into the respiratory tract as much as possible on outstretched arms. Then seal the oesophageal and pharyngeal balloons, e.g. with a syringe from the set. We confirm the correctness of the LTS-D assumption (here the previously installed capnometry sensor bows, assessment of chest movements - during ventilation support or replacement breathing, as well as auscultation of the stomach area and lung fields on both sides. The next step is to insert the stomach probe and confirm its position by auscultation of the stomach area, then putting a bag on it to control the outflow of any content. The last stage is to attach the larynx tube and probe with a holder and tapes from the set.

The above method of clearing the respiratory tract can actually be used with other supraglottic devices, e.g. I-gel mask or LMA laryngeal mask. In fact, the practical application of the laryngeal mask allows you to experience air leaks during ventilation with high pressure values (values over 24 cm H<sub>2</sub>O) [18,19] or asynchronous ventilation with conducted chest compressions during resuscitation. However, considering that in the management of patients with respiratory failure in COVID-19, lung-saving ventilator therapy with 4-8 ml/kg of appropriate body weight and a plateau not exceeding 30 cm H<sub>2</sub>O is recommended [20-22] these methods primarily for ventilating patients in pre-hospital medicine - remembering that this does not exclude the need for intubation, which in some cases can be postponed to help in the hospital.

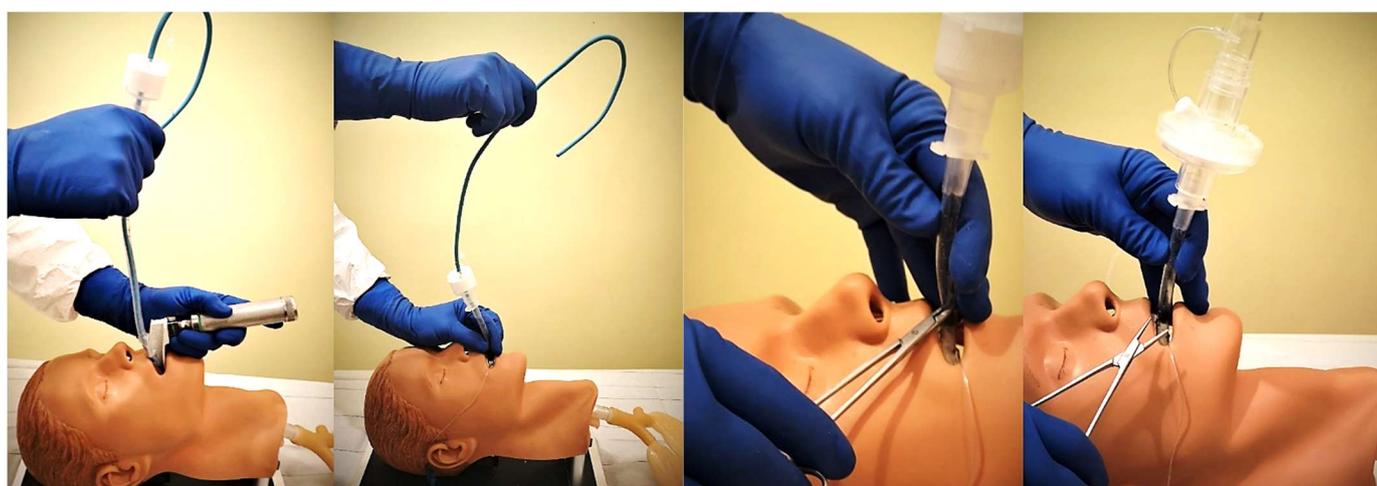
## ENDOTRACHEAL INTUBATION USING A TRACHEOFILTER

A modified endotracheal intubation procedure that minimizes the possibility of SARS-CoV-2 virus transmission can be performed by one person, but the assistant in this case is necessary to prepare the equipment. According to ITLS and AHA Guidelines, the most experienced person in team should be undergo tracheal intubation [12,17]. The following methods should be prepared: Bougie, tracheofilter (figure 9), pean medical forceps and standard equipment used for endotracheal intubation in direct laryngoscopy. The preparation of the proposed set begins with checking tightness of the cuff of the endotracheal tube.



**Figure 9.** Preparation of the intubation kit with tracheofilter

Then we connect the intubation tube with the tracheofilter and insert the Bougie through the central suction port, which is located in the tracheofilter. Bougie is inserted into the lumen of the endotracheal tube until a few centimetres extend beyond the tracheal part of the tube. The above set can be prepared by an assistant who takes the place as far as possible from the patient during the procedure. In the event of sudden cardiac arrest, may also considered connect oxygen drain to oxygen port located on tracheofilter as part of preoxygenation or apnoeic oxygenation. During tracheal intubation in cardiac arrest or Rapid Sequence Intubation (RSI) with suspected COVID-19, chest compressions are not recommended [5,11].



**Figure 10.** Modified endotracheal intubation procedure

A medic operator, despite using Bougie, independently performs the tracheal intubation procedure. After sliding endotracheal tube on Bougie, which is in the trachea, seal the balloon of the endotracheal tube and then retract Bougie. We close lumen of the endotracheal tube below tracheofilter using pean forceps. The breathing filter set with etCO<sub>2</sub> sensor prepared earlier replaces tracheofilter. We attach a self-inflating bag or respirator depending on availability, ventilation methods and clinical needs, while remembering about lung-saving ventilation for COVID-19. The final step before confirming the procedure for placing the endotracheal tube will be to release forceps clamp (figure 10). During each endotracheal intubation procedure, in case of its failure, one should remember about alternative methods or surgical protection of airway management according to the VORTEX concept [23].

## CONCLUSIONS

The methods of conducting passive oxygen therapy, controlling breathing, clear upper airway with use of supraglottic devices and modified endotracheal intubation will allow medical personnel to increase their safety in supplying airway management in patients with suspected or confirmed COVID-19. This is extremely important in times of epidemic, where medical personnel in prehospital care is at high risk of being infected with SARS-CoV-2 virus.

## Disclosure statement

The authors did not report any potential conflict of interest.

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