Airway management in a prehospital setting during the SARS-CoV-2 pandemic

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The SARS-CoV-2 pandemic has significantly changed the day-to-day work of emergency medical services. Due to clinical challenges in the treatment of SARS-CoV-2 in emergency and intensive care units, infection control of all healthcare professionals involved should become the focus.

PERSONAL PROTECTIVE EQUIPMENT

The authors recommend wearing minimum personnel protection equipment (PPE; at least FFP3 mask, eye protection, e.g. visor or goggles, hood, liquid-tight protective gown, disposable gloves) in the current situation for the process of airway management in confirmed and suspect patients. Clear plastic sheeting or intubation domes for intubation of patients with COVID-19 have been additionally implemented in many places in the clinical setting [1–4]. Simulation data in the clinical setting show an extension of the intubation time and reduce the first pass rate [5], so that an implementation in the preclinical setting seems difficult and only makes sense with sufficient training.

AIRWAY MANAGEMENT

In emergency medical services, airway management is crucial. Prehospital emergency medicine also provides different experiences of the staff in airway management, and in addition the rescue systems are equipped very differently.

Endotracheal intubation using direct laryngoscopy without adequate protection represents a high risk of SARS-CoV-2 infection. Invasive ventilation and bronchoscopy are procedures with high exposure to aerosol generation and therefore are associated with an increased risk of infection [6]. Basically, two mechanisms of distribution can be differentiated: droplets (> 5–10 microns diameter) or airborne particles (< 5 microns diameter). The droplets reach an area of approximately 1-2 metres around the patient. Airborne particles, however, can float in the air for a longer period of time before they descend [7].

Securing the airway in a prehospital setting is usually an emergency procedure, and preparation for intubation is not feasible. Therefore, the authors recommend the development of an adapted local algorithm for emergency tracheal intubation in possible COVID-19 patients. The special procedure should be trained regularly within the team with a focus on available equipment.

The algorithm should include following points [8]:

- use of adequate PPE,
- preoxygenation using a rebreathing circuit,
- rapid sequence induction (RSI),
- avoidance of bag-ventilation when possible or use of the two-hand technic,
- the most experienced airway manager should perform the tracheal intubation using the most appropriate and familiar method,
- ensure deep anaesthesia and relaxation,
- videolaryngoscopy in combination with a bougie or stylet allows a high first past rate,
- second generation supraglottic airway (SGA) should only serve as

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FIGURE 1. Two-hand bag-mask ventilation. Shown is two-hand bag-mask ventilation with use of an HME filter. The distance between the staff and patient should be as large as possible. Ensure that the mask is seated closely

an alternative aid in difficult airway management, as an alternative for mask ventilation, and in case of unsuccessful tracheal intubation,

- use of capnography; if possible, use mainstream CO_2 detection.

COVID-19 patients have a high risk of desaturation. Therefore, special attention should be paid to extensive preoxygenation. In emergency medical services, this can be achieved by applying oxygen with a reservoir mask with a flow rate of 15 L min^{-1} because usually no anaesthetic circle breathing system is available. If available, preoxygenation can also be performed with a tight-fitting mask and noninvasive ventilation in CPAP mode under FiO_2 of 1.0. Anaesthesia should be performed as an RSI. This is also accompanied by the omission of bag ventilation [9]. The cricoid pressure is subject to controversy and is not recommended by the authors [10]. If mask ventilation becomes necessary, e.g. in the case of an unexpectedly impossible intubation, it should be performed with two hands (Figure 1). Alternatively, an SGA can be inserted immediately. The use of SGA in the pandemic situation in the context of preclinical airway management as long as there is advanced expertise in intubation should only be used as a rescue device [9]. Only second-generation devices should be used [9]. Intubation should only be performed with a video laryngoscope in combination with a bougie to increase the first attempt success rate. Further recommended measures are the omission of intermediate ventilation, position control, and avoidance of auscultation [11]. These measures lead to a significant reduction of aerosol production and increases staff safety.

RESUSCITATION

Resuscitation and especially chest compression are aerosol-producing processes, which are of particular importance in the context of the pandemic [12, 13]. Thus, the current COVID-19 guideline of the European Resuscitation Council (ERC) emphasises the need for adequate personal protection during resuscitation. Before starting the aerosol-forming chest compressions, personal protective equipment consisting of the combination of an FFP3 mask (FFP2 or N95 only if FFP3 is not available), eye or face protection, a protective gown, and gloves should be worn [14]. The filtration efficiencies of the masks differ as follows: FFP1 – 80%, FFP2 – 94%, and FFP3 – 99%. Because the breathing of the rescue teams is restricted when using FFP3 masks, the authors consider it possible to wear FFP2 masks after securing the airway and using a heat and moisture exchange (HME) filter. The use of clear plastic sheeting can be considered to place between the patient and staff [15].

The following measures are aimed at reducing aerosols:

- immediate tracheal intubation by the most experienced team member,
- use of second-generation SGAs if intubation is not possible or as a replacement for mask ventilation,
- tight-fitting bag-mask ventilation (two-hand),
- HME between mask and bag,
- clear plastic sheeting,
- retention of pauses in the ratio of ventilation and chest compressions when using a supraglottic airway or bag-mask ventilation,
- consideration of use of a mechanical chest compression device [14].

The current guideline recommends the early endotracheal intubation or the introduction of supraglottic airway protection to minimise the duration of bag-mask ventilation. Neither of the two methods are preferred in the guideline [14]. The use of the videolaryngoscopy for endotracheal intubation is recommended for familiar users, because the distance between user and patient may be increased. The authors recommend for the experienced user the above-mentioned technique of video laryngoscopy in combination with a bougie. If an SGA is used during resuscitation, it is mandatory to ensure competence in the application, to use only second-generation devices, and to pay attention to the reduction of leakages [16].

SARS-CoV-2 pandemic poses a special challenge for emergency medical services. In particular, intubation and invasive ventilation represents an increased risk of infection from aerosols, which must be taken into account.

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