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Occupational hazards in anaesthesiology during the COVID-19 pandemic

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Abstract

According to the Occupational Safety and Health Administration of the Department of Labor of the United States, the exposure risk for anaesthesiologists working with COVID-19 patients can be classified as high or very high. This is mostly due to fact that the anaesthesiologists work in close contact with patients' airways, and the aerosol-generating nature of some procedures they perform. Fortunately, despite the occupational hazard, the incidence of COVID-19 among anaesthesiologists and intensivists remains relatively low. Current evidence suggests that the majority of SARS-CoV-2 infections in this group were either contracted outside of the work environment or can be attributed to personal protective equipment (PPE) malfunction. This article focuses on different aspects of anaesthesiologists' safety, risks connected with different clinical scenarios and procedures, issues related to testing and screening, as well as modifiable and non-modifiable risk factors for severe illness or from COVID-19. This analysis is accompanied by a review of guidelines dedicated to mitigating said risks. Educating the personnel, introducing appropriate procedures, and proper utilisation of PPE are essential to the safety of all parties involved in hospital care, particularly those with significant exposure risk.

Key words: COVID-19, SARS-CoV-2, exposure risk, anaesthesiologist.

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During the SARS-CoV outbreak in 2003, the risk of transmission of acute respiratory infection was higher, as compared to other healthcare workers (HCWs), among professionals performing endotracheal intubation and those involved in non-invasive ventilation (NIV), as well as manual ventilation before intubation and tracheostomy procedures [1]. Data from the COVID-19 pandemic, however, seem to indicate that despite potentially greater exposure to infectious aerosol, the mortality among anaesthesiologists and intensive care physicians is lower than in other specialities and among all HCWs. In one of the early reports from Wuhan, describing 138 patients hospitalised due to COVID-19, 40 of whom were hospital staff, just 2 patients were reported to have worked in an intensive care unit, while seven had worked in an emergency room [2]. During the early phase of the epidemic, before any additional precautions were applied, in Tongji hospital in Wuhan, out of 4 infected anaesthesia providers, 2 contracted the virus outside of work. Since the introduction of safety procedures in January 2020 until the publication of the quoted article (26.03.2020), no subsequent infections among anaesthesia providers were reported [3].

Ing *et al*. analysed publicly available data on physician deaths from COVID-19 and found that among 254 cases reported worldwide until 15.04.2020, anaesthesiologists comprised 2.4%, while 42.1% were general practitioners and emergency room physicians. Deaths were mostly attributed to the lack of appropriate personal protective equipment (PPE) [4].

As of October 2020, 181 Italian physicians have died due to COVID-19, of whom anaesthesiologists comprised 4.4% [5]. At the same time, in an unofficial, anonymous report honouring the deceased HCWs from the former Soviet Socialist republics, among 859 reported, at least 54 (6.3%) dead were physicians providing anaesthesia and reanimation services [6].

To date, Polish authorities have not published an official record of deaths among physicians. However, an article from 02.11.2020, referencing data obtained from the Ministry of Health, indicates that 16 physicians have died due to COVID-19. The article does not specify their specialities or whether the infection was attributable to their line of work [7].

This review is aimed at delineating the issue of anaesthesiologists' potential exposure to

SARS-CoV-2 virus and providing a synthesis on workplace safety in anaesthesia and intensive care settings.

ROUTES OF TRANSMISSION

Both main routes transmission of SARS-CoV-2, droplet and airborne, simultaneously pose the greatest threat to anaesthesiologists. Transmission via fomites (infected surfaces) is also an important issue due to the nature of this speciality [8]. Guidelines issued by Occupational Safety and Health Administration of the Department of Labor of the United States (OSHA) divide job tasks into four risk exposure levels: very high, high, medium, and low risk. Anaesthesia services are associated with high ("Providing care for a known or suspected COVID-19 patient not involving aerosol-generating procedures") or very high ("Performing aerosol-generating procedures […] on known or suspected COVID-19 patients") risk [9]. It should be emphasised that an asymptomatic patient may also be a source of infection [10].

Routes of transmission determine the preventive measures. Risk of exposure can be mitigated by appropriate PPE, reduction of rate and length of procedures carrying the increased risk, minimising the generation and containing the spread of infectious aerosol, as well as strict adherence to local procedures [11].

According to the European Centre for Disease Prevention and Control (ECDC), PPE donning and doffing procedures are critical to personnel safety [12]. Polish translation of the above-cited ECDC guidance is available at the official website of the Polish National Consultant in the field of anaesthesiology and intensive therapy [13].

OSHA guidelines put additional emphasis on the logistics of patient management/care. It is suggested that potentially contaminated and clean areas should be differentiated, with as many tasks as possible being performed in the latter so as to minimise physical contact and thus risk of exposure. Additionally, a strategy of "working from clean to dirty" should be employed, i.e. procedures connected with a lower risk of contamination should be performed first [9].

RESULTS OF SARS-COV-2 TESTS AND RISK STRATIFICATION

According to case definitions by the World Health Organisation (WHO) and ECDC, confirmation of COVID-19 diagnosis requires detection of SARS-CoV-2 nucleic acid or antigen in a laboratory specimen. Antigen testing should only be performed in symptomatic patients, and the used assay should meet diagnostic accuracy criteria. Until laboratory confirmation cases can be classified as suspected or probable, depending on epidemiological criteria and the presence of symptoms or radiographic features suggestive of COVID-19 [14–17]. While working with a patient with confirmed SARS-CoV-2 infection is a clear indication that appropriate preventive measures should be undertaken, anaesthesiologists should be aware that neither lack of symptoms nor negative laboratory tests mean that there is no risk of transmission because of the following:

- some infected patients can have false-negative results of RT-PCR tests [18];
- about 20% of infected patients will never develop any symptoms. According to Buitrago-Garcia *et al*., previous findings reporting a rate of asymptomatic course as high as 45% did, in fact, include patients in the presymptomatic phase [19];
- in a retrospective analysis by Kucirka *et al*., molecular tests performed in the early days of infection were negative in 54% of those who later developed COVID-19, with tests performed on the day of symptom onset yielding an average false-negative rate of 38% [20];
- while RT-PCR tests are characterised by very high specificity of approximately 100%, their sensitivity varies depending on the type of specimen and, according to some sources, may be as low as 32% or 63% for pharyngeal and nasal swabs, respectively, 73% for sputum, and 93% for broncho-alveolar lavage (BAL) specimens. Key factors influencing the accuracy include appropriate timing (relative to symptom onset) and technique of specimen collection. Data on test accuracy in asymptomatic carriers are scarce [21, 22].

According to the Infectious Diseases Society of America (IDSA), the mean sensitivity of RT-PCR assays is 76% (95% CI: 51–100%) for upper respiratory tract specimens (saliva, oral, nasal, and pharyngeal swabs) and 89% (95% CI: 84–94%) for lower respiratory tract specimens (sputum, tracheal aspirate, BAL). Hence, in the case of high pre-test probability and negative initial upper respiratory sample, the IDSA suggests collecting a lower respiratory tract sample. However, this is a conditional recommendation with very low certainty of evidence. Among the upper respiratory tract samples, nasopharyngeal and mid-turbinate swabs are indicated, as characterised by the highest sensitivity: 97% (95% CI: 92–100%) and 100% (95% CI: 93–100%), respectively [23].

A negative test result does not then negate the possibility of an infection but makes it less probable and should be interpreted taking into consideration factors such as exposure history and other epidemiological factors, and clinical examination, as well as the probability of a different diagnosis [24].

HOSPITAL ENVIRONMENT AS A RISK FACTOR

Due to the nature of their work, anaesthesiologists work mostly in hospitals, where the chance of potential exposure to both symptomatic and asymptomatic COVID-19 patients is very high. Additionally, co-workers and other hospital staff should also be considered as a potential source of infection. Typically, the anaesthesiologist's tasks include the following: providing anaesthesia and reanimation services, attending to patients in the intensive care units, consulting, and escorting unstable and vulnerable patients during transport. Apart from anaesthetising patients with confirmed negative PCR results, which should be relatively safe, those tasks are connected with potential contact with symptomatic and infectious patients. The risk of exposure is variable, depending on the type of provided service and particular clinical scenario.

RISKS CONNECTED WITH PARTICULAR PROCEDURES

A systematic review based on reports regarding outbreaks of airborne infections, mostly the 2003 SARS-CoV epidemic, identified particularly dangerous procedures during which a potentially infectious aerosol is generated and the risk of transmission is the greatest. The procedure connected with the highest risk is endotracheal intubation, but others such as bag valve mask ventilation, surgical airway management, and non-invasive ventilation were proven to carry increased risk. Chest compressions and defibrillation during cardiopulmonary resuscitation (CPR), airway suctioning before and after intubation, bronchoscopy, nebuliser treatment, manipulation of an oxygen mask, defibrillation, and insertion of a nasogastric tube were indicated as potentially risky, but the associated odds were not significant. No significant risk was identified for other procedures, including bi-level positive airway pressure (BiPAP) mask manipulation, endotracheal aspiration, the suction of body fluids, mechanical ventilation, manual ventilation, manual ventilation after intubation, high-frequency oscillatory ventilation, administration of oxygen (including high-flow oxygen, HFNO), chest physiotherapy, and collection of a sputum sample. According to the authors of the cited review, those results should be interpreted with caution due to the low quality of the pooled evidence [1]. It is safe to assume that all aerosol-generating procedures (AGPs) are connected with an increased risk. Apart from the ones listed above, scenarios in which infectious aerosol is generated include disconnection of a breathing circuit, planned and unplanned extubations, and performing CPR on a patient with unsecured airway. Additionally, airway suction in such patients, as well as tracheal suction in a mechanically ventilated patient (unless using a closed suction system), are considered as AGPs [25].

TABLE 1. General safety rules during a preanaesthetic assessment

Disinfection	Social distancing and barriers
Both the patient and the doctor should disinfect their hands with an alcohol solution	All parties present should wear fitted surgical masks
Equipment present in the doctor's office should be disinfected between patients	At least 1.5 m distance should be kept between people
–	If the clinical examination requires the patient to remove the mask, the doctor should wear protective goggles

RISKS CONNECTED WITH PARTICULAR TASKS

Anaesthesiologists typically work in many different locations and circumstances, thus experiencing different infection risk exposure levels. Characteristics of particular tasks and conditions under which they are performed determine the type and extent of risk and prompt specific precautions, which are described below [2, 3, 26, 27].

Main considerations regard the duration of exposure (the more prolonged the exposure, the higher the risk) [26], the mechanism and intensity of aerosol generation [28–30], as well as direct contact with contaminated and potentially contaminated surfaces (such as PPE during doffing) [12]. The importance of the latter is backed by identification of infectious viral particles in some of the samples taken from contaminated surfaces [31].

PREANAESTHETIC ASSESSMENT

Preanaesthetic assessment can be considered a relatively safe scenario, but appropriate safety measures should be applied, nonetheless. Patients should adhere to social distancing rules while waiting in line. Ideally, they should arrive just in time for the assessment [32]. The general safety rules are presented in Table 1.

OPERATING THEATRE

The increased level of risk in this scenario is a consequence of close contact with the airways of an infected patient. Critical points include tracheal intubation, manual ventilation and emergency surgical airway management, (accidental) disconnection of the breathing circuit, and extubation. Extubation is potentially the most dangerous due to the return of cough reflex, which is absent during the intubation procedure. Thoracic surgical procedures in which the airways are exposed to the surroundings carry additional risk of aerosol generation, which can be mitigated by stopping the ventilation while the airway remains open.

The personnel not directly engaged in the surgery can also be exposed to contaminated air during transport of infected patients or due to accidental opening of the operation room door.

In general, all non-emergent elective surgeries should be postponed until the patient is cured of the infection [33]. In a report by Nepogodiev *et al*., the postoperative mortality of patients with confirmed SARS-CoV-2 infection at the time of their elective surgery was 20.4%, with pulmonary complications occurring in 51.2% [34]. The high risk and personnel safety considerations mean that, in a case of positive or unknown (patient refuses to be tested) SARS-CoV-2 status, elective surgery has to be postponed [35–38]. At the same time, as mentioned before, neither patients with a single negative laboratory test result nor those without any symptoms (as the virus is detectable up to 48 h before symptom onset) should be considered non-infectious [39].

Both American and European Societies for Regional Anaesthesia and Pain Therapy (ASRA and ESRA) recommend using regional anaesthesia when possible, in order to avoid risks connected with airway instrumentation [40, 41]. Arguments have been raised against this recommendation, emphasising the risks connected with the generation of aerosol from an unsecured airway and the possibility of an emergency intubation [42].

Measures aimed at minimising the risk of exposure while providing anaesthesia services are summarised in Table 2.

INTENSIVE CARE UNITS

All the previously mentioned AGPs are typical of an ICU setting. Additional potential exposures include ventilator weaning and transporting a patient out of the ICU (e.g. for a CT examination). Risk exposure in the ICU setting differs from that connected with anaesthesia, with the major differences being simultaneous contact with multiple patients, higher probability of accidental breathing circuit disconnection and unplanned extubation, and the

TABLE 2. Measures mitigating the risk of infection during anaesthesia and airway management

Logistic measures and anaesthetic procedures	Comment
Surgical mask and plastic barriers during transfer to the OR	The patient should be wearing a surgical mask during transport to the OR. Using plastic barriers (aerosol boxes) while the patient is not wearing a mask may result in accumulation of viral particles on the inside of the barrier and pose a threat to the staff during its removal [43]
Preparation of the operating room	Surgeries of COVID-19 patients should be performed in a separate, dedicated, negative-pressure room. The room should be entered through an airlock. Opening of the inner and outer doors at the same time should be avoided [44, 45]
Avoiding sedation and passive oxygen therapy during regional blockades	A patient whose airway is not secured should wear a surgical mask at all times. Sedation should be avoided because it may lead to airway compromise and to an emergency requiring airway manipulation. Oxygen therapy should be avoided as a potential AGP [44, 46–48]
Pre-prepared COVID-19 intubation tray or a dedicated COVID-19 airway trolley	Preparation of a COVID-19 intubation tray or a dedicated COVID-19 airway trolley is recommended. Such sets should contain equipment routinely used in airway management as well as emergency front of neck access equipment (eFONA) [44] The introduction of appropriate checklists can further increase safety [49]
Minimising the exposure during airway management procedures required for general anaesthesia	Exposure-risk mitigating measures during airway management procedures include the following: limiting the periods in which airways are opened, preventing loss of seal during preoxygenation, ensuring profound paralysis before instrumenting airway, securing the links between elements of the breathing circuit, and starting the ventilation only after the cuff is inflated. Breaking the circuit should be avoided, but if it is necessary, the circuit should be disconnected between the anaesthesia workstation and the heat and moisture exchanger. Extubation should be performed in the operating room with appropriate cough-reflex management (e.g. by intravenous lidocaine, opioids, or dexmedetomidine); oxygen therapy through a mask with oxygen flow < 5 L min-1, should be started immediately afterwards. Videolaryngoscopy allows a greater distance to be maintained from the airway, but it requires prior training. Closed systems should be used for tracheal suctioning. Supraglottic devices are connected with a greater risk of leaks and aerosol generation than for the endotracheal tube, but if a supraglottic airway is indicated, the use of a second-generation device is recommended. A nasogastric tube, if necessary, should be inserted after the intubation [32, 38, 44, 50, 51]
Contingency plans for failed intubation. Difficult Airway Society protocol, VORTEX approach, CICO (cannot intubate, cannot oxygenate) scenario.	Front of neck accesses to the trachea may seem relatively safe when considering the potential for an aerosol generation as the patient is paralysed. However, both oxygen insufflation through a narrow-bore cannula, and insertion of the canula into the trachea may aerosolise the contents of the airway. The recommended technique in CICO situations is scalpel-bougie eFONA, which limits the contamination of the room [50, 52]
Airborne-precaution PPE for every member of the anaesthesia team	–

TABLE 3. ICU-specific safety measures

Safety measure	Comment
Proper utilisation of appropriate PPE	The level of protection should be adequate to the level of risk
Avoiding disconnection of the breathing circuit	If the circuit has to be disconnected: – the endotracheal tube should be clamped, and ventilation should be stopped [549] – heat and moisture exchanger (HME) should remain connected to the tube
Using closed systems for tracheal suctioning [25]	–
Performing AGPs in negative-pressure rooms [55]	–
Avoiding nebulisation in patients with unsecured airway, especially outside of rooms dedicated to containing airborne infections	If the use of an inhaled bronchodilator is necessary, metred-dose inhalators (MDI) should be used [56]
Using pressure support ventilation for ventilator weaning instead of a T tube [57]	–
Performing extubation only after the infection is cured	If the extubation happens earlier, the patient should immediately wear a surgical mask
Application of all available safety measures in a case where reintubation is warranted	Proper PPE, muscle paralysis, insertion of a clamped tube, and unclamping only after the cuff is inflated and the ventilator/bag is attached
Performing percutaneous tracheostomy under sedation and profound paralysis	The procedure should be delayed until the infection is cured
Minimising the amount of AGPs and containing the spread of aerosol	Examples include insertion of bronchoscopes through a suction port of a catheter mount [57]
Supplying a spontaneously breathing patient with an unsecured airway with a surgical mask	In patients breathing spontaneously through an artificial airway, a dedicated HME should be applied (preferably with HEPA filter) [58]
Postponing exchange of artificial airway tube until the patient is no longer infectious	If the need for emergency exchange of an airway occurs, full PPE should be worn before performing the procedure
Performing daily breathing circuit leak assessment and prevention [59]	–
Limiting the transport of infected patients to the bare minimum	During the 2003 SARS-CoV epidemic, some surgeries were performed in the ICU and other parts of the hospital where patients were treated [60]
Adjusting the pressure and ventilation within the rooms in which patients are treated	Negative pressure and sufficient rate of air exchange should be provided

potential sudden necessity to perform intubation or tracheostomy tube exchange. Moreover, patients with unsecured airways are a constant source of aerosol.

ICU-specific safety measures are listed in Table 3.

Interestingly, the risk of transmission is not limited to patients and their immediate surroundings. A Wuhan study states that, outside of patient treatment areas, as much 75% of computer mouses and 60% of trash cans were contaminated with viral particles [53].

INTRAHOSPITAL TRANSPORTATION OF PATIENTS

Anaesthesiologists sometimes escort severely ill patients of non-ICU wards. Transporting a mechanically ventilated patient can result in accidental breathing circuit disconnection, while escorting patients with unsecured airways is connected with prolonged exposure to the aerosol. Additionally, during the transfer of unstable patients, a decompensation requiring CPR or intubation may occur. Safety measures related to patient transportation are included in Table 4.

CONSULTING A PATIENT OUTSIDE OF THE ICU

In extreme situations, due to an insufficient number of intensive care beds, critically ill patients who do not require mechanical ventilation would often be treated outside of ICUs. Paradoxically, infectious patients who require mechanical ventilation pose a lesser threat to an anaesthesiologist than those with unsecured airway. Treatment of such critically ill patients on wards not designed for this purpose can often mean suboptimal conditions in terms of available equipment and ventilation systems, which can pose a serious threat to the personnel. Should such patient deteriorate, an intensivist consultation may be warranted, thus exposing the consultant to additional risk. According to the recommendations published on 25.04.2020 by the Polish Agency for Health Technology Assessment and Tariff System, methods of oxygen delivery used outside of the ICU include oxygen therapy glasses, Venturi masks, high-flow nasal cannulas, or non-invasive mechanical ventilation (application of the last two requires meeting additional criteria, including transmission prevention measures) [54].

TABLE 4. Safety measures during intrahospital transportation of patients

Planning and logistics	During transfer
Patient movement should be reduced to a minimum	Non-intubated patients should wear a surgical mask during transport
Before leaving the ICU, the airway should be secured appropriately in order to avoid emergency airway management	Disconnection of breathing circuit during the transfer of a mechanically ventilated patient should be avoided. In order to minimise the risk of accidental disconnection, sedation and paralysis should be considered
Only essential personnel should be engaged in the escort	Every person engaged in the procedure should wear appropriate PPE, according to local standards

Such patients constantly produce aerosol, which can persist for prolonged periods [61]. All methods of passive oxygen therapy are associated with some degree of aerosol generation. Due to the fact that the extent of this phenomenon is unknown, all personnel attending to such patients should wear full PPE [54]. In laboratory conditions, not taking talking or coughing into consideration, it has been established that spread of aerosol generated during oxygen therapy and non-invasive ventilation does not exceed 1 metre (nasal cannula, 5 L min^{-1} O_2) and can be as small as 10 cm for a non-rebreather mask with 12 L min^{-1} O_2 flow [62–65]. Measures aimed at the safety of HCWs exposed to non-intubated patients have been summarised in a review by Kaur *et al*. Contrary to the above-mentioned recommendations, it does not support the use of Venturi masks. Analogically, non-rebreather masks should not be used without appropriate filters. High-flow nasal cannulas should be fitted to the patient's face, and a surgical mask should be worn over it. Conclusions regarding the safety of non-invasive ventilation interfaces are identical to those published by the Agency in its recommendations, with the helmet being the safest, followed by total face mask with a double-limb circuit and total face masks with a single-limb circuit. Vented masks are considered the least safe option [54, 66].

Differences between guidelines are a natural consequence of continually gaining new information as the pandemic progress and some initial recommendations becoming outdated.

FIELD AND TEMPORARY HOSPITALS

Work in the field or in temporary hospitals may prove a challenge for a civilian anaesthesiologist. As of November 2020, the Polish army has two field hospitals at its disposal, and temporary civil hospitals are being created.

Such hospitals have proven to be an effective solution in countries where the amount of infected patients has exceeded the capacity of traditional hospitals, and they are mentioned in WHO guidelines as a potential measure to "augment COVID-19 patient care or essential health services" [67]. There are three major types of temporary hospitals: facilities used for quarantining mild to moderate cases of COVID-19 (such as Chinese Fangcang hospitals [68, 69]), those dedicated to providing intensive care, and step-down units for recovering patients [70, 71]. Some hospitals combine those functionalities. Working in such conditions may be connected with, as well as all of the 'typical' risks mentioned earlier, the additional burden resulting from working in an unknown environment and in a completely new team. Communication problems may arise, and work outside of a safe daily routine may prove cognitively and psychologically exhausting.

IN-HOSPITAL CARDIOPULMONARY RESUSCITATION

The European Resuscitation Council published a COVID-19 update to their guidelines [72]. In order to minimise the exposure risk connected with in-hospital emergencies, additional emphasis is put on early identification of patients at risk of sudden deterioration and prevention of cardiac arrests. Additionally, the patients in whom resuscitation must not be attempted should be identified in advance.

Resuscitation of a patient who is not intubated requires airborne-precaution PPE, which should be donned before the initiation of chest compression and/or opening of the airway. Minimal protection in such scenarios includes an FFP3/N99 facepiece (if unavailable – FFP2 or N95), eye and face protection, long-sleeved gown, and gloves. Local procedures may require wearing double gloves. The same level of precautions applies to resuscitation of invasively ventilated patients.

Defibrillation with an AED or a classic defibrillator is considered a procedure with low risk of aerosol generation and as such may be performed by HCWs equipped in droplet-precaution PPE (short-sleeved gown, gloves, fluid-resistant surgical mask, and eye protection).

Basic considerations regarding performing CPR on a patient with confirmed, probable, or suspected SARS-CoV-2 infection are listed in Table 5.

UNMODIFIABLE RISK FACTORS

While the issue of individual, unmodifiable risk factors of infection and severe course of the disease

TABLE 5. Major differences in sequences of actions for the in-hospital cardiac arrest of a patient with confirmed or suspected COVID-19 as compared to standard ALS and CPR procedures [72]

Non-intubated patient	Intubated patient
The number of people in the immediate surrounding of the patient should be minimised	Airborne-precaution PPE should be donned
Airborne-precaution PPE should be donned before initiation of chest compression and/or opening the airway	Mask-bag-valve ventilation should be avoided. Mechanical ventilator with $FiO_2 = 1.0$ and respiratory rate of 10 min^{-1} should be used
Use of HME or viral filter between the mask and the bag is now obligatory	In mechanically ventilated patients, the ventilator and breathing circuit should be examined to ensure that they have not contributed to the cardiac arrest. Special caution should be exercised when disconnecting the circuit
Mouth-to-mouth ventilation is strictly forbidden. Until the bag-mask device arrives, continuous chest compressions should be performed. In the meantime, an oxygen mask should be put on the patient's mouth, and oxygen therapy started	If a patient in the prone position requires resuscitation, chest compressions (between the scapulae) should be started immediately without repositioning of the patient. If the circulation is not restored within minutes from the initiation of the CPR procedure, turn the patient supine. Additional indications for earlier repositioning may occur (ineffective compressions, airway problems). Unplanned emergency repositioning can lead to accidental disconnection of the circuit and should be avoided
The bag-mask-valve ventilation should be performed by an experienced team using a two-provider approach. Choosing the right mask size and ensuring a tight seal are critical	–
Application of a supraglottic device or endotracheal intubation (preferably via videolaryngoscopy) should be performed as soon as possible	–
If a supraglottic airway is used, a 30 : 2 chest compression ventilation ratio should be applied, pausing the chest compressions to enable ventilation. This approach will minimise the gas leaks, which may lead to aerosol generation	–
When potentially reversible causes of cardiac arrest have been addressed and no return of spontaneous circulation was observed, stopping CPR should be considered earlier than would be typical	–
If extended resuscitation is indicated, the use of chest compression devices should be considered	–

is substantially different from the risks mentioned above, it cannot be omitted. In cases of HCWs exposed to a significant risk of SARS-CoV-2 infection on a daily basis, those factors have greater meaning than in the general population. The issues of absolute and relative risk management in anaesthesiologists and intensivists' line of work have been summarised in a review by Cook [73].

Individual risk is based on several factors, such as age, sex, ethnicity, and comorbidities. Age is the most critical risk factor – the risk of death in the course of COVID-19 increases with age [73, 74]. Male sex is also an independent risk factor [75]. A meta-analysis of 22 studies indicated that the rate of comorbidities is double among those who died due to COVID-19, as compared to all infected. The most burdensome comorbidity in terms of influence on the course of the infection was arterial hypertension, followed by diabetes and respiratory diseases [76]. Multiple other factors connected with severe course of the disease, including different chronic conditions, have been identified [77]. Because some of the comorbidities are age-related, older anaesthesiologists are additionally at risk.

Another unmodifiable factor is ethnicity with representatives of non-white groups being at greater risk. This observation was made relatively early in a report based on the British population [78]. A report by Public Health England indicates that Black African and Black Caribbean ethnicities are associated with the highest risk of death in the course of COVID-19 [79].

CONCLUSIONS

As indicated by the above considerations, providing anaesthesia and intensive care services is connected with constant high or very high infection risk exposure. While mortality in this group remains optimistically low, it should be emphasised that this can be attributed mostly to adherence to safety measures. Proper utilisation of PPE, application of risk-mitigating solutions, and following local procedures are crucial. Safety of the provider and other HCWs should always be prioritised. The only ways in which practising anaesthesiologists can minimise the risk of infection are adherence to procedures and preventive measures, mindful teamwork, and use of adequate PPE.

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