

Editorial

New dimensions in airway management: risks for healthcare staff

S. M. Crawley and **B. McGuire**

Consultant, Department of Anaesthesia, Ninewells Hospital and Medical School, Dundee, UK

Correspondence to: B. McGuire

Email: president@das.uk.com

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Twitter: @SimonCrawley9

In April 2020, the World Health Organization (WHO) confirmed the novel coronavirus disease (COVID-19) as a pandemic, with horrific death tolls on a global scale, including many brave healthcare workers. As experiences from our Italian colleagues started to filter through, many of us delivered staff training for COVID-19 adaptations to airway management and it was soon clear that the mood was different. The willingness to learn was ever present, but a new, palpable nervousness resided throughout the groups. Many colleagues were scared, ourselves included; like watching a tsunami from the shore, waiting for it to hit. The anxiety stemmed largely from the thought that an overwhelming number of patients may require intubation, but also unease based on personal risk, as frontline healthcare workers and, in particular, airway managers. Tracheal intubation and facemask ventilation rank highly on the WHO list of aerosol-generating procedures with odds ratios of infection at 6.6 and 2.8, respectively [1]. In carrying out our role, we and our team members would be right up close and personal to this frightening disease.

In this issue of *Anaesthesia*, El-Boghdadly et al. report the first prospective data collection on the issue of infection risk to healthcare workers managing the airway in patients with confirmed or suspected COVID-19 infection [2]. This was a collaborative international effort, involving 503 hospitals in 17 countries and all contributors to its rapid set-up and completion should be commended. The study team conducted a multicentre prospective data

collection seeking fixed answer data, through a purpose-built registry (<http://intubatecovid.knack.com>), on intubation characteristics; the use and make-up of personal protective equipment (PPE); and, importantly, sought subsequent self-reported healthcare worker COVID-19 infection status. This health status was the primary endpoint: a laboratory confirmed COVID-19 diagnosis or development of symptoms requiring self-isolation or hospitalisation; 10.7% of those who submitted data to the registry reached this endpoint. In understanding this result it is paramount we appreciate the context - it occurred at a time when many of the nations contributing cases, particularly the UK and the USA, were experiencing rapid upstrokes in COVID-19 infections and hospitalisations. Thus, overly simplistic interpretations of this headline statistic should be avoided. However, this study is hugely impactful as it elicits considerable secondary data on intubation practice and sets a benchmark for further data collection in explorations of risk to healthcare workers involved in airway management.

Airway management in the COVID-19 era

Although an international study, the majority of submitted cases originated from the UK (48.6%) and the USA (21.9%) and so examination of the data from El-Boghdadly et al. requires an awareness of clinical practice in these countries. Within the intubation procedural characteristics detected

by El-Boghdadly et al, it appears that much of that collaborative national guidance filtered down to be actioned on the ground.

Most intubations were performed out with the operating theatre (83%), in environments associated with worse outcomes [3]. This in itself may not be worthy of comment other than the fact that the reported intubation success rate was 98% for two attempts, an impressive figure for this patient cohort. In recognition of this high-risk scenario, intubation teams largely consisted of senior level staff (70%) and team size was kept to a minimum with 76% having four or fewer team members, maximising first-pass success, and reducing team exposure.

Oxygenation

Tracheal intubation in ICU is a high-risk procedure for patients, having been described as a physiologically difficult airway [4]. Hypoxaemia before commencing airway management is unsurprisingly associated with increased complications, even if the intubation is successful on the first attempt [5]. Peri-oxygenation techniques are paramount to patient safety and are employed to extend apnoea times, which can improve clinician performance as well as maintaining adequate haemoglobin saturation. Such techniques include: non-invasive ventilation; high flow nasal oxygen; and gentle bag-mask ventilation during the modified rapid sequence induction. All of these measures are classed as aerosol-generating procedures and so COVID-19 added a new perspective as these intubations would now become a high-risk procedure for staff as well as the patient and thus be additionally stressful. Guidance on airway management principles in COVID-19 patients suggested avoiding these very measures when possible, balancing patient complications against staff exposure to high viral loads [6].

The therapeutic effectiveness of HFNO is not in doubt, having been recommended by the Difficult Airway Society (DAS) for critical care intubations, but in the pandemic context its widespread use places a real burden on oxygen supplies and was advised against in the UK largely for this reason. Following advised caution on its use in previous outbreaks, the WHO recommended use only in carefully selected patients [7]. However, along with non-invasive ventilation, high-flow nasal oxygen has been widely used in COVID-19 type-1 respiratory failure with the aim of reducing ventilator need by avoiding intubation where possible. Some supported its use but only with limited flow rates, in an effort to reduce gas consumption and aerosolisation risk. Evidence of staff risk is sparse but studies examining droplet dispersal at varying flow rates, up to $60 \text{ l}\cdot\text{min}^{-1}$ showed

limited dispersion distances, although this increased significantly with coughing [8,9]. Many advantages of high-flow nasal oxygen are flow-related – work of breathing and positive airway pressure generation are improved at higher rates – thus, effort to cap flow rates could reduce therapeutic efficacy for little safety gain. Peri-intubation high-flow nasal oxygen use in COVID-19 physiologically difficult airways was advised against as it was felt that the risk to intubators in close proximity outweighed patient benefit [6]. This consensus probably accounts for the relatively low incidence of use (6.4%) in critical care intubations from the series by El-Boghdadly et al.

Before the pandemic, modern practice had been moving away from the classical construct of the rapid sequence intubation where manual ventilation was avoided. Gentle ventilation following induction reduces desaturation, maintains a degree of recruitment and its use post-induction was promoted in critically ill and obstetric patients at risk of desaturation [10,11]. In COVID-19, modern practice was again adapted, and manual ventilation was reserved for rescue ventilation, being a reactive action to desaturation. Only 16.1% of patients in El-Boghdadly et al. utilised bag-mask ventilation. When considering critical care intubations in the pre-COVID era, one would have imagined this to be nearer 100% in this patient population, where 71% presented with respiratory failure or cardiac arrest, although data on their oxygenation status are not provided.

Videolaryngoscopy

Videolaryngoscopy became specifically recommended for COVID intubations, an advancement on the DAS guideline for the critically ill where videolaryngoscopy was optional or recommended to be at least available. Comparing the adapted COVID-19 cognitive aid algorithms with the DAS original, one may notice no mention of direct laryngoscopy [6,10]. Videolaryngoscopy is recognised to improve team dynamic, improve view and delivers a higher first-pass success than direct laryngoscopy, all of which may shorten the time to establishing a secure airway as a result of additional attempts or failure [12]. Another aspect of its promotion is the increase in patient-operator distance, with the guise of moving the operator out of droplet dispersal range [13]. In this study, videolaryngoscopy was used in 76 % of intubations, contributing to an overall 90 % first-pass success. The first-pass success rate of intubation in the critically ill can be less 80%, with up to 20% of intubations taking more than three attempts [14]. Though intubator seniority will undoubtedly have been a contributory factor, the apparent success of videolaryngoscopy in these challenging patients enhances the “*make your first attempt*”

your best attempt" concept and may trigger a reinvigorated push for universal videolaryngoscopy, a goal that many strive for but only a few have achieved [15]. Another important issue is airway training. The recent impact of the pandemic on trainee exposure to airway management has been stark. As we move forward, the reduction in elective surgery, particularly high-turnover lists of minor cases, and the practice of minimising staff present during airway management will continue. With increasing pressure to ensure our new trainees get adequately trained, there is an argument for targeting competent skill in one intubation technique rather than partial skill in two. Given the evidence that Macintosh videolaryngoscopy is an effective way to teach direct laryngoscopy, this may be the way intubation training should go [16].

Risk to healthcare staff

The risks to airway managers can be mitigated by two main approaches, namely adequate provision of airborne protective personal protective equipment (PPE); and the adoption the aforementioned approaches and techniques considered to minimise aerosolisation or transmission. More novel innovations, such as the aerosol box, trended, but never gained official endorsements and eventually were shown to be unhelpful in many respects [17,18].

The initial headline data from Wuhan on intubation of COVID-19 patients was likely reassuring to most after publication of a zero-operator infection rate following 202 intubations undergoing modified rapid-sequence intubation, including bag-mask ventilation before laryngoscopy [19]. However, on closer examination, the dual layer personal protective equipment system used by intubators in this study is likely to have been more robust than most others have access to given the new worldwide demand. Also, the 14-day isolation that followed periods of work, removing potential pre-symptomatic infected staff from the workforce, will not be feasible in many healthcare systems. Furthermore, COVID-19 testing and optional chest CT was required before returning to work. Hence, comparison between the two datasets is difficult.

Personal protective equipment used within the 5148 airway interactions in the series by El-Boghdadly et al. was variable, with 88 % utilising equipment as recommended by the WHO, arguably a low figure for self-reported data. The true risk to intubators is uncertain as not all patients, nor all operators, were confirmed positive, but the final figure may seem high given all the practice adaptations actioned and the use of PPE. There was no correlation shown between the primary outcome and level of PPE, but numbers not using FFP3 or N95 masks or powered

respirator protection were small. The incubation period of COVID-19, before symptom development, is recognised to be on average 5 days but can be up to 14 days, yet only one in 15 in this study reported a primary endpoint in the first 14 days following potential exposure. Healthcare workers are at greater risk, but even in the midst of a pandemic it is impossible to correlate one's symptoms to one specific exposure, with potentially multiple exposures at work, home or in communities. Despite the difficult task in finding causality, which is recognised by the authors, the incidence of confirmed laboratory diagnosis, in addition to any staff spread from asymptomatic carriers or falsely negative tested individuals, will have major impact on a skilled workforce. A significant finding was the over representation of women reaching the primary endpoint. Seventy-seven percent of healthcare workers in the UK are women; however, there were not more female participants in this series [20]. Challenges in effective face test fitting among female staff could be a factor and moving forward this would need to be addressed by manufacturers [21,22].

Going forward in the new normal

The study by El-Boghdadly et al. will prove to be very important. Data collection is ongoing and the data will be changing, with differing rates and practices in different countries. In this dataset, 10.7% of participants achieved the primary endpoint, but we feel this should not be used to reflect the true risk to healthcare workers undertaking airway management in COVID positive or suspected patients. There are simply too many variables and alternative sources of infection. This headline statistic may, if taken the wrong context, add to the mental stress of those faced with similar scenarios in any second wave, irrespective of PPE used. Staff must remain vigilant, use robust and well-fitted PPE and take care when doffing post-procedures, using a buddy to check their technique, as they have done throughout this pandemic. Equally rigorous precautions and hygiene should be used throughout the workplace and in social circles as restrictions ease.

Staff sickness or self-isolation due to household sickness has put a strain on workforce and this will continue. The 'genius' of this virus is its ability to be carried by asymptomatic individuals, making it hard to completely break chains of infection. With the virus likely to become endemic, easy access to testing of all symptomatic staff or symptomatic family members will help protect the workforce and facilitate timely return to work. Despite the challenges, healthcare workers have adapted rapidly to new ways of working and now face the challenge of getting services back to normality to limit non-COVID morbidity and mortality.

Unfortunately, peri-operative COVID-19 infection increases morbidity and mortality to levels one would deem unacceptable for elective surgery and so moving forward new pathways must be created [23,24]. Pre-operative testing, 14-day patient shielding before admission, cohorting into unshielded and shielded patient streams are likely to have already become well established by time of print.

El-Boghdadly and his team worked quickly to transcend borders and the collaborative drive of the team and contributors in trying to quantify the risk to healthcare workers so rapidly is highly impressive, almost irrespective of the exploratory findings. Likewise, to other researchers around the world looking collaboratively for solutions to our COVID-19 problem, to keep us safe, you all deserve our recognition and appreciation. And to healthcare workers, you are rising to the challenge every day. We 'doff' our caps to you all. Stay safe.

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