
Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

worsening respiratory conditions and leading to urgent ECMO' does not sound correct. Lack of preparation, use of a direct laryngoscope as a primary intubation device, and inappropriate bougie use likely all contributed to such an outcome. This simple device remains a precious adjunct for airway management when carefully used in conjunction with direct or videolaryngoscopy.[10]

## Declarations of interest

MS has received paid consultancy from Teleflex Medical, Verathon Medical, and DEAS Italia; is a patent co-owner (no royalties) of DEAS Italia; and has received lecture grants and travel reimbursements from MSD Italia and MSD USA. GF has received royalties from Cook Medical (Frova Introducer; Bloomington, IN, USA) and Teleflex Medical (PercuTwist and EasyCric) for his airway device inventions. IH and GC declare no competing interests.

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# Airway management lessons from case reports of negative outcomes. Comment on *Br J Anaesth*; 125: e168–70

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*Always note and record the unusual … Publish it. Place it on permanent record as a short, concise note. Such communications are always of value* (Sir William Osler).[1]

Editor—A forthcoming issue of the *British Journal of Anaesthesia* (BJA) contains a report of two cases of tracheal trauma after difficult airway management in morbidly obese patients with coronavirus disease 2019 (COVID-19).[2] The authors should be commended for submitting these negative outcomes to the BJA, and the BJA must be congratulated for publishing them. High-ranking journals rarely accept such reports nowadays, and even though these reports often have major limitations, such as possible over-interpretation, lack of generalisability, or retrospective design,[3] we can still learn a lot from them.[4]

Here are six lessons from that report:

(i) *Airway management is (still) not as safe as we might believe*. It is rare that medical professionals report their own adverse events for at least two reasons: fear of reputational consequences and fear of legal consequences. Thus, there is likely a strong publication bias favouring case reports with positive results. Regarding safety of airway management,

results are likely too optimistic as well.[4] A good example is the interpretation of the results from The Fourth National Audit Project of the Royal College of Anaesthetists and the Difficult Airway Society (NAP4), the largest prospective study of major airway events occurring during anaesthesia, in the ICU and emergency department.[5] The authors themselves state that only roughly 25% of the cases with adverse events were captured, indicating a more accurate incidence of perhaps 1:5500 or even greater instead of the published incidence of 1:22 000 for major airway events.[6] Identifying the true incidence of adverse airway events is theoretically simple: we need further large prospective data including all cases, both elective and emergency, and cases with good and adverse outcomes, including death.[7]

(ii) *Obesity itself is a predictor of difficult airway management*. This was shown by the results of NAP4, in which obese patients were twice as common in the population that suffered incidents than in the group that did not,[5] and this was confirmed in a recent study from Australia.[8] Anatomical alterations, such as the combination of a large tongue and excessive upper airway soft tissue, and physiological alterations, such as decreased functional residual capacity and increased oxygen consumption, are important disadvantages for obese patients.[9] Whether obesity is a predictor of difficult mask ventilation is still debated.[10] Regarding tracheal intubation, an analysis of electronic records of more than 67 000 patients showed that a BMI of >30 kg $m^{-2}$ was significantly associated with increased likelihood of more than one tracheal intubation attempt, but the odds of difficult intubation remained unchanged once BMI exceeded 30 kg $m^{-2}$.[11]

(iii) *Laryngoscopy is not the same as intubation*. It is important to distinguish between these two procedures, as difficult laryngoscopy can be followed by easy tracheal intubation. (This is common during conventional tracheal intubation.) Likewise, easy laryngoscopy can be followed by difficult tracheal intubation ('you see that you fail'), which is the most common cause of failed tracheal intubation with videolaryngoscopy.[12] Even though the use of videolaryngoscopy improves the glottic view, there is currently no evidence that it reduces the number of tracheal intubation attempts or the incidence of respiratory complications.[13] Whether videolaryngoscopy would have prevented the adverse event in the cases described[2] remains unclear.

(iv) *Tracheal tube introducers ('bougies') and rigid stylets are potentially dangerous*. The cases reported show the potential dangers of rigid tools, such as tracheal tube introducers or rigid stylets, to facilitate tracheal intubation in patients with COVID-19, particularly in the absence of glottis visibility.[14,15]

(v) *Fibreoptic intubation is an established alternative in patients with morbid obesity*. Even though fibreoptic intubation is infrequently used as a first-choice technique for management of patients with morbid obesity, it is a tried-and-tested alternative for such situations[16] and should always be considered.

(vi) *Airway management in obese patients with COVID-19: combining protection and best practice is essential*. Various national airway societies have published consensus guidelines addressing airway management during the COVID pandemic.[17–19] Besides a few techniques that should be strictly avoided, such as high-flow nasal oxygen and small-bore cannula cricothyroidotomy with jet ventilation, management of the difficult airway always involves weighing the risks for the patient and other persons involved, with the likelihood of first-attempt success. The technique chosen may ultimately differ according to local practices, resources, and experience.

In conclusion, publishing airway management case reports, above all those with negative outcomes, remains important. We need to expose more than the tip of the iceberg so that we can improve our daily practice in airway management to improve patient safety.

## Declarations of interest

The author declares that they have no conflicts of interest.

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# Low-flow nasal cannula oxygen and potential nosocomial spread of COVID-19

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Editor—In the coronavirus disease 2019 (COVID-19) pandemic airway procedures such as intubation, noninvasive positive pressure ventilation, and high-flow nasal cannula are widely considered as potential risks for nosocomial transmission, and risks of infection are recognised even from asymptomatic patients.[1–3] Yet to date there has been little published and limited awareness regarding the risks of a far more prevalent practice: low-flow nasal cannula oxygen spread of COVID-19 from unsuspected patients. Even detailed studies of clinician exposures to unsuspected COVID-19 patients frequently do not include low-flow nasal cannula oxygen therapy as an exposure category.[4]

High viral loads of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) are present in human nares in symptomatic and asymptomatic patients.[5] Air dispersion from low-flow nasal cannulae can reach more than 1 meter away, a distance which, although less than that of an uncovered cough, produces a constant rate of dispersal similar to that of noninvasive ventilation masks set at more than double the oxygen flows.[6] Viral particles survive for multiple days on many surfaces, further facilitating nosocomial transmission.[7] Even without aerosolisation, surface contamination risks remain. During the first SARS epidemic, supplemental oxygen therapy emerged as a risk factor for nosocomial transmission on open wards, equivalent to patient bed crowding and failure to provide washing stations for providers.[8] Even with single-occupancy rooms, healthcare providers could be exposed to or spread SARS-CoV-2 after touching contaminated surfaces surrounding unsuspected COVID-19 patients presenting for other reasons. In a recent study, researchers sampling air inside COVID-19 negative-pressure patient rooms found the highest concentration of viral RNA in the room of a patient who was on oxygen 1 L $min^{-1}$ by nasal cannula, with no documented cough,[9] although in this context clinicians were wearing full protective equipment.

Some institutions have begun covering low-flow nasal cannulae, at least in certain contexts,[10,11] although discussions with peers across specialities and institutions suggest that practice is far from uniform and is sometimes limited to known COVID-19 patients. Existing data should give institutions pause to consider the infection risks of oxygen delivery for all patients, especially in cases where oxygen use is informed by habit, rather than evidence of clinical benefit. When low-flow oxygen via nasal cannula is clearly indicated, simple strategies can be used to mitigate the risk of spread. For example before extubation, a nasal cannula can be placed and covered with a surgical mask to limit the potential for environmental contamination.[11]

By a conservative estimate, if 10% of the occupants of the roughly 1 million hospital beds in the USA are on low-flow nasal cannula oxygen on any given day, that translates into 100,000 patients in US hospitals whose treatment may also be adding to nosocomial spread of SARS-CoV-2. Local conditions and supplies should guide considerations of using surgical masks to cover all low-flow nasal cannulae. If surgical masks are in short supply, other coverings,