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Emergency intubation in COVID-19 positive patients: comparison of pandemic surges at a UK center

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Dear Editor:

Over the past 2 years, a significant number of coronavirus disease 2019 (COVID-19) positive patients have required emergency tracheal intubation at our institution, presenting as two distinct pandemic surges. We have undertaken retrospective analysis of our intubation practices and outcomes, comparing first and second surges. All adult patients diagnosed with COVID-19, requiring emergency tracheal intubation between March 1 and June 1, 2020 (first surge), and between December 1, 2020, and March 1, 2021 (second surge) were included. Data were retrospectively extracted from electronic patient records and anonymized in accordance with national health service Trust information governance regulations and Caldicott Guardian procedures outlined under the Strategic Research Agreement. No specific ethics committee approval was required. Comparisons of outcomes in relation to categorical variables have been described using chi-square tests, and P-values were considered to be statistically significant if <0.05.

A total of 53 patients (median age, 57 years; male, 70%) underwent emergency tracheal intubation in the first surge, and 54 patients (median age, 60 years; male, 56%) in the second. Notable differences relate to: (1) seniority of primary intubator (trainee intubations increasing from 8% in the first surge to 13% in the second); (2) intubation technique (videolaryngoscopy use increasing from 79% to 100%); (3) first pass intubation success (decreasing from 85% to 76%); (4) oxygen desaturation rate, SpO_2 <90% post-tracheal intubation (worsening from 49% to 67%); (5) hypotension rate, systolic blood pressure <90 mm Hg after induction of anesthesia (worsening from 21% to 31%); (6) non-invasive ventilation prior to intubation (utilization increasing from 60% to 92%; treatment duration >2 days increasing from 28% to 59%); and (7) tracheal tube diameter (reducing from median 8.5 mm to 8.0 mm).

Median doses of induction and neuromuscular blocking agents were similar (fentanyl 2.50 μg/kg in first surge vs. 2.90 μg/kg in the second; propofol 1.22 mg/kg vs. 1.07 mg/kg; and rocuronium 1.20 mg/kg vs. 1.21 mg/kg). One cardiorespiratory arrest and one pneumothorax were reported (both second surge). Team size and composition were consistent between surges (median of 4 team members), comprising primary intubator, a trained airway assistant, a team leader (responsible for administering induction agents and fulfilling the role of secondary intubator), and an additional assistant.

There was increased trainee participation as primary intubator in the second surge. In the first surge, the primary intubator was a Consultant anesthetist/intensivist in all but four

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Table 1. First pass intubation success and common complications of emergency tracheal intubation in COVID-19 positive patients during the first and second pandemic surges

Variable	First surge patient (n=53)	Second surge patient (n=54)	P-value
First pass success at tracheal intubation	45 (85)	41 (76)	0.061
Oxygen desaturation (SpO_2 <90% post-intubation)	26 (49)	36 (67)	0.006
Hypotension (systolic blood pressure <90 mm Hg after induction)	11 (21)	17 (31)	0.058

Values are presented as number (%).
COVID-19: coronavirus disease 2019.

patients; however, it was recognized that this model of care was not sustainable for future surges—in order to meet the demands of re-established surgical services (re-deployment of Consultant anesthetists back to operating theatres) and to fulfil our commitment to airway training at a teaching hospital. In order to maintain patient safety, only trainees with over 4 years' specialist training in anesthesia/intensive care medicine were permitted to undertake tracheal intubation, supervised by a consultant (acting as team leader and secondary intubator).

The increased videolaryngoscopy use may be attributed to our COVID-19 airway education program undertaken between surges (which promoted its first line use), and greater familiarity from first surge usage. The reduced first pass success rate is most likely explained by greater trainee involvement and increased patient physiological instability in the second surge (necessitating earlier transition from intubation attempt to rescue oxygenation). Indeed, all complication rates were higher in the second surge (Table 1), despite similar induction drug doses. Marginally increased disease severity (first surge: Acute Physiology and Chronic Health Evaluation [APACHE] II median score, 14; mortality probability, 17% and second surge: APACHE II median score, 15; mortality probability, 20%), increased trainee participation as primary intubator, and longer duration of non-invasive ventilation prior to intubation may have contributed to these findings.

Tracheal tube size (median diameter) was reduced, which is notable for two reasons: firstly, this reflects the greater proportion of female patients; and secondly, despite the smaller tube size (and increased videolaryngoscopy), first pass intubation success was reduced. The principal cause of first pass intubation failure in the first surge was difficult tube passage through the glottis (accounting for 63% of failures), with virally-mediated glottic oedema [1] and subglottic suction drainage tracheal tubes (larger external diameter than regular tracheal tubes) potentially contributory factors. This finding undoubtedly influenced the use of smaller tracheal tubes in the second surge, but without the anticipated benefit, with difficult tube passage remaining the main cause of difficulties (46% of failures).

There are some limitations to our study. It is retrospective in nature, and of modest sample size, such that any inferences and conclusions must be interpreted with caution. Larger scale, multicenter investigation, comparing pandemic surges is warranted. While every center will differ in team composition and local protocols, our findings reinforce the need for the most experienced airway practitioner to fulfil the role of primary intubator, in order to optimize first pass success and minimize complications. Increased difficulty in passing the tracheal tube through the glottis should be specifically anticipated.

Judicious tracheal tube selection (diameter) is therefore crucial, balancing first pass intubation success with the subsequent advantages of larger tubes in respiratory weaning and airway toileting. Patient safety must be prioritized; however, trainees should also be provided with the opportunity to gain skills and experience in emergency airway management—which can best be achieved using videolaryngoscopy (providing both trainee and trainer with a view of the airway), careful patient selection, and appropriate supervision. The implications of non-invasive ventilation are uncertain, and specifically requires larger multi-center investigation. Our airway management strategy has evolved to keep pace with shifting service demands, but also the changing nature of the disease. We will continue to refine our service model and airway management practices based upon analysis of our outcomes.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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Conceptualization: PAW, CL. Data curation: PAW, MB, SG, AH, AG, JS. Formal analysis: PAW, MB, SG, AH, AG, JS. Methodology: PAW, CL. Project administration: PAW. Visualization: PAW. Writing–original draft: PAW, MB, SG, AH, JS, CL. Writing–review & editing: PAW.

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