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.

BJA

British Journal of Anaesthesia, 127 (2): e72–e80 (2021)

COVID-19 CORRESPONDENCE

Use of anaesthesia machines for mechanical ventilation and sedation in patients with COVID-19 ARDS

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Keywords: acute respiratory distress syndrome (ARDS); anesthesia machine; COVID-19; mechanical ventilation; sedation

Editor – Gouel-Cheron and colleagues[1] reported on the use of anaesthesia ventilators in patients with acute respiratory distress syndome (ARDS; N=50), the majority having COVID-19. Since the authors did not reference our previous study on the use of anaesthesia machines to ventilate and sedate patients with COVID-19 ARDS,[2] we take this opportunity to compare and synthesize the findings.

Our cohort included 35 patients with COVID-19 ARDS; these patients received invasive mechanical ventilation with Draeger Apollo anaesthesia machines (Draeger Medical, Telford, PA) in a single ICU. Sedation with isoflurane was also delivered to some patients (N=18) with no observed complications, and isoflurane administration was associated with reduced propofol and hydromorphone infusion.[2] Anaesthesia resident physicians and nurse anaesthetists assumed responsibilities for machine and breathing circuit maintenance. This included performance of machine check every 72 h, heat and moisture exchanger/high-efficiency particulate air filter and breathing circuit exchange at least every 24 h, and changes of water traps and CO_2 absorbers as needed. Challenges with management of patient-ventilator asynchrony, auto-PEEP, increases in airway pressures, and associated episodes of haemodynamic instability were reported in this same cohort and required continuous vigilance of anaesthesia-trained providers.[3] However, the frequency of these ventilator events was not quantified. In-hospital mortality was 22.9%.

Gouel-Cheron and colleagues[1] reported similar challenges with maintaining anaesthesia machines and breathing circuits, finding that median frequency of filter changes was once daily. A switch from anaesthesia ventilator to ICU ventilator appeared clinically necessary in at least two patients. Mortality in their cohort was 24%.

While neither of the studies evaluated the impact of anaesthesia machine on lung mechanics and patient outcomes, both studies concluded that prolonged ventilation with anaesthesia machines in patients with ARDS was feasible. Although this approach may expand hospital ventilator capacity during a surge of critically ill patients with COVID-19, the demands on the anaesthesia-trained personnel to perform ventilator disconnections and immediately respond to anaesthesia machine alarms may preclude broader use in overwhelmed healthcare systems.

Declaration of interest

The author declares that they have no conflict of interest.

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doi: 10.1016/j.bja.2021.05.002
Advance Access Publication Date: 10 May 2021

Neuromuscular monitoring and neuromuscular blocking agent shortages when treating critically ill COVID-19 patients: a multicentre retrospective analysis

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Keywords: cisatracurium; COVID-19; mechanical ventilation; neuromuscular blocking agent; train-of-four monitoring

Editor—We read with interest the recent meta-analysis by Weber and colleagues[1] discussing strategies to reduce the dose of neuromuscular blocking agent (NMBA) with adjuncts. The prolonged use of muscle paralysis in patients with moderate-to-severe COVID-19 acute respiratory distress syndrome (ARDS), massively admitted during the first French wave of the COVID-19 outbreak,[2] led to a shortage of NMBA supplies, especially cisatracurium. Conservation strategies were proposed, including use of neuromuscular block monitors measuring the train-of-four (TOF) count or ratio. ICU guidelines for sustained neuromuscular block recommend use of objective (quantitative, TOF ratio) monitoring, combined with clinical assessment, to ensure satisfactory recovery of neuromuscular function.[3,4] However, no national recommendation for monitor use in COVID-19 ARDS patients as a strategy for reducing the dose of NMBA used was available. We evaluated whether use of a TOF-count monitor in adult COVID-19 patients receiving mechanical ventilation reduced daily and weight-adjusted NMBA consumption during a period of supply shortage. The study was registered with ClinicalTrials.gov (NCT04459533).

We retrospectively analysed records of adult patients requiring mechanical ventilation for COVID-19 ARDS and having received cisatracurium for at least 48 h in nine ICUs of five academic hospitals during the first epidemic peak in France from February 27 to April 21, 2020. At that time use of qualitative (TOF count) monitoring (TOFscan®; Draeger, Lübeck, Germany; applied to the adductor pollicis muscle) to adjust cisatracurium infusion rate was standardised (Supplementary Fig. S1) and applied per physician discretion. The primary endpoint was cisatracurium consumption in mg kg^{-1} day^{-1}. Baseline characteristics, severity of patients using the Simplified Acute Physiology Score (SAPS) II and Sequential Organ Failure Assessment (SOFA scores, mechanical ventilation, arterial blood gas parameters at three time points (intubation, 48 h after intubation, 7 days after intubation), number of prone positionings, mechanical ventilation time, length of stay in ICU, and 90-day mortality were collected. Multiple logistic regression was used to identify independent risk factors for higher cisatracurium consumption (≥4 mg kg^{-1} day^{-1}). A *post hoc* power analysis based on the primary endpoint was calculated and yielded 72.7% accuracy for 5% alpha error. All calculations were performed using R software version 3.4.4 (R Core Team 2017, Vienna, Austria), and significance level was set at $P<0.05$. The study was approved by the local ethics committee; no written consent was required.

Out of 121 patients included, 86 were allocated to the TOF group (at least one qualitative TOF-count measurement reported in the electronic health record); otherwise they were allocated to the control group ($n=35$). Patient characteristics were comparable (Supplementary Table S1). No adjuncts (magnesium or alpha-adrenergic agonists) were used to reduce the dose of neuromuscular blocking drug administered.[1] Cisatracurium consumption was significantly lower in the TOF group (2.9 mg kg^{-1} day^{-1} [inter-quartile range, IQR=2.2–4.2] *vs* 4.4 mg kg^{-1} day^{-1} [IQR=2.5–6.1]; $P=0.02$) (Fig. 1). The number of patients with higher cisatracurium consumption (>4 mg kg^{-1} day^{-1}) in the TOF group was 26 (30.2%), and was 18 (51.4%) in the control group ($P=0.02$). The absence of monitoring was independently associated with higher cisatracurium consumption (odds ratio [OR]=2.77; 95% confidence interval [CI], 1.18–6.66; $P=0.02$). The number of prone positionings (OR=1.46; 95% CI, 1.11–1.46; $P=0.0007$) was also independently associated with greater cisatracurium