

## Succinylcholine rescue for sugammadex-induced laryngospasm. Comment on *Br J Anaesth* 2020; 125: 423–5

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Editor—In the recent editorial entitled ‘Another nail in the coffin of succinylcholine’ Blobner and Hunter<sup>1</sup> encourage withdrawing succinylcholine from current anaesthesia practice, in part because of increased risk of postoperative pulmonary complications. Since sugammadex affords a rapid return of spontaneous ventilation following even high doses of rocuronium,<sup>2</sup> the authors argue that succinylcholine provides little additional value to contemporary anaesthesia practice.<sup>1</sup> We respectfully disagree based on our experience of a case of life-threatening laryngospasm after sugammadex administration in a patient with an unanticipated difficult airway following a rapid sequence induction. In this case, succinylcholine turned out to be a valuable rescue treatment. A written informed consent was obtained from the patient to publish some details of this case.

A 100 kg, 34-yr-old male, ASA physical status 2, was scheduled for radiofrequency ablation for gastro-oesophageal reflux. Airway examination revealed an El-Ganzouri risk index<sup>3</sup> of two for a thyromental distance of 6–6.5 cm and a modified Mallampati score 2 with a neck circumference of 45 cm. Following preoxygenation and anaesthesia induction with propofol 200 mg and fentanyl 200 µg i.v., neuromuscular block was achieved using rocuronium 90 mg i.v. with train-of-four (TOF) response monitoring. After two failed attempts at tracheal intubation via videolaryngoscopy, mask ventilation with oxygen 100% was followed by a failed attempt with direct laryngoscopy (which offered a Cormack-Lehane Grade IV laryngeal view). Fiberoptic bronchoscope-guided intubation was then attempted, but despite successfully negotiating the bronchoscope into the trachea, repeated attempts to advance the tracheal tube through the vocal cords were unsuccessful. During this time, general anaesthesia was maintained by a targeted-controlled infusion of propofol with anaesthesia depth monitored using bispectral index (BIS) monitoring. A repeat dose of rocuronium 20 mg was given 45 min after induction to support airway management.

Mask holding subsequently became difficult, and an i-gel® (Intersurgical Ltd., Wokingham, UK) supraglottic airway was placed; the lungs were ventilated on pressure control mode of 18 cm H<sub>2</sub>O pressure delivering a tidal volume of 460 ml with oxygen saturation of 100% at fractional inspired oxygen concentration of 40%, square waveform capnogram and no added sounds on auscultation. At this stage, a decision was made to abort the procedure and awaken the patient. Following discussion regarding the choice of reversal agents, one of two involved anaesthetists suggested waiting for a TOF ratio >20% to reverse with neostigmine-glycopyrrolate, while the other suggested using sugammadex to save operating room time. Finally, with a TOF count of 0 and BIS of 50, sugammadex 400 mg i.v. was

administered, and ~90 s later a TOF ratio of 90% was attained. However, the patient immediately developed upper airway obstruction, evident as sudden flattening of the capnogram, with inability to ventilate the lungs and rapid desaturation to 92%. A jaw thrust with CPAP of 15 cm H<sub>2</sub>O and 100% oxygen failed to break the laryngospasm. A quick fiberoptic bronchoscope examination through the i-gel® revealed a closed glottis. When the saturation fell to 80%, succinylcholine 50 mg i.v. was administered, which was followed by prompt improvement in ventilation and oxygen saturation to the pre-sugammadex baseline. Following return of spontaneous ventilation, the propofol infusion was stopped, the patient recovered consciousness, and the supraglottic airway was removed uneventfully. After tracheal extubation, the patient had a mild sore throat, but no cough or hoarseness. A flexible nasal endoscopic examination revealed minimally oedematous uvula with normal pharyngeal and laryngeal structures including vocal cords. Unfortunately, no attempt was made to assess the subglottic structures and the patient was discharged without prior anaesthesia consultation.

While we recognise the possibility of airway oedema and secretions following multiple failed intubation attempts as a contributing factor for laryngospasm, the fact that airway obstruction developed only after sugammadex administration with a TOF ratio of 90% suggests sugammadex-induced laryngospasm.<sup>4</sup> Note also that an adequate depth of anaesthesia and no external stimulus were present at the time. Arterial oxygen saturation remained 98–100% until sugammadex was administered, followed by a period of desaturation that was refractory to non-pharmacological management. Succinylcholine, a drug considered obsolete by many, helped us rescue the airway; notably, no other drug has this specific therapeutic advantage. Atracurium is a possible alternative, but with a much slower onset,<sup>5</sup> while reparable with an enormous dose of rocuronium would clearly be foolhardy. Consequently, we believe that in scenarios such as this, succinylcholine offers an important viable solution.

While this is the first report describing the use of succinylcholine to treat sugammadex-induced laryngospasm, there are numerous reports in the literature describing sugammadex-induced laryngospasm.<sup>4,6,7</sup> Most such reports describe transient laryngospasm that resolved either spontaneously or with CPAP and oxygen 100%, all without complications.<sup>4,6,7</sup> However, two prior reports of sugammadex-induced laryngospasm causing negative-pressure pulmonary oedema<sup>8,9</sup> and one report of sugammadex-induced laryngospasm progressing to cyanosis and bradycardia<sup>10</sup> highlight potential difficulties with sugammadex. In these reports, the sugammadex-induced

laryngospasm persisted, resulting in complications despite the use of jaw thrust, CPAP, and oxygen 100%.<sup>8–10</sup> Of note, succinylcholine was not used as a therapeutic option in these cases.

Fibreoptic bronchoscopy-proven sugammadex-induced laryngospasm in unintubated patients has also been discussed by McGuire and Dalton<sup>4</sup> who noted that patients receiving propofol rather than inhalational anaesthesia developed less airway obstruction, whereas those receiving neostigmine or no reversal exhibited no obstruction. According to case reports in which sugammadex use after a failure to ventilate further complicated airway management,<sup>11,12</sup> McGuire and Dalton<sup>4</sup> opine that sugammadex-induced laryngospasm may be a contributing factor for the increased difficulty encountered in ‘cannot intubate, cannot oxygenate’ scenarios.<sup>4</sup> Although this work met criticism on ethical grounds,<sup>13</sup> it clearly merits attention, as the phenomenon described is both credible and important, especially when reviewed in the context of the referenced case reports. These cases highlight the importance of maintaining availability of succinylcholine for treatment of refractory laryngospasm.

### Declarations of interest

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## Perioperative automation: Time to become artificial intelligence literate? Response to *Br J Anaesth* 2020; 125: 843–6

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Editor—Artificial intelligence (AI) and machine learning (ML) research, publications, and applications in medicine are accelerating,<sup>1</sup> and anaesthesia is not exempt from this trend.<sup>2</sup>

The more AI-based algorithms become part of our perioperative work environment, the more we need to ensure that we have an appropriate understanding of the