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CORRESPONDENCE

Sugammadex and the cannot intubate/cannot ventilate scenario in patients with predicted difficult airway (1)

Letter 1

Editor—Curtis and colleagues[1] presented an interesting case in which a patient with anticipated difficult intubation was paralysed with rocuronium and developed a cannot intubate/cannot ventilate (CI/CV) situation. Sugammadex was administered, resulting in successful recovery of the patient's motor strength, but ventilation was still impossible, presumably due to swelling of the airway and bleeding caused by repeated intubation attempts. The patient's life was saved by timely performing of transtracheal needle oxygenation followed by an emergency tracheostomy. In the article, the authors claim they report what they believe 'to be the first case of the use of sugammadex in a CI/CV scenario'. However, we found a case published before by Desforges and McDonnell,[2] of sugammadex administration in a CI/CV scenario. In their case, a patient with a BMI of 38.5 kg m^{-2} and Mallampati class 3 undergoing sleeve gastrectomy received rocuronium to facilitate tracheal intubation which proved to be impossible. Considering that 'no convincing capnography trace could be detected while the Sp_{O_2} decreased to 69%', sugammadex was administered and successfully reversed the CI/CV condition, enabling effective spontaneous ventilation within 45 s of sugammadex administration. We consider the case report by Curtis and colleagues important for three reasons. First, we congratulate the authors for their systematic, step-by-step planning of anaesthesia and airway interventions in this case. Secondly, this case demonstrates that sugammadex will not recover effective spontaneous ventilation in all CI/CV cases. Repeated laryngoscopy and intubation attempts may cause airway oedema with obstruction and difficult ventilation even with regained motor strength. Furthermore, the patient may not be able to ventilate spontaneously due to the administration of central nervous system depressants (i.e. midazolam, fentanyl) during induction of anaesthesia. Thirdly, this case re-emphasizes the need for considering the performance of an awake intubation technique whenever facing a predicted airway management difficulty. It is our routine to opt for awake fibreoptic intubation whenever we expect a difficult-to-manage airway. The use of a short-acting neuromuscular blocking agent such as succinylcholine, hoping for a quick recovery of spontaneous ventilation in case a CI/CV will develop, seems unsafe as well. The time to functional recovery (i.e. 50% recovery of the control single twitch height of the adductor pollicis brevis muscle), a time that should permit adequate spontaneous ventilation with a patent airway, after 1 mg kg^{-1} succinylcholine was reported as 8.5 min.[3] They also mention that the majority of patients will develop life-threatening desaturation before functional recovery.

Declaration of interest

None declared.

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Letter 2

Editor—We read with interest the case report by Curtis and colleagues[1] on the use of sugammadex in a can't intubate, can't ventilate (CICV) scenario. They state that the case highlights that rapid reversal of neuromuscular block with sugammadex will not necessarily relieve airway obstruction caused by the instrumentation of a compromised airway and that it is not a substitute for emergency tracheal access. While we can only agree with this statement, we feel that the message of the report is misleading because we believe that they simply chose the wrong strategy for securing the patient's airway. Applying this inappropriate strategy then led to the total mechanical obstruction of the airway, thus creating the CICV situation. Therefore, the subsequent use of sugammadex, although returning patient's spontaneous respiration, did not restore airway patency. Is this not what one would expect in a situation like this?

It appears that they may have mistaken planning for an anticipated difficult intubation for dealing with an unanticipated difficult intubation. They wasted the advantage of anticipating difficult intubation and turned from 'how to avoid it' into just simply 'how to deal with it'. Their plan was basically to follow the Difficult Airway Society (DAS) guideline for the management of an unanticipated difficult intubation.[2] However, the authors of the DAS guideline explicitly state that this guideline is for a patient without upper airway

obstruction. For an anticipated difficult intubation, Curtis and colleagues chose to follow the unanticipated difficult intubation algorithm which is not planning. As summarized by Mason and Fielder,[3] based on both their experience and data from NCEPOD, there are only two options for a patient with upper airway obstruction; if the intubation is deemed possible, then such a patient should have inhalation induction (Plan A) in theatre with rigid bronchoscopy and emergency tracheostomy instantly available as a Plan B. If the intubation is considered impossible, then the patient needs an awake tracheostomy. The alternative approach of using an awake fibreoptic approach is also advocated by experts in fibreoptics.[4] Nevertheless, it is unwise to paralyse such a patient before the airway is secure. In addition, their management of initial Grade IV laryngoscopy by repeating it twice more with different blades is also of concern as this technique had been previously flagged up as hazardous. They rightly mention that the reports from NAP4 in 2011[5] found that 'problems arose when difficult intubation was managed by multiple repeat attempts at intubation. The airway problem regularly deteriorated to a "can't intubate can't ventilate" situation (CICV). It is well recognized that a change of approach is required rather than repeated use of a technique that has already failed'. This finding, however, was not new as it only confirmed what was known more than a decade earlier from the data of NCEPOD in 1998 that 'if a decision is made to intubate a patient with upper airway obstruction, a maximum of 2 attempts must be made as persistent attempts at tracheal intubation may result in total obstruction'.[3]

To summarize, it would be sensible, as also Curtis and colleagues conclude, with patients such as this, an awake nasendoscopy is a useful component of airway assessment in confirming the ease of access to the airway in an awake patient. This does not mean that the airway can be accessed in the anaesthetized patient, but does enable the awake option to be considered and is the senior author's preference for managing patients such as this.

Declaration of interest

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Letter 3

Editor—Curtis and colleagues report airway management for a patient with an upper airway tumour, describing their escalating responses culminating in a 'cannot intubate–cannot ventilate' situation.[1] While all scenarios are different, principles are shared, including elements of complexity, risk, uncertainty, and dynamism. Alone, each is important. When they couple, usually in a non-linear way,[2] a situation fraught with danger arises, sometimes called a 'combinatorial explosion'. Examples of uncertainty in the case described are the reported discrepancy between the findings of nasendoscopy and CT scan and the efficacy of sugammadex for rescue. Examples of coupling include: risk with dynamism; the deterioration of facemask ventilation during the airway management sequence (from 'easy' after induction with relaxation to 'not possible'), and uncertainty with risk; the use of the inhalation route for the provision of anaesthesia, with awareness possible, when delivery of vapour is interrupted or failed.

The authors outline their sequence of airway plans in keeping with a key recommendation of the Fourth National Audit Project (NAP4), formulation of an airway management strategy.[3] While not explicitly stated by the NAP4 authors, airway management strategies can be classified into reactive, proactive, or combined. The strategy described is essentially reactive, contingent upon a failure of the previous intervention. In a situation where the ability to mitigate for failure is low (such as this case, an airway tumour with conflicting preoperative information), we believe that when interventions are subsequent to a failed technique, the situation (and the patient) is often worsening and dangerous.

We propose that an alternative generic method for strategy formulation using a proactive principle could be helpful. A common feature of a proactive approach is that the initial interventions are done for an awake patient, building-in safety before committing to general anaesthesia, a form of 'insurance policy'.

For this case, one or more proactive approaches could include:

(i) insertion of a prophylactic cricothyroid cannula under local anaesthesia;[4]
(ii) an 'awake-look' after topical local anaesthesia or sedation.[5] This approach is the mainstay for flexible fibreoptic techniques but can be successfully applied for other airway devices, such as videolaryngoscopes;[6]
(iii) an awake retrograde technique.[7]

As mentioned, proactive approaches may be combined with reactive responses. For instance, the insertion of a

precautionary cricothyroid cannula may be followed by the induction of general anaesthesia. Should the cricothyroid cannula fail during problematic airway management, subsequent reactive responses are needed. The potential for a complication such as this (and others) should be considered.

Proactive approaches may be more suitable when the magnitude of one or more of the four elements, complexity, risk, uncertainty and dynamism, or 'CRUD' for short, is predicted or expected to summate dangerously.

Declaration of interest

D.R.B. has received airway equipment for evaluation and teaching from: Freelance Surgical, Intavent Direct, Cook Medical, and Smith Portex.

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Reply from the authors

Editor—We thank all correspondents for the interest in our case report.[1] In particular, we thank Drs Ezri and Evron for highlighting another case report of the use of sugammadex in a 'can't intubate, can't ventilate' situation,[2] which, at the time of submission of our own case report, had not been published. A number of other issues are raised in other letters that merit further attention.

The management strategy that we chose was deemed to be the best and safest plan in the circumstances. Others may disagree on our choice of technique. However, it has been shown by Cook and colleagues[3] that airway management experts have very different views on how to manage a problematic airway, with some experts specifically saying not to use a particular technique when others choose the same technique as the optimum way of managing a case.

One of the letters refers to a paper by Mason and Fielder[4] which states that in the management of such patients, there are only two ways of managing the airway: inhalation induction or awake tracheostomy. We feel that it is important to point out that this is an editorial, which by definition is the opinion of the authors. Several of the letters received describe the use of awake fibreoptic intubation in the management of such patients reinforcing the recent findings of Cook and colleagues.[3]

The use of an inhalation induction as a method of securing the airway also merits attention. In the NAP4 report,[5] one of the themes to emerge was the 'deterioration in the airway following inhalational induction and the subsequent inability to maintain spontaneous ventilation' in head and neck pathology cases. In the cases reported to NAP4, in only four of 27 (15%) inhalation inductions, there was no compromise to spontaneous ventilation, whereas nine of 23 (39%) of flexible fibreoptic techniques were successful. Can inhalation induction therefore confidently be regarded as one of the only two ways of managing the partially obstructed airway?

The concept of 'proactive' and 'reactive' airway management by Watson, Jefferson, and Ball is an interesting one. The Difficult Airway Society guidelines[6] are an example of a reactive form of airway management, whereas the American Society of Anesthesiologist's guidelines[7] are perhaps more proactive. The Aintree Difficult Airway Management (ADAM) website could be described as the most proactive resource for airway management available at present. Arguably, for anticipated difficult airways, a proactive approach would be more appropriate than a reactive one, whereas by their nature, unanticipated difficult airways require a reactive approach.

We are glad that our case report has stimulated discussion, and hope that it has highlighted the core messages, namely that sugammadex should not be regarded as a substitute for emergency oxygenation techniques, the importance of reassessing the airway with nasendoscopy in the light of conflicting investigations and adapting the management accordingly. Although some may consider this 'common sense', we thank those who, with the benefit of hindsight, recognize the importance of our case report by offering insightful and constructive critiques. This is the essence of an open culture to improve patient safety and the purpose of sharing such experiences.

Declaration of interest

None declared.

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Arrhythmogenic right ventricular dysplasia/cardiomyopathy and pancuronium

Editor—We read with interest the review on perioperative management of hereditary arrhythmogenic syndromes.[1] It states that pancuronium is contraindicated in patients with arrhythmogenic right ventricular dysplasia/cardiomyopathy (ARVD). This recommendation appears to be based on 13 reported cases, which are cited in the review. Interestingly, pancuronium was used in only one of these cases,[2] and in this case, the outcome was good. In the other reported cases, in which vecuronium, succinylcholine, or atracurium was used, death resulted. A case in which cisatracurim was used had a good outcome. Based on these case reports, it seems reasonable to assume that as pancuronium and cisatracurium were used in successful cases, they are safe, whereas vecuronium, succinychlcholine, and atracurium, which were associated with death, should in fact be contraindicated. In our institution, in the last 5 yr, at least five patients aged 26–61 with ARVD as a main, histologically confirmed, diagnosis leading to heart failure have been anaesthetized for heart transplantation using pancuronium as the neuromuscular blocking agent. All of these patients survived surgery. One patient died on postoperative day 15 due to primary graft dysfunction, one died as a result of an intracranial haemorrhage 3 months after operation, and the other three are still alive. In these cases, a combination of benzodiazepine and fentanyl was used to induce anaesthesia which was maintained with propofol infusion. We feel that these five cases highlight the fact that while theoretically there may be reasons to avoid pancuronium, in practice, pancuronium can safely be used in such cases. We would like to suggest that the authors reconsider their recommendations for the use of neuromuscular blocking agent in patients with ARVD.

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Reply from the authors

Editor—We thank Drs Valchanov and Ghosh for their interest in our review[1] and for sharing their experience in the anaesthetic management of patients with arrhythmogenic right ventricular dysplasia/cardiomyopathy (ARVD). In our review, we suggest that 'pancuronium is best avoided because of possible arrhythmogenicity'; since published data are insufficient to support specific recommendations on the use or avoidance of this particular agent, this suggestion is mostly based on the drug's well-known cardiovascular profile.

The authors note that in the cases reported in our review, pancuronium was used only in one case.[2] We consider that this is clearly indicated in the manuscript and in Table 4. According to the report, even though the patient survived surgery, she developed severe ventricular and supraventricular arrhythmias perioperatively. As several drugs were used concomitantly, a single triggering factor was difficult to identify. Regarding the three cases reported where vecuronium, succinylcholine, and atracurium were used,[3 4] the outcome was fatal. However, two of the patients died several hours after operation, while surgical factors along with fluid loading were implicated in the third death. There was no association between these deaths and the neuromuscular blockers used. In these cases, the outcome was not indicative of the drugs' safety.

The authors provide in their letter unpublished data from their institution regarding the safe use of pancuronium in patients with ARVD undergoing heart transplantation. Considering the limited published data, the information given by the authors is of great interest. In our review, we considered data from seven published reports, as there are no randomized prospective studies. These reports described the anaesthetic management of patients with ARVD who underwent non-cardiac surgery. Apart from the fact that data are