

## Unanticipated Difficult Airway: Can Sugammadex Rescue can't Intubate can't Ventilate (CICV) Scenario?

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### Introduction

Sugammadex is a modified gamma cyclodextrin and acts by encapsulating rocuronium in the plasma in a 1:1 ratio [1]. Once encapsulated, concentration of rocuronium in the plasma decreases and hence further rocuronium molecules diffuse into the plasma from the neuromuscular junction, which are then encapsulated by free sugammadex molecules [2]. Sugammadex also has some affinity for the other aminosteroid neuromuscular blocking drugs [3]. At a dose of 16mg/kg, it can reverse the most profound neuromuscular block produced by rocuronium in less time than it takes to recover from succinylcholine [4,5]. Therefore, it has a potential role in managing a difficult airway by restoring spontaneous ventilation and hence allowing the awakening of the patient.

### Muscle Relaxation and Upper Airway

During induction of general anaesthesia, the ability to ventilate a patient's lungs using a bag and mask device is an essential component of airway management. Following induction of general anaesthesia, administration of muscle relaxant may facilitate bag mask ventilation [6].

But in certain scenarios muscle relaxation may lead to collapse of upper airway due to complete loss of skeletal muscle tone [7], this may worsen the difficulty in mask ventilation. In the later scenario if ventilation is difficult it is important to reverse the neuromuscular blockade in order to regain spontaneous ventilation.

### Can't Intubate, can Ventilate Versus can't Intubate, can't Ventilate Scenario

In a scenario where mask ventilation is possible but tracheal intubation has failed, reversing muscle relaxation is likely to allow the patient to breath spontaneously. As sugammadex reliably reverses the rocuronium induced neuromuscular blockade [8,9], it is possible to rescue a can't intubate but can ventilate scenario where a decision has been made to wake up the patient. However they can't intubate can't ventilate (CICV) scenario differs greatly. The airway is often obstructed for many reasons and muscle relaxation is rarely the cause of difficult ventilation [10,11]. Although neuromuscular blockade is reversed, trauma due to repeated attempts at intubation, presence of supraglottic airway pathology, use of sedative drugs and residual effect of induction agent can compound the situation. In addition, there are practical problems as highlighted by Bisschops et al. [12] in a simulated CICV scenario. These problems included incorrect dosing, slow time to draw up sugammadex causing delays and distraction in the ultimate goal of oxygenating the patient. They concluded that there was insufficient evidence for using sugammadex in CICV scenario.

The fourth national audit project in the United Kingdom [13] recommends human factor training for all those involved in the care of patients with difficult airway. The outcomes of difficult airway management are also affected by human behaviours [14]. Often task fixation will cause delay in pronouncing a failed intubation and hence

delay in further interventions. A decision of awakening the patient is essential, in order to administer sugammadex in a failed intubation scenario.

If a CICV scenario is declared following administration of rocuronium, timely decision to administer sugammadex may potentially reverse the situation and hence avoiding the need for cricothyroidotomy. Desforges and McDonnell [15] described the first case of successful rescue of CICV scenario using sugammadex. Following induction of general anaesthesia and muscle relaxation, intubation was impossible in a 35 year old morbidly obese patient. At a stage when ventilation was difficult and peripheral saturations decreased to 69%, sugammadex was administered. Spontaneous ventilation was regained within a minute and the CICV situation was resolved. However, in a recent case report by Curtis et al. [11], sugammadex failed to rescue the CICV situation in a 78-year-old patient with oropharyngeal tumour, presented for a panendoscopy. Although spontaneous ventilation and reversal of neuromuscular blockade was achieved within 60 seconds with sugammadex, cricothyroidotomy was required to rescue the obstructed airway. This case demonstrated how multiple intubation attempts can cause rapid deterioration in the airway [16] and precipitate a CICV scenario from a controlled 'can't intubate but can ventilate' situation. Kyle et al. [10] described another similar case where failed intubation was encountered due to an unexpected vallecular cyst, despite reversal of neuromuscular blockade; the patients' airway remained obstructed necessitating emergency tracheostomy.

Optimum muscle relaxation facilitates mask ventilation and should be considered before declaring a can't intubate and can't ventilate scenario [17,18]. The fourth national audit project recommends that "no anaesthetist should allow airway obstruction and hypoxia to develop to the stage where an emergency surgical airway is necessary without having administered a muscle relaxant" [13]. Despite adequate muscle relaxation if ventilation is impossible and intubation has failed, cricothyroidotomy is essential to oxygenate the patient. Whilst preparing for cricothyroidotomy, in the absence of complete airway obstruction, administration of sugammadex can allow spontaneous ventilation and effective oxygenation. However, in the presence of airway obstruction one may have to proceed to cricothyroidotomy.

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## Conclusion

The CICV scenario is often multi-factorial and reversing muscle relaxation alone may not guarantee to rescue 'the can't intubate can't ventilate' scenario. Perhaps sugammadex has a valuable role in a situation where rocuronium has been used for muscle relaxation and airway management has been unexpectedly difficult and a decision has been made to wake the patient. In patients with no particular airway pathology simply reversing the muscle relaxation allows the patient to take over their own ventilation often reversing a critical situation. We recommend that it should be immediately available for rescuing these difficult airways. However, one should exercise caution to avoid false sense of security in a CICV situation. In addition to muscle paralysis a multitude of factors such as sedation, airway oedema, bleeding and human factors may play an important role in the management of CICV scenarios. Management of the CICV situation requires a focused systematic team approach to re-oxygenate the patient and sugammadex may be seen as an adjunct to that goal.

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