



## Case Report

# Reversal of profound neuromuscular blockade with sugammadex in an infant after bronchial foreign body removal<sup>☆</sup>



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**Abstract** Sugammadex is a selective chemical agent that can reverse neuromuscular blockade induced by vecuronium and rocuronium. The aim of this report is to discuss the effectiveness of sugammadex in the reversal of neuromuscular blockade in children younger than 2 years. A 16-month-old boy, weighing 10 kg, was admitted to the pediatric emergency department due to choking, cyanosis, and severe respiratory distress that occurred while he was eating peanuts. In the emergency department, the patient's condition deteriorated, and he went into respiratory arrest. He was immediately intubated and taken to the operating room. A rigid bronchoscopy was performed under general anesthesia, with administration of intravenous pentothal (5 mg/kg), rocuronium (0.6 mg/kg), and fentanyl (0.5 µg/kg) in the operating room. The foreign body was removed within 6 minutes, and the profound neuromuscular blockade was reversed with a dose of 2 mg/kg sugammadex. He was extubated successfully after obtaining the spontaneous respiratory activity, and adequate breathing was restored. Clinical use of sugammadex in children younger than 2 years is not recommended because of the lack of clinical studies. In this case report, the profound neuromuscular blockade was successfully reversed with a dose of 2 mg/kg sugammadex in a 16-month-old boy. However, more prospective clinical studies are required for the safe use of this agent in children.

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## 1. Introduction

Foreign body aspiration is an important cause of mortality and morbidity, particularly in children younger than 3 years. Profound sedation and neuromuscular blockade may be inevitable during bronchoscopy especially in children.

Sugammadex (Bridion; MSD, Oss, The Netherlands) is a modified  $\gamma$ -cyclodextrin molecule which acts as an antagonist of rocuronium and is capable of reversing the neuromuscular effects of neuromuscular agents [1]. Sugammadex can be used as an alternative to neostigmine for reversal of the neuromuscular effect of vecuronium and rocuronium. Moreover, it can either be used as an alternative to succinylcholine for fast intubation with rocuronium and also in some procedures that are short but necessitate profound neuromuscular blockade, such as electroconvulsive therapy.

In this report, we present successful reversal of a profound neuromuscular blockade with sugammadex in a short period after bronchoscopy in a 16-month-old boy.

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## 2. Case presentation

A 16-month-old boy was admitted to the pediatric emergency department with sudden onset respiratory distress, cyanosis, and choking that occurred while he was eating peanuts. The child's condition deteriorated; he lost consciousness, and in the emergency department, he had to be intubated quickly with 0.05 mg/kg midazolam without any neuromuscular blocker agent. He was immediately taken to the operating room for bronchoscopy and monitored with electrocardiogram, pulse oximetry, noninvasive arterial pressure, end-tidal CO<sub>2</sub>, and anesthetic gases. His heart rate was 175 beats per minute; noninvasive arterial pressure, 95/65 mm Hg; SpO<sub>2</sub>, 78%; end-tidal CO<sub>2</sub>, 35 mm Hg; and he had breathing effort. Pentothal 5 mg/kg, rocuronium 0.6 mg/kg, and fentanyl 0.5 µg/kg were administered intravenously for deep sedation and inhibition of spontaneous breathing during the procedure. The maintenance of anesthesia was supplied with 4 L/min of 100% O<sub>2</sub> and 2% of sevoflurane. Rigid bronchoscopy was performed to explore the trachea and distal airways after obtaining the time required for neuromuscular blockade. The overall procedure to remove the peanut that was completely obstructing the right bronchus took approximately 6 minutes. Oxygen saturation increased immediately to 95% after removal of the foreign body. TOF Watch SX (Organon, The Netherlands) was used to assess the neuromuscular blockade depth. A superficial electrode over the ulnar nerve and an acceleromyogram over the thumb were placed to measure the abductor pollicis longus muscle response. A bolus of intravenous 2 mg/kg sugammadex was injected in 10 seconds, and sevoflurane concentration was set to 0.6% after measuring "0" to train-of-four (TOF) response and "0" to posttetanic count response. We measured "4" for the TOF response 54 seconds after sugammadex injection. The TOF ratios 0.9 and 1.0 were achieved after 160 and 225 seconds, respectively. Anesthetic agents were stopped, and the patient was extubated after return of spontaneous respiratory activity.

The patient was monitored in the recovery room for 30 minutes after the operation. No clinical complications or recurarization were detected, and the patient was transferred to the pediatric intensive care unit.

## 3. Discussion

Bronchoscopy procedures still carry morbidity and mortality, but this risk significantly decreases in patients who can reach the hospital without delay. Deep sedation is needed during removal of the foreign body from the airway. The usage of neuromuscular agents usually depends on the anesthetist's choice. It has been reported that performing positive pressure ventilation using neuromuscular blocker may help remove foreign body, improve oxygenation, decrease atelectasis, and overcome increased airway resistance during the procedure. However, there is still no strong evidence of the advantage of choosing positive pressure

ventilation or spontaneous ventilation [2]. In this case, we used 0.6 mg/kg rocuronium during the induction of anesthesia to inhibit spontaneous activity for improve oxygenation, for achieving a proper visualization for grasping and removing the foreign body. It may be considered to use succinylcholine, yet we avoided doing this due to the side effects. Thus, rocuronium was used as an alternative to succinylcholine because it can quickly be reversed with the sugammadex in a risky situation during the operation. We considered awakening the patient as soon as possible after reaching a stable condition instead of remaining under anesthesia. Sugammadex 2 mg/kg dose was administered, and the patient was awakened to terminate undetermined condition and return to the physiologic status.

Although different dosages of sugammadex for different levels of neuromuscular blockade in adults has been reported, only a 2 mg/kg dose has been recommended for moderate level of neuromuscular blockade in children. Despite not having a response to posttetanic count, the recommended dose of sugammadex for pediatric patients was infused at the end of the bronchoscopy procedure. The patient was successfully extubated after achieving a 1.0 TOF ratio in 225 seconds, despite his profound neuromuscular blockade. Response to single twitch control stimulation could not evaluated because of the inability to calibrate before induction of the neuromuscular blocker agent.

It has been reported in 2 cases experienced after reversed with sugammadex in children younger than 2 years old [3,4]. We monitored our case after extubation in the recovery room because of the possibility of seeing a residual blockade after the dose we used in our patient, but no complication or residual blockade was encountered. It could be safer if the neuromuscular blockade was evaluated with double burst stimulation instead of evaluating it only with TOF measurement.

In conclusion, we show that sugammadex safely and effectively reversed the profound neuromuscular blockade in the 16-month-old boy. The effect time of neuromuscular agents may vary according to personal characteristics so it is better to evaluate the reversal of neuromuscular blockade with both double burst stimulation and the TOF value. Further clinical studies are necessary for the safe usage of sugammadex in children younger than the age of 2 years.

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