



Correspondence

A case of deep residual neuromuscular blockade after sugammadex administration



Sugammadex rapidly and completely reverses neuromuscular blockade by encapsulating rocuronium molecules. However, the optimal dose of sugammadex for counteracting rocuronium cannot be determined without neuromuscular monitoring. Herein, we present a case in which a single dose of sugammadex (4 mg/kg) was insufficient for antagonizing a normal dose of rocuronium.

A 74-year-old woman (148 cm, 48 kg) underwent emergency bowel resection under general anesthesia, due to incarceration of femoral hernia. She could not orally ingest food for 4 days before surgery, due to abdominal pain and vomiting. Laboratory investigations revealed elevated serum creatinine (1.50 mg/dL) and urea nitrogen (48.5 mg/dL) levels, suggesting dehydration. She had no history of liver dysfunction, renal dysfunction, or neuromuscular disorders.

Anesthesia was induced via propofol, rocuronium, and fentanyl, and maintained with desflurane and remifentanyl. The trachea was intubated with 40 mg (0.8 mg/kg) rocuronium and three additional doses of 10 mg (a total of 70 mg) were administered during surgery, which lasted for 2 h 28 min. During surgery, the patient was administered 1500 mL of crystalloids and 500 mL of colloids, and her urine output was 400 mL. A transversus abdominis plane block with ropivacaine was performed after the conclusion of the surgery. Sugammadex was administered (200 mg; 4 mg/kg) 59 min after the final dose of rocuronium. Although spontaneous breathing commenced (minute volume > 3.0 L/min) and end-tidal desflurane concentration dropped to $\leq 0.2\%$, she was unresponsive to verbal commands. Because her blood pressure exceeded 200 mmHg, the trachea was extubated.

After extubation, the patient still did not respond to verbal stimuli and exhibited paradoxical breathing. Her systolic blood pressure continued to rise and exceeded 210 mmHg. Residual paralysis was suspected, so a neuromuscular monitor was applied, which revealed that the patient was still under deep neuromuscular blockade (train-of-four count 0, post-tetanic count 8).

After administering propofol (20 mg) to minimize the risk of explicit memory, an additional dose of sugammadex (200 mg) was administered. The train-of-four ratio reached 107% 3 min later, and the patient opened her eyes soon after. She was discharged from the operating room uneventfully.

In this case, rocuronium and sugammadex were administered in the usual manner, and the administered dose of rocuronium was within the

normal range. However, the patient remained under deep neuromuscular blockade, even after administration of 4 mg/kg sugammadex. Two hundred milligrams of sugammadex may be insufficient to antagonize 70 mg of rocuronium, because 3.57 mg of sugammadex is needed to encapsulate 1.0 mg of rocuronium. However, it is unlikely that all rocuronium molecules remained in plasma during initial reversal.

Several factors may have contributed to the unexpected prolonged action of rocuronium. Reports suggest that rocuronium exhibits substantial individual variation in its duration of action [1–3]. In one study, the reported median time for reappearance of T1 after the administration of 0.9 mg/kg rocuronium was 33.8 min, but it ranged from 16.2 to 52.9 min [1]. The duration of action of rocuronium is also reportedly prolonged in elderly patients [2], and women are more sensitive to rocuronium than men, requiring approximately 30% less drug to achieve the same degree of neuromuscular blockade [3]. Desflurane prolongs the duration of action of rocuronium more than sevoflurane or propofol [4]. Finally, plasma rocuronium concentration and neuromuscular blockade may be enhanced by reduced circulating plasma volume caused by preoperative dehydration [5]. Although several anesthesiologists do not routinely use neuromuscular monitors, reversal with sugammadex in the absence of monitoring does not preclude residual neuromuscular blockade. This case clearly demonstrates the need to use a monitor as standard practice. The subject of this case report provided written informed consent for its publication.

Declarations of interest

None.

Disclosures

This study did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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2017;34:16–21.

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