

Sugammadex for reversal of neuromuscular blockade in a patient with myasthenia gravis: A comprehensive case report

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ABSTRACT

Myasthenia gravis (MG) is an autoimmune neuromuscular disorder characterized by muscle weakness. Surgical management of myasthenic patients requires careful perioperative planning to minimize the risks associated with anesthesia and surgery. Neuromuscular blocking agents (NMBAs) predispose such patients to post-operative residual paralysis and respiratory complications. One critical aspect is the reversal of neuromuscular blockade. Sugammadex, a modified γ -cyclodextrin, reverses the effects of steroidal NMBAs and is not accompanied by the risk of triggering a cholinergic crisis, a potential complication with cholinesterase inhibitors. We report the perioperative management of a 56-year-old female with MG undergoing thymectomy.

Key words: Myasthenia gravis, Neuromuscular blockade, Reversal, Rocuronium, Sugammadex

Myasthenia gravis (MG) is an autoimmune condition where antibodies target the acetylcholine receptor, leading to impaired neuromuscular transmission and characterized by fluctuating muscle weakness and fatigability. MG patients present a challenge for anesthesiologists. It is commonly observed that patients with MG are more sensitive to neuromuscular blocking agents (NMBAs) and that the frequency of post-operative complications, including myasthenic crisis, increases with the use of NMBAs [1]. Hence, surgical management of myasthenic patients requires careful perioperative planning to minimize the risks associated with anesthesia and surgery. The anesthetic approach is often modified to avoid or limit the use of NMBAs in these patients. Gritti and colleagues reported that increasing the percentage of patients receiving general anesthesia without NMBA from 67% to 94% increased the rate of patients being transferred to the surgical ward after surgery from 26.0% to 93.2%, significantly reducing intensive care unit (ICU) admission rates [2]. While it is advised to avoid NMBAs, there are situations where complete avoidance may not be feasible. In recent years, sugammadex has revolutionized the management of intraoperative neuromuscular blockade in MG patients [3]. Sugammadex is a modified γ -cyclodextrin that reverses the effects of steroidal NMBAs. Sugammadex initially binds and deactivates free rocuronium in the bloodstream, forming stable complexes

excreted in urine. It also helps disassociate rocuronium from neuromuscular junctions by creating a concentration gradient, facilitating its elimination [4].

This report outlines the perioperative management of an MG patient undergoing thymectomy, with a review of prior literature on the use of sugammadex and its application in MG cases.

CASE REPORT

A 56-year-old female with a body mass index of 28.1, diagnosed with MG 4 months prior, underwent elective thymectomy, presenting a unique set of challenges and the need for careful neuromuscular blockade management. The patient had previously experienced an acute myasthenic crisis and underwent plasmapheresis to optimize her condition. Preoperatively, she was maintained on a medication regimen, including tablet prednisolone 20 mg/day and tablet pyridostigmine 240 mg/day, resulting in a stable condition with no observable symptoms in the days leading up to the surgery. Comprehensive pre-operative evaluations, encompassing blood reports and physical examinations, returned normal results, providing a reassuring baseline for the impending procedure.

In anticipation of potential post-operative challenges, such as respiratory compromise, a backup ICU bed was arranged. Written consent for the procedure, anesthesia, collection of data, and publication was obtained. Her regular medications were administered on the morning of surgery.

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In the operating room, all basic monitors were applied, and anesthesia was induced with propofol 2 mg/kg, fentanyl 2 mcg/kg, and rocuronium 30 mg (0.4 mg/kg). After securing the airway with an endotracheal tube, anesthesia was maintained with sevoflurane in the air/oxygen mixture. During the intraoperative phase, which extended over 150 min, intravenous paracetamol and an intercostal nerve block were given. Notably, there were no additional NMBAs administered throughout the remaining duration of the surgery.

After completion of the surgery, the anesthetic agents were discontinued and the patient started breathing spontaneously with a tidal volume of 150 mL in pressure support mode. Intraoperative monitoring utilizing facial nerve stimulation revealed a concerning train-of-four (TOF) ratio of 2/4, prompting swift intervention with sugammadex at a dose of 2 mg/kg. Within 5 min, the TOF ratio improved to 4/4, and a remarkable increase in tidal volume to 400 mL was observed. Extubation was done successfully, and the patient regained full consciousness.

The patient was closely monitored in the post-anesthesia care unit for any respiratory compromise or residual muscle weakness for 3 h. The post-operative course proceeded without complications. The patient was discharged in stable condition.

DISCUSSION

Although sugammadex has been successfully used in MG, to our knowledge, this is the first report of such use in the Indian subcontinent. Patients with MG have significant variability in sensitivity to both depolarizing and non-depolarizing NMBAs, even intermediate-acting agents such as atracurium or vecuronium. Before the advent of sugammadex, cholinesterase inhibitors were the sole choice for reversing neuromuscular blockade. However, in myasthenic patients, caution is advised when using these drugs, as they may prove ineffective during chronic anticholinergic therapy and can potentially trigger a cholinergic crisis, which can mimic a myasthenic crisis clinically [5,6].

Sugammadex is a novel pharmacologic agent that was approved for clinical use in adults in December 2015 by the United States Food and Drug Administration. It is a modified γ -cyclodextrin and operates on a distinct mechanism from acetylcholinesterase inhibitors, effectively reversing neuromuscular blockade by encapsulating rocuronium or vecuronium [7,8]. The decision to use sugammadex, in this case, was based on the patient's diagnosis of MG and the desire to minimize the risks associated with traditional reversal agents. The successful outcome observed in this case is consistent with previous reports on the use of sugammadex in myasthenic patients.

Mouri and colleagues' study is the first study providing evidence in support of the potential benefits of sugammadex; it showed that the use of sugammadex reduced the median length of hospital stay after surgery, reducing the risk of perioperative myasthenic crisis and possibly decreased the risk of post-operative pneumonia compared with non-use of sugammadex [9]. Cost-effectiveness studies have shown that utilizing sugammadex

to expedite the reversal of NMBAs in the operating room can be economically advantageous [10,11].

In a recent Korean retrospective study of 180 MG patients undergoing video-assisted thoracoscopic surgery–thymectomy, sugammadex demonstrated a significantly shorter post-operative hospital stay (4 days) compared to neostigmine (5 days), with no significant differences in complications [12]. Similar results were observed in a retrospective study of 795 adult MG patients undergoing thymectomy in Japan. Those administered sugammadex showed a reduced incidence of post-operative myasthenic crisis (odds ratio: 0.48; 95% confidence interval: 0.25–0.91). In addition, the sugammadex group exhibited lower total hospitalization costs and a shorter post-operative length of stay compared to the control group [9]. In alignment with existing literature, a cohort of 118 MG patients undergoing surgery with rocuronium-induced neuromuscular blockade and sugammadex reversal displayed rapid recovery. No signs of post-operative recurarization or respiratory depression were noted, with an average time to reach a TOF of 0.9 in 117 s and an average time to extubation in 276 s [13].

So far, no randomized studies specific to myasthenic patients have been conducted. Case reports and series, including ours, support the preference for rocuronium–sugammadex when neuromuscular blockade is necessary. While most cases have shown successful use of sugammadex in reversing neuromuscular blockade in MG patients, there have been reported instances of failure even with high or repeated doses of sugammadex. Notably, these failures did not appear to be solely linked to the severity of the illness, as two patients had mild clinical symptoms and were undergoing elective surgeries [14].

CONCLUSION

Sugammadex emerges as the preferred choice to mitigate the risk of perioperative myasthenic crisis and potentially reduce the incidence of post-operative pneumonia in these cases. Considering these findings, further investigations into the routine use of sugammadex in the Indian population with MG are recommended. The substantial economic benefits associated with sugammadex underscore its value as a valuable tool for anesthesiologists, particularly in the context of current health-care costs.

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