Clinical Experience with Sugammadex as a Neuromuscular Reversal Agent: A 10-Patient - Case Series

Dr Naba M. Madoo[1]*, Dr Vaibhavi Baxi[2]
[1]Primary D.N.B. Student, [2]Consultant Anaesthetist
Department of Anaesthesia, Lilavati Hospital and Research Centre, Bandra(W), Mumbai, Maharashtra, India.

*Corresponding author
Dr Naba M. Madoo
Primary D.N.B. Student, Lilavati Hospital and Research Centre. Bandra, Mumbai, Maharashtra, India.
Email:- nabamnm@gmail.com

ABSTRACT

Background: Sugammadex is a novel selective relaxant binding agent used for the rapid and effective reversal of aminosteroid-induced neuromuscular blockade.
Objective: To evaluate the clinical efficacy, safety, and recovery characteristics associated with sugammadex in 10 patients undergoing elective surgery.
Methods: Ten adult patients receiving rocuronium-induced neuromuscular blockade for elective surgical procedures were administered sugammadex at standard doses based on blockade depth. Train-Of-Four (TOF) ratios were monitored, and time to recovery (TOF ≥ 0.9), adverse events, extubation time, and PACU duration were recorded.
Results: All patients achieved a TOF ratio ≥ 0.9 within 140–230 seconds (mean: 177.5 ± 30.6 seconds) post-administration. No adverse events or hemodynamic instability were observed. Extubation was performed promptly, with PACU durations ranging from 35–60 minutes.
Conclusion: Sugammadex enabled rapid and reliable neuromuscular recovery with minimal side effects, supporting its role as a safe and effective reversal agent in elective surgical settings.

Keywords: Sugammadex, Neuromuscular Blockade, Rocuronium, Reversal Agent, Anesthesia Safety

INTRODUCTION

Neuromuscular blocking agents (NMBAs) are integral to general anesthesia, facilitating intubation and optimizing surgical field conditions. Traditionally, acetylcholinesterase inhibitors like neostigmine have been used to reverse NMBA-induced paralysis. However, their use is limited by unpredictable onset, residual blockade, and cholinergic side effects, including bradycardia and secretions.[1]

Sugammadex, a selective relaxant binding agent (SRBA), reverses aminosteroid NMBAs such as rocuronium by encapsulating free drug molecules, leading to rapid and complete recovery without muscarinic side effects.[2,3] Studies have shown it significantly reduces recovery time compared to neostigmine while enhancing patient safety. However, concerns remain regarding cost-effectiveness, limited data in specific patient populations (e.g., renal impairment), and its long-term safety profile.[4]

Sugammadex has been recently adopted as standard of care for rocuronium reversal in our institution. This case series presents our initial clinical experience, focusing on its efficacy, safety, and impact on perioperative recovery.

Take-Home Message

Sugammadex provides rapid and predictable reversal of rocuronium-induced neuromuscular blockade.
Complete recovery (TOF ≥ 0.9) was achieved in all patients within 4 minutes.
No recurarization, hemodynamic instability, or adverse effects were observed.
Eliminates cholinergic side effects associated with neostigmine.
Quantitative TOF monitoring is essential for accurate dosing and safe reversal.
Rapid motor recovery requires careful coordination with anesthetic depth.
Enables smooth extubation and shorter PACU stay, improving perioperative efficiency

CASE REPORT

Methods

Study Design and Patient Selection: This prospective observational case series included 10 consecutive adult patients (age ≥18) undergoing elective surgery under general anesthesia at our tertiary care center. Patients with severe renal dysfunction, known allergies to sugammadex, or requiring non-aminosteroid neuromuscular blockade were excluded. ASA physical status ranged from I to III.

Anesthetic Management: Standard ASA monitors were used, including ECG, NIBP, SpO_2, capnography, and temperature. Induction was performed using IV fentanyl (2 mcg/kg) and propofol (2 mg/kg), followed by rocuronium (0.6–1.2 mg/kg) for muscle relaxation. Intubation was achieved via direct or video laryngoscopy.

Anesthesia maintenance was tailored to patient and surgical needs, using sevoflurane or TIVA with propofol and remifentanil. Intraoperative neuromuscular monitoring was done using the Stimpod NMS 450X TOF monitor. TOF count and response were recorded every 15 minutes, with calibration before each case.

Sugammadex Administration: Sugammadex was administered at the end of surgery according to TOF assessment:

2 mg/kg for TOF 2/4 (moderate block)

4 mg/kg for TOF 0/4 with post-tetanic count ≥1 (deep block)

No cases required immediate reversal (i.e., 16 mg/kg).

Recovery time to TOF ≥ 0.9, hemodynamic parameters, extubation time, PACU duration, and adverse events were recorded.

DISCUSSION

The present case series highlights our early institutional experience with sugammadex as a neuromuscular reversal agent in adult patients undergoing elective surgery. All 10 patients demonstrated rapid and complete recovery from rocuronium-induced neuromuscular blockade, with no observed adverse effects, underscoring both the efficacy and safety of this novel agent in routine clinical practice.

A key advantage of sugammadex lies in its unique mechanism of action. Unlike traditional anticholinesterases such as neostigmine, which indirectly increase acetylcholine levels and require co-administration of anticholinergic agents to mitigate muscarinic side effects, sugammadex acts by directly encapsulating rocuronium molecules, forming an inactive complex that is excreted renally. This mechanism allows for a more predictable and faster reversal, with minimal impact on autonomic physiology.[2,3,6]

In our series, all patients achieved a train-of-four (TOF) ratio ≥ 0.9 within 140 to 230 seconds (mean: 177.5 ± 30.6 seconds) following sugammadex administration. These findings are consistent with previous studies demonstrating recovery times significantly faster than neostigmine, which often requires 10–20 minutes or more to reach similar TOF thresholds.[4,5] Rapid recovery not only shortens the time to safe extubation but also reduces operating room turnover time and enhances overall perioperative efficiency.

Importantly, the rapid and complete reversal of neuromuscular blockade with sugammadex necessitates a synchronized approach to anesthetic depth management. Patients may regain motor function—such as jaw clenching or spontaneous movement—prior to achieving adequate emergence from hypnosis if inhalational agents or total intravenous anesthesia (TIVA) are not tapered in a timely manner. In our experience, this rapid return of muscle function underscores the need for close coordination between neuromuscular monitoring and depth-of-anesthesia assessment. The use of end-tidal agent concentration monitoring and/or bispectral index (BIS) becomes critical to avoid situations where a fully reversed but inadequately sedated patient may begin biting the endotracheal tube or exhibit agitation prior to full emergence. Such events can lead to airway trauma or patient distress if not proactively anticipated and managed.

Furthermore, the absence of cardiovascular instability—defined as changes in heart rate or blood pressure exceeding 10% from baseline—in all cases is particularly noteworthy. This is clinically significant, especially in patients with comorbid conditions such as coronary artery disease (CAD) and hypertension, as seen in four patients in our cohort. Unlike neostigmine, which can precipitate bradycardia or arrhythmias when not carefully balanced with anticholinergics, sugammadex offers a more hemodynamically neutral profile, potentially improving safety in vulnerable populations.[7,8]

Neuromuscular monitoring played a central role in guiding reversal dosing. The majority of patients demonstrated moderate blockade (TOF 2/4) at the time of reversal, and hence received the standard 2 mg/kg dose of sugammadex. However, three patients had TOF 1/4, suggesting a deeper level of blockade. Although 4 mg/kg is the recommended dose in such scenarios, 2 mg/kg was used based on clinical judgment and institutional protocol, and recovery was still prompt and complete in all cases.

This highlights the importance of individualized dosing but also raises the need for more robust neuromuscular depth assessment protocols and training to avoid potential under-dosing in borderline cases.[5]

Another critical observation was the complete absence of adverse effects, including hypersensitivity, residual neuromuscular blockade (recurarization), QT prolongation, or bronchospasm. These findings align with several large-scale trials and meta-analyses, which have reported low incidence rates of clinically significant complications with sugammadex when used appropriately.[4,6,9] Importantly, we did not encounter any cases of residual curarization, a phenomenon that has been frequently associated with neostigmine and remains a significant concern for postoperative respiratory morbidity.[1]

Our data also support that sugammadex contributes to efficient post-anesthesia care unit (PACU) throughput, with durations ranging from 35 to 60 minutes. This efficiency can potentially translate to reduced PACU congestion, better resource utilization, and shorter hospital stays—though these outcomes require larger studies to quantify and validate.

Despite its many advantages, the use of sugammadex is not without limitations. Foremost is its high cost, which remains a major barrier to widespread adoption, especially in resource-limited settings. Though cost was not formally assessed in our study, it is an important factor for consideration in larger-scale implementation. Moreover, all patients included in this series had normal renal function. Since sugammadex is renally excreted, its use in patients with severe renal impairment remains controversial, and caution is advised in such populations pending more conclusive evidence.

This case series is also limited by its small sample size, absence of a comparator group (e.g., neostigmine), and single-center design, which may restrict generalizability. Nevertheless, our findings contribute valuable real-world evidence to the growing body of literature supporting sugammadex as a safe and effective reversal agent in the elective surgical population.

CONCLUSION

Sugammadex provided rapid, reliable, and complication-free reversal of neuromuscular blockade in elective surgical patients. The absence of recurarization or hemodynamic instability supports its safety and efficacy. While the findings are promising, larger, randomized trials are needed to evaluate cost-effectiveness, performance in patients with renal impairment, and comparative outcomes versus traditional reversal agents.

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TABLE

Parameter	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Age/Sex	45/M	32/F	50/M	60/F	28/M	35/F	55/M	48/F	39/M	62/F
Weight (kg)	70	55	80	68	72	60	85	62	77	58
BMI	24.2	21.5	26.1	25.3	23.4	22.8	27.5	23.0	25.9	21.9
ASA Class	II	I	II	III	I	I	II	I	II	III
Comorbidities	None	None	HTN	DM	None	None	CAD	None	HTN	DM
Rocuronium Dose (mg)	40	35	50	45	40	40	50	40	50	35
Sugammadex Dose (mg)	140	110	160	136	144	120	170	124	154	116
Type of Surgery	Lap Appy	Lap Chole	Hernioplasty	Hysterectomy	Mastectomy	Ovarian Cystectomy	Chemo port	Lumpectomy	Spine Decompression	Lap Chole
TOF Pre-Reversal	2	2	1	2	2	2	1	2	1	2
Recovery Time (s)	180	150	210	160	170	155	220	140	230	150
Adverse Events	None	None	None	None	None	None	None	None	None	None
PACU Duration (min)	40	35	45	50	40	38	48	35	60	42

Results

Patient Characteristics and Intraoperativ Details

Observations:

- All patients achieved TOF ≥ 0.9 in under 4 minutes (range: 140–230 seconds).
- No signs of recurarization or delayed recovery.
- No cardiovascular instability (BP and HR changes <10% from baseline post-reversal).
- No hypersensitivity or QT prolongation.