

Background

- Neuromuscular blocking agents (NMBAs) are widely used during surgical procedures to provide optimal conditions for endotracheal intubation and to provide surgical relaxation by inhibiting skeletal muscle movement.
- Even though acetylcholinesterase inhibitors (i.e., neostigmine) are the most common medications used to antagonize the effects of nondepolarizing NMBAs, residual blockade continues to be a persistent problem and an ongoing patient safety issue.
- Incomplete recovery from NMBAs can result in critical postoperative adverse events (i.e., respiratory complications, airway obstruction, hypoxemia, etc.). For this reason, it is vital that practitioners ensure full reversal of NMBAs.
- Sugammadex, a cyclodextrin molecule, could be the ideal reversal agent for steroidal nondepolarizing NMBAs such as rocuronium, vecuronium, and pancuronium, especially when a deep or profound block exists.

Clinical Question

Is sugammadex safer and more efficacious than neostigmine for the reversal of nondepolarizing neuromuscular blockade?



Moderate block	Dose
If spontaneous recovery has reached the reappearance of the second twitch (T₂) in response to TOF stimulation	2 mg/kg

Deep block	Dose
If spontaneous recovery of the twitch response has reached 1–2 PTCs, no twitch responses to TOF	4 mg/kg

Bridion. MERCK Connect website. <https://www.merckconnect.com/bridion/dosing-administration/>. Updated September 2020. Accessed October 10, 2020.

Case Report

- A 17-year-old female who had recently been evaluated for chronic pharyngitis presented for a tonsillectomy and adenoidectomy. The patient denied any pertinent medical history and preoperative vital signs were stable.
- Following anesthetic induction with IV fentanyl 50 mcg, lidocaine 100 mg, propofol 200 mg, and rocuronium 50 mg, the patient's trachea was successfully intubated.
- Since this patient was less than 18-years old, rocuronium was used on induction to avoid the potential adverse side effects associated with succinylcholine in pediatric patients (i.e., bradycardia, malignant hyperthermia crisis from undiagnosed malignant hyperthermia, severe hyperkalemia, myalgia, etc.).
- In the early maintenance period of the case, the patient had two post-tetanic twitches. Sugammadex 200 mg IV was administered to ensure full, rapid recovery of skeletal muscle and to avoid the adverse muscarinic effects associated with neostigmine.
- The recommended dosing for sugammadex is 4 mg/kg in the presence of 1 to 2 post-tetanic twitches. The dose administered was sufficient in reversing the neuromuscular blockade as evidenced by four twitches on Train-of-Four (TOF) and tetany without fade for 5 seconds at 50 Hz.
- The case was completed, and the patient was transported to the post-anesthesia care unit where she continued to recover without complications.

Level of Evidence

- Hristovska et al. *Cochrane Database Syst Rev*, 2017 – Melnyk & Fineout-Overholt Level I
- Brull et al. *Asian J Anesthesiology*, 2017 – Level II
- Fahmy et al. *Ain-Shams J Anaesthesiol*, 2019 – Level II
- Molto et al. *Rev Colomb Anesthesiol*, 2019 – Level II

Evidence Based Discussion

- In order to avoid critical postoperative events, it is essential to ensure full reversal of NMBAs. It is estimated that one-third of patients who receive traditional reversal (i.e., neostigmine) for NMBAs will still have some degree of residual blockade in the postoperative period.
- Neostigmine, an acetylcholinesterase inhibitor, antagonizes the effects of nondepolarizing NMBAs. However, due to its indirect mechanism of action, it can be unpredictable, is unreliable in reversing deep blocks, and is associated with adverse side effects (i.e., bradycardia, hypersalivation, nausea, vomiting, etc.).
- Sugammadex provides quick, reliable reversal of NMBAs regardless of the depth of neuromuscular block. Studies show sugammadex allows for faster recovery from NMBAs, reduces occurrence of residual postoperative blockade, and reduces the incidence of undesirable effects when compared to neostigmine.
- In this case, sugammadex was chosen to reverse the nondepolarizing neuromuscular blockade to facilitate rapid resumption of spontaneous ventilation and to ensure the patient could maintain a patent airway. The use of rocuronium and sugammadex allowed for adequate paralysis and full reversal while maintaining hemodynamic stability and avoiding the potential side effects associated with succinylcholine, glycopyrrolate, and neostigmine.

Level of Evidence (cont.)

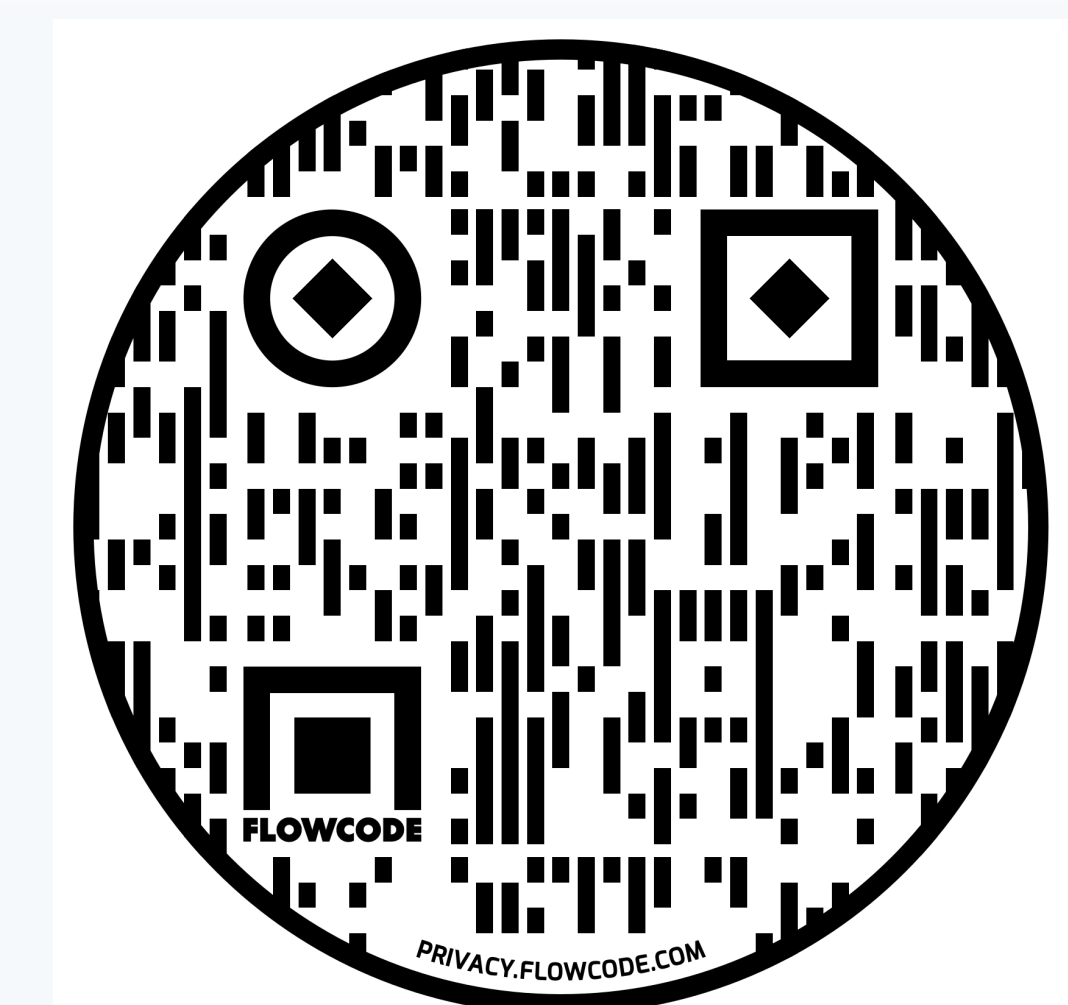
- El Sayed et al. *Egypt J Anaesth*, 2016 – Level II
- Iwasaki et al. *BMC Anesthesiol*, 2017 – Level II
- Abad-Gurumeta et al. *Anaesthesia*, 2015 – Level I
- Carron et al. *J Clin Anesth*, 2016 – Level I
- Lee. *Anesth Pain Med*, 2019 – Level II

Translation to Practice

- Although acetylcholinesterase inhibitors are commonly used to reverse nondepolarizing neuromuscular blockade, research supports sugammadex being a safer, faster, and more effective medication for reversal of any level of nondepolarizing neuromuscular block.
- Sugammadex has the potential to become the gold standard for reversal of steroidal neuromuscular blocking agents in the future.
- Based on the evidence, sugammadex should be available in all facilities for the reversal of steroidal neuromuscular blocking agents, especially for situations like the one described in this case study.
- Patient safety is always the top priority and transitioning to sugammadex for reversal of steroidal neuromuscular blockade would increase patient safety and reduce adverse events in the postoperative period.
- Based on this literature review, a detailed written protocol would be developed that clearly outlines when sugammadex should be used, including appropriate monitoring of neuromuscular blockade. This protocol would include evidence-based rationales as well as resources for additional education.
- Further research weighing the cost-benefit relationship to the use of sugammadex in routine clinical practice would be beneficial and would potentially help to make sugammadex more readily available for use in the operating room.

References

Scan this QR code for a complete reference list.



Questions?

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