

# **Sugammadex Compared to Neostigmine for Neuromuscular Blockade Reversal**

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## **Structured Abstract**

### **Background**

Neuromuscular blocking agents are widely used during surgery to provide optimal conditions for endotracheal intubation and to provide surgical relaxation by inhibiting skeletal muscle movement. Although acetylcholinesterase inhibitors are the most common medications used to antagonize the effects of nondepolarizing neuromuscular blocking agents, residual blockade is a persistent problem. Incomplete recovery from neuromuscular blocking agents can result in critical postoperative adverse events (i.e., respiratory complications, airway obstruction, hypoxemia, etc.). Sugammadex, a modified gamma-cyclodextrin, could be the ideal reversal agent for steroidal nondepolarizing neuromuscular blocking agents such as rocuronium, vecuronium, and pancuronium, especially when a deep or profound block exists. Sugammadex works by selectively encapsulating aminosteroidal nondepolarizing neuromuscular blocking agents, thus reversing their neuromuscular blocking action. It is a safe, effective agent that can be used to reverse any level of neuromuscular blockade, and the fast onset allows for rapid airway control and can decrease the anesthesia recovery period. This selective binding agent is able to reliably reverse neuromuscular blockade without the unpredictable efficacy and adverse muscarinic side effects that are commonly associated with acetylcholinesterase inhibitors. Research shows reversal of neuromuscular blockade with sugammadex is overall superior to neostigmine as it induces rapid and predictable reversal of any level of neuromuscular block, decreases the occurrence of residual block in the postoperative period, and increases overall patient safety.

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. Induction was initiated with IV fentanyl 50 mcg, lidocaine 100 mg, propofol 200 mg, and rocuronium 50 mg, and the patient's trachea was successfully intubated. Rocuronium was used on induction since the patient was less than 18-years-old to avoid the potential adverse effects associated with succinylcholine in pediatric patients (i.e., bradycardia, malignant hyperthermia crisis, severe hyperkalemia, etc.). In the early maintenance period of the case, the patient had two post-tetanic twitches and sugammadex 200 mg IV was given to ensure full, rapid recovery of skeletal muscle and to avoid the adverse muscarinic effects associated with neostigmine. 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 successfully completed, and the patient was transported to the post-anesthesia care unit where she continued to recover without complications.

## **Clinical Question**

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

## **Evidence Based Discussion**

In order to avoid critical postoperative events, it is essential to ensure full reversal of neuromuscular blocking agents. It is estimated that one-third of patients who receive reversal for neuromuscular blocking agents will still have some degree of residual blockade in the postoperative period. Neostigmine, an acetylcholinesterase inhibitor, antagonizes the effects of nondepolarizing neuromuscular blocking agents; however, due to its indirect mechanism of action, it can be unpredictable and is unreliable in reversing deep blocks. Neostigmine is the most potent acetylcholinesterase inhibitor and produces adverse side effects. Antimuscarinic drugs are often given prior to neostigmine to avoid these adverse muscarinic side effects, but these muscarinic antagonists also have adverse side effects of their own.

Sugammadex provides quick, reliable reversal of neuromuscular blocking agents regardless of the depth of neuromuscular block. Studies have shown that sugammadex allows for faster recovery from neuromuscular blocking agents, reduces the occurrence of residual postoperative blockade, and reduces the incidence of undesirable effects when compared to neostigmine. In the presented 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 while maintaining hemodynamic stability and avoiding the potential side effects associated with succinylcholine, glycopyrrolate, and neostigmine.

## **Translation to Practice**

Despite the common use of acetylcholinesterase inhibitors for the reversal of nondepolarizing neuromuscular blockade, research supports sugammadex being a safer, faster, and more effective medication for reversal of any level of nondepolarizing neuromuscular block. Patient safety is always the highest 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.

*Keywords:* sugammadex, neostigmine, neuromuscular blockade reversal

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