Postpoliomyelitis Syndrome and Reversal With Sugammadex: A Case Report

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Postpolio syndrome (PPS) is a disabling process characterized by progressive muscle weakness and atrophy that typically emerges decades after an initial poliomyelitis infection. Although the exact incidence of PPS is unknown, it is estimated that 25% to 40% of all poliomyelitis survivors are affected. Patients with PPS may have increased sensitivity to numerous anesthetic agents including neuromuscular blocking drugs. A case report of a patient with PPS undergoing general anesthesia for a cystoscopy procedure is presented. Because of a previous general anesthetic using traditional muscle relaxant reversal of neostigmine, which resulted in prolonged paralysis (6-8 hours) and an intensive care unit admission, sugammadex was used in the cystoscopy procedure. Excellent results were achieved. Following extubation, the patient sustained adequate respiratory effort demonstrated by respiratory rate, end-tidal carbon dioxide, and oxygen saturation within normal limits. Sugammadex administration led to a markedly improved outcome for a patient with a disabling muscle-weakening neurologic disorder. Use of this medication may be of value to other anesthesia providers caring for patients with PPS in an operative setting.

Keywords: Poliomyelitis, postpolio syndrome, sugammadex.

Poliomyelitis is an infectious disease caused by transmission of a human enterovirus known as poliovirus. As the poliovirus multiplies, it progressively destroys motor neurons, resulting in symptoms ranging from minor acute flaccid paralysis of skeletal muscles to devastating consequences such as permanent paralysis of the diaphragm. With the worldwide dissemination of the poliomyelitis vaccine since the 1950s, the disease has been nearly eradicated. The incidence of poliovirus has declined from an estimated 350,000 cases in 1988 across 125 countries to just 175 reported cases in 2019.1

Although the likelihood of encountering a patient with active poliomyelitis is minimal in the United States, there is a substantial population of poliomyelitis survivors affected by postpolio syndrome (PPS) who may present in operative suites. Postpolio syndrome is characterized by progressive muscle weakness and eventual atrophy decades after the initial poliovirus infection. The exact incidence of PPS is unknown; however, it is estimated that 25% to 40% of all poliomyelitis survivors are affected by PPS.2 Most individuals affected by PPS are over the age of 60 years.

The purpose of this report is to describe the successful anesthetic administration and recovery in a patient with PPS who had complications after a prior general anesthetic with neostigmine reversal of neuromuscular blockade. In the current case, the patient required muscle relaxation based on the surgeon’s request. After the procedure concluded, neuromuscular blockade was successfully reversed with sugammadex.

Case Summary

A 69-year-old presented for a nonemergent transurethral resection of a bladder tumor (TURBT) requiring general anesthesia. He weighed 93 kg and had a body mass index of 29 kg/m². Before surgical resection, the patient presented with intermittent gross hematuria related to a malignant neoplasm of the bladder. The relevant medical history consisted of PPS, scoliosis, postoperative nausea and vomiting (PONV), and hyperlipidemia. The patient demonstrated limited lower motor functional status requiring leg braces and assistance to stand and wheelchair assistance for mobility.

The patient reported a previous general anesthetic for a cholecystectomy at the same institution. Noted on chart review, rocuronium, 25 mg, was used to achieve surgical paralysis, and neostigmine, 5 mg, and glycopyrrolate, 0.8 mg, were used for reversal of paralysis. The patient experienced prolonged paralysis (6-8 hours), necessitating admission to the intensive care unit (ICU) for supportive care. This unfortunate experience was concerning for the patient in the face of the upcoming TURBT.

Although TURBT procedures do not necessitate paralysis, the surgical team responsible for this case expressed concern that any motor movement could result in a poor outcome because of the location of the tumor; the team therefore requested muscle relaxation. The patient was
not a candidate for neuraxial anesthesia due to severe spinal curvature and verbalization of preference for general anesthesia. The anesthesia team’s plan included the administration of low-dose rocuronium with the goal of maintaining a maximal train-of-four (TOF) count of 2. Because full reversal with traditional reversal agents had not been achieved in the patient’s previous anesthetic, the decision was made to use sugammadex. The team discussed the possibility of transfer to the ICU if the sugammadex reversal was not successful and prolonged paralysis occurred. The patient consented to the procedure and the anesthetic plan.

Anesthetic induction was performed with fentanyl, 75 µg; lidocaine, 100 mg; propofol, 220 mg; and rocuronium, 20 mg. Succinylcholine was avoided because of the patient’s decreased functional status and potential for the development of hyperkalemia, despite a case report showing the safe use of succinylcholine in patients with PPS. Administration of rocuronium as the neuromuscular blocking agent was chosen to allow for a direct comparison with the patient’s previous anesthetic in which he received it for the cholecystectomy and experienced prolonged paralysis. Over the course of the case, the patient received an additional 15 mg of rocuronium in 5-mg increments, maintaining a maximal TOF count of 2 throughout the case. Neuromuscular monitoring was maintained by use of TOF monitoring of the left orbicularis oculi muscle. The case was uneventful, requiring minimal sympathetic agents (epinephrine, 20 µg, and ephedrine, 10 mg). The patient was also medicated for PONV with ondansetron, 4 mg, and dexamethasone, 4 mg.

On emergence, sugammadex, 360 mg, was administered for reversal of neuromuscular blockade. Given the patient’s demonstrated sensitivity to rocuronium in a previous case and with only a TOF count of 1 demonstrated at the orbicularis oculi, a suboptimal monitoring site, the more conservative sugammadex dose of 4 mg/kg was chosen. Within 5 minutes a TOF count of 4 without fade in response was obtained, and the patient achieved adequate tidal volumes with a regular rate in spontaneous ventilator mode without assistance.

The patient was extubated uneventfully in the operating room and was transferred to the postanesthesia care unit. The patient did not experience respiratory distress or symptoms of increased work of breathing following surgery. The patient later moved to a medical-surgical unit for observation and was discharged home the next day.

Discussion

This report describes a successful approach to anesthesia in a patient with PPS who experienced prolonged paralysis after a previous anesthetic. Because of a reduction in the number of functioning motor neurons in patients with PPS, these individuals may have a higher sensitivity to nondepolarizing neuromuscular blockade agents. Given this patient’s history of prolonged paralysis and weakness following prior administration of rocuronium, use of this drug raised concerns about recurrence of paralysis and weakness. Options were limited because of the surgical need for muscle relaxation during the cystoscopy, the patient’s scoliosis, and the patient’s preference to have general over neuraxial anesthesia. This patient’s previous experience with rocuronium contrasts with an earlier report describing the safe use of rocuronium in a PPS-affected patient without reversal.

The authors recognize that a weakness of the described technique is the use of the orbicularis oculi muscle for TOF monitoring. The current literature indicates that the use of TOF monitoring at the adductor pollicis muscle is superior to that of the eye muscles. These individuals may have a higher sensitivity to nondepolarizing agents known as cyclodextrins, which work by binding to the steroidal ring of nondepolarizing muscle relaxants and leading to reversal of the neuromuscular blockade. Traditional reversal agents such as neostigmine function as cholinesterase inhibitors, increasing the amount of acetylcholine to enable reversing the neuromuscular blockade. Due to the pathophysiology of PPS and its effect on motor neurons, we hypothesized that reversal with sugammadex would be more effective than neostigmine for this patient because of the more complete reversal of the residual neuromuscular blockade. In fact, the excellent clinical outcomes observed following reversal with sugammadex represented a substantial improvement over the prior anesthetic outcome for this patient. Further research to define the mechanism of reversal of neuromuscular blockade would be of benefit for improving the safety of anesthesia in patients with PPS.

REFERENCES


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**DISCLOSURES**

The authors have declared no financial relationships with any commercial entity related to the content of this article. The authors did not discuss off-label use within the article.