Anesthetic Considerations for Patients with Postpolio Syndrome: A Case Report

Donna Wheeler, CRNA, MS

Postpolio syndrome is a disorder related to the recurrence of neuromuscular symptoms in survivors of paralytic poliomyelitis. A comprehensive understanding of the pathophysiology is necessary for the anesthesia provider to develop a safe anesthetic plan. This case report discusses the anesthetic challenges and considerations in patients with postpolio syndrome, focusing on the importance of careful pharmacologic dosing of opioids, and neuromuscular agents as well as perioperative and postoperative issues related to aspiration risks, cold intolerance, and positioning.

Keywords: Anesthesia, neuromuscular disorder, postpolio syndrome.

The poliovirus vaccine was introduced more than 50 years ago, effectively ending the polio epidemic.1 The polio crisis reached its highest point in the United States in the early 1950s. New cases typically arise now in Africa, Southeast Asia, or the Middle East. The clinical manifestations and recovery vary widely among patients.1 The number of survivors of this disease is thought to be anywhere between 250,000 and 1 million in the United States.2,3 Of these survivors, many are experiencing a recurrence of neuromuscular symptoms collectively called postpolio syndrome. Symptoms include respiratory tract dysfunction, fatigue, intolerance to cold, pain, and muscle weakness.1 It is thought that the poliovirus damages the reticular activating system, the site at which many anesthetic drugs theoretically work.4 This may account for the extreme sensitivity these patients demonstrate to anesthetic medications as well as to the increased potential for delayed awakenings and other postoperative complications. The patient in the following case report arrived at the operating room holding area with multiple articles discussing the anesthetic considerations in patients with postpolio syndrome, as a result of his experience with anesthesia during the previous 10 years. The case report discusses anesthetic challenges posed when presented with a patient with postpolio syndrome.

Case Summary

An 85-kg, 178-cm, 78-year old man with an ASA physical status III presented for an excision of a melanoma skin cancer from the left shoulder. He had no known drug allergies. Surgical history included a 3-vessel coronary artery bypass graft (CABG) surgery in 1998. His medical history included paralytic poliomyelitis at the age of 19 years. His poliomyelitis included paralysis of most major muscle groups but did not include the use of the iron lung or severe respiratory tract deficiencies necessitating assistive devices. In this patient, recurrent symptomatic muscle weakness developed starting approximately 19 years after poliomyelitis. During the preoperative interview, the patient described a prolonged awakening and hospitalization experience after the CABG because of his postpolio syndrome. He had no other surgical history.

The blood pressure reading was 139/69 mm Hg, pulse was 50/min, respiratory rate was 13/min, temperature was 37.2° C, and oxygen saturation was 100% on room air. Blood chemistry and complete blood cell count panel indexes were all within normal limits. The chest radiograph did not show any acute disease. His electrocardiogram demonstrated sinus bradycardia with a first-degree atrioventricular block. Results of the physical examination revealed bilateral lower extremity muscle weakness, necessitating the use of a cane and leg braces. He denied any history related to deficiencies with the respiratory muscles, including difficulty with breathing, swallowing, or sleep apnea. Airway assessment demonstrated a Mallampati class II with full range of motion to neck, no loose or missing teeth and a thyromental distance greater than 6 cm. His medications included tamsulosin, 0.4 mg/d; valsartan, 80 mg/d; oxybutynin, 5.0 mg twice daily; alendronate, 70 mg weekly; aspirin, 81 mg/d; omeprazole, 20 mg/d; simvastatin, 40 mg/d; and metoprolol, 25 mg/d.

The surgeon was consulted regarding the depth and breadth of the incision needed for excision of the lesion. After consultation and thorough explanation of the procedure with the patient and surgeon, it was decided that the surgeon would use local anesthetic and the anesthesia team would monitor the patient with the goal of using no additional medications. The patient understood that at any time he could request sedation or pain medication. The patient did not want a general anesthetic; however, he consented to receive a general anesthetic in the event of an emergency. The preoperative discussion also covered the possibility that in the event that sedation or analgesia was necessary, the patient may require...
monitoring for a minimum of 24 hours. A 20-gauge intravenous line was started in the right hand.

The patient was taken to the operating room, where standard monitors and oxygen via nasal cannula were placed. The operating room was prewarmed to 21.1°C (70°F). The patient was assisted to the right lateral position. Padding for all pressure points was provided, and the patient verbalized comfort in the required position before the procedure started. The surgeon injected 14 mL of a mixture of 0.5% bupivacaine with epinephrine plus 1% lidocaine around the surgical site. Total surgical time was 43 minutes. The patient tolerated the procedure well without complications, complaints, or need for any sedation. He bypassed the recovery room and was sent home within 30 minutes.

**Discussion**

- **Epidemiology.** Poliomyelitis has historically been categorized into 3 types: abortive, nonparalytic, and paralytic. Abortive is minor, presenting with flulike symptoms. Nonparalytic presents like viral meningitis. Paralytic polio presents with more severe symptoms of muscle pain, with the potential for rapid progression toward paralysis. The potential risk in individuals affected by the poliovirus for the development of the paralytic type was 1% to 2%. An estimated 60% of those who had paralytic poliomyelitis are affected by postpolio syndrome.

  Of people affected by the virus, children were less likely to have paralytic poliomyelitis than were adults; however, if the paralytic form did develop, children recovered more fully than did adults. Recovery from the poliovirus usually began 2 to 3 weeks after onset and peaked at 7 to 10 months. Recovery varied from complete without deficits to continued lifelong residual deficits such as paralysis or respiratory difficulties.

  During the initial disease process of paralytic poliomyelitis, the poliovirus attacks the cells in the anterior horn of the spinal cord, resulting in a loss of motor neurons. The surviving neurons sprout collaterals and reinnervate the motor units during the healing process. These new motor neurons are larger and fewer than those that were destroyed. The cause of postpolio syndrome is not fully understood. The generally accepted theory at this time is thought to be either a decreasing number or overuse of the polio-affected motor neurons during the aging process. Degeneration of the neuron sprouts explains the muscle weakness seen in postpolio patients, but theory regarding why the motor neurons degenerate is unclear. Proposed hypotheses include overuse of already enlarged motor neurons working harder and regeneration of new neurons unable to keep pace. Some researchers suggest that the poliovirus may be dormant in the body and is reactivated. Another possibility is that some motor neurons of polio-affected patients are smaller than normal. Normal erosion of motor neurons occurs around age 60 years. Patients with postpolio syndrome may be more susceptible to attrition at an earlier age, manifesting itself as muscle weakness related to loss of motor neuron function.

  Postpolio syndrome is diagnosed in patients with a history of paralytic polio who have had a neurologic recovery of at least 15 years, followed by a gradual or new onset of muscle weakness, pain, or other neurological symptoms. The most common symptoms of postpolio syndrome are fatigue, weakness, muscle pain, respiratory difficulties, cold intolerance, and dysphagia. To the author's knowledge, the literature does not discuss or link any other possible triggers to postpolio syndrome, such as diet, other diseases, exercise, or lifestyle habits.

- **Anesthetic Considerations.** There are several important anesthetic considerations for patients presenting with postpolio syndrome in regard to the pathophysiology of presenting symptoms. The choice of using a general anesthetic vs a regional anesthetic should be based on the preoperative assessment, type of surgery, and patient desires. The use of a neuraxial anesthetic in patients with neuromuscular disorders was previously avoided because of unknown risks and potential worsening of symptoms. However, a retrospective study of 139 patients, 79 of whom had postpolio syndrome, determined that there was no increased risk of complications nor any worsening of neurological symptoms with neuraxial anesthesia. A case report from Canada also describes a successful report of a spinal anesthetic in a patient with postpolio syndrome presenting for a cesarean delivery. Doses of the local anesthetics were not decreased in either of the studies. It is unknown, however, whether the motor neurons of patients with postpolio syndrome are more vulnerable to the effects of local anesthetics and if these patients may be more sensitive to overall toxic concentrations.

  Up to 42% of patients with postpolio syndrome have respiratory tract involvement ranging from laryngeal muscle weakness to vocal cord paralysis. Dysphagia is present in 10% to 20% of these patients as well. This should alert the anesthetist to the increased potential of postoperative apnea and aspiration. The literature further discusses this issue by suggesting careful titration of opioids and muscle relaxants because of the increased sensitivity to these medications in these patients. There is controversy in the literature regarding the use of the depolarizing muscle relaxant succinylcholine, with potential risk of hyperkalemia, severe myalgia, and a longer duration of action. A case report of a patient with postpolio syndrome presenting for electroconvulsive therapy describes using a short-acting, nondepolarizing drug instead of succinylcholine as an alternative to avoid any potential hyperkalemia. Other studies demonstrate the successful use of succinylcholine in multiple patients with postpolio syndrome but clearly state that the risks vs
benefits should be considered on a case-by-case basis.\textsuperscript{9,10}  

There are also anesthetic considerations when using nondepolarizing neuromuscular agents, necessitating careful neuromuscular monitoring because of the potential increased sensitivity to these agents. Careful titration of any nondepolarizer based on the use of neuromuscular function monitoring is essential. The literature suggests careful titration, starting with half the normal dose, as well as selecting shorter-acting agents.\textsuperscript{1,11} A study of nondepolarizing agents and patients with postpolio syndrome supports the concept of this patient group having increased sensitivity.\textsuperscript{11} The results from that study suggested that due to identical duration of action of nondepolarizing agents between patients with postpolio syndrome and non–polio-affected patients, the changes seen in those with postpolio syndrome are related to pharmacodynamic changes rather than pharmacokinetics.\textsuperscript{11} These pharmacodynamic differences are thought to result from changes in receptor site number and/or sensitivity. Changes in the receptor site are thought to be due to altered prejunctional acetylcholine receptors related to lesions from the poliovirus, a decrease in acetylcholine synthesis, or a decrease in the choline acetyltransferase activity.\textsuperscript{11}

Other anesthetic considerations should include the careful positioning of these patients because of potential chronic pain. A thorough preoperative assessment is valuable in establishing baseline deficits. Furthermore, these patients typically have a profound cold intolerance. Care should include warming the ambient air of the operating room, using warming blankets, and warming intravenous fluids as indicated as well as continued warming efforts in the postoperative period to avoid shivering.\textsuperscript{1,2,4,7}

Consideration to place of surgery for patients with postpolio syndrome presenting for surgery should include all of the potential postoperative complications. Same-day surgical centers may not have adequate services to accommodate the patient with postpolio syndrome in the event that overnight monitoring is needed.\textsuperscript{3} “Fast tracking” a patient with postpolio syndrome is not recommended as well. If any sedating medication is administered during the perioperative period, it is prudent that the patient has proper respiratory monitoring.\textsuperscript{1,12}

**Conclusion**

The patient in this case report presented for a procedure that lent itself to the use of local anesthetics and monitored anesthesia care. No sedating medications were administered, thereby allowing this patient to bypass the standard recovery phase of anesthesia. The literature review clearly states that patients with postpolio syndrome are not typically good candidates for bypassing the first phase of postoperative recovery because of their increased risk of postoperative respiratory and sedation complications.\textsuperscript{1,4} Patients with postpolio syndrome presenting for surgery should be thoroughly evaluated for their coexisting diseases, and the anesthetic plan should be tailored to their specific requirements, taking into consideration the anesthetic concerns discussed throughout this case report.

**REFERENCES**


**AUTHOR**

Donna Wheeler, CRNA, MS, is a nurse anesthetist with Little Rock Anesthesia Services, Little Rock, Arkansas. At the time this paper was written, she was a senior student attending the Nurse Anesthesia program at Midwestern University in Glendale, Arizona. Email: tdwheels2003@yahoo.com.

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