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Case Report

Response to neuromuscular blockade with rocuronium during general anesthesia in a patient with dermatomyositis - A case report -

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Dermatomyositis is an idiopathic inflammatory myopathy characterized by skin changes and muscle weakness. Depending on the involvement of various muscles, dermatomyositis can cause aspiration pneumonia, ventilatory impairment, and heart failure. Several reports have documented normal or prolonged neuromuscular blockade following administration of different non-depolarizing neuromuscular blockers in patients with dermatomyositis. We observed delayed onset of blockade and prolonged recovery following administration of 0.6 mg/kg rocuronium in a patient with dermatomyositis. However, when the train-of-four ratio reached 0.3, the patient was administered pyridostigmine and glycopyrrolate, which led to normal response to reversal of rocuronium. The patient was extubated without respiratory complications. The outcomes of this case indicate that response to the usual dosage of muscle relaxants in patients with dermatomyositis might be different from that in patients without this condition. Anesthesiologists should pay attention to preoperative cardiorespiratory evaluation and intraoperative neuromuscular monitoring.

Key Words: Dermatomyositis, Pyridostigmine bromide, Rocuronium bromide.

Dermatomyositis (DM) is a disease of unknown etiology characterized by typical skin lesions and bilateral, progressive, symmetrical proximal muscle weakness caused by perivascular non-supportive inflammatory processes [1].

Because of its low incidence, there are few reports on anesthetic management of patients with DM during general anesthesia. Moreover, there are contradictory reports on onset and recovery from neuromuscular blockade with various muscle relaxants in patients with DM.

Anesthetic management in patients with DM might be challenging, it depends on disease severity, presence of coexisting diseases, and abnormal response to muscle relaxants.

Here, we report a case of delayed onset of neuromuscular blockade and prolonged recovery after administration of 0.6 mg/kg rocuronium, followed by normal response to reversal after administration of pyridostigmine in a patient with DM.

CASE REPORT

A 50-year-old woman (height 162 cm, weight 49 kg) was scheduled for bilateral salpingo-oophorectomy with total abdominal hysterectomy under general anesthesia. She had been diagnosed with DM 8 months ago and treated with corticosteroids and immunosuppressive agents. She presented with rashes on the ears, left posterior neck, dorsal regions of both hands, and posterior thighs and buttocks along with an itching sensation and history of tenderness in the proxi-

mal regions of both arms. The patient exhibited weakness of upper extremities when both arms were abducted. Upon neurological assessment, the strength grade of upper limbs was found to be approximately 4/5. Gottron's papules were observed on both hands. Gross findings of skin biopsy on the right dorsal hand and left posterior neck indicated DM. The serum creatine phosphokinase concentration was 4,130 IU/L. The findings of nerve conduction study and electromyography revealed electrophysiologic abnormalities suggestive of generalized active myopathy. A moderate restrictive ventilatory pattern was observed upon preoperative pulmonary function test. Electrocardiography (ECG) findings revealed normal sinus rhythm and chest radiography findings revealed bronchitis and emphysematous pattern.

Upon arrival of the patient in the operating room, monitoring was commenced with ECG, noninvasive blood pressure measurement, pulse oximetry, and capnography. Invasive arterial blood pressure, urine output, and esophageal temperature were also monitored. Bispectral index (BIS) XP (Model A 2000, Aspect Medical Systems, USA) and train-of-four (TOF) (TOF-Watch SX, Organon, Ireland) monitors were applied.

After preoxygenation, anesthesia was induced by intravenous administration of 70 mg propofol, 0.05 μg/kg/min remifentanil, and oxygen, without premedication. Anesthesia was maintained with sevoflurane in 50% oxygen and 0.05–0.15 μg/kg/min remifentanil in order to maintain a BIS score of 40–50, and an end-tidal CO_2 of 30–35 mmHg during general anesthesia.

The ulnar nerve was stimulated by a 5-s, 50-Hz tetanic stimulus, followed by supramaximal stimulation after application of calibration in the TOF mode (0.2-ms duration pulses, frequency 2-Hz, duration 2-s) at 15-s intervals before tracheal intubation, Stimulation lasted with 15 minutes intervals, until the end of anesthesia. Complete neuromuscular block was obtained 330-s after administration of 0.6 mg/kg rocuronium before tracheal intubation.

There was no response to TOF stimulation for 75 minutes during surgery. Surgery was completed without additional administration of muscle relaxant or anesthetic complications. When the TOF ratio reached 0.3, 5 minutes after skin closure, the patient was administered 10 mg pyridostigmine and 0.4 mg glycopyrrolate upon which the TOF ratio reached 0.9 within 10 minutes. Upon extubation, the patient was able to take deep breaths and respond to verbal instruction. She was transferred to the postoperative anesthetic care unit and placed under neuromuscular monitoring for 60 minutes. There was no postoperative residual muscular paralysis or other complications.

DISCUSSION

In the present case, DM was diagnosed according to five criteria on the basis of clinical features including symmetrical muscle weakness and myopathic changes on electromyography, increased muscle enzymes concentration, characteristic histological findings on muscle biopsy, and presence of heliotrope rashes and Gottron's papules on the skin [2,3]. The incidence of DM in adults is very low 5 to 10 cases per 1 million persons per year. The disease develops between 30 and 60 years of age, with women being twice as likely to be affected as men. It has also been associated with malignant diseases, particularly ovarian cancer in women [4–6]. Treatment of patients with DM usually involves systemic corticosteroid administration with or without immunosuppressive agents.

Involvement of pharyngeal muscles or the pulmonary system may cause aspiration or interstitial pneumonia. Patients with DM may also present with respiratory impairment due to progressive weakness of intercostal and diaphragmatic muscles. Although abnormal ECG findings may be observed, clinical cardiac symptoms are uncommon in DM [7].

In patients with severe DM, anesthetic management is challenging because of involvement of various muscles and abnormal response to neuromuscular blocking drugs (NMBDs). Consequently, DM may be associated with perioperative complications and mortality.

Previous studies have reported varying responses to various NMBDs in patients with DM. Flusche et al. [8] observed significantly delayed recovery from a single dose of vecuronium in an elderly patient with multiple medical problems. Following administration of 0.13 mg/kg vecuronium, it took 2.5 hours for visual confirmation of first thumb adduction with nerve stimulation, and the patient required postoperative ventilatory care despite additional administration of a reversal agent. This result may be explained by renal insufficiency, aminoglycoside medication, and the effects of DM. In contrast, in a report by Brown et al. [9], the recovery time from neuromuscular blockade with 0.25 mg/kg atracurium after succinylcholine administration was within the upper

limit of the normal range during nitrous oxide, oxygen, and fentanyl anesthesia. Additionally, in their study, Röckelein et al. [10] reported that the time of onset and duration of action indicated slightly increased sensitivity to atracurium after administration of 0.35 mg/kg atracurium with isoflurane.

Recently, however, there have been reports indicating slow onset of action and delayed recovery of neuromuscular function after administration of 0.6 mg/kg rocuronium. In patients without neuromuscular diseases, after induction of general anesthesia with 2 μg/kg fentanyl, and 2 mg/kg propofol, the onset time of neuromuscular blockade at the adductor pollicis with rocuronium, as determined by acceleromyography was reported to be 111.0 ± 34.8 s [11]. In contrast, in a patients with DM, Kendigelen et al. [12] reported complete neuromuscular block in 285-s with sevoflurane and remifentanil infusion. The authors explained that in patients with DM, reduced capillary blood flow to muscles because of perivascular inflammation results in slow diffusion of rocuronium from plasma to the neuromuscular junction. In another case, the onset time for neuromuscular blockade was also delayed for as long as 315-s, however, recovery of spontaneous respiration was observed 50 minutes after intubation with a similar anesthetic technique [13]. Although a similarly slow onset of action of rocuronium was observed in the present case, the duration of neuromuscular blockade was more prolonged than that reported in previous cases.

The speed of onset of action of NMBDs may be influenced by the drug potency, equilibrium between plasma and effect site, and receptor affinity. However, muscular blood flow might be a more important factor in case of perivasculopathy with DM. Moreover, patients with DM present with symptom of subacute progressive muscle weakness over several weeks to months. In the present case, the interval between disease onset and surgery was 8 months, which is shorter than the intervals reported in the previous case reports (5 years [9] and 1.5 years [12]). We are not aware of the complete recovery time for neuromuscular transmission abnormalities or perivasculopathy in subjects with DM. Perhaps, the active stage of DM might cause more delayed onset and prolonged duration of action of NMBDs. Although both atracurium and rocuronium are low-potency NMBDs with intermediate duration of action, it is difficult to explain the reason for the difference in onset time between the two on the basis of reduced muscular blood flow in DM. It might be attributable to differences in severity of perivascular inflammation, interval period, or other unknown factors in DM.

In the present case, we were apprehensive about the choice of reversal agent for NMBD at the end of surgery. Although several case reports have described the use of sugammadex in patients with various neuromuscular disorders, there is insufficient information about the response and complications of sugammadex usage in patients with DM. We could not predict the response of sugammadex to the prolonged duration of action of rocuronium and had to take care of hypersensitivity reactions and postoperative recurarization. Because there was no cardiopulmonary impairment or difficult airway management, we considered additional administration of sugammadex in case of insufficient recovery from neuromuscular blockade.

Although pyridostigmine has a relatively slow onset of action, because of its longer duration of action, we decided to observe for recovery of neuromuscular blockade after administration of pyridostigmine and glycopyrrolate. Most patients exhibiting four responses to TOF stimulation require approximately 10 to 15 minutes to reach a TOF ratio of 0.9 after administration of pyridostigmine. Muenster et al. [14] reported that in patients with Duchenne muscular dystrophy, administration of 0.1 mg/kg pyridostigmine upon recovery of T1 to 25% significantly decreased the recovery time of TOF from rocuronium-induced neuromuscular blockade to 90%. In our case, the TOF ratio reached 0.9 within 10 minutes of administration of 200 μg/kg pyridostigmine. Therefore, we speculate that a natural decrease in rocuronium concentration at the perijunctional area over time and a normal competitive antagonistic effect of pyridostigmine at the postsynaptic acetylcholine receptor resulted in normal recovery from NMBD in spite of the slow onset and prolonged duration of action of rocuronium due to vasculopathies in DM. Moreover, there were no changes in the function, structure or number of postsynaptic acetylcholine receptors in this case.

In general, in cases where profound neuromuscular blockade is still present at the end of surgery, pyridostigmine should be administered at a maximal dose of 350 μg/kg. However, because of the possibility of ceiling effect of anticholinesterases, we propose that sugammadex may be used an alternative reversal agent in case of brief surgical procedures or difficult airway management in patients with DM. The encapsulating formation of sugammadex and rocuroni-

um causes a rapid decrease in free rocuronium concentration in plasma and provides faster reversal in the absence of TOF response to neuromuscular blockade. In previous reports [11,12], the authors noted that administration of 2 mg/kg sugammadex could completely reverse neuromuscular blockade within a few minutes. This is similar to the normal recovery pattern in patients with DM.

We encountered a case of delayed onset and prolonged duration of neuromuscular blockade after administration of rocuronium in a patient with DM, where reversal was achieved within a normal duration by pyridostigmine administration. To ensure optimal perioperative care under general anesthesia for patients with DM, anesthesiologists should perform preoperative evaluation of cardiopulmonary dysfunction, record of the history of onset, and keep in mind the variable response to NMBDs among patients. Moreover, intraoperative neuromuscular monitoring should be performed for management of patients with delayed onset and prolonged duration of neuromuscular blockade.

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