CASE REPORT

Anesthesia in a patient with multiple-system atrophy using a combination of rocuronium and sugammadex

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Abstract : Multiple-system atrophy is an adult-onset progressive neurodegenerative disease affecting the central nervous system, including the spinal cord. There has been no perioperative guideline of the muscle relaxants used in multiple-system atrophy, although a recent article recommends anesthesiologists to use shorter-acting drugs at the lowest possible doses in the patients. Here, we document the first case with multiple-system atrophy undergoing surgery managed with a combination of rocuronium and sugammadex. The recovery time to the train-of-four count 2 after intravenous rocuronium 0.6 mg/kg, or the time from the start of sugammadex 2 mg/kg intravenously to the train-of-four ratio over 0.9 was prolonged in our case more than 20 and 2 minutes compared with those in healthy subjects, respectively. Neuromuscular monitoring, in addition to the careful vigilance in the perioperative period, seems mandatory in the patients. J. Med. Invest. 68 : 381-382, August, 2021

Keywords **:** *Multiple-system atrophy, rocuronium, sugammadex*

INTRODUCTION

Multiple-system atrophy is an adult-onset progressive neurodegenerative disease affecting the central nervous system, including the spinal cord (1). The estimated point prevalence is 7.8 per 100,000 among persons older than 40 years of age (1). Motor symptoms are common in patients with multiple-system atrophy, and sudden death occurs due to acute bilateral vocal-cord paralysis (1). There has been no perioperative guideline of the muscle relaxants used in multiple-system atrophy. However, a recent article recommends anesthesiologists use shorter-acting drugs at the lowest possible doses in the patients (2). Here, we document the first case with multiple-system atrophy undergoing surgery managed with a combination of rocuronium and sugammadex.

CASE REPORT

Informed consent to publication was obtained from the patient. A 70-year-old male (159 cm, 49.8 kg, BMI 19.7) was scheduled for anterior cervical fixation and the delayed posterior one due to cervical spondylotic myelopathy. He was diagnosed as probable multiple-system atrophy more than two years from the onset with the decreased perfusion of the cerebellar hemisphere and the symptoms, including urinary incontinence, orthostatic hypotension, and ataxia of the limbs (1). His preoperative pulmonary function testing revealed the obstructive respiratory abnormality (vital capacity 2.31 L [percent vital capacity 75% ; forced expiratory volume 0.7 L [forced expiratory volume percent in one second 37%]]), whereas his respiratory symptom was unremarkable. Upon the anterior fixation at the supine position, anesthesia was induced with remifentanil 0.5 μg/kg/min in combination with a propofol target-controlled infusion at 3 μg/ml. Neuromuscular monitoring (TOF Watch SX, Nihon Kohden, Tokyo, Japan) at the left adductor pollicis muscle by the ulnar nerve stimulation was initiated. The calibration of monitoring, including the 50 Hz-tetanus stimulation and train-of-four stimulation until the twitch height became stable, was completed. The train-of-four count reached zero at 1.9 minutes after rocuronium 0.6 mg/kg intravenously. The train-of-four count 2 reappearance time after rocuronium was 50.8 minutes, and sugammadex 2 mg/kg was administered for the motor-evoked-potential monitoring, leading to the train-of-four ratio over 0.9 at 4.8 minutes after the sugammadex. Upon the posterior cervical fixation two weeks later, anesthesia was induced with remifentanil (0.5 μg/kg/min) and propofol (target-controlled infusion 3 μg/ml) simultaneously. TOF-Cuff (RGB Medical Devices, Madrid, Spain) was employed at the left arm for neuromuscular monitoring after the Auto-Pilot mode's calibration since TOF Watch SX is unreliable at the prone position. The train-of-four count became 0 at 2 minutes after intravenous rocuronium 0.6 mg/kg ; train-of-four count 2 reappearance time after the rocuronium was 53 minutes ; the train-of-four ratio reached over 0.9 at 4 minutes after the sugammadex 2 mg/kg intravenously. Tracheal intubation in the patient was performed using a video laryngoscope (McGRATH™ MAC, MEDTRONIC JAPN CO., LTD., Tokyo, Japan). Body temperature measured using the built-in thermister toward a bladder indwelling balloon catheter maintained from 36.9 to 37.4℃ during the above neuromuscular monitoring. Neither respiratory complication nor refractory hypotension was noted during perioperative periods upon both surgical procedures.

DISCUSSION

In our patient, the recovery time to train-of-four count 2 after intravenous rocuronium 0.6 mg/kg (mean 51.9 minutes), or the time from the start of sugammadex 2 mg/kg intravenously to the train-of-four ratio over 0.9 (mean 4.4 minutes) was prolonged. Indeed, these values are more than 20 and 2 minutes compared

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with those in healthy subjects, respectively (3, 4). However, the dose requirement of vecuronium in a patient with olivopontocerebellar atrophy, one of the old categories of multiple-system atrophy, was reportedly normal (5). Therefore, further studies will require to conclude both compounds' pharmacological characteristics in patients with multiple-system atrophy.

We employed different neuromuscular monitoring systems, including TOF Watch SX using the acceleromyography principle and TOF-Cuff operating by another mechanism. The durations from the intravenous sugammadex to the train-of-four ratio reached over 0.9 were not significantly different between the patient's two-time exposure to rocuronium. These results indicate that both monitoring systems are clinically meaningful upon the perioperative management of patients with multiple-system atrophy, although a previous study indicated a possible underestimation of train-of-four ratios neuromuscular recovery period by TOF-Cuff (6).

A recent systematic literature search regarding multiple-system atrophy documented the intraoperative problems in patients with the disease state, including difficulties with airway management and hypotension (2). However, our patient did not show any respiratory complication or refractory hypotension during perioperative periods upon both surgical procedures. These results may result from the fact that the patient was probably in the late premotor phase of multiple-system atrophy only with urinary incontinence, orthostatic hypotension, and cerebellar features (1). Recent literature recommends clinicians use shorter-acting drugs at the lowest possible doses in patients with the disease since residual effects of intravenous and inhalational anesthetics, opioids, and muscle relaxants may influence their postoperative respiratory outcomes (2). Also, rapid sequence induction and tracheal intubation are desirable because there is an inherent risk of pulmonary aspiration from gastroparesis (2). It is critical to prepare for a difficult airway because muscle rigidity may result in difficulty with tracheal intubation in patients with multiple-system atrophy (2). Therefore, we administered the rocuronium dose expecting its rapid action at the time of tracheal intubation in our case. However, we do not have a clear recommendation about the optimal rocuronium initial dose upon anesthetic induction.

In conclusion, approximately 50% of patients with multiple-system atrophy require walking aids within three years after the onset of motor symptoms (1), and thus, neuromuscular monitoring and careful vigilance in the perioperative period seem mandatory in the patients.

DECLARATION OF CONFLICTING INTERESTS

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