



Antagonism of the Effect of Rocuronium with Sugammadex in a Patient with Myasthenia Gravis

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Abstract

Myasthenia Gravis (MG) is an autoimmune disorder which is characterized by the decrease of number, function, and capacity of ach receptors in muscle-nerve junctions. Anaesthesia is important patients with MG especially when they need muscle relaxants, which is a risky condition due to the possibility of postoperative residual neuromuscular blockage. Before the discovery of Sugammadex, cholinesterase inhibitors were used to reverse the effects of non-depolarising muscle relaxants to treat MG patients. In these cases, practitioners had to deal with several side effects in MG patients. Sugammadex encapsulates the steroid structured muscle relaxants and immediately reverses their effects. Therefore, anaesthesiologists started to use Sugammadex to decrease the need of postoperative residual blockage and mechanical ventilation. In this case report, we aim to share our experiences of Sugammadex use and relate readers how it eliminated the effect of rocuronium in an MG patient who underwent VATS.

Key Words: Myasthenia Gravis; Rocuronium; Sugammadex.

Myasthenia Gravisli Hastada Rokuronyum Etkisinin Sugammadex ile Antagonize Edilmesi

Özet

Myasthenia Gravis (MG), kas sinir kavşağında asetilkolin reseptörlerin sayı ve fonksiyon kapasitesinin azalması ile karakterize otoimmün bir hastalıktır. Myasthenia gravisli hastaların kas gevşetici kullanılması gereken durumlarda artmış postoperatif residüel nöromusküler blokaj riski nedeniyle anestezisi önem arz etmektedir. Sugammadexin keşfinden önce non depolarizan kas gevşeticilerin etkisini geri döndürmede kullanılan kolinesteraz inhibitörleri spesifik bir antagonist olmadığı gibi aynı zamanda MG hastaların tedavisinde de kullanılmaktadır. Bu durum MG'li hastalarda istenmeyen etkilere yol açabilmektedir. Sugammadex steroid yapılı kas gevşeticileri enkapsule ederek etkilerini hızlı bir şekilde ortadan kaldırır. Bu özelliğinden dolayı MG'li hastalarda postoperatif rezidüel blok ve mekanik ventilasyon gereksinimini azaltmak amacıyla anesteziistler tarafından kullanılmaya başlanmıştır. Bu olgu sunumunda, VATS yapılan bir hastada rokuronyumun etkisinin sugammadexle antagonize edilmesi ile ilgili deneyimimizi paylaşmayı amaçladık.

Anahtar Kelimeler: Myasthenia Gravis; Rokuronyum; Sugammadex.

INTRODUCTION

Myasthenia gravis (MG) is an autoimmune disease affecting neuromuscular transmission. Ophthalmoplegia, ptosis, and muscle weakness resulting from repetitive movements characterise the disease (1). The fact that autoantibodies that develop against the acetylcholine receptors reduce the number of acetylcholine receptors brings about sensitisation against non-depolarizing muscle relaxants (NDMBAs) in varying degrees while the effect of depolarising muscle relaxation is prolonged (1). In such cases, local and regional anaesthesia is usually the first option while neuromuscular blockade is also necessary for many surgical procedures (2). If the use of neuromuscular agents is required, practitioners should apply a short or medium term non-depolarising agent titrated with neuromuscular monitoring (1). These agents should be administered by taking their risks and benefits into consideration due to the fact that cholinesterase inhibitors may cause residual blocking and cholinergic crisis (2).

A newly developed drug with its cyclodextrin structure, Sugammadex is capable of undoing neuromuscular blockade performed by steroid muscle relaxants at all levels. Sugammadex selectively encapsulates steroid muscle relaxant molecules and quickly eliminates their effect (3).

In this study, we aim to share our experiences of an MG patient who underwent video-assisted thoracoscopic surgery (VATS) during which we antagonised the effects of rocuronium by using Sugammadex.

CASE REPORT

A 48-year-old male patient (86kg) was diagnosed with myasthenia gravis following a series of tests performed 2 months ago when he presented with repetitive muscle weakness and ptosis complaints. The results of these tests also showed thymus hyperplasia. When the 2x60 mg/day pyridostigmine treatment did not help in declining the complaints, the patient was scheduled for a thymectomy surgery with VATS. The patient did not undergo any premedication before the operation. The

noninvasive arterial blood pressure, electrocardiography, and pulse oximetry was monitored. The neuromuscular block was placed in the left ulnar nerve with train-of-four (TOF) method for monitoring.

After a 2-to-3-minute preoxygenation with 100% O₂, the induction of anaesthesia was achieved with 100 mcg of fentanyl and 180 mg of propofol. After the loss of eyelash reflex, the patient was ventilated with a mask. Then we performed TOF calibration, we administered 40 mg of rocuronium as the induction dose. As the TOF value dropped down to 0% 95 seconds after the rocuronium injection, the patient was intubated with a 37 F left double-lumen tube. The anaesthesia was maintained at 50% O₂ - 50% air and we administered 6% desflurane controlled air ventilation and 0.5 mcg/h remifentanyl infusion. After checking the location of the tube with fiberoptic bronchoscope in the left lateral position, we started one lung ventilation. During the intraoperative process, the hemodynamic data of the patient were stable and the patient did not need additional muscle relaxants. Following a 170-minute operation, we stopped the remifentanyl and desflurane and put the patient in supine position. The TOF value was 60% and we started 200 mg iv sugammadex. In 60 seconds, the TOF value rose up to 93% and, after 2 minutes, the patient had spontaneous 450-500 ml breathing creating 20-25 cmH₂O negative pressure along with spontaneous opening of the eyes upon which we extubated the patient. In the postoperative period, the patient spent 4 hours in the intensive care unit with stable hemodynamic data. We did not observe any residual neuromuscular blockade either. So we transferred the patient to the service floor.

DISCUSSION

Myasthenia gravis is an autoimmune disease of the neuromuscular junction characterized by development of autoantibodies (IgG) against postsynaptic acetylcholine receptors. Patients suffer from skeletal muscle weakness and fatigability as well as exacerbations and remissions. It often accompanies thymus gland abnormalities. Hyperplasia of the thymus gland is seen in more than 70% of the patients while 10%-15% of the patients have thymoma. In addition to pharmacological treatment, thymectomy is a widely applied surgical treatment option for MG patients (1).

VATS is considered to be an alternative method to minimal invasive surgery due to decreased postoperative pain, early mobilisation, and shorter hospital stay it offers. However, unlike open surgery, VATS requires one lung ventilation (OLV). Because OLV requires a double lumen endobronchial tube (DLT), a deeper muscle relaxation is needed compared to single-lumen tube application (2). However, anaesthesiologists do not prefer to use muscle relaxants in patients with MG. If using muscle relaxant is really ineluctable, practitioners should use low doses of agents with short and medium-term effects and monitor the neuromuscular cycle (1).

A great number of studies report that short-term mivacurium was safely used in MG patients after reducing the dose which ensured suitable intubation conditions as well as seamless extubation in the postoperative period in the majority of patients (4, 5). Because of plasmapheresis or pyridostigmine administration, butyrylcholinesterase activity may be decreased in myasthenic patients, which may eventually result in prolonged mivacurium connected blockade in the preoperative period.

Long-acting neuromuscular blocking drugs should be avoided in MG patients. By reducing the effect of NDMBAs like rocuronium, vecuronium, and cisatracurium by 50%, adequate muscle relaxation can be achieved in MG patients (2). Before the development of Sugammadex, cholinesterase inhibitors were the only option to fix the non-depolarizing muscle relaxant related neuromuscular block. Because these agents may be ineffective when used chronically and since they are able to induce cholinergic crisis, which is almost impossible to clinically distinguish from myasthenia crisis, they should be used with caution in myasthenic patients (1).

Several anaesthetic techniques have been used in myasthenic patients. Central nerve blocks can be preferred to peripheral nerve blocks in extremity surgery methods. For patients under general anaesthesia, this can be achieved either by total intravenous anaesthesia or inhalation anaesthetics (4-7). In such cases, practitioners usually prefer anaesthesia based on volatile agents. Since inhalation anaesthetics can provide muscle relaxation, myasthenic patients's need for additional muscle relaxants during the operation is minimised. Due to MG patients' low blood solubility, practitioners favour desflurane and sevoflurane (7). In our case, we preferred desflurane as the inhalation anesthetics and finalised the operation without the need of additional muscle relaxants. Kiran et al. (8) have shown that sevoflurane has provided adequate muscle relaxation in MG patients undergoing sternal thymectomy.

Sugammadex is able to swiftly eliminate the effect of even a steroid-based NDMBA in the first 3 minutes of application. According to the density of the block, 2 to 16 mg/kg of Sugammadex may be administered (3). The studies and case reports on the use of the drug on patients with MG have shown that 2-4 mg/kg Sugammadex helps practitioners extubate patients smoothly without the need for mechanical ventilation (2, 9, 10).

In their case report of an MG patient, Karaman et al. (11) have shown that using Sugammadex, the specific antidote of rocuronium, not only helps good intubation and surgical conditions but also eliminates the need for postoperative mechanical ventilation.

In their study on 10 patients who underwent VATS due to MG, Sungur et al. (2) have similarly reported that they have successfully antagonised the effects of rocuronium by using Sugammadex. They further state that all of their

patients were extubated in the operation room without any residual neuromuscular signs in the postoperative period.

RESULTS

In MG patients, there is always the risk of an increased susceptibility to non-depolarizing muscle relaxants along with a likewise increased risk of residual blocks in postoperative period. However, studies and case reports on patients with MG, parallel to our case, have shown that Sugammadex is successful in quickly antagonising the effects of steroid muscle relaxants while it also eliminates mechanical respiratory support requirements in the postoperative period.

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