Sugammadex as the reversal agent for rocuronium in a patient with autosomal dominant cerebellar ataxia: a case report

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Abstract

Autosomal dominant cerebellar ataxias are a group of neurodegenerative disorders with variable involvement of the central and peripheral nervous systems. A major anesthetic concern in these patients is the potential hypersensitivity to non-depolarizing neuromuscular blockers. Sugammadex is a unique neuromuscular reversal agent which acts by directly binding to aminosteroid non-depolarizing muscle relaxants, such as rocuronium. Sugammadex was first approved in Canada in February 2016. One of its main indications is in patients with muscular or neuromuscular diseases. We demonstrated the use of rocuronium with sugammadex as the reversal agent in a patient with an autosomal dominant cerebellar ataxia undergoing laparoscopic bilateral tubal ligation.

Introduction

Hereditary ataxias are a group of neurodegenerative disorders characterized by uncoordinated movements, staggering gait, truncal imbalance, dysarthria, and nystagmus. The pathophysiology of hereditary ataxia describes variable involvement of the cerebellum, spinocerebellar tracts, basal ganglia, spinal cord, and peripheral nerves. The subtypes of hereditary ataxias are associated with various genetic alleles and phenotypic variants.[1] Hereditary ataxia can be inherited in an autosomal dominant or autosomal recessive manner.

Currently, over 30 subtypes of autosomal dominant cerebellar ataxias (ADCA) have been identified.[1] The prevalence of ADCA is approximately 1 to 5 per 100,000.[2] In comparison, Friedreich ataxia, the most common hereditary ataxia, is inherited in an autosomal recessive manner and has a prevalence of 1 per 50,000.[3]

The anesthetic management of hereditary ataxia raises a number of concerns. Due to the low prevalence of ADCA, there are limited studies on safe anesthetic management of patients with ADCA, rendering case reports the main source of evidence-based practice. The use of regional anesthesia in patients with neurodegenerative diseases may cause progression of neurological deficits.[4] These patients may also have unpredictable responses to neuromuscular blockade. Variable sensitivity to non-depolarizing neuromuscular blockers has been widely reported among patients with hereditary ataxia.[5-9] In addition, there may be a tendency to develop hyperkalemia with the administration of depolarizing neuromuscular blockers.[5] Succinylcholine and barbiturates have also been reported to cause prolonged apnea in some patients with Huntington's chorea.[10,11]

Sugammadex is a unique neuromuscular reversal agent. It reverses neuromuscular blockade by directly binding to aminosteroid non-depolarizing muscle relaxants, such as rocuronium and vecuronium. Sugammadex was first approved in Canada in February 2016.[12] One of its main indications is for use in patients with muscular or neuromuscular disease. However, there are no randomized controlled studies on its use in these patients. Most evidence has been in the form of anecdotal case reports.[13]

To our knowledge, this case report is the first to discuss the use of sugammadex as the reversal agent for rocuronium in a patient with ADCA undergoing laparoscopic bilateral tubal ligation.

Case

Written consent for publication was obtained from the patient. A 43-year-old female with ADCA scheduled for laparoscopic bilateral tubal ligation was first seen in the pre-anesthetic clinic 2 weeks prior to the scheduled surgery. She first presented 2 years ago to her family practitioner with a 6-month history of neurological symptoms, including poor hand coordination, imbalance with frequent falls, and slurred speech. She had no visual, auditory, or cognitive problems. She denied seizures and had no difficulty swallowing. Her past medical history included an uneventful caesarean section under spinal anesthesia ten years ago. Her family history included a mother, grandmother, the sister of her mother, and her son being diagnosed with ADCA. Her son had a mutation of the ATP8 gene and was under follow-up by a neurologist. Her only regular medication was citalopram 10 mg at night. On examination, she had mild dysarthria, wide-based, staggering gait, poor coordination on fingers-to-nose test, and inability to perform rapid alternating movements. The rest of the examination was normal, as were other routine preoperative tests, including ECG, electrolytes, urea, creatinine, and complete blood count.

The surgical procedure, anesthetic plan, and risks involved were discussed with the patient and consent was obtained. She was to undergo general anesthesia using muscle relaxant and endotracheal

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intubation with positive pressure ventilation. After overnight fasting, she was taken to the operating room. She was monitored with ECG, oxygen saturation, noninvasive blood pressure (3-minute intervals), capnography, end tidal carbon dioxide and volatile agent, and train of four (TOF) monitoring. Pre-oxygenation was employed. She was induced with propofol 3 mg/kg, fentanyl 2 mcg/kg, and rocuronium 0.6 mg/kg. She was intubated with a size 7 endotracheal tube approximately 90 seconds later. Air entry was adequate and endotracheal tube was confirmed with capnography.

Anesthesia was maintained with 50% oxygen in air and 1 minimum alveolar concentration (MAC) of desflurane. Hydromorphone 0.5 mg in total was given intraoperatively in divided doses. Dexamethasone 4 mg was given at the beginning and ondansetron 4 mg was given at the end of the procedure. Intravenous ketorolac 30 mg and Tylenol suppository 650 mg were given upon completion of the procedure. She did not require any further muscle relaxant during the procedure. Hemodynamics were stable and no anesthetic or surgical complications were encountered during the operation. The procedure lasted one hour. At the end of the procedure, her TOF score was 3/4 with fade, and she was reversed with sugammadex 2 mg/kg. She was extubated uneventfully and transferred to the recovery area breathing spontaneously. The patient was discharged home on the same day as per routine discharge criteria.

Discussion

One of the major anesthetic concerns in our patient with ADCA is the potential variable response to non-depolarizing neuromuscular blockers.[5-9] Hypersensitivity to rocuronium can cause incomplete reversal, impaired respiratory function, possible desaturation, re-intubation, unplanned ICU admission, and delayed recovery and discharge.

Regional anesthesia would avoid the use of non-depolarizing neuromuscular blockers. Although regional anesthesia may worsen neurological deficits in patients with existing neurodegenerative disorders, it has been previously described in patients with cerebellar ataxia.[14-16] Rofaeel et al. demonstrated labour epidural anesthesia in a patient with ADCA with no neurological sequelae up to two years post-delivery.[14] Another patient with olivopontocerebellar degeneration underwent uneventful vaginal hysterectomy with combined spinal-epidural anesthesia.[15] Spinal anesthesia has also been reported in a patient with Friedreich ataxia.[16]

The use of general anesthesia without muscle relaxant has been reported in patients with hereditary ataxia. Pancaro et al. reported the use of propofol and sufentanil to facilitate intubation, followed by remifentanil and propofol infusion with the use of bispectral index monitoring for maintenance of anesthesia.[17]

In our patient with ADCA, we elected to use general anesthesia with rocuronium instead of regional anesthesia or general anesthesia without muscle paralysis because we determined that it would provide the best anesthetic for laparoscopic surgery in our setting. Laparoscopic surgery has been traditionally performed under general anesthesia with muscle paralysis due to respiratory changes caused by the creation of pneumoperitoneum. In addition, studies have shown that muscle paralysis reduces intra-abdominal pressure, provides ideal surgical conditions, and reduces surgical time and complications, such as iatrogenic injury.[18,19] Although regional anesthesia has been used in laparoscopic procedures, Bajwa et al. concluded that the anesthetic technique for laparoscopic procedures remains a debatable issue and frequently depends on the experience of the anesthesiologist.[20]

Our patient received 0.6 mg/kg of rocuronium for intubation, which is the recommended intubating dose. After a duration of one hour, her TOF count was only 3 with significant fade, suggestive of a degree of hypersensitivity to neuromuscular blockade. Neostigmine is an acetylcholinesterase inhibitor traditionally used for the indirect reversal of non-depolarizing neuromuscular relaxants. It is routinely used for neuromuscular reversal in patients with no neuromuscular diseases. However, several studies have shown that rapid reversal to a TOF ratio of greater than 0.9 is not guaranteed in all patients despite administration of neostigmine at a TOF count of 4.[21-23] Neostigmine also has unpredictable efficacy and produces undesirable autonomic responses, such as bradycardia, hypotension, and bronchoconstriction.[24]

Given that our patient had ADCA, it was even more prudent to ensure adequate reversal. We opted to use sugammadex as the reversal agent instead of neostigmine in order to avoid the risk of inadequate reversal due to hypersensitivity to rocuronium. Sugammadex is a selective relaxant-binding agent which reverses neuromuscular blockade by directly binding to rocuronium or vecuronium. Compared to neostigmine, sugammadex provides faster and more predictable reversal of any degree of block, has a better safety profile, reduces postoperative residual paralysis, and enables more efficient use of healthcare resources.[24]

Conclusion

Overall, this case report demonstrates the safe use of rocuronium with sugammadex in a patient with ADCA. Given the low prevalence of ADCA and other forms of hereditary ataxias, comprehensive randomized controlled trials on the effects of neuromuscular blockade in this population are lacking. This is unfortunate as these patients are most susceptible to complications from neuromuscular blockade. This case report successfully demonstrates effective reversal of rocuronium with sugammadex in a patient with hypersensitivity to non-depolarizing neuromuscular blockade. While case reports provide some evidence for clinical practice, findings cannot be generalized to the wider population of patients with hereditary ataxias. Further research in the form of randomized controlled trials will be required to examine the risks and benefits of sugammadex in hereditary ataxias.

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