IBIMA Publishing
International Journal of Case Reports in Medicine
http://www.ibimapublishing.com/journals/IJCRM/ijcrm.html
Vol. 2013 (2013), Article ID 362694, 4 pages
DOI: 10.5171/2013.362694

Case Report

Sugammadex Use in the Reversal of Deep Neuromuscular Block in a Six-Year-Old Child after an Emergency Procedure in Ear, Nose and Throat Surgery Department

Paolo Murabito, Giovanni Savarino, Caren Conticello, Marco Farina, Carmela Stissi and Marinella Astuto

Department of Anaesthesia and Intensive Care, "Policlinico" University Hospital, Catania, Italy

Correspondence should be addressed to: Paolo Murabito; paolomurabito@tiscali.it

Received 25 April 2013; Accepted 28 May 2013; Published 4 July 2013

Academic Editor: Tommaso Pellis

Abstract

Tonsillectomy is a frequently performed procedure in children; its common postoperative complication is bleeding. We present a case report of a 6-year-old patient undergoing surgical haemostasis after an acute post-tonsillectomy bleeding.

A rapid intubation sequence was performed to reduce the risk of blood inhalation and bronchospasm: fentanyl (1 mcg/kg) and propofol (3mg/Kg) were used for a rapid induction of anaesthesia, and rocuronium (1.2 mg/Kg) was used for neuromuscular block.

Neuromuscular function was monitored using the TOF-Watch SX acceleromyography at the adductor thumb muscle. Surgical haemostasis lasted for 12 minutes after rocuronium administration, so the neuromuscular block was still deep (TOF 0, PTC 2).

Sugammadex (4mg/Kg) was administered to allow a rapid reversal of the block. After the sugammadex bolus, we started a continuous monitoring with TOF-Watch SX until a TOF ratio of 0.9 was reached. A TOF ratio of 0.9 was reached 3 minutes after the administration of sugammadex. The patient was then extubated in the operating room and monitored in recovery room for 60 minutes. No further complications arose, either in the recovery room or in the ward.

Keywords: Children, sugammadex, deep block, PORC, rapid sequence intubation, tonsillectomy.

Introduction

Tonsillectomy is a surgical procedure indicated for a great variety of disorders, including recurrent tonsillitis, peritonsillar abscess, tonsillar hypertrophy with obstructive sleep disorders, and staging in cases of malignant lymphoma. It is also one of the most frequently performed procedures in children (Krishna and Lee 2001; Mattila et al. 2001; Kontorinis and Schwab 2011).

Cite this Article as: Paolo Murabito, Giovanni Savarino, Caren Conticello, Marco Farina, Carmela Stissi and Marinella Astuto (2013), "Sugammadex Use in the Reversal of Deep Neuromuscular Block in a Six-Year-Old Child after an Emergency Procedure in Ear, Nose and Throat Surgery Department," International Journal of Case Reports in Medicine, Vol. 2013 (2013), Article ID 362694, DOI: 10.5171/2013.362694

Postoperative complications following tonsillectomy historically fall into two major categories: haemorrhage and airway problems, such as aspiration, acute pulmonary edema, bronchospasm and laryngospasm (Randall and Hoffer 1998).

Over the years, the incidence of post-tonsillectomy bleeding (reported between 0% and 20%) has decreased, but continues to pose serious problems (Handler, Miller et al. 1986).

Sugammadex is a modified gamma-cyclodextrin, developed as a reversal agent for steroidal neuromuscular blocking drugs.

It forms a tight one-to-one complex with rocuronium (or vecuronium), encapsulating the drug in the plasma and hence reducing its concentration at the neuromuscular junction and rapidly reversing the block (Naguib 2007).

Sugammadex is biologically inactive; it does not bind to plasma proteins and it is safe and well tolerated.

It can also reverse very deep neuromuscular blockade induced by rocuronium reducing the risk of postoperative residual curarization (PORC) (Jones et al. 2008).

Sugammadex, in addition, facilitates the use of rocuronium for rapid sequence induction of anaesthesia because it has an onset-offset profile that is faster than 1.0 mg/kg succinylcholine (Lee et al. 2009).

The clinical use of sugammadex contributes to eliminate many limits in our current practice in the reversal of rocuronium and possibly other steroidal neuromuscular blockers.

The novelty that we want to highlight in our case report is the use of sugammadex to reverse a deep neuromuscular block. The data found in the literature concerns, instead, the reversal from a moderate block.

Case Report

A six-year-old boy, weighing 27 Kg, classified as American Society Anesthesiologists (ASA) I, was listed for elective tonsillectomy. Written informed consent for the anaesthesia was obtained from his parents.

Upon arrival in the operating room, in order to obtain a painless venous access, sevoflurane, nitrous oxide, and oxygen were used for induction, so an i.v. cannula was placed. While the intravenous access was secured, routine monitoring of ECG, pulse oximetry, and automated noninvasive blood pressure was started.

The patient received a continuous infusion of remifentanil 0.5 μg kg^{-1} min^{-1}; after 4 min, he received propofol. Propofol was administrated in TCI, using the Alaris Asena PK syringe pump (Alaris Medical System, Basingstoke, UK), and the pharmacokinetic parameters used were those determined by Kataria et al. based on a pediatric model.

Four minutes after the beginning of propofol infusion, laryngoscopy and tracheal intubation were performed using a Macintosh laryngoscope.

Neuromuscular blocking agents were not used either for intubation or for maintenance, according to an internal guideline for this kind of procedures in children. Pain control was achieved by the administration of acetaminophen 15 mg/Kg and morphine 0.05 mg/Kg. At the end of the operation, the patient was admitted to the recovery room for postoperative monitoring, but, after 15 minutes, an important bleeding was observed and the patient was transferred immediately to the operating room for surgical haemostasis.

A rapid sequence intubation, avoiding mask ventilation, was performed by means of propofol (3mg/kg), fentanyl (1 mcg/Kg), and rocuronium (1.2 mg/kg) in bolus. Anaesthesia was maintained with

sevoflurane 2%. Surgical haemostasis lasted for about 12 minutes. Neuromuscular function was monitored using Train of Four (TOF) nerve stimulation and acceleromyography (TOF-Watch SX) at the adductor thumb muscle, starting after the induction of anaesthesia. TOF and PTC (Post-Tetanic Count) were assessed to evaluate the depth of the block.

At the end of the procedure, the neuromuscular block was still deep (TOF 0, PTC 2); therefore, we administered 4 mg/Kg of sugammadex to allow a rapid reversal of the block. After the sugammadex bolus, we started a continuous monitoring with TOF-Watch SX until a TOF ratio of 0.9 was reached. A TOF ratio of 0.9 was reached 3 minutes after the administration of sugammadex.

The patient was then extubated in the operating room and monitored in recovery room for 60 minutes. No further complications arose, either in the recovery room or in the ward.

Pain intensity was assessed through Wong Baker Scale (Face Scale) both in the recovery room and in the ward. Reported pain was of 4 in the recovery room; in the ward measurement, it went down to 3, so no treatment was reckoned as necessary.

Discussion

We developed an internal protocol that does not include the use of neuromuscular blocking agents for tonsillectomy procedure in children, neither for intubation nor for maintenance. During tonsillectomy in fact, intubation is necessary but neuromuscular block is not required to facilitate surgical access (Bartolek et al. 2012; Minardi et al. 2012).

In order to allow the surgical haemostasis for the acute bleeding, a rapid intubation sequence was performed to reduce the risk of blood inhalation and bronchospasm. Rocuronium was therefore used to accelerate the procedure and improve the opportunity of successful intubation.

The commonly used dose of rocuronium for induction of anaesthesia is 0.3–0.6 mg/Kg. Higher doses reduce the onset time and increase the duration of action: this effect is useful for a rapid sequence intubation, but inappropriate in situations where rapid recovery of neuromuscular function is required, for the risk of post-operative residual curarization (PORC) (Magorian et al. 1993).

Recent studies show that the intraoperative use of muscle relaxants and the possible residual neuromuscular block (PORC) are significant risk factors in anaesthetic-related morbidity and mortality (Murphy and Brull 2010).

Studies on volunteers prove that even minimal values of residual paralysis (TOF ratio 0.7–0.9) are correlated with the weakness of the upper airway muscles and impaired pharyngeal function and may lead to a higher risk of inhalation and airway obstruction. Clinical studies have also identified adverse postoperative events related to the intraoperative use of muscle relaxants (Murphy and Brull 2010).

For what concerns the decurarization strategy, anticholinesterases are useful to antagonize a superficial block, but are ineffective for the reversal of a deep block, and entail a significant side effect profile (Meretoja 2010). Therefore, having to reverse a deep block, we chose to use sugammadex, even though there are very few data in the literature on the use of sugammadex to reverse a deep block in children.

The new approach to achieve both rapid onset and rapid recovery from deep neuromuscular block involves, respectively, high doses of rocuronium and a corresponding dose of sugammadex, according to the level of the block at the end of the procedure.

In the technical note of sugammadex, even if no indications for infants are reported, there is a specific database for the use of sugammadex to reverse deep block in

pediatric patients, in which the safety profile is similar to that one of adult patients.

In this circumstance, we felt that the risks connected to prolonged ventilation, such as bronchospasm, blood inhalation and ingestion, justified the “off label” use of sugammadex.

There are few data in literature about sugammadex administration in children. Perhaps our experience could work as an incitement to start further investigations on the uses of sugammadex in children.

References

Bartolek, D., Jakobovic, J., Bartolek, F., Finci, D. & Munjiza, A. (2010). "Reduced-Dose Rocuronium for Day-Case Tonsillectomy in Children Where Volatile Anaesthetics are Not Used: Operating Room Time Saving," *Paediatric Anaesthesia;* 20(1):47-55.

Handler, S. D., et al., (1986). "Post-Tonsillectomy Hemorrhage: Incidence, Prevention and Management," *The Laryngoscope,* 96(11): P. 1243-7.

Jones, R. K., et al., (2008). "Reversal of Profound Rocuronium-Induced Blockade with Sugammadex: A Randomized Comparison with Neostigmine," *Anesthesiology,* 109(5): P. 816-24.

Kataria, B. K., Ved, S. A., Nicodemus, H. F., Hoy, G. R., Lea, D., et al. (1994). "The Pharmacokinetics of Propofol in Children Using Three Different Data Analysisapproaches," *Anesthesiology* 80: 104-122.

Kontorinis, G. & Schwab, B. (2011). "Significance of Advanced Haemostasis Investigation in Recurrent, Severe Post-Tonsillectomy Bleeding," *The Journal of Laryngology & Otology,* 125(9): P. 952-7.

Krishna, P. & Lee, D. (2001). "Post-Tonsillectomy Bleeding: A Meta-Analysis," *The Laryngoscope,* 111(8): P. 1358-61.

Lee, C., et al., (2009). "Reversal of Profound Neuromuscular Block by Sugammadex Administered Three Minutes after Rocuronium: A Comparison with Spontaneous Recovery from Succinylcholine," *Anesthesiology,* 110(5): P. 1020-5.

Magorian, T., Flannery, K. B. & Miller, R. D. (1993). "Comparison of Rocuronium, Succinylcholine, and Vecuronium for Rapid-Sequence Induction of Anesthesia in Adult Patients," *Anesthesiology,* 79(5): P. 913-8.

Mattila, P. S., et al., (2001). "Causes of Tonsillar Disease and Frequency of Tonsillectomy Operations," *Archives of Otolaryngology Head & Neck Surgery,* 127(1): P. 37-44.

Meretoja, O. A. (2010). "Neuromuscular Block and Current Treatment Strategies for Its Reversal in Children," *Pediatric Anesthesia,* 20(7): P. 591-604.

Minardi, C., Astuto, M., Spinello, C. M., Pagano, L., Pellegrino, S., et al. (2012). "Dose-Response of Propofol for Tracheal Intubation in Children Correlated to Intubation Condition Score and Cerebral State Index. Randomized, Double-Blinded Trial," *Journal of Anesthesia & Clinical Research,* 3:202.

Murphy, G. S. & Brull, S. J. (2010). "Residual Neuromuscular Block: Lessons Unlearned. Part I: Definitions, Incidence, and Adverse Physiologic Effects of Residual Neuromuscular Block," *Anesthesia & Analgesia,* 111(1): P. 120-8.

Naguib, M. (2007). "Sugammadex: Another Milestone in Clinical Neuromuscular Pharmacology," *Anesthesia & Analgesia,* 104(3): P. 575-81.

Randall, D. A. & Hoffer, M. E. (1998). "Complications of Tonsillectomy and Adenoidectomy," *Otolaryngology--Head and Neck Surgery,* 118(1): P. 61-8.

Rigouzzo, A., Servin, F. & Constant, I. (2010). "Pharmacokinetic-Pharmacodynamic Modeling of Propofol in Children," *Anesthesiology,* 113: 343-352.