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CLINICAL INFORMATION

Rocuronium and sugammadex in a 3 days old neonate for draining an ovarian cyst. Neuromuscular management and review of the literature



Ricardo Vieira Carlos^{a,*}, Marcelo Luis Abramides Torres^a, Hans D. de Boer^b

^a Department of Anesthesiology, Instituto da Criança, Hospital das Clínicas, Faculdade de Medicina, Universidade de São Paulo, São Paulo, SP, Brazil

^b Department of Anesthesiology and Pain Medicine, Martini General Hospital Groningen, Groningen, The Netherlands

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Abstract A case is reported in which a 3-days old neonate with a giant ovarian cyst was scheduled for surgery. The patient received a dose of sugammadex to reverse a rocuronium-induced neuromuscular block. A fast and efficient recovery from neuromuscular block was achieved within 90 s. No adverse events or other safety concerns were observed. Furthermore, a review of the literature on the use of sugammadex in neonates was performed.

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PALAVRAS-CHAVE

Recém-nascidos;
Cisto ovariano;
Sugammadex;
Rocurônio;
Agente de reversão

Rocurônio e sugamadex em recém-nascido de 3 dias para drenagem de um cisto ovariano. Controle neuromuscular e revisão da literatura

Resumo Relato do caso de uma criança recém-nascida de 3 dias de idade com um cisto ovariano gigante programada para a cirurgia. A paciente recebeu uma dose de sugamadex para reverter o bloqueio neuromuscular induzido por rocurônio. Uma recuperação rápida e eficiente do bloqueio neuromuscular foi obtida dentro de 90 segundos. Não foram observados efeitos adversos ou outros problemas de segurança. Além disso, uma revisão da literatura sobre o uso de sugamadex em recém-nascidos foi realizada.

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* Corresponding author.

E-mail: ricardovieirac@gmail.com (R.V. Carlos).

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Introduction

Neonatal ovarian cysts are uncommon. The incidence of these cysts is 1/2500 live birth and are often detected during antenatal echography in the late pregnancy.¹⁻³ These cysts are associated with prenatal and postnatal complications like ovarian torsion which could lead to ovarian loss, especially in voluminous cysts.¹ Therefore, the management of these ovarian cysts include observation and surgical intervention when symptomatic.^{1,2}

Rocuronium is a commonly used neuromuscular blocking agent (NMBA) in clinical anesthesia and administered in all age groups, including neonates. Sugammadex is the first selective relaxant binding agent designed to reverse a neuromuscular block (NMB) induced by either rocuronium or vecuronium. Sugammadex has been investigated in adults and children older than 4 years of age, but there is limited data available about the efficacy and safety of sugammadex reversal of a rocuronium-induced NMB in neonates.^{3,4}

We report a case in which a 3 days old neonate with a giant ovarian cyst received a dose of sugammadex to reverse a rocuronium-induced deep NMB. The safety and efficacy of sugammadex are discussed. Furthermore, a review of the literature on the use of sugammadex in neonates was performed.

Case report

A 3 days-old female neonate (weight 2.98 kg) presented with a giant ovarian cyst with a volume of 180 mL confirmed by ultrasonography. Physical examination revealed a palpable mass in the abdominal region. Further examination showed no other pathology. After obtaining informed consent from the mother, the neonate was scheduled for open surgery to drain the cyst under general anesthesia.

An intravenous (IV) line was inserted previously. Standard intraoperative monitoring included ECG, NIBP, pulse oximetry, capnography, anesthetic gas analyzer and esophageal thermometer. The neuromuscular function was monitored using train-of-four (TOF) stimulation of the ulnar nerve and was quantitated with acceleromyography (TOF-Watch™ SX, Schering-Plough Ireland Ltd., Dublin, Ireland). The primary efficacy variable for reversal was defined as the time from the start of the administration of sugammadex, to recovery of the TOF-ratio to 0.9.

After preoxygenation, anesthesia was induced with sevoflurane through facial mask and intravenous opioid. Procedures for the set-up, calibration and stabilization of neuromuscular monitoring were executed. The patient then received an IV bolus injection of rocuronium 0.9 mg kg⁻¹. This was followed by endotracheal intubation, and the lungs were ventilated with a mixture of oxygen and air in a ratio of 2:3. The surgical procedure was uneventful, 240 mL of fluid was drained from the ovarian cyst and a partial oophorectomy was performed. The duration of anesthesia was 75 min. At the end of the procedure neuromuscular monitoring showed one post-tetanic count (PTC 1), indicating a deep NMB. Reversal of rocuronium-induced NMB was performed by administration of 4.0 mg kg⁻¹ sugammadex (12 mg). The time to recovery from rocuronium-induced

NMB to a TOF-ratio of 0.9 was 90 s. No changes from baseline were observed in blood pressure or heart rate after administration of the sugammadex dose. Eighth minutes after the administration of sugammadex the trachea was extubated and the patient was discharged to the neonatal care. The patient's recovery from anesthesia was uneventful and no signs of residual NMB or recurarization were observed.

Review of the literature

The review of the literature was performed in PubMed and in personal archives of both authors with search criteria sugammadex and neonates. Inclusion criteria were: neonates treated with sugammadex, articles in English language. These publications were collected and analyzed. The literature search on sugammadex and neonates showed only two publications which met the inclusion criteria (none in Pubmed) in which 24 patients were described and will be discussed in Section "Discussion".^{4,5}

Discussion

The reversal of a rocuronium-induced profound NMB with sugammadex 4.0 mg kg⁻¹ in our patient was fast, complete and without signs of postoperative residual curarization (PORC) or recurarization. Sugammadex was safe and well tolerated. Reversal of NMB is important for the acceleration of the patient's recovery and the prevention of PORC. Rocuronium-induced NMB can be reversed by cholinesterase inhibitors. However, reversal of NMB with cholinesterase inhibitors (in combination with muscarinic antagonists) has limitations due to its mechanism of action (ineffective against profound NMB) and is often associated with undesirable cholinergic side-effects.

Sugammadex is able to bind the steroidal NMB drug rocuronium or vecuronium, forming a complex. Encapsulation of the rocuronium molecule by sugammadex results in a rapid decrease in free rocuronium in the plasma and subsequently at the nicotinic receptor at the motor endplate, leading to a rapid reappearance of muscle activity. After encapsulation, rocuronium is not available to bind to the nicotinic receptor in the neuromuscular junction. This promotes the liberation of acetylcholine receptors, and muscle activity reappears.

Discussion of the review of the literature

In two publications 24 neonatal cases in which sugammadex was administered were described.^{4,5} In one publication a 20 day-old patient (weight 2.6 kg) received 12 mg sugammadex to reverse a rocuronium-induced deep neuromuscular block. Within 2 min the TOF-ratio recovered >0.9. No concerns about safety related to sugammadex were reported.⁵ In the other publication 23 patients were reported who were divided into two groups: A, 1 day old ($n=8$, mean weight [kg and SD] 2.8 [0.8]) and B, 1-7 days old ($n=15$, mean weight [kg and SD] 2.4 [0.8]).⁴ All neonates received sugammadex 4.0 mg kg⁻¹ for reversal of a rocuronium-induced deep NMB. The recovery to a TOF-ratio was in group A 1.4 (0.9) (min and SD) and 1.2 (0.5) respectively. Sugammadex was safe

and well tolerated. In all patients the recovery was fast and complete.

The results of our patient were in line with the results found in the literature and doses of sugammadex 4.0 mg kg^{-1} produced similar recovery times as in other age groups.³ Therefore dosing and recovery times are identical in all age groups and the use of sugammadex in neonates may be also comparable beneficial as shown in other patients age groups. This has to be confirmed in more cases or dedicated studies. Furthermore, neuromuscular management in neonates should also consist of the choice of an appropriate NMBA, objective neuromuscular monitoring and adequate reversal to prevent PORC.

Disclosure

Ethical approval: no ethical approval was necessary; the mother consented her approval for publication.

Conflicts of interest

The authors declare no conflicts of interest.

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