Rev Bras Anestesiol. 2015;65(4):240–243

REVISTA BRASILEIRA DE ANESTESIOLOGIA
Official Publication of the Brazilian Society of Anesthesiology
www.sba.com.br

SCIENTIFIC ARTICLE

Use of sugammadex on burn patients: descriptive study

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Received 13 August 2014; accepted 8 October 2014
Available online 7 June 2015

KEYWORDS
Sugammadex;
Cyclodextrin;
Burn injury;
Rocuronium;
Neuromuscular block;
Neostigmine

Abstract
Objectives: A burn patient is a challenge for any anesthesiologist, undergoing several surgeries during admission, and requiring general anesthesia and muscle relaxation most of the times. The victim may have respiratory system impairment and a response to muscle relaxants that differs from the healthy patient, thus proper monitoring and reversal is crucial. We analyzed sugammadex effectiveness and safety in this population.
Materials and methods: It was a prospectively descriptive study, including 4 patients, and all of them were considered major burn patients, who underwent escharotomy with general anesthesia and neuromuscular relaxation. The main variable was the time for recovery of a TOF higher than 0.9 after the administration of sugammadex before extubation.
Results: Mean time of recovery from a TOF ratio higher than 0.9 following the administration of Sugammadex was of 4.95 min 95% CI (3.25–6.64, $p = .53$).
Conclusions: The reversion of neuromuscular relaxation with sugammadex appears to be effective and safe in the burn patient. More analytical, comparative studies of larger populations would be necessary to confirm these data.

PALAVRAS-CHAVE
Sugammadex;
Gama-Ciclodextrinas;
Queimaduras;
Rocurônio;
Bloqueio neuromuscular;
Neostigmina

Uso de sugamadex no paciente queimado: estudo descritivo

Resumo
Objetivos: O paciente queimado representa um desafio para o anestesiologista, pois submete-se a várias intervenções cirúrgicas durante sua hospitalização, necessitando de anestesia geral e relaxamento muscular na maior parte delas. Apresenta sistema respiratório comprometido e uma resposta aos relaxantes musculares que difere do paciente sadio; portanto, um monitoramento correto e reversão tornam-se imprescindíveis. Avaliamos a eficácia e segurança do sugamadex nesta população.

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http://dx.doi.org/10.1016/j.bjane.2014.10.001

Material e métodos: Estudo descritivo com caráter prospectivo que inclui quatro pacientes, todos eles considerados grandes queimados, submetidos a escarectomia com anestesia geral e relaxamento neuromuscular. Como variável principal tomou-se o tempo de recuperação de TOF superior a 0,9 após a administração de sugamadex antes de extubação.
Resultados: O tempo médio de recuperação de uma razão TOF superior a 0,9 após a administração de sugamadex foi de 4,95 min (IC95% 3,25-6,64; p = 0,53).
Conclusões: A reversão do relaxamento neuromuscular com sugamadex parece ser eficaz e segura no paciente queimado. Seriam necessários mais estudos analíticos, comparativos e de maior população para confirmar esses dados.

Introduction

Burns are tissue injuries produced by skin aggression from any source of energy. The severity criteria would be involvement of more than 25% of total body surface, burns that follow inhalation syndrome, involvement of face, eyes, hands, feet and perineum.[1] Mortality of major burn patients is approximately 13.9%.[2,3] In our unit, 174 patients were attended in the year of 2012. These patients underwent several surgical interventions during their stay in the hospital, with most of them under general anesthesia, orotracheal intubation, and neuromuscular relaxation.

Sugammadex is a modified cyclodextrin used for reversion of rocuronium- and vecuronium-induced nondepolarizing muscle block.[4,5] The dose of sugammadex varies depending on the level of muscle relaxation, with mean time for recovery of a TOF ratio higher than 0.9 of 3 min. (min).[6,7] Several studies demonstrated the superiority of this drug compared to neostigmine[8–10] regarding safety and time for recovery. It was successfully used in the obese patient, in the elderly, and also in children older than two years.[11] However, its use in the major burn patient had not been studied. The main objective of this work was to analyze the efficacy of sugammadex in this patient profile in whom the metabolic-hemodynamic changes may alter its pharmacology and in whom, due to respiratory system involvement (if constant), an appropriate reversal of neuromuscular blockers is crucial. Secondary objectives are the measurement of neuromuscular relaxation recovery time after its administration, the comparison of these results with those existing in the literature in other types of patients, report of the emergence of adverse effects related to its administration, and report of main anesthetic considerations of major burn patient.

Materials and methods

A prospective descriptive study of four cases was conducted over two months. Inclusion criteria were as follows: major burn patient who underwent escharotomy under general anesthesia and orotracheal intubation. Exclusion criteria were: allergy to sugammadex, severe renal impairment (creatinine clearance below 30 mL min^{-1}, intraoperative hemodynamic instability requiring administration of amines, or the need for blood transfusions. All patients were monitored with electrocardiogram, oxygen saturation, non-invasive blood pressure and monitoring of neuromuscular blockade by accelerometry (TOF watch). Induction was conducted with propofol (2.5 mg kg^{-1}), fentanyl (2 μg kg^{-1}) and rocuronium (0.6 mg kg^{-1}). Maintenance was performed with sevoflurane at 1 CAM, with the administration of a booster dose of relaxant (30% the initial dose) on those who showed recovery from block (emergence of 2 responses in TOF). At the end of the surgery, and before extubation, sugammadex was administered in all cases, with the dose according to the level neuromuscular block (deep block 4 mg kg^{-1}, moderate block 2 mg kg^{-1}, recovery phase with 4 responses to TOF ratio 1 mg kg^{-1}). The patients were extubated after recovery of TOF higher than 0.9. The variable considered was time in minutes since the administration of sugammadex until recovery of TOF higher than 0.9. All the time we followed the ethical standards of the human experimentation committee of our center. For data analysis, we used the software IBM SPSS *Statistics* 22.0.

Results

Four patients with ages between 69 and 76 years were included. The clinical characteristics of the patients are summarized in Table 1, and Fig. 1 shows one of the patients included in the study. The average percentage of body surface area burned was 17.25%. Two of the patients received a booster dose of rocuronium (20 and 25 mg respectively). The average recovery time from a TOF ratio greater than 0.9 after sugammadex administration before extubation was 4.95 min with a 95% confidence interval of 3.25–6.64 ($p = 0.53$). The median of the same variable was of 4.65 min. Typical deviation was of 1.06.

Discussion

The involvement of the respiratory system is almost constant in major burn patients; there is vasodilation that contributes to respiratory mucosa edema and increased permeability of