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### Scientific and Technological Research

## Postoperative residual curarization at the post-anesthetic care unit of a university hospital: A cross-sectional study<sup>☆</sup>



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#### ABSTRACT

**Introduction:** Postoperative residual curarization has been related to postoperative complications.

**Objective:** To determine the prevalence of postoperative residual curarization in a university hospital and its association with perioperative conditions.

**Method:** A prospective registry of 102 patients in a period of 4 months was designed to include ASA I–II patients who intraoperatively received nondepolarizing neuromuscular blockers. Abductor pollicis response to a train-of-four stimuli based on acceleromyography and thenar eminence temperature (TOF-Watch SX<sup>®</sup>, Organon, Ireland) was measured immediately upon arrival at the postanesthetic care unit and 30 s later. Uni-bivariate analysis was planned to determine possible associations with residual curarization, defined as two repeated values of T4/T1 ratio <0.90 in response to train-of-four stimuli.

**Results:** Postoperative residual curarization was detected in 42.2% of the subjects. Pancuronium was associated with a high risk for train-of-four response <0.9 at the arrive at postoperative care unit [RR:2.56 (IC95% 1.99–3.30);  $p = 0.034$ ]. A significant difference in thenar temperature (°C) was found in subjects with train-of-four <0.9 when compared to those who reach adequate neuromuscular function ( $29.9 \pm 1.6$  vs.  $31.1 \pm 2.2$ ; respectively,  $p = 0.003$ ). However, we were unable to demonstrate a direct attribution of findings in train-of-four response to temperature ( $R^2$  determination coefficient = 0.08%).

**Conclusions:** A high prevalence of postoperative residual curarization persists in university hospitals, despite a reduced use of “long-lasting” neuromuscular blockers. Strategies to

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assure neuromuscular monitoring practice and access to therapeutic alternatives in this setting must be considered. Intraoperative neuromuscular blockers using algorithms and continued education in this field must be priorities within anesthesia services.

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## Relajación residual posoperatoria en la unidad de cuidados postanestésicos de un hospital universitario: Estudio de corte transversal

### R E S U M E N

#### Palabras clave:

Bloqueantes neuromusculares  
Anestesia  
Periodo Perioperatorio  
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Retraso en el despertar  
posanestésico

**Introducción:** La relajación residual postoperatoria ha sido asociada con mayores complicaciones postoperatorias.

**Objetivo:** determinar la prevalencia de relajación residual postoperatoria en un hospital universitario y su relación con condiciones perioperatorias.

**Métodos:** Se diseñó un registro prospectivo de 4 meses de duración, que incluyó pacientes ASA I-II que intraoperatoriamente recibieran bloqueadores neuromusculares. Se registró la respuesta del *abductor pollicis* a un estímulo de tren de cuatro mediante aceleromiografía y se midió la temperatura de la eminencia tenar (TOF-Watch SX<sup>®</sup>, Organon, Ireland) inmediatamente al ingreso a recuperación y a los 30 segundos. Se realizó análisis uni y bivariado para determinar posibles asociaciones con relajación residual postoperatoria, definida como dos respuestas sucesivas al estímulo tren-de-cuatro con una relación T4/T1 <0.90.

**Resultados:** Se reclutaron 102 pacientes, encontrando una prevalencia de relajación residual del 42.2%. Pancuronio fue asociado con un riesgo elevado de TOF <0.9 al ingreso a recuperación [RR:2,56 (IC95% 1.99-3.30); p=0.034]. Se evidenció una diferencia significativa en la temperatura tenar de los pacientes que presentaban relajación residual, al compararla con pacientes que recuperaron su función neuromuscular [Grupo evento = 29.9 ± 1.6 (n = 43); Grupo control = 31.1 ± 2.2 (n = 59)]. Sin embargo no se logró determinar una atribución directa de relajación residual a esta medición (coeficiente de determinación = 0.08%).

**Conclusión:** Persiste una alta prevalencia de relajación residual postoperatoria en los hospitales universitarios, a pesar del uso reducido de bloqueadores neuromusculares de larga duración. Se hace indispensable encaminar estrategias para incentivar la monitoria neuromuscular y establecer algoritmos que permitan un manejo eficiente de los bloqueadores neuromusculares.

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## Introduction

Nondepolarizing neuromuscular blocking agents (ND-NMBA) have commonly used in surgical units to facilitate endotracheal intubation and during procedures under general anesthesia to provide adequate surgical conditions or optimize ventilatory support. Postoperative residual curarization (PORC), defined as the presence of T4/T1 ratio <0.9 ratio in response to the “train-of-four” (TOF) stimulation,<sup>1-3</sup> has been subject of multiple publications over the past three decades with an incidence reported up to 40%, even when the cut-off of TOF ratio to define PORC was as low as <0.7.<sup>4-9</sup>

The value of TOF ratio <0.9, to define PORC, was recommended after papers which reported that, below this cutoff, functional recovery of the laryngeal muscles and upper esophagus were not complete, even if the patient were holding ventilation in normal limits and overcoming clinical tests.<sup>3,10</sup> Subsequent reports showed that rates of TOF <0.9 were associated with longer length of stay in the Post Anesthesia Care Unit

(PACU).<sup>11,12</sup> This adverse event is still being present today, even with the use of intermediate acting ND-NMBA or use of drugs such as neostigmine for reversing neuromuscular block.<sup>7,13-15</sup> In Latin America there is a poor clinical applicability of neuromuscular relaxation monitoring (NMRM) as well as in the rest of the world.<sup>16</sup>

This study aimed to assess the prevalence of PORC on admission to the PACU of patients treated at a university hospital as our primary objective, and to determine possible associations with demographic aspects and perioperative variables.

## Materials and methods

Prior institutional ethics approval, a prospective observational registry of patients ASA I and II >18 years undergoing elective or emergency surgery under general anesthesia (in whom the use of ND-NMBA be envisaged) was designed. The size of the

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