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Publicação Oficial da Sociedade Brasileira de Anestesiologia  
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## SPECIAL ARTICLE

# Deep versus moderate neuromuscular block during one-lung ventilation in lung resection surgery

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Received 27 October 2015; accepted 1 December 2015

### KEYWORDS

Neuromuscular block;  
One-lung ventilation;  
Lung resection  
surgery

### Abstract

**Background and objectives:** Neuromuscular relaxants are essential during general anesthesia for several procedures. Classical anesthesiology literature indicates that the use of neuromuscular blockade in thoracic surgery may be deleterious in patients in lateral decubitus position in one-lung ventilation. The primary objective of our study was to compare respiratory function according to the degree of patient neuromuscular relaxation. Secondary, we wanted to check that neuromuscular blockade during one-lung ventilation is not deleterious.

**Methods:** A prospective, longitudinal observational study was made in which each patient served as both treated subject and control. 76 consecutive patients programmed for lung resection surgery in Gregorio Marañon Hospital along 2013 who required one-lung ventilation in lateral decubitus were included. Ventilator data, hemodynamic parameters were registered in different moments according to TOF response (intense, deep and moderate blockade) during one-lung ventilation.

**Results:** Peak, plateau and mean pressures were significantly lower during the intense and deep blockade. Besides compliance and peripheral oxygen saturation were significantly higher in that moments. Heart rate was significantly higher during deep blockade. No mechanical ventilation parameters were modified during measurements.

**Conclusions:** Deep neuromuscular blockade attenuates the poor lung mechanics observed during one-lung ventilation.

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<http://dx.doi.org/10.1016/j.bjane.2015.12.002>

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Please cite this article in press as: Casanova J, et al. Deep versus moderate neuromuscular block during one-lung ventilation in lung resection surgery. Rev Bras Anesthesiol. 2016. <http://dx.doi.org/10.1016/j.bjane.2015.12.002>

## PALAVRAS-CHAVE

Bloqueio neuromuscular;  
Ventilação seletiva;  
Cirurgia de ressecção pulmonar

## Bloqueio neuromuscular profundo *versus* moderado durante a ventilação pulmonar seletiva em cirurgia de ressecção pulmonar

### Resumo

*Justificativa e objetivos:* Os relaxantes neuromusculares são essenciais durante a anestesia geral para vários procedimentos. A literatura clássica de anestesiologia indica que o uso do bloqueio neuromuscular em cirurgia torácica pode ser prejudicial em pacientes posicionados em decúbito lateral com ventilação seletiva. O objetivo primário deste estudo foi comparar a função respiratória de acordo com o grau de relaxamento neuromuscular do paciente. O objetivo secundário foi verificar que o bloqueio neuromuscular durante a ventilação seletiva não é prejudicial.

*Métodos:* Estudo observacional, prospectivo e longitudinal no qual cada paciente serviu como indivíduo de estudo e controle. Setenta e seis pacientes consecutivos, agendados para cirurgia de ressecção do pulmão no Hospital Gregorio Marañon ao longo de 2013, submetidos à ventilação seletiva em decúbito lateral foram incluídos. Os dados do ventilador e os parâmetros hemodinâmicos foram registrados em diferentes momentos de acordo com a resposta TOF (bloqueio intenso, profundo e moderado) durante a ventilação seletiva.

*Resultados:* As pressões de pico, platô e média foram significativamente menores durante os bloqueios intenso e profundo. Além disso, complacência e saturação periférica de oxigênio foram significativamente maiores nesses momentos. A frequência cardíaca foi significativamente maior durante o bloqueio profundo. Não houve alteração dos parâmetros da ventilação mecânica durante as mensurações.

*Conclusões:* O bloqueio neuromuscular profundo atenua a mecânica pulmonar deficiente observada durante a ventilação seletiva.

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## Introduction

In general, the use of neuromuscular relaxants (NMRs) during surgery requiring general anesthesia has been justified by the need to induce total muscle paralysis in order to avoid undesirable patient movements that could pose a hazard for correct surgical maneuvering, and to ensure optimum conditions for endotracheal intubation.

Anesthesia in lung resection surgery requires the use of NMRs to avoid diaphragmatic movements or reflex coughing that can cause potentially dangerous situations, particularly when the surgeon is manipulating vital lung structures such as bronchi, vessels or nerves. On the other hand, correct positioning of the double-lumen tube must be checked by introducing the fibrobronchoscope through each lumen, and this also may cause unexpected patient movements, including cough. The aspiration of secretions (a common practice in these patients) likewise may give rise to undesired patient movements. On the other hand, routine lung recruitment maneuvering in surgery of this kind requires the use of NMRs to facilitate opening of the collapsed lung regions.

However, the classical anesthesiology texts indicate that the use of NMRs in this type of surgery may be harmful in patients in lateral decubitus and with the upper lying lung isolated from ventilation, since paralysis of the lower half of the diaphragm causes the abdominal organs to exert greater pressure upon the dependent lung – reducing pulmonary compliance and increasing the airway pressures.<sup>1</sup> This in turn would further worsen the lung mechanics during this delicate period of one-lung ventilation (OLV).<sup>2</sup> Although

there is very little information on the clinical effect of NMRs in chest surgery, more data are available on the use of these drugs in situations of low compliance and high airway pressures, such as acute respiratory distress syndrome<sup>3</sup> or laparoscopic abdominal surgery.<sup>4</sup> Improvements in gas exchange, airway pressure and lung compliance have been observed in patients administered NMRs during mechanical ventilation in critical care units.

We hypothesize that the absence of muscle tone (diaphragm and chest wall muscles) induced by NMRs will cause the gas mixture supplied by the mechanical ventilator to facilitate ventilation during OLV by improving thoracic compliance and/or reducing the airway pressures.

The primary objective of our study was to compare respiratory function (airway pressure and static lung compliance) according to the degree of patient neuromuscular relaxation.

## Methods

A prospective, longitudinal observational study was made in which each patient served as both treated subject and control. The study was approved by the Ethics Committee of Gregorio Marañon University General Hospital (Doctor Esquerdo 46 street, Madrid, Spain) (CEIC 377/13) in January 2013. The patients were included in the protocol after signing the corresponding informed consent document.

The protocol contemplated the consecutive inclusion, in 2013, of all patients ( $n=76$ ) scheduled for lung

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