

Neuromuscular Blockade and Risk of Postoperative Pneumonia

To the Editor:

I read with interest the recent article by Bulka *et al.*,¹ which highlighted the association between perioperative use of neuromuscular blocking drugs and risk of postoperative pneumonia. It would have been useful to know which airway devices were used for the patients studied, because endotracheal intubation itself is known to be a risk factor for postoperative pneumonia and could therefore be a confounding factor. Of course, in the majority of cases, neuromuscular blockade is a prerequisite for endotracheal intubation, but not infrequently in the United Kingdom neuromuscular blockade is used in combination with a supraglottic airway device; this is generally restricted to cases where muscle relaxation is required to facilitate surgery and there is no requirement for a definitive airway. It would be telling if the strong association between the use of neuromuscular blocking drugs and postoperative pneumonia persisted irrespective of whether the trachea was intubated.

Competing Interests

The author declares no competing interests.

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References

1. Bulka CM, Terekhov MA, Martin BJ, Dmochowski RR, Hayes RM, Ehrenfeld JM: Nondepolarizing neuromuscular blocking agents, reversal, and risk of postoperative pneumonia. *ANESTHESIOLOGY* 2016; 125:647–55

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Accounting for Planned Postoperative Intubation

To the Editor:

We read with interest the article by Bulka *et al.*¹ regarding the use of intraoperative nondepolarizing muscle relaxants (NDMRs) and their association with postoperative pneumonia. We commend them for increasing knowledge in an area that is exceedingly important. In this article, postoperative pneumonia occurred more frequently in patients who received an NDMR *versus* propensity-matched patients who were not administered an NDMR. Furthermore, within the NDMR subset, lack of neostigmine administration was associated with a greater than twofold higher incidence of postoperative pneumonia than their propensity-matched counterparts.

Although not explicitly stated in the article, we wonder why these patients were not routinely reversed at the end of

their procedure. As described in the accompanying editorial,² this may have resulted from concerns of paradoxical muscle weakness and/or other side effects of acetylcholinesterase inhibitors. However, another plausible explanation may be that some of these patients were being transported to the intensive care unit for postoperative mechanical ventilation, thus not requiring NDMR reversal. In our experience, the overwhelming reason for nonreversal is predetermined postoperative intubation regardless of patient demographics, attending anesthesiologist, surgeon, or surgical procedure. Because endotracheal intubation and intensive care unit residence are both strongly associated with nosocomial pneumonia,³ there is a high likelihood that the effect of nonreversal on this outcome is confounded by continued postoperative intubation. To determine whether this manner of confounding exists, separate analyses should be performed that only include patients who were extubated at the end of the surgical procedure before leaving the operating room. Although tedious, these additional investigations would strengthen the argument about the importance of NDMR reversal.

There are also separate issues with the propensity match, in particular with the match for the NDMR/no-NDMR analysis. It can be argued that the biggest determinant of NDMR use is the particular surgical procedure itself, and surgeries that are associated with postoperative pneumonia (thoracotomies, laparotomies, *etc.*)^{4–7} are routinely not performed without NMDR. To control for surgical procedure, the authors used Clinical Classifications Software (CCS; Agency for Healthcare Research and Quality; Rockville, Maryland) groupers in the propensity match. Although there are more than 230 single-level CCS procedure categories, there is still too much variability within certain groupings to provide an adequate representation of the surgical procedure variable for the context of the study. As an example, CCS category 96 (fifth most common CCS code in study), “other OR lower gastrointestinal therapeutic procedures,” includes more than 80 Current Procedural Terminology codes with both laparoscopic and open colorectal procedures. Thus, a laparoscopic case may have been paired with a laparotomy despite the dissimilar incidence of postoperative pneumonia attributable to these procedures.⁴ This is also true for a number of other CCS groupers including category 40, “other diagnostic procedures of respiratory tract and mediastinum,” which includes both thoracoscopic surgeries and thoracotomies with differing inherent rates of postoperative pneumonia.⁵ Although the CCS classifier is inadequately broad in this respect, the authors still were unable to produce a propensity match with an unbiased (standardized difference less than 10%)⁸ surgical procedure variable for the NDMR/no-NDMR analysis. To better separate the effects of the surgical procedure from NMDR use with regard to the incidence of postoperative pneumonia, a balanced match with an adequate procedural variable (*e.g.*, hard-matched Current Procedural Terminology code) must be performed.