

# Postoperative Nausea and Vomiting Implications in Neostigmine versus Sugammadex

Presenters: Corey Johnson, BSN, RN, SRNA, Colton James, BSN, RN, SRNA, Sarah Traugber, BSN, RN, SRNA, Charles Walker, BSN, RN, SRNA

Faculty Advisor: Dr. Dwayne Accardo, DNP, APRN, CRNA

College of Nursing - The University of Tennessee Health Science Center - Memphis, TN

## Purpose

The purpose of this DNP project is to determine if the neuromuscular blockade (NMB) reversal agents neostigmine and sugammadex affect the incidence of postoperative nausea and vomiting (PONV).

### Specific Aims

- Compare PONV rates with neostigmine versus sugammadex
- Determine if pharmacologic decision-making can be justified for PONV prophylaxis
- Identify gaps in current literature regarding paralytic reversals' effects on PONV
- Consider confounding factors that could also contribute to PONV regardless of drug
  - i.e. Female gender, non-smoking status, postoperative opioid consumption

## Background

- PONV is one of the most common postoperative complaints by patients
- Current prevention of PONV revolves around pre-medication with antiemetics and minimizing exposure to triggers
- PONV can initiate a trend of poor outcomes when it persists, such as delaying patient discharge and increasing costs
- Pharmacologic agents commonly used in anesthesia can potentiate PONV
- Neuromuscular blockade (NMB) reversal agents, sugammadex and neostigmine, can implicate PONV
  - High-dose neostigmine, an acetylcholinesterase inhibitor, has been reported to increase PONV by stimulating muscarinic receptors and increasing acetylcholine (ACh), a known PONV trigger, at the chemoreceptor trigger zone (CTZ)
  - Sugammadex has considerable benefits by reducing adverse drug effects in comparison to neostigmine through encapsulating the paralytic agent rather than increasing ACh
- Despite an increased cost with sugammadex, it has potential to be a rationale for standardized use if PONV can be linked to neostigmine

## Methods

### Eligibility Criteria

- General anesthesia cases with NMBD use
- Full-text, English, peer-reviewed articles published between 2014-2020

### Information Sources & Search

- Systematic search conducted between August 2019-November 2020
- PubMed, CINAHL, MEDLINE (EBSCO), Google Scholar
- Search Terms: "Sugammadex Neostigmine PONV," "Neuromuscular blockers and PONV," "Paralytic reversal agents and PONV"
- Publication date limited to 2014-2020

### Selection of Sources of Evidence

- Meta-analyses, systematic reviews, randomized controlled trials, case control studies, or evidence based practice projects
- Explicit mention of PONV in both groups
- Abstracts excluded
- >18 years of age

### Data & Synthesis of Results

- Charted via an electronic table
- Variables: incidence of PONV in a sugammadex group; incidence of PONV in a neostigmine group; incidence of postoperative analgesic consumption in a sugammadex group; incidence of postoperative analgesic consumption in a neostigmine group
- Followed PRISMA statement extension for scoping reviews

## Results

Study Authors	Higher (relative) incidence of PONV		Statistically significant?
	Sugammadex	Neostigmine	
Claroni et al.		X	No
Geldner et al.	X		No
Hurford et al.		X	No
Koyuncu et al.		X	No
Ledowski et al.		X	Yes
Paech		X	No
Tas Tuna et al.		X	No
Yagan et al.		X	Yes

- 7 out of 8 studies showed an increased incidence of PONV in patients reversed with neostigmine over sugammadex reversal
- 2 of the 7 studies showed a statistically significant difference in PONV outcomes with neostigmine versus sugammadex
  - Both studies found higher incidence of PONV in the neostigmine population compared to the sugammadex population
- 5 of the 7 studies that showed a difference in PONV outcomes between the two reversal agents did not yield statistically significant results
- 6 of the 8 total studies reviewed did not show a statistically significant difference in PONV outcomes in neostigmine versus sugammadex reversal

## Implications for Practice

- Sugammadex provides more effective reversal and has more favorable pharmacokinetics
- Sugammadex has less side effects than neostigmine and does not require the coadministration of an anticholinergic
- There is not sufficient data suggesting a statistically significant reduction in PONV when using sugammadex in comparison to neostigmine
- PONV alone is not a sufficient reason for the justification of using sugammadex versus neostigmine
  - Several hospital pharmacies require a rationale for using sugammadex in order to reduce costs

## References

- Barry, N., Uffman, J. C., Tumin, D., & Tobias, J. D. (2018). Preliminary indications for the use of sugammadex after its addition to a formulary at a tertiary care children's hospital. *The Journal of Pediatric Pharmacology and Therapeutics*, 23(1), 48–53. doi:10.5863/1551-6776-23.1.48
- Claroni, C., Covotta, M., Torregiani, G., Marcelli, M. E., Tuderti, G., Simone, G., Scotto di Uccio, A., Zinilli, A., & Forastiere, E. (2019). Recovery from anesthesia after robotic-assisted radical cystectomy: Two different reversals of neuromuscular blockade. *Journal of Clinical Medicine*, 8(11), 1-10. doi:10.3390/jcm8111774
- Gan, T. J., Belani, K. G., Bergese, S., Chung, F., Diemunsch, P., Habib, A. S., Jin, Z., Morton, Kovac, A. L., Meyer, T. A., Urman, R. D., Apfel, C. C., Ayad, S., Beagley, L., Candiotti, K., Englesakis, M., Hendrick, T., Kranke, P., Lee, S., Lipman, D., Minkowitz, H. S., Morton, J., & Phillip, B. K. (2020). Fourth consensus guidelines for the management of postoperative nausea and vomiting. *Anesthesia and Analgesia*, 131(2), 411–448. https://doi.org/10.1213/ANE.0000000000004833
- Geldner, G., Niskanen, M., Laurila, P., Mizikov, V., Hübler, M., Beck, G., Rietbergen, H., & Nicolayenko, E. (2016). A randomised controlled trial comparing sugammadex and neostigmine at different depths of neuromuscular blockade in patients undergoing laparoscopic surgery. *Anaesthesia*, 67(9), 991–998. doi: 10.1111/j.1365-2044.2012.07197.x
- Hurford, W. E., Eckman, M. H., & Welge, J. A. (2020). Data and meta-analysis for choosing sugammadex or neostigmine for routine reversal of rocuronium block in adult patients. *Data in Brief*, 32. doi:10.1016/j.dib.2020.106241
- Koyuncu, O., Turhanoglu, S., Akkurt, C. O., Karcioglu, M., Ozkan, M., Ozer, C., Sessler, D. I., & Turan, A. (2015). Comparison of sugammadex and conventional reversal on postoperative nausea and vomiting: A randomized, blinded trial. *Journal of Clinical Anesthesia*, 27(1), 51-56. doi:10.1016/j.jclinane.2014.08.010
- Ledowski, T., Falke, L., Johnston, F., Gillies, E., Greenaway, M., De Mel, A., Tiong, W., & Phillips, M., (2014). Retrospective investigation of postoperative outcome after reversal of residual neuromuscular blockade sugammadex, neostigmine or no reversal. *European Journal of Anaesthesiology*, 31(8), 423-429. https://doi.org/10.1097/EJA.000000000000010
- Paech, M. J., Kaye, R., Baber, C., & Nathan, E. A. (2017). Recovery characteristics of patients receiving either sugammadex or neostigmine and glycopyrrolate for reversal of neuromuscular block: a randomised controlled trial. *Anaesthesia*, 73(3), 340–347. https://doi.org/10.1111/anae.14174
- Tas Tuna, A., Palabiyik, O., Orhan, M., Sonbahar, T., Sayhan, H., & Tomak, Y. (2017). Does sugammadex administration affect postoperative nausea and vomiting after laparoscopic cholecystectomy: A prospective, double-blind, randomized study. *Surgical Laparoscopy, Endoscopy & Percutaneous Techniques*, 27(4), 237-240. https://doi.org/10.1097/SLE.0000000000000439
- Yağan, Ö., Taş, N., Mutlu, T., & Hancı, V. (2017). Comparison of the effects of sugammadex and neostigmine on postoperative nausea and vomiting. *Brazilian Journal of Anesthesiology (English Edition)*, 67(2), 147–152. https://doi-org.ezproxy.uthsc.edu/10.1016/j.bjane.2015.08.003