

Parkview Health

Parkview Health Research Repository

Pharmacy Residency

Pharmacy Research

2018

Sugammadex vs. neostigmine vs. spontaneous reversal in pulmonary complications post surgery

Allison Clemens PharmD

Follow this and additional works at: <https://researchrepository.parkviewhealth.org/pharmresidency>



Part of the [Pharmacy and Pharmaceutical Sciences Commons](#)

Sugammadex vs. Neostigmine vs. Spontaneous Reversal in Pulmonary Complications Post Surgery

Allison Clemens, PharmD
PGY1 Pharmacy Resident
Parkview Health | Fort Wayne, Indiana

The speaker has no actual or potential conflict of interest in relation to this presentation.

Background

- Sugammadex is a selective relaxant binding agent
 - Indicated for the reversal of rocuronium bromide, vecuronium bromide, and pancuronium bromide
- Neostigmine is an acetylcholinesterase inhibitor
 - Indicated for reversal of nondepolarizing neuromuscular blockade
 - Must be used with atropine or glycopyrrolate

Background



ASA Status

1

- A normal healthy patient

2

- A patient with mild systemic disease

3

- A patient with severe systemic disease

4

- A patient with severe systemic disease that is a constant threat to life

5

- A moribund patient who is not expected to survive without the operation

6

- A declared brain-dead patient whose organs are being removed for donor purposes

Previous Study

Sugammadex versus neostigmine for reversal of neuromuscular blockade and postoperative pulmonary complications (STRONGER) trial

Objective	<ul style="list-style-type: none">• Compare sugammadex to neostigmine for the reversal of neuromuscular blockade on incidence of major pulmonary concerns
Methods	<ul style="list-style-type: none">• The trial matched 22,856 patients in each treatment arm
Primary Outcome	<ul style="list-style-type: none">• Major pulmonary complications after noncardiac inpatient surgery

Previous Study

Sugammadex versus neostigmine for reversal of neuromuscular blockade and postoperative pulmonary complications (STRONGER) trial

Results

- Out of the 45,712 patients studied 1,892 (4.1%) were diagnosis with the primary outcome
 - 3.5% Sugammadex vs 4.8% Neostigmine
- Reduced pneumonia risk by 47%
 - adjusted odds ratio, 0.53; 95% CI, 0.44 to 0.62

Key Findings

- Sugammadex was associated with a 30% reduced risk of pulmonary complications
 - Adjusted odds ratio, 0.70; 95% CI, 0.63 to 0.77

Self-Assessment Question #1

Sugammadex is a neuromuscular blocking reversal agent that works by binding to steroidal NMBAs. Which of the following is not reversed by sugammadex?

- a) Rocuronium
- b) Vecuronium
- c) Succinylcholine
- d) Pancuronium

Self-Assessment Question #1

Sugammadex is a neuromuscular blocking reversal agent that works by binding to steroidal NMBAs. Which of the following is not reversed by sugammadex?

- a) Rocuronium
- b) Vecuronium
- c) Succinylcholine
- d) Pancuronium

Self-Assessment Question #2

Sugammadex is an attractive neuromuscular blocking reversal agent for many reasons. Which of the following is not an advantage of using sugammadex?

- a) Sugammadex works faster than neostigmine plus atropine
- b) Sugammadex can reverse deep neuromuscular paralysis
- c) Sugammadex can be used in patients with reduced renal function
- d) Sugammadex can be stored at room temperature

Self-Assessment Question #2

Sugammadex is an attractive neuromuscular blocking reversal agent for many reasons. Which of the following is not an advantage of using sugammadex?

- a) Sugammadex works faster than neostigmine plus atropine
- b) Sugammadex can reverse deep neuromuscular paralysis
- c) Sugammadex can be used in patients with reduced renal function
- d) Sugammadex can be stored at room temperature

Purpose

To evaluate if there is a meaningful, clinically significant reduction of pulmonary complications with sugammadex use vs neostigmine use or spontaneous reversal

Setting

Parkview Health

- Not-for-profit, community-owned organization
- Northeast Indiana and northwest Ohio
- 10 hospital health system
 - Over 900 inpatient beds
 - Over 200 primary care clinics
- Completes >10,000 surgeries per year



Design

- Retrospective matched cohort
- Single center: Parkview Regional Medical Center (PRMC)
- Timeframe: January 2017 - January 2020
- Study groups

Group 1	Group 2	Group 3
Sugammadex Reversal	Neostigmine Reversal	Spontaneous Reversal

Design

Inclusion Criteria

- Completed surgical procedure at PRMC
- ≥ 18 years old
- Received general anesthesia
- Endotracheal intubation
- $\text{CrCl} \geq 30 \text{ mL/min}$
- Received rocuronium or vecuronium
- Index only procedure per admission or 30-day period

Exclusion Criteria

- ≥ 90 years old
- Neuromuscular disease
- Malignant hyperthermia
- Burns
- No ASA status
- $\text{ASA} \geq 5$
- Received both Sugammadex and Neostigmine
- Received NMBA after Sugammadex and Neostigmine

Matching

Age	Sex	ASA Score	BMI (kg/m ²)	Procedure Type	Procedure Length (hours)
Within 5 years of age	Male	1	< 18.5	Abdominal	<1:30
	Female	2	18.5-24.9	Thoracic	1:31- 2:99
		3	25-29.9	Other	> 3:00
		4	> 30		

Endpoints

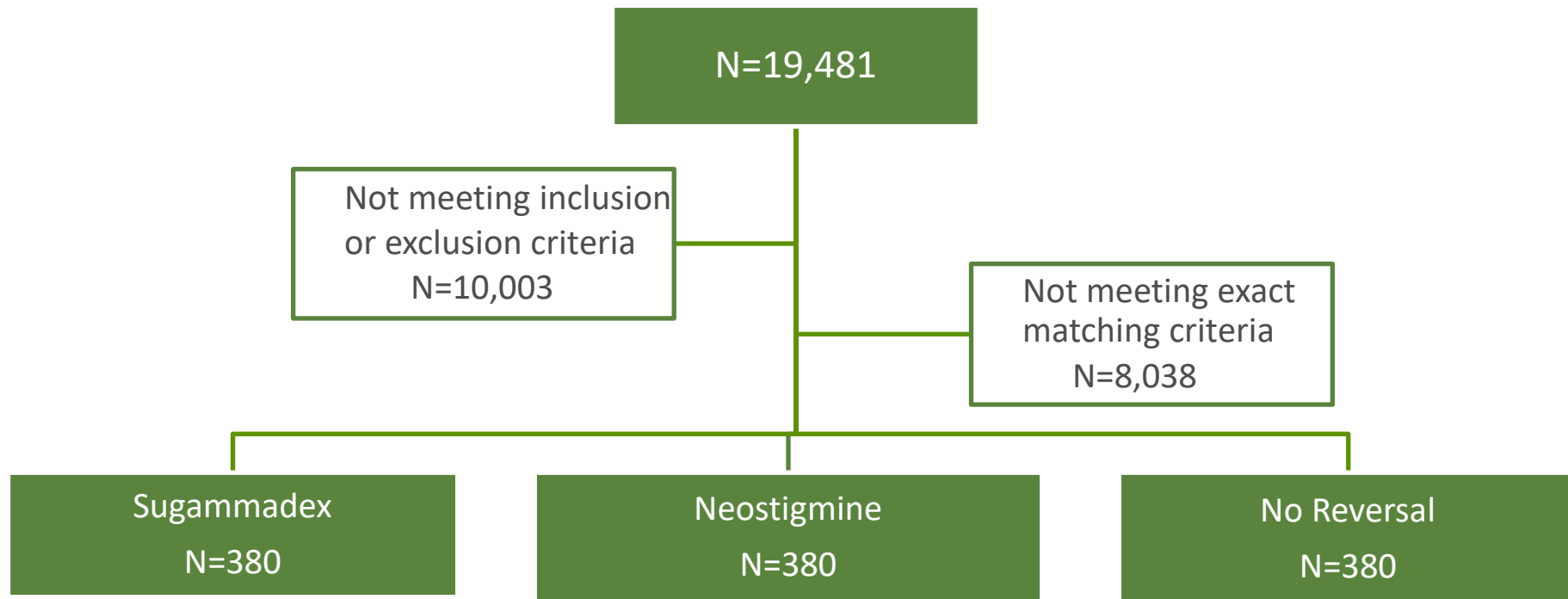
Primary

- Composite endpoint of pneumonia, respiratory failure, and other respiratory complications within 30 days of surgery

Secondary

- Pneumonia
- Respiratory failure
- Other respiratory complications

Patient Inclusion



Baseline Characteristics

	Sugammadex (N = 380)	Neostigmine (N = 380)	No Reversal (N = 380)
Age, mean \pm SD	57.7 \pm 16.3	57.6 \pm 16.3	57.7 \pm 16.4
Female, N (%)	194 (51.1%)	194 (51.1%)	194 (51.1%)
Weight, kg \pm SD	90.9 \pm 26.4	92.2 \pm 26.6	90.7 \pm 24.6
BMI, kg/m ² \pm SD	31.5 \pm 8.5	31.4 \pm 8.3	31.3 \pm 8.1
ASA, mean \pm SD	2.5 \pm 0.6	2.8 \pm 0.6	2.5 \pm 0.6

Comorbid Conditions

	Occurrence (N=1140)	Odds Ratio	95% CI	P-value
Chronic pulmonary disease	38	-	-	0.997
Chronic Heart Failure	61	0.431	0.050-3.695	0.443
Hypertension	592	0.879	0.204-3.781	0.862
Cardiac arrhythmias	85	0.299	0.051-1.738	0.179
Coronary artery disease/ Acute coronary syndrome	188	0.827	0.156-4.378	0.823
Chronic obstructive pulmonary disease/ Asthma	217	0.255	0.054-0.944	0.041

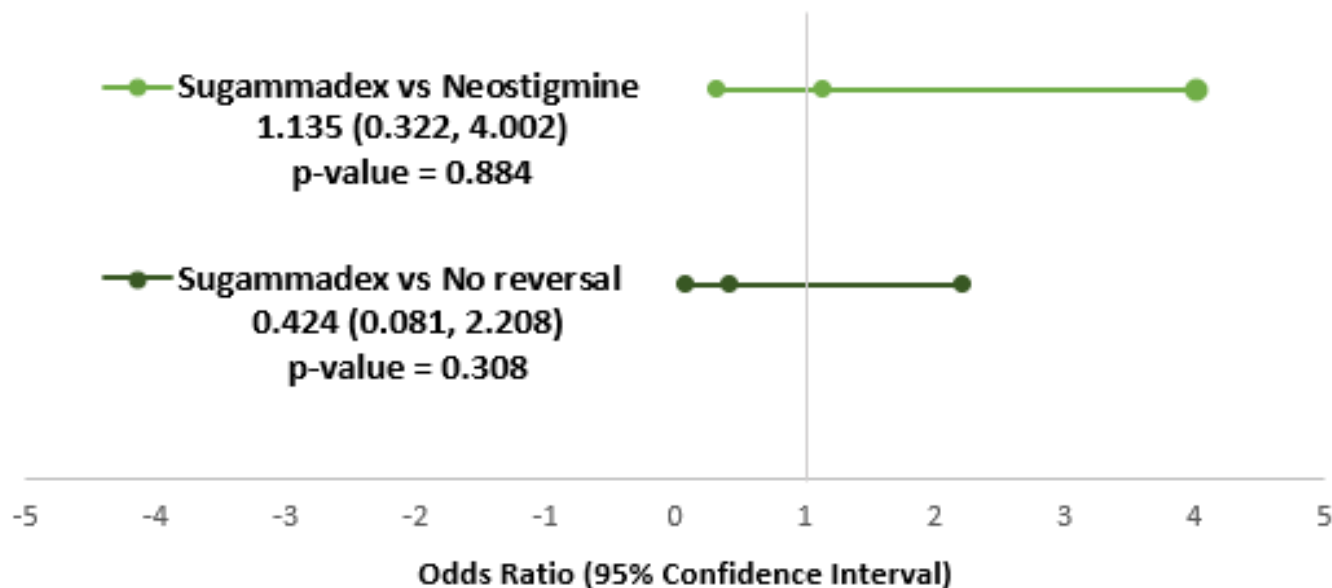
Primary Outcome

- Composite Pulmonary Complication
 - Pneumonia, respiratory complications, and other respiratory complications within 30 days of surgery

	Sugammadex (N = 380)	Neostigmine (N = 380)	No Reversal (N = 380)
Pulmonary Complications, N (%)	5 (1.32%)	5 (1.32%)	2 (0.53%)

Primary Outcome

Composite Pulmonary Complications



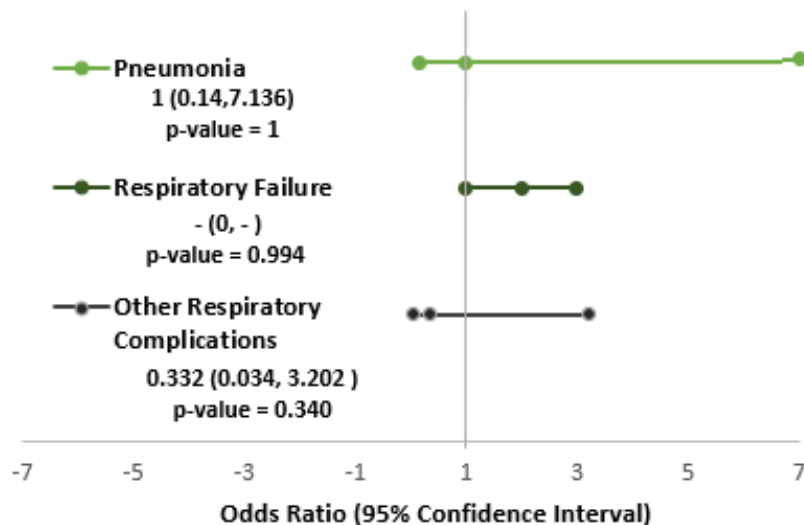
Secondary Outcome

- Pneumonia, respiratory complications, and other respiratory complications

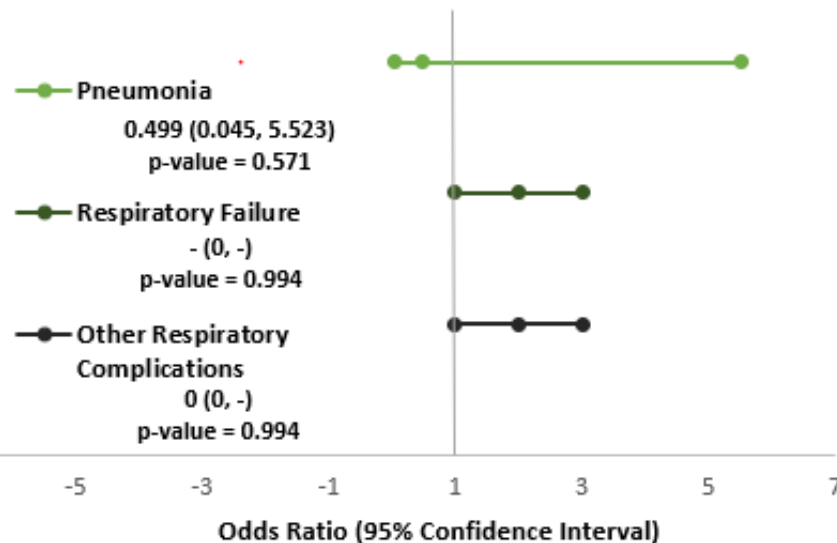
	Sugammadex (N = 380)	Neostigmine (N = 380)	No Reversal (N = 380)
Pneumonia, N (%)	2 (0.53%)	2 (0.53%)	1 (0.26%)
Respiratory Complications, N (%)	0 (0%)	1 (0.26%)	1 (0.26%)
Other Respiratory Complications, N (%)	3 (0.79%)	2 (0.53%)	0 (0%)

Secondary Outcome

Sugammadex vs Neostigmine



Sugammadex vs No Reversal



Results

Summary

- Comorbid conditions
 - An at-risk population was not identified
- Composite pulmonary complication
 - No statistically significant difference observed
- Pneumonia, respiratory complications, and other respiratory complications
 - No statistically significant difference observed

Limitations

- Single center, small sample size
- Large population of patients excluded
 - CrCl < 30 ml/min
 - Received both reversal agents
 - Missing medication documentation
 - Age > 90 yo
- Lack of train of four documentation
- Lack of standardized documentation in anesthesia notes
- Not able to complete a total cost of care analysis

Future Directions

- Cost analysis for total cost of care
- Collaborate with anesthesiologists to execute safe and cost-effective patient care

Conclusion

- Fewer post-operative pulmonary complications compared to national reported average
- No difference in pulmonary complications seen between trial arms
- Additional cost of Sugammadex did not provide an added benefit

Acknowledgements

Mentors

- Will Armstrong, PharmD, BCPS
- Tara Jellison, PharmD, MBA, FASHP
- Sarah Ferrell, PharmD, BCPPS
- Sarah Pfaehler, PharmD, MBA, BCPS

References

- Lieutaud T, Billard V, Khalaf H, et al. Muscle relaxation and increasing doses of propofol improve intubating conditions. *Can J Anaesth* 2003; 50:121.
- Li YL, Liu YL, Xu CM, et al. The effects of neuromuscular blockade improves surgical conditions (NISCO). *Surg Endosc* 2015; 29:627.
- Lexi-Comp: [Internet]. Sugammadex. Hudson OH: Lexi-Comp. c1978-2020 [Updated 2020; cited 2020 August. Available From: <http://online.lexi.com>
- Murphy GS. Residual neuromuscular blockade; incidence, assessment, and relevance in the postoperative period. *Minerva Anesthesiol* 2006; 72:97.
- Kirmeier E, Eriksson LI, Lewald H, et al. Post-anesthesia pulmonary complications after use of muscle relaxants (POPULAR): a multicenter, prospective observational study. *Lancet Respir Med* 2019; 7:129.
- Saager L, Maisese EM, Bash LD, et al. Incidence, risk factors, and consequences of residual neuromuscular block in the united states: The prospective, observation, multicenter RECIT-US study. *J Clin Anesth* 2019; 55:33.
- Tajaate N, Schreiber JU, Fuchs-Buder T, et al. Neostigmine-based reversal of intermediate acting neuromuscular blockade agents to prevent postoperative residual paralysis: A systematic review. *Eur J Anesthesiol* 2018; 35:184.
- Amorim P, Lagarto F, Gomes B, et al. Neostigmine vs. Sugammadex: observational cohort study comparing the quality of recovery using the postoperative quality recovery scale. *Acta Anaesthesiol Scand* 2014; 58:1101.
- Hristovska AM, Dutch P, Allingstrup M, et al. Efficacy and safety of Sugammadex vs neostigmine in receiving neuromuscular blockade in adults. *Cochrane Database Syst Rev* 2017; 8:CD012763.
- Krause M, McWilliams SK, Bullard KJ, et al. Neostigmine versus Sugammadex for reversal of neuromuscular blockade and effects on Reintubation for respiratory failure or newly initiated noninvasive ventilation: An Interrupted Time Series Design. *J Clin Anesth*. 2020; 131(1): 141-151
- Kheterpal S, Vaughn MT, Dubovoy TZ, et al. Sugammadex versus neostigmine for reversal of neuromuscular blockade and postoperative pulmonary complications (STRONGER). *Anesthesiology*. 2020;132:1371-1381.
- IBM Corp. Released 2020. IBM SPSS Statistics for Windows, Version 27.0. Armonk, NY: IBM Corp

Sugammadex vs. Neostigmine vs. Spontaneous Reversal in pulmonary complications post surgery

Allison Clemens, PharmD
PGY1 Pharmacy Resident
Parkview Health | Fort Wayne, Indiana

The speaker has no actual or potential conflict of interest in relation to this presentation.