

Muscle Relaxants and Their Reversal

Intraoperative teaching · CA-1

THE QUESTION

Where the evidence disagrees

This topic was selected because an evidence synthesis beats a textbook on it: the trials disagree, or the guidance has moved recently.

THE EVIDENCE

What each source contributes, and how strong it is

Study design first — a cohort and a randomised trial do not carry the same weight.

Design	Year	Journal	What it found
Other	1992	Anesth Analg	Succinylcholine 1 mg/kg and rocuronium 0.6 mg/kg produced intubating condition
Other	2015	Cochrane Database Syst Rev	The Cochrane review of 50 trials and 4,151 patients found succinylcholine supe
Other	2022	Acta Anaesthesiol Scand	The dose of rocuronium buys speed and pays for it in time
Other	2009	Br J Anaesth	Neostigmine antagonises block only where spontaneous recovery has already begun
Other	2009	Br J Anaesth	Sugammadex encapsulates rocuronium rather than out-competing it at the junction
Other	2020	Anesthesiology	Choosing the better reversal drug helps but does not absolve you — a matched c

9 resolved citations behind this deck; every point above traces to one of them.

IN PRACTICE

What the cohorts and reviews add

6 findings, each on the slide that follows.

ANESTH ANALG 1992

Succinylcholine 1 mg/kg and rocuronium 0.6 mg/kg produced intubating condition

Succinylcholine 1 mg/kg and rocuronium 0.6 mg/kg produced intubating conditions at 60 seconds that a blinded assessor could not tell apart

COCHRANE DATABASE SYST REV 2015

The Cochrane review of 50 trials and 4,151 patients found succinylcholine supe

The Cochrane review of 50 trials and 4,151 patients found succinylcholine superior to rocuronium for achieving excellent intubating conditions in...

ACTA ANAESTHESIOLOGICA 2022

The dose of rocuronium buys speed and pays for it in time

The dose of rocuronium buys speed and pays for it in time: in patients over 80, 0.9 mg/kg reached a train-of-four count of zero in 108 seconds and...

BR J ANAESTH 2009

Neostigmine antagonises block only where spontaneous recovery has already begun

Neostigmine antagonises block only where spontaneous recovery has already begun — the standing advice is to wait until at least the second twitch of...

IN PRACTICE

Succinylcholine 1 mg/kg and rocuronium 0.6 mg/kg produced intubating condition

Other · Anesth Analg

Succinylcholine 1 mg/kg and rocuronium 0.6 mg/kg produced intubating conditions at 60 seconds that a blinded assessor could not tell apart, but succinylcholine both arrived and left faster: twitch depression to 5% of control took 0.8 minutes versus 1.2 minutes, and recovery to 90% of control twitch took 11.3 minutes after succinylcholine against 36.1 minutes

after rocuronium.

Pühringer et al., *Anesth Analg* 1992 · PMID 1616158

IN PRACTICE

The Cochrane review of 50 trials and 4,151 patients found succinylcholine superior

Other · *Cochrane Database Syst Rev*

The Cochrane review of 50 trials and 4,151 patients found succinylcholine superior to rocuronium for achieving excellent intubating conditions in rapid sequence induction (risk ratio 0.86), with no statistical difference against rocuronium 1.2 mg/kg — where succinylcholine remained clinically superior only because of its shorter duration of action.

Tran et al., *Cochrane Database Syst Rev* 2015 · PMID 26512948

IN PRACTICE

The dose of rocuronium buys speed and pays for it in time

Other · *Acta Anaesthesiol Scand*

The dose of rocuronium buys speed and pays for it in time: in patients over 80, 0.9 mg/kg reached a train-of-four count of zero in 108 seconds and lasted 118 minutes, while 0.3 mg/kg took 228 seconds and lasted 46 minutes — and two-thirds of the low-dose patients never reached a count of zero at all.

Vested et al., *Acta Anaesthesiol Scand* 2022 · PMID 35675032

IN PRACTICE

Neostigmine antagonises block only where spontaneous recovery has already begun

Other · *Br J Anaesth*

Neostigmine antagonises block only where spontaneous recovery has already begun — the standing advice is to wait until at least the second twitch of the train-of-four is detectable, its full effect still takes up to 10 minutes, and because it works by flooding every muscarinic receptor in the body it must be given with an antimuscarinic, a pairing that is itself dose-dependently associated with postoperative tachycardia.

Srivastava et al., *Br J Anaesth* 2009 · PMID 19468024

IN PRACTICE

Sugammadex encapsulates rocuronium rather than out-competing it at the junction

Other · *Br J Anaesth*

Sugammadex encapsulates rocuronium rather than out-competing it at the junction, so its dose is chosen from the depth of block — about 2 mg/kg once the second twitch has returned, 4 to 8 mg/kg at a post-tetanic count of 1 to 2, and 16 mg/kg for immediate reversal — and in a Cochrane meta-analysis of 41 trials it reached a train-of-four ratio above 0.9 in 2.0 minutes from the second twitch against 12.9 minutes for neostigmine, and in 2.9 minutes from a post-tetanic count of 1 to 5 against 48.8 minutes.

Srivastava et al., *Br J Anaesth* 2009 · PMID 19468024

IN PRACTICE

Choosing the better reversal drug helps but does not absolve you — a matched cohort

Other · *Anesthesiology*

Choosing the better reversal drug helps but does not absolve you — a matched cohort of 45,712 American surgical patients found sugammadex associated with a 30% lower risk of major pulmonary complications than neostigmine, while a 22,803-patient European prospective study found that using a neuromuscular blocking agent at all was associated with more pulmonary complications, and neither monitoring, nor giving a reversal agent, nor extubating at a train-of-four ratio of 0.9 or more removed that association.

Kheterpal et al., *Anesthesiology* 2020 · PMID 32282427

IN THE ROOM

What this changes about the next case

Colour is the strength of the evidence behind each step, not the urgency.

1

1

Succinylcholine 1 mg/kg and rocuronium 0.6 mg/kg produced intubating conditions at 60 seconds that a blinded assessor could not tell apart, but succinylcholine both arrived and left faster: twitch depression to 5% of control took 0.8 minutes versus 1.2 minutes, and recovery to 90% of control twitch took 11.3 minutes after succinylcholine against 36.1 minutes after rocuronium.

2

2

The Cochrane review of 50 trials and 4,151 patients found succinylcholine superior to rocuronium for achieving excellent intubating conditions in rapid sequence induction (risk ratio 0.86), with no statistical difference against rocuronium 1.2 mg/kg — where succinylcholine remained clinically superior only because of its shorter duration of action.

3

The dose of rocuronium buys speed and pays for it in time: in patients over 80, 0.9 mg/kg reached a train-of-four count of zero in 108 seconds and lasted 118 minutes, while 0.3 mg/kg took 228 seconds and lasted 46 minutes — and two-thirds of the low-dose patients never reached a count of zero at all.

4

Neostigmine antagonises block only where spontaneous recovery has already begun — the standing advice is to wait until at least the second twitch of the train-of-four is detectable, its full effect still takes up to 10 minutes, and because it works by flooding every muscarinic receptor in the body it must be given with an antimuscarinic, a pairing that is itself dose-dependently associated with postoperative tachycardia.

5

Sugammadex encapsulates rocuronium rather than out-competing it at the junction, so its dose is chosen from the depth of block — about 2 mg/kg once the second twitch has returned, 4 to 8 mg/kg at a post-tetanic count of 1 to 2, and 16 mg/kg for immediate reversal — and in a Cochrane meta-analysis of 41 trials it reached a train-of-four ratio above 0.9 in 2.0 minutes from the second twitch against 12.9 minutes for neostigmine, and in 2.9 minutes from a post-tetanic count of 1 to 5 against 48.8 minutes.

KEY TAKEAWAYS

What to carry into the next case

Succinylcholine 1 mg/kg and rocuronium 0.6 mg/kg produced intubating condition

Anesth Analg 1992

The Cochrane review of 50 trials and 4,151 patients found succinylcholine supe

Cochrane Database Syst Rev 2015

The dose of rocuronium buys speed and pays for it in time

Acta Anaesthesiol Scand 2022

Neostigmine antagonises block only where spontaneous recovery has already begun

Br J Anaesth 2009

Safe reversal is not a drug you gave, it is a number you measured — a train-of-four ratio of at least 0.9 on a quantitative monitor, with the reversal dose chosen from the depth of block actually in front of you.

QUESTIONS I'LL ASK YOU IN THE ROOM

1. If you cannot intubate and cannot ventilate this patient, which relaxant do you wish you had given, and how long until it does not matter?
2. How deep is the block right now? Tell me what the monitor says, not what the clock says.
3. You have neostigmine and sugammadex on the cart. What decides which one — and what decides the dose?
4. He is lifting his head off the pillow. Is he reversed? How would you know if he were not?

ORAL BOARDS STEM

A 45-year-old with a small bowel obstruction, vomiting since yesterday, needs a laparotomy tonight. The examiner asks which relaxant you would give at induction and why, and what your plan is if the first look is a grade 3 view. Then he jumps to the end of the case: rocuronium was redosed 20 minutes ago because the surgeon wanted more room, the fascia is closed, and he asks what you will give to reverse, how you will choose the dose, and what you need to have seen before the tube comes out.

Safe reversal is not a drug you gave, it is a number you measured — a train-of-four ratio of at least 0.9 on a quantitative monitor, with the reversal dose chosen from the depth of block actually in front of you.

SOURCES

- [1] Pühringer et al., Anesth Analg 1992 · PMID 1616158
- [2] Tran et al., Cochrane Database Syst Rev 2015 · PMID 26512948
- [3] Vested et al., Acta Anaesthesiol Scand 2022 · PMID 35675032
- [4] Srivastava et al., Br J Anaesth 2009 · PMID 19468024
- [5] Shay et al., Anesth Analg 2020 · PMID 30896593
- [6] Hristovska et al., Anaesthesia 2018 · PMID 29280475
- [7] Jones et al., Anesthesiology 2008 · PMID 18946293
- [8] Kheterpal et al., Anesthesiology 2020 · PMID 32282427
- [9] Kirmeier et al., Lancet Respir Med 2019 · PMID 30224322