

ORIGINAL RESEARCH

The Impact of Muscle Relaxant Choice on Postoperative Outcomes in Abdominal Surgery: A Retrospective Analysis

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ABSTRACT

Objective: This retrospective analysis aimed to assess the impact of muscle relaxant choice on postoperative outcomes in patients undergoing abdominal surgery.

Methods: Data from 800 patients who underwent abdominal surgery were analyzed. Patients were categorized into two groups based on the type of muscle relaxant used: depolarizing muscle relaxants (DMRs) or non-depolarizing muscle relaxants (NDMRs). The primary outcomes included postoperative complications, length of hospital stay, and mortality. Statistical analysis was performed using chi-squared tests and t-tests where appropriate.

Results: Patients receiving DMRs (47.5%) experienced a significantly higher incidence of postoperative complications (33.2%) compared to those receiving NDMRs (21.4%, $p < 0.05$). Furthermore, the DMR group had a longer hospital stay (8.6 ± 3.2 days) compared to the NDMR group (6.2 ± 2.8 days, $p < 0.05$). However, there was no significant difference in mortality rates within 30 days post-surgery between the two groups (3.2% DMR vs. 2.8% NDMR, $p = 0.50$).

Conclusion: The choice of muscle relaxant significantly impacts postoperative outcomes in abdominal surgery. Patients receiving DMRs had a higher risk of postoperative complications and an extended hospital stay, although overall mortality rates were similar. These findings suggest a potential preference for NDMRs to improve postoperative outcomes, emphasizing the importance of careful consideration when selecting muscle relaxants for abdominal surgery. Further prospective research is needed to confirm these results and establish causality definitively.

Keywords: muscle relaxants, abdominal surgery, postoperative outcomes, depolarizing agents, non-depolarizing agents.

INTRODUCTION

Abdominal surgery, a cornerstone of modern surgical practice, encompasses a wide array of procedures aimed at treating numerous medical conditions, from gastrointestinal disorders to gynecological and urological issues. The success of abdominal surgery relies heavily on the surgeon's ability to create an optimal surgical field while ensuring patient comfort and safety. Central to achieving these goals is the judicious use of neuromuscular blockade agents, commonly referred to as muscle relaxants [1-5].

Muscle relaxants, or neuromuscular blocking agents, have been an indispensable component of surgical anesthesia since their introduction in the mid-20th century. Their primary function is to induce temporary paralysis of skeletal muscles, thereby facilitating endotracheal intubation, improving surgical access, and reducing patient movement during surgery. This paralysis allows for a stable and motionless surgical field, crucial for precision and safety during abdominal procedures.

However, the choice of muscle relaxant is not a one-size-fits-all decision. The pharmacological properties of these agents differ significantly, particularly in terms of mechanism of action, duration of action, and potential side effects. This variation has prompted ongoing debate among anesthesiologists and surgeons regarding the selection of the most appropriate muscle relaxant for specific surgical scenarios [6-10].

The two broad categories of muscle relaxants used in clinical practice are depolarizing (DMR) and non-depolarizing (NDMR) agents. DMRs, exemplified by succinylcholine, produce a transient and intense muscle depolarization by mimicking acetylcholine, leading to a brief but profound paralysis. In contrast, NDMRs, represented by drugs like rocuronium and vecuronium, act by blocking the transmission of nerve impulses at the neuromuscular junction without depolarization. This results in a more sustained and controllable muscle relaxation.

The choice between DMRs and NDMRs has significant implications for patient outcomes in abdominal surgery. The selection of the appropriate muscle relaxant is contingent upon several factors, including the type and duration of the surgery, patient characteristics, and the preferences of the surgical and anesthesia teams. Given the clinical and ethical significance of this decision, there is a pressing need to explore the impact of muscle relaxant choice on postoperative outcomes.

This retrospective analysis seeks to address this critical issue by evaluating the association between muscle relaxant choice and postoperative outcomes in patients undergoing abdominal surgery. We aim to provide comprehensive insights into the potential advantages and disadvantages of DMRs and NDMRs, shedding light on their respective safety profiles, efficacy, and overall impact on patient care. By examining a substantial cohort of patients, we hope to contribute valuable information that can guide clinicians in making informed decisions regarding muscle relaxant selection, ultimately enhancing the quality and safety of abdominal surgical procedures.

MATERIALS AND METHODS

STUDY DESIGN

This retrospective analysis was conducted at tertiary care center and aimed to assess the impact of muscle relaxant choice on postoperative outcomes in patients who underwent abdominal surgery. Ethical approval for this study was obtained from the Institutional Review Board (IRB), and all patient data were de-identified to ensure privacy and compliance with ethical guidelines.

DATA COLLECTION

We collected data from electronic health records (EHRs) of patients who underwent abdominal surgery between 2010 and 2022. The inclusion criteria were as follows: patients aged 18 years or older, all types of abdominal surgeries, and availability of complete medical records. Patients with incomplete records or those who received muscle relaxants for indications other than surgery were excluded.

MUSCLE RELAXANT CLASSIFICATION

Patients were categorized into two groups based on the type of muscle relaxant administered during surgery: depolarizing muscle relaxants (DMRs) and non-depolarizing muscle

relaxants (NDMRs). Information regarding the specific muscle relaxant used, dosage, and duration of administration was extracted from the EHRs.

OUTCOME MEASURES

The primary outcome measures included postoperative complications, length of hospital stay, and mortality. Postoperative complications were defined as any adverse events occurring within 30 days post-surgery, encompassing surgical site infections, pneumonia, deep vein thrombosis, and others. Length of hospital stay was calculated as the number of days from surgery until discharge, and mortality was assessed as the number of deaths within 30 days after surgery.

STATISTICAL ANALYSIS

Statistical analysis was performed using SPSS (Statistical Package for the Social Sciences) software version ver 20. Descriptive statistics were used to summarize patient demographics, surgical characteristics, and muscle relaxant usage. Continuous variables were expressed as means \pm standard deviation, while categorical variables were presented as frequencies and percentages.

To assess the impact of muscle relaxant choice on postoperative outcomes, we employed chi-squared tests for categorical variables and t-tests for continuous variables. A p-value <0.05 was considered statistically significant.

RESULTS

DEMOGRAPHIC CHARACTERISTICS

A total of 800 patients who underwent abdominal surgery were included in this retrospective analysis. Of these, 380 (47.5%) received depolarizing muscle relaxants (DMRs), while 420 (52.5%) received non-depolarizing muscle relaxants (NDMRs). The demographic characteristics of the two groups were well-matched, with no statistically significant differences in age, gender distribution, or the prevalence of comorbidities [Table 1].

Table 1: Demographic Characteristics

Characteristic	DMR Group	NDMR Group	p-value
Age (years)	56.2 \pm 10.5	57.8 \pm 9.8	p<0.05
Gender (M/F)	190/190	210/210	p=0.50
Comorbidities (%)	72%	75%	p=0.75

POSTOPERATIVE COMPLICATIONS

The primary outcome of interest, postoperative complications, was analyzed to assess the impact of muscle relaxant choice on patient outcomes. Patients receiving DMRs exhibited a significantly higher incidence of postoperative complications (33.2%) compared to those receiving NDMRs (21.4%, p<0.05) [Table 2].

Table 2: Postoperative Complications

Complication	DMR Group (%)	NDMR Group (%)	p-value
Surgical site infection	15.8%	9.5%	p<0.05
Pneumonia	7.4%	6.2%	p=0.60
Deep vein thrombosis	5.3%	4.0%	p=0.45
Other complications	4.7%	1.7%	p=0.70
Total complications	33.2%	21.4%	p<0.05

LENGTH OF HOSPITAL STAY

The analysis of the length of hospital stay revealed that patients who received DMRs had a significantly longer duration of hospitalization (8.6 ± 3.2 days) compared to those who received NDMRs (6.2 ± 2.8 days, $p < 0.05$) [Table 3].

Table 3: Length of Hospital Stay

Outcome	DMR Group (days)	NDMR Group (days)	p-value
Length of hospital stay	8.6 ± 3.2	6.2 ± 2.8	$p < 0.05$

MORTALITY RATES

The analysis of mortality rates within 30 days post-surgery showed no statistically significant difference between the DMR and NDMR groups (3.2% DMR vs. 2.8% NDMR, $p = 0.50$) [Table 4].

Table 4: Mortality Rates

Outcome	DMR Group (%)	NDMR Group (%)	p-value
Mortality within 30 days	3.2%	2.8%	$p = 0.50$

DISCUSSION

The results of this retrospective analysis indicate that the choice of muscle relaxant in abdominal surgery can have a substantial impact on postoperative outcomes. Notably, patients receiving depolarizing muscle relaxants (DMRs) experienced a higher incidence of postoperative complications and a longer duration of hospitalization compared to those receiving non-depolarizing muscle relaxants (NDMRs). These findings align with previous studies and suggest potential advantages of NDMRs in terms of safety and controllability during surgery.

The higher incidence of postoperative complications in the DMR group may be attributed to the transient but intense muscle depolarization induced by DMRs, which can result in fasciculations and myalgias upon emergence from anesthesia. Such effects may contribute to patient discomfort and potentially increase the risk of complications, particularly in cases of more extended surgeries.

The longer hospital stay observed in patients receiving DMRs may be linked to the delayed recovery of neuromuscular function associated with these agents. Extended muscle paralysis can lead to a protracted period of mechanical ventilation, further contributing to prolonged hospitalization. In contrast, NDMRs offer better controllability and reversibility of neuromuscular blockade, potentially allowing for faster postoperative recovery.

It is noteworthy that there was no statistically significant difference in mortality rates between the DMR and NDMR groups. This suggests that while muscle relaxant choice may influence certain postoperative outcomes, it does not appear to impact overall survival within the 30-day postoperative period. However, it is essential to consider that mortality rates can be influenced by various factors, including patient-specific characteristics and the nature of the surgical procedure.

CONCLUSION

These findings highlight the importance of careful consideration when choosing muscle relaxants for abdominal surgery. While DMRs may still have a role in specific clinical scenarios, the results suggest a potential preference for NDMRs to improve postoperative outcomes, particularly in terms of complications and length of hospital stay. However, it is crucial to acknowledge the limitations of this retrospective analysis, including its observational nature and the potential for unmeasured confounding variables. Further

prospective research, including randomized controlled trials, is warranted to validate these findings and establish causality definitively.

REFERENCES

1. Debaene B, Plaud B, Dilly MP, Donati F. Residual paralysis in the PACU after a single intubating dose of nondepolarizing muscle relaxant with an intermediate duration of action. *Anesthesiology*. 2003;98(5):1042-1048.
2. Naguib M, Brull SJ, Kopman AF, et al. Consensus statement on perioperative use of neuromuscular monitoring. *Anesth Analg*. 2018;127(1):71-80.
3. Murphy GS, Szokol JW, Avram MJ, et al. Intraoperative acceleromyographic monitoring reduces the risk of residual neuromuscular blockade and adverse respiratory events in the postanesthesia care unit. *Anesthesiology*. 2008;109(3):389-398.
4. Hunter JM, Naguib M. Residual neuromuscular block: causes and consequences. *Anesthesiol Clin*. 2010;28(2):325-343.
5. Della Rocca G, Pompei L, Pagan DE, et al. Venous thromboembolism prophylaxis in patients undergoing abdominal surgery: A systematic review and meta-analysis. *World J Surg*. 2015;39(4):961-972.
6. Dahl JB, Møiniche S. Pre-emptive analgesia. *Br Med Bull*. 2004;71:13-27.
7. Fuchs-Buder T, Meistelman C, Alla F, Grandjean A, Wuthrich Y, Donati F. Antagonism of low degrees of atracurium-induced neuromuscular blockade: dose-effect relationship for neostigmine. *Anesthesiology*. 2010;112(1):34-40.
8. Marshall S, Chung F. Discharge criteria and complications after ambulatory surgery. *Anesth Analg*. 1999;88(3):508-517.
9. Eriksson LI. Reduced hypoxic chemosensitivity in partially paralysed man. *Acta Anaesthesiol Scand*. 1995;39(5):598-602.
10. Murphy GS, Brull SJ. Residual neuromuscular block: lessons unlearned. Part II: methods to reduce the risk of residual weakness. *Anesth Analg*. 2010;111(1):129-140.
11. Kirmeier E, Eriksson LI, Lewald H, et al. Post-anaesthesia pulmonary complications after use of muscle relaxants (POPULAR): a multicentre, prospective observational study. *Lancet Respir Med*. 2019;7(2):129-140.
12. Blobner M, Eriksson LI, Scholz J, et al. Reversal of rocuronium-induced neuromuscular blockade with sugammadex compared with neostigmine during sevoflurane anaesthesia: results of a randomised, controlled trial. *Eur J Anaesthesiol*. 2010;27(10):874-881.
13. Kirmeier E, Eriksson LI, Lewald H, et al. POPULAR Contributors. Post-anaesthesia pulmonary complications after use of muscle relaxants (POPULAR): a multicentre, prospective observational study. *Lancet Respir Med*. 2019;7(2):129-140.
14. Fuchs-Buder T, Meistelman C, Raft J. Sugammadex: clinical development and practical use. *Korean J Anesthesiol*. 2013;65(6):495-500.
15. Carron M, Zarantonello F, Lazzarotto N, Tellaroli P, Ori C. Role of sugammadex in accelerating postoperative discharge: a meta-analysis. *J Clin Anesth*. 2017;39:38-44.
16. Cammu G, Van Vlem B, van den Heuvel M, Stet L, el Galta R. Use of rocuronium and sugammadex in the morbidly obese. *Minerva Anesthesiol*. 2012;78(2):222-230.
17. Hristovska AM, Duch P, Allingstrup M, Afshari A. The comparative efficacy and safety of sugammadex and neostigmine in reversing neuromuscular blockade in adults. A Cochrane systematic review with meta-analysis and trial sequential analysis. *Anaesthesia*. 2018;73(5):631-641.
18. Madsen MV, Staehr-Rye AK, Claudius C, et al. Neuromuscular blockade for optimising surgical conditions during abdominal and gynaecological surgery: a systematic review. *Acta Anaesthesiol Scand*. 2015;59(1):1-16.
19. Stevens RD, Lazaridis C, Chalela JA. The role of neuromuscular blockade in patients with acute brain injury: a systematic review. *Neurocrit Care*. 2009;10(1):137-147.
20. Seno K, Suzuki T, Kawamoto M, et al. Rocuronium is more suitable than vecuronium as an alternate to succinylcholine for rapid-sequence induction based on time-course of action. *J Anesth*. 2005;19(3):189-193