

**Review Article**

# Comparative Effectiveness of Rocuronium and Succinylcholine in Rapid Sequence Intubation: A Systematic Review

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## ABSTRACT

**Background:** Rocuronium and succinylcholine (suxamethonium) are neuromuscular blocking agents that may be considered for use in rapid sequence intubation (RSI). Rapid sequence intubation is an airway management technique that facilitates swift induction and muscle relaxation, recognized as the most expedient and successful method for securing the airway in emergencies. Therefore, the selection of an ideal muscle relaxant is essential in this setting.

**Objective:** This systematic review aims to evaluate and analyze the available evidence comparing the effectiveness of the muscle relaxants rocuronium and succinylcholine in patients undergoing rapid sequence intubation. Based on the search and screening process, four studies were included, which met the inclusion criteria and were analyzed further.

**Methods:** The literature search was conducted through electronic databases using specific keywords in published journal databases, including ScienceDirect, PubMed, and Google Scholar. The search terms used were *muscle relaxant*, *rocuronium*, *succinylcholine*, and *rapid sequence intubation*. Based on the search and screening process, four articles met the inclusion criteria and were analyzed further. These articles were evaluated to determine their relevance to the objectives of this systematic review. Data analysis was performed to identify the main findings regarding the comparison of the effectiveness of rocuronium and succinylcholine as muscle relaxants in patients undergoing rapid sequence intubation.

**Results:** This systematic review demonstrates that succinylcholine and rocuronium have comparable clinical quality and effectiveness. Analysis of the four articles that met the inclusion criteria revealed that both succinylcholine and rocuronium provide good and comparable effectiveness. These findings indicate that succinylcholine and rocuronium are appropriate muscle relaxants for rapid sequence intubation when used according to their respective indications and contraindications.

**Conclusion:** Based on the findings of this systematic review, it can be concluded that both succinylcholine and rocuronium can be used effectively for tracheal intubation, with acceptable intubation conditions in both groups. However, the use of succinylcholine and rocuronium should take into account patient-specific indications and contraindications.

**Keywords:** Rocuronium; Succinylcholine; Comparison; Rapid Sequence Intubation; Muscle Relaxant

## **INTRODUCTION**

Rapid sequence intubation (RSI) is a method employed for swift airway management to avert potential pulmonary aspiration in at-risk patients. This technique is employed by practitioners in diverse medical fields, such as critical care specialists, anesthesiologists, and emergency medical staff. RSI is intended for patients suffering from acute respiratory failure resulting from insufficient oxygenation or ventilation, and for airway protection in individuals with impaired mental condition. A methodical approach to RSI is crucial for guaranteeing procedural success. Clinicians must assess risks prior to intervention and position the patient optimally with a thorough understanding of the relevant airway anatomy. All necessary equipment should be readily available at the bedside, including alternative airway devices in case of intubation failure (Schrader & Urits, 2022).

The primary goal of RSI is to rapidly and safely secure the airway while actively minimizing the risk of aspiration. Anesthetic induction and intubation in patients with a full stomach represent a classic example of high-risk procedures in which airway protection is critical. To reduce the likelihood of pulmonary aspiration, the classical rapid sequence induction technique (classic RSI) has traditionally been employed (Sinclair et al., 2020).

The Relative Strength Index (RSI) was initially articulated in 1970. Despite the lack of high-quality evidence supporting its safety and efficacy, RSI has progressively been included into standard anesthetic practice. Classic RSI consists of several steps, including monitoring of vital signs, establishment of intravenous access, patient positioning prior to anesthetic induction, functional and active suctioning using a wide-bore suction catheter, preoxygenation, intravenous induction of anesthesia, administration of a fast-onset intravenous neuromuscular blocking agent, application of the Sellick maneuver, and endotracheal intubation with a cuffed tracheal tube (Klucka et al., 2020).

When anesthesia is induced with propofol in elective cases, endotracheal intubation conditions approximately 60 seconds after administration of neuromuscular blocking agents do not differ between succinylcholine and rocuronium (Sluga et al., 2005). The two most commonly used neuromuscular blocking agents in clinical practice are succinylcholine and rocuronium. Both agents are widely used to facilitate rapid sequence intubation in intensive care settings (Hampton, 2021).

Succinylcholine is the most commonly used neuromuscular blocking agent in RSI. Succinylcholine is contraindicated in certain disorders and diseases commonly seen in critically sick patients due to its depolarizing mechanism of action, which elevates extracellular potassium levels. Rocuronium exhibits the most rapid onset among presently available non-depolarizing neuromuscular blocking medicines. As the only contraindication to rocuronium is the rare occurrence of allergic reactions, this agent is considered an attractive alternative to succinylcholine (Marsch et al., 2011).

Comparing these two agents is particularly important, especially in patients with diverse medical conditions. Several studies suggest that rocuronium may serve as an effective and safe alternative to succinylcholine, particularly in patients with contraindications to succinylcholine use. However, existing data remain limited and often inconsistent, highlighting the need for further research to provide clear guidance for clinical practitioners.

In light of this context, studies evaluating the quality and efficacy of rocuronium versus succinylcholine in patients undergoing rapid sequence intubation are scarce. Therefore, this systematic review is expected to provide deeper insights into the optimal choice of neuromuscular blocking agents and to contribute to improved safety and clinical outcomes in patients requiring emergency intubation.

## **METHODS**

### ***Inclusion and Exclusion Criteria***

This systematic review included studies published between 2020 and 2024, written in English or Indonesian, and focused on patients undergoing rapid sequence intubation (RSI). The selected studies were Randomized Controlled Trials (RCTs), Cohort Studies, or Analytical Cross-Sectional designs. Articles that met these criteria were included for further analysis. Studies were excluded if they did not meet the inclusion criteria, such as if they were not full-text articles or did not focus on RSI.

### ***Literature Search Strategy***

A comprehensive literature search was conducted using the PICO framework (Population, Intervention, Comparison, and Outcome) across three electronic databases: ScienceDirect, PubMed, and Google Scholar. The search terms included Rocuronium, Succinylcholine, Comparison, Rapid Sequence Intubation, and Muscle Relaxant. From the search, 995 articles were identified in ScienceDirect, 3 articles were retrieved from PubMed, and 2,210 articles were found through Google Scholar. These articles were initially screened for relevance based on their title, abstract, and availability. The search strategy used Boolean operators, such as AND (to combine terms like "Rocuronium AND Succinylcholine") and OR (to include broader terms like "muscle relaxant OR neuromuscular blocking agent")

### ***Methodological Quality Assessment***

The methodological quality of the selected studies was evaluated using the Joanna Briggs Institute (JBI) critical appraisal tool, which assessed the appropriateness of study designs and alignment with research objectives. Studies with JBI scores of "good" or "very good" quality were included. The final selection consisted of four articles, with JBI scores ranging from 76.92% to 100%. The articles selected were from various study designs, including RCTs and retrospective cohort studies.

### ***Study Description***

This systematic review aimed to compare the effectiveness of Rocuronium and Succinylcholine in facilitating Rapid Sequence Intubation. After an extensive screening process, six studies were found to meet the inclusion criteria, but only four studies were selected for the final analysis. The selection process is illustrated in the PRISMA flow diagram, which visualizes the inclusion and exclusion process.

### ***Data Extraction and Synthesis***

A synthesis table was created to summarize key findings from the selected studies. The table included the following categories: Author(s)/Year, Study Design, Key Findings, and Strengths and Limitations of each study. The synthesis process involved a descriptive approach, allowing for the comparison of findings across different studies. The data were then analyzed based on the effectiveness of Rocuronium versus Succinylcholine in RSI.

### ***Data Charting and Evidence Mapping***

Following a scoping review approach, evidence was mapped according to the PCC framework (Population, Concept, Context). The population was defined as patients undergoing RSI, with the concept focusing on the comparison of Rocuronium and Succinylcholine. The context included various healthcare settings, particularly emergency and critical care environments. This approach provided a broader view of the available evidence regarding the use of these neuromuscular blocking agents in RSI.

## **RESULTS**

The literature search conducted across three databases (ScienceDirect, PubMed, and Google Scholar) identified a total of 3,208 articles. After screening based on title, abstract, availability of full text, topic relevance, and predefined inclusion and exclusion criteria, four articles were

deemed eligible for inclusion in this systematic review. The study selection process is illustrated using a PRISMA flow diagram.

The methodological quality of the included studies was assessed using the Joanna Briggs Institute (JBI) critical appraisal tools. The results demonstrated that all included articles were of good to very good methodological quality, with JBI scores ranging from 76.92% to 100%. Two studies employed a Randomized Controlled Trial (RCT) design, one was a retrospective cohort study, and one was a multicenter double-blind RCT. Overall, the evidence analyzed in this systematic review was derived from study designs with an adequate level of scientific rigor.

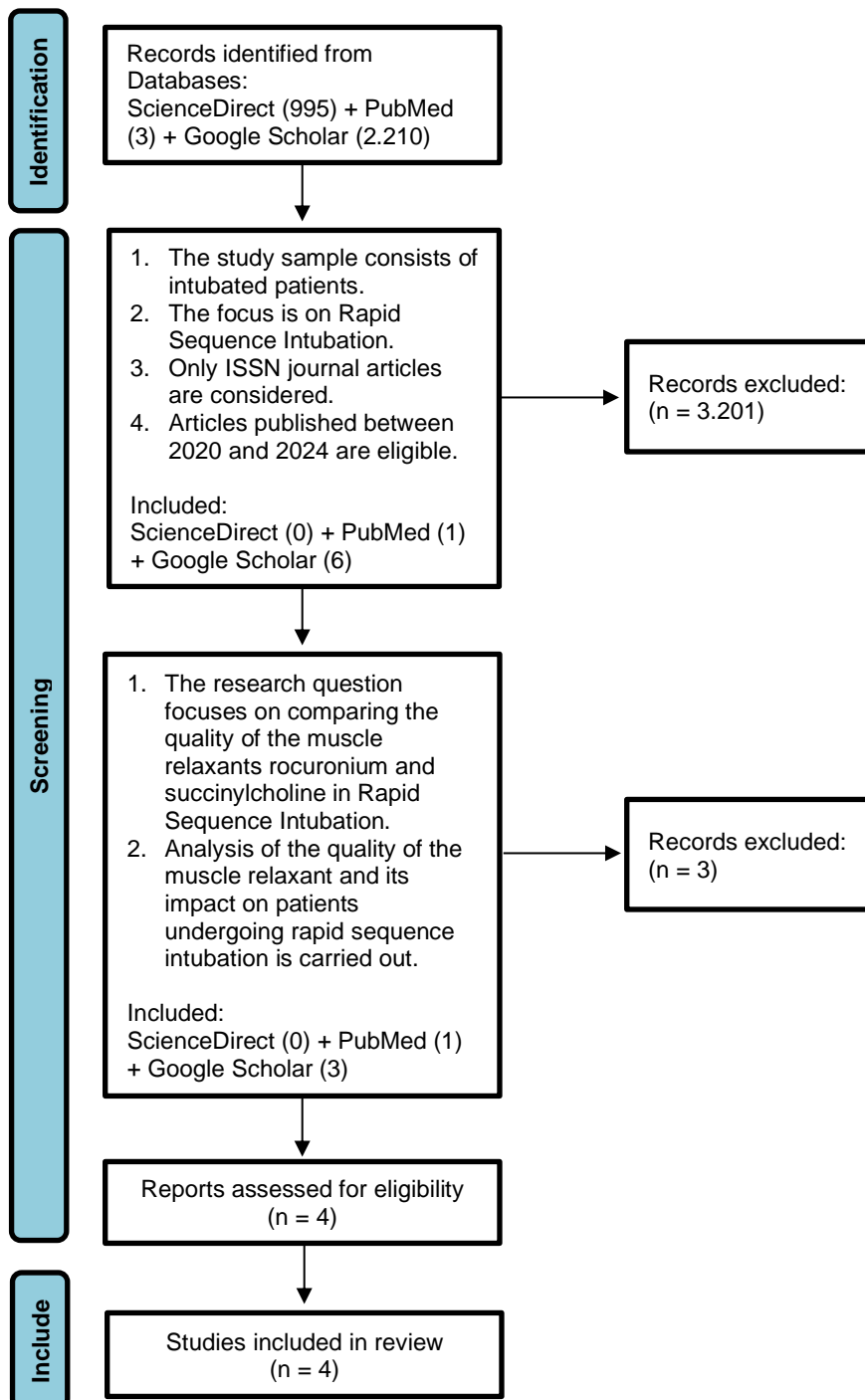


Figure 1. PRISMA Flowchart

All four included studies consistently reported that succinylcholine and rocuronium demonstrated comparable clinical effectiveness when used as muscle relaxants for Rapid Sequence Intubation (RSI). The primary outcome measures assessed included the quality of intubation conditions, onset time or time to successful intubation, and first-pass intubation success rate.

Most studies reported that intubation conditions in both groups were rated as good to excellent, with no statistically significant differences between succinylcholine and rocuronium. However, succinylcholine tended to demonstrate a faster onset of action compared to rocuronium. Despite this difference, first-pass intubation success rates and intubation difficulty scores were generally similar between the two agents.

**Table 1. Data Extraction Table (Article Characteristics)**

Researchers (Year)	Title	JBI Level	Methods	Criteria	Intervention	Results	Advantages and Limitations
Nga Number Serge et al. (2021)	Comparison between Rocuronium and Succinylcholine for Rapid Sequence Intubation in Adults	76.92%	Randomized Controlled Trial. Sample size: 105 adult patients. Data were analyzed using Statistical Package for the Social Sciences version 20 with the Mann–Whitney U test. Intubation conditions were assessed using the Viby-Mogensen score.	Inclusion criteria: Adult patients undergoing rapid sequence induction with general anesthesia. Exclusion criteria: Pregnant women, patients refusing general anesthesia, and patients converted from failed regional anesthesia.	Group one received propofol and succinylcholine at a dose of 1 milligram per kilogram. Group two received propofol and rocuronium at a dose of 1.2 milligrams per kilogram.	Both groups showed acceptable intubation quality and comparable intubation time of less than sixty seconds, with no statistically significant difference.	Strengths: Random allocation and use of validated assessment tools. Limitations: Single-blind design with potential observer bias.
Gui Li et al. (2021)	Comparison of Rocuronium and Succinylcholine for Emergency Tracheal Intubation: A Retrospective Study	90.91%	Retrospective cohort study involving 267 adult patients. Data were analyzed using Statistical Package for the Social Sciences version 25 with t-tests and Fisher exact tests. Intubation difficulty was assessed using the Cormack–Lehane classification.	Inclusion criteria: Adult patients older than eighteen years requiring emergency tracheal intubation. Exclusion criteria: Pregnancy, history of myocardial infarction, and allergy to rocuronium or succinylcholine.	Patients received either succinylcholine at a dose of 1 milligram per kilogram or rocuronium at a dose of 1.2 milligrams per kilogram following preoxygenation.	There was no significant difference in the rate of successful intubation. The rocuronium group required a higher number of intubation attempts.	Strengths: Large sample size and use of clinically validated tools. Limitations: Retrospective design with risk of selection bias and uncontrolled confounding factors.
Vested et al. (2024)	Intubation Conditions during Rapid Sequence Intubation with Rocuronium or Suxamethonium	100%	Double-blind randomized controlled trial involving 90 patients aged eighty years or older. Statistical analysis included	Inclusion criteria: Patients aged eighty years or older with American Society of Anesthesiologists physical status class I to IV and body mass index	Patients received either rocuronium or suxamethonium at a dose of 1 milligram per kilogram of actual body weight.	No statistically significant differences were found in intubation conditions, intubation time, or	Strengths: Double-blind randomized controlled design and focus on elderly patients. Limitations: Absence of

	nium in Elderly Patients		independent t-tests, Mann–Whitney U tests, chi-square tests, and Fisher exact tests.	below thirty-five kilograms per square meter. Exclusion criteria: Neuromuscular disorders, hyperkalemia, malignant hyperthermia, and severe renal impairment.		intubation difficulty between the two groups.	detailed subgroup analysis.
Wahid et al. (2020)	Comparison of Rocuronium and Succinylcholine for Rapid Sequence Induction in Patients Undergoing General Anesthesia	100%	Randomized controlled trial involving 140 adult patients. Data were analyzed using Statistical Package for the Social Sciences version 21 with chi-square testing.	Inclusion criteria: Adult patients aged twenty-five to fifty-five years with American Society of Anesthesiologists physical status class I or II. Exclusion criteria: Anticipated difficult airway, obesity, neurological disorders, and drug hypersensitivity.	Group one received succinylcholine at a dose of 1 milligram per kilogram, while group two received rocuronium at a dose of 1 milligram per kilogram following induction of anesthesia.	No statistically significant difference in intubation conditions was observed between the two groups, with a p-value of 0.570.	Strengths: Clear randomized design and ethical approval. Limitations: Short follow-up duration and limited reporting of adverse effects.

**DISCUSSION**

The findings of this systematic review indicate that both succinylcholine and rocuronium are effective and largely equivalent muscle relaxants for facilitating Rapid Sequence Intubation. This aligns with the fundamental principles of RSI, which emphasize rapid airway control, patient safety, and optimal intubation conditions.

The study by Nga Nomo Serge et al. (2021) demonstrated that both agents produced clinically acceptable intubation conditions with comparable intubation times, although succinylcholine exhibited a slightly faster onset of action. This rapid onset remains a key advantage of succinylcholine and explains its longstanding role as the preferred neuromuscular blocking agent in RSI, particularly in emergency situations requiring immediate airway control.

Similar findings were reported by Gui Li et al. (2021), where no significant difference was observed in first-pass intubation success rates between succinylcholine and rocuronium. Nevertheless, the succinylcholine group experienced fewer failed intubations and required fewer intubation attempts. These results suggest a potential practical advantage of succinylcholine in emergency department settings. However, given the retrospective design of the study, the findings should be interpreted with caution due to the possibility of selection bias and uncontrolled confounding factors.

In elderly patients, the randomized controlled trial conducted by Vested et al. (2024) found no significant differences between rocuronium and succinylcholine regarding intubation conditions, time to intubation, or first-pass success rates. Notably, succinylcholine achieved complete neuromuscular blockade more rapidly than rocuronium. This finding reinforces the consistent advantage of succinylcholine in terms of onset speed, although it does not necessarily translate into superior overall intubation quality.

The study by Wahid et al. (2020) further supported these conclusions, demonstrating no statistically significant differences in intubation conditions between the two agents. This strengthens the evidence that rocuronium is a viable and effective alternative, particularly in patients with contraindications to succinylcholine.

Overall, this systematic review highlights that the choice between succinylcholine and rocuronium for RSI should not be based solely on clinical effectiveness. Patient-specific

factors, potential contraindications, and resource availability such as access to sugammadex for rapid reversal of rocuronium must also be considered. Therefore, the selection of neuromuscular blocking agents in RSI should be individualized and context-dependent, with patient safety as the primary consideration.

## CONCLUSION

This systematic review concludes that succinylcholine and rocuronium demonstrate comparable effectiveness in facilitating Rapid Sequence Intubation, with similar intubation conditions and first-pass success rates. Succinylcholine provides a faster onset of action, while rocuronium remains a safe and effective alternative, particularly in patients with contraindications to succinylcholine. Therefore, the choice of neuromuscular blocking agent for RSI should be individualized based on patient characteristics and clinical context.

## CONFLICT OF INTEREST STATEMENT

The authors declare that there is no conflict of interest associated with this study. There are no known financial or personal relationships that could have influenced the content or conclusions of this systematic review.

## AUTHOR CONTRIBUTION

F was responsible for conceptualization, literature searching, and data extraction. JNH conducted data analysis. LA interpretation of the results. All authors contributed to manuscript writing and critical revision. All authors reviewed, revised, and approved the final manuscript and agreed to be accountable for all aspects of the work.

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