

## Abstract

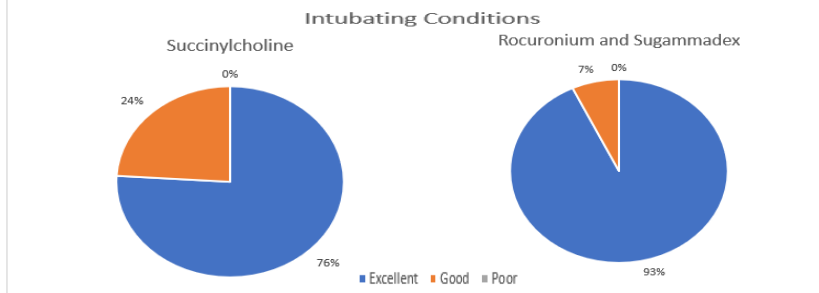
Succinylcholine is a depolarizing neuromuscular blocking agent (NMBA) that is frequently used in surgical anesthesia to facilitate endotracheal intubation to secure the patient's airway and provide mechanical ventilation. Specifically, succinylcholine is used for rapid sequence induction (RSI). To avoid succinylcholine's harmful side effects, an alternative non-depolarizing NMBA called rocuronium can be considered. It should be noted that the 30-70-minute duration of action of rocuronium is significantly longer than that of succinylcholine. However, the newly developed reversal agent known as sugammadex, has been proven to reduce the usual reversal time of rocuronium significantly (Sørensen, 2012). The purpose of this study is to compare the use of succinylcholine with the use of rocuronium with sugammadex reversal in the setting of rapid sequence inductions to determine if the use of the latter combination is more beneficial in terms of recovery speed. This study uses fifty-five patients split into two groups based on the NMBA used and measured values such as the time between recovery of spontaneous ventilation and neuromuscular function. It also measured the intubating conditions found in the two groups. The results showed that the Rocuronium and Sugammadex group had a significantly faster recovery in both spontaneous ventilation and neuromuscular function. There was also no clinical significance found between intubating conditions in the two groups. This led to the conclusion that the use of the use of rocuronium with sugammadex in RSI is more beneficial than the use of succinylcholine.

## Introduction

Rapid sequence induction (RSI) and intubation is a technique developed to facilitate the rapid endotracheal intubation of patients with a high risk of aspiration. The goal of this technique is to minimize the time between loss of protective airway reflexes and tracheal intubation. In the setting of RSI, succinylcholine is the NMBA of choice to provide paralysis due to its rapid onset of 1-2 minutes, production of excellent intubating conditions, and relatively fast spontaneous recovery time of 5-10 minutes. The rapid recovery time of succinylcholine is one of the key factors that make it a top choice. This is because in situations where intubation fails, the patient can be ventilated until succinylcholine wears off, thus reducing the chances of desaturation (decreased saturation of hemoglobin with oxygen) (Sørensen, 2012). Despite its beneficial factors, the use of succinylcholine has been shown to have a multitude of adverse effects which have led many to search for better alternatives. Some of the more concerning adverse effects being arrhythmias and cardiac arrest due to the release of intracellular potassium through muscle cell membrane depolarization. Additionally, patients who are unpredictably deficient in an enzyme known as pseudocholinesterase may experience a prolonged paralyzing effect due to insufficient metabolizing of succinylcholine. Other known adverse effects of succinylcholine worth mentioning include initiation of malignant hyperthermia, muscle hypertonia, hypersalivation, myalgia, and elevated intraocular, intragastric, and intracranial pressures.

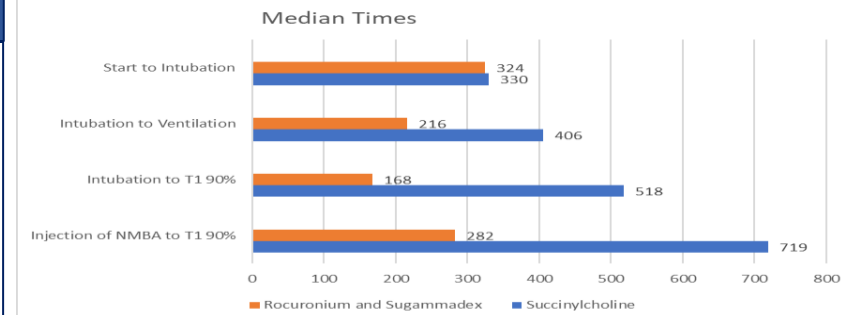
## Methods and Procedure

The fifty-five patients chosen for the study analyzed were between 18 and 65 years of age and were also undergoing rapid sequence induction and intubation. Patients were randomly selected to be given either 1 mg/kg succinylcholine or 1 mg/kg rocuronium followed by 16 mg/kg sugammadex to facilitate the RSI. The RSI for each procedure began the same so that the only variable was the NMBA used. First the patient was preoxygenated followed by administration of 10 mcg/kg alfentanil and 2 mg/kg propofol. Afterwards, a propofol infusion was started to insure patient sedation. At this point, the patient received either 1 mg/kg succinylcholine or 1 mg/kg rocuronium. Cricoid pressure was then applied, and the endotracheal tube was placed. Using visualization of thoracic movement, auscultation of the chest, and the appearance of a typical capnography waveform, the placement of the tube was verified. Cricoid pressure was then released for both groups and 16 mg/kg of sugammadex was given to patients that received rocuronium. The first outcome measured was the time from correct placement of the endotracheal tube to the recovery of spontaneous ventilation, defined as a respiratory rate of more than 8 breaths per minute (bpm), a tidal volume of at least 3 ml/kg and an arterial oxygen saturation above 90% for 30 seconds(s). The second outcome measured was the time from tracheal intubation to 90% of the recovery of the first twitch on the train-of-four (TOF) monitor (T1 90%), measuring the speed of recovery of neuromuscular function.



## Results

For the primary outcome of this experiment, it was determined that the time between endotracheal intubation and spontaneous ventilation was faster in the rocuronium-sugammadex group than in the succinylcholine group. The median time to recovery of spontaneous ventilation was faster in the rocuronium-sugammadex group than in the succinylcholine group. For the secondary outcome, it was determined that the T1 90% was faster with the rocuronium-sugammadex combination than with succinylcholine. It was also observed that intubating conditions and the time it took to achieve correct endotracheal intubation were not significantly different between the two patient groups.



## Discussion

The results of this experiment found that the use of rocuronium followed by sugammadex led to a significantly faster recovery of spontaneous ventilation than succinylcholine. The results also showed that recovery of neuromuscular function was quicker with rocuronium and sugammadex than with succinylcholine. This data supports the use of rocuronium and sugammadex as an adequate replacement for succinylcholine for rapid sequence inductions. This data may also prove the combination to be more beneficial. With the use of succinylcholine, the average duration of action can be up to 10 minutes. This means if the patient cannot be intubated, they must be ventilated until it wears off. However, in situations where ventilation is not possible, desaturation may occur leading to poor patient outcomes. The rapid reversal of rocuronium with sugammadex and the quick recovery of spontaneous ventilation reduces the concern of these "can't intubate, can't ventilate" situations. Despite these discoveries, one limitation to the use of rocuronium with sugammadex is its cost. A study done by Ledowski in 2012 looked to determine the cost-effectiveness of sugammadex. Ledowski found that the unrestricted use of sugammadex radically increased the hospital's anesthesia related costs. However, they also observed a decrease in the duration of hospital stay after surgery and a suggested reduction in the occurrence of post-operative pulmonary complications due to muscle paralysis, both of which could result in reduced overall costs.

## Conclusion

Based on the results of this experiment, the use of the rocuronium - sugammadex combination is an adequate replacement for succinylcholine in the setting of RSIs due to its quicker recovery speed. The use of succinylcholine provided no significant advantages over the use of rocuronium and instead comes with the increased risk of desaturation and severe adverse effects. Additionally, the high cost of using sugammadex can be justified by the costs saved through reduction in patient hospital stays and reduction in poor post-operative patient outcomes.

## References

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