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# Rocuronium Versus Succinylcholine for Rapid Sequence Induction of Anesthesia and Endotracheal Intubation

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**Abstract:** Succinylcholine has been used in the past for rapid sequence induction (RSI) due to its short acting and fast onset. It can, however, produce clinically significant undesirable effects such as hyperkalemia, bradycardia, myalgia, and long-lasting paralysis in patients with atypical pseudocholinesterase. Rocuronium is a non-depolarizing agent with a short latency and long duration of action. Rocuronium bromide is used for rapid sequence intubation (RSI) due to its rapid action and short duration of effect. Currently, rocuronium bromide is used for RSI because of its short onset and duration of action. This was a randomized comparative study of 60 adults (ASA physical status I-II and Mallampati grade I-II) during the period of 1 March 2023 to 30 January 2024 at Baghdad teaching hospital and Rizgari teaching hospital. The 30 first participants (Group A) were treated with rocuronium 0.6 mg/kg and the next 30 (Group B) with succinylcholine 1.5 mg/kg. The intubating conditions were scored according to the Cooper scoring system at around 60 seconds with a maximum of 75 or 90 seconds for assessment if necessary. The patients receiving rocuronium (n=27) had excellent intubating conditions in 90%, and good conditions in the remaining 3 patients; patients receiving succinylcholine (n=30) had 100% excellent intubating conditions. There were no reports of poor or inadequate conditions. First-attempt intubation was successful in 28/30 patients (93%) in the rocuronium group and 29/30 (97%) of the succinylcholine group. Overall, clinically acceptable conditions ($p>0.05$) were not statistically different between the two groups of study. The two agents in this limited study were found to give clinically acceptable intubating conditions. A higher percentage of excellent conditions was obtained with succinylcholine, which also may be used when succinylcholine is contraindicated. There are limitations in conclusions drawn for uncommon complications due to the small sample size and lack of blinding.

**Keywords:** Rocuronium, Succinylcholine, Rapid Sequence Induction, Endotracheal Intubation, Neuromuscular Blocking Agents

## Introduction

Rapid sequence induction and endotracheal intubation can be used when there is a need for immediate airway control and the risk for aspiration (e.g., emergency surgery, full stomach). The goal is to establish an appropriate airway in a timely fashion and to minimize the time during which the regurgitation and aspiration of food can occur [1,2].

Traditionally the drug of choice has been succinylcholine because of its rapid onset and typical duration of action. It is a depolarizing neuromuscular blocking agent but has many side effects and contraindications (including severe hyperkalemia in susceptible patients, bradyarrhythmia's, post-operative myalgia, precipitating malignant hyperthermia, and prolonged paralysis with atypical plasma cholinesterase) which limit its use. [3,4]

Rocuronium is a relatively rapidly acting non-depolarizing amino steroidal neuromuscular blocking agent. The one concern with succinylcholine is its longer duration of action; however, sugammadex may be used for reversal of rocuronium-induced neuromuscular blockade, if indicated and available [5,6]. Some evidence that the rate of excellent intubating conditions may be higher with succinylcholine, and may not be as apparent with excellent and good conditions [7]. The primary purpose was to compare the quality of endotracheal-intubating conditions following the use of rocuronium with those after succinylcholine with rapid sequence induction. Specific goals were (1) the condition of laryngoscopy, (2) vocal-cord position and movement, (3) reaction to intubation, (4) overall Cooper scores and (5) first-attempt intubation success.

## Materials and Methods

### Study design and setting

This comparative study was conducted in the emergency operating theatres of Baghdad Teaching Hospital and Rizgari Teaching Hospital as a randomized study from 1 March 2023 to 30 January 2024. Sixty patients were included in the final analysis.

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**Eligibility criteria**

Adults of ASA physical status I or II, either sex with Mallampati grade I or II were included. Emergency procedures mainly included trauma laparotomies and appendectomies. Hyperkalemia, neurological disorders, burns, history of or expected difficult intubation (requiring awake fiberoptic intubation), contraindication to propofol (shock), and known allergy to rocuronium were excluded.

**Allocation of groups and anesthesia technique**

Patients were randomized to the Group A (rocuronium bromide 0.6 mg/kg) or Group B (succinylcholine/suxamethonium chloride 1.5 mg/kg). Pulse, non-invasive blood pressure, oxygen saturation, ECG and end-tidal carbon dioxide were measured routinely. Patients were preoxygenated for 3 minutes. Propofol 1.5 mg/kg was used for induction and the neuromuscular blocker was given once the eyelid reflex had disappeared. Laryngoscopy started at 60 seconds and may be delayed to 75/90 seconds if needed. To minimize operator variability, intubation was done by the same anesthesiologist.

**Outcome assessment**

The main end point was intubating condition (Cooper scoring). There was a maximum of 3 points for each of the following: laryngoscopy, vocal-cord condition, and response to intubation, for a total score of 3–9. The classified scores of 3-5 as poor; inadequate conditions were classified as ≤2 even though this is outside of the total score range mentioned. Desaturation was considered to be oxygen saturation < 90% or drop > 5% from the baseline during induction and the first three minutes after intubation.

**Statistical analysis**

Data analysis was done using the SPSS version 20. Descriptive data were presented in terms of means, standard deviations, and counts, percentages. The statistical significance of a p value was set at 0.05. The tables below are reproduced of the reported values.

**Results**

Thirty patients were included in each group and 60 patients were analyzed. The baseline characteristics of the patients are summarized in Table 1. The two groups were comparable in age, sex, ASA status and Mallampati grade as described in Table 1.

**Table 1.** Baseline demographic and clinical characteristics

| Characteristic | Group A: Rocuronium (n=30) | Group B: Succinylcholine (n=30) | Reported p-value |
|---|---|---|---|
| Age, years (mean ± SD) | 33.06 ± 6.043 | 30.86 ± 5.012 | 0.844 |
| Sex, male:female | 18:12 | 17:13 | 0.566 |
| ASA physical status I / II | 20 / 10 | 21 / 9 | 0.661 |
| Mallampati grade I / II | 12 / 18 | 10 / 20 | 0.883 |

Table 2 shows the component scores for the laryngoscopy, vocal-cord and response to intubation. In both groups, indicates that most of the cases are score-3. Table 2 shows that the incident, which had a score of 3, was rated numerically more often with succinylcholine for vocal-cord conditions and response to intubation. These component comparisons were not significant at $p < 0.05$ level.

**Table 2.** Component scores for intubating conditions

| Component and score | Rocuronium n (%) | Succinylcholine n (%) | Reported p-value |
|---|---|---|---|
| Laryngoscopy: score 3 | 23 (76.7%) | 25 (83.3%) | 0.781 |
| Laryngoscopy: score 2 | 7 (23.3%) | 5 (16.7%) | 0.812 |
| Laryngoscopy: score 1 | 0 | 0 | Not applicable |
| Vocal cords: score 3 | 26 (86.7%) | 29 (96.7%) | 0.512 |
| Vocal cords: score 2 | 4 (13.3%) | 1 (3.3%) | 0.353 |
| Vocal cords: score 1 | 0 | 0 | Not applicable |
| Response to intubation: score 3 | 25 (83.3%) | 30 (100%) | 0.091 |
| Response to intubation: | 5 (16.7%) | 0 | 0.081 |

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| | | | |
|---|---|---|---|
| score 2<br>Response to intubation: score 1 | 0 | 0 | Not applicable |

Table 3 shows a summary of overall intubating-condition categories. The conditions in 90% of the rocuronium group and 100% of the succinylcholine group are excellent. As indicated in Table 3, all the participants in both groups had good or excellent conditions. The difference in excellent ratings was not statistically significant, but was numerically in favor of succinylcholine.

**Table 3.** Overall intubating conditions

| Category | Rocuronium (n=30) | Succinylcholine (n=30) | Reported p-value |
|---|---|---|---|
| Excellent (8–9 points) | 27 (90%) | 30 (100%) | 0.693 |
| Good (6–7 points) | 3 (10%) | 0 (0%) | 0.237 |
| Poor (3–5 points) | 0 (0%) | 0 (0%) | Not applicable |
| Inadequate (≤2 points) | 0 (0%) | 0 (0%) | Not applicable |

The results of the first intubation attempt are summarized in Table 4. The first intubation attempt was successful in 28 patients who received rocuronium and 29 who received succinylcholine. Intubation was finally successfully achieved in all 60 patients as seen in Table 4 below. Two patients were intubated with rocuronium and one patient was intubated with succinylcholine.

**Table 4.** First-attempt intubation success

| Outcome | Rocuronium (n=30) | Succinylcholine (n=30) |
|---|---|---|
| Successful on first attempt | 28 (93.3%) | 29 (96.7%) |
| Required second attempt | 2 (6.7%) | 1 (3.3%) |
| Successful intubation after second attempt | 30 (100%) | 30 (100%) |

## Discussion

Rocuronium 0.6 mg/kg and succinylcholine 1.5 mg/kg were equally effective at providing clinically acceptable intubating conditions in adults undergoing emergency surgery in this study. Excellent conditions were reported in 90% of the rocuronium group and all the patients in the succinylcholine group. These results agree with the literature, which shows a higher incidence of excellent conditions with succinylcholine, but with the combination of excellent and good conditions, the difference may be less [8-10].

Use of rocuronium may be indicated when succinylcholine is contraindicated or a contraindication. Succinylcholine may liberate potassium and may be hazardous in a burn trauma or severe trauma and in conditions that cause up regulation of extrajunctional acetylcholine receptors like denervation or neuromuscular disease. May also trigger malignant hyperthermia and may lead to prolonged paralysis in patients who have a defect in pseudocholinesterase [11,12,13]. Avoids the depolarizing mechanism and these characteristic risks associated with succinylcholine, but has a longer duration of action and requires proper planning for continued ventilation and proper recovery of the neuromuscular system. If available, rocuronium has a specific agent for reversal (sugammadex) [14,15].

The results are not meant to be evidence of equivalence of the drugs in all RSI settings. The number of study participants was 30 and there was no blinding. Group allocation might have been mentioned as fasciculations and heterogeneous onset. The study also was small enough that it could not be certain of the relative risk of uncommon but severe side effects.

The disadvantages were that the patients were small, there was no double blinding, the scoring was subjective by the observer and for rare complications, patients were small. There are also inconsistencies in the reported statistical values for some baseline characteristics and some components of the outcome measure in the study. The findings are therefore representative of the sample reported and its validity should be checked in larger well-designed studies.

## Conclusion

Rocuronium 0.6 mg/kg and succinylcholine 1.5 mg/kg both gave good-to-excellent intubating conditions in this randomized comparison of 60 adults undergoing emergency surgery. Excellent conditions occurred more often with succinylcholine (100%) than rocuronium (90%) and intubation was ultimately successful in all patients in both groups. Wherever succinylcholine is contraindicated the use of rocuronium may be clinically advantageous, provided the

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longer duration of action and the requirement for continued mechanical assistance of ventilation and appropriate reversal is taken into account. More blinded or independently assessed studies are warranted to define the differences in efficacy and safety.

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