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ORIGINAL RESEARCH

Administration of low dose rocuronium and low dose succinylcholine for ease of insertion of LMA - A prospective comparative study

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ABSTRTACT

Background: Since laryngeal mask airway (LMA) has so many benefits over conventional facemasks and endotracheal tubes, it is a commonly used tool in airway management. It is still difficult to provide ideal circumstances for LMA insertion while preserving cardiovascular stability. This study investigates the use of succinylcholine and rocuronium at low dosages to ease the insertion of LMA during Propofol anesthesia. **Methodology:** 111 patients were included in the study and randomly assigned to three equal groups of 37 after receiving informed consent and approval from the institute's ethical committee. Randomly selected patients undergoing elective short general surgery procedures were given one of three medications: Propofol + placebo (saline),Propofol + low-dose rocuronium (0.1 mg/kg), Propofol + low-dose succinylcholine (0.1 mg/kg) for LMA insertion. Information was gathered regarding gagging and coughing, the number of attempts, ease of insertion, and jaw relaxation. **Results:** Compared to saline-placebo (40.5%), jaw relaxation was significantly better with rocuronium (86.5%) and succinylcholine (73.0%) (p=0.0005). When compared to saline-placebo (54.1%), rocuronium (94.6%) and succinylcholine (81.1%) had significantly easier insertions (p=0.0027). statistically significant difference (p=0.175) was not observed in the number of successful first attempts for rocuronium (78.4%), succinylcholine (59.5%), and saline-placebo (62.2%) among the groups. significant difference was not seen in coughing or gagging between the groups (p=0.485). **Conclusion:** In patients undergoing elective general surgery, the use of low-dose succinylcholine and low-dose rocuronium greatly improves the circumstances for LMA insertion during Propofol anesthesia.

Keywords: LMA, Low Dose Rocuronium, Low Dose Succinylcholine

INTRODUCTION

Significant advancement has been made in anesthesia in the past two decades, especially in airway management. Anesthesiologists have worked on designing a variety of supraglottic airway devices as less invasive and more dependable substitutes for facemask ventilation.

The LMA has a number of benefits over the facemask and endotracheal tube[1]. Research have demonstrated that using an LMA instead of a facemask improves oxygenation during anesthesia. Because of its versatility, it can be used for resuscitation, emergency ventilation, inhaled anesthetic administration, ventilation during anesthesia, and even as a tracheal intubation assist device [2, 3, 4]. Additionally, the management of patients with difficult airways is greatly aided by the LMA.

The LMA improves patient tolerance over the tracheal tube, guaranteeing a more stable airway during emergence while additionally maintaining the airway clear during the postoperative phase [5, 6].

Because of its widespread acceptance, it is currently used in up to thirty percent of patients receiving general anesthesia[7]. Nonetheless, there is still a need for an ideal induction method that preserves cardiovascular stability and guarantees appropriate insertion conditions.

An optimal mouth opening and a suitable level of anesthesia are required for a successful LMA insertion[8,9, 10]. Easier insertion is made possible by

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increased patient sedation and relaxation of jaw muscles. Propofol is the recommended induction agent, but it might not be sufficient to create an ideal environment. Propofol fixed dosages may cause problems like coughing, hiccups, laryngeal spasm, patient movements, and hemodynamic complications. Although the necessary dose varies from patient to patient, a depth of anesthesia high enough to suppress airway reflexes is necessary for the successful insertion of LMA without the use of muscle relaxants [10, 11, 12, 13]. The typical dosage of Propofol is 2.5–3 mg/kg.Although it frequently causes unfavorable hemodynamic effects, Propofol is preferred over sodium thiopental because of its superior suppression of pharyngeal and laryngeal reflexes[11, 12, 13, 14] . Co-induction with medications such as midazolam, ketamine, low-dose muscle relaxants, or opioids [15, 16] may reduce these effects.

The appropriate anesthetic depth can be achieved by adjusting the dose based on the clinical response instead of utilizing a fixed dose, which lowers the risk of cardiopulmonary complications [17, 18, 19, 20]. Apnea, motor response to jaw thrust, and loss of verbal contact are clinical indicators for LMA insertion. Jaw thrust is a good predictor of enough anesthetic depth for a complication-free insertion since it is similar to the LMA insertion stimulus [21, 22, 23, 24]. Although it is controversial, it has been demonstrated that using muscle relaxants in small doses in conjunction with Propofol can enhance the insertion conditions for LMA [25, 26, 27].

Due to its quick onset and moderate duration, rocuronium bromide is frequently used for both rapid sequence induction and standard endotracheal intubation [28], with little to no adverse reactions. Sugammadex, a derivative of γ-cyclodextrin, has been introduced to effectively counteract the effects of rocuronium [29]. Even though they are good at suppressing laryngeal reflexes, rapid-onset neuromuscular blocking medications like succinylcholine can result in severe myalgia [30] and prolonged apnea. Lowering the dosage of suxamethonium [30] can lessen these side effects, and the short-acting benzodiazepine midazolam facilitates the insertion of LMA by muscle relaxation.

METHODS

In a tertiary care teaching hospital, this prospective double-blinded study was conducted. Institutes Ethics Committee approval was obtained. 111 patients between the ages of 20 and 60 who had physical status I or II on the American Society of Anaesthesiologists (ASA) who were scheduled for elective surgeries under general anesthesia (GA) were included in the study after obtaining written informed consent (Figure 1). Excluded from the study were patients with a history of neck surgeries, pregnant women, patients with burns and swellings in the neck region, and patients with oral or perioral pathology, such as tumors, abscesses.

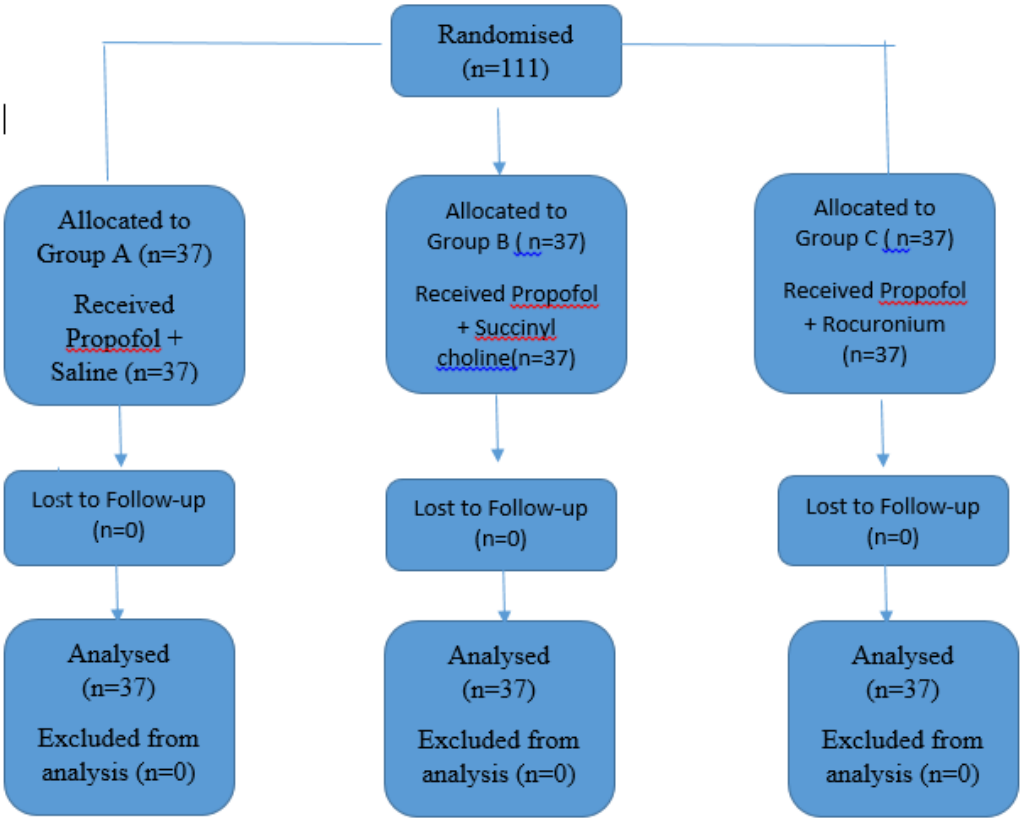

Figure 1: Consort flow diagram.

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Three study groups of 37 patients each were randomly assigned by computer-generated random sequence numbers. Groups A, B, and C were given Propofol plus placebo, succinyl choline + Propofol, and Propofol plus rocuronium, respectively. Laryngeal Mask Airway surgeries under general anesthesia were included in the study. These included the following procedures: skin grafting, tympanoplasty, gynecomastia surgery, excision of lipoma, breast lumps wide local excision, and implant removal. Following the insertion of the device, the patients were brought into the operating room, where standard monitoring tools including an EtCO2, sphygmomanometer cuff, pulse oximeter, and ECG leads were used to take baseline readings. After the IV line was secured with a 20G cannula, the patient was premedicated with injectable midazolam (0.01 mg/kg IV), glycopyrrolate (0.2 mg IV), and ondansetron (0.15 mg/kg IV).

The patient was pre-oxygenated for three minutes at 100% oxygen. Body weight was used to determine which LMA size was appropriate. As per the guidelines, individuals weighing between 30 and 50 kg should wear size number 3, while those weighing between 50 and 70 kg should wear size 4.

Propofol at a dose of 2 mg/kg was administered over 30 seconds. The efficacy of anesthesia was assessed by determining the loss of the eyelash reflex. If the initial dose proved insufficient, additional boluses of 0.25 mg/kg were administered every 15 seconds until the necessary depth of anesthesia was reached.The study medication (succinylscoline/Rocuronium 0.1 mg/kg) was given after the eyelash reflex was abolished.Using the standard insertion technique, the LMA was inserted 1 minute after the study drug was administered. We measured the patient's ease of insertion, gagging and coughing, and jaw relaxation. The number of attempts for insertion was noted.Hemodynamics were recorded at different times during the procedure, such as before premedication, one minute before induction, thirty seconds after induction, one minute after LMA insertion. If the first attempt at insertion was unsuccessful, 2% isoflurane was used to maintain the patient anesthesia, and 1 mg/kg of Propofol was administered again.After 30 seconds, the insertion was attempted again, using additional doses of 1 mg/kg of Propofol as necessary.

Standard methods such as electrocardiogram, non-invasive blood pressure monitoring (NIBP), pulse oximetry (Sp02), and end-tidal carbon dioxide (EtCO2) measurement were used to monitor the patients. To maintain intraoperative anesthesia, a 50:50 mixture of oxygen, nitrous oxide, and 1% isoflurane was used. Standard analgesics administered to all patients were 1 gm of intravenous Paracetamol and 0.6 mg/kg of intravenous Pentazocine. At the end of the procedure, all anesthetics were stopped, and 100% oxygen was administered.

After the patient regained adequate consciousness and pharyngeal reflexes, the LMA was removed. Patients were observed for any spasm, coughing, or vomiting following removal. Patients underwent a 24-hour observation period in the ward following surgery.

The duration of surgery for Control (Mean=45, SD=42.5), Succinylcholine (Mean=68, SD=42.5), and Rocuronium (Mean=35.5, SD=6.78) required a total sample size of 111 (for each group of 37, assuming equal group sizes) with a 5% level of significance and 95% power, according to the G*Power ver. 3.1.9.4 software used for sample size calculation. A Microsoft Excel sheet is used to initially record the gathered data. After that, statistical analyses are carried out with SPSS (Version 20). The mean, standard deviation (SD), counts, percentages, and diagrams are displayed as the results.

An independent sample t-test is used to compare two groups of continuous variables that are normally distributed. Applying the Mann-Whitney U test determines whether the variables are not normally distributed. The categorical variables of the two groups are compared using the Fisher's exact test or the Chi-square test. ANOVA is used to analyse normally distributed variables when comparing more than two groups, and the Kruskal-Wallis H Test is used to analyse non-normally distributed variables. In statistical analysis, a p-value of <0.05 is significant.

RESULTS

All the groups were similar with respect to demographic profile (Table 1).

Table 1 : Demographic and baseline characteristics

Group	Gender (male/female)	Mean Age ± SD (years)	Weight Mean ± SD (kg)	Height Mean ± SD (m)	BMI Mean ± SD	p-value
Group A (Saline-placebo)	25/12	40 ± 12	58.41 ± 11.98	1.61 ± 0.18	22.36 ± 1.59	0.706879
Group B (0.1 mg/kg Succinylcholine)	27/10	38 ± 12	58.28 ± 10.95	1.60 ± 0.18	22.59 ± 1.50	0.706879
Group C (0.1 mg/kg Rocuronium)	24/13	40 ± 12	58.26 ± 11.82	1.60 ± 0.16	22.64 ± 1.43	0.706879

Statistically insignificant $p > 0.05$

Jaw relaxation (Table 2) differed significantly among the groups. Group A (Saline-placebo) had 40.5% of patients with good relaxation, compared to 73.0% in Group B (Succinylcholine) and 86.5% in Group C

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(Rocuronium).There was statistical confirmation that these differences were significant by the chi-square test (20.02, p = 0.0005). (Figure 2)

Table 2: Conditions during LMA insertion - Jaw Relaxation

JAW RELAXATION	Group A (Saline-placebo)	Group B (0.1 mg/kg Succinylcholine)	Group C (0.1 mg/kg Rocuronium)	Chi-square Test	P-value
Good	15 (40.5%)	27 (73.0%)	32 (86.5%)		
Incomplete	12 (32.4%)	7 (18.9%)	4 (10.8%)		
Poor	10 (27.1%)	3 (8.1%)	1 (2.7%)		
Total	37 (100%)	37 (100%)	37 (100%)	20.02	0.0005
Statistically Significant (p < 0.05)					

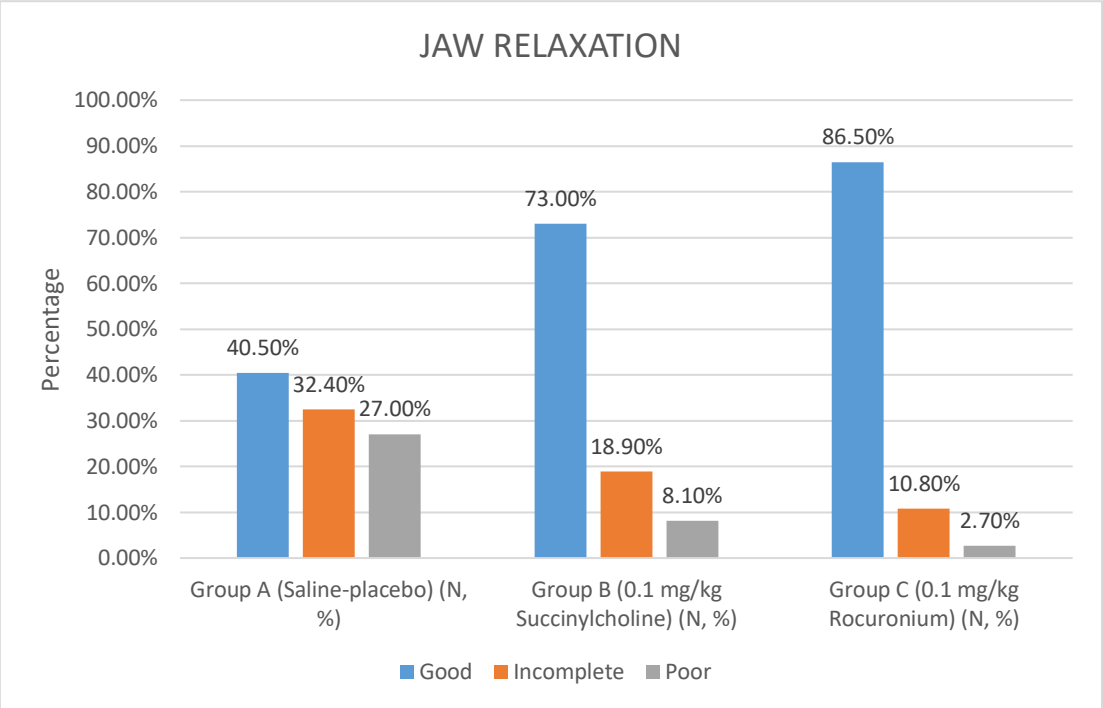

Figure 2: Graph Comparing the Jaw Relaxation between Groups A, B and C

Table 3 demonstrates that the groups' ease of insertion varied significantly.53.1% of patients in Group A (saline-placebo) and 81.1% in Group B (succinylcholine) and 94.6% in Group C (Rocuronium) reported having an excellent insertion. The chi-square test (20.07, p = 0.0027) confirmed these differences were statistically significant. (Figure 3)

Table 3: Conditions during LMA insertion - Ease of Insertion

EASE OF INSERTION	Group A (Saline-placebo)	Group B (0.1 mg/kg Succinylcholine)	Group C (0.1 mg/kg Rocuronium)	Chi-square Test	P-value
Excellent	20 (54.1%)	30 (81.1%)	35 (94.6%)		
Good	8 (21.6%)	5 (13.5%)	1 (2.7%)		
Poor	6 (16.2%)	2 (5.4%)	1 (2.7%)		
Unacceptable	3 (8.1%)	0 (0.0%)	0 (0.0%)		
Total	37 (100%)	37 (100%)	37 (100%)	20.07	0.0027
Statistically Significant (p < 0.05)					

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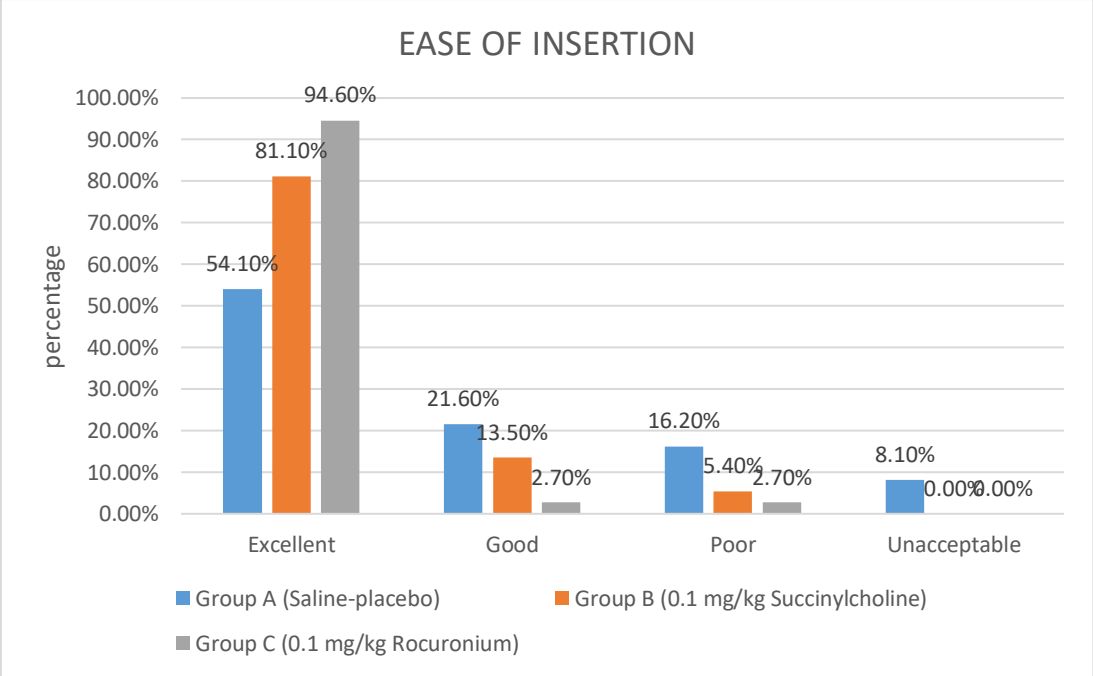

Figure 3: Graph Comparing the Ease of Insertion between Groups A, B and C

The number of attempts (Table 4) for successful insertion did not differ significantly among the groups. Group A (Saline-placebo) had 62.2% success on the first attempt, Group B (Succinylcholine) had 59.5%, and Group C (Rocuronium) had 78.4%. The chi-square test (3.49, p = 0.175) indicated no statistically significant difference. (Figure 4)

Table 4: Comparison of number of attempts between the groups of A, B and C

NUMBER OF ATTEMPTS	Group A (Saline-placebo)	Group B (0.1 mg/kg Succinylcholine)	Group C (0.1 mg/kg Rocuronium)	Chi-square Test	P-value
First Attempt	23 (62.2%)	22 (59.5%)	29 (78.4%)		
Second Attempt	14 (37.8%)	15 (40.5%)	8 (21.6%)		
Total	37 (100%)	37 (100%)	37 (100%)	3.49	0.175
Statistically insignificant p >0.05					

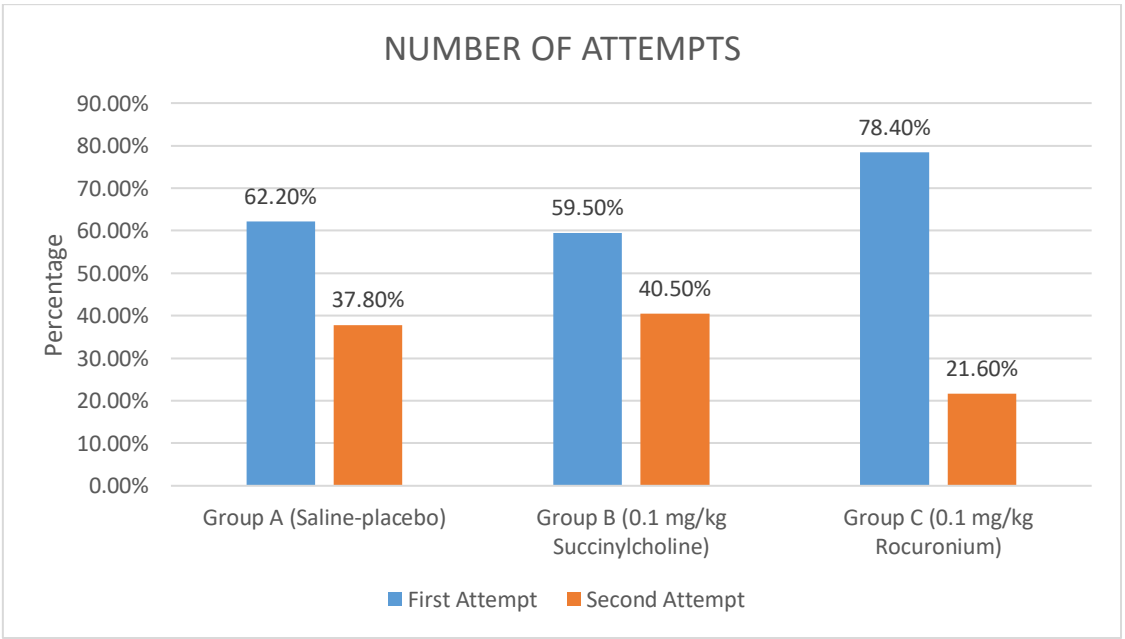

Figure 4: Graph Comparison of number of attempts between the groups of A, B and C

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Coughing and gagging (Table 5) did not differ significantly among the groups. Group A (Saline-placebo) had 78.4% of patients without symptoms, Group B (Succinylcholine) had 86.5%, and Group C (Rocuronium) had 91.9%. The chi-square test (5.47, p = 0.485) indicated no statistically significant difference (Figure 5).

Table 5 : Comparison of Coughing and Gagging between the groups of A, B and C

Coughing and Gagging	Group A (Saline-placebo)	Group B (0.1 mg/kg Succinylcholine)	Group C (0.1 mg/kg Rocuronium)	Chi-square Test	P-value
None	29 (78.4%)	32 (86.5%)	34 (91.9%)		
Mild	4 (10.8%)	3 (8.1%)	2 (5.4%)		
Moderate	2 (5.4%)	2 (5.4%)	1 (2.7%)		
Severe	2 (5.4%)	0 (0.0%)	0 (0.0%)		
Total	37 (100%)	37 (100%)	37 (100%)	5.47	0.485
Statistically insignificant p >0.05					

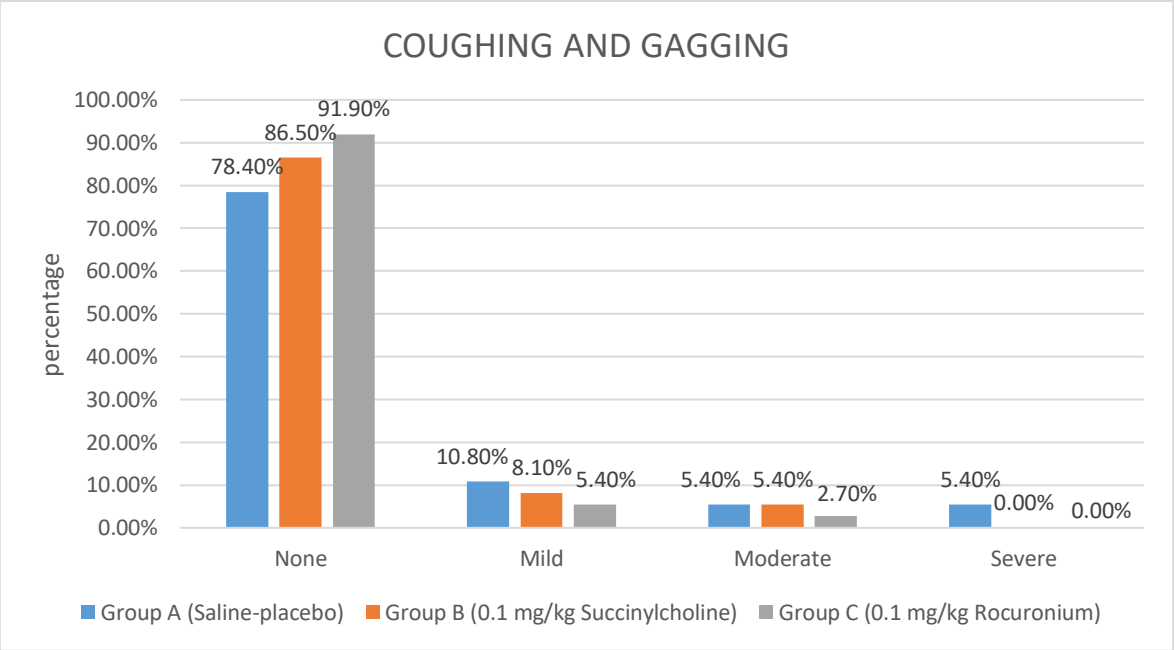

Figure 5: Graph showing Comparison of Coughing and Gagging between the groups of A, B and C

DISCUSSION

The patients were similar in terms of age, weight, height, and BMI.

However, there were more men than women among the participants.

The effectiveness of low-dose rocuronium and succinylcholine in achieving sufficient jaw relaxation was assessed in this study. The results demonstrated that both muscle relaxants significantly improved the patients' jaw relaxation, which made the LMA insertion less traumatic and easier.

When compared to succinylcholine, rocuronium showed better jaw relaxation in our study. The result obtained is similar to that of Eslam Nada et al. (2018) [31], who observed that low-dose rocuronium improved jaw relaxation and decreased the amount of Propofol needed for LMA insertion. Similar results were reported by Nasseri K. (2017) [32], who discovered that low-dose rocuronium improved jaw relaxation and made LMA insertion easier for patients undergoing cataract surgery. The increased jaw relaxation observed with rocuronium can be attributed to its fast onset and intermediate duration of action, which ensure that the jaw muscles are sufficiently relaxed for the duration required to insert the LMA.Because of this characteristic, rocuronium is a good choice for procedures requiring quick muscle relaxation.

In comparison to the control group, our study's results showed that low-doses of succinylcholine and rocuronium both made LMA insertion easier. When it came to ease of insertion, however, rocuronium outperformed succinylcholine.

Studies in the past, including those by Amithesh Pathak et al. (2023) [33].and Motahareh et al. (2023) [34]have shown that the use of muscle relaxants greatly improves the conditions for LMA insertion. In particular, it has been demonstrated that rocuronium lowers the total number of insertion attempts and raises the success rate of first-attempt insertions.

Rocuronium enhanced the overall conditions for insertion, making it smoother to accomplish a successful LMA placement, as noted by Naguib M. (2001) [29].

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The number of attempts needed for a successful LMA insertion in this study was less for the Rocuronium group than for the Succinylcholine group. This is consistent with the findings of Leah R. George (2017) [35], who found that higher dosages of succinylcholine produced better insertion conditions than lower dosages. Because of its consistent and predictable effects, rocuronium offers a slight advantage in terms of ease of insertion, allowing for a controlled easy procedure.There is support for this conclusion from Motahareh et al. (2023) [34], who found out that muscle relaxants reduced the number of insertion attempts. In their studies, authors noted that combined use of muscle relaxant with Propofol lead to a statistically significant reduction in the number of attempts required to place the LMA and an increase in ease for this task. Another study by Leah R. George (2017) [35] indicated that conditions facilitating LMA insertion may require a higher dose of succinylcholine (0.25 mg/kg) instead of a low 0.1 mg/kg dose. This means that the issue of dosage must be optimized. This concurs with the findings made in the present study that pay much attention to the choice of the ideal muscle relaxant and dosage in order to reduce the attempts that may be needed to get the LMA in place.

The coughing and gagging observations made in this study were also testified to by Shivani Rao et al. (2020) [36], who found that low-dose succinylcholine administration decreased the incidence of coughing, gagging, and laryngospasm. Their results demonstrated that the side effects of muscle relaxants, which are typically linked to higher dosages of the drug, could be successfully avoided by taking smaller doses of the medication.

These results were confirmed by Liao et al. (2017) [35] and Gunaseelan et al. (2017) [37], who proposed that the use of low-dose muscle relaxants maintains optimal conditions for LMA insertion while lowering the risk of airway trauma and other complications.

CONCLUSION

In conclusion low-dose Rocuronium and low-dose Succinylcholine administration offer considerably better conditions of jaw relaxation, ease of insertion and patient comfort during the use of LMA. These findings have provided evidence for the effectiveness of muscle relaxants in enhancing LMA insertion, and the improved safety and standard of airway management for elective short general surgery operations. The present findings may only be applicable for this particular setting with a relatively small sample size and it is recommended that future studies must involve a large and diverse population of patients. This will assist in supporting these conclusions and allow for an enhanced understanding of the other advantages and disadvantages of these protocols.

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Conflicts of interest: There are no conflicts of interest.

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