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**Original Research Article**

# A comparative study of rocuronium over suxamethonium for intubation conditions in elective surgeries in age between 18 to 65 years

Dr. Srikanth Rangu[1], *Dr. V Praveen Kumar[2], Dr. Vanagondi Siva Kumar[3], Dr. Sachin Gangapuri[4]

1. 4. Senior Resident, Department of Anaesthesiology, Malla Reddy Institute of Medical Sciences, Suraram, Quthbhullapur, Hyderabad, Telangana.
2. Assistant Professor, Department of Anaesthesiology, Malla Reddy Institute of Medical Sciences, Suraram, Quthbhullapur, Hyderabad, Telangana.
3. Associate Professor, Department of Anaesthesiology, Malla Reddy Institute of Medical Sciences, Suraram, Quthbhullapur, Hyderabad, Telangana.

*Corresponding Author: Dr. V Praveen Kumar, Department of Anaesthesiology, Malla Reddy Institute of Medical Sciences, Suraram, Quthbhullapur, Hyderabad, Telangana.

***ABSTRACT:***

***Background:*** *Suxamethonium has two important characteristics-it produces intense paralysis rapidly and its effects are likely to wane before pre-oxygenated patient get hypoxic. It has rapid onset and a shorter duration of action (3 to 5 minutes). It makes this drug a useful drug for good skeletal muscle relaxation to facilitate tracheal intubation but simultaneously it isassociated with adverse effects that limit or contraindicate its use in certain cases*

***OBJECTIVES:*** *To compare the effectiveness of rocuronium over suxamethonium for intubating conditions in elective surgeries.*

1. *To compare the onset of action of both the groups.*
2. *To assess the intubating conditions after administering both the groups.*
3. *To compare the duration of action of both the groups.*
4. *To compare the hemodynamic effects of both the groups.*

***MATERIAL & METHODS:*** ***Study Design:*** *A Prospective Randomized comparative study.* ***Study area:*** *The study was conducted in the Department of Anaesthesiology, Malla Reddy Institute of Medical Sciences, Suraram, Quthbhullapur, Hyderabad, Telangana.* ***Study Period:*** *October 2020 to August 2021.* ***Study population:*** *All the patients who were undergoing the elective surgeries in the department of General Surgery during the study period.* ***Sample size:*** *study consisted a total of 80 cases.* ***Sampling method:*** *Simple Random sampling method. All patients were pre-oxygenated with 100% oxygen for 3 to 5 minutes. Pre*

*induction heart rate and blood pressure were measured. Patient is induced with Propfol 1-2 mg/Kg-1IV. The patients received intravenous either rocuronium 0.9 mg Kg-1 or suxamethonium 1.5 mg Kg-1. Patients were ventilated with 100% O2 for 60 or 90 seconds. Intubating conditions are assessed 60 seconds after administration of the neuromuscular blocker in 20 patients receiving either agent and after 90 seconds in remaining 20 patients in each group.*

***Results:*** *The duration of action among both the study groups was longer with Rocuronium and the difference between the means of duration of action was statistically significant with P value of <0.0000001.*

***CONCLUSION:*** *From the present study it can be concluded that, Suxamethonium provided excellent intubating conditions over Rocuronium at 60 seconds. Intubating conditions were excellent for both the drugs at 90 sec. The duration of action was longer with Rocuronium and the difference between the means of duration of action was statistically significant.*

***Keywords:*** *Endotracheal intubation, Suxamethonium, Rocuronium*

## INTRODUCTION:

Endotracheal intubation is very common procedure to secure airway while administering general anaesthesia. It is the translaryngeal placement of endotracheal tube into trachea via the nose or mouth. This procedure includes laryngoscopy and intubation.

The history and development of intubation and laryngoscopy started way back in 18$^{th}$ century. In 1880, Sir William Maceven, a Scottish surgeon was the first to perform endotracheal intubation. In 1895 Kirstein became the first to perform endotracheal intubation using a laryngoscope. The credit of developing the scientific principles of direct laryngoscopy and endotracheal intubation belongs to the American Otolaryngologist Dr. Chevallier Jackson. In 1913-jackson devised a U-shaped laryngoscope. In 1913-Janeway introduced L-shaped laryngoscope with batteries in the handle. [1]

Laryngoscopes are required to view the larynx and adjacent structures under direct vision for the purpose of endotracheal intubation. This causes direct trauma to the oropharynx and larynx and apart from this it also causes sympathetic stimulation resulting in rise in heart rate, systolic blood pressure, diastolic blood pressure and mean arterial pressure. This rise in hemodynamic parameters is transient and may be seen in healthy individuals. It can prove hazardous in patients with systemic hypertension, coronary artery disease, and cerebro vascular disease. [2] Complications like myocardial ischaemia, infarction, left ventricular failure, arrhythmias, intracranial hemorrhage can occur due to this response. [3] The major cause of the haemodynamic stress response is due to the stimulation of supraglottic area by the laryngoscope blade followed by additional stimulation contributed by tracheal tube placement.

Tracheal intubation is commonly facilitated by muscle relaxation. The group of drugs that act on neuro muscular junction aids in attaining muscle relaxation by of nerve impulses at the neuromuscular junction. They act by producing Phase-I depolarizing blockade, phase-II blockade or non-depolarizing blockade.

Suxamethonium has two important characteristics-it produces intense paralysis rapidly and its effects are likely to wane before pre-oxygenated patient get hypoxic. It has rapid onset and a shorter duration of action (3 to 5 minutes). It makes this drug a useful drug for good skeletal

muscle relaxation to facilitate tracheal intubation but simultaneously it isassociated with adverse effects that limit or contraindicate its use in certain cases. [4,5]

Rocuronium bromide is a non-depolarizing neuromuscular blocker [6] that actsin a different way then succinylcholine for skeletal muscle relaxation. It has a faster onset of action in 1 to 2 minutes but the duration of blockade is 20 to35 min. [7] The ED95 of Rocuronium bromide is 0.3mg/kg. The onset of 3 to 4times of ED95 of rocuronium bromide resembles the onset of action of succinylcholine 1mg/kg, which makes Rocuronium bromide - the only nondepolarizing muscle relaxant that can be used as an alternative to succinylcholine when the rapid onset of blockade is needed to facilitate tracheal intubation. [8,9]

Hence the present study was undertaken to study the effectiveness of rocuronium over suxamethonium for intubating conditions in elective surgeries.

**OBJECTIVES:** To compare the effectiveness of rocuronium over suxamethonium for intubating conditions in elective surgeries.

5. To compare the onset of action of both the groups.
6. To assess the intubating conditions after administering both the groups.
7. To compare the duration of action of both the groups.
8. To compare the hemodynamic effects of both the groups.

**MATERIAL & METHODS:**

**Study Design:** A Prospective Randomized comparative study.

**Study area:** The study was conducted in the Department of Anaesthesiology, Malla Reddy Institute of Medical Sciences, Suraram, Quthbhullapur, Hyderabad, Telangana.

**Study Period:** October 2020 to August 2021.

**Study population:** All the patients who were undergoing the elective surgeries in the department of General Surgery during the study period.

**Sample size:** study consisted a total of 80 cases.

**Sampling method:** Simple Random sampling method.

**Inclusion criteria:**

1. Patients of age 18-65 years.
2. Both Gender.
3. Patients with American Society of Anaesthesiologists physical status I and II.
4. Malammpatti Grade I and II
5. Patients with controlled Hypertension (BP<140/90 mmHg)
6. Patients with controlled blood sugar levels (FBS <160mg/dl)
7. Mild COPD, controlled Bronchial asthma.
8. BMI < 30kg/$cm^2$
9. Patients who are willing to give an informed written consent.

**Exclusion criteria:**

1. Patients allergic to the study drugs.
2. Patients who are assessed as difficult cases for securing airway are excluded.
3. ASA physical status III, IV and V
4. Emergency surgeries.
5. Patients with cervical spine abnormalities.
6. Hemodynamically unstable patients
7. Hypertension with BP >140/90 mmHg



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8. Diabetes Mellitus with FBS >160 mg/dl
9. BMI > 30 kg/cm$^2$
10. Uncontrolled bronchial asthma
11. Moderate and severe COPD
12. History of drug sensitivity
13. Patients on medication which interact with muscle relaxants
14. All patients with neuromuscular disease
15. Patients who are not willing to participate in the study.

**Ethical consideration:** Institutional Ethical committee permission was taken prior to the commencement of the study.

**Study tools and Data collection procedure:**

All the patients meeting the inclusion criteria were taken into the study. A pre-designed, pre-tested, semi structured and pre-coded proforma was used for recording all the findings. The questions were partially closed ended. After obtaining Ethical clearance from the Institutional Ethical Committee, study was conducted.

All patients were pre-oxygenated with 100% oxygen for 3 to 5 minutes. Pre induction heart rate and blood pressure were measured. Patient is induced with Propfol 1-2 mg/Kg-1IV. The patients received intravenous either rocuronium 0.9 mg Kg-1 or suxamethonium 1.5 mg Kg-1. Patients were ventilated with 100% O2 for 60 or 90 seconds. Intubating conditions are assessed 60 seconds after administration of the neuromuscular blocker in 20 patients receiving either agent and after 90 seconds in remaining 20 patients in each group. The intubating conditions will be assessed according to the scoring system proposed by Krieg et al (1980) modified by Cooper et al (1992). The parameters taken into consideration are jaw relaxation, vocal cord movement and gross response of the patient to intubation. After intubation the cuff of the endotracheal tube is inflated and the tube connected to Bain's circuit and controlled ventilation is started with nitrous oxide, oxygen and isoflurane. Intubating conditions will be assessed after 60 seconds (R1, S1) and 90seconds (R2, S2) in each group after administration of the drug. Hemodynamic responses will be observed for every 1 minute for 5minutes after administration of the drug.

The patients were randomly allocated into two groups of R and S of 40 each.

• Group R {n=40}, received 0.9 mg/kg Rocuronium

• Group S {n=40}, received 1.5 mg/kg Suxamethonium.

Each group was further divided into two subgroups 1 and 2 each with the first subgroup being assessed for intubating conditions 60 seconds (R1 and S1) and the second subgroup assessed 90 seconds (R2 and S2) after administration of the corresponding drug

**Statistical analysis:**

Data was entered into Microsoft excel data sheet and was analyzed using SPSS 22 version software. Categorical data was represented in the form of Frequencies and proportions. Chi-square test was used as test of significance for qualitative data. Continuous data was represented as mean and standard deviation. Independent t test or Mann Whitney U test was used as test of significance to identify the mean difference between two quantitative variables and qualitative variables respectively. P value <0.05 will be a statistically significant study.



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**OBSERVATIONS & RESULTS:**

**Table 1: Age distribution of study population**

| Age in years | Group R | Percentage | Group S | Percentage |
|---|---|---|---|---|
| Less than or equal to 20 years | 3 | 7.5 | 3 | 7.5 |
| 20-29 years | 9 | 22.5 | 10 | 25 |
| 30-39 years | 10 | 25 | 10 | 25 |
| 40-49 years | 8 | 20 | 4 | 10 |
| 50-59 years | 5 | 12.5 | 5 | 12.5 |
| 60 years | 5 | 12.5 | 3 | 7.5 |
| Total | 40 | 100 | 40 | 100 |
| Mean ± Standard deviation | 42.5 ± 8.80 years | | 43.1 ± 7.96 years | |

Among the Rocuronium study group, 25% belonged to age group of 30-39 years, followed by 20-29 years (22.55%) and 40-49 years (20%). 12.5% was contributed by 50-59 years and 60 years. Less than or equal to 20 years contributed to 7.5%.

Among the Suxamethonium group, 25% was contributed by age group of 20-29 years and 30-39 years each, followed by 50-59 years (12.5%) and 40-49 years (10%). 40-49 years' age group contributed to 13.33%. Less than or equal to 20 years and 60 years contributed to 7.5% each.

**Table 2: Gender distribution**

| Gender | Group R | Percentage | Group S | Percentage |
|---|---|---|---|---|
| Male | 21 | 52.5% | 21 | 52.5% |
| Female | 19 | 47.5% | 19 | 47.5% |
| Total | 40 | 100% | 40 | 100% |

Gender distribution was same among both the groups. 52.5% were males and 47. % were females.

**Table 3: comparison of demographic and anthropometric characteristics**

| Parameter | Group R | Group S | P value |
|---|---|---|---|
| Age in years | 42.5 ± 8.80 years | 43.1 ± 7.96years | 0.75 |
| Gender | 21 (Males), 19(Females) | 21 (Males), 19(Females) | 0.9 |
| Weight in kgs | 69.16 ± 8.92 kgs | 65.1 ± 9.26 kgs | 0.08 |
| Height in cms | 165.9 ± 7.75 cms | 163.56 ± 7.87 cms | 0.25 |

The demographic and anthropometric characteristics of study population were comparable in terms of age, gender, weight in kgs and height in cms with P >0.05.

**Table 4: ASA grading**

| ASA status | Group R | Percentage | Group S | Percentage |
|---|---|---|---|---|
| I | 32 | 80 | 29 | 72.5 |
| II | 8 | 20 | 11 | 27.5 |
| Total | 40 | 100 | 40 | 100 |

Among group R, 80% belonged to ASA - I, 20% belonged to ASA - II.

Among group S, 72.5% belonged to ASA - I, 27.5% belonged to ASA - II.

**Table 5: Mallampatti grading**



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| Mallampatti grading | Group R | Percentage | Group S | Percentage |
|---|---|---|---|---|
| I | 31 | 77.5 | 29 | 72.5 |
| II | 9 | 22.5 | 8 | 20 |
| III | 0 | 0 | 3 | 7.5 |
| Total | 40 | 100 | 40 | 100 |

Among group R, 77.5% belonged to Mallampatti - I, 22.5% belonged to Mallampatti - II.

Among group S, 72.5% belonged to Mallampatti - I, 20% belonged to Mallampatti - II. 7.5% belonged to Mallampatti-III.

**Table 6: Grading of intubation conditions based on Coopers scale at 60 secs:**

| Coopers scale | Group R | Percentage | Group S | Percentage |
|---|---|---|---|---|
| 8-9 (Excellent) | 14 | 35 | 34 | 85 |
| 6-7 (Good) | 20 | 50 | 6 | 15 |
| 3-5(Fair) | 6 | 15 | 0 | 0 |
| 0-2 (Poor) | 0 | 0 | 0 | 0 |
| Total | 40 | 100 | 40 | 100 |

Among group R, 35% had excellent intubating conditions, 50% had good intubating conditions and 15% had fair conditions.

Among group S, 85% had excellent intubating conditions, 15% had good intubating conditions.

**Table 7: Grading of intubation conditions based on Coopers scale at 90 secs:**

| Coopers scale | Group R | Percentage | Group S | Percentage |
|---|---|---|---|---|
| 8-9 (Excellent) | 40 | 100 | 40 | 100 |
| 6-7 (Good) | 0 | 0 | 0 | 0 |
| 3-5(Fair) | 0 | 0 | 0 | 0 |
| 0-2 (Poor) | 0 | 0 | 0 | 0 |
| Total | 40 | 100 | 40 | 100 |

Among both the study groups, all of them had excellent intubating conditions at 90 sec.

**Table 8: Duration of action**

| Group | Duration of action in min | Range | T test | P value |
|---|---|---|---|---|
| Group R | 26.9 ±5.46 min | 25-43 min | 19.08 | <0.0000001 |
| Group S | 8.2±**2.93 min** | 6-14 min | | |

The duration of action among both the study groups was longer with Rocuronium and the difference between the means of duration of action was statistically significant with P value of <0.0000001.

**Table 9: mean heart rate**

| Mean Heart rate | Group R | Group S | P Value |
|---|---|---|---|
| Baseline | 92.7±11.5 | 90.2±11.1 | 0.30 |



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| | | | |
|---|---|---|---|
| Induction | 90.5±8.7 | 88.1±9.7 | 0.22 |
| Intubation | 109.5 ± 5.98 | 102.6±7.8 | 0.0001** |
| 1 minute after induction | 114.1±7.9 | 105.2±10.2 | 0.00001** |
| 3 minutes after induction | 102.7±7.1 | 95.8±11.7 | 0.001** |
| 5 minutes after induction | 96.2±12.1 | 91.69±11.8 | 0.07 |

**Significant

Among Group R, the baseline heart rate was 92.7 ± 11.5 beats per minute. It was 96.2 ± 12.1 beats 5 minutes after induction. Among Group S, the baseline heart rate was 90.2 ± 11.1 beats per minute. It was 91.69 ± 11.8 beats 5 minutes after induction. There was a significant difference in both the groups during intubation, 1 minute after induction and 3 minutes after induction.

**DISCUSSION:**

A Prospective Randomized comparative study was conducted in the Department of Anaesthesiology, Malla Reddy Institute of Medical Sciences. It is a tertiary care centre in Hyderabad. The aim was to compare the effectiveness of Rocuronium over Suxamethonium for intubating conditions in elective surgeries.

In the present study, among the Rocuronium study group, 25% belonged to age group of 30-39 years, followed by 20-29 years (22.55%) and 40-49 years (20%). 12.5% was contributed by 50-59 years and 60 years. Less than or equal to 20 years contributed to 7.5%. Among the Suxamethonium group, 25% was contributed by age group of 20-29 years and 30-39 years each, followed by 50-59 years (12.5%) and 40-49 years (10%). 40-49 years' age group contributed to 13.33%. Less than or equal to 20 years and 60 years contributed to 7.5% each.

In their study done by Yadav JC et al., [10] The mean ages of the both the groups are comparable with our study. Sankararao DVG et al., [11] in group R, mean age was 28.36 ±13.59 and in group S, it was 29.1 ±11.08 which was not in agreement with our study. Madhusudan M et al., [12], in group R, mean age was 41.3±11.6 which was comparable with our study.

In the present study, Gender distribution was same among both the groups. 52.5% were males and 47. % were females.

**Table 10: comparing gender distribution with other studies:**

| Author | Group R | Group S |
|---|---|---|
| Present study (M: F) | 21:19 | 21:19 |
| Yadav JC et al., [10] (M: F) | 20:20 | 20:20 |
| Sankararao DVG et al., [11] (M: F) | 29:21 | 21:29 |
| Madhusudan M et al., [12] (M: F) | 13:12 | 12:13 |



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In the present study, among group R, 77.5% belonged to Mallampatti - I, 22.5% belonged to Mallampatti - II.Among group S, 72.5% belonged to Mallampatti - I, 20% belonged to Mallampatti - II. 7.5% belonged to Mallampatti-III.

In the present study, among group R, 35% had excellent intubating conditions, 50% had good intubating conditions and 15% had fair conditions.Among group S, 85% had excellent intubating conditions, 15% had good intubating conditions.

**Table 11: comparing Intubating conditions at 60 secs:**

| Author | Scoring system | Group R | Group S |
|---|---|---|---|
| Present study | Coopers | 35% Excellent | 85% excellent |
| Yadav JC et al., [10] | Coopers | 82.5% Excellent<br>17.5% Good | 100% excellent |
| Sankararao DVG et al., [11] | Lund& Stovner | 50% Excellent<br>34% Good<br>16% Satisfactory | 68% Excellent<br>32% Good |

In the present study, among both the study groups, all of them had excellent intubating conditions at 90 sec.

**The findings of the present study can be compared with the following studies:**

| Author | Scoring system | Group R | Group S |
|---|---|---|---|
| Present study | Coopers | 100% Excellent | 100% excellent |
| **Yadav JC et al.,[10]** | Coopers | 82.5% Excellent<br>17.5% Good | 100% excellent |
| Sankararao DVG et al., [11] | Lund& Stovner | 50% Excellent<br>34% Good<br>16% Satisfactory | 68% Excellent<br>32% Good |

In the present study, the duration of action among both the study groups was longer with Rocuronium and the difference between the means of duration of action was statistically significant with P value of <0.0000001. Sankararao DVG et al., [11] also proved the same significant regarding this.

In the present study, among Group R, the baseline heart rate was 92.7±11.5 beats per minute. It was 96.2±12.1 beats 5 minutes after induction. Among Group S, the baseline heart rate was 90.2±11.1 beats per minute. It was 91.69±11.8 beats 5 minutes after induction.There was a significant difference in both the groups during intubation, 1 minute after induction and 3 minutes after induction. In their study done by Yadav JC et al., [10] and Sankararao DVG et al., [11] heart rate of both the groups was comparable at all the intervals.

In the present study, among Group R, the baseline mean arterial Blood Pressure (mmHg) was 96.1±10.72. It was 100.7 ±6.08 mmHg at 5 minutes after induction. Among Group S, the



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baseline mean arterial Blood Pressure (mmHg) was 93.2±11.1. It was 101.6±7.42 mmHg at 5 minutes after induction. In their study done by Yadav JC et al., [10] and Sankararao DVG et al., [11] mean Arterial Blood pressure of both the groups was comparable at all the intervals.

**CONCLUSION:**

From the present study it can be concluded that, Suxamethonium provided excellent intubating conditions over Rocuronium at 60 seconds. Intubating conditions were excellent for both the drugs at 90 sec. The duration of action was longer with Rocuronium and the difference between the means of duration of action was statistically significant. No side effects were noted in both the study groups.

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