Open Access

Original Article

Comparison of Rocuronium and Succinylcholine in Establishing Rapid Intubating Conditions; A Quasi Experimental Study

Muhammad Adil, Asad Jaffi, Faheem Feroze, Haroon Javed Awan, Ahmed Farrukh, Tayab Saeed

Department of Anesthesia, Combined Military Hospital Rawalpindi/National University of Medical Sciences (NUMS) Pakistan

ABSTRACT

Objective: To compare rocuronium and succinylcholine in establishing rapid intubating conditions.
Study design: Quasi-experimental study.
Place and Duration of Study: Department of Anesthesia, Combined Military Hospital (CMH), Rawalpindi, Pakistan, from Jan to Jun 2021.
Methodology: A total of 580 adult patients undergoing emergency or elective surgery under general anesthesia were included. Both groups received propofol 2mg/kg as induction agent while Group-A received succinylcholine 1 mg/kg and Group-B received rocuronium 0.8 mg/kg. We assessed rapid intubating conditions such as vocal cord abduction, easy laryngoscopy in less than 30 seconds and response to intubation. Intraoperative general anesthesia was maintained with isoflurane 1.2% with flow rate of 5 L/min at FiO2 of 0.6. Monitoring of heart rate, oxygen saturation, electrocardiogram, mean arterial pressure (MAP), temperature and end tidal carbon dioxide was done.
Results: The mean age of patients in Group-A was 37.33 ± 7.86 years and in Group-B was 37.25 ± 8.27 years. Majority of the patients 346(59.66%) were between 36 to 50 years of age while 254 patients (43.79%) were males and 326(56.21%) were females with male to female ratio of 1:1.3. Frequency of establishing rapid intubating conditions in Group-A (succinylcholine) was found in 160(55.17%) patients while in Group-B (rocuronium), it was found in 135(46.55%) patients with *p*-value of 0.038.
Conclusion: Succinylcholine was found to be more effective in terms of frequency of establishing rapid intubating conditions as compared to rocuronium.

Keywords: Rapid intubating conditions, rocuronium, succinylcholine, tracheal intubation.

How to Cite This Article: *Adil M, Jaffi A, Feroze F, Awan HJ, Farrukh A, Saeed T. Comparison of Rocuronium and Succinylcholine in Establishing Rapid Intubating Conditions; A Quasi Experimental Study. Pak Armed Forces Med J 2026; 76(1): 115-119. DOI: https://doi.org/10.51253/pafmj.v76i1.12486*

INTRODUCTION

An essential step in securing a patient's airway during the administration of general anesthesia is tracheal intubation and multiple studies have recognized failed tracheal intubation or difficult tracheal intubation (DTI) as a significant cause of anesthesia-related death and illness.[1] For orotracheal intubation to be straightforward, four specific anatomical features are required: a fully functional temporomandibular joint allowing for adequate mouth opening, a satisfactory pharyngeal space assessed by examining the back of the mouth, a sufficient submandibular space measured as the distance between the thyroid cartilage and the chin, which is the area where the tongue needs to be moved to allow glottis to be visualized by the laryngoscope, and finally, proper extension of the cervical spine at the atlanto-occipital joint, where impairment of any of these characteristics, makes intubation challenging.[2] A specific type of endotracheal intubation called rapid sequence intubation (RSI) can be utilized to induce sedation and paralysis.[3,4] as shown by a study[5] where both rocuronium and succinylcholine were used to achieve rapid intubating conditions, with first-pass intubation success rate for succinylcholine being 87.0%, while with rocuronium, it was 87.5%. A comparative study concluded that first intubation success rate was similar to rocuronium and succinylcholine where, in 30 patients with bowel obstruction, 15 were intubated by rocuronium and 15 by succinylcholine, [6] every patient in both categories was successfully intubated on the initial attempt. A similar study concluded that first attempt intubation success rate is similar to rocuronium and succinylcholine.[7] However, there are controversies in the existing literature.[8,9] as to which muscle relaxant is superior for RSI in emergency and elective procedures to achieve early intubating conditions. This study will compare the effects of succinylcholine and rocuronium in establishing early intubating conditions.

Correspondence: Dr Muhammad Adil, Department of Anesthesia, Combined Military Hospital Rawalpindi Pakistan
Received: 21 Jul 2024; revision received: 12 Aug 2024; accepted: 13 Aug 2024

METHODOLOGY

This quasi-experimental study was done at Department of Anesthesia, Combined Military Hospital (CMH), Rawalpindi, Pakistan, from January to June 2021, after approval of Ethics Review Board through Letter Number. The World Health Organization (WHO) sample size calculator was used to determine the sample size, with a confidence range of 95% and a margin of error 5% with proportion of population in Group-A with establishment of rapid intubating conditions as 0.5583 (P1) and proportion of population with establishment of rapid intubating conditions in Group-B as 0.4417(P2)[1]. A total of 600 patients were considered where 20 patients were excluded after which 580 patients were enrolled. By using non-probability consecutive sampling, 290 participants were randomly distributed into two uniform groups, Group-A (succinylcholine) and Group-B (rocoronium).

Inclusion Criteria: All adult patients, belonging to either gender, between the ages of 18 to 50 years, undergoing emergency or elective surgery under general anesthesia and having ASA Status I, II and III were included.

Exclusion Criteria: Pediatric patients, patients with ASA Status IV and above, obese patients (Body Mass Index>30kg/m2) and patients with deranged electrolytes were excluded.

Every patient gave their written consent after being informed about the study protocol in a detailed manner. All selected cases were placed randomly in either Group-A or Group-B using lottery method. A skilled anesthesiologist, who was not involved in data collection, attempted intubation after patient history, clinical examination and investigations was reviewed and vital signs were recorded by the researcher. Both groups received propofol 2mg/kg as induction agent while Group-A received 1 mg/kg of succinylcholine and Group-B recieved 0.8 mg/kg of rocuronium. Rapid intubating conditions were assessed, which were: vocal cord abduction, easy laryngoscopy in less than 30 seconds and response to intubation. Intraoperative general anesthesia was maintained with isoflurane 1.2% with flow rate of 5 L/min at FiO2 of 0.6. For reversal of anesthesia neostigmine 0.04mg/kg along with glycopyrrolate 0.01mg/kg was used. Monitoring of heart rate, oxygen saturation, electrocardiogram, MAP, temperature and end tidal carbon dioxide was done. Statistical Package for Social Sciences (SPSS) version 26.0 was used for data analysis and chi-square test was applied where level of significance was 5%. Quantitative variables like age and BMI are presented as means and standard deviations and qualitative variables like gender and rapid intubation were presented as frequency and percentage with *p*-value of less than 0.05 regarded as significant.

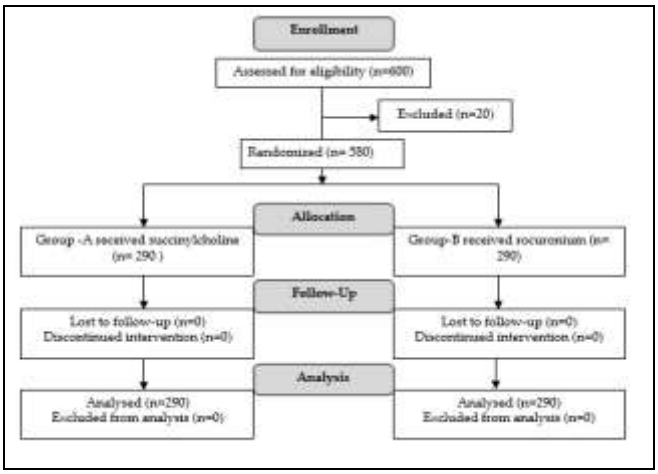

Figure: Patient Flow Diagram (n=580)

RESULTS

In this research, the participants' ages ranged from 18 to 50 years, with an average age of 37.28±8.12 years. In Group-A, the mean age of patients was 37.33 ± 7.86 years and in Group-B was 37.25±8.27 years. Most of the patients 346 (59.66%) were between 36 to 50 years of age as shown in Table I.

Out of 580 patients, 326(56.21%) were females and 254(43.79%) were males with male to female ratio of 1:1.3. Mean height was 159.13±15.72 cm. Mean weight was 76.11 ± 8.12 kg. Mean heart rate was 80.42±10.66 bpm. Mean MAP was 99.12±7.59 mm Hg(Table I).

In our study, frequency of establishing rapid intubating conditions in Group-A (Succinylcholine) was found in 160(55.17%) patients while in Group-B (Rocuronium) was found in 135(46.55%) patients with p-value of 0.038 (Table II).

Association of Rapid intubating conditions with respect to age, gender, height, weight, MAP and HR is shown in Table III.

DISCUSSION

Among the non-depolarizing neuromuscular blocking medications, rocuronium has the quickest onset time and is a desirable substitute for succinylcholine due to its lack of side effects.[10,11] but

Table-I: Demographic Data of Enrolled Patients (n=580)

		Group-A (290 patients)	Group-B (290 patients)	Total (580 patients)
		n (%)	n (%)	n (%)
Age (years)	18-35	105 (36.21%)	129 (44.48%)	234 (40.34%)
	36-50	185 (63.79%)	161 (55.52%)	346 (59.66%)
	Mean ± SD	37.33 ± 7.86	37.25 ± 8.27	37.28 ± 8.12
Gender	Male	133 (45.86%)	121 (41.72%)	254 (43.79%)
	Female	157 (54.14%)	169 (58.28%)	326 (56.21%)
Height (cm)	≤150	124 (42.76%)	96 (33.10%)	220 (37.93%)
	>150	166 (57.24%)	194 (66.90%)	360 (62.07%)
	Mean ± SD	158.36 ± 16.11	159.76 ± 15.11	159.13 ± 15.72
Weight (kg)	≤70	108 (37.24%)	101 (34.83%)	209 (36.03%)
	>70	182 (62.76%)	189 (65.17%)	371 (63.97%)
	Mean ± SD	76.44 ± 8.91	76.02 ± 7.93	76.11 ± 8.12
Heart Rate (bpm)	≤80	194 (66.90%)	209 (72.07%)	403 (69.48%)
	>80	96 (33.10%)	81 (27.93%)	177 (30.52%)
	Mean ± SD	80.95 ± 10.52	80.01 ± 10.74	80.42 ± 10.66
Mean Arterial Pressure	≤100	162 (55.86%)	166 (57.24%)	328 (56.55%)
	>100	128 (44.14%)	124 (42.76%)	252 (43.45%)
	Mean ± SD	99.25 ± 7.72	99.0 ± 7.48	99.09 ± 7.51

**SD: Standard Deviation, BPM: Beats per minute*

rocuronium is linked to worse intubation circumstances 12-16 and a lengthier intubation process in the operating theatre when compared to succinylcholine as severe hypoxemia.[11,13] is the most common complication of RSI in the ICU. It is important to consider the impact of suboptimal intubation circumstances and a lengthier intubation sequence, according to recent evidence succinylcholine was more effective than rocuronium10 but intubation was done in the operating room for every patient so results from one setting may not be transferable to another due to significant differences in operating room conditions.[11] Both medications were tested for RSI in one trial where a 9-point scale to evaluate intubating conditions after 60 seconds was used while we used apnea, vocal cord movement, and stomach motions as our criteria.[14] Another study compared efficacy of succinylcholine with rocuronium for RSI during haemorroidectomy and concluded that rocuronium can be a good substitute 15 with other studies reporting similar excellent intubating conditions.[16-18] One study evaluated intubating conditions using solely rocuronium, where over 95% of patients had ideal intubating conditions.[19] however, thiopental and alfentanil were administered as induction agents by other studies and intubation circumstances were evaluated at 40 seconds rather than 60 seconds.[20] Another study utilized both low and high dosages of rocuronium, while we only employed one, with induction agent affecting the intubation in that study's results.[21] Etomidate was used in a study that evaluated laryngoscopy and intubating conditions where, in contrast to our study where 94% of patients who met inclusion criteria were able to undergo effective intubation while using intubating conditions, they found that 92% of patients given succinylcholine were able to do so, while they used laryngoscopy.[22]

Table II: Comparison of the Rocuronium and Succinylcholine in terms of Frequency of Establishing Rapid Intubating Conditions (n=580)

		Group-A (290 patients)	Group-B (290 patients)	*p*-value
		n (%)	n (%)	
Rapid Intubating Conditions	Yes	160(55.17%)	135(46.55%)	0.038
	No	130(44.83%)	155(53.45%)	

LIMITATIONS OF STUDY

This study has several limitations. The single-center setting limits the generalizability of findings to other patient populations and healthcare settings. Furthermore, the abstract does not mention blinding of the anesthesiologist performing the intubation to the study drug administered, which could introduce observer bias in the subjective assessment of intubating conditions. The short study duration of six months and the lack of long-term follow-up for postoperative complications also limit the comprehensive evaluation of these neuromuscular blocking agents' safety profiles. Finally, the use of non-standardized intubation conditions (both emergency and elective surgeries combined) may have introduced confounding variables that could affect the reliability of the comparison.

Table-III: Association of Rapid intubating conditions with respect to age, gender, height, weight, MAP and HR (n=580).

Effect modifiers		Group-A (290 patients)		Group-B (290 patients)		*p*-value
		Rapid intubating conditions		Rapid intubating conditions		
		Yes	No	Yes	No	
Age (years)	18-35	54 (9.30%)	51(8.80%)	82(14.10%)	47(8.10%)	0.06
	36-50	106(18.20%)	79(13.60%)	53(9.10%)	108(18.60%)	0.0001
Gender	Male	74(12.80%)	59(10.10%)	51(8.80%)	70(12.10%)	0.03
	Female	86(14.80%)	71(12.20%)	84(14.50%)	85(14.70%)	0.360
Height (cm)	≤150	50(8.60%)	74(12.80%)	20(3.40%)	76(13.10%)	0.0001
	>150	110(18.90%)	56(9.70%)	115(19.80%)	79(13.60%)	0.17
Weight (kg)	≤70	54(9.30%)	54(9.30%)	54(9.30%)	47(8.10%)	0.62
	>70	106(18.30%)	76(13.10%)	81(13.90%)	108(18.60%)	0.003
Heart Rate (bpm)	≤80	98(16.90%)	96(16.50%)	89(15.30%)	120(20.70%)	0.11
	>80	62(10.70%)	34(5.90%)	46(7.90%)	35(6.10%)	0.29
Mean Arterial Pressure	≤100	108(18.60%)	54(9.30%)	83(14.40%)	83(14.40%)	0.002
	>100	52(8.90%)	76(13.10%)	52(8.90%)	72(12.40%)	0.83

**SD: Standard Deviation, BPM: Beats per minute*

CONCLUSION

Succinylcholine was found to be more effective in terms of frequency of establishing rapid intubating conditions as compared to Rocuronium, in patients undergoing surgery under general anesthesia, strengthening the evidence favoring its use for rapid intubating conditions.

Conflict of Interest: None.

Funding Source: None.

Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

MA & AJ: Data acquisition, data analysis, critical review, approval of the final version to be published.

FF & HJA: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

AK & TS: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

REFERENCES

1. Christensen MI, Vested M, Creutzburg A, Nørskov AK, Lundstrøm LH, Afshari A. Effects of avoidance versus use of neuromuscular blocking agents for facilitation of tracheal intubation in children and infants. Acta Anaesthesiol Scand 2024; 68(7): 888-895. https://doi.org/10.1111/aas.14429
2. Vested M, Kristensen CM, Pape P, Vang M, Hartoft M, Hjelmdal C, et al. Comparison of onset time, duration of action, and intubating conditions after cisatracurium 0.15 mg/kg in young and elderly patients. BMC Anesthesiol 2022; 22(1): 339. https://doi.org/10.1186/s12871-022-01881-5
3. Levin NM, Fix ML, April MD, Arana AA, Brown CA 3rd. The association of rocuronium dosing and first-attempt intubation success in adult emergency department patients. Can J Emerg Med 2021; 23(4): 518-527. https://doi.org/10.1007/s43678-021-00119-6
4. Czarnetzki C, Albrecht E, Masouyé P, Baeriswyl M, Poncet A, Robin M, et al. Rapid sequence induction with a standard intubation dose of rocuronium after magnesium pretreatment compared with succinylcholine: a randomized clinical trial. Anesth Analg 2021; 133(6): 1540-1549. https://doi.org/10.1213/ANE.0000000000005324
5. Persa L, Kamenik M, Nevenka, Skvarc K, Mekis D. Rocuronium versus succinylcholine for rapid sequence intubation in patients with bowel obstruction. Signa Vitae 2019; 15(2): 52-58. https://doi.org/10.22514/SV152.102019.8
6. Guihard B, Chollet-Xemard C, Lakhnati P, Vivien B, Broche C, Savary D, et al. Effect of rocuronium vs succinylcholine on endotracheal intubation success rate among patients undergoing out-of-hospital rapid sequence intubation: a randomized clinical trial. JAMA 2019; 322(23): 2303-2312. https://doi.org/10.1001/jama.2019.18254
7. Bohringer C, Moua H, Liu H. Is there still a role for succinylcholine in contemporary clinical practice? Transl Perioper Pain Med 2019;6(4):129-136. https://doi.org/10.31480/2330-4871/100
8. Kriswidyatomo P, Paramitha MP. Rapid sequence induction/intubation controversies. Hong Kong J Emerg Med 2021; 28(5): 314-319. https://doi.org/10.1177/1024907920910835
9. Nauka PC, Chen JT, Shiloh AL, Eisen LA, Fein DG. Practice, outcomes, and complications of emergent endotracheal intubation by critical care practitioners during the COVID-19 pandemic. Chest 2021; 160(6): 2112-2122. https://doi.org/10.1016/j.chest.2021.06.008
10. De Jong A, Ouratra SN, Roca O, Jaber S. How to improve intubation in the intensive care unit. Update on knowledge and devices. Intensive Care Med 2022; 48(10): 1287-1298. https://doi.org/10.1007/s00134-022-06849-0
11. Schütz N, Roth D, Schwameis M, Röggla M, Domanovits H. Can venous blood gas be used as an alternative to arterial blood gas in intubated patients at admission to the emergency department? A retrospective study. Open Access Emerg Med 2019; 11: 305-312. https://doi.org/10.2147/OAEM.S228420
12. Russotto V, Rahmani LS, Parotto M, Bellani G, Laffey JG. Tracheal intubation in the critically ill patient. Eur J Anaesthesiol 2022; 39(5): 463-472. https://doi.org/10.1097/EJA.0000000000001627
13. Sharda SC, Bhatia MS. Etomidate compared to ketamine for induction during rapid sequence intubation: a systematic review and meta-analysis. Indian J Crit Care Med 2022; 26(1): 108-113. https://doi.org/10.5005/jp-journals-10071-24086
14. Tang L, Zhao X, Li S, Huang L, Li J, Chen L, et al. Impact of succinylcholine vs. rocuronium on apnea duration for rapid sequence induction: a prospective cohort study. Front Med 2022; 9: 717477. https://doi.org/10.3389/fmed.2022.717477

15. Ali SQ, Khan MA, Yasin B. Intubating conditions 60 seconds after giving muscle relaxant for rapid sequence induction: comparison between succinylcholine and rocuronium. Pak Armed Forces Med J 2011; 61(1): 25-29.
16. Ahad A, Khaskheli MS, Langah IA, Meraj MM. Comparison of succinylcholine and rocuronium for rapid sequence intubation in cesarean section. Anaesth Pain Intensive Care 2018; 22(4): 459-463.
17. Wahid F, Hussain A, Faiz-ur-Rehman OU. Comparison of rocuronium and succinylcholine for rapid sequence induction in patients undergoing surgery under general anaesthesia. J Rawalpindi Med Coll 2020; 24(2): 125-129. https://doi.org/10.37939/jrmc.v24i2.1258
18. Lysakowski C, Suppan L, Czarnetzki C, Tassonyi E, Tramèr MR. Impact of the intubation model on the efficacy of rocuronium during rapid sequence intubation: systematic review of randomized trials. Acta Anaesthesiol Scand 2007; 51(7): 848-857. https://doi.org/10.1111/j.1399-6576.2007.01367.x
19. El-Orbany MI, Joseph NJ, Salem MR. Tracheal intubating conditions and apnoea time after small-dose succinylcholine are not modified by the choice of induction agent. Br J Anaesth 2005; 95(5): 710-4. https://doi.org/10.1093/bja/aei241
20. Davis DP, Heister R, Poste JC, Hoyt DB, Ochs M, Dunford JV. Ventilation patterns in patients with severe traumatic brain injury following paramedic rapid sequence intubation. Neurocrit Care 2005; 2(2): 165-171. https://doi.org/10.1385/NCC:2:2:165
21. Sluga M, Ummenhofer W, Studer W, Siegemund M, Marsch SC. Rocuronium versus succinylcholine for rapid sequence induction of anesthesia and endotracheal intubation: a prospective, randomized trial in emergent cases. Anesth Analg 2005; 101(5): 1356-1361. https://doi.org/10.1213/01.ANE.0000180196.58567.FE
22. Venkateswaran R, Chaudhuri S, Deepak KM. Comparison of intubating conditions following administration of low-dose rocuronium or succinylcholine in adults: a randomized double blind study. Anesth Essays Res 2012; 6(1): 62-69. https://doi.org/10.4103/0259-1162.103377

.....