

Comparison between Rocuronium and Succinylcholine for Rapid Sequence Induction in Adult: Experience of A Referral Hospital in Central Africa

Nga Nomo Serge^{1,8*}, Binyom Pierre René⁸, Jemea Bonaventure^{3,6}, Djomo Tamchom^{4,7}, Iroume Cristella^{3,6}, Kuitchet Aristide^{2,5}, Essomba René⁸, Nkoumou Samson¹, Binam Fidèle⁶

¹Department of Anesthesia and Intensive Care, Essos Hospital Center, Yaounde

²Departement of Anesthesia And Intensive Care, Regional Hospital of Maroua

³Departement of Anesthesia And Intensive Care, University Hospital Center of Yaounde

⁴Departement of Anesthesia And Intensive Care, Douala Gynaeco-Obstetric And Paediatric Hospital

⁵Faculty of Medicine and Biomedical Science, University of Ngaoundere, Cameroon

⁶Faculty of Medicine and Biomedical Science, University of Yaounde, Cameroon

⁷Faculty of Health Science, University of Buea, Cameroon

⁸Higher Institute of Medical Technology, University of Douala, Cameroon

DOI: [10.36347/sasjs.2021.v07i08.014](https://doi.org/10.36347/sasjs.2021.v07i08.014)

| Received: 26.07.2021 | Accepted: 23.08.2021 | Published: 26.08.2021

*Corresponding author: Dr. Nga Nomo Serge

Abstract

Original Research Article

Background: A l'état actuel des connaissances, l'ISR reste le meilleur compromis pour l'intubation des patients à estomac plein. Le curare de référence reste la succinylcholine à la posologie de 1 mg/kg. En cas de contre-indication, le rocuronium (1,2 mg/kg) peut être utilisé si l'on possède son antidote: le sugammadex utilisé pour lever la curarisation en cas de difficulté d'intubation. **Aim of study:** the aim of study was to describe and compare the intubation conditions offered by succinylcholine and rocuronium in rapid sequence induction at the Essos hospital in Cameroon. **Methods:** This was a descriptive, prospective and comparative study, randomized single-blind, from June 2018 to January 2019. It took place in the anesthesia-intensive care unit of the Essos hospital in Cameroon. The adult patients, seen in consultation with anesthesia for urgent surgery under general anesthesia with RSI were included in the study. The patients were randomly divided into two groups: celocurine group (1mg/kg) and rocuronium group (1,2mg/kg). For each patient, the tracheal intubation conditions were assessed according to the score proposed by the work of Viby-Mongensen et al in 1999. Data were entered from Microsoft Word 2016 software, and were analyzed using SPSS 20.0 software. **Results:** The cohort was predominantly young with 44.28% of ASA I class participants and 37.5% of ASA II class. Fasciculations were the main side effect (42.85%) experienced by patients in the celocurine group, followed by hypotension (17.14%) and tachycardia (8.57%). The main side effects of patients in the rocuronium group were hypotension (5.71%) and bradycardia (2.85%). The intubation conditions were "excellent" in 90% of cases and "good" in 10% of cases in both groups. **Conclusion:** Rocuronium and succinylcholine provide excellent and acceptable intubation conditions with minimal side effects.

Keywords: rocuronium, succinylcholine, rapid sequence induction.

Copyright © 2021 The Author(s): This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY-NC 4.0) which permits unrestricted use, distribution, and reproduction in any medium for non-commercial use provided the original author and source are credited.

INTRODUCTION

Rapid sequence induction (RSI) is the gold standard of airway control for general anesthesia in the full stomach patient [1-3]. It contributes to the prevention of inhalation of acidic gastric contents and to the safety of the airways in the latter [1]. It requires the administration of a hypnotic and an appropriate dose of short-onset and short-acting curare. The advantage of curares is to generate muscle relaxation which makes it possible to obtain satisfactory intubation conditions. Research and technical progress in the field of anesthesia have enabled the pharmaceutical industry to manufacture high performance curares for rapid

sequence induction. The goal is always to obtain the curare which combines at the same time a fast installation time, a short duration of action and / or adjustable, an absence of undesirable effects, an independent elimination of the organic functions, to have inactive metabolites and non-toxic. In this indication, succinylcholine has been the gold standard for many years, but rocuronium bromide also seems to offer an interesting prospect. Rocuronium has aroused great interest in rapid sequence induction in recent years in many countries around the world [3, 4]. According to some authors, rocuronium appears to give better intubation conditions during rapid sequence induction,

for others the preference is for succinylcholine or celocurine. The intubation conditions offered by rocuronium and succinylcholine in RSI have benefited from little research in developing countries. The objective of this work is to describe and compare the intubation conditions offered by succinylcholine and rocuronium in rapid sequence induction at the Essos hospital in Cameroon.

1. MATERIALS AND METHODS

This was a descriptive, prospective and comparative study, randomized single-blind, from June 2018 to January 2019. It took place in the anesthesia-intensive care unit of the Essos hospital in Cameroon. The investigation period was three months from October 13, 2018 to January 13, 2019. After approval by the ethics committees of the Catholic University of Central Africa and the Essos hospital center, the adult patients, seen in consultation with anesthesia for urgent surgery under general anesthesia with RSI were included in the study. Pregnant women, locoregional anesthesia failures converted to general anesthesia and patients who had their refusal were not included. The premedication consisted only of psychotherapy. The

patients were randomly divided into two groups. After 5 minutes pre-oxygenation with pure oxygen, rapid sequence induction was the only modality for all patients. Group 1 (or suxamethonium group) consisted of patients recruited during the first half of the study, they received succinylcholine during the ISR. Group 2 (or rocuronium group) consisted of patients recruited in the second half of the study, they received rocuronium during the ISR. The anesthetic induction protocol for group 1 patients is as follows: propofol (3mg / kg IVD), succinylcholine (1mg / kg IVD). Patients in group 2 received an injection of propofol (3 mg / kg IVD) and rocuronium (1.2 mg / kg IVD). For each patient, the tracheal intubation conditions were assessed (Table I) according to the score proposed by the work of Viby-Mongensen *et al.* in 1999 [5]. The tracheal intubation conditions were said:

- Excellent if the score was between 11-12
- Good if the score was between 8-10
- Averages for a score between 4-7
- Bad or weak for a score between 0-3.

Table-1: Intubation conditions according to Viby-Mongensen *et al.* (1999)

Score	Intubation conditions			
	Sagging jaw	Reaction to laryngoscopy	Mobility of the vocal cords	Movement of Members
0	impossible	severe cough	Tight	Vigorous
1	Insufficient	Moderate cough	Closing	Low level
2	half	Diaphragm movement	Mobile	average level
3	Full	Any	Immobility	Immobility
Total	Excellent (11-12); good (8-10); medium (4 -7); low (0-3)			

Four items were studied to clinically assess the quality of the intubation conditions:

- The relaxation of the jaw,
- The reaction to laryngoscopy
- The mobility of the vocal cords,
- The movement of the limbs.

At the end of the procedure, the quality of the intubation was said to be "acceptable" when the intubation conditions were "excellent" or "good". It was said to be "unacceptable" when the intubation conditions were "average" or "poor". Succinylcholine and rocuronium were the dependent variables studied. The independent variables were age, sex, body mass index, medical and anesthesiologic history, ASA status, intubation conditions, onset of treatment of curare and side effects of each curare. Data were entered from

Microsoft Word 2016 software, and were analyzed using SPSS 20.0 software. We determined the odds ratio with its 95% confidence interval (CI). The values of $p < 0.05$ were retained as statistically significant.

2. RÉSULTATS

During the survey period, 105 patients underwent an anesthesia procedure in the operating quarters of Essos Hospital Center, of which 35 met the inclusion criteria. There was similar heterogeneity in the two groups. Sociodemographic data are shown in Table II. Our series was dominated by the female sex 65.71%, or 25.71% in the celocurine group and 40% in the rocuronium group. The modal class was that of patients whose age was between 40 and 60 years, because having the largest number 28.56% (n = 10).

Table-II: Sociodemographic characteristics of the study population

age in years	Sex Male (M) Female (F)	Group 1		Group 2		Total	
		n	%	n	%	N	%
[15 - 25[	M	1	2,85%	0	0%	1	2,85%
	F	1	2,85%	1	2,85%	2	5,71%
[25 - 40[	M	5	14,28%	3	8,57%	8	22,85%
	F	2	5,71%	5	14,28%	7	19,99%
[40 – 60[	M	0	0%	3	8,57%	3	15%
	F	4	11,42%	6	17,14%	10	28,56%
>60	M	0	0%	0	0%	0	0%
	F	2	5,71%	2	5,71%	4	11,42%
Total		15	42,85%	20	57,14%	35	100%

The group of obese patients (BMI> 30) was 34.28% (n = 12). Digestive surgery represented the most common specialty, 31.42% in the rocuronium

group and 17.14% in the celocurine group (Table III). Gynecologic surgery was the second most frequent surgery in our series (28.57%).

Table-III: Distribution of participants by type of surgery

Type of surgery	Celocurine group		Rocuronium group		Total	
	n	%	n	%	N	%
Digestive	6	17,14%	11	31,42%	17	48,57%
ENT	3	8,57%	01	2,85%	4	11,42%
Gynecological	4	11,42%	06	17,14%	10	28,57%
Trauma	2	5,71%	02	5,71%	4	11,42%
Vascular	00	0%	01	2,85%	1	2,85%
Total	15	42,85%	20	57,14%	35	100%

The majority of the workforce, 74.27% (n = 26), belonged to class 1 of the Cormak Lehane classification with 22.85% in group 1 and 51.42% in group 2. The cohort was predominantly young with 44.28% of ASA I class participants and 37.5% of ASA II class. Fasciculations were the main side effect (42.85%) experienced by patients in the celocurine group, followed by hypotension (17.14%) and

tachycardia (8.57%). The main side effects of patients in the rocuronium group were hypotension (5.71%) and bradycardia (2.85%). The intubation conditions were "excellent" in 90% of cases and "good" in 10% of cases in both groups (Figure 1). The mean time to intubation in the celocurine group was 53 seconds, compared to 59.29 seconds in the rocuronium group.

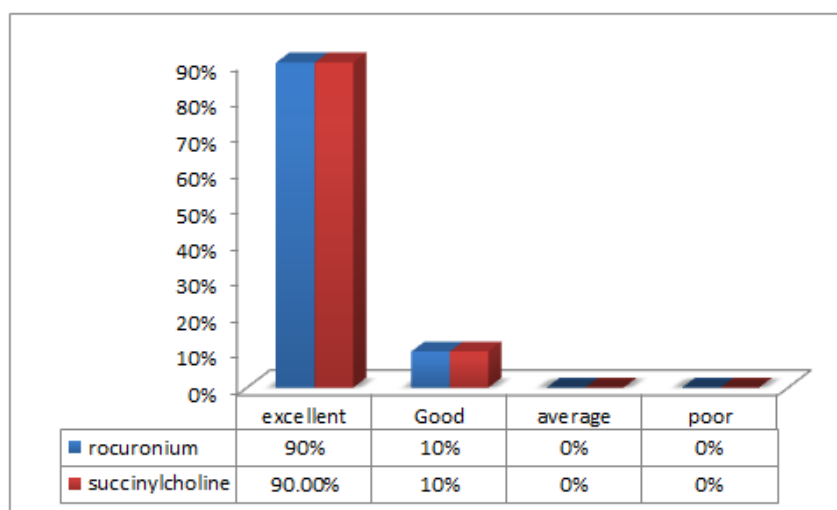


Fig-1: Distribution of participants according to the quality of the intubation conditions

The quality of tracheal intubation was acceptable in both groups and comparable intubation times in both groups, less than 60 seconds.

Table-IV: Results of Mann-Whitney U applied to the intubation time

		Mean score of the intubation time (s)	Sign.	nddl	Conclu-sion
Curare	Celocurine group	53,00	0,934	33	Non signifi-catif
	Rocuronium group	59,25			

"Nddl" represents the number of degrees of freedom, and "sign" the probability of validating the research hypothesis with an acceptable risk (<0.05).

3. DISCUSSION

RSI refers to a technique of tracheal intubation under direct laryngoscopy after intravenous administration of a hypnotic agent and a rapid-acting curare. In Africa, rapid sequence intubation (ISR) has become a "standard of care" in the invasive management of the airways in emergency medicine, anesthesia and medical resuscitation since the publication of several expert conferences in the years 1998-2000 [6-8]. We followed 35 participants, 65% female and 35% male. The sex ratio was 1.85 in favor of women. This result is similar to that obtained in the work of Traoré *et al.* in 2003, in Mali [9]. The female predominance was 54.55% in their work on SRI comparing rocuronium to celocurine. Our result is probably explained by the fact that the sampling was random. In our series, gynecologic surgery was the second most common type during the survey period, thus justifying the increase in the sample size of women in the study population.

The average age was 39 with extremes ranging from 18 to 63. The 40-60 years age group was the most represented with a frequency of 28.56% or 11.42% in the celocurine group and 17.14% in the rocuronium group. The study population consisted predominantly of young adults. It is a segment of the population that is robust, without crippling defects. The pharmacology of rocuronium and celocurine is barely modified in this segment of the population [10-12]. Obese subjects represented 34.28% of our study population. In this proportion of obese patients 14.28% belonged to group 1 and 20% to group 2. In a publication on RSI Beleka, Khamankar *et al.* excluded obese patients [13]. These authors state that obesity constitutes an independent risk factor for inhalation of gastric contents and which may constitute a bias in the interpretation of the results [13]. The injection of curare in our study took into account the ideal low weight of the patient, which helps to minimize bias in the interpretation of the results. The ¾ of the workforce did not present a predictive criterion for difficult intubation at the pre-anesthetic assessment. A significant portion of the study population (81.33%) comprised the young, robust adult age group without disabling defects. Our results are similar to those of Belekar *et al.*, Who noted in their series that the patients mainly belonged to the ASA1 and ASA2 classes [13]. The pharmacology of rocuronium and celocurine is barely modified in this population [10-12]. The intubation conditions were favorable with

succinylcholine was 53 seconds versus 59.25 seconds for rocuronium. It follows that succinylcholine and rocuronium provide satisfactory and superimposable intubation conditions in a short time. This period remained less than 60 seconds in all casent. Our results are similar to those of many authors who have questioned this subject [14-16]. The doses of rocuronium used in the studies carried out on case of rapid sequence induction in general anesthesia range from 0.6 to 1.2 mg / kg [16, 17] and for succinylcholine at 1 mg / kg [15, 16, 18, 19]. In our work, the Mann-Whitney U test applied to these times showed a statistically significant lack of correlation. This does not allow us to extrapolate our results to the general population.

4. CONCLUSION

Rapid sequence induction is the gold standard for intubating the full stomach patient under anesthesia. Succinylcholine has long been the curare of choice in this indication, because it provides an optimal benefit / risk ratio. Rocuronium, recently introduced in the therapeutic arsenal of the anesthesiologist in sub-Saharan Africa, is also of great interest in this indication. In our series, the muscle relaxation obtained with succinylcholine and rocuronium allows tracheal intubation in a short time, less than 60 seconds for all patients. These two molecules provide excellent and acceptable intubation conditions with minimal side effects. However, in a poor environment hostile to the practice of general anesthesia, it is justified to integrate the notion of cost of the anesthetic procedure to help make the right choice of the ideal molecule in the ISR. Anesthetic safety should be given priority in all cases. Large cohort studies are needed in our practice environment to consolidate our results.

REFERENCES

1. Klucka, J., Kosinova, M., Zacharowski, K., De Hert, S., Kratochvil, M., Toukalkova, M., ... & Stourac, P. (2020). Rapid sequence induction: An international survey. *European journal of anaesthesiology*, 37(6), 435.
2. de Carvalho, C. C., da Silva, D. M., de Athayde Regueira, S. L. P., de Souza, A. B. S., Rego, C. O., Ramos, I. B., & Neto, J. M. D. S. (2021). Comparison between rocuronium and succinylcholine for rapid sequence induction: A systematic review and network meta-analysis of randomized clinical trials. *Journal of clinical anesthesia*, 72, 110265.
3. Allene, M. D., Melekie, T. B., & Ashagrie, H. E. (2020). Evidence based use of modified rapid sequence induction at a low income country: A

- systematic review. *International Journal of Surgery Open*, 25, 17-23.
4. Tran, D.T., Newton, E.K., Mount, V.A., Wells, G.A., Perry, J.J. (2015). Rocuronium versus succinyl choline for rapid sequence induction. *Cochrane database syst Rev*, 10 ; CD002788.
 5. Viby-Mogensen, J. (1999). Why, how and when to monitor neuromuscular function. *Minerva anesthesiologica*, 65(5), 239-244.
 6. Chastre, J., Bedock, B., Clair, B., Gehanno, P., Lacaze, T., Lesieur, O., ... & Samain, E. (1998). Quel abord trachéal pour la ventilation mécanique des malades de réanimation?(à l'exclusion du nouveau-né). *Réanimation*, 7, 438-442.
 7. Sfar. (2000). Conférence de consensus: indications de la curarisation en anesthésie. *Ann Fr Anesth Reanim*, 19; 344S-472S.
 8. Adnet, F., Alazia, M., Ammirati, C., Bonnet, F., Brunet, F., Secrétaire, J. E., ... & Dipendaele, J. F. (2000). Modalités de la sédation et/ou de l'analgésie en situation extrahospitalière. *Ann Fr Anesth Reanim*, 19(fi), 56-62.
 9. Coulibaly, Y., Traore, A., Doumbia, D., Traore, J., Yena, S., Samake, B., Keita, M., Diango, D. (2003). Utilisation du bromure de rocuronium en pratique anesthesiologique a l'hopital du point G. *Mali Médical 2003 T XVIII N° 1&2:35-38*
 10. Bovet, D., Bovet-Nitti, F. (1948). Curare. *Experimentia*, 4 ; 325-348.
 11. Khirwadkar, R., & Hunter, J. M. (2012). Neuromuscular physiology and pharmacology: an update. *Continuing Education in Anaesthesia, Critical Care & Pain*, 12(5), 237-244.
 12. Albrecht, E. (2015). Curares. *Manuel pratique d'anesthésie*, Elsevier Masson ; 111-120, disponible sur le site <https://doi.org/10.1016/B978-2-294-73189-1.00008-8>.
 13. Belekar, V. R., & Khamankar, S. (2013). Rocuronium for tracheal intubation in patients undergoing emergency surgery. *Int J Pharmacol Res*, 3, 18-22.
 14. Mayank, A., Omprakash, S., Santosh, T., & Jaya, L. (2015). Comparative evaluation of etomidate and thiopentone sodium with rocuronium for rapid sequence intubation in pregnant patients undergoing lower segment caesarean section a comparative study. *Int. J. Adv. Res.* 5(1),1314-1319.
 15. Sajayan, A., Wicker, J., Ungureanu, N., Mendonca, C., & Kimani, P. K. (2016). Current practice of rapid sequence induction of anaesthesia in the UK- a national survey. *BJA: British Journal of Anaesthesia*, 117(suppl_1), i69-i74.
 16. Cook, F., & Plaud, B. (2010). Curares en réanimation: indications, pharmacologie, monitoring. *Analgesie et sédation en réanimation*, 117-127.
 17. McCourt, K. C., Salmela, L., Mirakhur, R. K., Carroll, M., Mäkinen, M. T., Kansanaho, M., ... & Olkkola, K. T. (1998). Comparison of rocuronium and suxamethonium for use during rapid sequence induction of anaesthesia. *Anaesthesia*, 53(9), 867-871.
 18. Tran, D. T. T., Newton, E. K., Mount, V. A. H., Lee, J. S., Mansour, C., Wells, G. A., & Perry, J. J. (2017). Rocuronium vs. succinylcholine for rapid sequence intubation: a Cochrane systematic review. *Anaesthesia*, 72(6), 765-777.
 19. Sluga, M., Ummenhofer, W., Studer, W., Siegemund, M., & Marsch, S. C. (2005). Rocuronium versus succinylcholine for rapid sequence induction of anesthesia and endotracheal intubation: a prospective, randomized trial in emergent cases. *Anesthesia & Analgesia*, 101(5), 1356-1361.