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Comparison of tracheal intubation conditions after 45 seconds, 60 seconds rocuronium and succinylcholine treatments in elective surgery

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ABSTRACT

Muhdar Abubakar, Priyono PH, Humisar Sibarani, & Wayan Widana - *Comparison of tracheal intubation conditions after 45 seconds, 60 second rocuronium and succinylcholine treatments in elective surgery.*

The tracheal intubating conditions of rocuronium and succinylcholine under balanced anasthesia with midazolam, fentanyl, penthotal, nitrous oxide, oxigen and halothane were studied in 38 patients undergoing elective surgery. Patients were given either 0.6 mg/kg rocuronium or 1 mg/kg succinylcholine intravenously. forty five seconds after the administraion of rocuronium, or 60 seconds after the administration of rocuronium or succinylcholine, the trachea was intubated and the intubating conditions were scored by blinded assessor. Intubating conditions were the same between the rocuronium and succinylcholine group. (p = 0.18) The hemodynamic effect were the same among the three groups. The result showed that all patients with 0.6 mg/kg rocuronium could be intubated within 45 seconds as well as 60 seconds; however, those intubated within 60 seconds were similar to those with 1 mg/kg succinylcholin.

Key words: intubating conditions - rocuronium - succinylcholine - tracheal intubation - hemodynamic effect

ABSTRAK

Muhdar Abubakar, Priyono PH, Humisar Sibarani, Wayan Widana - *Perbandingan kondisi intubasi trakhea setelah pemberian 45 detik, 60 detik rocuronium dan suksinilkolin pada pasien bedah elektf.*

Kondisi intubasi trakhea rocuronium dan suksinilkolin telah diteliti dalam balans anesthesia dengan menggunakan fentanyl, penthotal, N_2O, oksigen dan halothane pada 36 pasien yang mengalami pembedahan elektif. Pasien diberi 0,6 mg/kg rocuronium atau 1 mg/kg suksinilkolin intravena. Setelah 45 atau 60 detik pemberian rocuronium dan 60 detik pemberian suksinilkolin dilakukan intubasi trakhea dan dinilai kondisi intubasi trakhea. Kondisi intubasi antara rocuronium dan suksinilkolin tidak menunjukkan perbedaan bermakna (p = 0,18). Keadaan hemodinamik antara ke tiga grup tidak berbeda. Semua pasien dengan 0,6 mg/kg rocuronium dapat diintubasi dalam 45 detik maupun 60 detik tetapi intubasi trakhea dalam 60 detik memberikan kondisi intubasi yang sama dengan 1 mg/kg suksinilkolin.

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Since the introduction of vecuronium and atracurium in 1983 and 1984, respectively, we have seen a relative explosion of research on the development of muscle relaxants. Forty one years before the introduction of vecuronium, anesthesiologist worked with just a few muscle relaxants: d-tubocurarine, succinylcholine, metacurin, gallamine, and pancuronium. Eleven years after

1983, five more new muscle relaxants have been introduced into clinical practice: vecuronium, atracurinium, pipecuronium, doxacurium, and mivacurium, rocuronium will soon be approved for use and other nondepolarizing compounds are being actively studied[1].

Suxamethonium, with its rapid onset and short duration of action, is still used, mainly because of the rapid development of good intubation conditions resulted in. However, it falls short of the "Ideal" muscle relaxant due to its numerous side effects. The search of ideal neuromuscular blocking agents has focused on depolarizing agents because most of the side effects of suxemethonium reflect its depolarizing mechanism of action[2].

Anesthesiologists desire a nondepolarizing muscle relaxant with very rapid onset of action in order to replace succinycholine in patients where rapid control of the airway is necessary or when succinycholine is contraindicated. A number of schemes has been devised to facilitate rapid endotracheal intubation with nondepolarizing muscle relaxants. These include "priming" that is, giving a fraction (1/5-1/10 of the ED_{95}) of the intubating dose (2-3 X Ed_{95}) two to four minutes before administering the intubating dose of the muscle relaxants, and administering very large doses (4-5 X Ed_{95}) of the nondepolarizing muscle relaxants[3,4]. While each of these techniques speed the onset of neuromuscular block to a degree, they do so at a cost. With priming one risks a significant degree of weakness with the pretreatment dose of muscle relaxant. In the case of administering a large dose of the nondepolarizing relaxant, the duration of action of the relaxant is increased.

Rocuronium is a new, nondepolarizing neuromuscular blocking drug that has been reported to develop optimal tracheal intubating conditions more rapidly than vecuronium[4]. In initial clinical studies, the ED_{95} of rocuronium was found to be 0.3 mg/kg[5]. Short onset time results in rapid development of optimal tracheal intubation conditions. Therefore, this study was undertaken to compare tracheal intubating conditions to hemodynamic effect of action of a single bolus dose of 0.6 mg/kg of rocuronium (2 X ED_{95}) 45 seconds and 60 seconds with a single bolus dose of 1 mg/kg succinylcholine (3 X ED_{95}) in elective surgery patients with balanced anesthesia.

METHODS

After obtaining institutional approval and informed written consent, 45 patients of either sex consenting ASA class I, of normal weight, between 17 and 65 years of age, scheduled for elective surgery were included in the study. Patients were excluded from the study if they had or suspected difficulty intubation, neuromuscular disease, or if they were taking medications known to interact with muscle relaxant, had hepatic, and renal disease. They were allocated randomly into three groups to receive muscle relaxant. The anaesthetist was blinded to the muscle relaxant used.

Patients were premedicated with 1 ug/kg fentanyl and 0,1 mg/kg midazolam intravenously 10 minutes before induction. Blood pressure and heart rate were measured every 1 minute using a Dinamap model noninvasive blood pressure monitor via brachial cuff. Anesthesia was induced with thiopental 5 mg/kg, and 0.6 mg/kg rocuronium, the trachea was intubated after 45 seconds for group a, and after 60 seconds for group b, or 1 mg/kg succinylcholine after 60 seconds.

Anesthesia was maintained with nitrous oxide/oxygen (2:1), halothane 1 mac. The intubating conditions were always assessed by the same experienced anesthesiologists who performed tracheal intubation thereafter. This person did not know the muscle relaxant used, and was not in charge in the anaesthetic procedure. Intubation conditions were scored as excellent, good, fair and poor.

TABLE 1. – Scoring of intubation conditions

Score	Jaw relaxation	Vocal cords	Respons intubation
0	Poor (impossible)	Closed	Severe coughing
1	Minimal (difficult)	Closing	Mild coughing
2	Moderate (fair)	Moving	Slight diafragmatic movement
3	Good (easy)	Open	None

Scoring of intubation conditions. Total score of 8-9 = excellent, 6-7 = good, 3-5 = fair, 0-2 = poor.

The demographic, and hemodynamic data of the three groups were compared by Analysis of variance. The intubating conditions of the three

groups were analyzed by Kruskal-Wallis test. Differences were considered significant at $p < 0.05$. All values are given as mean ± SD.

RESULTS

There were no significant differences in the demographic characteristics amongn the three groups of the patients except the age (TABLE 2).

TABLE 2. – Demographic characteristics

Group	Rocunorium 45s	Rocunorium 60s	Succinylcholin
Weight(kg) (X ± SD)	45.56 ± 7.14	54.15 ± 10.08	50.82 ± 6.21
Height (cm) (X ± SD)	159.75 ± 6.35	160.23 ± 7.66	160.64 ± 7.59
Age (year) (X ± SD)	37.25 ± 13.59	36.46 ± 18.91	23.10 ± 5.24
Sex (male/female)	5/7	6/7	6/5

Intubating conditions were rated as excellent or good for all patients except one patient with fair intubating conditions on rocuronium 45 seconds group. TABLE 3 shows that the proportions of patients with excellent, good in the three groups.

TABLE 3. – Intubating conditions of the three groups

Group	Excellent (%)	Good (%)	Fair (%)	Total of patients
Rocuronium 45s	7(58.33)	4 (33.33)	1 (8.33)	12
Rocuronium 60s	10(76.92)	3 (23.07)	0 (0.00)	13
Succinylcholine	10(90.00)	1 (9.09)	0 (0.00)	11

The hemodynamic effects of rocuronium and succinylcholine before and after intubations were showed in TABLE 4 and 5. The hemodynamic effect can be shown with both MAP (Mean Arterial Blood Pressure = 1/3 systolic + 2/3 diastolic)

No significant differences could be demonstrated in the overall hemodynamic effects before and after administration of muscle relaxant ($p > 0.05$)

DISCUSSION

The results of the present study indicated that rocuronium resembles succinylcholine in producing good to excellent intubating conditions approximately 1 minute after its administration. Only one patient showed fair intubating conditions. It is conceivable therefore, that rocuronium might affect the vocal cords and probably other laryngeal muscle more rapidly than adductor pollicis muscle[5].

Adhering to the clinical practice, in this study the standard intubating doses of both compounds was used. However, these conditions probably favored the rate block development after succinylcholine as the standard intubating dose of this drug is larger than that of rocuronium.

Although our observations and others[6] suggest that rocuronium, when compared to succinylcholine, produced similar intubating conditions at a comparable rate, it should be emphasized that the assessment of inaccurate intubating conditions is difficult and remains. A clean and entirely unbiased comparison with succinylcholine and its fasciculations is even more difficult in spite of all attempts to blind the intubating anesthesiologist.

TABLE 4. – The effect of rocuronium 45 s, rocuronium 60s and succinylcholine on MAP

Group	Before Intubation	After Intubation				
		1 minute(X ± SD)	2 minutes (X ± SD)	3 minutes (X ± SD)	5 minutes (X ± SD)	5 minutes (ü ± SD)
Rocuronium 45 s	90.67 ± 6.05	97.92 ± 18.46	104.60 ± 25.57	94.57 ± 9.64	93.76 ± 9.64	87.33 ± 6.64
Rocuronium 60s	93.16 ± 10.47	96.92 ± 23.52	117.3 ± 22.66	106.15 ± 22.09	99.06 ± 16.36	91.16 ± 10.99
Succinylcholine	86.27 ± 5.35	102.45 ± 11.90	100.64 ± 16.40	93.45 ± 14.33	94.82 ± 9.66	88.09 ± 13.73

TABLE 5. – The effect of rocunorium 45s, rocunorium 60s and succinylcholine on Heart Rate.

Group	Before Intubation	After Intubation				
		1 minute(X ± SD)	2 minutes (X ± SD)	3 minutes (X ± SD)	5 minutes (X ± SD)	5 minutes (ü ± SD)
Rocuronium 45 s	88.75 ± 5.59	92.08 ± 10.92	95.83 ± 14.35	94.893 ± 12.36	93.08 ± 8.93	93.33 ± 8.37
Rocuronium 60s	89.63 ± 12.20	100.00 ± 16.37	102.69 ± 11.06	103.61 ± 13.60	101.77 ± 13.91	100.38 ± 14.68
Succinylcholine	85.73 ± 13.22	90.00 ± 12.18	98.91 ± 12.18	98.09 ± 12.08	95.91 ± 11.26	93.55 ± 10.60

In this study there were no significant changes in both heart rate and mean arterial pressure with the dose of 0.6 mg/kg rocuronium under balanced anesthesia. In view of the widespread investigations with rocuronium showing that the cardiovascular effects were of no clinical significance it is surprising that Booth and colleagues[7] reported an increase greater than 30% in heart rate with a dose of 0.6 mg/kg. Either no or only mild transient increase in heart rate was observed[8,9,10].

We concluded that in this study the intubating conditions approximately 60 seconds after the administration of rocuronium were satisfactory and similar to those observed after succinylcholine.

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