Original Article

Priming Technique of Rocuronium in Facilitating Intubation-A Study in Khulna Medical College Hospital, Khulna, Bangladesh

***Mahfuza Khanam[1], Mohammad Rezaul Momin[2], Roxana Ferdousi[3], Md. Moniruzzaman[4]**

Abstract

Introduction: Ability to intubate the trachea rapidly and safely is still very important, especially in emergency anesthesia where there is possibility of regurgitation and aspiration of gastric contents. For making intubation quick, easy and atraumatic, the role of short-acting depolarizing Neuromuscular blocking agents (NMBA) need to be justified in this situation. **Objective:** To assess the Priming Technique of Rocuronium in Facilitating Intubation. **Methods:** This prospective, randomized study was carried out in the Department of Anesthesiology and ICU, Khulna Medical College & Hospital, Khulna from January to December 2022. Total 75 patients admitted in Surgery, Gynae & Obs. and ENT departments of KMCH, undergoing elective surgery were selected for the study. After recruitment, patients were divided into three groups, 25 patients in each group (Group I- received thiopentone (5mg/kg) and Fentanyl following induction, Group II- received Suxamethonium and Group III- received rocuronium). Randomization was done by systematic sampling. **Results:** In priming group any unpleasant symptoms during priming like visual disturbance, feeling of dyspnea, difficulty in controlling tongue were closely observed. Intubating conditions were assessed using the intubation criteria of Cooper et al. The difference between the priming and the single dose rocuronium group was not statistically significant in terms of timing of intubation ($p = 0.329$). While evaluating intubating conditions, no significant difference was also observed between priming group (group-II) and single dose rocuronium group (group-III) in jaw relaxation ($p=0.698$), vocal cords movement ($p=0.646$) and response to intubation ($p=0.514$). Much earlier intubation was observed in Group I compared to the other two groups ($p = 0.039$) and in terms of intubating conditions. Smooth intubation was significantly higher in Suxamethonium group (Group-I). In terms of unpleasant effects of priming it was observed that 1.3% of the patients of priming group had visual disturbances, 4% dyspnoea, 1.3% difficulty in controlling tongue and 2.6% difficulty in swallowing during the priming interval and remaining 90.6% was free of any unwanted side effects. **Conclusion:** Using priming technique with standard intubating dose of rocuronium has no beneficial effects on reducing intubation time and providing better intubating conditions over single bolus injection of rocuronium. Therefore, Rocuronium in single bolus injection can replace Suxamethonium for quick endotracheal intubation in surgical procedures of short and medium duration.

Keywords: Priming Technique, Rocuronium, Facilitating Intubation.

1. Junior Consultant (Anesthesiology), Khulna Medical College Hospital, Khulna, Bangladesh
2. Junior Consultant (Anesthesiology), Upazila Health Complex, Botiaghata, Khulna
3. Anesthesiologist, Khulna Medical College Hospital, Khulna, Bangladesh
4. Assistant Professor (Anesthesiology), Khulna Medical College, Khulna, Bangladesh

***Address of Correspondence:** Dr. Mahfuza Khanam, Junior Consultant (Anesthesiology), Khulna Medical College Hospital, Khulna, Bangladesh. Email: mahfuzakmc@gmail.com.

Introduction

Tracheal intubation is usually performed after induction of anesthesia followed by relaxation of skeletal muscle. The ability to intubate the trachea rapidly and safely is still paramount in all clinical situations. Suxamethonium is still the drug of choice for this purpose. This short-acting depolarizing NMBA (Neuromuscular blocking agents) is probably the most popular drug used for making intubation quick, easy and atraumatic. Among the factors influencing onset time is the rapidity with which neuromuscular blockers are delivered to the neuromuscular junction cleft [1]. Induction agents that maintain cardiac output and blood pressure may promote a faster delivery of the neuromuscular blocking agent to the site of action [2,3]. But this drug has many side effects like post-operative muscle pain, hyperkalemia, malignant hyperthermia, masseter rigidity etc. For these reasons, researchers have concentrated on developing an alternative drug to suxamethonium or an alternative method of using non-depolarizing NMBA for rapid sequence induction of intubation technique. In most of the patients, clinically acceptable intubating conditions are obtained within 60 to 90 seconds after a 0.6 mg/kg dose of rocuronium with a clinical duration of action of 30 to 40 minutes under balanced anaesthesia [1]. Based on onset of action, Magorian et al [2] suggested that 0.9 to 1.2 mg/kg rocuronium may be necessary as an alternative to suxamethonium, but this megadose correspondingly increases the clinical duration of action [3]. Clinical durations were shown to be 50 minutes following a 0.9 mg/kg dose and around 80 minutes following a 1.2 mg/kg dose of rocuronium [1, 2]. Priming technique with rocuronium has been investigated by several authors to reduce the onset time and to optimize its efficacy and reduce the incidence of side-effects Griffithetal [4, 5] Jaochim et.al. [6] used a priming dose of 0.06 mg/kg and after priming interval of 3 minutes, intubating dose of 0.54 mg/kg were administered to compare onset time and intubating conditions with the patients receiving rocuronium 0.6 mg/kg in bolus dose. In the present study, a priming dose of rocuronium 0.06 mg/kg and a priming interval of 3 minutes were chosen to compare the influence of priming technique on the onset time and intubating conditions with standard intubating dose (0.6 mg/ kg) and outcome was also compared with a control group receiving suxamethonium (1.5 mg/kg). Moreover, the side-effects associated with the use of suxamethonium like, post- operative muscle pain, hyperkalemia, malignant hyperthermia, masseter rigidity etc. were assessed here. Another aim of this study was to observe whether priming technique is associated with any unpleasant symptoms like, visual disturbance, feeling of dyspnea etc.

Materials & Methods

This prospective, randomized study was carried out in the department of Anaesthesiology and ICU, Khulna. Medical College Hospital, Khulna, Bangladesh from January to December 2022. Seventy five patients, aged between 17-45 years, ASA I & II, Mallampati class I & II admitted in Surgery, Gynae & Obs. and ENT departments of KMCH, undergoing elective surgery, requiring general anesthesia and endotracheal intubation were selected for the study. After recruitment, patients were divided into three groups, 25 patients in each group. Group-I patients (n=25) received Thiopentone (5mg/kg) and Fentanyl (2µgm/kg), followed by intubating dose of Suxamethonium (1.5mg/ kg). Group-II patients (n=25) received priming dose of Rocuronium (0.06mg/kg), 3 minutes later, anesthesia was induced with Thiopentone (5mg/kg) and Fentanyl (2µgm/kg), followed by intubating dose of Rocuronium (0.54mg/kg). Group-III patients (n=25) received Thiopentone (5mg/kg) and Fentanyl (2µgm/ kg), followed by intubating dose of

Rocuronium 0.6mg/kg in single dose. Intubating conditions were assessed using the criteria of Cooper et al. [4]. Statistical analysis (sample size, mean) were calculated for all quantitative variables of each group. TOF ratio (Train of four ratio) and hemodynamic variables were compared between the groups. Intubating conditions were also compared. Informed consent was taken individually from patient and ethical clearance was taken from the Ethical review committee of Khulna Medical College Hospital, Bangladesh.

Results

Table I. Demographic characteristics among the three groups (N=75).

Variable	Group-I (n=25)	Group-II (n=25)	Group-III (n=25)	*p* value
Age (yrs)	35.4±8.0	30.4±9.0	31.5±10.5	0.099
Weight (kg)	52.5±6.9	47.6±8.7	49.6±8.8	0.073
Sex	6/19	17/8	8/17	0.24

**p* values were calculated by using ANOVA.

Age and sex distribution of the study population is depicted in table I. The mean age of Group-I was higher (35.4±8.0 years) than that of Group-II (30.4±9.0 years) and Group-III (31.5±10.5 years). The weight and sex distribution of the subjects in three groups was almost homogenous.

Table II. Hemodynamic state 3 minutes after priming in Group-II (N=75).

Hemodynamic variables	Mean±SD
Heart rate (b/min)	81±9
Systolic BP (mmHg)	113.9±10.7
Diastolic BP (mmHg)	72.3±6.9
SpO_2 (%)	100±0
TOF ratio (%)	87±5.8

Table II shows the haemodynamic state 3 minutes after priming in Group-II. The mean heart rate was 81±9/minute, mean systolic blood pressure 113.9±10.7 mmHg, mean diastolic blood pressure 72.3±6.9 mmHg, mean SpO_2 100±00 (%) and mean TOF ratio 87±5.8 (%).

Table III. Comparison of timing of intubation among the groups (N=75).

Timing of intubation	Group-I (n=25) n (%)	Group-II (n=25) n (%)	Group-III (n=25) n (%)
30s	8 (32)	5 (20)	3 (12)
60s	17 (68)	16 (64)	14 (56)
90s	00 (00)	4 (16)	7 (28)
>90s	00 (00)	00 (00)	1 (4)

Table III shows timing at intubation shows that 32% of the patients of Group-1, 20% of Group-II and 12% of Group-III were successfully intubated at 30 sec following induction.

Table IV. Comparison of jaw relaxation among the three groups (N=75).

Jaw relaxation	Group-I (n=25) n (%)	Group-II (n=25) n (%)	Group-III (n=25) n (%)	*p* value
Minimum	00	00	1 (4)	
Moderate	10 (40)	10 (40)	11(44)	0.698
Good	15 (60)	15 (60)	13(52)	

**p* values were calculated by using ANOVA.

Table IV shows that 60% of the subjects of Group-I and Group-II and 52.0% of Group-III exhibited good relaxation of jaw relaxation at the time of intubation. The moderate relaxations were 40%, 40% and 44.0% in Group-I, Group-II and Group-III respectively.

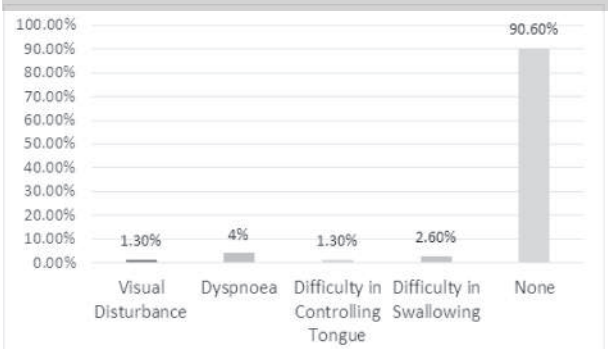


Figure 1: Side effects encountered by Group II patients 3 minutes after priming (N=75).



Figure 2: Comparison of state of vocal cords at intubation among the groups (N=75).

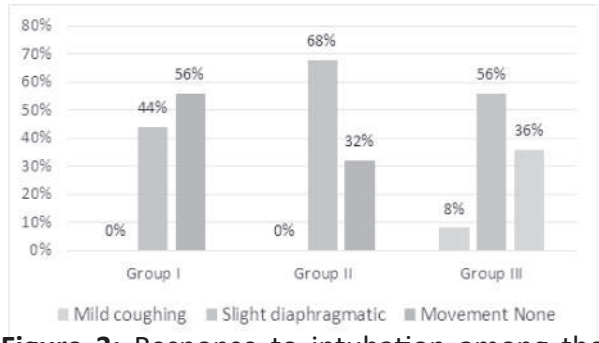


Figure 3: Response to intubation among the three groups (N-75).

Discussion

The priming principle' has been described by Foldes [7] consists of administering a small dose of non- depolarizing NMBA to facilitate rapid intubation after induction. Various techniques are used to reduce intubation time of non-depolarizing NMBA like 'priming principle'. While application of mega-dose of rocuronium may be suitable for rapid-sequence induction and intubation, but at the cost of

Table V. Comparison of intubation score among the three groups (N=75).

Intubation score	Group-I (n=25) n (%)	Group-II (n=25) n (%)	Group-III (n=25) n (%)	*p* value
0-2 (Poor)	00	00	00	
3-5 (Fair)	00	00	00	
6-7 (Good)	9 (36)	12 (48)	14 (56)	0.286
8-9 (Excellent)	16 (64)	13 (52)	11 (440)	
Mean±SD	7.8±1.2	7.6±1.2	7.2±1.6	

Table V shows that based on intubation score 64.0% of Group-I, 52.0% of Group-II and 44.0% of Group-III were categorized as having excellent outcome.

Table VI. Comparison of TOF ratio at different stages of intubation in Group I & III.

TOF ratio	Group-I (n=25) Mean±SD	Group-III (n=25) Mean±SD	*p* value
3 minutes after priming	87.0+ 5.8	Not done	
At intubation	57.4±8.4	54.5+7.8	0.644
Just after intubation	39.7±13.8	36.4 ±14.6	0.457

p values were calculated by using t test.

Table VI shows TOF ratio (train of four ratio) at different stages of intubation in Group I in contrast to Group III.

much longer duration of action [2]. Table-1 shows the distribution of demographic characteristics among the three groups. The mean age of Group-I was higher (35.4±8.0 years) than that of Group-11 (30.4±9.0 years) and Group-III (31.5±10.5 years) although the difference did not reach the level of significance (p = 0.099). The weight of the subjects in three groups was almost homogenous. The groups were also homogeneous in terms of sex distribution (p = 0.241). Yavascaoglu et al. [8] studied 75 adult patients (17-67 years) using different priming interval (two minutes) and priming doses (priming dose: rocuronium 0.06 or 0.1 mg/kg, intubating dose 0.54 or 0.5mg / kg). Hemodynamic state at intubation and just after intubation demonstrated that the hemodynamic variables were within physiological range and almost homogeneously distributed among the groups and no adverse outcome was noticed. All the hemodynamic variables were also stable at three minutes after priming in group-II (Table-2).

In the present study, timing at intubation showed that 32% of the patients of group-I, 20% and 12% of the patients of group-II and group-III respectively were successfully intubated at 30 second following induction. The rest of Group-1 (68%), 64% of Group II and 56% of Group-III were effectively intubated at 60 sec. The Suxamethonium group allowed much earlier intubation compared to the other two groups (p = 0.039). This result correlates poorly with the findings of Griffith et al. [5], Yavascaoglu et al. [8] and Naguib all [9] observed significant acceleration of onset time of rocuronium using same priming dose and priming interval. Satisfactory intubating conditions had been reported without muscle relaxant following a propofol-alfentanyl induction [10]. In addition, propofol was reported to produce significant depression of laryngeal reflexes [11, 12]. On the other hand, in this study, we used thiopental sodium (TPS), neither additional dose of TPS nor any inhalational agent except oxygen was used prior to tracheal intubation.

This is particularly true for fast-acting muscle relaxants where peripherally assessed onset of neuromuscular block can give no exact indication of moment when optimum laryngeal relaxation has first been achieved [13]. The observation of Jaochim et al. [6] correlates well with the present study in terms of TOF-ratio, which was around 0.57 and 0.54 at the time of successful intubation in group-II and group III respectively. In terms of intubating conditions, no significant difference was observed between group-II and group III in jaw relaxation (p = 0.698), vocal cords movement (p = 0.646) and response to intubation (p = 0.514). This result agrees with the study of Griffith et al. [5]. In this study it was found that about three-quarter (73%) of the patients of group-III, were feasible to be intubated within 60 seconds following single bolus dose of rocuronium 0.6 mg/kg. This result agrees with the findings of Scheiber et al. [14]. Our study also showed that the Suxamethonium group allowed much earlier intubation compared to the other two groups (p = 0.039) and in terms of intubating conditions, smooth intubation was significantly higher in Suxamethonium group (p = 0.043). This finding correlated well with the study of Cheng et al. [15].

Based on the intubation score as described by cooper et al [1], 64.0% of Group-1, 52.0% of Group-II and 44.0% of Group-III were categorized as having excellent outcome. The rest of the respective groups, except the subjects of the group-III had good outcome. The mean intubation scores in three groups were not statistically different (p = 0.286). In terms of unpleasant effects of priming, we observed that 1.3% of the patients of priming group had visual disturbances, 4% dyspnea, 1.3% difficulty in controlling tongue and 2.6% difficulty in swallowing during the priming interval and

90.6% was free of any unwanted side-effects. The TOF- ratio, 3 minutes after priming was around 0.87, this observation correlates well with the findings of Aziz et al [16]. From the results of this study, we also observed that Suxamethonium group allowed much earlier intubation compared to other two groups and in terms of intubating conditions, smooth intubation was significantly higher in Suxamethonium group. We also found that more than 75% of the patients of the remaining two groups were feasible to be intubated within 60 seconds with good to excellent intubating conditions and the mean intubation scores among the three groups were not statistically different (p=0.286). Therefore, rocuronium 0.6 mg/kg in single bolus dose following induction with thiopental sodium can be suitable alternative to Suxamethonium for rapid tracheal intubation for surgical procedures of short and medium duration.

Conclusion

Using priming technique with standard intubating dose of rocuronium has no beneficial effects on reducing intubation time and providing better intubating conditions over single bolus injection of rocuronium and this technique is not completely devoid of harmful effects to the patients. So, Rocuronium in single bolus injection can replace Suxamethonium for quick endotracheal intubation in surgical procedures of short and medium duration.

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