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Original Article

Evaluation of Timing and Priming Principle Using Rocuronium Bromide on Intubating Conditions and Neuromuscular Blockade in Patients Undergoing General Anaesthesia

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ABSTRACT

Background: Neuromuscular blocking agents are essential for facilitating endotracheal intubation and improving surgical conditions during general anaesthesia. Rocuronium, a non-depolarizing agent, is preferred due to its rapid onset and intermediate duration. Techniques such as the timing principle and priming principle are used to speed up its onset of action. This study evaluates the pharmacodynamic benefits and safety of these two administration methods.

AIM: To compare the effectiveness and rapidity of onset of rocuronium bromide for tracheal intubation using timing and priming principles in patients undergoing general anaesthesia.

Materials And Methods: This randomized double-blind study included 134 ASA I/II patients (18–60 years) undergoing elective surgery under general anaesthesia. Patients were divided into Group A (timing principle) and Group B (priming principle). Neuromuscular monitoring was done using Train-of-Four (TOF). Group B received 1/10th intubating dose of rocuronium (0.06 mg/kg) as priming, while Group A received placebo. The study evaluated time for T1 fade, intubating conditions, side effects, and hemodynamic parameters.

Results: Both groups were demographically similar. The T1 fade time was significantly shorter in the priming group (1.45 ± 0.48 min) compared to the timing group (3.30 ± 1.25 min). Intubating conditions were similar, though the response to intubation slightly favored the priming group. Hemodynamic parameters remained stable in both groups, with mild side effects (diplopia, ptosis) slightly more common in the priming group but not statistically significant.

Conclusion: The priming technique provided faster onset of neuromuscular blockade without affecting intubation quality or patient safety, making it useful in time-sensitive situations. The priming principle for administering rocuronium is a safe, effective, and efficient strategy to hasten neuromuscular blockade onset and enhance intubating conditions. Its clinical application may contribute to smoother anaesthesia induction and reduced intubation time, especially beneficial in high-risk or emergency procedures.

Keywords*: Timing, Priming, Rocuronium, Cooper Scale,TOF*

INTRODUCTION

General anaesthesia requires muscle relaxation to allow safe intubation and optimal surgical conditions. This is achieved using neuromuscular blocking drugs such as Rocuronium, which blocks acetylcholine receptors at the neuromuscular junction and causes temporary muscle paralysis.

Two important techniques affecting its effectiveness are the timing principle and the priming principle. Timing involves giving the muscle relaxant before the induction drug at the onset of weakness, while priming involves giving a small dose before the main dose to speed up neuromuscular blockade. This study evaluates how these techniques influence intubation conditions, onset of blockade, duration of action, and recovery time. The aim is to improve the clinical use of Rocuronium and enhance the safety and efficiency of general anaesthesia.

AIM

The aim of the study is to compare the effectiveness and rapidity of onset of action of rocuronium bromide for tracheal intubation using priming and timing principle.

MATERIALS AND METHODS

Study Design

This randomized, double-blinded clinical trial compared the efficacy of the timing principle and priming principle of Rocuronium bromide for endotracheal intubation in patients undergoing general anaesthesia. The study was conducted at the Institute of Anaesthesiology and Critical Care, Rajiv Gandhi Government General Hospital, Madras Medical College, Chennai.

Study Population

A total of 134 patients, aged 18–60 years and classified as ASA physical status I or II, scheduled for elective surgery under general anaesthesia with endotracheal intubation were included. Patients were randomly allocated into two groups:

- **Group A (Timing principle):** 67 patients
- **Group B (Priming principle):** 67 patients

Written informed consent was obtained from all participants.

Inclusion Criteria

1. Age 18–60 years
2. ASA physical status I or II
3. Elective surgery under general anaesthesia requiring endotracheal intubation
4. Provided informed consent

Exclusion Criteria

- Allergy to Rocuronium
- Pregnancy
- Neuromuscular disorders or significant electrolyte imbalance
- Refusal to participate

Study Protocol

Upon arrival in the operating room, standard ASA monitors (ECG, pulse oximetry, and non-invasive blood pressure) were applied and baseline parameters recorded (HR, SBP, DBP, SpO_2).

Anaesthesia Induction

All patients received premedication 10 minutes before the priming dose:

- Glycopyrrolate 0.2 mg IV
- Midazolam 0.03 mg/kg IV
- Fentanyl 2 mcg/kg IV

Patients were then randomly assigned to one of the following groups:

Group A (Timing Principle):

Received 1 ml normal saline as placebo followed by Rocuronium 0.6 mg/kg after 3 minutes.

Group B (Priming Principle):

Received Rocuronium 0.06 mg/kg (1/10th priming dose) followed by the remaining 0.54 mg/kg after 3 minutes. Patients were observed for diplopia, ptosis, or breathing difficulty.

Neuromuscular Monitoring

Neuromuscular blockade was monitored by applying a supramaximal electrical stimulus to the ulnar nerve at the wrist. Train-of-four (TOF) stimulation was delivered at 10 mA above the minimum current required to elicit four responses. The time taken for T1 disappearance was recorded as the onset of neuromuscular blockade.

Intubation and Evaluation
After disappearance of T1, endotracheal intubation was performed using a modified rapid sequence intubation technique. Intubating conditions were graded using Cooper's scale:

- Excellent (score 8–9)
- Good (score 6–7)
- Fair (score 3–5)
- Poor (score 0–2)

A blinded investigator assessed and recorded the intubation score.

Postoperative Management
Anaesthesia was maintained with oxygen–nitrous oxide (50:50) and inhalational agents with additional neuromuscular blockers as required. At the end of surgery, neuromuscular blockade was reversed with Neostigmine 0.05 mg/kg IV and Glycopyrrolate 0.01 mg/kg IV. Patients were monitored in the recovery room.

Data Collection and Analysis
Parameters recorded included:

- Onset time of neuromuscular blockade (time from intubating dose to disappearance of T1)
- Intubation scores and conditions

Data were analyzed using descriptive statistics. Continuous variables were expressed as mean ± standard deviation, and categorical variables as frequency and percentage.

4. **Independent Student's t-test** was used to compare onset time between groups.
5. **Chi-square test** was used to compare intubation conditions.

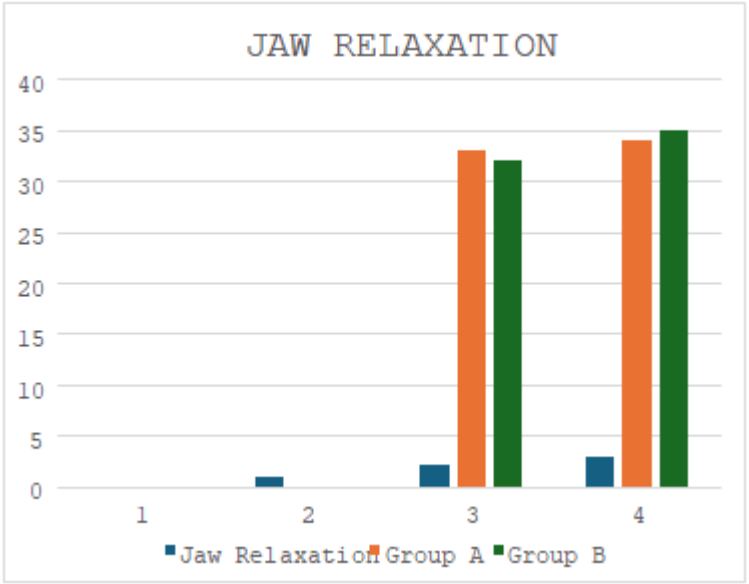
Groups were demographically well matched, minimizing confounding effects on outcomes.

INTUBATION CONDITIONS:

- **Jaw Relaxation:** Similar scores in both groups; no significant difference (p=0.450).

Table1 : JAW RELAXATION

Jaw Relaxation	Group A		Group B		p value
	No of Cases	Percentage	No of Cases	Percentage	
0	0	0.0	0	0.0	.450
1	0	0.0	0	0.0	
2	33	49.2	32	47.8	
3	34	50.7	35	52.2	
Total	**67**	**100.0**	**67**	**100.0**	



Graph 1 : JAW RELAXATION

Jaw relaxation scores are similar in both groups, with roughly half of the patients scoring 2 or 3, indicating adequate muscle relaxation for intubation. The lack of statistical difference (p=0.450) suggests both timing and priming principles yield comparable effects on jaw muscle relaxation.

Vocal Cord Condition: No significant difference; both groups achieved comparable relaxation (p=0.506).

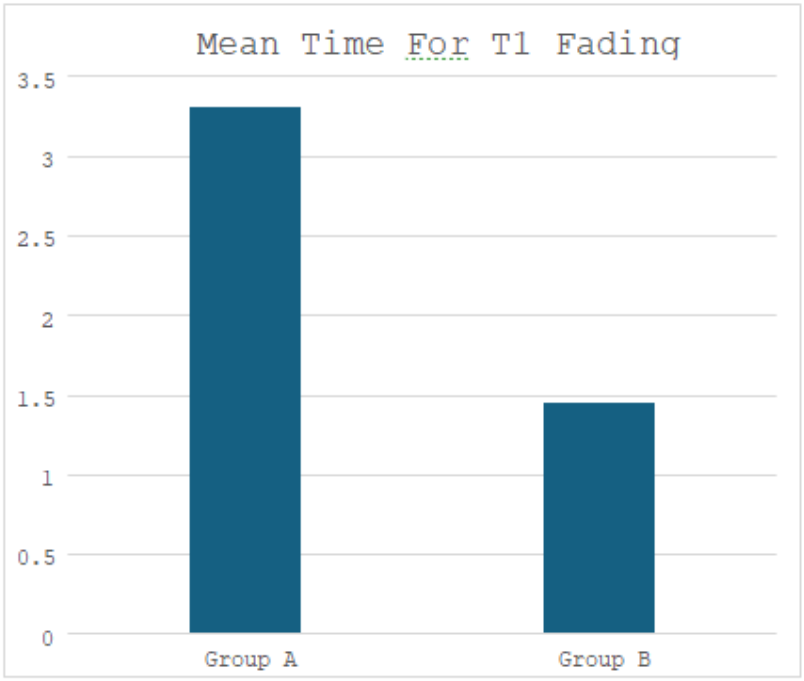
Response to Intubation: Borderline significant difference (p=0.049), indicating a possible slight advantage in intubation response with priming method, though clinically both groups performed well.

Interpretation: Both timing and priming principles provide good muscle relaxation and intubating conditions, with a slight edge possibly in priming for smoother intubation.

NEUROMUSCULAR BLOCKADE ONSET:
Mean Time for T1 Fading (TOF Monitoring): Significantly faster onset in the priming group (Group B: 1.45 ± 0.48 min) compared to the timing group (Group A: 3.30 ± 1.25 min), p=0.039.

Table 2 : MEAN TIME FOR T1 FADING

Mean Time For TI Fading	Gro	up A	Group B		p value
	Mean	SD	Mean	SD	
	3.30	1.25	1.45	0.48	.039



Graph 2 : MEAN TIME FOR T1 FADING

This table reveals a significant difference (p=0.039) in the mean time taken for T1 to fade on Train-of-Four monitoring, with Group B (priming principle) showing a notably faster onset (1.45 ± 0.48 minutes) compared to Group A (timing principle, 3.30 ± 1.25 minutes). This supports that priming accelerates the onset of neuromuscular blockade.

Interpretation: Priming principle significantly accelerates the onset of neuromuscular blockade.

SIDE EFFECTS:

- **Ptosis:** No significant difference between groups (p=0.076).
- **Diplopia:** Higher incidence in priming group (28.4% vs 17.9%), but not statistically significant (p=0.069), indicating a possible trend towards more diplopia with priming.

HEMODYNAMIC PARAMETERS:

- There was no significant differences in hemodynamic parameters at base line,30 minutes, and 1 hour.

SUMMARY OF MAJOR FINDINGS

- The priming principle provides a significantly faster onset of neuromuscular blockade compared to the timing principle.
- Both principles offer comparable intubating conditions, jaw relaxation, and vocal cord relaxation.
- Hemodynamic stability and oxygenation are equally maintained in both groups.
- Side effects are similar, though there may be a trend toward increased diplopia with the priming principle. Priming may offer clinical advantages in reducing onset time without compromising safety or intubation quality.

DISCUSSION

The present study compared the priming principle and timing principle in facilitating endotracheal intubation using rocuronium. The results demonstrated that the priming principle produced a significantly faster onset of neuromuscular blockade compared to the timing principle which is similar to the study done by Kumar et al. (2020) confirmed that priming with a sub-dosed bolus of Rocuronium reduces the time required for intubation and improves the quality of muscle relaxation.

Priming has been shown to reduce the total dose of NMBA required to achieve satisfactory neuromuscular blockade, thereby reducing the risk of side effects and complications (Cammu et al., 2015) which is similar to our study The priming dose is typically around 10-20% of the total dose, which has been shown to effectively enhance the onset of action and reduce the need for additional dosing during the procedure (Patti et al., 2019) which is similar to our study priming dose .

This may be explained by the pharmacological mechanism of priming, where a small initial dose occupies a proportion of acetylcholine receptors at the neuromuscular junction, allowing the subsequent intubating dose to act more rapidly.

Despite the faster onset, both techniques provided comparable intubating conditions, including jaw relaxation, vocal cord relaxation, and overall intubation scores. This indicates that both principles are equally effective in achieving satisfactory conditions for endotracheal intubation.

Hemodynamic parameters and oxygen saturation remained stable and comparable between the two groups throughout the study period, suggesting that both techniques maintain cardiovascular stability during induction of anesthesia.

The incidence of side effects was similar in both groups, although a slight tendency toward diplopia was noted in the priming group. This may be related to the partial neuromuscular blockade produced by the priming dose prior to induction. However, this effect was transient and not clinically significant. Overall, the findings suggest that the priming principle can reduce the onset time of rocuronium without compromising intubation conditions, safety, or hemodynamic stability.

CONCLUSION

The priming principle is a safe and effective method to accelerate Rocuronium's onset of action, providing better intubating conditions more rapidly compared to the timing principle. Its adoption in anaesthesia practice may improve clinical outcomes by reducing intubation times and minimizing risks associated with delayed muscle relaxation, thereby optimizing patient care during general anaesthesia.

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