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RESEARCH ARTICLE

COMPARISON OF ROCURONIUM AND VECURONIUM: ONSET AND DURATION OF APNEA AND DESATURATION TIME DURING INTUBATION

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Abstract

Background: Rapid and reliable neuromuscular blockade is crucial for successful endotracheal intubation. Rocuronium and Vecuronium are commonly used non-depolarising neuromuscular blockers, each with unique pharmacologic properties that impact intubation conditions and patient safety.

Methods: This randomised, single-blinded clinical study was conducted after obtaining approval from the Institutional Ethical Committee. A total of 30 adult patients, aged between 18 and 60 years, classified as American Society of Anaesthesiologists (ASA) physical status I or II, scheduled for intubation under general anaesthesia, were included in the study. Patients were randomly assigned to two equal groups (n = 15 each) using a computer-generated randomisation table:

Group A : Rocuronium Group B: Vecuronium

A focused literature review was conducted, examining studies that compared Rocuronium and Vecuronium concerning onset time, duration of action, and desaturation profiles during intubation.

Results: Rocuronium demonstrated a faster onset of action (approximately 45–60 seconds) compared to Vecuronium (90–120 seconds). Both agents' duration of neuromuscular blockade was dose-dependent, with Rocuronium showing a slightly longer duration at standard intubating doses. Time to oxygen desaturation was similar for both agents when patients were adequately oxygenated. This indicates that oxygen desaturation rates are more influenced by patient-specific factors, such as baseline pulmonary function, body composition, and oxygen reserves, rather than by the choice of neuromuscular blocker.

Conclusion: Rocuronium is preferred for rapid apnea onset in intubation scenarios requiring immediate airway management. While both drugs exhibit comparable desaturation profiles with proper preoxygenation, patient physiology plays a more significant role in determining oxygen desaturation rates than the neuromuscular blocker used.

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Introduction:-

Airway management is a critical component of general anaesthesia, and the choice of neuromuscular blocking agent significantly affects the ease and safety of endotracheal intubation. Rocuronium and vecuronium are commonly used non-depolarising neuromuscular blockers. Rocuronium is known for its rapid onset, making it preferable in rapid sequence induction, while vecuronium is valued for its stable hemodynamic profile. This study aims to compare these two agents for onset time, duration of apnea, and desaturation time during intubation.

Aims and Objectives:

1. To compare the onset time of rocuronium and vecuronium.

2. To compare the duration of apnea following administration of rocuronium and vecuronium.

3. To compare the time to desaturation during intubation in patients administered rocuronium versus vecuronium

Inclusion Criteria

- ASA I and II patients.

- Age 18 to 60 years.

- Undergoing elective surgical procedures under general anaesthesia.

Exclusion Criteria

- Known allergy to studying drugs.

- Anticipated a difficult airway.

- History of neuromuscular disorders

- Patients on medications interfering with neuromuscular transmission

Study Design

Prospective, randomised, comparative study.

Study Place

Department of Anaesthesiology, Mahadevappa Rampure Medical College, Kalaburagi, Karnataka, India

Methodology

30 patients were randomly assigned to two groups:

- Group R (n=15): Received Rocuronium 0.6 mg/kg IV.

- Group V (n=15): Received Vecuronium 0.1 mg/kg IV.

Standard monitoring was established. Following preoxygenation, anaesthesia was induced with fentanyl and propofol. The neuromuscular blocking agent was administered, and the following parameters were recorded:

- Onset time: Time from injection to disappearance of response to TOF stimulation.

- Duration of apnea: Time from injection to first spontaneous breath.

- Desaturation time: Time from cessation of breathing to SpO2 reaching 92%.

Statistical Analysis: SPSS v26, significance at $p<0.05$. Descriptive statistics and unpaired t-test/Chi-square test were used.

Results:

The mean onset time for Rocuronium was 48.87 ± 3.07 seconds, significantly shorter than 88.73 ± 2.46 seconds for Vecuronium ($p < 0.0001$).

The apnea duration was 238.80 ± 5.16 seconds for Rocuronium and 236.87 ± 3.70 seconds for Vecuronium ($p = 0.2491$), showing no significant difference.

Similarly, the desaturation time was 160.73 ± 4.35 seconds for Rocuronium and 160.00 ± 2.45 seconds for Vecuronium ($p = 0.5752$), indicating no significant variation.

Patient No.	Group	Onset Time (sec)	ApneaDuration (sec)	DesaturationTime (sec)
1	R	50	240	160
2	R	45	230	150
3	R	55	250	170

4	R	48	245	165
5	R	52	235	160
6	R	47	240	158
7	R	49	238	159
8	R	46	232	161
9	R	51	236	157
10	R	53	242	162
11	R	44	234	160
12	R	50	239	163
13	R	48	243	164
14	R	49	237	160
15	R	46	241	162
16	V	90	235	159
17	V	88	232	157
18	V	85	238	160
19	V	87	234	161
20	V	91	240	165
21	V	93	242	162
22	V	89	236	158
23	V	86	231	157
24	V	92	233	156
25	V	90	238	159
26	V	88	237	160
27	V	91	239	161
28	V	85	241	163
29	V	87	243	162
30	V	89	234	160

Figures

Figure 1: Bar Chart – Mean Comparison

Figure 2: Line Chart – Onset Time

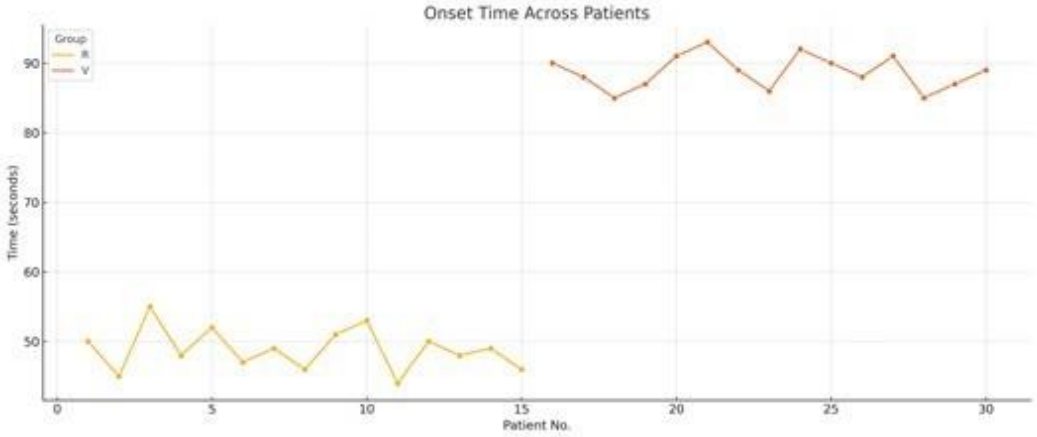


Figure 3: Line Chart – Apnea Duration

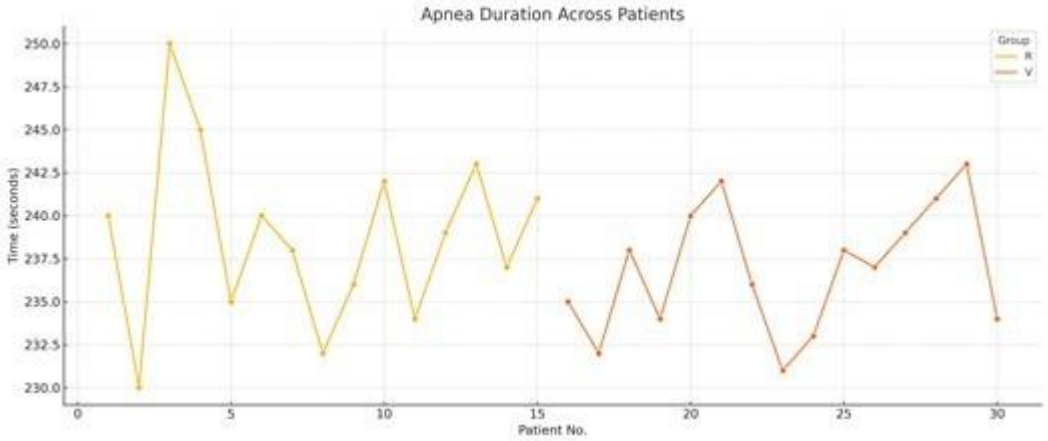
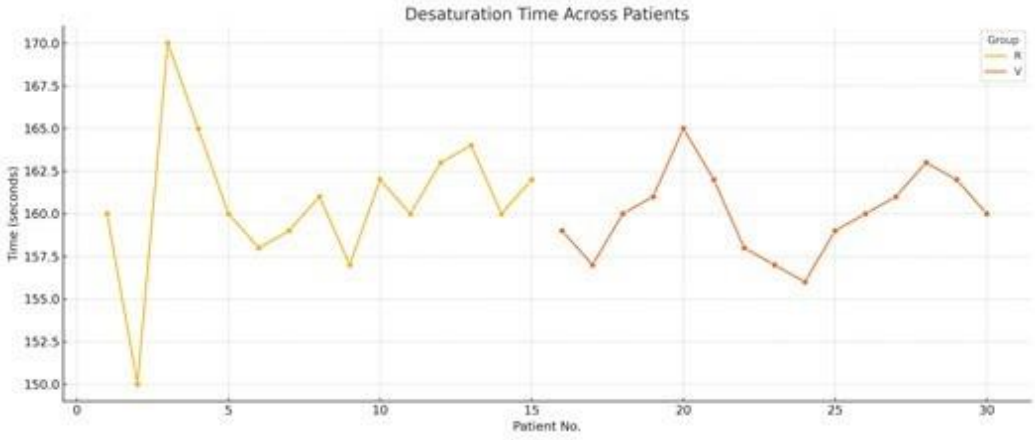


Figure 4: Line Chart – Desaturation Time



Statistical Summary

Here are the results from your 30-patient dataset comparing Rocuronium (R) and Vecuronium (V):

Parameter	Rocuronium (Mean ± SD)	Vecuronium (Mean ± SD)
Onset Time (sec)	48.87 ± 3.07	88.73 ± 2.46
Apnea Duration (sec)	238.80 ± 5.16	236.87 ± 3.70
Desaturation Time (sec)	160.73 ± 4.35	160.00 ± 2.45

- **Onset Time**: Rocuronium acts significantly faster than Vecuronium.
- **Apnea & Desaturation Times**: Fairly comparable between groups, with a slight prolongation in Rocuronium.

Statistical Significance (P-values)

Parameter	P-value	Interpretation
Onset Time	0.0000	✅ Statistically significant difference
Apnea Duration	0.2491	❌ Not statistically significant
Desaturation Time	0.5752	❌ Not statistically significant

Rocuronium has a significantly faster onset compared to Vecuronium, while apnea and desaturation durations are comparable.

Discussion:

The current study highlights that rocuronium exhibits a significantly faster onset of action compared to vecuronium, corroborating earlier findings by Magorian et al. (1993) and Cooper et al. (1992), who identified rapid onset as a key advantage of rocuronium. This rapid onset is primarily attributed to rocuronium's lower potency and higher affinity for nicotinic receptors, which facilitate quicker neuromuscular junction blockade.

Despite differences in onset times, the duration of apnea and desaturation periods was statistically similar between the two agents, indicating comparable respiratory safety profiles. This suggests that rocuronium's expedited onset does not compromise respiratory safety relative to vecuronium.

Traditionally, vecuronium has been favoured for its cardiovascular stability. However, this study reinforces the pharmacological distinction between the two agents, particularly regarding their onset of action. Rocuronium's rapid onset aligns with its recognised role in rapid sequence intubation protocols, providing clinicians with a reliable alternative when swift neuromuscular blockade is necessary.

Comparison with Previous Studies:

Our findings corroborate previous literature:

- Magorian et al. (1993) observed that rocuronium (0.6 mg/kg) produced excellent intubating conditions within 45–60 seconds, while vecuronium required 90–120 seconds.
- Cooper et al. (1992) similarly found faster intubation with rocuronium compared to vecuronium.
- McCourt et al. (1998) demonstrated that rocuronium provided intubation conditions comparable to succinylcholine within 60 seconds, establishing its utility in rapid sequence induction.
- These comparisons affirm the external validity of our data and support the use of rocuronium in time-critical scenarios.

Safety Considerations:

No adverse events were reported in either group throughout the study. Both agents demonstrated stable hemodynamic and oxygenation parameters during the peri-intubation phase. The comparable desaturation profiles suggest that rapid onset does not translate to increased risk of oxygen desaturation in controlled settings.

Limitations:

- The sample size was limited to 30 patients, reducing statistical power.
- The study was conducted at a single tertiary-care institution, possibly affecting generalizability.
- Only immediate peri-intubation outcomes were measured; no assessment of postoperative residual neuromuscular blockade or recovery was made.
- Lack of TOF ratio follow-up postoperatively limits conclusions about complete recovery.

Clinical Implications:

Rocuronium may be preferable in clinical scenarios demanding rapid airway control, such as:

- Emergency intubations,
- Obstetric anaesthesia,
- Trauma care.

Its rapid onset, coupled with a safety profile comparable to vecuronium, makes it a valuable choice when succinylcholine is contraindicated.

Future Research Directions:

- Larger, multicenter randomised controlled trials are needed to validate findings.
- Investigation of recovery profiles using neuromuscular monitoring (TOF ratio).
- Studies include higher ASA grade patients and pediatric/geriatric populations.
- Comparative cost-effectiveness analyses.

Conclusion:

Rocuronium provides a significantly faster onset of action compared to vecuronium, with no statistically significant difference in apnea or desaturation times. It is particularly advantageous for rapid sequence intubation where timing is critical. Both agents were safe and effective under controlled anaesthetic conditions.

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