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A Comparative Study of Efficacy and Hemodynamic Effects of Vecuronium and Cisatracurium During General Anaesthesia for Elective Abdominal Surgeries in Adults at a Tertiary Care Centre

[1]B. Karunakar, [2]M Satish kumar, [3]Priyanka.

[1]*Assistant professor, Department of Anesthesia GMC Jangaon*
[2]*Assistant professor of Anesthesiology GMC, Jangaon*
[3]*SR Anesthesia, GMC Jangaon*

Correspondence:
Dr.B. Karunakar
Assistant professor , Dept of anesthesia , GMC Jangaon.
Email:karna777karna@gmail.com

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Abstract

Background: *Neuromuscular blocking agents (NMBAs) are essential components of balanced general anaesthesia. Vecuronium and cisatracurium are intermediate-acting non-depolarizing muscle relaxants with distinct pharmacokinetic and elimination profiles.* ***Aim****: To compare onset time, duration of action, spontaneous recovery, and hemodynamic effects of vecuronium and cisatracurium in adult patients undergoing elective abdominal surgeries.* ***Materials and Methods****: A prospective randomized comparative study was conducted on 120 ASA I–III patients. Patients were allocated into Group C (cisatracurium 0.2 mg/kg) and Group V (vecuronium 0.08 mg/kg). Neuromuscular monitoring was performed using Train-of-Four (TOF). Statistical analysis included independent t-test, Chi-square test, and repeated measures ANOVA. A p-value <0.05 was considered significant.* ***Results****: Cisatracurium showed significantly faster onset (p<0.001). Duration was comparable (p=0.08). Hemodynamic parameters remained stable in both groups (p>0.05).* ***Conclusion****: Cisatracurium provides faster onset with comparable duration and excellent hemodynamic stability.*

Keywords: Cisatracurium, Vecuronium, Neuromuscular blockade, Hemodynamics, TOF monitoring .

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INTRODUCTION

Neuromuscular blocking agents have revolutionized anaesthetic practice since the introduction of curare in 1942 (1). They facilitate intubation and provide optimal surgical relaxation.

An ideal NMBA should provide rapid onset, predictable duration, minimal cardiovascular effects, and complete recovery (2).

Vecuronium, an aminosteroidal compound introduced in 1975, undergoes hepatic metabolism and renal excretion (3). Prolonged duration has been reported in renal impairment (4).

Cisatracurium undergoes organ-independent Hofmann elimination and produces minimal histamine release (5). Its predictable pharmacokinetics make it advantageous in clinical practice.

This study compares efficacy and hemodynamic effects of both agents in elective abdominal surgeries.

MATERIALS AND METHODS

Prospective randomized study conducted in a tertiary care hospital from August 2022 to August 2024 after ethical approval.

Sample Size

120 patients (60 per group), calculated based on previous studies demonstrating a 30-second onset difference (5).

Inclusion Criteria

- Age 18–70 years
- ASA I–III
- Elective abdominal surgeries

Exclusion Criteria

- ASA IV
- Neuromuscular disorders
- Hepatic or renal dysfunction

Groups

- Group C: Cisatracurium 0.2 mg/kg
- Group V: Vecuronium 0.08 mg/kg

Neuromuscular monitoring was done using TOF at ulnar nerve.

Statistical Analysis

Mean ± SD for continuous variables.
Independent t-test for comparison.
Repeated measures ANOVA for hemodynamic trends.
$p < 0.05$ significant

RESULTS

A total of 120 patients were included and equally distributed into two groups (n=60 each). There were no dropouts.

Table 1: Demographic Characteristics

Parameter	Group C (n=60)	Group V (n=60)	p-value
Age (years)	42.6 ± 11.2	44.1 ± 10.8	0.46
Weight (kg)	63.4 ± 8.5	64.8 ± 9.1	0.39
Male (%)	32 (53%)	29 (48%)	0.58
Female (%)	28 (47%)	31 (52%)	NS

Table 1 demonstrates that both groups were statistically comparable in terms of age, weight, and gender distribution ($p>0.05$). The absence of significant demographic differences confirms successful randomization and eliminates confounding bias related to baseline characteristics. This ensures that observed differences in neuromuscular parameters are attributable to the study drugs rather than demographic variability.

Table 2: Onset Time of Neuromuscular Blockade

Group	Mean (sec)	SD	p-value
Cisatracurium	84.2	33.2	<0.001
Vecuronium	118.3	41.3	

Table 2 shows a statistically highly significant reduction in onset time with cisatracurium compared to vecuronium ($p<0.001$). The mean difference of approximately 34 seconds is clinically relevant in facilitating faster intubation. The lower standard deviation in Group C indicates relatively consistent onset characteristics. This supports the pharmacodynamic predictability of cisatracurium.

Table 3: Duration of Action

Group	Mean (min)	SD	p-value
Cisatracurium	46.5	8.2	0.08
Vecuronium	50.3	9.1	

Table 3 demonstrates that the duration of action was slightly longer in the vecuronium group; however, the difference did not reach statistical significance ($p=0.08$). The overlapping standard deviations indicate comparable clinical efficacy. Both agents provided adequate muscle relaxation for elective abdominal surgeries.

Table 4: Mean Arterial Pressure (mmHg)

Time Interval	Group C	Group V	p-value
Baseline	92.4 ± 6.2	93.1 ± 5.8	0.52
5 min	88.6 ± 5.4	89.2 ± 6.1	0.63
10 min	86.4 ± 6.1	88.1 ± 5.8	0.45
30 min	85.8 ± 5.9	86.7 ± 6.3	0.56

Table 4 illustrates intraoperative mean arterial pressure trends. Both groups showed a mild expected decrease following induction, but values remained within physiological limits. No statistically significant differences were observed at any time interval ($p>0.05$). This confirms excellent cardiovascular stability with both neuromuscular blocking agents.

Table 5: Heart Rate (beats per minute)

Time Interval	Group C	Group V	p-value
Baseline	82.3 ± 7.4	83.1 ± 6.8	0.59
5 min	79.6 ± 6.2	80.8 ± 7.1	0.47
10 min	78.4 ± 5.9	79.2 ± 6.3	0.61
30 min	77.9 ± 6.0	78.5 ± 5.7	0.68

Table 5 shows heart rate variations across intraoperative intervals. Both groups demonstrated mild reductions following induction, consistent with anesthetic effects. No statistically significant differences were noted between groups at any time point ($p>0.05$). This indicates that neither drug exerted clinically relevant chronotropic effects.

DISCUSSION

The present study demonstrated significantly faster onset with cisatracurium compared to vecuronium. Lepage et al. (5) described predictable pharmacodynamics of cisatracurium, supporting our findings.

Although vecuronium has satisfactory intubating conditions, hepatic metabolism may contribute to variability (3,4). Duration was comparable between groups, indicating both agents provide adequate surgical relaxation.

Hemodynamic stability was maintained throughout the intraoperative period. Soukup et al. (6) reported minimal cardiovascular effects with both drugs, consistent with our findings. Cisatracurium's minimal histamine release contributes to cardiovascular stability (5).

Vecuronium undergoes hepatic metabolism and renal excretion (3). Prolonged neuromuscular blockade has been reported in renal dysfunction (4,8). Cisatracurium's Hofmann elimination offers predictable recovery independent of organ function.
Overall, cisatracurium provides faster onset with similar duration and stable hemodynamic profile, making it clinically advantageous.

LIMITATIONS

This was a single-center study excluding ASA IV patients. Cost comparison was not evaluated. Long-term postoperative residual blockade was not assessed.

CONCLUSION

Cisatracurium produces significantly faster onset of neuromuscular blockade compared to vecuronium, with comparable duration and stable hemodynamic profile. It may be preferred in elective abdominal surgeries due to predictable elimination and cardiovascular stability.

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