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Original Research Article

Hemodynamic Changes of Vecuronium and Cisatracurium during Abdominal Surgeries under General Anaesthesia

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Abstract

Introduction: Vecuronium and cisatracurium are neuromuscular blocking agents used in abdominal surgeries under general anesthesia. Vecuronium may cause mild bradycardia and hypotension, whereas cisatracurium offers better hemodynamic stability due to minimal histamine release and predictable effects. This study compares their impacts on heart rate and blood pressure to determine the preferable agent.

Methods: This prospective study involved general and systemic examinations, airway assessments, and necessary investigations. Patients fasted for 8 hours and were connected to a multi-parameter monitor. Premedication included IV glycopyrrolate, midazolam, and fentanyl, followed by propofol induction. Patients received either vecuronium or cisatracurium, with hemodynamic parameters and neuromuscular function monitored throughout surgery.

Results: A total of 90 patients were included, 45 in each group. Group C had a mean onset time of 86.3 seconds and recovery time of 46.6 minutes. Group V had a mean onset time of 114.22 seconds and recovery time of 58.2 minutes. Hemodynamic parameters showed no significant differences between groups.

Conclusion: Cisatracurium demonstrated a faster onset and recovery time compared to vecuronium, with both agents showing no significant differences in hemodynamic parameters. Thus, cisatracurium may be preferable for surgeries requiring rapid onset and recovery, ensuring efficient postoperative care without compromising cardiovascular stability.

Keywords: Cisatracurium, Vecuronium, Hemodynamic Stability, Onset Time, Recovery Time.

Introduction

Vecuronium and cisatracurium are neuromuscular blocking agents commonly used in abdominal surgeries under general anesthesia (GA) to facilitate endotracheal intubation and optimize surgical conditions. Both agents exhibit distinct hemodynamic profiles, crucial for maintaining intraoperative stability. Vecuronium, an aminosteroid non-depolarizing muscle relaxant, is known for its cardiovascular stability, but can cause mild bradycardia and hypotension in some patients due to vagolytic effects. [1] In contrast, cisatracurium, a benzylisoquinolinium compound, is preferred for patients with cardiovascular risk due to its minimal histamine release and stable hemodynamic profile. [2]

Recent studies indicate that cisatracurium provides superior hemodynamic stability compared to vecuronium, with significantly less impact on heart rate and blood pressure. [3] Comparative research highlights that while both agents are effective in providing muscle relaxation, cisatracurium's lower propensity to cause cardiovascular fluctuations makes it more favorable in surgeries where hemodynamic stability is paramount. [4] Additionally, pharmacokinetic evaluations suggest that cisatracurium's Hofmann elimination process contributes to its predictable and consistent effects, further supporting its use in sensitive patient populations. [5] The study aims to compare the hemodynamic effects of Vecuronium and Cisatracurium in patients undergoing abdominal

surgeries under GA, focusing on their impact on heart rate and blood pressure to determine the preferable agent for intraoperative cardiovascular stability.

Methods

It was a prospective research conducted in the department of the department of Anaesthesiology, Konaseema Institute of Medical Sciences and Research Foundation, Amalapuram. Study was conducted between March 2023 to May 2024. Study protocol was approved by the institutional Ethics committee. Inclusion criteria encompassed patients aged 18 – 65 years, classified ASA I or II, scheduled for elective abdominal surgery under GA. Exclusion criteria consisted patients >65 years, those classified as ASA III and IV, individuals with neuromuscular diseases, those with a known or anticipated difficult airway, and patients receiving drugs known to interact with neuromuscular function.

After recruitment, general and systemic examinations, airway assessments, and necessary investigations were recorded. Written informed consent was obtained, and patients were advised to fast for 8 hours. On surgery day, patients were connected to a multi-parameter monitor displaying ECG, pulse rate, oxygen saturation, and noninvasive blood pressure. An IV line was secured, and IV fluids were started. Ulnar nerve stimulation was prepared using ECG electrodes placed at specific anatomical points to elicit thumb adduction.

Premedication included IV glycopyrrolate 0.2 mg, midazolam 1 mg, and fentanyl 2 µg/kg. Preoxygenation with 100% oxygen was administered for 3 minutes. Induction involved propofol 2 mg/kg IV. Following loss of consciousness, the ulnar nerve was stimulated to determine the optimal current for neuromuscular monitoring. Patients received a bolus of either vecuronium 0.08 mg/kg (group V) or cisatracurium 0.2 mg/kg (group C) over 5-10 seconds. Ventilation was maintained with 66.6% nitrous oxide and 33.3% oxygen. Intubation was performed after the disappearance of train-of-four responses, with conditions scored per Cooper et al. guidelines. Anesthesia was maintained with nitrous oxide, oxygen, and sevoflurane. Hemodynamic parameters were recorded at intervals post-intubation. Neuromuscular function was monitored every 5 minutes, and the duration of action was noted from the injection of the bolus dose to the reappearance of two train-of-four responses.

Statistical Analysis: All statistical analyses were conducted using SPSS software trial version 20.0 and MS Excel-2010. The Chi-square test was employed to evaluate associations among categorical variables. A P value of <0.05 was deemed statistically significant, indicating meaningful associations between variables.

Results

Total 90 member were included, 45 each group. In group C the male female ratio was 25:20 and in group V, it was 23:22; statistically there was no significant difference. Group C had a mean onset time of 86.3 seconds (SD = 32.2), while group V showed a longer onset of 114.22 seconds (SD = 43.1), with significant difference ($P < 0.005$). Group C had a mean duration of 44.8 minutes (SD = 12.51), while group V had a mean duration of 58.44 minutes (SD = 16.6), with no significant difference ($P > 0.005$). Statistically there was no significant difference in the mean systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), heart rate (HR), respectively in groups. Group C had a mean recovery time of 46.6 minutes (SD = 1.8), while group V showed a longer mean recovery time of 58.2 minutes (SD = 1.4), with significant difference ($P < 0.001$).

Discussion

Abdominal surgeries under general anesthesia encompass a variety of procedures involving organs within the abdominal cavity, such as appendectomies, cholecystectomies, hernia repairs, colectomies, and gastric bypass surgeries. General anesthesia induces unconsciousness, muscle relaxation, and analgesia, facilitating safe surgical procedures. [6] Patients typically require endotracheal intubation for airway management and ongoing monitoring of vital signs, fluid balance, and electrolyte levels to ensure hemodynamic stability and optimize recovery. [7]

In this study comparing the effects of Vecuronium (group V) and Cisatracurium (group C) during abdominal surgeries under general anesthesia, a total of 90 patients were included, with 45 in each group. The male-to-female ratio was similar between the groups, indicating no significant demographic differences impacting the study outcomes similar to Smith et al. {8] report. The onset time of neuromuscular blockade was significantly faster in group C (86.3 seconds, SD = 32.2) compared to group V (114.22 seconds, SD = 43.1), a finding consistent with previous research highlighting Cisatracurium's rapid onset due to its chemical structure and metabolism. [9]

Regarding the duration of action, there was no statistically significant difference between group C (mean duration 44.8 minutes, SD = 12.51) and group V (mean duration 58.44 minutes, SD = 16.6). This aligns with studies suggesting that while Vecuronium may have a longer duration of

action, differences are not always clinically significant in routine surgical settings. [10] Postoperative outcomes such as recovery times were not explicitly mentioned but are crucial in assessing patient outcomes and recovery profiles between the two groups. Comprehensive postoperative care, including pain management and monitoring for complications, is vital in ensuring optimal recovery and reducing postoperative morbidity. [11]

In this study evaluating group V and group C during abdominal surgeries under general anesthesia, hemodynamic parameters such as SBP, DBP, MAP, and HR were monitored. Statistical analysis revealed no significant differences in these parameters between the two groups, indicating that both neuromuscular blocking agents maintain comparable cardiovascular stability during surgery. [12] This finding aligns with previous research emphasizing the hemodynamic stability provided by both Vecuronium and Cisatracurium, making them suitable for patients with varied cardiovascular profiles. [13]

A notable difference was observed in the mean recovery times between the groups. Group C had a mean recovery time of 46.6 minutes (SD = 1.8), whereas group V exhibited a significantly longer mean recovery time of 58.2 minutes (SD = 1.4) ($P < 0.001$). This significant disparity in recovery times suggests that Cisatracurium facilitates a faster return to baseline neuromuscular function postoperatively compared to Vecuronium. [14] The rapid recovery associated with Cisatracurium can be attributed to its unique metabolism, primarily through Hofmann elimination, which is independent of renal and hepatic function, leading to more predictable and consistent recovery profiles. [11]

The faster recovery time with Cisatracurium may have significant clinical implications, particularly in enhancing postoperative care and reducing the risk of residual neuromuscular blockade, which is associated with complications such as respiratory distress and delayed extubation. [15] Rapid recovery can also contribute to more efficient use of operating room resources and improved patient throughput, benefiting both healthcare providers and patients.

In conclusion, while both Vecuronium and Cisatracurium provide comparable hemodynamic stability during abdominal surgeries under general anesthesia, Cisatracurium offers a significant advantage with faster recovery times. This benefit can enhance postoperative outcomes and efficiency. Selecting Cisatracurium may thus be preferable in clinical settings where rapid recovery is essential for patient care and operational efficiency.

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