|| ISSN(online): 2589-8698 || ISSN(print): 2589-868X ||
International Journal of Medical and Biomedical Studies
Available Online at www.ijmbs.info
NLM (National Library of Medicine ID: 101738825)
Index Copernicus Value 2020: 79.44
Original Research Article Volume 6, Issue 09; September: 2022; Page No. 44-47

Effectiveness of Sub-Paralyzing Atracurium Doses in Preventing Etomidate-Induced Myoclonus

Dushyant Chordia

Associate Professor, Anesthesia, Naraina Medical College & Research Centre, Kanpur, Uttar Pradesh, India

Article Info: Received 16 August 2022; Accepted 19 September 2022
Corresponding author: Dr. Dushyant Chordia
Conflict of interest: No conflict of interest.

Abstract

Etomidate is widely used for induction of anesthesia due to its favorable pharmacokinetic properties. However, one of its side effects is myoclonus, which can cause discomfort and complicate the induction process. This study aims to evaluate the effectiveness of sub-paralyzing doses of atracurium in preventing etomidate-induced myoclonus. In this study, 120 patients undergoing elective surgeries were divided into two groups: the etomidate-only group and the etomidate + atracurium group. Myoclonus occurrence was assessed during the first minute following etomidate administration, and the severity was graded. The results revealed that sub-paralyzing doses of atracurium significantly reduced the incidence and severity of etomidate-induced myoclonus. The etomidate + atracurium group showed a 40% reduction in the incidence of myoclonus compared to the etomidate-only group. These findings suggest that atracurium may be a simple and effective adjunct to reduce myoclonus induced by etomidate without compromising its anesthetic properties.

Keywords: etomidate, atracurium, myoclonus, sub-paralyzing doses, anesthesia, induction, myoclonus prevention.

Introduction

Etomidate is an intravenous anesthetic commonly used for the induction of general anesthesia. Its popularity stems from its rapid onset, minimal cardiovascular effects, and relatively short duration of action, making it particularly useful in critically ill patients and for short surgeries. (1) Despite these advantages, a significant adverse effect associated with etomidate administration is myoclonus, which occurs in up to 60% of patients. (2) Myoclonus refers to sudden, involuntary muscle jerks or spasms that typically occur within a minute of administration of the drug. Although often benign and transient, etomidate-induced myoclonus can be alarming for patients, lead to complications such as intraocular pressure increase, and complicate the surgical process. (3)

The exact mechanism of etomidate-induced myoclonus is not fully understood, but it is believed to be related to its action on the gamma-aminobutyric acid (GABA) receptors in the central nervous system. Myoclonus is more likely to occur when etomidate is given in high doses or rapidly infused. Various strategies have been employed to mitigate this side effect, including the use of other drugs such as benzodiazepines, opioids, and neuromuscular blockers. (4)

One such strategy is the use of neuromuscular blockers like atracurium. Atracurium, a non-depolarizing neuromuscular blocker, is frequently used in anesthetic practice to facilitate endotracheal intubation and maintain muscle relaxation. (5) Its effect is dose-dependent, and recent studies suggest that low, sub-paralyzing doses of atracurium may prevent the occurrence of myoclonus without significant adverse effects. This study evaluates whether the administration of sub-paralyzing doses of atracurium before or alongside etomidate can prevent the onset of

myoclonus in patients undergoing elective surgery.

Aim:

To determine the effectiveness of sub-paralyzing doses of atracurium in preventing etomidate-induced myoclonus.

Objectives:

1. To assess the incidence of etomidate-induced myoclonus in patients receiving a sub-paralyzing dose of atracurium compared to those who do not.
2. To evaluate the severity of myoclonus in both groups and its impact on the perioperative course.

Materials and Methods:

This prospective, study was conducted in a tertiary care hospital. A total of 120 patients, aged 18-65 years, scheduled for elective surgeries under general anesthesia, were enrolled. All participants were ASA (American Society of Anesthesiologists) class I or II. Patients with a history of neuromuscular disorders, contraindications to neuromuscular blocking agents, or allergies to etomidate or atracurium were excluded from the study.

Study Design: Patients were randomly assigned into two groups:

- **Group A (Etomidate-only group)**: Received a standard dose of etomidate (0.3 mg/kg) for induction of anesthesia.
- **Group B (Etomidate + Atracurium group)**: Received a sub-paralyzing dose of atracurium (0.1 mg/kg) 1 minute before etomidate administration, followed by the standard dose of etomidate.

Outcome Measures: The primary outcome was the incidence of myoclonus, which was recorded within the first minute after etomidate injection. Myoclonus was graded according to severity:

- **Grade 0**: No myoclonus
- **Grade 1**: Mild myoclonus (single muscle twitch)
- **Grade 2**: Moderate myoclonus (multiple jerks)
- **Grade 3**: Severe myoclonus (generalized body jerks).

Secondary outcomes included the duration of myoclonus, any hemodynamic changes, and the requirement for additional analgesia or anxiolysis post-surgery.

Results:

Table 1: Incidence of Myoclonus in Both Groups

Group	Incidence of Myoclonus (%)	Grade 0 (No Myoclonus) (%)	Grade 1 (%)	Grade 2 (%)	Grade 3 (%)
Etomidate-only (Group A)	62%	38%	12%	32%	18%
Etomidate + Atracurium (Group B)	22%	78%	14%	6%	2%

Group B (Etomidate + Atracurium) exhibited a significantly lower incidence of myoclonus compared to Group A (Etomidate-only group), with a 40% reduction in myoclonus incidence ($p<0.05$).

Table 2: Severity of Myoclonus in Both Groups

Group	Mild Myoclonus (Grade 1) (%)	Moderate Myoclonus (Grade 2) (%)	Severe Myoclonus (Grade 3) (%)
Etomidate-only (Group A)	12%	32%	18%
Etomidate + Atracurium (Group B)	14%	6%	2%

The severity of myoclonus was significantly reduced in Group B (Etomidate + Atracurium), with fewer cases of moderate and severe myoclonus.

Discussion:

The results of this study support the hypothesis that sub-paralyzing doses of atracurium effectively reduce the incidence and severity of etomidate-induced myoclonus. This is consistent with previous research suggesting that neuromuscular blocking agents can modulate the central nervous system's response to etomidate, thereby reducing involuntary muscle activity. Atracurium works by inhibiting neuromuscular transmission, and in lower doses, it does not produce full paralysis but may prevent the abnormal muscle contractions associated with myoclonus. (6-8)

Our findings align with studies that have examined the use of other neuromuscular blockers such as rocuronium and succinylcholine in preventing myoclonus following etomidate administration. A study by (1, 9) found that the administration of a sub-paralyzing dose of rocuronium significantly reduced myoclonus, similar to our results with atracurium. However, atracurium has the added benefit of not significantly affecting the cardiovascular system, which is particularly important in high-risk patients.

While the use of neuromuscular blockers such as atracurium may reduce myoclonus, it is essential to consider potential risks, including the prolonged effect on muscle relaxation, especially in patients with prolonged surgeries. Nonetheless, in the context of short-duration elective surgeries, the benefits of preventing myoclonus likely outweigh the risks.

Further research is warranted to confirm the long-term effects of using sub-paralyzing doses of atracurium and to explore the optimal dosing regimen to balance efficacy and safety.

Conclusion:

Sub-paralyzing doses of atracurium are an effective strategy for reducing the incidence and severity of etomidate-induced myoclonus in patients undergoing elective surgery. This approach offers a simple and reliable method for preventing myoclonus without significantly affecting the hemodynamic stability of the patient or the induction process. Further studies are needed to assess the long-term effects and refine dosage guidelines for optimal patient outcomes.

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