Efficacy of Magnesium Sulfate in Attenuating the Hemodynamic Response to Laryngoscopy and Endotracheal Intubation

Abstract

Background: Laryngoscopy and endotracheal intubation are known to cause a transient but marked sympathetic response, leading to increased heart rate and blood pressure. This response can be hazardous, particularly in patients with cardiovascular disease. Magnesium sulfate, due to its calcium channel-blocking and sympatholytic effects, may offer protective benefits.

Objective: To evaluate the efficacy of intravenous magnesium sulfate in attenuating cardiovascular responses during laryngoscopy and endotracheal intubation.

Methods: This prospective, randomized clinical study included adult patients scheduled for elective surgery under general anesthesia. Patients were assigned to two groups: Group A received magnesium sulfate 30 mg/kg IV before intubation, while Group B served as control. Heart rate (HR), systolic blood pressure (SBP), diastolic BP (DBP), and mean arterial pressure (MAP) were recorded at baseline, 30 seconds after drug administration, during laryngoscopy, and at intervals post-intubation.

Results: Group A demonstrated significantly lower HR and BP rises during and after intubation compared to Group B ($p < 0.05$). No adverse effects were observed.

Conclusion: Magnesium sulfate effectively blunts the hemodynamic response to laryngoscopy and intubation, and can be a useful adjunct in general anesthesia, particularly in patients at risk of cardiovascular complications.

Keywords: Magnesium sulfate, Hemodynamic response, Laryngoscopy, Intubation, General anesthesia, Sympathetic stimulation

1. Introduction

General anesthesia almost always involves endotracheal intubation, a procedure known to provoke a sympathetic surge that manifests as hypertension and tachycardia. These hemodynamic responses may lead to serious complications, including myocardial ischemia, arrhythmias, pulmonary edema, and cerebral hemorrhage [1–3].

Various pharmacologic interventions have been studied to attenuate this response, such as opioids, beta-blockers, and calcium channel blockers, each with its limitations [4–6]. Magnesium sulfate, a naturally occurring cation with calcium antagonistic and NMDA receptor-blocking effects, may reduce catecholamine release and vascular tone, thereby attenuating this stress response [7–9].

Recent studies continue to support the role of magnesium sulfate in attenuating pressor responses during laryngoscopy and intubation, showing comparable efficacy to agents like dexmedetomidine and clonidine [10,11].

This study investigates the effectiveness of intravenous magnesium sulfate in reducing the hemodynamic changes associated with laryngoscopy and intubation in healthy adult patients undergoing general anesthesia.

2. Materials and Methods

Design: A prospective, randomized controlled study conducted at Khartoum Teaching Hospital.

Population: Patients aged 18–65 years, ASA I–II, scheduled for elective surgeries requiring general anesthesia with intubation. Exclusion criteria included cardiovascular, renal, or neuromuscular diseases, or magnesium hypersensitivity.

Randomization and Intervention:
- Group A (Magnesium Group): Received 30 mg/kg of IV magnesium sulfate 30 seconds before intubation.
- Group B (Control Group): Received an equivalent volume of normal saline.

Anesthesia Protocol: Premedication included midazolam and atropine. Anesthesia induction involved fentanyl, propofol, and suxamethonium. Laryngoscopy and intubation were standardized.

Monitoring and Data Collection: HR, SBP, DBP, and MAP were recorded at:
- Baseline
- 30 seconds after drug administration
- Immediately after intubation
- 1, 3, and 5 minutes post-intubation

Statistical Analysis: Data were analyzed using SPSS. Continuous variables were compared using the Student's t-test, with $p < 0.05$ considered statistically significant.

3. Results

Hemodynamic parameters were similar at baseline. After administration of magnesium sulfate, a mild increase in HR was noted at 30 seconds, but post-intubation responses were significantly attenuated in Group A:

Group A showed significantly lower peak values post-intubation compared to Group B ($p < 0.05$ for all parameters). No adverse events were reported.

4. Discussion

Laryngoscopy and endotracheal intubation are among the most critical moments in anesthesia, causing marked sympathetic stimulation [12,13]. This response is mediated by catecholamine release and can provoke dangerous spikes in blood pressure and heart rate.

In our study, intravenous magnesium sulfate significantly reduced this response. It appears to exert its effect through multiple mechanisms: blocking calcium influx, inhibiting catecholamine release, and causing peripheral vasodilation [14–16].

Despite a brief rise in HR after administration, magnesium's overall effect was beneficial. Group A maintained more stable hemodynamics throughout the intubation period than the control group.

These results are in agreement with prior studies demonstrating the sympatholytic properties of magnesium sulfate [2,13,17].

5. Conclusion

- Marked cardiovascular responses occur within one minute of intubation without pharmacologic attenuation.
- These changes persist for several minutes, risking complications.
- Magnesium sulfate (30 mg/kg IV) given before intubation significantly blunts these effects.
- The greatest impact is observed on blood pressure, with a milder effect on heart rate.

6. Recommendations

- Magnesium sulfate is affordable, available, and effective; it should be considered routine in patients undergoing intubation under general anesthesia, especially those with cardiovascular or neurologic vulnerabilities.
- Further studies are recommended in high-risk populations and in comparison with other agents such as beta-blockers or opioids.
- National guidelines may consider including magnesium sulfate as a standard option for blunting pressor responses during airway manipulation.

7. References

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