Original Article

Comparing the effects of Intravenous Magnesium Sulphate and Intravenous Clonidine on Hemodynamic Responses during Laryngoscopy and Tracheal Intubation under General Anesthesia in Patients undergoing Elective Abdominal Surgeries, A Prospective Randomized Double-Blind Study

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Abstract

Background: Laryngoscopy and tracheal intubation elicit sympathetic responses that may cause deleterious cardiovascular effects, particularly in high-risk patients. Various pharmacological agents are used to blunt this response. This study compares intravenous magnesium sulphate and clonidine in attenuating hemodynamic changes during laryngoscopy and intubation. **Material and Methods:** Eighty ASA I–II patients aged 18–60 years undergoing elective open abdominal surgeries were randomized into two groups. Group M (n=40) received 30 mg/kg magnesium sulphate IV, and Group C (n=40) received 2 µg/kg clonidine IV, both diluted in 100 ml normal saline and infused over 10 minutes before induction. Hemodynamic parameters (HR, SBP, DBP, MAP) were recorded at baseline, post-infusion, post-induction, immediately after intubation, and up to 10 minutes after intubation. **Results:** Both groups showed significant reductions in HR, SBP, DBP, and MAP from baseline. Maximum reduction in SBP, DBP, and MAP occurred at 10 minutes' post-intubation, greater in the magnesium group ($p<0.05$). Attenuation of HR response was comparable between groups. **Conclusion:** Both magnesium sulphate and clonidine effectively attenuated pressor responses to laryngoscopy and intubation. Magnesium sulphate demonstrated superior attenuation of blood pressure rise, while clonidine produced stable heart rate control.

Keywords: Magnesium sulphate, Clonidine, Hemodynamic response, Laryngoscopy, Intubation.

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Introduction

Laryngoscopy and endotracheal intubation are indispensable procedures in modern anesthesia practice, allowing airway protection, ventilation, and oxygenation during surgery and critical care. However, direct laryngoscopy and tracheal stimulation activate intense sympathetic reflexes, resulting in tachycardia, hypertension, and increased catecholamine release.

The magnitude of this pressor response is influenced by patient factors (age, ASA grade, cardiovascular reserve), depth of anesthesia, drugs used for induction, and the duration and difficulty of laryngoscopy. Therefore, various pharmacological strategies have been investigated to blunt these responses, including opioids, β-blockers, calcium channel blockers, vasodilators, α2-agonists, and magnesium sulphate.

Magnesium sulphate acts as a calcium antagonist at vascular smooth muscle, attenuates catecholamine release, and produces vasodilation. It reduces systemic vascular resistance and thereby blunts the hypertensive response to intubation. In addition, it enhances neuromuscular blockade and has antiarrhythmic properties.

Clonidine, an imidazoline derivative and selective α2-adrenergic agonist, reduces sympathetic outflow by acting on presynaptic α2 receptors in the central nervous system. It decreases circulating norepinephrine levels, leading to reduced heart rate and blood pressure. Its sedative and anxiolytic effects are additional advantages.

Several studies have shown the efficacy of clonidine and magnesium sulphate in reducing the pressor response, but comparative data are limited. This study was therefore conducted to compare the hemodynamic efficacy of intravenous magnesium sulphate versus clonidine during laryngoscopy and intubation in patients undergoing elective open abdominal surgeries.

Materials and Methods

This was a prospective, randomized, double-blind study conducted in ACSR Government Medical College and Hospital after obtaining ethical clearance and written informed consent.

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Participants: Eighty patients of either sex, aged 18–60 years, ASA I–II, scheduled for elective open abdominal surgeries under general anesthesia requiring endotracheal intubation were enrolled.

Inclusion criteria:

- Age 18–60 years
- ASA physical status I or II
- Elective open abdominal surgery requiring tracheal intubation

Exclusion criteria:

- Anticipated difficult airway (Mallampati grade IV)
- Hypertension, coronary artery disease, arrhythmias
- Raised intracranial or intraocular pressure
- Obesity (BMI > 30 kg/m²)
- Allergy to study drugs
- Pregnancy or lactation
- Renal or hepatic impairment
- Multiple attempts at intubation

Randomization and Intervention

Patients were randomized into two groups (n=40 each) by computer-generated numbers and sealed envelopes:

- Group M: 30 mg/kg magnesium sulphate in 100 ml normal saline, infused IV over 10 minutes before induction.
- Group C: 2 µg/kg clonidine in 100 ml normal saline, infused IV over 10 minutes before induction.

Both patients and the anesthesiologist recording data were blinded to group allocation.

Anesthetic Technique

All patients were premedicated with oral alprazolam (0.25 mg) and ranitidine (150 mg) the night before surgery. Standard monitoring included ECG, SpO_2, NIBP, and $EtCO_2$. After study drug infusion, induction was performed with fentanyl (2 µg/kg) and propofol (2 mg/kg). Vecuronium (0.1 mg/kg) facilitated intubation after 3 minutes. Anesthesia was maintained with oxygen–nitrous oxide (50:50) and isoflurane (0.5–2%). Muscle relaxation was maintained with intermittent vecuronium.

Parameters Recorded

Hemodynamic variables were recorded at:

- Baseline
- End of infusion
- After induction
- Immediately post-intubation
- 1, 2, 3, 4, 5, 7, and 10 minutes post-intubation
- HR, SBP, DBP, and MAP were measured. Adverse events (bradycardia, hypotension, arrhythmias) were documented.

Statistical Analysis

Data were analyzed using SPSS 17. Continuous data were expressed as mean ± SD and compared by Student's t-test. Categorical variables were analyzed by Chi-square test. A p value <0.05 was considered significant.

Results

Table 1: Demographic Data

Variable	Group M (Magnesium)	Group C (Clonidine)	p-value
Age (years)	45.9 ± 10.8	46.2 ± 9.4	0.878
Sex (M/F)	24/16	21/19	0.499
Weight (kg)	56.2 ± 12.0	54.4 ± 9.9	0.457
BMI (kg/m²)	22.3 ± 3.7	22.1 ± 3.3	0.808
ASA I/II	33/7	37/3	0.176

Table 2: Heart Rate (beats/min)

Time Interval	Group M	Group C	p-value
Baseline	85.8 ± 14.9	87.5 ± 15.7	0.615
After induction	83.5 ± 13.9	84.6 ± 13.0	0.710
Immediate post-intubation	89.5 ± 12.7	90.7 ± 11.7	0.649
5 min	78.8 ± 12.3	79.9 ± 9.9	0.675
10 min	75.9 ± 12.7	75.9 ± 9.8	0.992

Table 3: Systolic Blood Pressure (mmHg)

Time Interval	Group M	Group C	p-value
Baseline	126.5 ± 17.3	131.4 ± 15.4	0.191
After induction	114.2 ± 14.0	119.7 ± 13.5	0.079
Immediate post-intubation	127.6 ± 17.0	131.1 ± 17.5	0.367
5 min	105.0 ± 10.2	108.6 ± 10.9	0.134
10 min	101.2 ± 10.3	108.4 ± 12.3	0.006*

Table 4: Diastolic Blood Pressure (mmHg)

Time Interval	Group M	Group C	p-value
Baseline	75.3 ± 8.9	77.2 ± 13.1	0.439
After induction	70.2 ± 10.2	73.3 ± 10.2	0.175
5 min	66.2 ± 7.9	69.7 ± 9.7	0.083
10 min	63.9 ± 7.9	67.9 ± 9.0	0.037*

Table 5: Mean Arterial Pressure (mmHg)

Time Interval	Group M	Group C	p-value
Baseline	88.2 ± 11.1	90.5 ± 12.7	0.403
After induction	82.2 ± 11.2	85.2 ± 10.4	0.210
5 min	76.3 ± 7.5	80.1 ± 8.5	0.037*
10 min	73.5 ± 9.0	77.7 ± 8.5	0.036*

Table 6: Adverse Events

Event	Group M	Group C
Hypotension	2	3
Bradycardia	1	2
Arrhythmia	0	1

Interpretation: Both magnesium and clonidine attenuated hemodynamic responses effectively. Magnesium showed significantly greater reduction in SBP, DBP, and MAP at 10 minutes, whereas HR attenuation was similar between groups.

Discussion

Laryngoscopy and intubation are potent noxious stimuli that evoke exaggerated cardiovascular responses. In normotensive patients, these responses may be transient and tolerated, but in those with cardiovascular disease, they can precipitate ischemia, arrhythmias, or stroke.

In this study, both magnesium sulphate and clonidine effectively reduced HR, SBP, DBP, and MAP after intubation. Magnesium produced significantly greater reduction in arterial pressures at 10 minutes post-intubation, consistent with its vasodilatory action via calcium channel blockade and inhibition of catecholamine release. Similar findings were reported by Panda et al. (2017) and Jain et al. (2018), who observed that magnesium sulphate attenuated hypertensive surges more effectively than clonidine.

Clonidine, however, provided more stable HR control, which is advantageous in ischemic heart disease. Our results corroborate studies by Singh et al. (2016) and Gupta et al. (2019), which demonstrated clonidine's ability to suppress tachycardia while maintaining acceptable blood pressure stability.

Meta-analyses have shown both magnesium and α2-agonists to be effective in attenuating hemodynamic responses, though direct head-to-head comparisons are limited. Our findings add to this evidence by confirming that magnesium is more potent for BP control, while clonidine offers balanced HR management.

Limitations of our study include exclusion of hypertensive and high-risk cardiac patients, relatively small sample size, and short follow-up limited to 10 minutes post-intubation. Larger multicentric trials including high-risk populations are needed to generalize findings.

Conclusion

Both intravenous magnesium sulphate and clonidine are effective in attenuating hemodynamic responses to laryngoscopy and tracheal intubation. Magnesium sulphate is more effective in controlling arterial pressures, whereas clonidine provides superior HR stability. Clinical selection should be individualized depending on patient comorbidities and surgical risk profile.

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Conflicts of interest

There are no conflicts of interest.

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