DOI: 10.21088/ijaa.2349.8471.13226.5

Indian Journal of Anesthesia and Analgesia
Volume 13 Number 2 April - June 2026

REVIEW ARTICLE

Nebulized Dexmedetomidine Versus Lignocaine for Attenuation of Hemodynamic Responses to Laryngoscopy and Intubation in Hypertensive Patients

Nazir Nazia[1], Kumar Devender[2], Athota Sushma[3], Khanuja Samiksha[4], Garima Sinha[5]

HOW TO CITE THIS ARTICLE:

Nazir Nazia, Kumar Devender, Athota Sushma. Nebulized Dexmedetomidine Versus Lignocaine for Attenuation of Hemodynamic Responses to Laryngoscopy and Intubation in Hypertensive Patients. Ind J Anesth Analg. 2026; 13(2): 79-85.

ABSTRACT

Context: Laryngoscopy and intubation provoke sympathetic surges that can endanger hypertensive patients. Nebulised dexmedetomidine and lignocaine can be used to blunt this response, but their relative effectiveness remains uncertain.

Aims: The study aimed to compare the effectiveness of preoperative nebulization with dexmedetomidine versus lignocaine in blunting the hemodynamic response to laryngoscopy and intubation in hypertensive patients undergoing general anaesthesia for elective surgeries. The changes in systolic blood pressure, anaesthetic, and analgesic requirements were also recorded.

Settings and Design: Randomised, double-blind study with 100 ASA class II hypertensive patients (18–60 y) scheduled for elective surgery under general anaesthesia were allocated to receive either dexmedetomidine 1 µg/kg (n = 50) or 4 % lignocaine 1 mL (40 mg, n = 50) via jet-nebuliser 15 min before induction.

Methods and Material: Heart rate (HR), systolic and diastolic blood pressure (SBP, DBP), mean arterial pressure (MAP) and SpO2 were recorded at baseline, after nebulization and every minute for 10 min post-intubation. Time to first rescue analgesia, intra-operative fentanyl and propofol consumption, time to extubation, and adverse events were documented.

Statistical analysis used: Independent t-tests, χ^2 tests and repeated-measures ANOVA (SPSS v27;$p < 0.05$ considered significant).

AUTHOR'S AFFILIATION:

[1] Professor, Department of Anesthesiology, GIMS, Greater Noida, India.

[2] Resident, Department of Anesthesiology, GIMS, Greater Noida, India.

[3] Resident, Department of Anesthesiology, GIMS, Greater Noida, India.

[4] Professor, Department of Anesthesiology, GIMS, Greater Noida, India.

[5] Assistant Professor, Department of Anesthesiology, GIMS, Greater Noida, India.

CORRESPONDING AUTHOR:

Nazir Nazia, Professor, Department of Anesthesiology, GIMS, Greater Noida, India.

E-mail: nazunazir@gmail.com

➢ **Received :** 17-12-2025 ➢ **Accepted :** 20-01-2026

Results: Dexmedetomidine significantly prolonged analgesia (6.95 ± 0.06 min vs 4.94 ± 0.43 min) and lowered propofol use (100.1 ± 5.4 mg vs 104.7 ± 5.5 mg; both $p < 0.001$) without altering fentanyl requirement or time to extubation. HR, SBP, DBP, MAP and SpO2 trajectories did not differ between groups throughout the observation window ($p > 0.05$), indicating equivalent haemodynamic stability. Lignocaine showed numerically more instances of postoperative nausea, vomiting and sore throat compared to dexmedetomidine.

Conclusions: Nebulised dexmedetomidine has an advantage over lignocaine in better haemodynamic stability, postoperative analgesia and anaesthetic needs, with a lower side-effect profile.

Key Messages: Preoperative nebulisation with dexmedetomidine provides haemodynamic stability during laryngoscopy and intubation with fewer side effects.

KEYWORDS

• Dexmedetomidine • Lignocaine • Nebulisation • Laryngoscopy • Haemodynamic response • Hypertension • Intubation

INTRODUCTION

Anesthesiologists play a crucial role in securing the airway during general anesthesia, with endotracheal intubation being the gold standard. However, direct laryngoscopy and intubation trigger a stress response that leads to transient but significant hemodynamic changes such as tachycardia, hypertension, and arrhythmias.[1] These effects, driven by sympathetic stimulation of the upper airway, can be detrimental in patients with conditions like hypertension, coronary artery disease, recent myocardial infarction, or raised intracranial pressure.[2] Various agents such as beta blockers, opioids, calcium channel blockers, and lignocaine have been used to attenuate this response with varying success.[3]

Dexmedetomidine, a selective alpha-2 adrenergic agonist, provides sedative, analgesic, and sympatholytic effects while maintaining cardiovascular stability.[4,5] Compared to clonidine, it has greater alpha-2 selectivity and a shorter duration of action.[6] Its use in the perioperative period is increasing due to its ability to reduce anesthetic and analgesic requirements. Nebulized dexmedetomidine offers a non-invasive route with good bioavailability (65–85% via nasal and buccal mucosa) and may provide an attractive alternative to intravenous administration for blunting intubation-induced hemodynamic stress.[7]

Lignocaine, a well-established agent for attenuating airway reflexes, has also been effectively used in nebulized form, particularly during awake fiberoptic intubation.[8] It is generally safe, with minimal adverse effects when used topically. However, in patients prone to bradycardia or hypotension, nebulized dexmedetomidine may offer a safer and more effective alternative.[9]

This study aims to compare the effects of dexmedetomidine and lignocaine on heart rate and to compare heart rate changes between the two groups following laryngoscopy and intubation, systolic blood pressure changes, intraoperative anesthetic and analgesic requirements, time to extubation, and the 2-hour incidence of postoperative nausea, vomiting, and sore throat between the groups.

MATERIALS AND METHODS

This randomized, double-blind, parallel-group study was conducted in the Department of Anaesthesia, in a tertiary care hospital, Greater Noida, to compare the effects of preoperative nebulization with dexmedetomidine versus lignocaine on the hemodynamic response to laryngoscopy and intubation in hypertensive patients undergoing elective surgeries under general anaesthesia. The study was approved by the Institutional Ethics Committee (GIMS/IEC/HR/2023/15), and written informed consent was obtained from all participants.

A total of 100 ASA II hypertensive patients aged 18–60 years were enrolled and randomly assigned to two groups (n=50 each). Group 1 received 1 µg/kg dexmedetomidine diluted in 4 mL saline, while Group 2 received 1 mL of 4% lignocaine plus 3 mL saline via nebulization 30 minutes before induction. Randomization was computer-generated with allocation concealment using sealed opaque envelopes, and both patients and investigators were blinded to group assignments.

Nebulization was performed using a jet nebulizer with oxygen at 6–8 L/min for 15–20 minutes. Patients were continuously monitored for heart rate, oxygen saturation, and sedation using the Modified Observer's Assessment of Alertness/Sedation (MOAA/S) scale. Nebulization was discontinued if bradycardia (HR <50 bpm), sedation (MOAA/S <3), or desaturation (SpO_2 <92%) occurred. All patients received standard premedication with ondansetron, midazolam, and fentanyl. Anaesthesia was induced with propofol and vecuronium, followed by intubation using a Macintosh laryngoscope by an experienced anesthesiologist. Anaesthesia was maintained with isoflurane in a 50% air-oxygen mixture, titrated to maintain a MAC of 1.0–1.3. Hemodynamic deviations (>20% change from baseline) were treated with appropriate interventions such as fentanyl, mephentermine, or atropine.

Heart rate and systolic blood pressure were recorded before and after nebulization, and every minute for 10 minutes following intubation. Secondary parameters included anesthetic and analgesic consumption, time to extubation, and postoperative complications like nausea, vomiting, and sore throat (graded 0–3). Patients were also observed for intraoperative adverse events such as bradycardia, hypotension, and desaturation. Preoperative assessment included routine laboratory investigations, ECG, and chest X-ray, while continuous intraoperative monitoring of HR, BP, MAP, SpO_2, $EtCO_2$, and MAC was performed. Postoperatively, patients were monitored for 3 hours before discharge to the ward. The primary outcome was attenuation of hemodynamic response, categorized as <10% (attenuated), 10–20% (moderate), or >20% (significant) rise in HR or SBP compared to baseline.

Sampling and statistical analysis:

Based on the study by Misra S. et al.,[10] which evaluated the effect of preoperative dexmedetomidine nebulization on hemodynamic responses, the sample size was calculated using heart rate difference as the primary parameter. Assuming a 20% difference in maximum heart rate between the dexmedetomidine and lignocaine groups, with $\alpha = 0.05$ ($Z\alpha/2 = 1.96$), power = 0.90 ($Z\beta = 1.28$), standard deviation (σ) = 7.85, and minimal clinically important difference (δ) = 5, the sample size per group (n) was derived. The calculated sample size was approximately 52 per group, and accounting for rounding and potential attrition, a total of 100 patients (50 per group) were included in the study.

Randomization was achieved using a computer-generated sequence with allocation concealment ensured by sealed opaque envelopes opened on the day of surgery. Both patients and investigators performing laryngoscopy, intubation, and data collection were blinded, while an independent investigator prepared the nebulization drugs. Data were recorded in Microsoft Excel and analyzed using SPSS version 27.

Continuous variables such as heart rate, systolic blood pressure, and extubation time were expressed as mean ± SD and compared using the independent t-test. Categorical variables, including postoperative nausea, vomiting, and sore throat, were analyzed using the Chi-square or Fisher's exact test. Repeated-measures ANOVA was used to evaluate changes in HR and SBP over time, with a p-value <0.05 considered statistically significant.

RESULTS

A total of 110 hypertensive patients were enrolled, of which 10 were excluded due to difficult airway, leaving 100 patients equally divided into dexmedetomidine (Group D) and lignocaine (Group L) groups. Both groups were comparable in demographic and anthropometric characteristics, including age, gender, height, weight, and BMI (P>0.05). The mean age was 45.10 ± 8.47 years in Group D and 46.20 ± 9.43 years in Group L, with a male predominance in both groups. Baseline preoperative vitals (HR, SBP, DBP, MAP, and SpO_2) were also comparable and statistically non-significant between the two groups.

Intraoperatively, the mean time to first rescue analgesia was significantly longer in the dexmedetomidine group (6.95 ± 0.06 min vs. 4.94 ± 0.43 min, P<0.001), while propofol consumption was significantly lower (100.12 ± 5.39 mg vs. 104.72 ± 5.53 mg, P<0.001). There was no significant difference in fentanyl usage, time to extubation, or surgery duration (P>0.05). Heart rate and blood pressure (systolic, diastolic, and mean arterial pressure) rose transiently after laryngoscopy in both groups, peaking around 3–4 minutes, followed by a gradual decline. However, intergroup differences at all time points were statistically non-significant (P>0.05), indicating both drugs effectively attenuated hemodynamic responses to laryngoscopy and intubation. Oxygen saturation (SpO_2) remained stable and comparable in both groups throughout the perioperative period.

Postoperatively, the incidence of nausea and vomiting was lower in the dexmedetomidine group (8%) compared to the lignocaine group (14%), though not statistically significant (P>0.05). Similarly, sore throat was reported in 18% of patients in Group D and 24% in Group L. Adverse events such as bradycardia and hypotension were infrequent and comparable between groups (bradycardia: 4% vs. 2%; hypotension: 6% vs. 4%, P>0.05). Overall, nebulized dexmedetomidine demonstrated better analgesic duration and anesthetic-sparing effects without significant hemodynamic instability or adverse events compared to lignocaine.

Table 1: Comparison of Heart Rate (HR) Changes between Groups

Time Point	Dexmedetomidine (Mean ± SD)	Lignocaine (Mean ± SD)	t-value / χ^2-value	p-value
Before nebulization (Baseline)	84.78 ± 6.27	83.94 ± 6.30	0.668	0.506
After nebulization	80.78 ± 4.87	80.86 ± 4.08	0.089	0.929
1 min after intubation	80.82 ± 5.68	79.64 ± 4.08	1.193	0.236
2 min after intubation	81.26 ± 5.17	79.40 ± 4.71	1.880	0.063
3 min after intubation	84.64 ± 6.28	82.66 ± 5.37	1.694	0.094
4 min (Peak response)	95.30 ± 9.47	94.10 ± 8.77	0.657	0.512
5 min	94.94 ± 10.67	91.26 ± 7.80	1.968	0.052
10 min post-intubation	80.62 ± 10.96	79.38 ± 10.99	0.670	0.504

S.D.= Standard Deviation

Table 2: Comparison of efficacy outcomes between Groups

Parameter	Dexmedetomidine (Mean ± SD / n %)	Lignocaine (Mean ± SD / n %)	t-value / χ^2-value	p-value
Systolic BP (mmHg) (Baseline)	130.84 ± 15.59	130.30 ± 9.75	0.208	0.836
Mean Arterial Pressure (MAP) (Baseline)	97.90 ± 8.72	96.86 ± 4.41	0.752	0.454
Propofol Requirement (mg)	100.12 ± 5.39	104.72 ± 5.53	4.213	< 0.001
Fentanyl Requirement (μg)	82.36 ± 8.68	83.26 ± 8.22	0.596	0.900
Time to First Rescue Analgesia (min)	6.95 ± 0.06	4.94 ± 0.43	32.725	< 0.001
Time to Extubation (min)	11.61 ± 3.82	12.32 ± 4.94	0.804	0.423
Postoperative Nausea/Vomiting	4 (8%)	7 (14%)	0.919	0.338
Postoperative Sore Throat	9 (18%)	12 (24%)	0.542	0.461
Bradycardia	3 (6%)	1 (2%)	0.344	0.558
Intraoperative Hypotension	4 (8%)	2 (4%)	0.211	0.646

MAP = Mean Arterial Pressure, SD = Standard Deviation, n%= number (percentage)

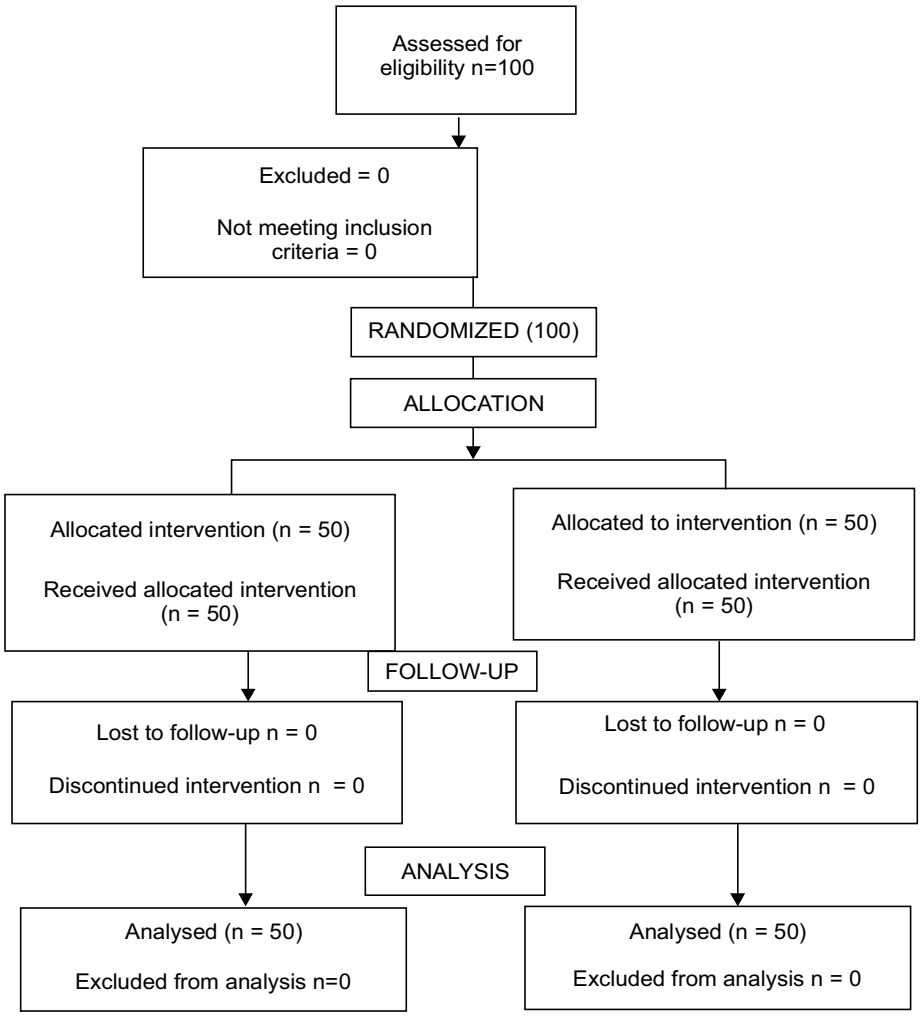

Figure 1: CONSORT flow diagram

Abbreviations

Abbreviation	Full Form
α-2	Alpha-2 (adrenergic receptor)
ANOVA	Analysis of Variance
ASA	American Society of Anesthesiologists
BMI	Body Mass Index
BP	Blood Pressure
CPT 1	Central Compartment 1
DBP	Diastolic Blood Pressure
$EtCO_2$	End-Tidal Carbon Dioxide
ETT	Endotracheal Tube
GX	Glycinexylidide
HR	Heart Rate
ID	Internal Diameter

Abbreviation	Full Form
IV	Intravenous
MAP	Mean Arterial Pressure
MEGX	Monoethyl-Glycine-Xylidide
MOAA/S	Modified Observer's Assessment of Alertness/Sedation
OR	Odds Ratio
PONV	Post-Operative Nausea and Vomiting
POST	Post-Operative Sore Throat
SBP	Systolic Blood Pressure
SD	Standard Deviation
SpO_2	Peripheral Capillary Oxygen Saturation
SPSS	Statistical Package for the Social Sciences
VAS	Visual Analog Scale

DISCUSSION

This study investigated the efficacy and safety of preoperative nebulized dexmedetomidine (1 µg/kg) versus nebulized lignocaine (4% 1 mL diluted to 4 mL) in attenuating the hemodynamic response to laryngoscopy and endotracheal intubation in hypertensive patients undergoing elective, short-duration, non-cardiac, non-neurosurgical procedures. A randomized, double-blind, parallel-group design enrolled 100 patients (50 per group) after excluding 10 patients for difficult airway. Baseline demographics, anthropometry, ASA grade and pre-nebulization vitals (HR, SBP, DBP, MAP, SpO_2) were comparable between groups.

Nebulization was performed 30 minutes before induction using a jet nebulizer; standard anaesthetic technique and rescue protocols were applied uniformly. Primary outcome measurement was heart rate response recorded before nebulization, after nebulization (baseline), and every minute for 10 minutes after intubation; secondary outcomes included SBP, anesthetic/analgesic consumption, time to extubation, and 2-hour postoperative PONV and sore throat.

The principal findings show that both nebulized dexmedetomidine and nebulized lignocaine attenuated the immediate hemodynamic stress response to laryngoscopy and intubation: HR, SBP, DBP and MAP rose transiently after intubation (peaking around 3–4 minutes) and trended toward baseline by 10 minutes with no statistically significant intergroup differences at any measured time point. Notably, nebulized dexmedetomidine produced clinically meaningful anesthetic-sparing and analgesic-prolonging effects the dexmedetomidine group had a significantly longer time to first rescue analgesia (6.95 ± 0.06 vs. 4.94 ± 0.43 min; P<0.001) and required less propofol intraoperatively (100.12 ± 5.39 mg vs. 104.72 ± 5.53 mg; P<0.001). There were no significant differences in intraoperative fentanyl use, time to extubation, duration of surgery, or perioperative SpO_2 between groups.

Safety profiles were acceptable and comparable: postoperative nausea and vomiting occurred in 8% of the dexmedetomidine group versus 14% in the lignocaine group (not statistically significant), sore throat was reported in 18% versus 24%, and adverse events such as bradycardia (4% vs. 2%) and intraoperative hypotension (6% vs. 4%) were infrequent and managed per protocol. These observations align with prior studies suggesting that nebulized dexmedetomidine can attenuate sympathetic responses with minimal clinically significant hemodynamic compromise while offering added sedation-analgesia benefits.[11,12,13,14] Taken together, nebulized dexmedetomidine appears at least equivalent to nebulized lignocaine in blunting immediate intubation responses and superior in reducing anesthetic requirements and prolonging time to rescue analgesia.[15]

Strengths of the study include its randomized double-blind design, focused hypertensive patient cohort, and systematic perioperative monitoring. Limitations comprise single-center conduct, restriction to two drug regimens and doses, a relatively short (10-minute) post-intubation observation window for hemodynamics, and potential heterogeneity in surgical stimuli. Clinically, preoperative nebulization with dexmedetomidine can be considered a practical, noninvasive option to attenuate intubation stress in hypertensive patients, with the added benefit of anesthetic-sparing effects. Future work should pursue multicenter trials, longer monitoring intervals, dose-response evaluations, comparisons with other agents and routes, and broader patient populations (including geriatric and pediatric cohorts) to refine protocols and confirm generalizability and cost-effectiveness.

CONCLUSION

Dexmedetomidine provided a longer duration of analgesia and reduced intraoperative propofol consumption compared to lignocaine. Both groups showed similar hemodynamic stability and incidence of adverse events. The findings suggest that both dexmedetomidine and lignocaine are suitable options for managing hemodynamic responses during laryngoscopy and intubation, with dexmedetomidine offering additional benefits in terms of analgesia and anesthetic consumption.

Acknowledgement: Nil

Conflict of Interest: Nil

REFERENCES

1. Anandani D.N., Kapdi M.S., Patel A.D., Jain P. Comparison of intravenous lignocaine and dexmedetomidine for attenuation of hemodynamic stress response to laryngoscopy and endotracheal intubation. J Evoul Med Dent Sci. 2021; 10(16): 1123-29.
2. Low J.M., Harvey J.T., Roberts C.P., Dagnino J. Studies of anaesthesia in relation to hypertension: Adrenenergic response to laryngoscopy. Br J Anaesth. 1986; 58(5): 471-47.
3. Khan F.A., Ullah H. Pharmacological agents for preventing morbidity associated with the haemodynamic response to tracheal intubation. Cochrane Database Syst Rev. 2013; (7): CD004087.
4. Kumar N.R., Jonnavithula N., Padhy S., Sanapala V., Vasram N.V. Evaluation of nebulised dexmedetomidine in blunting haemodynamic response to intubation: A prospective randomised study. Indian J Anaesth. 2020; 64(10): 874-9.
5. Kumar S., Kushwaha B., Prakash B., Jafa S., Malik A. Comparative study of effects of dexmedetomidine and clonidine premedication in perioperative hemodynamic stability and postoperative analgesia laparoscopic cholecystectomy. Internet J Anaesth. 2014; 33:1–8.
6. Grewal A. Dexmedetomidine: New avenues. J Anaesthesiol Clin Pharmacol. 2011; 27(3): 297–302.
7. Zanaty O.M., ElMetainy S.A. A comparative evaluation of nebulized dexmedetomidine, nebulized ketamine, and their combination as premedication for outpatient pediatric dental surgery. Anesth Analg. 2015; 12(1): 167–71.
8. Singh V., Pahade A, Mowar A. Comparison of intravenous vs nebulized dexmedetomidine for laryngoscopy and intubation induced sympathoadrenal stress response attenuation. Anaesth Pain Med. 2022; 12(5): e132607.
9. Kashyap O.P., Kumar A., Singh D., Srivastava S. Comparison between nebulised versus intravenous lignocaine to suppresss the haemodynamic response to laryngoscopy and tracheal intubation. J Clin and Diag Res. 2021; 15(3): UC10-16.
10. Ellatif SE, Mowafy S. Pre-emptive nebulized ketamine versus nebulized lidocaine for endoscopic nasal surgeries. Research and opinion in Anesthesia and intensive care 2019; 6(4): 408-17.
11. Misra S., Behera B.K., Mitra J.K., Sahoo A.K., Jena S.S., Srinivasan A. Effect of preoperative dexmedetomidine nebulization on the hemodynamic response to laryngoscopy and intubation: a randomized control trial. Korean J Anesthesiol. 2021; 74(2): 150-7.
12. Abdel-Ghaffar H.S., Kamal S.M., Sherif F.E., Mohamed S.A. Comparison of nebulized dexmedetomidine, ketamine, or midazolam for premedication in preschool children undergoing bone marrow biopsy. Br J Anaesth. 2018; 121(2): 445–52.
13. Bhattacharjee D.P., Nayek S.K., Dawn S., Bandopadhyay G., Gupta K. Effects of dexmedetomidine on hemodynamics in patients undergoing laparoscopic cholecystectomy: A comparative study. J Anaesth Clin Pharmacol. 2010; 26: 45–8.
14. Sudheesh K., Harsoor S.S. Dexmedetomidine in anaesthetic practice: A wonder drug? IJA 2011; 55: 323-4.
15. El-Shmaa N.S., El-Baradey G.F. The efficacy of labetalol vs dexmedetomidine for attenuation of hemodynamic stress response to laryngoscopy and endotracheal intubation. J Clin Anesth. 2016; 31: 267–73.