ISSN: 2091-2749 (Print)
2091-2757 (Online)

Submitted on: 6 Oct 2025
Accepted on: 15 Dec 2025

https://doi.org/10.3126/jpahs.v12i2.88952

A comparative study between I-gel and endotracheal tube for airway management in hypertensive patients undergoing elective laparoscopic cholecystectomy

Puja Thapa[1], Mallika Rayamajhi[1], Biswa Ram Amatya[1], Aashish Shah[2], Thaneshwar Rijal[2], Alok Raj Gautam[2], Pradip KC[2]

[1]Assoc. Prof., [2]Asst. Prof., Dept. of Anaesthesiology, Nepalese Army Institute of Health Sciences, Kathmandu, Nepal

Abstract

Introduction: Laryngoscopy and endotracheal intubation during general anesthesia provoke sympathetic stimulation, resulting in transient but significant hemodynamic changes. These may be detrimental in hypertensive patients. The I-gel, a second-generation supraglottic airway device, may attenuate this response. This study compares the hemodynamic responses and perioperative outcomes of I-gel and endotracheal tube (ETT) in hypertensive patients undergoing elective laparoscopic cholecystectomy.

Method: A hospital-based prospective, non-randomized, comparative observational study was conducted among ASA II hypertensive patients undergoing elective laparoscopic cholecystectomy. Airway management used I-gel or ETT per anesthesiologist preference, with the first 30 eligible patients assigned to each group. Hemodynamic parameters including heart rate (HR) and mean arterial pressure (MAP) were recorded at predefined intervals. Ease of insertion and perioperative complications were also compared.

Result: A total of 60 patients were included in the study, with 30 in each group. The demographic parameters were comparable between the two groups. Time for insertion was significantly shorter in the I-gel group (11.34±0.78 s) than in the ETT group (13.42±1.31 s; $p<0.0001$). At 1 and 3 minutes post-insertion, both HR and MAP were significantly lower in the I-gel group compared to the ETT group. No significant differences were found in insertion attempts. The I-gel group reported fewer postoperative complications such as sore throat and hoarseness.

Conclusion: The I-gel device offers superior hemodynamic stability and ease of insertion in hypertensive patients undergoing elective laparoscopic cholecystectomy, making it a safer alternative to ETT in this population.

Keywords: Laryngoscopy; Endotracheal Intubation; Hypertension; Laparoscopic cholecystectomy

How to Cite: Thapa P, Rayamajhi M, Amatya BR, Shah A, Rijal T, Gautam AR, et al. A comparative study between I-gel and endotracheal tube for airway management in hypertensive patients undergoing elective laparoscopic cholecystectomy. J Patan Acad Health Sci. 2025 Dec;12(2):5-9.

Correspondence: Dr. Puja Thapa, Dept. of Anaesthesiology, Nepalese Army Institute of Health Sciences, Kathmandu, Nepal
Email: puja.thapa@naihs.edu.np

Introduction

Laryngoscopy and tracheal intubation, while essential for airway control in general anesthesia, induce notable sympathetic stimulation. This manifests as increased heart rate, blood pressure, and potential arrhythmias. Although generally transient, such responses can have serious consequences in hypertensive individuals, including myocardial ischemia and cerebrovascular events.[1–3]

Supraglottic airway devices (SADs) offer a less invasive alternative to endotracheal tubes (ETT). The I-gel, a second-generation SAD with a non-inflatable cuff, ensures an effective seal without laryngeal compression.[4] Research conducted on both manikins and patients has demonstrated that inserting the I-gel is significantly easier compared to the insertion of other SADs.[5] This potentially minimizes sympathetic stimulation, facilitates easier insertion, and reduces postoperative airway complications.[6–8]

Both ETTs and I-gel devices are commonly used during general anesthesia. However, not much comparison has been made between the two in hypertensive patients. Although some studies support I-gel use in elective surgeries, they do not focus on this high-risk group. [9–12] Given the cardiovascular vulnerabilities in hypertensive patients, the I-gel's design makes it a promising alternative.

This study aims to compare the hemodynamic responses and insertion-related parameters between I-gel and ETT in hypertensive patients undergoing elective laparoscopic cholecystectomy.

Method

This was a prospective, comparative observational study, conducted in the Department of Anaesthesiology of of Shree Birendra Hospital, Kathmandu, Nepal, which is a teaching hospital of Nepalese Army Institute of Health Sciences (NAIHS).

The duration of the study was for five months, from Feb 2024 to Jun 2024. Ethical approval was taken from the institutional review committee of NAIHS vide ref no. 939.. It was calculated that 30 patients in each group would be required to have a 95% confidence interval and a power of 80% in the study based on data from a previous study.[9] After obtaining the written informed consent, 60 patients with American Society of Anesthesiologists (ASA) Physical Status II and controlled hypertension were enrolled using convenience sampling. Airway management was performed using either an I-Gel or an endotracheal tube (ETT), based on the attending anesthesiologist's preference. The first 30 eligible patients in each group were assigned to the i-Gel and ETT groups, respectively. The patients included in the study were aged between 30 and 70 years, had controlled hypertension, and were scheduled for elective laparoscopic cholecystectomy. Patients were excluded if they had ASA Grade III or higher, an anticipated difficult airway, morbid obesity, delayed gastric emptying, or refused to participate in the study.

All participants received 5 mg of diazepam the night before the surgery. A thorough pre-anesthesia evaluation was conducted, and written informed consent was obtained from each patient. Upon arrival in the operation theatre, standard monitoring was initiated, and intravenous crystalloids were administered at a rate of 6–8 ml/kg/hr. Premedication consisted of intravenous midazolam (0.04 mg/kg) and fentanyl (1.5 µg/kg). Anesthesia was induced with propofol, titrated to the loss of the eyelash reflex. Neuromuscular blockade was achieved using vecuronium (0.1 mg/kg). After a three-minute waiting period, the designated airway device, either an I-gel or an endotracheal tube (ETT), was inserted by a consultant anesthesiologist. Anesthesia was maintained using 100% oxygen and 1–1.5% isoflurane. Additional doses of vecuronium were administered as needed during the procedure.

Hemodynamic parameters, including Heart Rate (HR) and Mean Arterial Pressure (MAP), were recorded at baseline, before induction, after induction, at 1, 3, and 5 minutes post-insertion, and at 1 minute post-extubation. End-tidal CO_2 ($EtCO_2$), Oxygen Saturation (SpO_2), and peak airway pressure were recorded at 10-minute intervals throughout the procedure. The ease of insertion was evaluated based on the number of attempts and the time taken for insertion. Any complications such as sore throat, hoarseness, postoperative nausea and vomiting (PONV), arrhythmias, or hemodynamic instability were documented.

All data were analyzed using SPSS software. Continuous variables were compared using the Student's t-test, while categorical variables were analyzed using the Chi-square test. A p-value of less than 0.05 was considered statistically significant.

Result

A total of 72 patients were screened for eligibility during the study period. Twelve were excluded due to comorbidities or other exclusion criteria (Figure 1). Ultimately, 60 patients were enrolled, with 30 assigned to the I-gel group and 30 to the ETT group.

No significant differences were observed between the I-gel and Endotracheal Tube (ETT) groups regarding age, gender distribution, or body mass index (BMI), indicating comparable baseline characteristics, Table 1.

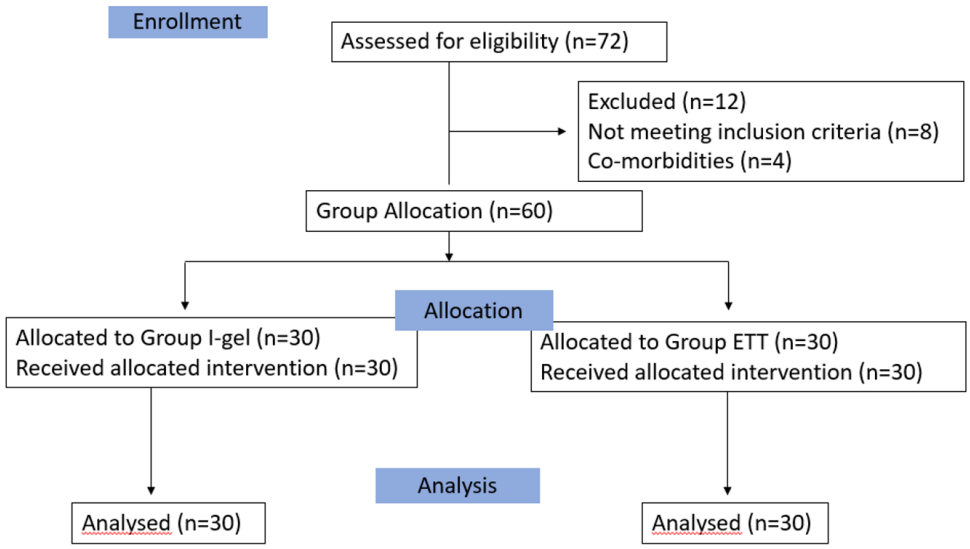

Figure 1. Flow diagram of the participants in the study

The mean insertion time was significantly shorter in the I-gel group compared to the ETT group (11.34 ± 0.78 s vs. 13.42 ± 1.31 s; p <0.001).

The success rate of first-attempt airway insertion was comparable between the two groups. In the I-gel group, 28 patients (93.3%) were successfully managed on the first attempt, compared with 26 patients (86.7%) in the endotracheal tube (ETT) group. A 2×2 contingency analysis showed no statistically significant difference between the groups (Fisher's exact test, p=0.673), Table 2.

Table 1. Demographic characteristics of the study participants

Parameter	Group I-gel (n=30)	Group ETT (n=30)	P-value
Age (years)	52.73 ± 9.22	48.86 ± 10.10	0.126
BMI (kg/m²)	24.60 ± 1.65	24.74 ± 1.53	0.734
Gender (M:F)	46.7% : 53.3%	33.3% : 66.7%	0.292#

#Chi-square test

Table 2. Insertion characteristics in the two groups

Parameter	Group I-gel (n=30)	Group ETT (n=30)	P-value
Time(seconds)	11.34 ± 0.78	13.42 ± 1.31	<0.001
No of attempt (% of first attempt)	28 (93.3)	26 (86.7)	0.673#

#Fisher exact test

Table 3. Heart rate (beats/min) in the two groups

Time interval	Group I-gel (n=30)	Group ETT (n=30)	P value
Baseline	72.86±7.37	73.20±7.45	0.86
Before Induction	85.72±6.43	83.43±5.68	0.149
After Induction	72.36±7.78	75.64±6.89	0.089
1 min	84.45±4.54	93.37±5.90	<0.001
3 min	85.67±6.66	91.89±7.09	0.001
5 min	78.57±5.55	80.78±6.88	0.175
After Extubation (1 min)	79.34±9.42	85.12±9.65	0.022

Table 4. Mean arterial pressure (mmHg) in the two groups

Time interval	Group I-gel (n=30)	Group ETT (n=30)	P value
Baseline	106.72 ±8.89	103.61±7.8	0.155
Before Induction	114.65±7.4	117.69±9	0.158
After Induction	89.19±8.2	85.47±7.3	0.068
1 min	115.29±6.14	132.31±9.62	<0.001
3 min	111.75±8.47	120.29±7.32	<0.001
5 min	92.53±8.23	99.23±9.89	0.006
After Extubation (1 min)	98.37±6.1	105.83±8.6	0.0003<0.003

The findings revealed that heart rates were similar at baseline and during induction, but significantly higher in the ETT group at 1 and 3 minutes after insertion (p<0.001 and <0.001) and after extubation (p= 0.022). Overall, the i-gel group exhibited more stable physiological responses, with smaller heart rate fluctuations compared to the ETT group, Table 3.

Table 5. Postoperative complications in the two groups

Side effects	Group I-gel (n=30)	Group ETT (n=30)
Blood on removal of device	2 (6.7)	2 (6.7)
Hoarseness	2 (6.7)	4 (13.3)
Sore throat	1 (3.3)	3 (10.0)
PONV	0 (0)	1 (3.3)

The incidence of sore throat and hoarseness was lower in the I-gel group compared to the ETT group, suggesting less airway trauma (Table 5).

Discussion

Our study showed that the I-gel group had better hemodynamic stability compared with the ETT group in patients with controlled hypertension. Recently, the supraglottic airway device (SAD) has gained popularity over the tracheal tube for controlled ventilation during anaesthesia, as it provides benefits such as reduced haemodynamic disturbance during induction, maintenance, emergence and quicker case turnover.[7,13] In our study, we compared the use of the I-gel supraglottic airway device with conventional endotracheal intubation in hypertensive patients undergoing elective laparoscopic cholecystectomy under general anaesthesia.

Both the groups showed an increase in HR and MAP; however, the rise was significantly greater in patients who underwent endotracheal intubation compared to those managed with the I-gel. At 1 and 3 minutes post-insertion, HR and MAP were significantly lower in the I-gel group. These findings are consistent with several recent studies evaluating supraglottic airway devices (SADs) in similar settings.[14–17] Oza et al [18] reported that hypertensive patients managed with I-gel exhibited lower peri-insertion hemodynamic fluctuations than those intubated with an endotracheal tube, supporting the notion that SADs cause less airway irritation and sympathetic activation. These findings also align with the study conducted by Ahirwal et al[10], who reported attenuated pressor responses and reduced airway morbidity in patients undergoing middle ear surgeries when managed with I-gel rather than ETT. In high-risk cardiac surgery patients, Ahmed et al[15] demonstrated that I-gel attenuated sympathetic stimulation under sevoflurane–fentanyl anesthesia, supporting its role in populations where hemodynamic stability is crucial. Furthermore, Chatterjee et al[19] reported significantly reduced hemodynamic stress responses with I-gel compared to ETT during infraumbilical surgeries.

Our study demonstrated that insertion time was shorter in the I-gel group, which also achieved a higher first-attempt success rate. Additionally, the I-gel group experienced less hoarseness, sore throat, and postoperative nausea and vomiting (PONV), with a comparable incidence of visible blood on removal of the device in both groups. The AIRWAYS-2 trial [20] also supports the I-gel's rapid insertion and reduced pressor response similar to our findings, reinforcing its clinical value in hypertensive patients. Similarly, Dhanda et al[9] found that the I-gel not only reduced insertion time but also resulted in fewer cardiovascular responses during laparoscopic surgeries, aligning well with our results of shorter insertion times and stable hemodynamics. Additionally, a study by Vijayarahavan et al[14] compared endotracheal tube and laryngeal mask airway in hypertensive patients and demonstrated that the Laryngeal Mask Airway (LMA)had superior hemodynamic stability and fewer postoperative complications such as sore throat and hoarseness.

The results indicate that I-gel allowed quicker insertion, fewer complications, and greater hemodynamic stability than endotracheal intubation in hypertensive patients. Potential observer bias in this study could have occurred in the assessment of variables like ease of insertion, hoarseness and sore throat.

Conclusion

I-gel insertion in hypertensive patients undergoing laparoscopic cholecystectomy results in significantly lower peri-insertion hemodynamic fluctuations, shorter insertion time and fewer postoperative airway complications compared to endotracheal intubation. The I-gel, with its ease of use and favorable safety profile, serves as an effective alternative for airway management in this high-risk population.

Conflict of Interest
None

Funding
None

Author Contribution
Concept, Design, Planning: PT, MR, BRA, TR, AS, ARJ, PKC; Literature review: PT, TR, AS; Data collection: PT. ARJ, PKC; Data Analysis: PT, MR, BRA, TR, AS, ARJ, PKC; Draft manuscript: PT, MR, BRA; Revision of Draft: PT, MR, BRA, TR, AS, ARJ, PKC; Final Manuscript: PT, MR, BRA, TR, AS, ARJ, PKC; Accountability of the work: PT, MR, BRA, TR, AS, ARJ, PKC.

References

1. Kaymak C, Kocabaş NA, Durmaz E, Oztuna D. Beta2 adrenoceptor (ADRB2) pharmacogenetics and cardiovascular phenotypes during laryngoscopy and tracheal intubation. Int J Toxicol. 2006;25(6):443–9. DOI

2. Hedge J, Balajibabu PR, Sivaraman T. The patient with ischaemic heart disease undergoing non cardiac surgery. Indian J Anaesth. 2017 Sept;61(9):705–11. DOI
3. Mangano DT, Hollenberg M, Fegert G, Meyer ML, London MJ, Tubau JF, et al. Perioperative myocardial ischemia in patients undergoing noncardiac surgery—I: Incidence and severity during the 4 Day perioperative period. Journal of the American College of Cardiology. 1991 Mar 15;17(4):843–50. DOI
4. Levitan RM, Kinkle WC. Initial anatomic investigations of the I-gel airway: a novel supraglottic airway without inflatable cuff. Anaesthesia. 2005 Oct;60(10):1022–6. DOI
5. Jackson KM, Cook TM. Evaluation of four airway training manikins as patient simulators for the insertion of eight types of supraglottic airway devices. Anaesthesia. 2007 Apr;62(4):388–93. DOI
6. Richez B, Saltel L, Banchereau F, Torrielli R, Cros AM. A new single use supraglottic airway device with a noninflatable cuff and an esophageal vent: an observational study of the i-gel. Anesth Analg.2008 Apr;106(4):1137–9. DOI
7. Massoud S, Soud D, Helmy K, Elsayed M. A comparative study between i-gel versus cuffed endotracheal tube in laparoscopic surgeries in adult patients. Zagazig University Medical Journal. 2014 May 1;20(3):1–8. DOI
8. Badheka JP, Jadliwala RM, Chhaya VA, Parmar VS, Vasani A, Rajyaguru AM. I-gel as an alternative to endotracheal tube in adult laparoscopic surgeries: A comparative study. J Minim Access Surg. 2015;11(4):251–6. DOI
9. Dhanda A, Singh S, Bhalotra AR, Chavali S. Clinical Comparison of I-Gel Supraglottic Airway Device and Cuffed Endotracheal Tube for Pressure-Controlled Ventilation During Routine Surgical Procedures. Turk J Anaesthesiol Reanim. 2017 Oct;45(5):270–6. DOI
10. Ahirwal K, Kaushal RP, Kaushal B, Nema N. A Study to Evaluate Advantages of I-Gel Over Endotracheal Intubation in Middle Ear Surgeries. Ahirwal K, Kaushal RP, Kaushal B, Nema N. A Study to Evaluate Advantages of I-Gel Over Endotracheal Intubation in Middle Ear Surgeries.Int J Curr Pharm Res.2025; 17(4); 149-54. DOI
11. Levi DB, Hoogendoorn J, Samuels S, Maguire L, Troncoso R, Gunn S, et al. The i-gel® supraglottic airway device compared to endotracheal intubation as the initial prehospital advanced airway device: A natural experiment during the COVID-19 pandemic. JACEP Open. 2024 Apr 1;5(2):e13150. DOI
12. Ning M, Zhong W, Li J, Wang T, Lu Y. Comparison between I-gel® and endotracheal intubation in terms of the incidence of postoperative sore throat following thyroid surgery: a randomized observational trial. Am J Transl Res. 2022 Jan 15;14(1):373-380. PMID
13. Cork RC, Depa RM, Standen JR. Prospective Comparison of Use of the Laryngeal Mask and Endotracheal Tube for Ambulatory Surgery. Anesthesia & Analgesia. 1994 Oct;79(4):719. DOI
14. Vijayarahavan N, Mahilamani PP, Paramasivan A. Comparison of changes in haemodynamic parameters in hypertensive patients after laryngoscopic endotracheal intubation or laryngeal mask airway insertion. Indian Journal of Clinical Anaesthesia. 2025 July 28;7(1):8–11. DOI
15. Elgebaly AS, Eldabaa AA. Is I-gel airway a better option to endotracheal tube airway for sevoflurane-fentanyl anesthesia during cardiac surgery? Anesth Essays Res. 2014;8(2):216–22. DOI
16. Oza V, Mehta J, Parmar V, Sharma B. Comparison between I-gel and endotracheal tube for hemodynamic stability and perioperative complications in hypertensive patients undergoing elective surgery under general anaesthesia. 2020;14(3). DOI
17. Adhikari K, Devkota K, Sharma BD. Hemodynamic responses between I-gel and endotracheal tube in patients undergoing laparoscopic surgeries. Journal of Chitwan Medical College. 2022 Mar 15;12(1):29–33. DOI
18. Ahirwar K, Gupta S, Gupta A, Tirkey SP, Goyal P. A comparative study between I-gel and endotracheal tube in elective laparoscopic cholecystectomy surgeries under general anesthesia. Asian Journal of Medical Sciences. 2023;14(5). DOI
19. Chatterjee AB, Malik K, Ganguly P, Roy D. A Comparative Study Regarding the Haemodynamic Stress Response and Efficacy of Endotracheal Intubation and i-gel Insertion During Infraumbilical Surgery. jebmh. 2020 Apr 8;7(15):777–81. DOI
20. Benger JR, Lazaroo MJ, Clout M, Voss S, Black S, Brett SJ, et al. Randomized trial of the i-gel supraglottic airway device versus tracheal intubation during out of hospital cardiac arrest (AIRWAYS-2): Patient outcomes at three and six months. Resuscitation. 2020 Dec 1;157:74–82. DOI