Section: Anaesthesiology

Original Research Article

RANDOMIZED CONTROLLED STUDY COMPARING THE HEMODYNAMIC RESPONSE TO LARYNGOSCOPY AND ENDOTRACHEAL INTUBATION WITH MCCOY, MACINTOSH, AND KING VISION VIDEO LARYNGOSCOPE BLADES IN ADULT PATIENTS

Jazirah Sultana. A[1], H.M.Haja Shareef[2]

[1]*Junior Resident, Department of Anaesthesiology, Government Kilpauk Medical College & Hospital, India.*
[2]*Associate Professor, Department of Anaesthesiology, Government Medical College, Kallakurichi, India.*

Received *: 27/10/2025*
Received in revised form *: 26/12/2025*
Accepted *: 13/01/2026*

Corresponding Author:
Dr. H.M.Haja Shareef,
Associate Professor, Government Medical College, Kallakurichi, India.
Email: hajashareef72 gmail.com

DOI: 10.70034/ijmedph.2026.1.128

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2026; 16 (1); 720-724

ABSTRACT

Background: Laryngoscopy and endotracheal intubation elicit sympathetic stimulation, resulting in transient hemodynamic changes. The device design and force required during laryngoscopy may influence these responses. This study compared the hemodynamic stress responses associated with Macintosh, McCoy, and King Vision video laryngoscope blades during elective surgical intubation.

Materials and Methods: A prospective comparative study was conducted on 69 ASA I–II adult patients aged 19–49 years who underwent elective surgery under general anesthesia. Patients were randomized to undergo intubation using Macintosh (Group A), McCoy (Group B), or King Vision (Group C) laryngoscopes. Hemodynamic parameters (heart rate, systolic, diastolic, and mean arterial pressures) were recorded at baseline, at intubation, and at 30 s, 1 min, and 5 min post-intubation. A repeated-measures ANOVA with Greenhouse–Geisser correction was used to assess within- and between-group differences.

Results: The baseline characteristics were comparable across all groups. Intubation duration was significantly longer with King Vision than with Macintosh and McCoy ($p < 0.001$), whereas the durations with the latter two were similar. All groups exhibited significant time-dependent increases in heart rate and blood pressure immediately after intubation ($p < 0.01$), which returned to baseline by 5 min. No significant interaction between the device type and time was observed for any hemodynamic variable, indicating comparable stress responses across all the laryngoscopes.

Conclusion: Macintosh, McCoy, and King Vision laryngoscopes produced similar transient hemodynamic responses during intubation. Although the intubation time was longer with the King Vision, it did not confer an additional hemodynamic burden. Therefore, device selection may be guided by airway characteristics and clinician preference rather than hemodynamic considerations.

Keywords: Laryngoscopes; Intubation, Intratracheal; Hemodynamics; Blood Pressure; Heart Rate; Airway Management; Laryngoscopy.

INTRODUCTION

Endotracheal intubation is a core airway management technique in anesthesia, emergency care, and critical care medicine, ensuring effective oxygenation and ventilation during operative and non-operative procedures. Direct laryngoscopy using blades such as the Macintosh or McCoy, as well as video laryngoscopes including the King Vision device, remains the most common method for visualising the

vocal cords and guiding the endotracheal tube into the trachea.[1,2] Despite its routine use, laryngoscopy and intubation trigger a pronounced sympathoadrenal response, characterized by abrupt increases in heart rate, arterial pressure, intracranial pressure, and circulating catecholamine levels.[3,4] This haemodynamic surge typically begins within seconds, peaks within 1–2 minutes, and returns to baseline within approximately five minutes.[5] While this response is often well tolerated in healthy individuals, it may be hazardous in patients with cardiovascular or cerebrovascular disease, hypertension, increased intracranial or intraocular pressure, or limited physiological reserve. Adverse events such as tachyarrhythmias, myocardial ischaemia, ventricular failure, or cerebrovascular accidents may occur when the haemodynamic response is exaggerated.[4,6]

Pharmacological adjuncts—including opioids, β-blockers, α2-agonists, vasodilators, and local anaesthetics—have been used to attenuate these responses, but their efficacy is variable and patient-dependent.[7-9] The force exerted during laryngoscopy plays a substantial role in eliciting the cardiovascular reflexes associated with airway manipulation. Mechanical stimulation of oropharyngeal and laryngopharyngeal mechanoreceptors activates autonomic pathways that contribute to tachycardia and hypertension.[10,11] Blade design influences the degree of force applied and the ease of glottic visualization. The McCoy blade, with its hinged levering tip, reduces the need for anterior lifting force compared to the Macintosh blade. Video laryngoscopes such as the King Vision further minimise force requirements by providing an enhanced glottic view without alignment of the oral–pharyngeal–laryngeal axes.[12-15] Several comparative studies have reported differing haemodynamic profiles among these devices, suggesting that blade design may influence stress response during laryngoscopy and intubation.[12-16]

Given the clinical importance of attenuating the cardiovascular response to airway instrumentation, particularly in high-risk patients, a comparative evaluation of laryngoscopic devices remains essential. This study aimed to compare the hemodynamic stress response, specifically the changes in heart rate and mean arterial pressure, associated with laryngoscopy and endotracheal intubation using the Macintosh, McCoy, and King Vision video laryngoscopes in adult patients undergoing elective surgery.

MATERIALS AND METHODS

This prospective interventional study was conducted in the Department of Anaesthesiology at Government Kilpauk Medical College and Government Royapettah Hospital, Chennai. The study included six ASA I–II patients aged 19–49 years who underwent elective surgery under general anesthesia requiring endotracheal intubation. Patients with anticipated difficult airway (Mallampati class III–IV), cardiovascular disease, uncontrolled hypertension, diabetes mellitus, or those receiving medications that affected autonomic responses were excluded. The sample size was calculated using Epi Info based on the effect size reported by Buhari et al,[16] estimating that 60 patients (20 per group) would provide 80% power at a 5% significance level. A total of 69 patients were recruited to compensate for possible dropouts.

All participants underwent a detailed preoperative evaluation, airway assessment, and routine laboratory investigations. In the operating theatre, standard monitoring (ECG, SpO_2, NIBP, heart rate) was applied, and intravenous access was secured using an 18G cannula. Patients were premedicated with glycopyrrolate 2 µg/kg IV and preoxygenated with 100% oxygen for three minutes. Anesthesia was induced with fentanyl (2 µg/kg), propofol (2 mg/kg), and atracurium (0.5 mg/kg). Baseline hemodynamic parameters were recorded three minutes after atracurium administration.

Patients were randomly assigned to undergo laryngoscopy using one of the following devices. Laryngoscopy was performed using one of the three allocated devices (Macintosh, McCoy, or King Vision video laryngoscope) by anesthesiologists proficient in all three techniques. The blades were gently introduced, with the Macintosh and McCoy blades positioned in the vallecula, and the McCoy lever activated when applicable. The videolaryngoscope was inserted at the midline, allowing glottic visualization with minimal lifting force. Endotracheal intubation was performed using an appropriately sized cuffed tube. Heart rate, systolic pressure, diastolic pressure, and mean arterial pressure were recorded at baseline (B), intubation (I), and 30 s (I+0.5), 1 min (I+1), and 5 min (I+5) after intubation. Hemodynamic responses were analyzed based on changes from baseline within and between the three groups.

The study protocol was reviewed and approved by the Institutional Ethics Committee of the Government Kilpauk Medical College, Chennai (Protocol ID: 605/2021; Reg. No. ECR/1385/Inst/TN/2020). Written informed consent was obtained from all participants, and confidentiality was maintained.

Statistical analysis

The data collected were analyzed using IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY: IBM Corp. Descriptive statistics, including the mean, standard deviation (SD),and frequency, were employed to characterize the data. Qualitative data were analyzed using the chi-square test. Normality was assessed using the Shapiro–Wilk test, which confirmed that HR, DBP, SBP, and MAP exhibited a normal distribution.

To ascertain the significant differences among the three intubation groups, a one-way analysis of variance (ANOVA) with post hoc Tukey's HSD test was employed. For repeated measures, a two-way

repeated measures ANOVA adjusted for multiple comparisons using the Bonferroni test was utilized. Statistical significance was set at $p < 0.05$.

RESULTS

Table 1: Baseline Characteristics of Participants and duration across the Three Laryngoscopy Groups

Variable	Macintosh (Group A)	McCoy (Group B)	King Vision (Group C)	p-value
Sex (F/M)[a]	10/10	7/13	10/10	0.545
ASA I/II[a]	13/7	14/6	10/10	0.400
Mallampati I/II[a]	12/8	11/9	11/9	0.674
Cormack–Lehane Grade (I / II / IIA /IIB/ IIIA/IIIB/IV)[a]	5 / 7 / 5 / 1/2	7 / 6 / 5 / 2	12 / 6 / 2	0.030*
Duration of Intubation (s)[b] (mean±SD)	11.80 ± 1.88	11.85 ± 1.81	20.20 ± 3.09	0.001*†

Foot notes: * (p<0.05) ;[a-] Chisquare test; [b-] One way ANOVA with Post-hoc Tukey HSD ; † = post-hoc significance between groups.

Table 1 presents the baseline characteristics of the participants across the three laryngoscopy groups—Macintosh (Group A), McCoy (Group B), and King Vision (Group C). Demographic variables such as sex distribution, ASA status, Mallampati classification, were comparable across all groups with no significant differences observed. Whereas Cormack–Lehane grading class I was significantly higher in King Vision group. However, there was a highly significant difference in the duration of intubation between groups (p =0 .001). Post-hoc Tukey's comparisons showed that King Vision required a significantly longer intubation time than both Macintosh (Δ = +8.40 seconds, $p < .001$) and McCoy (Δ = +8.35 seconds, $p < .001$)**, whereas Macintosh and McCoy did not differ appreciably from each other (p = 1.00, ns).

Table 2: Heart Rate and Systolic Blood Pressure across Groups at Each Time Point

Variable	Macintosh (Group A)	McCoy (Group B)	King Vision (Group C)	p-value
Heart Rate (bpm)				
Baseline	83.15 ± 5.72	85.45 ± 6.97	83.85 ± 6.31	0.507
At Intubation	102.10 ± 6.48	101.65 ± 8.70	104.35 ± 6.29	0.455
30 sec	99.80 ± 6.59	99.55 ± 8.62	101.85 ± 6.06	0.542
1 min	95.15 ± 6.23	95.05 ± 8.70	97.40 ± 5.90	0.496
5 min	87.70 ± 5.89	87.75 ± 8.03	86.95 ± 6.44	0.918
SBP (mmHg)				
Baseline	116.00 ± 6.93	118.45 ± 4.14	116.15 ± 6.39	0.351
Intubation	134.65 ± 6.62	133.35 ± 4.58	132.15 ± 5.22	0.368
30 sec	132.05 ± 6.36	131.45 ± 4.76	130.40 ± 5.82	0.652
1 min	128.35 ± 6.21	128.50 ± 4.58	127.80 ± 5.72	0.916
5 min	121.50 ± 6.51	122.60 ± 4.95	119.10 ± 6.06	0.170
DBP (mmHg)				
Baseline	71.40 ± 7.86	70.25 ± 6.26	69.65 ± 7.01	0.730
Intubation	83.50 ± 7.42	79.80 ± 6.69	80.30 ± 6.71	0.200
30 sec	81.35 ± 7.53	78.50 ± 6.81	79.10 ± 6.64	0.404
1 min	79.00 ± 7.48	76.60 ± 6.79	77.05 ± 6.86	0.520
5 min	74.35 ± 7.93	72.30 ± 6.87	70.45 ± 7.47	0.261
MAP (mmHg)				
Baseline	85.75 ± 7.20	86.35 ± 5.28	85.80 ± 7.41	0.952
Intubation	100.55 ± 5.97	97.60 ± 5.67	97.55 ± 5.54	0.175
30 sec	98.25 ± 6.20	96.20 ± 5.76	96.10 ± 5.51	0.425
1 min	95.50 ± 6.25	93.90 ± 5.57	93.55 ± 5.39	0.524
5 min	90.05 ± 6.57	89.00 ± 5.72	87.00 ± 6.54	0.304

All three groups demonstrated an expected increase in heart rate, blood pressure and mean arterial pressure following intubation. However, no statistically significant differences were observed between Macintosh, McCoy, and King Vision laryngoscopes at any measured time interval. [Table.2]

Table 3: Repeated-Measures ANOVA Results for Hemodynamic Variables Across Time and Groups

Variable	Interaction Effect (Group × Time)	Main Time Effect
Heart Rate	0.101 (ns)	0 .001*
Systolic Blood Pressure	0 .132 (ns)	0 .001*
Diastolic Blood Pressure	0 .427 (ns)	0 .001*
Mean Arterial Pressure	0 .547 (ns)	0 .001*

Footnotes: All variables violated Mauchly's test of sphericity ($p < .001$); Greenhouse–Geisser correction was applied for all repeated-measures ANOVA analyses; statistically significant *($p < .05$); ns = not significant.

A repeated-measures analysis of variance (ANOVA) was performed to evaluate the differences in hemodynamic changes over time and between the three laryngoscope groups (Macintosh, McCoy, and King Vision). Mauchly's test of sphericity was violated for all variables ($p < .001$); therefore, Greenhouse–Geisser correction was applied. The analysis showed that The interaction effect between group and time was not statistically significant for heart rate ($p = .101$), systolic blood pressure ($p = .132$), diastolic blood pressure ($p = .427$), or mean arterial pressure ($p = .547$), indicating that the temporal pattern of hemodynamic response was similar across all three laryngoscope types. In contrast, the main effect of time was significant for all variables: heart rate ($p < .001$), systolic blood pressure ($p < .01$), diastolic blood pressure ($p < .001$), and mean arterial pressure ($p < .001$), demonstrating that each parameter increased significantly immediately after intubation and then gradually returned to baseline. Post-hoc pairwise comparisons using Bonferroni adjustment further confirmed a significant rise from baseline to 30 s and 1 min post-intubation for all variables ($p < .01$), with no significant differences at the 5-minute time point, indicating recovery across all groups. Collectively, these results show that while intubation produced the expected transient hemodynamic surge, the magnitude and pattern of the response did not differ between the Macintosh, McCoy, and King Vision laryngoscopes.

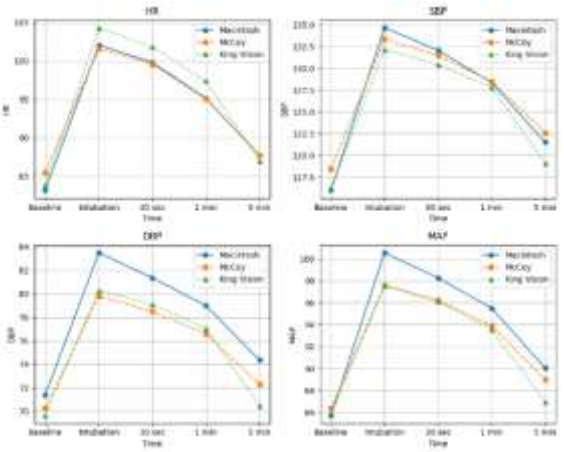

Figure 1: Panel-wise line plots showing changes in heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial pressure (MAP) following laryngoscopy and endotracheal intubation using Macintosh, McCoy, and King Vision laryngoscopes. All groups exhibited similar temporal trends with a peak at intubation and gradual return toward baseline, indicating a significant main effect of time without a significant group × time interaction.

DISCUSSION

The present study compared the hemodynamic stress response to endotracheal intubation using Macintosh, McCoy, and King Vision video laryngoscopes in adult patients undergoing elective surgery. The baseline characteristics were comparable across groups, ensuring that the differences in the observed physiologic responses were attributable to the intubation devices rather than patient-specific factors. A key finding was a significantly longer intubation time with the King Vision laryngoscope than with the Macintosh and McCoy blades, while the latter two had nearly identical intubation times. Despite differences in procedural duration, all three devices produced similar hemodynamic profiles, characterised by transient increases in heart rate and blood pressure immediately after intubation, which returned to baseline within 5 minutes.

The prolonged intubation duration associated with King Vision aligns with previous evidence indicating that hyperangulated video laryngoscopes may require additional time to deliver the endotracheal tube, despite improving the Cormack–Lehane grade of view.[14,15] Studies evaluating airway grading have shown that improved visualization does not necessarily translate into easier tube passage, as factors such as blade curvature and tube navigation may prolong the procedure.[21,22] In contrast, both the Macintosh and McCoy blades, which are based on the direct alignment of the oral, pharyngeal, and laryngeal axes, are familiar to clinicians and are consistently associated with shorter intubation times.[12]

Despite the King Vision requiring more time, this did not correspond to greater hemodynamic stress. This finding supports the concept that the force applied during laryngoscopy, rather than duration, is a primary determinant of sympathetic activation.[10,11,23] Video laryngoscopes exert less lifting force on the airway structures, which may counterbalance the increased procedural time and explain the comparable hemodynamic responses between the two groups. Buhari et al. similarly found no significant hemodynamic differences between Macintosh, McCoy, and C-MAC blades.[16] Sharma et al. reported that King Vision and Macintosh blades produced similar heart rate and blood pressure responses during intubation.[19]

Comparisons between Macintosh and McCoy in the earlier literature have shown mixed findings. McCoy's levering mechanism was designed to lift the epiglottis with reduced force, theoretically lowering stress responses; however, clinical studies have shown variable reductions in hemodynamic parameters.[12,24] Han et al. demonstrated that under controlled propofol–remifentanil anesthesia, McCoy did not significantly attenuate hemodynamic response compared with the Macintosh,[24] supporting the present results.

The hemodynamic trends observed—peaking immediately post-intubation and normalizing within minutes—are consistent with classical descriptions of sympathoadrenal discharge following laryngoscopy.[3,4] The absence of significant group-by-time interaction effects in this study indicates that none of the devices provoked a disproportionately

high response. These results align with the findings of Nandakumar et al., who reported similar hemodynamic trajectories among Macintosh, McCoy, and Glidescope laryngoscopes.[13] Moreover, recent evidence from Kim et al. confirms that C-MAC video laryngoscopy induces hemodynamic responses comparable to those of the Macintosh laryngoscope, reinforcing that modern video laryngoscopes do not consistently mitigate cardiovascular stimulation.[18]

The significant main time effect for all hemodynamic variables highlights the expected pressor response to airway manipulation, whereas the return to baseline at five minutes underscores its transient nature in healthy adults. A randomized study by Erdivanli et al. also demonstrated no significant hemodynamic disadvantage with the King Vision compared with the Macintosh,[25] further strengthening the current findings.

Overall, this study shows that although the King Vision laryngoscope requires a longer intubation duration, it does not confer a hemodynamic disadvantage. Macintosh and McCoy laryngoscopes remain efficient intubation tools with comparable cardiovascular profiles, supporting their continued widespread use. In hemodynamically stable patients, the choice of laryngoscope may be guided by airway visualization needs, operator familiarity, and clinical context rather than expected hemodynamic differences.

CONCLUSION

The Macintosh, McCoy, and King Vision video laryngoscopes produced comparable hemodynamic responses during laryngoscopy and endotracheal intubation in ASA I–II adults. Although the King Vision device required a significantly longer intubation time, it did not result in greater cardiovascular stimulation. All three laryngoscopes elicited the expected transient increases in heart rate and blood pressure, with values returning toward baseline within minutes. These findings indicate that in hemodynamically stable patients, the choice of laryngoscope may be guided by airway visualization needs and operator preference rather than anticipated hemodynamic effects.

REFERENCES

1. Alvarado AC, Panakos P. Endotracheal tube intubation techniques. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023.
2. Scott J, Baker PA. How did the Macintosh laryngoscope become so popular? Paediatr Anaesth. 2009;19 Suppl 1:24–9.
3. Swarnamba U, Veena K, Shaikh S. Comparison of lornoxicam and fentanyl in attenuating hemodynamic response to laryngoscopy and intubation. Anesth Essays Res. 2016;10(3):478–83.
4. Kil HK, Bishop MJ, Bedford RF. Physiologic and pathophysiologic responses to intutbation. Anesthesiol Clin North Am. 1995;13:361–75.
5. Kumar A, Seth A, Prakash S, Deganwa M, Gogia AR. Attenuation of hemodynamic response with fentanyl, lignocaine nebulization, and combination therapy. Anesth Essays Res. 2016;10:661–6.
6. Deo GP, Gautam S, Shrestha IN, et al. Hemodynamic responses to laryngoscopy and intubation using Macintosh, Miller, and McCoy blades. J Chitwan Med Coll. 2019;9(4):47–51.
7. Mahajan L, Kaur M, Gupta R, et al. Attenuation of pressor response with dexmedetomidine versus magnesium sulphate. Indian J Anaesth. 2018;62:337–43.
8. Gupta S, Tank P. Comparative study of esmolol and fentanyl in attenuating pressure response. Saudi J Anaesth. 2011;5:2–6.
9. Udupi S, Asranna K, Thimmaiah S, Mathew S. Hemodynamic response of lignocaine in laryngoscopy and intubation. Trends Anaesth Crit Care. 2020;32:33–8.
10. Tomori Z, Widdicombe JG. Reflexes from the upper airway. J Physiol. 1969;200(1):25–49.
11. Mu L, Sanders I. Sensory nerve supply of the human oro- and laryngopharynx. Anat Rec. 2000;258:406–20.
12. McCoy EP, Mirakhur RK, McCloskey BV. Stress response to laryngoscopy: Macintosh versus McCoy blade. Anaesthesia. 1995;50(11):943–6.
13. Nandakumar K, Bhalla A, Pandey R, et al. Comparison of Macintosh, McCoy, and Glidescope video laryngoscope in obese patients. Saudi J Anaesth. 2018;12:433–9.
14. Avula R, Vemuri N, Tallapragada R. A prospective study evaluating the efficacy of King Vision video laryngoscope. Anesth Essays Res. 2019;13:36–40.
15. Choudhary J, Barai A, Das S, Mukherjee N. Evaluation of glottic visualization using the King Vision video laryngoscope in limited glottic view. Indian J Anaesth. 2021;65:874–9.
16. Buhari FS, Selvaraj V. Hemodynamic response to intubation using McCoy, Macintosh, and C-MAC laryngoscopes. J Anaesthesiol Clin Pharmacol. 2016;32(4):505–9.
17. Sathyavathy K, Sunil R, Unwin L, James MM, NK N, Greeshma S. Ease of Intubation and Hemodynamic Response to Laryngoscopy and Endotracheal Intubation with Macintosh and Hugemed Video Laryngoscope. Eur J Cardiovasc Med. 2024;14(4):877–84
18. Kim HJ, Shin HY, Lee JH. Comparison of hemodynamic responses between C-MAC video laryngoscope and Macintosh in adults: a randomized trial. J Clin Anesth. 2021;68:110104.
19. Sharma B, Kumar M, Kumari P, et al. Hemodynamic changes during intubation using King Vision versus Macintosh laryngoscopes: a randomized study. J Anaesth Clin Pharmacol. 2022;38(2):258–64.
20. O'Leary AM, Sandison MR, Roberts KW. Mallampati revisited: 20 years on. Can J Anaesth. 2008;55(4):250–1.
21. Krage R, van Rijn C, van Groeningen D, et al. Cormack–Lehane classification revisited. Br J Anaesth. 2010;105:220–7.
22. Cook TM. A new practical classification of laryngeal view. Anaesthesia. 2000;55(3):274–9.
23. Shimoda O, Ikuta Y, Isayama S, Sakamoto M, Terasaki H. Skin vasomotor reflex induced by laryngoscopy: comparison of McCoy and Macintosh blades. Br J Anaesth. 1997;79:714–8.
24. Han TS, Kim JA, Park NG, et al. Hemodynamic effects of intubation with McCoy versus Macintosh blades under propofol–remifentanil anesthesia. Korean J Anesthesiol. 2009;56:387–91.
25. Erdivanli B, Sen A, Batcik S, Koyuncu T, Kazdal H. King Vision video laryngoscope versus Macintosh: a randomized controlled trial. Braz J Anesthesiol. 2018;68:499–506.
26. Sezen Ö, Şimşek T, Şimşek AK, Arslan G, Saracoglu KT, Saracoglu A. Comparison of direct and indirect images and hemodynamic response of two different video laryngoscopes to tracheal intubation. BMC Anesthesiol. 2025 Feb 20;25(1):86. doi: 10.1186/s12871-025-02966-7.
27. Gayen D, Mandal S, Das D, Chakraborty S, Rahman S, Roy P, Mandal M. Comparison of Hemodynamic Responses to Orotracheal Intubation with Tuoren Video Laryngoscope and Macintosh Direct Laryngoscope in Adult Hypertensive Patients. Asian J Med Sci. 2024;15(11):46–52.