Research Article *Frontiers in Medical Case Reports, ISSN: 2582-8142*

DOI: http://dx.doi.org/10.47746/FMCR.2023.4102

Comparison of the Hemodynamic Effects of Intubation via Fastrach Laryngeal Mask Airway with Standard Direct Laryngoscopy in Hypertensive Patients

Gökhan Göktan[1] | Ayşe Ülgey[2]*

***Correspondence:** Ayşe Ülgey

Address: [1]Nevşehir Goverment Hospital Department of Anesthesiology and Reanimation, Kayseri/Turkey; [2]Erciyes University Medical Faculty Department of Anesthesiology and Reanimation, Kayseri/Turkey

e-mail ✉: aulgey@erciyes.edu.tr

Received: 30 November 2022; **Accepted:** 16 January 2023

ABSTRACT

Background/Aim: In this study, hemodynamic response and postoperative complications of intubation via laryngoscopy compared to laryngeal mask airway were investigated in hypertensive patients.

Materials and Methods: Following ethics committee approval, 120 ASA II-III patients (aged 18-65 years) with stage 1 or 2 hypertension who required endotracheal intubation in an elective surgery were randomly assigned into 2 groups. Group L (n = 60) was defined as the direct laryngoscopy in endotracheal intubation group, and Group F (n = 60) used the Fastrach LMA in endotracheal intubation. The HR, SAP, DAP, MAP and SpO_2 were recorded at baseline (after premedication by midazolam), after anesthesia induction (when no response was recorded to TOF stimulation), during intubation, and on minutes 0, 1, 2, 3, 4 and 5 after intubation. The patients were transferred to the recovery room after extubation. Patients were asked at the postoperative 30th minute whether they experienced a sore throat or hoarseness. To check pharyngolaryngeal morbidity, sore throat and hoarseness were assessed by a 4-point scale.

Results: Demographic characteristics were found to be similar in both groups. Thyromental and sternomental distance and difficulties in mask ventilation were found to be similar. It was found that time to intubation was significantly higher in group F. In group L, the HR, DAP and MAP values increased on minute 0 after intubation when compared to the baseline values and returned to baseline values within one minute. In group F, the HR, SAP, DAP and MAP decreased on minute 0 compared to the baseline. Postoperative morbidity was comparable between the groups. No significant difference was found in sore throat and hoarseness between the groups.

Conclusion: Intubation via LMA is more advantageous in alleviating hemodynamic responses. Intubation via direct laryngoscopy is a more rapid method when compared to intubation via LMA. There was no significant difference in upper respiratory tract morbidity between the groups.

Keywords: *Intubation, Hypertension, LMA, Larengeal Mask, Arterial Pressure*

DOI: http://dx.doi.org/10.47746/FMCR.2023.4102

Introduction

Direct laryngoscopy and endotracheal intubations used in airway management induce hemodynamic changes (Barak *et al*., 2003). Laryngoscopy and tracheal intubation can cause tachycardia, intracranial pressure elevation, hypertension, arrhythmia, and, particularly in patients with limited reserves, myocardial ischemia by causing an elevated sympathoadrenal response and circulating catecholamine levels via stimulation of the supraglottic region (Shribman *et al*., 1987). Even transient hyperdynamic responses can lead to serious complications in patients with symptomatic aortic aneurysm, recent myocardial infarction, cerebral aneurysm or intracranial hypertension (Thomson, 1989).

The incidence of such problems can be decreased by using alternative devices such as fiberoptic bronchoscope, light wand and laryngeal masks (LMA). Intubation using LMA is introduced as a device facilitating intubation without using a laryngoscopy (Brimacombe *et al*., 1992; Friedman *et al*., 1997), and it is proposed that it is less of a stimulant compared to intubation via direct laryngoscopy. In this study, we compared the effects of intubation using Fastrach (LMA) with a standard direct laryngoscopy on hemodynamic response and postoperative respiratory complications.

Materials and Methods

The study was approved by the Ethics Committee of the University (approval: 2017/375; 07.07.2017). The study was conducted in accordance with the principles outlined in the Declaration of Helsinki and written informed consents were obtained from all participants. The study included 120 ASA class II-III patients (aged 18-65 years) who had stage I or II hypertension. The patients were assigned into two groups. Patients with stage III or higher hypertension, those with respiratory or central nervous system disorders, those with a history of difficult intubation, patients with a mouth opening <2 cm, pregnant women, patients with gastroesophageal reflux disease or delayed gastric emptying, morbidly obese patients and those with difficulty in cooperation (demans, mental retardation etc.) were excluded.

Before surgery, the standard fasting time was confirmed and thyromental distance (TMD), sternomental distance (SMD) and Mallampati gradings were recorded. An intravenous line was inserted at the antecubital region or dorsum of the hand using a 20 G cannula, and normal saline (2 ml/kg/hour) was initiated in the waiting room before surgery. In all patients, midazolam (IV, 2 mg) was given for premedication.

DOI: http://dx.doi.org/10.47746/FMCR.2023.4102

After transferring to the operation theatre, the patients were placed at the supine position and were monitored according to ASA standard monitoring practices, including electrocardiography (lead DII), heart rate, non-invasive systolic arterial pressure (SAP), diastolic arterial pressure (DAP), mean arterial pressure (MAP) and peripheral oxygen saturation (SpO_2). Before intubation, pre-oxygenation (100% oxygen over 3-4 minutes) was performed and the patients were randomly assigned into two groups: group L (n = 60), underwent intubation via laryngoscopy, and group F (n = 60) underwent intubation via LMA-Fastrach. In both groups, anesthesia induction was achieved using an intravenous propofol (2 mg/kg), fentanyl (1 μg/kg) and rocuronium (0.6 mg/kg). Ventilation was maintained via a mask until TOF (Train-of-four) reached 0.

The difficulty in mask ventilation was classified as follows:

1. Mild (requiring no Guedel airway)

2. Moderate (requiring Guedel airway)

3. Difficult (requiring Guedel airway and jaw thrust)

4. Failure (requiring advanced airway management)

When TOF was 0, endotracheal intubation was performed via direct laryngoscopy in group L and LMA-Fastrach in group F. In both groups, the number of intubation attempts and time to successful intubation were recorded. The intubation time in group L was recorded as the time from blade insertion into the mouth, to tube passage across vocal cords. Whereas in group F time was measured from insertion of Fastrach into the mouth to the point where it was removed from the mouth after intubation. It was intended to exclude cases in which intubation failed after three attempts. In both groups, the intubation tube cuffs were inflated there was no air leakage.

In both groups, anesthesia was maintained using a 50% O_2: 50% N20 mixture and 2-3% sevoflurane. HR, SAP, DAP, MAP, and SpO_2 were measured at baseline (after premedication), before induction and on minutes 0, 1, 2, 3, 4, and 5 after intubation. In all patients, intravenous morphine (0.05 mg/kg) was given 5 minutes before withdrawing anesthetic agents. Anesthetic gases were stopped 5 minutes before completing surgery and 100% oxygen was given in all patients. When TOF was >2 and PTC (posttetanic count) was >15, muscle relaxation was reversed by neostigmine (0.04 mg/kg and atropine 0.02 mg/kg).

DOI: http://dx.doi.org/10.47746/FMCR.2023.4102

The patients were transferred to the postoperative recovery unit. Sore throat and hoarseness was assessed on minute 30 after surgery. They were rated using a 4-points scale for pharyngolaryngeal morbidity control (Table 1).

Table 1: The Sore throat and hoarseness scale.

	Sore Throat	Hoarseness
1. Degree	None	None
2. Degree	Less than the common cold	Feel sick
3. Degree	Like the common cold	Feel sick and listener
4. Degree	Very severe	severe, aphonic

Data were analyzed using the SPSS version 22.0. The Chi-square test was used to assess binominal data and the Shapiro-Wilk test was used to assess normal distribution of numeric data. The Mann Whitney U test was used to assess non-parametrical data whereas the paired-sample t test was used to assess parametrical variables. A p value <0.05 was considered as statistically significant.

Results

There were no differences between the groups in term of age, gender, ASA classification and BMI (Table 2).

Table 2: Demographic data and ASA classes in the groups.

	Group L (n:60)	Group F (n:60)	*p**
Age (yrs)	59.37 ± 9.30	59.27 ± 11.63	0.873
Female	39 (65%)	41 (68.3%)	0.702
Male	21 (35%)	19 (31.7%)	0.71
ASA II	44 (73%)	47 (78.3%)	0.512
ASA III	16 (26.7%)	13 (21.7%)	543
BMI (kg/m^2)	27.70 ± 4.06	27.40 ± 4.25	0.612
*Mann Whitney U Test			

There were no significant differences in ventilation difficulty, TMD, SMD, Mallampati grade, sore throat and hoarseness between groups. However, it was found that intubation time and number of intubation attempts were significantly lower in group L (Table 3).

DOI: http://dx.doi.org/10.47746/FMCR.2023.4102

Table 3: Ventilation difficulty, sore throat, hoarseness, SMD, TMD and Mallampati scores in the groups.

		Group L (n:60)	Group F (n:60)	*P values*
Ventilation difficulty	Mild	33 (55%)	36 (60%)	*p:0.85*
	Moderate	25 (41.7%)	22 (36.7%)	
	Severe	2 (3.3%)	2 (3.3%)	
Sore throat	None	45 (75%)	49 (81.7%)	*p:0.67*
	Less than the common cold	10 (16.7%)	7 (11.7%)	
	Like the common cold	5 (8.3%)	4 (6.7%)	
Hoarseness	None	50 (83.3%)	54 (90%)	*p:0.20*
	Feel sick	7 (11.7%)	6 (10%)	
	Feel sick and listener	3 (5%)	0 (0%)	
SMD (cm)		13.54 ± 1.15	13.90 ± 1.18	*p:0.174*
TMD (cm)		7.52 ± 0.89	7.62 ± 0.75	*p:0.332*
Mallampati	1	40 (66.7%)	42 (70%)	*p:0.9*
	2	15 (25.0%)	13 (21.7%)	
	3	5 (8.3%)	5 (8.3%)	
Number of intubation attempts	1	56 (93.3%)	44 (73.3%)	*p:0.009*
	2	3 (5%)	14 (23.3%)	
	3	1 (1.7%)	2 (3.3%)	
Intubation time		12.22 ± 3.83	58.30 ± 14.35	*p:<0.001*

It was found that HR was lower in group F than in group L at all time points. Increased HR as a hemodynamic response to endotracheal intubation was significantly less frequent in group F compared to group L (Fig. 1). It was found that heart rate was increased by 4.64 % after intubation in group L however, no such increase was detected in group F. Rather, a decrease by 0.20 % was recorded.

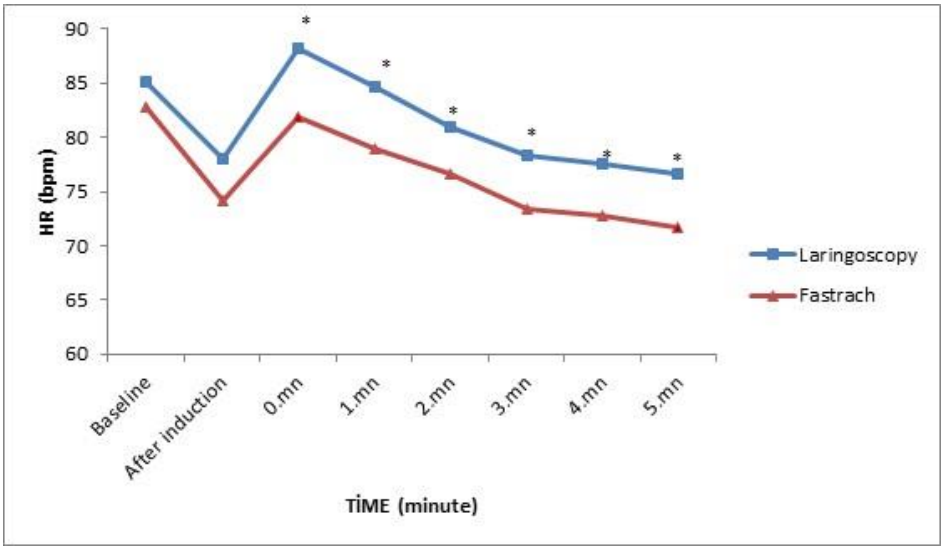

Figure 1: HR values in the groups. (* p<0.05)

DOI: http://dx.doi.org/10.47746/FMCR.2023.4102

The SAP values were found to be lower in group F compared to group L at all time points other than the baseline. However, no significant difference was detected between group L and F in mean SAP values for all time points other than postoperative minute 5 ($p>0.05$). The reduction in SAP compared to baseline values was significantly higher in group F compared to group L. The SAP decreased by 2.22% in group L and by 13.76% in group F when compared to the baseline (Fig. 2).

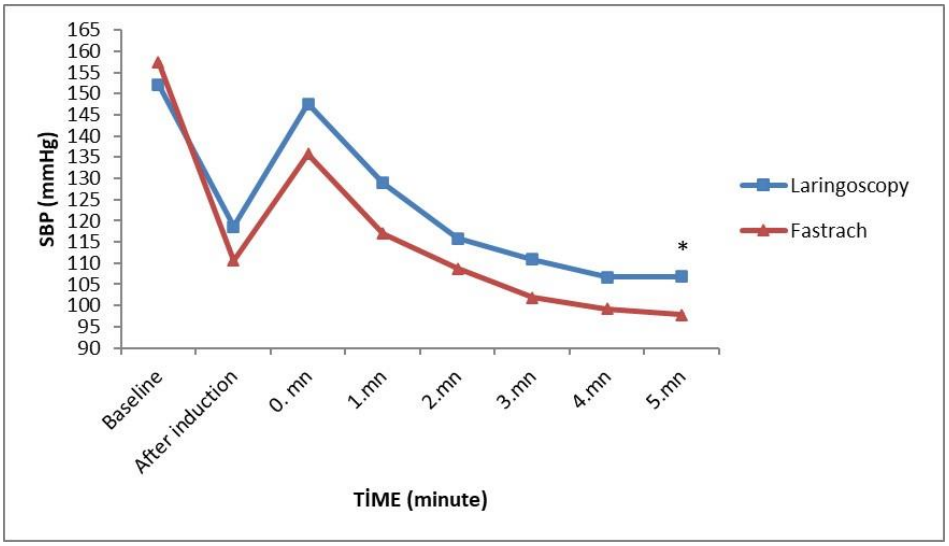

Figure 2: Systolic arterial pressure values in the groups. (* $p<0.05$)

The DAP values were found to be lower in group F compared to group L at all time points other than the baseline. The difference was found to be significant for measurements on minute 0 and 5 after intubation ($p<0.05$) (Fig. 3).

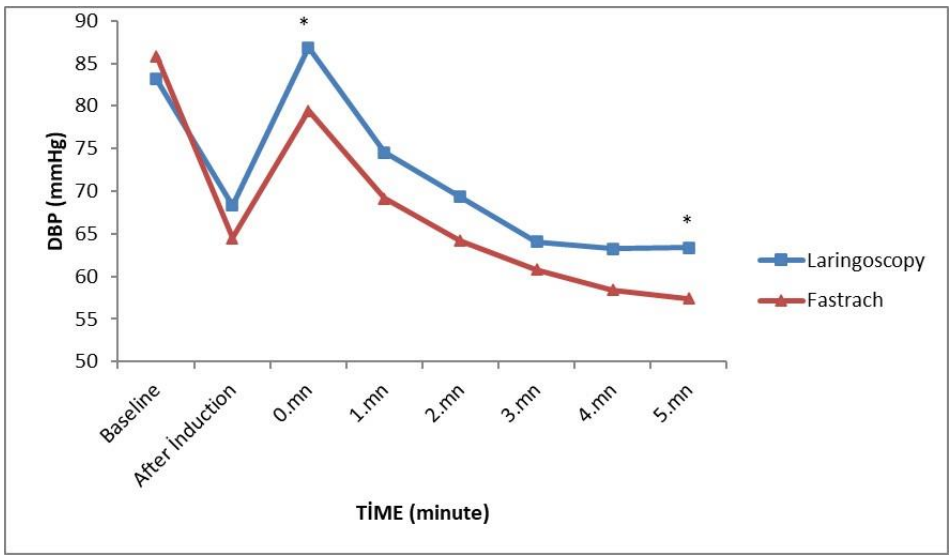

Figure 3: Diastolic arterial pressure values in the groups. (* $p<0.05$)

DOI: http://dx.doi.org/10.47746/FMCR.2023.4102

The DAP decreased by 6.44% in group L while it decreased by 6.54% in group F when compared to the baseline.

Discussion

This study shows that endotracheal intubation via LMA-Fastrach resulted in a lower hemodynamic response when compared to direct laryngoscopy.

Although there are many studies comparing the post-procedure hemodynamic effects of LMA Fastract-mediated endotracheal intubation and classical direct laryngoscopy in normotensive patients, studies comparing them in hypertensive patients are limited.

In normotensive patients, Zhang, *et al*. (2006) found no significant difference in hemodynamic response in their study comparing orotracheal intubation vial LMA-Fastrach and direct laryngoscopy. It was reported that heart rate increased above baseline values in both groups, and the 1st minute HR increased above the baseline values in the LMA-Fastrach group. Authors suggested that LMA-Fastrach caused stimulation similar to laryngoscopy at peri-laryngeal structures during both insertion and removal (Zhang *et al*., 2006). Another study compared hemodynamic response and upper respiratory tract morbidity between orotracheal intubation via LMA-Fastrach and direct laryngoscopy (Kavitha *et al*., 2011). No significant difference was found in hemodynamic response to orotracheal intubation between groups (Kavitha *et al*., 2011).

Sener, *et al*. (2012) compared hemodynamic effects of intubation via direct laryngoscopy and LMA-Fastrach in hypertensive patients. Authors reported that there was no decrease in hemodynamic response in the LMA-Fastrach group compared to the direct laryngoscopy group and there was no difference between the groups in terms of upper airway morbidity.

Joo and Rose compared effects of blinded intubation via LMA-Fastrach, intubation via fiberoptic-assisted LMA-Fastrach and endotracheal intubation via direct laryngoscopy on hemodynamic response and postoperative morbidity. The authors found comparable success rates among groups. However, they found that MAP was higher in the direct laryngoscopy group. The authors concluded that LMA-Fastrach could be used as the primary airway for oxygenation and ventilation, comprising an alternative to intubation via direct laryngoscopy (Joo and Rose, 1999).

In another study, the hemodynamic effects of intubation via LMA-Ctrach and direct laryngoscopy were evaluated. The authors found that the increases in HR and SAP after intubation were significantly

greater in the direct laryngoscopy group, emphasizing that LMA can be advantageous in minimizing hemodynamic response to endotracheal intubation in normotensive patients (Yadav *et al*., 2014).

Bharti and Naik (2006), evaluated effects of intubation via direct laryngoscopy with LMA-Fastrach on hemodynamic response in 80 normotensive patients. The authors observed significant increases in SAP, DAP and MAP after intubation in the direct laryngoscopy group. In our study, a decrease in SAP was observed in the direct laryngoscopy group and a significant increase in the value of HR was observed

Siddiqui and Khan (2007), randomly assigned 100 ASA I-II patients into two groups and compared hemodynamic effects of intubation via direct laryngoscopy and LMA-Fastrach. The SAP, DAP and MAP values on minute 1 after intubations were found to be lower than the baseline in the LMA group, while they remained above baseline values in the direct laryngoscopy group. In our study, SAP values after intubation did not exceed baseline values in both groups, and MAP and DAP were found to be similar in both groups.

Rastogi, *et al*. (2015) refers randomly assigned 80 ASA I-II patients (aged 18-60 years) into two groups and compared the hemodynamic effects of intubation using a Macintosh blade and LMA-Fastrach. The study showed that LMA was advantageous in relieving hemodynamic effects and maintaining ventilation until intubation was achieved, despite being more time-consuming and requiring an increased number of attempts. We also found similar results in our study.

There are also studies stating that the LMA-Fastrach method creates more hemodynamic responses during endotracheal intubation. Choyce, *et al*. (2002) refers compared the hemodynamic responses to intubation via direct laryngoscopy and LMA-Fastrach in normotensive patients and reported that there was an increase in HR and blood pressure in both groups. However, LMA-Fastrach caused a second increase during removal and the authors concluded that direct laryngoscopy was superior.

In a study on 500 patients with ASA I-II physical status, it was reported that a second increase in hemodynamic response, similar to reported by Choyce, *et al*. (2002) can be avoid by the neutral position of the head-neck with an appropriately sized LMA-Fastrach (Baskett *et al*., 1998).

LMA-Fastrach is designed to allow insertion during the neutral position of the patient's head. In our study, we observed hemodynamic effects differing from those reported by Zhang, *et al*. (2006). After endotracheal intubation, the HR value increased above the baseline value in only group L. The difference observed on minute 0 after intubation was found as significant in group L. Regarding blood pressure values, DAP and MAP increased above the baseline values only in group L.

DOI: http://dx.doi.org/10.47746/FMCR.2023.4102

In a study on patients that underwent coronary artery surgery, stress response to intubation was compared between direct laryngoscopy and LMA. In both groups, blood pressure and plasma catecholamine concentrations were significantly decreased following anesthesia induction. The decreases in patients intubated using LMAs were found to be more prominent than those that underwent intubation via direct laryngoscopy. The authors reported that intubation via laryngeal mask is more beneficial in reducing cardiovascular and endocrine stress responses and advantageous in high-risk cardiac patients (Kahl *et al*., 2004).

Kihara, *et al*. (2000) randomly assigned 150 normotensive and hypertensive patients in groups with 25 patients in each group and compared hemodynamic response to direct laryngoscopy, light wand and LMA-Fastrach. The authors observed no significant difference in normotensive patients while a decreased hemodynamic stress response to LMA-Fastrach in hypertensive patients was seen. In our study in hypertensive patients, it was shown that LMA-Fastrach is more advantageous regarding hemodynamic responses in these patient groups.

In several studies, intubation times were found to be significantly higher in LMA-Fastrach when compared to direct laryngoscopy in agreement with our study (Kihara *et al*., 2000; Sener *et al*., 2012; Kihara *et al*., 2001; Cırık *et al*., 2019). This is due to the fact that intubation using LMA-Fastrach involves 3 steps including insertion and confirmation of Fastrach position, insertion and confirmation of the endotracheal tube, and removal of the Fastrach.

In studies by Kihara, Kavitha and Joe, it was reported that there was no significant difference in pharyngolaryngeal morbidity between intubation using direct laryngoscopy or LMA-Fastrach. In our study, there was no statistically significant difference between the two groups either (Kihara *et al*., 2000; Joo and Rose, 1999; Kavitha *et al*., 2011; Kihara *et al*., 2001).

Conclusion

In conclusion, it was seen that endotracheal intubation via LMA-Fastrach results in less hemodynamic responses without an increase in airway morbidity in hypertensive patients. Thus, it may be a good alternative to endotracheal intubation via direct laryngoscopy.

Conflicts of Interest: The authors have no conflicts of interest to declare.

Informed Consent: Ethical approval for this study was obtained from Faculty Ethics Committee. Informed consent forms were obtained from the patients before the study.

DOI: http://dx.doi.org/10.47746/FMCR.2023.4102

References

Barak M, Ziser A, Greenberg A, Lischinsky S, Rosenberg B. Hemodynamic and catecholamine response to tracheal intubation: direct laryngoscopy compared with fiberoptic intubation. *J Clin Anesth* 2003; 15: 132-136.

Baskett PJ, Parr MJ, Nolan JP. The intubating laryngeal mask. Results of a multicentre trial with experience of 500 cases. *Anaesthesia* 1998; 53: 1174-1179

Bharti N, Naik AK. Ease of insertion and haemodynamic effects following tracheal intubation using Intubating Laryngeal Mask Airway: A comparison with conventional Macintosh laryngoscope. *Indian J Anaesth* 2006; 50: 205-208

Brimacombe J, Newell S, Swainston R, Thompson J. A potential new technique for awake fibreoptic bronchoscopy--use of the laryngeal mask airway. *Med J Aust* 1992; 156: 876-877.

Choyce A, Avidan MS, Harvey A, Patel C, Timberlake C, Sarang K, Tilbrook L. The cardiovascular response to insertion of the intubating laryngeal mask airway. *Anaesthesia* 2002; 57: 330-333.

Cırık MO, Baldemir R, Avcı S, Tezel H, Aldemir MT. Comparison of fastrach LMA and ILMA methods for airway management. *A Epidemiol Public Health* 2019; 2: 1006.

Friedman PG, Rosenberg MK, Lebenbom-Mansour M. A comparison of light wand and suspension laryngoscopic intubation techniques in outpatients. *Anesth Analg* 1997; 85: 578-582

Joo HS, Rose DK. The intubating laryngeal mask airway with and without fiberoptic guidance. *Anesth Analg* 1999; 88: 662-666.

Kahl M, Eberhart LH, Behnke H, Sänger S, Schwarz U, Vogt S, Moosdorf R, Wulf H, Geldner G. Stress response to tracheal intubation in patients undergoing coronary artery surgery: direct laryngoscopy versus an intubating laryngeal mask airway. *J Cardiothorac Vasc Anesth* 2004; 18: 275-280.

Kavitha J, Tripathy DK, Mishra SK, Mishra G, Chandrasekhar LJ, Ezhilarasu P. Intubating condition, hemodynamic parameters and upper airway morbidity: A comparison of intubating laryngeal mask airway with standard direct laryngoscopy. *Anesth Essays Res* 2011; 5: 48-56.

Kihara S, Watanabe S, Taguchi N, Suga A, Brimacombe JR. Tracheal intubation with the Macintosh laryngoscope versus intubating laryngeal mask airway in adults with normal airways. *Anaesth Intensive Care* 2000; 28: 281-286

Kihara S, Yaguchi Y, Brimacombe J, Watanabe S, Taguchi N. Routine use of the intubating laryngeal mask airway results in increased upper airway morbidity. *Can J Anaesth* 2001; 48: 604-608

Rastogi B, Singh VP, Gandhi A, Jain M, Gupta K, Singh M, Majid W, Sharma D. Comparative evaluation of hemodynamic response with intubating laryngeal mask airway and intubation with Macintosh Blade–A prospective study. *Glob Anaesth Perioper Med* 2015; 1: 34-39.

DOI: http://dx.doi.org/10.47746/FMCR.2023.4102

Sener EB, Ustun E, Ustun B, Sarihasan B. Hemodynamic responses and upper airway morbidity following tracheal intubation in patients with hypertension: conventional laryngoscopy versus an intubating laryngeal mask airway. *Clinics (Sao Paulo)* 2012; 67: 49-54.

Shribman AJ, Smith G, Achola KJ. Cardiovascular and catecholamine responses to laryngoscopy with and without tracheal intubation. *Br J Anaesth* 1987; 59: 295-299.

Siddiqui NT, Khan FH. Haemodynamic response to tracheal intubation via intubating laryngeal mask airway versus direct laryngoscopic tracheal intubation. *J Pak Med Assoc* 2007; 57: 11-14.

Thomson IR. The haemodynamic response to intubation: a perspective. *Can J Anaesth* 1989; 36: 367-369.

Yadav D, Mohammed S, Sharma UD, Karnawat R, Biyani G. Comparison of intubation by LMA CTrach vs Intubation by direct laryngoscopy in patient with normal airway. *Indian J Clin Anaesth* 2014; 1: 4-12.

Zhang G, Xue F, Sun H. Comparative study of hemodynamic responses to orotracheal intubation with intubating laryngeal mask airway. *Chin Med J*. Zhongguo Yi Xue Ke Xue Yuan Xue Bao. 2006; 28: 406-409.