ORIGINAL RESEARCH PAPER

Volume - 10 | Issue - 06 | June - 2021 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

A COMPARATIVE STUDY OF CARDIOVASCULAR RESPONSE AND POSTOPERATIVE SORE THROAT INCIDENCE IN LARYNGEAL MASK AIRWAY AND ENDOTRACHEAL INTUBATION

Anaesthesiology

Dr. Abhishek	DNB, Department of Anaesthesia, Santokba Durlabhji Memorial Hospital cum Medical Research Institute, Jaipur, Rajasthan
Dr. Kiran Handa	Senior Consultant, Department of Anaesthesia, Santokba Durlabhji Memorial Hospital cum Medical Research Institute, Jaipur, Rajasthan
Dr. Ashish Pareek*	Consultant, Department of Anaesthesia, Santokba Durlabhji Memorial Hospital cum Medical Research Institute, Jaipur, Rajasthan.*Corresponding Author

ABSTRACT

Aim: Airway instrumentation with endotracheal intubation and laryngeal mask airway are associated with cardiovascular stress response and post operative sore throat. The aim of the present study was to compare the cardiovascular response and post operative sore throat incidences among laryngeal mask airway (LMA) versus endotracheal tube (ETT).

MATERIAL AND METHODS: The present study was conducted on 80 patients of 18-60 years of age. The patients were randomly divided in two groups and each of them received either ETT or LMA depending on the group. After intubating or inserting LMA patients were monitored for hemodynamics (SBP, DBP, MAP, HR) and the same vitals were monitored after extubating or LMA removal and post operative sore throat was also noted. Statistical analysis was done where p-value of <0.05 was considered to be statistically significant.

RESULTS: The baseline clinical hemodynamic variables were comparable in both groups with statistically no significant difference between both groups ($p>0.05$). Statistically significant ($p<0.05$) difference was found at T1, T2, T3, T5, T7, TE1, TE3, TE5 between both groups suggesting that increase in HR occurs more in group E. Similarly $p<0.05$ was found at T1, T2, TE1, TE3 which shows that increase in SBP was also more in group E. The mean DBP at T1 in group E was 86.3±4.1 mmHg and in group L was 83.8±5.4 mmHg ($p<0.001$). Similarly $p<0.05$ was found at T1, T2, TE1, TE3, TE5 which implies that increase in MAP occurs more in group E. The incidence of postoperative sore throat at 6 hours was statistically significant and more in group E.

CONCLUSION: It was observed that there was an increase in HR, SBP, DBP, MAP after intubation or LMA insertion and after extubation or LMA removal in both the groups but this increase was significantly more in group E. Postoperative sore throat was also present significantly more in group E.

KEYWORDS

Sore throat; endotracheal intubation; laryngeal mask airway; hemodynamic changes.

INTRODUCTION

Injuries to the airway are well-recognized complications of general anesthesia (GA). Sore throat had been rated as the eighth most adverse effect in the postoperative period following GA, which can contribute to postoperative morbidity and patient dissatisfaction. It is a common minor complaint after general anaesthesia affecting as many as 60% of patients.[1]

Several risk factors for postoperative sore throat due to an endotracheal tube (ETT) have been identified which include female gender, age, surgical site, use of nitrous oxide, and duration of surgery. Laryngeal mask airway (LMA), the most popular supraglottic airway device, is said to have a lower incidence of postoperative sore throat and voice problems though wide variations in their incidence are reported. In pediatric age group, the incidence of a sore throat between endotracheal intubation and LMA are not significant.

Increasingly the endotracheal tube (ETT) is being replaced by the laryngeal mask airway (LMA). The LMA is an effective method of airway management. It is easy to insert and is reusable. Once it has been properly positioned, it provides an incomplete seal around the laryngeal inlet, thereby leading to decreased contamination of the environment with anaesthetic gases.

Direct laryngoscopy and tracheal intubation are associated with increases in heart rate (HR) and blood pressure.[2,3] These stress responses are undesirable, particularly in patients with hypertension, myocardial ischaemia or cerebrovascular diseases.[4] Airway management using direct laryngoscope (DL) and endotracheal intubation are known to induce hemodynamic changes. The stress response to laryngoscope is well known to be centrally mediated sympathetic reflex, presumed that stretching of the laryngeal and pharyngeal tissue during laryngoscopy was the major cause of the hemodynamic response. DL produces marked short-term stress responses, with determined effect on the coronary and cerebral circulations in high-risk patients, particularly in those with systemic hypertension. Previous studies on circulatory effects of anesthesia in treated and untreated hypertensive patients observed that most of the patients experienced three periods of circulatory instability: during intubation, after tracheal intubation, and during the immediate period surrounding awakening as the release of endogenous catecholamines increases myocardial oxygen demand.

Several approaches have been used to suppress these responses, but none has been proved totally effective.[5] The laryngeal mask airway (LMA) was designed as an alternative to tracheal intubation to maintain a patent airway during anaesthesia with minimal morbidity.[6] The use of the LMA may be beneficial in overcoming the drawbacks of laryngoscopy and tracheal intubation, particularly the pressor stress responses.

The objectives of the present study were to study the haemodynamic changes like heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP) and mean arterial pressure (MAP) among LMA versus ETT and to study the severity of post operative sore throat among LMA verses ETT.

MATERIAL AND METHODS

The present prospective randomised control study was carried out at the Department of Anesthesiology at Santokba Durlabhji Memorial Hospital cum Medical Research Institute, Jaipur after taking approval from the Hospital Ethical Committee. The duration of the study was 14 months or till desired sample size is obtained, whichever is earlier from January 2019 to February 2020. The present study was conducted on 80 patients. Computer generated random number were used to allocate patients into 2 groups (www.Random.org)

Inclusion criteria:

1. Patients in the age group of 18-60 years of age.
2. Having ASA [American Society of Anaesthesiologists] grade I and II.
3. Patients who give informed written consent to be included in study.
4. Patients selected for elective surgery in whom either LMA or ETT is clinically indicated.

Exclusion criteria:

1. Age less than 18 years

2. Age more than 60 years
3. Having ASA [American Society of Anaesthesiologists] grade III and IV
4. Emergency patients
5. Patients with haemodynamic instability
6. Abdominal surgeries

All the enrolled patients were randomly allocated into 2 groups on basis of computer-generated randomization chart
1) Group E-40 patients undergoing endotracheal intubation
2) Group L-40 patients undergoing LMA insertion

A detailed pre-anaesthetic check-up (PAC) including history, physical examination and routine investigations necessary according to the age and clinical conditions was carried out in the patients and written informed consent was taken.

Anaesthetic technique
All patients in this study were induced by standard general anaesthesia technique followed by either endotracheal intubation or LMA insertion depending on the above 2 groups. On arrival in operation room pulse-oximeter, non-invasive blood pressure, electrocardiogram were applied and the patient's heart rate (HR) in beats per minute (bpm), systolic blood pressure (SBP) in millimetres of mercury (mmHg), diastolic blood pressure (DBP) in mmHg, mean arterial pressure (MAP) in mmHg and peripheral oxygen saturation (SpO2) were recorded as baseline data. After securing a peripheral intravenous line, infusion of Ringer lactate was started. Premedication was done with Inj. glycopyrrolate (0.004mg/kg), Inj. ondansetron (0.1mg/kg) and Inj. fentanyl (1μgm/kg) intravenously. Preoxygenation was done for 3 minutes, and anaesthesia was induced with Inj. propofol (2 mg/kg) and Inj. succinylcholine (1mg/kg) (succinylcholine was given SOS in L group of patients i.e., if airway is difficult).

After 1 minute of induction, patients in E group were intubated according the appropriate tube size and LMA was inserted in L group of patients. Confirmation of correct placement was done by auscultation and end tidal CO_2 ($ETCO_2$). Anaesthesia was maintained using 50% nitrous oxide (N_20)/air and 50% Oxygen(O_2).

HR, SBP, DBP and MAP were recorded at-
T0 - Baseline(before premedication)
T1 - 1 Minute after intubation/LMA insertion
T2 - 2 Minutes after intubation/LMA insertion
T3 - 3 Minutes after intubation/LMA insertion
T5 - 5 Minutes after intubation/LMA insertion
T7 - 7 Minutes after intubation/LMA insertion
T10 - 10 Minutes after intubation/LMA insertion
T15 - 15 Minutes after intubation/LMA insertion
TE0 - Immediately before extubation/LMA removal
TE1 - 1 Minute after extubation/LMA removal
TE3 - 3 Minutes after extubation/LMA removal
TE5 - 5 Minutes after extubation/LMA removal

During the study, the occurrence of hypotension (fall in SBP >20% from baseline), hypertension (rise in SBP >20% from baseline), bradycardia (fall in HR >20% from baseline), tachycardia (rise in HR >20% of baseline), arrhythmias, and ST-T changes were noted and treated.

Both groups of patients were asked about complaints of sore throat 6 hours and 12 hours after full recovery from anaesthesia. All data thus collected was recorded on a predesigned study proforma

Statistical analysis
- Continuous variables were summarised as mean and standard deviation and were analysed by using paired and unpaired T test.
- Nominal/categorical variables were expressed as proportion and were analysed by using Chi square test/Fisher exact test.
- P-value <0.05 will be taken significant.
- Medcalc 16.4 version software was used for all statistical calculations.

RESULTS
Table 1 shows age distribution of study subjects with a p=0.690 which denotes that age distribution is not statistically significant. Table 2 shows gender distribution of study subjects with a p=0.823 which denotes that gender distribution is not statistically significant. Table 3 compares the mean weight among study group with p=0.062 which denotes that weight distribution is not statistically significant. Table 4 shows distribution of study subjects according to ASA grade with a p=0.116 which denotes that ASA grading distribution is not statistically significant. Table 5 compares the baseline hemodynamic parameters among study groups including HR, SBP, DBP, MAP all having p>0.05 indicating the difference between baseline parameters among 2 groups is not statistically significant.

Graph 1 compares the mean heart rate at specified intervals and it is observed that the difference is statistically significant at T1, T2, T3, T5, T7, TE1, TE3, TE5. Graph 2 compares the mean SBP at specified intervals and it is observed that the difference is statistically significant at T1, T2, TE1, TE3. Graph 3 compares the mean DBP at specified intervals and it is observed that the difference is statistically significant at T1. Graph 4 compares the mean MAP at specified intervals and it is observed that the difference is statistically significant at T1, T2, TE1, TE3, Te5.

Table 6 compares the distribution of study subjects according to NRS score at 6 hours with a p-value=0.015 which shows statistically significant difference between 2 groups. Table 7 compares the distribution of study subjects according to NRS score at 12 hours with a p-value=1.000 which shows statistically insignificant difference between 2 groups.

DISCUSSION
Sore throat is among the most adverse effects during the postoperative period following GA which can lead to postoperative morbidity and dissatisfaction among the patients. Laryngeal mask airway, the most popular supraglottic airway device, is said to have a lower incidence of postoperative sore throat. Increasingly the endotracheal tube (ETT) is being replaced by the laryngeal mask airway (LMA).

Direct laryngoscopy and tracheal intubation are associated with increases in heart rate (HR) and blood pressure.[2,3] These stress responses are undesirable, particularly in patients with hypertension, myocardial ischaemia or cerebrovascular diseases.[4] The stress response to laryngoscope is well known to be centrally mediated sympathetic reflex, presumed that stretching of the laryngeal and pharyngeal tissue during laryngoscopy was the major cause of the hemodynamic response.

This study was designed to compare the cardiovascular response and postoperative sore throat incidence among LMA versus ETT. Eighty ASA physical status I and II patients in the age group of 18-60 years who were scheduled for elective surgeries were studied. The patients were randomly allocated into two groups of 40 each. Study group L was inserted LMA and study group E was inserted ETT.

Demographic Variables
All patients were between 18 to 60 years of age. Random allocation of the patients was done in two groups. Statistical analysis has demonstrated that the mean age of patients in group L was 35.88±9.53 years and in group E was 32.38±7.56 years respectively. There was no statistically significant difference between the groups with regard to age (p>0.05). Similarly there was no statistically significant difference in mean weight, height, gender, ASA status. This implies that the two groups were evenly matched with respect to age weight, height, gender, ASA status.

Effect on Hemodynamics
In the present study, baseline heart rate in group E was 71±6 bpm and in group L was 72.6±8.5 bpm. Baseline SBP in group E was 121.5±6 mmHg and in group L was 122.4±8.2 mmHg. Baseline DBP in group E was 76.7±5 mmHg and in group L was 78.5±6.1 mmHg. Baseline MAP in group E was 89.7±5.2 mmHg and in group L was 91.8±6.6 mmHg. The baseline clinical variables are comparable in both groups with statistically no significant difference between both groups (p>0.05).

Heart Rate (HR)
The mean HR at T1 in group E was 87.5±5.9 bpm and in group L was 79.2±8.6 bpm (p<0.001) and at TE1 in group E was 86.5±6.3 bpm and in group L was 79±8.4 bpm (p<0.001). Similarly p<0.05 was found at T1, T2, T3, T5, T7, TE1, TE3, TE5 which shows statistically significant difference between both groups. Thus we observed that increase in HR occurs in both the groups but more in group E.

Systolic Blood Pressure (SBP)

The mean SBP at T1 in group E was 136.8±4.9 mmHg and in group L was 130.2±7.8 mmHg (p<0.001) and at TE1 in group E was 132.9±4.8 mmHg and in group L was 127.4±7.2 mmHg (p<0.001). Similarly p<0.05 was found at T1, T2, TE1, TE3 which shows statistically significant difference between both groups. Thus we observed that increase in SBP occurs in both the groups but more in group E.

Diastolic Blood Pressure (DBP)

The mean DBP at T1 in group E was 86.3±4.1 mmHg and in group L was 83.8±5.4 mmHg (p<0.001) which shows statistically significant difference between both groups. Thus we observed that increase in DBP occurs in both the groups but more in group E.

Mean Arterial Pressure (MAP)

The mean MAP at T1 in group E was 102.3±4.5 mmHg and in group L was 97.7±5.9 mmHg (p<0.001) and at TE1 in group E was 99.1±4.5 mmHg and in group L was 95.5±5.4 mmHg (p<0.001). Similarly p<0.05 was found at T1, T2, TE1, TE3, TE5 which shows statistically significant difference between both groups. Thus we observed that increase in MAP occurs in both the groups but more in group E.

Postoperative Sore Throat

At 6 hours p=0.015 for comparison of sore throat between group E and L. Thus we observed that incidence of postoperative sore throat is statistically significant and more in group E. At 12 hours p=1.000 for comparison of sore throat between group E and L. Thus we observed that postoperative sore throat is statistically insignificant at 12 hours.

Similar to the present study Oczenski W et al., conducted a prospective, randomized, and controlled trial and found significant increases in HR (p<0.001), SBP, DBP, and MAP (P<0.01) in the ETT groups compared with the LMA group.[7] EJ Ali Peirovifar et al., conducted a randomized clinical trial and found out sore throat complication was observed in 40% and 5% of the patients in ETT and LMA groups respectively (p< 0.001).[8]

Splinter WM et al., conducted a randomized, single-blind study of 112 patients of age 3 to 12 years undergoing minor peripheral surgery.[9] The groups were similar, except that airway maintenance was either with a laryngeal mask airway (LMA) or Endotracheal tube (ETT). The overall incidence of sore throat was 9%.The difference between the groups (LMA 13% vs ETT 5%) was not statistically significant. All of the reported sore throats were rated as mild. In conclusion, postoperative sore throat after minor paediatric surgery is uncommon. If it does occur, it is mild and the incidence is unaffected by the choice of an LMA or ETT.

Edakkattil R et al., studied patients (ages of 10-79) who underwent head and neck surgeries by ETT intubation and LMA anaesthesia.[10] They concluded that the postoperative sore throat can be effectively reduced by LMA similar to the findings of the present study. The pain score and frequency of patients with pain in the LMA group was less than that of ETT group. No correlation of pain score with different cuff pressure and size of tube or mask could be evidenced.

Lin et al., concluded that the i-gel LMA has been reported to have lower incidence of post operative sore throat by numerous studies.[11] Dhanger et al., conducted a study and found that post operative sore throat after LMA insertion is common and essential steps should be taken to avoid it.[12] It was concluded that gargling with 2% lignocaine viscous solution effectively reduces the incidence as well as severity of postoperative sore throat without any adverse reactions.

Future larger scale multi-centre studies would be required to address the confounders above to better refine the findings, which is important as it could affect clinical practice, cost and patient outcomes.

Tables

Table 1: Age distribution of study subjects

Age group (in years)	Group E		Group L		Total	
	N	%	N	%	N	%
20-29	17	42.5	13	32.5	30	37.5
30-39	13	32.5	11	27.5	24	30
40-49	8	20	14	35	22	27.5
50-59	2	5	2	5	4	5
Total	**40**	**100**	**40**	**100**	**80**	**100**
Mean ±SD	32.38 ±7.56		35.88 ±9.53			

Chi-square = 2.336 with 3 degrees of freedom; P = 0.690 (NS)

Table 2: Gender distribution of study subjects

Gender	Group E		Group L		Total	
	N	%	N	%	N	%
Female	19	47.5	19	47.5	38	47.5
Male	21	52.5	21	52.5	42	52.5
Total	**40**	**100**	**40**	**100**	**80**	**100**
Chi-square = 0.050 with 1 degree of freedom; P = 0.823						

Table 3: Comparison of mean weight (Kg) among study groups

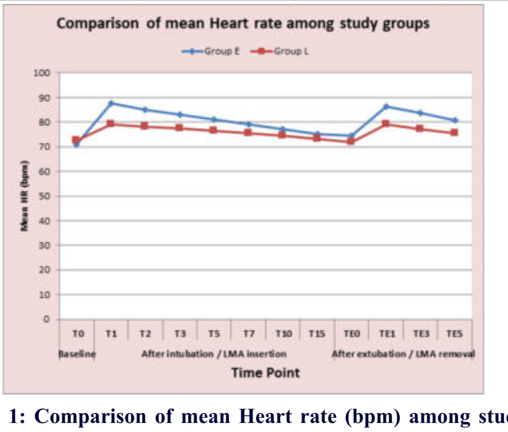
Group	N	Mean	Std. Deviation
Group E	40	64.1	5.7
Group L	40	66.6	6.1
t test = -1.892 ;at 78 degree of freedom; p = 0.062 (NS)			

Table 4: Distribution of study subjects according to ASA grade

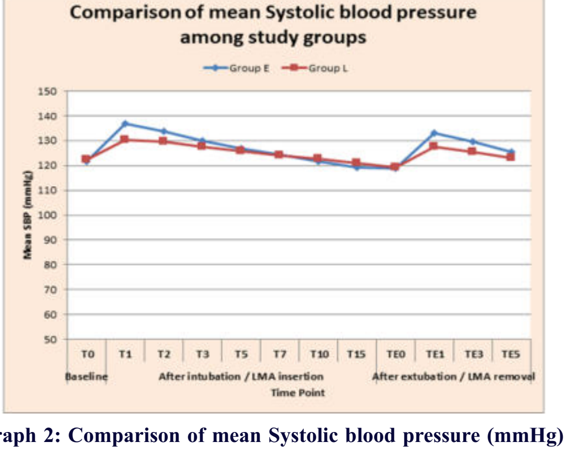
ASA grade	Group E		Group L		Total	
	N	%	N	%	N	%
ASA 1	40	100	36	90	76	95
ASA 2	0	0	4	10	4	5
Total	**40**	**100**	**40**	**100**	**80**	**100**
Fisher Exact Test -- P = 0.116 (NS)						

Table 5: Comparison of baseline hemodynamic parameters among study groups

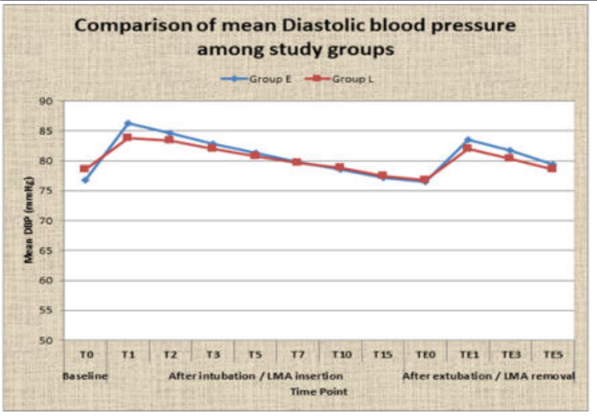
Parameters	Group E	Group L	P value
Heart rate (bpm)	71 ±6	72.6 ±8.5	0.319
SBP (mmHg)	121.5 ±6	122.4 ±8.2	0.565
DBP (mmHg)	76.7 ±5	78.5 ±6.1	0.153
MAP (mmHg)	89.7 ±5.2	91.8 ±6.6	0.113



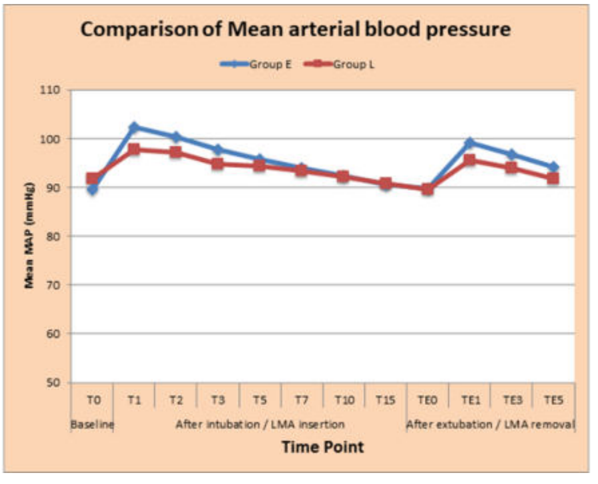
Graph 1: Comparison of mean Heart rate (bpm) among study groups



Graph 2: Comparison of mean Systolic blood pressure (mmHg) among study groups



Graph 3: Comparison of mean Diastolic blood pressure (mmHg) among study groups



Graph 4: Comparison of Mean arterial pressure (mmHg) among study groups

Table 6: Distribution of study subjects according to NRS score at 6 hours

NRS Score at 6 hrs	Group E		Group L		Total	
	N	%	N	%	N	%
0	27	67.5	36	90	63	78.8
1	0	0	2	5	2	2.5
2	2	5	2	5	4	5
3	3	7.5	0	0	3	3.8
4	5	12.5	0	0	5	6.2
5	3	7.5	0	0	3	3.8
Total	**40**	**100**	**40**	**100**	**80**	**100**
Chi-square = 14.286 with 5 degrees of freedom; P = 0.015 (S)						

Table 7: Distribution of study subjects according to NRS score at 12 hours

NRS Score at 12 hrs	Group E		Group L		Total	
	N	%	N	%	N	%
0	39	97.5	40	100	79	98.8
1	1	2.5	0	0	1	1.2
Total	**40**	**100**	**40**	**100**	**80**	**100**
Fisher Exact Test - P = 1.000						

CONCLUSION

On the basis of results derived in the present study, it can be concluded that endotracheal intubation and extubation is associated with more significant increase in heart rate, systolic blood pressure, diastolic blood pressure and mean arterial pressure as compared to laryngeal mask airway insertion and removal. It can also be concluded that there is significantly more incidence of sore throat in the postoperative period after general anaesthesia with endotracheal intubation as compared with laryngeal mask insertion. Therefore, avoiding endotracheal intubation wherever possible may be beneficial in some patients particularly in patients with hypertension, myocardial ischaemia or cerebrovascular diseases and laryngeal mask airway may provide better patient satisfaction in view of less post operative sore throat. However larger study should be conducted to derive final conclusion.

REFERENCES

1. Mandoe H, Nikolajsen L, Lintrup U, Jepsen D, Molgaard J. Sore throat after endotracheal intubalion. Anesth Analg 1992;72:897-900.
2. Watcha MF, Chu FC, Stevens JL, White PF. Intraocular pressure and hemodynamic changes following tracheal intubation in children. J Clin Anesth 1991;3:310–3.
3. Lamb K, James MFM, Janicki PK. The laryngeal mask airway for intraocular surgery: effects on intraocular pressure and stress responses. Br J Anaesth 1992; 69: 143–7.
4. Fox EJ, Sklar GS, Hill CH. Complications related to the pressure response to endotracheal intubation. Anesthesiology 1977;47:524–5.
5. Kovac AL. Controlling the hemodynamic response to laryngoscopy and endotracheal intubation. J Clin Anesth 1996;8:63–79.
6. Bein B, Scholz J. Supraglottic airway devices. Best Pract Res Clin Anaesthesiol 2005;19:581–93.
7. Oczenski W, Krenn H, Dahaba AA, Binder M, Schwarz S, Jellinek H et al. Hemodynamic and catecholamine stress responses to insertion of the combitube, laryngeal mask airway or tracheal intubation. Anesth Analg 1999;88:1389-94.
8. Peirovifar A, Eydi M, Mirinejhad MM, Mahmoodpoor A, Mohammadi A, Golzari SEJ. Comparison of postoperative complication between Laryngeal Mask Airway and endotracheal tube during low-flow anesthesia with controlled ventilation. Pak J Med Sci 2013;29(2):601-5.
9. Splinter WM, Smallman B, Rhine EJ, Komoca L. Postoperative sore throat in children and the laryngeal mask airway .Can J Anaesth 1994;41:1081-3.
10. Edakkattil R, Ajaya Kumar P. Postoperative sore throat in patients undergone head and neck surgeries under endotracheal intubation and laryngeal mask anaesthesia. Int J Otorhinolaryngol Head Neck Surg 2017;3(2):371-5.
11. Lin GJ, Lim YC, Wang J, Shahla S. An audit of post-operative sore throat using different laryngeal mask airways. Indian J Anaesth 2020;64:513-6.
12. Dhanger S, Vaidiyanathan B, Rajesh IJ, Tripathy DK. Comparison of the efficacy of lignocaine viscous gargle versus ketamine gargle for the prevention of post-operative sore throat after classic laryngeal mask airway insertion: A prospective randomised trial. Airway 2018;1:13-6.