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Laryngeal mask airway supreme versus endotracheal tube for elective breast surgeries under general anaesthesia-a randomised comparative study

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Abstract

Introduction: LMA has gained popularity as an alternative technique of airway management as compared to endotracheal tube as it is easier and faster to insert than the ETT and cause minimal trauma to the patient's airway.

Experimental approach: Total 60 patients scheduled for elective breast surgeries under general anaesthesia were randomly allocated into two groups (LMAS or ETT) comprising 30 each. Parameters like number of attempts, time taken for the insertion of device, haemodynamic response and postoperative complications like sore throat, dysphagia, neck pain etc. were compared between both the devices.

Major findings: Intubation at one attempt was found to be higher for the LMAS than ETT, mean time required for ETT insertion was 27.20 ± 2.33 sec which was significantly more than LMA insertion. Use of LMAS resulted in more haemodynamic stability, whereas post-operative complications were seen more with ETT than LMAS.

Conclusion: LMA supreme can be more safely and effectively used over ETT for breast surgery as it results in better peri-operative outcomes.

Keywords: Laryngeal mask airway supreme, insertion time, sorethroat, haemodynamic, attempts

Introduction

Airway management plays a pivotal role in practice of anaesthesia. Whatever the method used, it should be appropriate and safe, with minimal side effects. Over decades, endotracheal intubation has been the mainstay of airway management that has been routinely used for maintaining an open airway and allowing unobstructed breathing. However, use of ETT is associated with certain risks of laryngotracheal injury as this part of airway gets directly stimulated by this device [1, 2, 3, 4].

The Laryngeal mask airway designed by Dr. Archie J. Brain in 1981 and reported for the first time in medical literature on 1983 offers various advantages over the ETT, mainly in short to middle duration procedures [5]. LMA has gained popularity as it is easier and faster to insert than the ETT and cause minimal trauma to the patient's airway as it is positioned superior to the larynx [2, 6, 7].

Various previous studies reported that, LMA Supreme provides an added benefit of haemodynamic stability as it can be inserted blindly without the aid of laryngoscope and thus can be used as an alternative technique for airway management in patients undergoing breast surgeries as compared to endotracheal tube [8, 9, 10].

LMA Supreme developed in 2007 is a second generation, disposable supraglottic airway device made up of polyvinyl chloride, shaped at 90 degree angle to facilitate insertion. It has a gastric channel along the posterior midline to facilitate passage of gastric tube that functionally separates respiratory and digestive systems [11, 12, 13, 14, 15].

Several prospective and retrospective studies have compared LMA versus ETT and revealed that LMA offers enormous advantages over the ETT, specially in short to middle duration surgeries, but very few studies have compared use of LMAS with ETT in breast surgeries. Our hypothesis was, as breast surgeries are associated with less airway manipulation and reduced need for relaxation, so securing airway with LMA, a supraglottic device would result in more favourable outcomes over ETT. We conducted this randomized comparative

study to compare LMAS and ETT on the basis of rate of insertion, haemodynamic changes, perioperative complications.

The objective of the study was to determine the efficacy and clinical use of LMAS as compared to endotracheal intubation on the basis of various intraoperative and postoperative parameters in patients undergoing elective breast surgeries.

Other objectives were, to compare number of attempts required for insertion of devices, to compare the time taken for the insertion of device, to determine haemodynamic response to insertion like pulse rate, mean blood pressure and to see if there is any difference with respect to the postoperative complications like sore throat, dysphagia, neck pain etc. between both the devices

Material and Methods

This prospective randomized comparative study was conducted in the Department of Anaesthesiology, M.G.M Medical college and M.Y. Hospital, Indore after obtaining approval by institutional ethics committee over a duration of 12 months i.e. from august 2019 to Augusts 2020. We recruited adult patients between 20 to 70 years of age, with American Society of Anaesthesiologists physical status Grade I, II who were to undergo elective breast surgeries under general anaesthesia. Exclusion criteria were, Patient refusal, Obesity (Body mass index >35 kg/m²), mouth opening <2 fingers, with high risk for pulmonary aspiration, patients with failed insertion of LMA i.e. after 3 Attempts.

Patients were randomized into two groups using a shuffled deck of cards with even under group ETT and odd under group LMA. Airway was secured with LMA Supreme in group 1 whereas and with ETT in group 2. After obtaining their written informed consent, patients were premedicated with Inj. Midazolam 0.04mg/kg and Inj. Glycopyrrolate 0.004mg/kg intravenously in the preoperative room routine multipara monitor was attached in the operating theatre, showing SpO₂, heart rate (HR), non-invasive blood pressure, respiratory rate and ECG. Preoxygenation was done with 100% Oxygen for 3 min. Induction was done with Inj. Fentanyl 2microgm /kg, Inj. Propofol 2mg/kg and Inj. Succinylcholine 1.5mg/kg. After manual ventilation under face mask for 1 min. In patients under group 1, LMA Supreme was inserted after lubricating its posterior surface with water-soluble jelly and keeping the patients head in a semi-sniffing position. Cuff of the device was inflated and then the vitals were recorded. In Group 2, endotracheal tube was inserted with the help of laryngoscope and curved Macintosh Blade size 3 or 4. Number of attempts required for insertion of device, insertion time (time interval when the device was held in hands for insertion till its confirmation by first capnography curve) was noted. Haemodynamic response on device insertion was observed. Loading dose of vecuronium 0.08mg/kg was given. A circle anaesthesia breathing system was connected with tidal volume 6-8 ml/kg, RR 12-14 breaths/min. Effective ventilation was defined as a square wave capnograph trace with end-tidal CO₂ values ranging from 30-45 cmH₂O and thoracoabdominal movements. In case of failure after a maximum of three attempts in any group, patient was eliminated from study group and replaced by a new patient to make number of patients 30 each for statistical significance. Maintenance of anaesthesia was done with Oxygen, Nitrous oxide, Sevoflurane and neuromuscular

blockade with intermittent doses of Vecuronium 0.02mg/kg. Lungs were ventilated with volume controlled mechanical ventilation delivering anaesthesia machine with a closed circuit having CO₂ absorber. At the end of surgery neuromuscular blockade was reversed with I/V Inj. Glycopyrrolate 0.02mg/kg and Inj. Neostigmine 0.05mg/kg. After recovery of spontaneous ventilation, when the patient followed to the commands given, the device used was removed.

Complications like sore throat, dysphagia and Neck pain were assessed postoperatively in each patient every 12 hourly upto 24hrs of follow up and were managed with gargles in the recovery room.

Statistical analysis

Sample size calculation was based on the comparison of means of two independent groups. OPEN EPI software was used for calculating the sample size. By putting the means and standard deviations for two groups as per the previous study [1] the sample size obtained is 30 for each sample, i.e. sample 1 (n=30) and sample 2 (n=30) with a confidence interval of 95% and 80% power of the study. Observations were compared using Unpaired 't' test, Pearson Chi-square test and a proportional comparison between the two groups was done using Fisher's Exact test. Value of < 0.05 was taken as statistically significant.

Results: Both the groups were comparable with regard to demographic profile, i.e. age, sex, ASA physical status, weight and height.

The mean duration of anaesthesia between both the groups was not significant. (LMA: 74.80 ± 17.372min, ETT: 75.82 ± 15.11 min; p= 0.650).

Table 1: Comparison of Demographic Profile between both the groups

Parameters	LMA	ETT	p-value
No. of patients	30	30	
Age (yrs)	34.12± 10.12	39.62± 12.02	0.070
Gender (Male/Female)	6/24	7/32	
ASA class (I/II)	8/22	9/21	
BMI (kg/m ²)	20.02± 1.52	21.10± 1.50	0.850
Duration of anaesthesia	74.80± 17.32	75.82± 15.11	0.650

Table 2: Distribution of patients according to number of attempts

Number of Attempts	LMA Group		ETT Group	
	No.	%	No.	%
One attempt	26	86.66	25	83.3
Two attempts	4	13.3	5	16.7
Three attempts	0	0.0	0	0.0
Total	30	100.0	30	100.0

In LMA Group, in 26 (86.7%) patients intubation was done in one attempt, in 4 (13.3%) patients it was done in two attempts

In ETT Group, in 25 (83.3%) patients intubation was done in one attempt and in 5 (16.7%) patients it was done in two attempts. Three attempts for insertion was not required in either group.

Table 3: Comparison of mean insertion time

Group	Mean Insertion Time [Mean ± SD]	't' value	P value
LMA Group	21.00 ± 3.20	-5.909, df=58	0.002*
ETT Group	26.20 ± 2.33		

Unpaired 't' test applied. P value < 0.05 was taken as statistically significant

The above table shows the comparison of mean insertion time between the LMA and ETT groups.

The mean insertion time in the LMA group was 21.00 ± 3.20 seconds and in ETT group it was 26.20 ± 2.33 seconds. The difference was found to be statistically significant ($p=0.002$), showing a significantly higher mean insertion time in the ETT group.

Table 4: Comparison of Heart rate

Heart Rate (Mean)	LMA	ETT	't' Value	P value
Baseline	81.12 ± 9.02	81.84 ± 6	-0.316	0.622,NS
After Insertion	86.62 ± 9.62	94.24 ± 8.1	-3.144	0.003,S
After extubation	78.12 ± 7.5	80.5 ± 6.12	-2.12	0.028,S

The mean pre-operative pulse rate was 81.12 ± 9.02 bpm and 81.84 ± 6 in LMA and ETT group respectively which increased after insertion of the device and well as after extubation, in both the groups, but the mean pulse rate was significantly lower in the LMA group as compared to the ETT group ($p < 0.05$).

Table 5: Comparison of Mean blood pressure

MBP blood pressure	LMA	ETT	t value	P value
Baseline	88.63 ± 9.52	90 ± 5.62	-0.820	0.391
After Intubation	93.54 ± 3.96	98.72 ± 6.03	-3.20	0.002
After Extubation	88.07 ± 3.42	90.84 ± 4.64	-3.403	0.001

The MBP in LMA group at preoperative level was 88.63 ± 9.52 mm Hg, on the other hand it was 90 ± 5.62 in ETT group. After insertion and extubation of the device, the MBP increased in both the groups but the increase in mean MBP was significantly lower in the LMA group in comparison to the ETT group ($p < 0$).

Table 6: Distribution of patients on the basis of post-operative complications at 0 hrs

Complications	LMA	Percentage	ETT	Percentage
Sorethroat	2	6.7	7	23.3
Dysphagia	0	0	3	10
Neck Pain	1	3.3	4	23.3

Table 7: AT 12 hrs

Complications	LMA	Percentage	ETT	Percentage
Sorethroat	2	6.7	8	26.6
Dysphagia	0	0	3	10
Neck Pain	1	3.3	4	23.3

Table 8: At 24 hrs

Complications	LMA	Percentage	ETT	Percentage
Sorethroat	3	3.3	9	30
Dysphagia	0	0	3	6.6
Neck pain	0	0	5	23.3

Overall 4(13.3%) patients had any of the above mentioned adverse events during the whole of the study period in the LMA group, while in the ETT group 17(56.7%) patients had any of the above mentioned adverse events.

The proportional comparison was done using Fisher's exact test and p value obtained was equal to 0.007, which is statistically significant. This shows a significantly higher

proportion of adverse events in the ETT group in comparison to the LMA group.

Discussion

LMA Supreme can serve as a better alternative to endotracheal intubation in breast surgeries. Various studies are available about its applications but few articles have been published showing its comparison with ETT in the breast surgeries.

Our study was conducted to compare the LMA and the ETT in a cohort of 60 patients divided into 2 groups comprising 30 each, on the basis of various parameters in patients undergoing elective breast surgeries under general anaesthesia.

Both the groups were compared on the basis of similar parameters like demographic profile, no. of attempts taken for insertion of device, Haemodynamic variables (pulse rate and B.P) and post-operative complications.

Demographic profile was comparable between both the groups.

In our study, it was found that, the number of insertion attempts was higher for the LMA than for the ETT in first attempt. Insertion of the LMA was successful in 26 (86.7%) patients in one attempt, and in 4 (13.3%) patients it was done in two attempts.

In ETT Group, in 25 (83.3%) patients intubation was done in one attempt and in 5 (16.7%) patients it was done in two attempts.

In majority of the patients in both the groups, the intubation was done in 1 attempt.

The findings in our study is consistent with the findings of Hohlrieder *et al.* [16] who compared this parameter between LMA proseal and ETT in 100 patients undergoing breast and gynaecological surgeries.

Insertion time

In our study, the mean time required for the insertion of ETT was 26.20 ± 2.33 sec which was significantly more compared to time required for LMA supreme insertion which was 21.00 ± 3.20 sec ($p = 0.002$). Similar findings were seen in the study done by Singham *et al.* [1] and Mahmood HE *et al.* [17]

Haemodynamic changes

Our study demonstrated that there was a haemodynamic response consisting of an increase in HR and MAP associated with laryngoscopy and ETT and LMA during, insertion as well as extubation. The response produced by laryngoscopy with ETT insertion was significantly greater than that caused by LMA insertion.

Findings of our study were consistent with study conducted by Singham *et al.* [1] who reported that haemodynamic variables at baseline and before insertion were nearly similar in both the groups, however post insertion significantly increased values in HR and mean blood pressure was observed in the ETT group as compared to the LMA group. Similarly significant increase in haemodynamic variables was seen at extubation also.

In our study, we observed the patients postoperatively every 12 hourly for 24 hours and compared the complications like sore throat, dysphagia and Neck pain in both the groups and found that the incidence of postoperative complications was associated more with the ETT group as compared to the LMA group.

Overall 4(13.3%) patients had any of the above mentioned adverse events during the whole of the study period in the LMA group, while in the ETT group 17(56.7%) patients had any of the above mentioned adverse events showing a significantly higher proportion of adverse events was present in the ETT group as compared to the LMA group. Our findings were concordant with the findings of Abdi and colleagues^[14].

Possible limitations of the study is its small sample size, future studies are recommended in larger group of patients.

Conclusion

We conclude that LMA Supreme is easier to insert, requires lesser time for insertion and provides an added benefit of haemodynamic stability during both insertion and removal of device. Thus, LMA Supreme may be used as a suitable alternative to endotracheal intubation for airway control during general anaesthesia in breast surgeries.

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