Comparison of efficacy of the Laryngeal tube with the Laryngeal mask airway in securing the upper airway

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Abstract

Introduction: The descriptive study is to compare this new device, the Laryngeal tube airway with the Laryngeal mask airway in securing the upper airway during short surgical procedures under general anesthesia.

Methodology: After obtaining Institutional approval and written informed consent from all patients, 60 patients ASA I/II, aged 20-50 in this study. They were randomly classified into two groups, Group I (LT) and Group II (LMA).

Results: The first attempt success rate in securing the airway with LT was 80.0% and the success rate with LMA was 86.6%. The time taken for securing the airway with LT was 37.76 ± 5.27 and with LMA was 29.26 ± 4.22 sec

Conclusion: Laryngeal tube is superior to LMA in providing a better airway seal.

Keywords: Laryngeal mask airway, Laryngeal tube airway, Complications

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Introduction

The Laryngeal mask airway (LMA), a supraglottic airway device was introduced in 1991 for securing the upper airway in difficult intubation situations[1]. The Laryngeal tube airway (LT) is another supraglottic airway device introduced recently for maintaining the patency of the airway during short surgical procedures thus avoiding unnecessary tracheal intubation[2].

The foremost cause of anaesthesia related morbidity and mortality is due to difficulty in managing the airway. The incidence of intubation difficulties and failed intubation has been reported to be 3% and 0.5-2% respectively. In the event of loss of airway, it is of prime importance to re-establish it before the patient suffers and irreversible injury due to inadequate or compromised oxygenation[3,4]. Hence it is the primary responsibility of the anaesthesiologist to safeguard the airway during anaesthesia by use of airway adjuncts like LMA, LT etc.

The Laryngeal mast airway was invented by Dr.Archie Brain in the year 1981. In August 1991, it was approved by the US Food and Drug Administration. A new alternative to the LMA is the Laryngeal tube (VBM. Medizintechnik, Sulzam Neckar, Germany), which is a modification of the Oesophageal – tracheal combitube. LT was introduced in the European market in 1999[5].

Methodology

This study compares the efficacy of the Laryngeal tube airway and the Laryngeal mask airway (LMA) in securing the upper airway and also the incidence of gastric insufflations, upper airway trauma and post operative complications. After obtaining Institutional approval and written informed consent from all patients, 60 patients ASA I/II, aged 20-50 in this study. They were randomly classified into two groups, Group I (LT) and Group II (LMA). There was no difference between the two groups with respect to demographic and surgical data.

A standardized anaesthesia protocol was followed for all the patients.

1. Type of study : Prospective observational study.
2. LMA size used : Three
3. LT size used : Four, Five

Inclusion Criteria:

- Patients undergoing short elective surgeries under GA.
- ASA I & II
- MPC I & II
- Age between 20 and 50 years
- Weight between 40 and 70 kgs
- Height between 150 and 170 cms

Exclusion Criteria:

- Age less than 20 yrs and above 50 years
- ASA III, IV & V
- MPC III, IV
- Risk of gastric aspiration

- Pregnant patients.
- Morbidly obese
- Cardiovascular disease
- Hypertension
- Cervical spine disease
- Known difficult airway
- Mouth opening less than 2 finger breadths.
- URI/LRI
- Head and neck surgery
- Thoracic and upper abdominal surgery.
- Lateral position
- Pathology in mouth, pharynx and larynx.
- Increased intracranial tension.

During the preoperative visit, the selected patients were explained about the procedure, complications and purpose of the study and informed consent was obtained.

On the day of the surgery, all patients were premedicated in the morning 45 minutes before the scheduled time for surgery in the premedication room with inj. Pentazocine lactate 0.6mg/kg, Inj. Glycoprollate 0.01 mg/kg intramuscularly. Patients shifted inside the theatre and were connected to standard monitors like ECG, Pulse oximeter, Capnography and NIBP monitor before induction. Patients were randomly allocated to Group I (LT) and Group II (LMA). 10ml/kg isotonic saline was infused through 18 gauge cannula for all patients were induced with Inj.Propofol 2mg/kg intravenously followed by succinylcholine 2mg/kg IV. In patients who were successfully ventilated by facemask, the laryngeal tube or the laryngeal mask airway of appropriate size was introduced with the standard technique described above.

Successful placement of LT and LMA was judged based on chest wall movement, auscultation, and ETCO2 monitoring. If adequate ventilation was not possible, both the LMA and laryngeal tube were manipulated in situ before removal and reinsertion. When the airway was not established even after 3 attempts at insertion, the technique was considered failed. When an adequate airway was established, both the LT and LMA was fixed with bite blocker to prevent biting of the tube. Anaesthesia was maintained with oxygen, nitrous oxide and in halation agent halothane 0.5-1.5% titrated and spontaneous ventilation was continuously monitored.

If resistance was felt selected manoeuvres were followed including: up and down manoeuvre, raising the mask upwards, partial withdrawal, adjusting the head neck position, or adding air to the cuff. At the end of surgery, halothane and nitrous oxide was discontinued and patient allowed to breath 100% oxygen. Extubation was done when the patient responded to oral commands, presence of spontaneous eye opening and returning of adequate airway reflexes.

Rescue Measures: In the case of failed insertion, patient was intubated with appropriate size Endotracheal tube and ventilation maintained till spontaneous recovery. An emergency tray with cricothyrotomy set was kept available to manage difficult to ventilate situations.

Parameter studied: The following data were recorded; age, sex, height and weight of the patient, size of LT & LMA used, ease of intubations, time taken for securing the airway, number of attempts, gastric insufflation, cuff pressure, upper Airway trauma and post-operative complications like hoarseness of voice, sore throat, sore jaw, dysphagia, dysphonia and sore neck.

Ease if intubation score: Ease of intubation was assessed by recording the number of adjusting manoeuvre require to secure the airway.

1. Easy (immediate effective ventilation is possible)
2. Difficult (effective ventilation is possible only after adjustment of the position of tube either pushing in or pulling out).
3. Impossible (effective ventilation is not possible and tracheal intubation performed).

Time taken for intubation: Calculated from the loss of eyelash reflex to delivery of the first tidal lung volume.
Cuff Pressure: Cuff pressure of both the laryngeal tube airway and the laryngeal mask airway was measured with the help of the pressure gauge.
Upper airway trauma: Assessed by looking for, blood staining after removal of the tube and minor tongue/ lip / dental trauma.
Post-operative complication: Enquiring the patient for sore throat, dysphagia, dysphonia, hoarseness of voice, soreneck, sore jaw 18-24 hrs postoperatively.
Failure to intubate: Defined as inability to place the laryngeal tube airway and the laryngeal mask successfully after maximum of three attempts.

Results

A total of 60 female cases of lump in the breast, posted for excision, were randomly allocated to one of the two groups. Group I-use of laryngeal tube (n=30) and Group II – use of LMA (n=30), for securing the airway under general anaethesia with spontaneous ventilation. The assessment of the outcome (number of attempts made and time taken to secure the airway, cuff pressure, post-operative complications etc.) was possible on all the 60 cases included in the study.

The distribution of cases in Group I (LT) and Group II (LMA) with respect to the socio-demographic and other factors were described using numbers and proportions (%). The differences in the proportion of cases between the study and the control groups, on factors measured on a nominal scale were tested for statistical significance using Chi-square test. The Yate's correction was employed whenever the expected

frequencies were lesser than five units. Fischer's exact probability test was used whenever zero frequencies were encountered. The Student t-test was used wherever the factors studied were measured on an interval scale. Pearson's correlation co-efficient (r) was used to assess the degree of association between two variables measured on interval scale. A value of "r" between 0 and 1 indicates a positive correlation (i.e) a direct relationship is observed. In other words, when the value of one variable increases, the value of the other also increases. A negative value of "0 to minus 1" indicates an inverse relationship that if the value of one variable increases the value of the other decreases. Odds ratio is employed to study the risk of experiencing the outcome studied in Group I compared to Group II in a univariate setting. A value of unity indicates "no risk", a value less than one indicates "decreased risk" and a value more than one indicates "increased risk" of experiencing the outcome.

Table 1: Distribution of Cases by Age Group Among LT and LMA Groups

Age Group (in years)	Group I (LT)		Group II (LMA)	
	Number	%	Number	%
20 – 29	11	36.7	13	43.3
30 – 39	15	50.0	13	43.3
40 – 47	4	13.3	4	13.4
All ages	**30**	**1000.0**	**30**	**100.00**
Mean	31.0		30.5	
S.D.	7.244		8.007	
Median	30.5		300.5	
Range	20 – 46		20 – 47	
t-value p-value	0.271 P=0.79; Not significant			
2-value p-value	0.31 0.86			

The distribution of cases by classified age group reveals no significant difference (p=0.86) between Group I and Group II. The distribution of actual age shows that the median ages of cases in Groups I and II were the same. However, the difference in the mean age between the two groups were not statistically significant (p=0.79).

Table 2: Correlation of Factors and Outcome Measures Among LT and LMA Groups

Factor tested for association	Outcome tested for association	Correlation coefficient (r)	p-value
Age	Time taken No. of attempts	0.101 -0.041	0.44 0.76
BMI	Time taken No. of attempts	0.233 0.085	0.07 0.52
Weight	Time taken No. of attempts	0.297 0.109	0.02 0.41

There was a weak positive association between age and time taken for securing the airway (r=0.101; p=0.44) and a weak negative correlation between age and number of attempts in securing airway (r=-0.041; p=0.76) but not statistically significant. There was a positive correlation between BMI and time taken (r=0.233; p=0.07) and number of attempts (r=0.085; p=0.52) for securing airway. There was a significant association only between weight and time taken (r=0.297; p=0.02) and not with number of attempts (r=0.109; p=0.41). The absence of a significant association between these factors and the groups studied can reasonably lead to the conclusion that the differences, if any, in the outcome studied, are "only" due to the "device" used.

Table 3: Assessment of Airway by MPC Among LT and LMA Groups

MPC	Group I (LT)		Group II (LMA)	
	Number	%	Number	%
I	27	90.0	28	93.3
II	3	10.0	2	6.7
Total	**30**	**100.0**	**30**	**100.0**
X2-value	0.22			
p-value	P=0.64; Not significant			

Their assessment of airway by Mallampatti classification (MPC) among the LT and LMA groups did not show any statistically significant differences in its outcome categorized as I and II (p=0.64).

Table 4: Number of Attempts to Secure the Airway Among LT and LMA Groups

MPC	Group I (LT)		Group II (LMA)	
	Number	%	Number	%
One	24	80.0	26	86.7
Two	4	13.3	3	10.00
Three	2	6.7	1	3.3
Total	**30**	**100.0**	**30**	**100.0**
X2-value	0.56			
p-value	P=0.76; Not significant			

Airway has been secured in the first attempt in majority of the instances in both the groups: it was 86.7% in Group II (i.e.) LMA compared to 80% in the Group I (i.e.) LT. However, the difference in the distribution of the number of attempts in securing the airway were not statistically significant between the two groups.

Table 5: Time Taken to Secure the Airway in LT and LMA groups

Time taken (in seconds)	Group I (L)T)	Group II (LMA)
No. of cases	30	30
Mean	36.8	27.0
S.D.	5.27	4.22
Median	36.5	26.5
Range	28-45	20-40
t-value	1.908	
p-value	P=0.06; Not significant	

The time taken, in terms of seconds, in securing the airway was lesser among Group II subjects (average time in 27 seconds; Median time is 26.5 seconds) than Group I (average time is 37 seconds: Median time is 36.5 seconds). This difference was statistically significant (p<0.001).

Table 6: Scoring of Ease of Intubation Among LT and LMA groups

Ease of intubation score	Study group		Control group	
	Number	%	Number	%
1. Easy	24	80.0	26	86.7
2. Difficult	6	20.0	4	13.3
3. Impossible	0	0.0	0	0.0
Total	**30**	**100.0**	**30**	**100.0**
X^2 – value p – value				
Odds ratio 95% CI	1.65 (0.34-7.9			

CI: Confidence interval

In none of the subjects was it found "impossible" to do any of the two procedures. In a majority of the subjects among Group I (80%) and Group II (87%), it was "easy" to secure the airway. The differences in the distribution of cases were not statistically significant (p=0.73). There was 63% increased possibility of performing it "with difficulty" among the subjects in Group I compared to Group II. However, this is not statistically significant.

Table 7: Number of Cases Developing Gastric Insufflations Among LT and LMA Groups

Gastric insufflations	Group I (LT)		Group II (LMA)	
	Number	%	Number	%
Yes	100	0.0	2	6.7
No	30	100.0	28	93.3
Total	**30**	**100.0**	**30**	**100.0**
Fisher's exact p – value	0.25; Not significant			

There were no instances of anyone developing gastric insufflations among the subjects in Group I compared to two subjects among Group II following the respective surgical procedures. The differences, however, are not statistically significant.

Table 8: Number of Cases Developing Post Operative Complications among LT and LMA Groups

Blood staining	Study group		Control group	
	Number	%	Number	%
Yes	1	3.3	4	13.3
No	29	96.7	26	86.7
Total	**30**	**100.0**	**30**	**100.0**
X^2 – value	0.87			
p - value	0.35; Not significant			

The number of cases with operative complications after the surgical procedure (12-24 hours) was carried out is identically distributed among the LT and LMA subjects. No differences are forthcoming.

Discussion

Laryngeal Tube (VBM, Medizintechnik, Germany): The Laryngeal tube is a new supraglottic airway device introduced in 1999 for securing the airway in difficult intubation situations. It is also used for the maintainance of airway during short surgical procedures (<2 hrs) under spontaneous breathing or controlled ventilation.

It consists of an 'S' shaped tube with a small distal oesophageal cuff and a larger proximal oropharyngeal cuff providing an airtight – seal.

Laryngeal Mask Airway: The Laryngeal mask airway is the most commonly used supraglottic airway device designed to provide and maintain a seal around the laryngeal inlet for spontaneous ventilation and allow controlled ventilation at modest levels of positive pressure.

In our study, the Laryngeal tube was compared with the more commonly used LMA for maintenance of airway during short surgical procedures under general anaethesia. Various parameters were compared which correlates with the study results of various authors.

***First Attempt Success Rate*:** This study had shown that with the Laryngeal tube (Group I) we were able to secure the airway in 24 of 30 patients in first – attempt (80%) which correlated with the success rate of Joseph Brimacombe et al[6] (87%) and Wrobel M et al[7] (90%). With the Laryngeal mask airway (Group II) we were able to secure the airway in 26 of 30 patients in first attempt with success rate of 86.6% which correlated with the success rate of Joseph Brimacombe et al[6] (85%) and T.Asai et al[2] (94%).

The difference between the two groups in achieving the effective airway doesn't has any statistical significance (P=0.76). This difference may be due to the minimal exposure to the new device, the Laryngeal tube.

Time Taken for Securing the Airway: The mean time taken for securing the airway in Group I (LT) was 36.76 secs with SD of 5.27 secs which coincides with the study of Wrobel M et al[7] (35.1 secs).

The mean time taken for securing the airway in Group II (LMA) was 29.96 secs with SD of 4.22 secs which correlated with the time taken by T.M. Cook et al[8] (Median 18.5, secs interquartile range 14.26).

In our study the mean time difference between two Groups were 9.8 secs which was statistically significant value (p< 0.001). This difference may be attributed to

the smaller sample size and limited exposure to the Laryngeal tube insertion.

Gastric Insufflation: The incidence of gastric insufflation was clinically assessed by looking for the bulge over the epigastrium and confirmed by auscultating over the area.

None of the persons in Group I (LT) developed gastric insufflations where as two persons in Group II (6.7%) by LMA had the same.

T.Asai et al[9] reported in a study of 21 patients in May 12, 2002, in which he did not notice any gastric insufflations when the Laryngeal tube was used but noted gastric insufflations in three patients when the Laryngeal mask was used. This correlated with our study and did not have any statistical significance (P= 0.25).

No incidence of gastric insufflations in the Laryngeal tube group is due to the design of the device. The distal oesophageal cuff forms a seal around the upper oesophageal inlet and prevent the gas from entering the stomach.

Cuff Pressure: The mean – initial cuff pressure required to maintain airtight seal was 67.5 cm H2O in Group I (LT) which was significantly low when compared with Group II (LMA), 99.5 cmH_2O. This pressure difference correlated with the study conducted by Wrobel M et al[7] where be required cuff pressure of 75.1 cmH_2O and 109.5 cmH_2O in LT and LMA groups respectively. This pressure difference between two groups are statistically significant ($p < 0.001$).

The increased pressure required for the LMA to provide airtight seal may be responsible for the increased incidence of sore throat and dysphagia observed in the postoperative period.

Postoperative Complications: It can be further divided into immediate and late complications.

Immediate Complications: It is the one which occurs during introduction of the device and immediately after extubation. They are

a. Upper airway trauma – by looking for blood stain on the Posterior aspect of the cuff immediately after extubation.
b. Minor tongue injury
c. Dental Trauma

In our study only blood staining was noticed in 4 persons in Group I by LT (13.3%) and 5 persons in Group II by LMA (16.7%). The difference however, are not statistically significant (P = 72)

Delayed Complications: The late postoperative complication like sore throat, dysphagia, dysphonia, hoarseness of voice, soreneck, sorejaw are elicited from the patients in the postoperative ward for 18 – 24 hrs.

One person in Group I (LT, 3.3%) developed sore throat where as in Group II (LMA), three persons developed sore throat, (10%) and one patient had dysphagia (3.3%).

Wrobel M et al[7] in May 27, 2004 reported his study of 100 patients in which the incidence of postoperative complication in the LMA group was 54% and 31% in LT group. This difference was significantly higher when compared to our study which may be due to the difference in sample size.

The increased incidence of postoperative complications in Group II (LMA) may be due to more cuff pressure required to produce airtight seal.

Conclusion

- Laryngeal tube is a simple, safe, easy and effective device for securing the airway.
- Laryngeal Tube may be recommended as an alternative airway device to LMA
- Upper airway trauma and postoperative complications is not higher with the use of LT.

Conflict of Interest: None
Source of Support: Nil

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