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LOW FLOW ANESTHESIA;

TO DETERMINE THE INCIDENCE OF COMPLICATIONS WHEN USING LARYNGEAL MASK AIRWAY AND COMPARE IT WITH ENDOTRACHEAL TUBE INTUBATION

drhamidraza1@gmail.com

Dr. Hamid Raza[1], Dr. Bashir Ahmed[2], Dr. Kamlaish[3]

1. Assistant Professor Anesthesiology & ICU, Liaquat University of Medical and Health Sciences Jamshoro.
2. Assistant Professor Anesthesiology and ICU, Dow University of Health Sciences, Civil Hospital Karachi.
3. Consultant Anesthetist, Dow University of Health Sciences, Civil Hospital Karachi.

Correspondence Address:
Dr. Hamid Raza
B 15 Samanabad Bhitai Town
Qasimabad Hyderabad, Pakistan.
drhamidraza1@gmail.com

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ABSTRACT… Objectives: The aim of our study is to determine the incidence of complications when using Laryngeal mask airway and compare it with endotracheal tube intubation, during administration of low flow anesthesia. **Study Design:** A randomized control trial. **Period:** 3 months from February 2015 to April 2015. **Setting:** Tertiary Care Hospital in Karachi Pakistan. **Materials and Methods:** The study population consisted of n= 100 patients who underwent elective operative procedures of the eye. Patients who belonged to the ASA classification type I and II were allocated into two groups using a random number generator. Group A consisted of all the patients on whom endotracheal tube was used as airway and group B included all the patients on whom Laryngeal mask airway was used. The complications were noted on a pre-designed proforma. Data was analyzed using SPSS version 23. **Results:** The study population consisted of n= 100 patients out of which n= 43 were males and n= 57 were females, 42% of the patients belonged to ASA classification I and 58% belonged to the ASA classification II. Leakage of air was observed in 7% of the patients, postoperative shivering was observed in 20%, sore throat was observed in n= 22 patients, of which n= 18 patients belonged to the ETT group and n= 4 patients belonged to the LMA group. Endotracheal carbon dioxide levels did not show any significant difference. **Conclusion:** According to the results of our study, Laryngeal mask airway has a lower incidence of post-operative complications, provided that its positioning and cuff pressure are noted and maintained regularly, and it can be used as a safe alternative to endotracheal intubation when using low flow controlled anesthesia respectively.

Key words: Laryngeal mask airway, endotracheal intubation, low flow anesthesia, complications of airway.

ABBREVIATIONS
FGF= Fresh gas flow, LMA= Laryngeal mask airway, ETT= Endotracheal tube, PPV= positive pressure ventilation, ECG= Electrocardiograph

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INTRODUCTION

According to Baker (1994) the classification of anesthesia gas flow is as, minimal flow: a flow of less than 500ml of FGF/minute, low flow: as a flow of greater than 0.5 to 1 liter/minute, medium flow: as a flow of 2 to 4 liter/minute and very high flow: a flow of greater than 4 liter/minute, but it relies on an adequate seal to be established between the device and the patients mouth or nasal cavity. Low flow anesthesia, has its own advantages in that it is economic to use, is easily maintained in terms of temperature and humidity of air, and causes low air pollution.[1,2,3,4] The two most commonly used mechanisms to provide artificial ventilation are the laryngeal mask airway and the Endotracheal tubes. LMA is regarded as being a safer method for supra glottic airway when it comes to be used for the purposes of general anesthesia as compared to the ETTs which are used particularly for difficult airways and when spontaneous ventilation is required.[5,6,7] Laryngeal mask airway is used for PPV in children and adults, despite it not providing a complete water tight seal.[8,9] According to some studies the use of laryngeal mask airway is safer when a low flow anesthesia is utilized.[10,11] As with any intervention procedure the use of LMA or ETT also have its fair share of complications, the incidence of sore

throat post operatively is reported to be higher with the use of ETT than Laryngeal mask airway, while complications such as hoarseness, bleeding and injury to the nerves and surrounding structures is more reported with LMA.[12,13,14,15] The complication with the use of airways can be explained by the use of a high pressure cuff with nitrogen oxide gas during the maintenance anesthesia.[16,17] It is therefore observed that postoperatively ETT is bound to have more complications as compared to Laryngeal mask airway basing on the fact that it is more invasive and pressure of the cuff can cause necrosis of the surrounding structures, similarly using LMA requires tight seal, and is not as controlled as compared to ETTs, and the cuff pressure of LMAs also cause complications such as sore throat. In light of the above mentioned facts the purpose of our study is to evaluate the complications of the two methods of airway, when used for low flow anesthesia with controlled ventilation.

MATERIALS AND METHODS

The type of study is a randomized control trial, conducted for a period of 3 months from February 2015 to April 2015, at a tertiary care hospital in Karachi Pakistan. The study population consisted of n= 100 patients who underwent elective operative procedures of the eye for a duration of close to an hour, at our hospital. The inclusion criteria included all the patients who were above 16 years of age and gave full consent to participate in the study, and did not have any complications at the start of the study, the exclusion criteria was all those patients who were below 16 years of age and had history of difficult airway, sore throat, allergy, and any respiratory or throat related illness in the last 10 days. Patients who belonged to the ASA classification type I and II were allocated into two groups using a random number generator. Group A consisted of all the patients on whom endotracheal tube was used as airway and group B included all the patients on whom Laryngeal mask airway was used. As for pre medication 2mg of midazolam was administered to all the patients in the study. Propofol 2mg/kg was used for induction, along with Fentanyl 2ug/kg, atracurium 0.5mg/kg and lidocain 1mg/kg then mask ventilation with pure oxygen was performed for 3 min. In the laryngeal mask airway group appropriate size of LMA was used and inserted using a standard technique, the cuff was inflated using normal saline prior to insertion, after insertion the cuff was inflated regularly till the sound of leak was obliterated. As for endotracheal intubation group, appropriate size tube was utilized (7.5 in females and 8 in males) and cuff was inflated till 25mm of Hg cuff pressure, and the pressure was monitored throughout the procedure. Anesthesia was maintained with using O2/N2O 50%, fresh gas flow and isoflurane at 6 liter/minute for the first 10minutes for the high uptake period for delivery of isoflurane and N2O, and then later FGF decreased to 1 liter/minute and isoflurane was set at 1%. 50-100ug of fentanyl was injected in case of insufficient anesthesia. Tidal volume was kept at a steady 8ml/kg and adjusted accordingly. Blood pressure, ETCO2, pulse oximetry and ECG was noted throughout the procedure, also any leakage from the system, rebreathing etc. were also noted. At the end of surgery isoflurane was discontinued 5 minutes prior, and FGF increased to about 6 liter/minute and pure oxygen given to appropriately clear out the anesthetics from the system. Patients were extubated and then transferred to the recovery room. In the recovery room complications were noted for a period of 3 hours postoperatively. The complications were noted on a pre-designed proforma. Data was analyzed using SPSS version 23, mean and standard deviations were used to quantify variables, qualitative variables were analyzed using Pearson Chi square test and qualitative variables were analyzed using unpaired t test. A p value of less than 0.05 was considered to be statistically significant.

RESULTS

The study population consisted of n= 100 patients out of which n= 43 were males and n= 57 were females, 42% of the patients belonged to ASA classification I and 58% belonged to the ASA classification II. The various complications observed in the patients is represented graphically in Figure-1. Leakage of air was observed in 7% of

the patients n= 3 patients in the ETT group and n= 4 patients in the LMA group having a p value of 0.6, postoperative shivering was observed in 20% of the patients of which n= 9 patients belonged to the ETT group and n=11 belonged to the LMA group having a p value of 0.7, sore throat was observed in n= 22 patients, of which n= 18 patients belonged to the ETT group and n= 4 patients belonged to the LMA group, having a p value of less than 0.01. The rest of the observed complications are described in table-I. Endotracheal carbon dioxide levels did not show any significant difference being 36.7 +/- 3.1 in ETT group and 37.4 +/- 2.5 in LMA group.

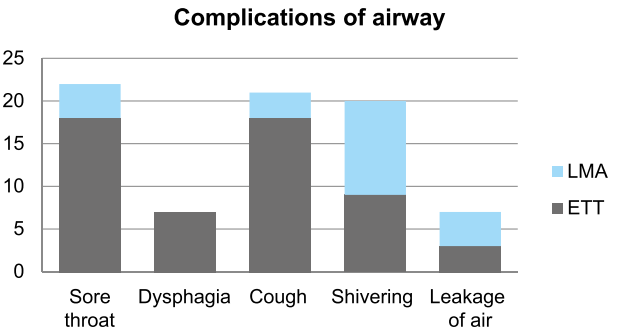

Figure-1. Complications of ETT and LMA in the patient population.

Characteristic	Group A (ETT group) n=50	Group B (LMA group) n= 50	P value
Gender			
Male	20 (20%)	23 (23%)	>0.05
Female	30 (30%)	27 (27%)	>0.05
ASA classification			
Type I	23 (23%)	19 (19%)	>0.05
Type II	27 (27%)	31 (31%)	>0.05
Age in years	70.3 +/- 6.5	66.1 +/- 10.7	>0.05
Duration of anesthesia	36 +/- 5	42 +/- 4	>0.05
Associated complications			
Sore throat	18 (18%)	4 (4%)	0.001
Dysphagia	7 (7%)	0 (0%)	0.02
Cough	18 (18%)	3 (3%)	0.001
Shivering	9 (9%)	11 (11%)	0.7
Leakage of air	3 (3%)	4 (4%)	0.6

Table-I. Characteristics of patients undergoing low flow anesthesia administration.

DISCUSSION

One of the concerns for using appropriate device for airway is the associated complications of each device, respiratory complications like bronchospasm and laryngospasm, sore throat and post-operative cough are the major complications. Factors such as size of the airway, the design, handling, lack of humidity, cuff pressure and design, suctioning, high gas flow and manipulation are the variables that contribute to these complications with the procedure.[18]

According to a study by Engelhard et al they demonstrated that in a low flow circle system anesthesia, laryngeal mask airway is an effective alternative in children, and also concluded that due to the massive leak in using an uncuffed endotracheal tube it is very hard achieve low fresh gas flow.[19] According to a meta analysis, which compared laryngeal mask airway with endotracheal intubation it was demonstrated that laryngeal mask airway is easy to place, and does not rely on the experience of the anesthetist, it provides improved hemodynamic stability at the time of induction and at the time of emergence from the anesthesia, it only very slightly increases the intraocular pressure, had lower rates of complications such as coughing and sore throat. However it also has some prominent disadvantages when compared to ETT such as a lower quality of seal, and gastric insufflations incidence is high.[20] According to a

study by Ates et al, laryngeal mask airway is a safe procedure for surgeries pertaining to the eye with stable hemodynamics and less number of complications.[21] While Cameron et al observed a comparatively tight seal and lack of gas leakage when it comes to the use of Laryngeal mask airway[7], while Wahlen et al observed that a mal positioned laryngeal mask airway is a threat for gastric insufflations of air in the pediatric population, when used with positive pressure ventilation.[22] But no such phenomenon was found in our study, which might be explained due to the fact that we checked the position and monitored the pressures (less than 15 to 20 cm of water). According to Honnemann et al there is more gas leak with LMA as compared to ETT, but with the use of latest anesthesia machines, a reduction of FGF to 0.5 liter per minute was possible in 96.7% of the patients, and the incidence of complications observed were higher in the ETT group[11], similar to the results of our study. Rieger et al, found the morbidity comparison of LMA and ETT to be questionable, they were unable to find a distinct advantage of one over the other[23], while Yu et al demonstrated a statistically significant lower incidence of laryngospasm, hoarseness of voice and cough in the laryngeal mask airway group compared to the ETT group.[24] Wrong et al showed a strong association between the incidence of sore throat and higher cuff pressures, hence the cuff pressures to be monitored closely and over time to decrease the incidence of sore throat[25,26], Bugard et al observed that the cuff pressure increases dramatically in the first 60 seconds of insertion, and after three minutes of insertion the pressure can be reduced safely without having any gas leak.[16] Dadmehr et al found no difference between LMA and ETT in the first 24 hours postoperatively.[27] While according to a study there is no significant difference in the post-operative shivering in the two groups when same anesthetic agent is used[28], which is similar to our study. Our study showed a higher incidence of complication with ETT as compared to LMA, the majority of complications with LMA are due to cuff pressures, but how ever in low flow anesthesia a tight seal and high cuff pressure is a pre requisite, there were some limitations in our study, that is it was a single center study and focused on patients undergoing ophthalmic surgeries, we also noted only some of the complications, and did not see long term complications, further large multi centric studies with a large sample size are therefore recommended.

CONCLUSION

According to the results of our study, Laryngeal mask airway has a lower incidence of post-operative complications, provided that its positioning and cuff pressure are noted and maintained regularly, and it can be used as a safe alternative to endotracheal intubation when using low flow controlled anesthesia respectively.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

Sr. #	Author-s Full Name	Contribution to the paper	Author=s Signature
1	Dr. Hamid Raza	Write-up, Statistical analysis, Drafting, Corresponding author	
2	Dr. Bashir Ahmed	Data collection, Write-up, Analysis, Proof Reading	
3	Dr. Kamlaish	Data collection, Write-up, Analysis, Literature review