Original Research Article

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To Compare The Haemodynamic Resopnses and Adequacy of Ventilation Between Laryngoscopic Endotracheal Intubation and Laryngeal Mask Airway Classic Insertion in Short Surgical Procedures Under General Anaesthesia with Muscle Relaxation

Tahir Ali Khan[1], Surendra Raikwar[2], Aditya Agarwal[3]

[1]Assistant Professor, Department of Anaesthesia, Chirayu Medical College, Bhopal, Madhya Pradesh 462030, India. [2]Associate Professor [3]Professor and Head, Department of Anaesthesia, Gandhi Medical College, Bhopal, Madhya Pradesh 462001, India.

Abstract

The haemodynamic response associated with laryngoscopy and tracheal intubation may be harmful to certain patients. The laryngeal mask airway (LMA) avoids the need for laryngoscopy and allows positive pressure ventilation of the lungs in appropriate patients. This study compared the haemodynamic response, ease of insertion and adequacy of ventilation, of tracheal intubation with that of LMA-Classic insertion in patients undergoing short surgical procedures.

Sixty patients undergoing short surgical procedures between 18-60 years of ASA grade I and II were randomly allotted to one of the two groups of 30 each (group ETT vs group LMA). Laryngoscopic tracheal intubation or LMA-classic insertion was performed after induction of anaesthesia with fentanyl and propofol, and muscle relaxation with succinylcholine. Anaesthesia was maintained with halothane and nitrous oxide in oxygen. Haemodynamic response, ease of insertion and adequacy of ventilation was observed and compared. The increase in HR, SBP, DBP and MAP in the laryngeal mask airway group was significantly less than that in ETT group. Also the observed haemodynamic variables returned to baseline earlier in LMA group than in ETT group. There was no statistical difference observed in oxygenation and adequacy of ventilation between the two groups with no significant difference in periopertive adverse events in both the groups.

Our study supports the usefulness of laryngeal mask airway as an alternative to endotracheal tube in airway management during general anaesthesia (with muscle relaxation) in appropriate patients for short surgical procedures.

Keywords: Haemodynamic; Laryngeal Mask Airway; Muscle Relaxant; Pressor; Ventilation.

Introduction

Endotracheal intubation is the gold standard method for maintaining a patent airway during anaesthesia but stimulation of oropharyngolaryngeal structures during laryngoscopy and endotrcheal intubation produce reflex sympathetic stimulation and raised level of plasma catecholamines, hypertension, tachycardia, ventricular arrhythmias and intracranial hypertension [1,2]. Laryngeal mask airway, a supraglottic airway device offers some of the advantages of endotracheal tube while avoiding its fundamental disadvantages, since the vocal cords need to be neither visualized nor forced upon. This study was undertaken to compare the hemodynamic responses between laryngoscopic endotracheal intubation and laryngeal mask airway insertion in short surgical procedures. Other objective was to compare the ease of insertion, adequacy of ventilation and any associated complication during the procedure between the two devices.

Material and Methods

After obtaining approval from the ethical committee, the study was conducted on Sixty adult patients (age 18 to 60 years) of ASA Grade I and

Corresponding Author: Tahir Ali Khan, Assistant Professor, Department of Anaesthesia, Chirayu Medical College, Bhopal, Madhya Pradesh 462030, India.
E-mail: drtahiralikhan1311@gmail.com

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Grade II undergoing elective surgical procedures expected to last less than sixty minutes under general anaesthesia. Patients at increased risk of aspiration, with known or predicted difficult airway, or patients with any significant systemic disease were excluded. Pre anaesthetic check up was done, procedures explained and informed written consent was obtained. All the patients were fasted for minimum 6 hrs. Patients were then randomly divided into two groups (30 patients in each group).

Group I: (ETT group): Endotracheal Tube group

Group II: (LMA group): Laryngeal Mask Airway group

All patients were premedicated with injection midazolam 0.02 mg/kg, injection glycopyrolate 0.2mg, injection ranitidine 50mg and injection ondansatron 4 mg. After stabilization period of 5 minutes, baseline values of heart rate, systolic BP, diastolic BP and MAP were recorded. Intravenous Fentanyl 2mcg/kg was given 3 min prior to induction, followed by preoxygenation. Patients were induced with propofol 2mg/kg and succinylcholine 1.5mg/kg. Intermittent positive pressure ventilation with 100 percent oxygen was given for 1 minute and airway devices were inserted in both the groups.

Correct placement of LMA or ETT was confirmed by bilateral chest movements, chest auscultation, epigastric auscultation and a square waveform on capnography. LMA insertion was defined as easy if insertion within the pharynx was completed without resistance through a single manoeuvre. However, in case of any resistance to insertion or more than one necessary manoeuvre, the procedure was considered as difficult. ETT placement was defined as difficult if a guide was used or if laryngeal manoeuvre was applied.

Values of heart rate, systolic BP, diastolic BP, MAP were recorded at different intervals like:

a. Before induction
b. After induction.
c. At laryngoscopy and intubation or insertion of laryngeal mask.
d. One minute after intubation or insertion of laryngeal mask.
e. Three minutes after intubation or insertion of laryngeal mask
f. Five minutes after intubation or insertion of laryngeal mask

Anaesthesia was maintained with intermittent positive pressure ventilation with nitrous oxide and oxygen (50:50), halothane (0.5%-1%) and injection atracurium as per the surgical requirements. Any kind of painful stimulus including surgical incision was not allowed upto 5 minutes. Intraoperative monitoring included ECG, pulse rate, SBP, DBP, MAP, SpO_2 and $ETCO_2$. At the end of surgery residual neuromuscular block was reversed with the mixture of glycopyrrolate and neostigmine. The device was removed when patient regained consciousness and responded to verbal commands. Post op cough, Nausea, Vomitting, Minor trauma of mouth, tooth or Pharynx, and sore throat was assessed in recovery room and 24 hrs postoperatively. Any incidence of clinically detectable pulmonary aspiration was also assessed.

All the values were expressed as mean ± standard deviation. Statistical comparison were performed by students paired and unpaired t-test and chi-square test using Graphpad Quickcalc software. P value of <0.05 was considered to be statistically significant.

Results & Discussion

In our study we tried to compare the cardiovascular responses to laryngeal mask airway insertion and tracheal intubation while assessing the adequacy of ventilation with muscle relaraxation. Both the groups were comparable with regards to age, height, weight, mallampatti score, ASA grade and duration of anaesthesia. There was a female predominance in both the groups, however the number of males and females in both the groups were comparable (Table 1 and Figure 1).

The ease of insertion was comparable in both the groups with easy insertion in 86.67% in LMA group compared to 90% in ETT group. Mean time taken for successful placement was 22.2 sec and 21.3 sec for LMA and ETT groups respectively, which was comparable (Table 2). No failed insertion or requirement of second attempt was reported in either group. The ease of application was apparent in our patients, virtually in all cases like it has been reported by other great authors such as Verghese C and Brimacombe JR (3) , who reported difficulties in only 0.24% in 11,910 patients. It is worth mentioning that, in our protocol, muscle relaxant was used, further facilitating ventilation and placement of the LMA, contrasting with the most of the publications reported. However, we believe that can do without muscle relaxants for the placement of the LMA. Also the patients with anticipated difficult airway were excluded from the study further improving the success rates of insertion of both the devices.

Both systolic and diastolic blood pressures were found to be increased at laryngoscopy and endotracheal intubation or laryngeal mask insertion (Tables 3 & 4). But the increase in BP in the LMA group was not as much as in the ETT group. It was statistically significant ($p<0.05$). There was a statistically significant difference between the two groups at end of three minutes and five minutes also ($p< 0.05$). These results were in accordance with majority of the studies comparing the hemodynamic

Table 1: Demographic Profile

	Group LMA	Group ETT	P value
Age	26.3 ± 6.9	25.5 ± 7.1	0.213
Sex (m/f)	8/22	7/23	
Height (cm)	161.1 ± 7.7	162.8 ± 8.3	0.414
Weight (kg)	54.3 ± 4.4	55.7 ± 4.7	0.238
Mallampatti I	27	26	
Mallampatti II	3	4	
Asa grade I	29	28	
Asa grade II	1	2	
Duration of anaesthesia	44.6 ± 5.6	46.2 ± 6.4	0.307

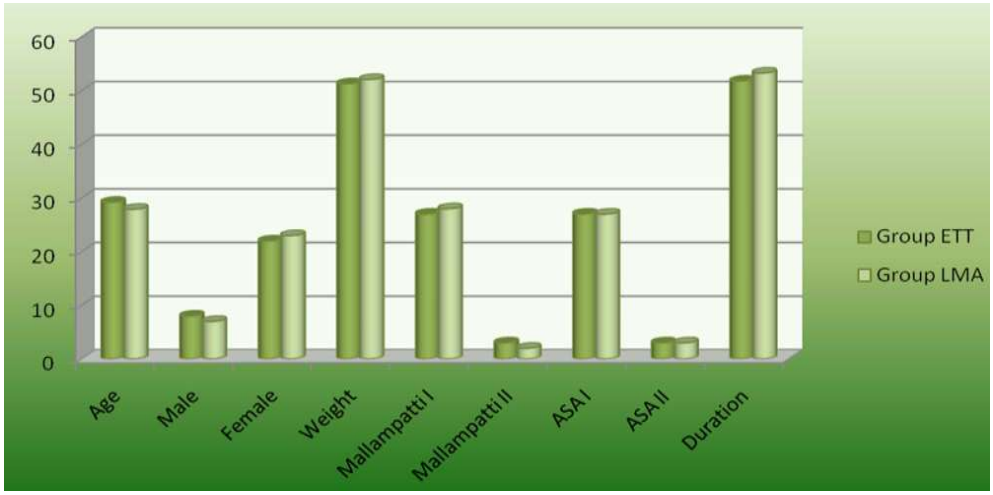

Fig. 1: Demographic profile

Table 2: Details of airway management

	LMA	ETT	p value
Size of device (3/4, 7.5/8.5)	23/7	22/8	
Ease of insertion (Easy/Difficult//failed)	26/4/0	27/3/0	
Time taken for insertion of device, mean ± SD (sec)	22.2 ± 7.2	21.3 ± 8.6	0.251

Table 3: Haemodynamic responses - Systolic Blood Pressure

	LMA	ETT	p value	% Change From Baseline	
Baseline	115.8±8.2	117.2±8.9	0.528	LMA	ETT
After induction	105.5±7.4	106.7±7.6	0.589	-8.9%	-9.1%
Immediately after device insertion	117.2±7.6	129.5±6.8	<0.0001	+1.2%	+10.4%
1 min	114.6±8.1	122.4±7.3	0.0002	-1.1%	+4.4%
3 min	112.1±5.2	119.5±6.7	<0.0001	-3.2%	+1.9%
5 min	108.1±6.3	114.2±5.7	0.0002	-6.6%	-2.6%

Table 4: Haemodynamic Response - Diastolic Blood Pressure

	LMA	ETT	p value	%change from baseline	
Baseline	80.2±5.9	79.6±6.4	0.707	LMA	ETT
After induction	75.6±6.3	74.9±6.1	0.663	-5.8%	-5.9%
Immediately after device insertion	81.4±6.7	90.3±5.8	<0.0001	+1.4%	+13.4%
1 min	79.1±5.7	89.7±5.9	<0.0001	-1.4%	+12.6%
3 min	75.3±4.2	82.8±5.6	<0.0001	-6.2%	+4.0%
5 min	73.3±4.9	81.1±6.2	<0.0001	-8.7%	+1.8%

effects, however in our study, the mean maximum increase in systolic blood pressure was 10.4% in ETT group compared to 1.2% in LMA group which was much lower than most of the studies like Wilson et al. [4] and Clement et al. [5]. This can be attributed to use of midazolam, fentanyl and propofol in our study in contrast to thiopentone used in the abovementioned study. Mean arterial pressures at the time of insertion of devices were increased in both the groups with a significant increase in the ETT group ($p<0.05$) as compared to LMA group. Also the MAP in LMA group returned to baseline earlier than ETT group with a statistically significant difference between the mean ar1erial pressures of the both groups at the end of three minutes and five minutes ($p < 0.05$). Similar results were reported by Barclay et al. (6) who found that the insertion of laryngeal mask had minimal effects on mean arterial pressure relative to pre induction values as compared to endotracheal tube (Table 5).

In our study, heart rate at the time of insertion of LMA or endotracheal intubation was increased in both groups but the increase was significant in control group ($p<0.05$). Heart rate reached its basal value within five minutes. But the heart rate was still high in control group after five minutes also. There was significant difference of heart rate at one minute and three minutes intervals between control and study group (Table 6).

Thus, all the haemodynamic parameters measured in our study showed a similar trend and the results were in accordance with Lamb K et al. [7], Montazari K et al. [8], Harun-or-Rashid et al. [9], Bennett SR et al. [10], Idrees A et al. [11], Kihara et al. [12], Marietta et al. [13] and several other studies. Results of our study are consistent with the previous studies in that the haemodynamic response to laryngeal mask insertion is less than to that of endotracheal intubation, though the magnitude of this difference showed variation among different studies (Figures 2 to 5). Apart from the individual patient's responses and discrepancies in the number of patients studied, the other possible explanation for the differences among the study results could be the relative inexperience with the use of LMA and differences in anaesthetic agents used in different studies. The observations of our study were not plotted beyond 5 minutes because of the possible return of neuromuscular conduction. Even though the intervals selected to record the haemodynamic response were closely related with the maximum changes that could occur after stimulation of airway, the absence of continuous monitoring in our study might be a limiting factor.

Adequate ventilation with muscle relaxation was established in all cases and no air leak was noted with positive pressure. Respiratory parameters like SpO_2 and $EtCO_2$, and tidal volume were comparable between and within groups at all evaluation times ($p > 0.05$). Ventilation was optimal, with an $EtCO_2 < 40$ mmHg and $SpO_2 > 98\%$ in all patients in both the groups at all evaluation times (Table 7). Our results were supported by Maltby JR et al. [14] who compared Gastric distension and ventilation during laparoscopic cholecystectomy between LMA-Classic and tracheal intubation and concluded that positive pressure ventilation with a correctly placed LMA-Classic of appropriate size permits adequate pulmonary ventilation. In our study, we used muscle relaxation both during induction and also during maintenance of anaesthesia.

Table 5: Haemodynamic Response - Mean Arterial Pressure

	LMA	ETT	p value	% change from baseline	
Baseline	92.6±7.2	92.1±6.8	0.783	LMA	ETT
After induction	85.6±6.1	85.5±5.7	0.947	-7.6%	-7.2%
Immediately after device insertion	94.1±7.7	107.7±7.3	<0.0001	+1.6%	+16.9%
1 min	90.9±5.2	105.2±5.8	<0.0001	+1.8%	+14.2%
3 min	87.6±5.6	97.1±4.9	<0.0001	-5.4%	+5.4%
5 min	84.9±6.3	92.3±6.6	<0.0001	-8.3%	+0.2%

Table 6: Haemodynamic Response - Pulse Rate

	LMA	ETT	p value	% change From baseline	
Baseline	82.1±8.9	81.3±9.6	0.739	**LMA**	**ETT**
After induction	83.2±8.2	83.7±8.3	0.815	+1.3%	+2.9%
Immediately after device insertion	91.6±7.8	101.3±9.1	<0.0001	+11.5%	+24.6%
1 min	90.8±6.8	99.6±7.5	<0.0001	+10.5%	+22.5%
3 min	86.6±5.4	97.2±7.2	<0.0001	+5.4%	+19.5%
5 min	81.4±6.4	91.5±6.8	<0.0001	-0.8%	+12.5%

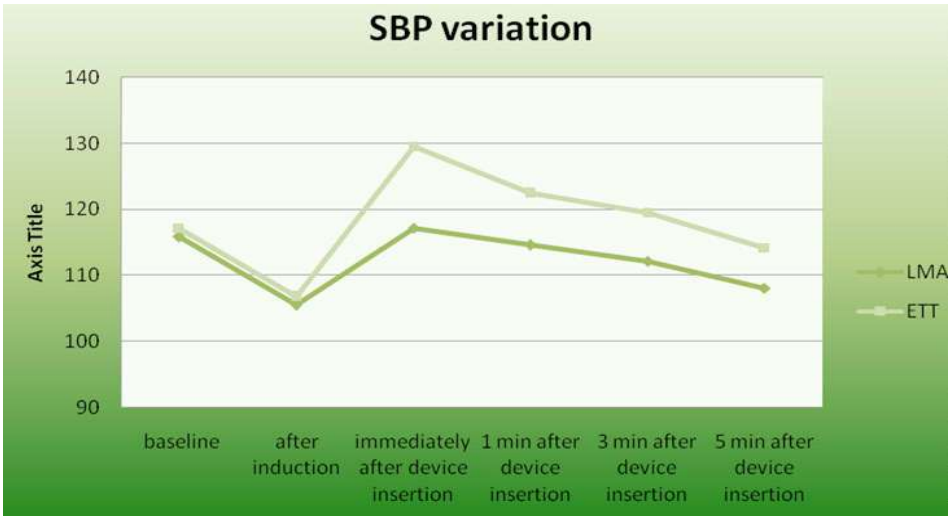

Fig. 2: Systolic Blood Pressure variation

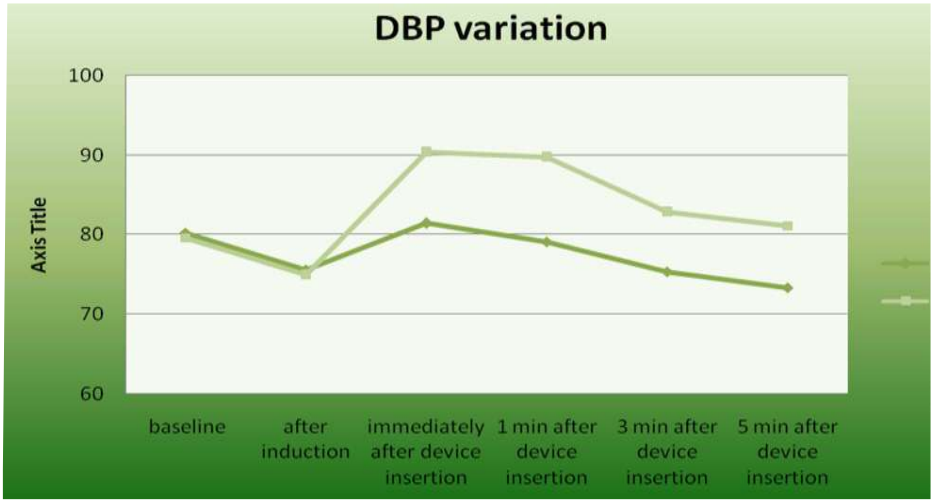

Fig. 3: Diastolic Blood Pressure Variation

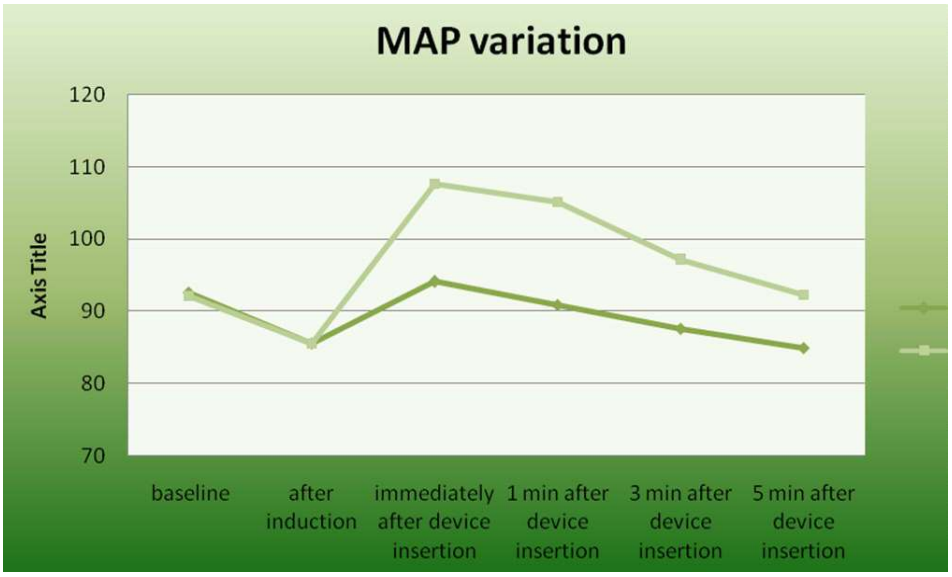

Fig. 4: Mean Arterial Pressure variation

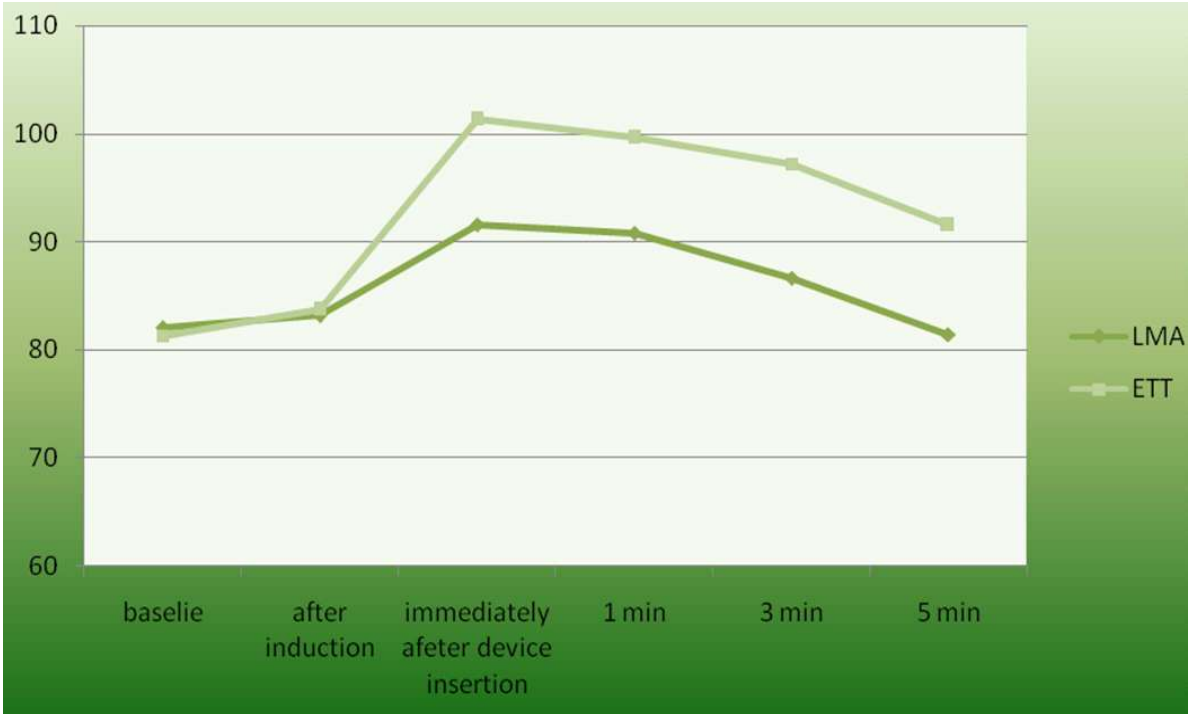

Fig. 5: Heart Rate Variation

Table 7: Adequacy of Ventilation

	LMA	ETT
Postop cough	5/30	9/30
Nausea/vomiting	3/30	4/30
Minor trauma	2/30	1/30
Sore throat	6/30	11/30
Bronchospasm/ laryngospasm	0/30	0/30
Pulmonary aspiration	0/30	030

Table 8: Associated Adverse Outcomes

	LMA	ETT
Postop cough	5/30	9/30
Nausea/vomiting	3/30	4/30
Minor trauma	2/30	1/30
Sore throat	6/30	11/30
Bronchospasm/ laryngospasm	0/30	0/30
Pulmonary aspiration	0/30	030

There was no incidence of regurgitation or clinically detectable pulmonary aspiration in any patient in our study. This may be attributed to the fact that we included patients with proper NBM and that too for short surgical procedures expected to last less than 60 minutes. In large analyses as that of Brimacombe and Berry [15], the incidence of pulmonary aspiration of gastric contents with a frequency of 2/10,000 is indicated. There was no incidence of laryngospasm, bronchospasm or any other significant adverse event reported in either group. Cough on removal of LMA was seen in 2 patients, while it was seen in 4 patients in ETT group. Minor trauma on removal was seen in 2 patients in LMA group as compared to 1 patient in ETT group. Postoperative sore throat was noted in 5 patients in LMA group compared to 9 patients in ETT group (Figure 6). There was no incidence of any other major adverse outcome (Table 8).

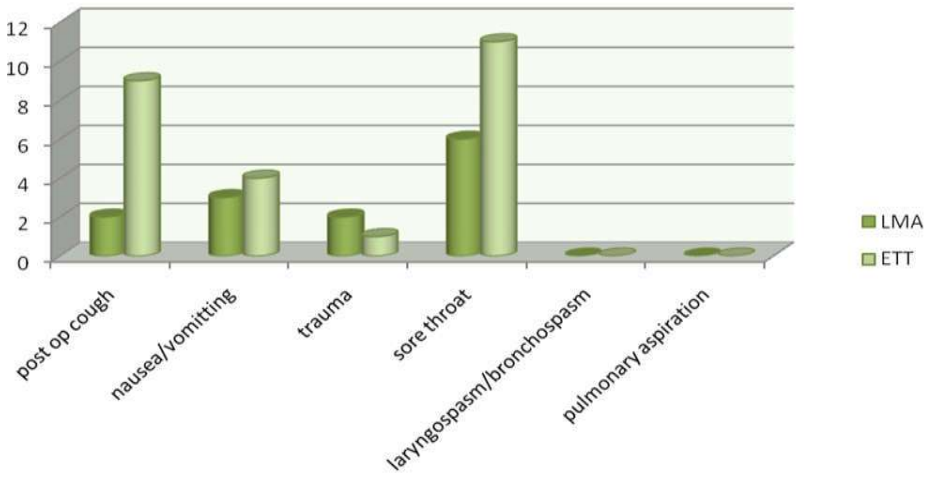

Fig. 6: Adverse Outcome

Conclusion

Our results suggest that insertion of LMA is associated with attenuated haemodynamic response compared with tracheal intubation, with adequate ventilation and lesser adverse effects. Thus LMA may be a useful alternative to ETT for general anaesthesia, even with muscle relaxation, specially in patients undergoing short surgical procedures.

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