Original Article

Comparative Study between the Laryngeal Mask Airway and Endotracheal Tube on Haemodynamic Changes for Laparoscopic Cholecystectomy Under General Anaesthesia

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Abstract

Background: *Evidence based data in the very recent years suggest that in spite of tremendous advances in contemporary anaesthetic practice and advances, airway management continue to be of paramount importance to anaesthesiologists and data regarding the outcomes of use of LMA (laryngeal mask airway) in contrast to ETT (endotracheal tube) are scanty in our clinical setup.*

Aims & Objectives: *In this RCT (Randomized Control Clinical Trial), the ultimate aim was to depict the anaesthetic safety and haemodynamic changes of use of LMA in contrast to ETT for the patients of routine laparoscopic cholecystectomy (ASA II & III).*

Methods and Materials: *This randomized control clinical trial (RCT) was conducted in BIRDEM General Hospital, Dhaka, Bangladesh with a total number of 60 patients (30 patients with endotracheal tube & 30 patients with LMA) were selected on the basis of systemic random sampling. The haemodynamic changes, oxygenation, ventilation and intraoperative and postoperative laryngopharyngeal complication (LPM) were noted.*

Results: *The ultimate result of this study suggest that in Group A (ETT group), mean±SD of age was 48±1.9 and in Group B (LMA group), it was 52±1.7. Demographic status suggests that the average BMI in both group were 28.9 and 30.6 respectively. In ETT group, majority of patients (69%) had ASA grade II, in contrast, in LMA group, it was 52%. Average anaesthetic duration in both group were 45 & 50 minutes respectively. There found significant difference in haemodynamic parameter during Intubation and LMA insertion. There were no statistically significant differences in oxygen saturation (SpO2) between the two groups before or during peritoneal insufflation. Laryngeal complications, like coughing and vomiting following removal of tube were found in 6.7% and 3.3% patients respectively with the use of LMA. No case of tube leak, gastric insufflation, regurgitation, aspiration, trauma to lip, teeth, tongue, dysphagia, dysphonia and dysarthia was recorded. P-values suggests statistically insignificant result here (>0.05).*

Conclusion: *The effectiveness and safety of LMA in terms of intra and postoperative haemodynamic status, SaO_2 and laryngeal complications are clinically comparable to those of endotracheal tube. And LMA insertion causes less changes of haemodynamic parameters when compared with that of ET intubation. Our finding suggests that LMA can be safe and beneficial alternative to ETT.*

Key words:*Laryngeal mask airway, endotracheal tube, laparoscopic cholecystectomy.*

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Introduction:

Laryngeal mask airway was introduced by Dr. Brain in 1980s and caused a revolution in airway management[1]. Today, this device has a special position in anesthesiology procedures and among many of anesthesiologists[2,3]. LMA provides a proper way for ventilating the patient while protecting his or her airway[4].

Now-a-days, LMA is used as a proper device for protecting the patient's airway during many of the operations[5-6]. However, American society of anesthesiologists[3,7,8], Australian and European council of resuscitation, and American heart Association[9-11] approve the usage of LMA only in emergency situations and in cardio-pulmonary resuscitation. The reason for this issue seems to be the inadequate evidence on the efficacy and safety of LMA. Many studies were conducted on usage of LMA for protecting the patients' airway during surgery and showed that this device has many benefits including easier insertion, no need for laryngoscope[12], fewer homodynamic complications[13], and less harmful complication for the larynx and vocal cords[14]. Furthermore, LMA is better tolerated by patients[15] and learning of its usage is easy for physicians and other health care providers[16-20]. Also LMA is a cost beneficent device[21]. It needs to be mentioned that some complications have also been reported for LMA. The most important of these complications are related to digestive system including vomiting and aspiration[12,22] and to larynx including sore throat, coughing, vocal cord paralysis[23,24], and acute epiglottis[25].

Complications such as nausea and vomiting and laryngeal complications such as coughing and sore throat are most common complications after general anesthesia. Nausea and vomiting usually happen in one third of patients after the general anesthesia[26] and can be followed by serious complications such as aspiration, pneumonia and even rupture of esophagous[27]. The sore throat and other laryngeal complications also happen in 60% of patients in the post general anesthesia period[28]. It should be mentioned that such complications can result in delay of patients' discharge, increased health care costs, and decreased patients' satisfaction[29-38].

Therefore, any effort taken to decrease such complications would be important. Several studies have been conducted related to comparison the cardio-respiratory, digestive and laryngeal perioperative complications by using ETT and LMA. In a group of studies no difference has been observed in peritoperative complications. For example, in a study conducted by Splinter and Smallman, no difference was indicated between ETT and LMA regarding the sore throat and coughing in the peritoperative period[39]. Other studies have indicated that the risk of complication after use of LMA were further than ETT[40,41]. Finally, some other studies have reported that a risk of nausea, vomiting[42], sore throat[43-48], and coughing[49-50] after use of LMA were less than ETT. As it turned out, in spite of the increase in the application of LMA, there is still controversy about the efficacy of LMA in comparison to ETT. This problem restricts the wide application of LMA. Therefore, the aim of present study was to compare the perioperative cardi-respiratory, digestive (nausea and vomiting) and laryngeal (sore throat and coughing) complications by using ETT and LMA in peritoperative period of selective laparoscopic cholecystectomy under general anaesthesia.

Methods & materials:

This randomized controlled clinical trial was designed to conduct among the 60 patients (30 patients with endotracheal tube & 30 patients with LMA) of routine laparoscopic cholecystectomy in BIRDEM General Hospital, Bangladesh from a period of 15.07.2016 to 15.01.2017 with a view to depict the of safety of Laryngeal Mask Airway in contrast to endotracheal Tube in terms of peroperative and immediate postoperative complications. Respective patients of 20 to 60 years age group with ASA II or III included as study population. Different pathology (for which operation was done), BMI, co-morbidity were confounding variable here. Patients with congenital anomaly and morbid obesity were excluded from study population. Systemic random sampling was used as the sampling technique. In each patient, after preoxygenation, anaesthesia was introduced with propofol, fentanyl and

vecuronium. Anaesthesia was maintained with N_2O, O_2, Halothane and vecuronium. Ventrilation was set at 8 ml/kg and respiratory rate was 12/ min.

Patients with endotracheal tube (ETT) were included in Group A (Control group) & patients with LMA were in Group B (Experimental group). Data were processed, presented in tabulated form and discussed with compare & comparison on the basis of statistical analysis.

Results:

Age and sex distribution of both group of patients is depicted in Table 1 which suggests that majority (40%) of the patients of Group A were in 40 to 50 years age group whereas, in a case of Group B, most of the patients (43.3%) were in group B.

Figure 2 reveals the demographic distribution and duration of anaesthetic period (minutes) of patients in both control and experimental groups.

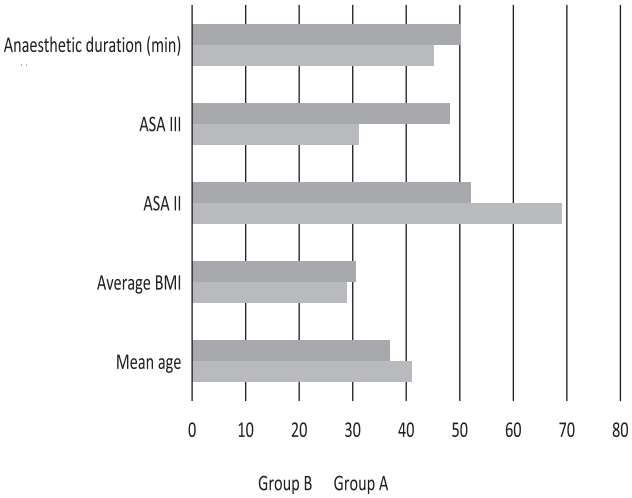

Fig 1 *Demographic data & average anaesthetic duration in both study groups.*

Table-1 *Age & sex distribution in both control and experimental groups.*

	Group A (n=100)			Group B (n=100)		
Age in years	No. of patients	%	Mean±SD	No. of patients	%	Mean±SD
20-30	02	6.7	48±1.9	01	3.3	52±1.7
30-40	07	23.3		06	20	
40-50	12	40		13	43.3	
50-60	09	30		10	33.3	
Total	30	100		30	100	

Table II. *Average SBP and DBP in both study groups.*

Time of	SBP* (Mean±SD)		P-value	DBP** (Mean±SD)		P-value
measurement	Group A	Group B		Group A	Group B	
Baseline	136±10	133±06	>0.05	81±07	82±05	>0.05
At 10^{th} second	141±08	139±05		85±08	85±04	
At 01^{st} minute	137±08	136±06		82±06	84±04	
At 3^{rd} minute	133±05	129±05		82±05	80±06	
At 5^{th} minute	130±09	131±04		79±10	80±06	
At pneumoperitoneum	138±05	134±03		84±05	81±06	
At extubation	135±06	132±05		80±08	79±07	

*SBP means systolic blood pressure, **DBP means diastolic blood pressure.

Table-III *Average MAP and HR in both study groups.*

Time of measurement	MAP* (Mean±SD) Group A	Group B	P-value	HR** (Mean±SD) Group A	Group B	P-value
Baseline	99±08	101±05	>0.05	84±09	79±03	>0.05
At 10th second	105±07	104±04		89±05	88±05	
At 01st minute	102±10	101±02		85±10	80±06	
At 3rd minute	100±08	103±04		86±06	81±04	
At 5th minute	99±10	99±05		79±07	78±04	
At pneumoperitoneum	101±05	101±05		81±10	82±06	
At extubation	100±06	101±04		83±06	83±05	

*MAP means mean arterial pressure, **HR means heart rate.

Haemodynamic status in different time of peroperative period is represented in Figure 2 in terms of heart rate (HR) and mean arterial pressure (MAP).

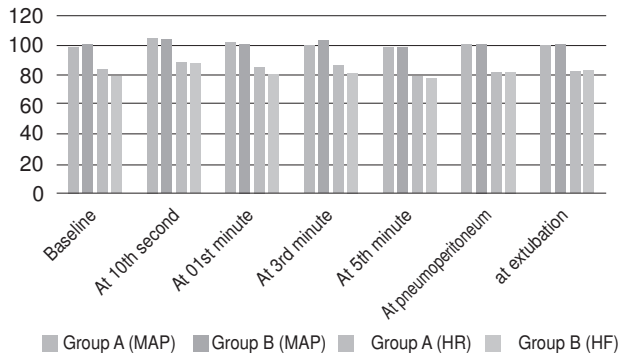

Fig 2 *Haemodynamic parameters (MAP= Mean Arterial Pressure, HR= Heart Rate).*

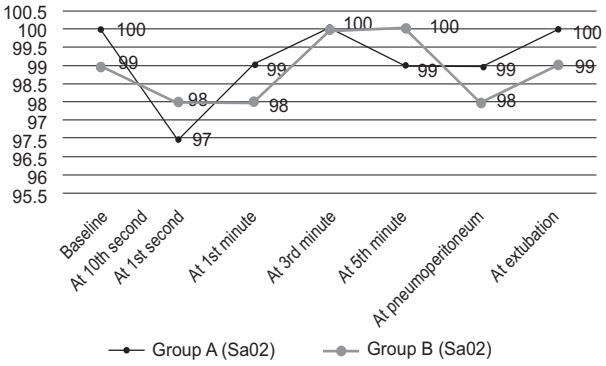

Fig 3 *Percentage saturation of Oxygen (SaO_2) in both study groups.*

Laryngeal morbidity at different phases is represented in Table 4 which suggests no significant difference between the findings in ETT and LMA groups. P-values are statistically less significant here.

Table 4 *Laryngeal morbidity in Group A & B.*

	Group A		Group B		P value
Intraoperative	n	%	n	%	>0.05
Leak	00	00	00	00	
Gastric insufflation	00	00	00	00	
Aspiration, regurgitation	00	00	00	00	
At removal					
Coughing	04	13.3	02	6.7	
Blood stain device	00	00	00	00	
Trauma to lip, teeth, tongue	00	00	00	00	
Postoperative					
Vomiting	02	6.7	01	3.3	
Sore throat	00	00	00	00	
Dysphagia, dysphonia, dysarthia	00	00	00	00	

Discussion:

In Group A (control group), majority of the patients (12 out of total 30 patients, 40%) were in 40 to 50 years of age group followed by 30% (09 patients out of total 30 patients) were in 30 to 40 years age group. Mean±SD of age in this group was 48±1.9, in contrast, in experimental group, most of the patients were in (13 out of total 30 patients, 43.3) were in 40 to 50 years of age group followed by 33.3% (10 patients (out of total 30 patients) were in 50 to 60 years age group. Mean±SD of age in this group was 52±1.7. Demographic data (Figure 1) suggests that the average BMI in both group were 28.9 and 30.6 respectively. In ETT group, most of the patients (69%) had ASA grade II, whereas in LMA group 52% patients had ASA grade II. Average anaesthetic duration in both group were 45 & 50 minutes respectively.

Table 2 suggests that there is no gross clinically significant variation in systolic and diastolic pressure in both groups. P values are >0.05 here, hence statistically insignificant. In case of mean arterial pressure and heart rate, almost same results were found (Table 3). In both control and experimental groups, there was no clinically or statistically significant difference.

Haemodynamic status in both groups in terms of heart rate and mean arterial pressure was also depicted in figure 2 which suggest no significant difference in between both groups at different phases of peroperative period. Figure 3 depict that there was no significant changes in percentage saturation of Oxygen in both groups in relation to different timing of measurement and it was >97% at any point. In a research study, there also found no significant differences in outcomes in between the use of ETT and LMA tube[51].

In question of laryngeal complications, table 4 suggests that coughing and vomiting following removal of tube were found in 6.7% and 3.3% patients respectively with the use of LMA, in contrast, in case of use of ETT, the incidences were slightly higher (13.3% and 6.7% respectively). No case of regurgitation and aspiration was recorded. Other intra-operative problem like tube leak, gastric insufflation was nil in both groups. Regarding the issue of other laryngeal morbidity immediately following removal of tube, it was observed that trauma to lip, teeth, tongue and blood stain on device were found nil in both groups (Table 4). The incidence of postoperative sore throat was also nil with the use of LMA and ETT, and no case with postoperative complications like dysphagia, dysphonia, dysarthia were found in both control and experimental groups. P-values suggests insignificant result here (>0.05). In a study of Namita S. et al[51]. it was found that in case of haemodynamic status, there was no significant comparative results between ETT and LMA groups also. In issue of intraoperative laryngeal morbidity, the prevalence of tube leakage and gastric insufflation were 1 case and 3 cases respectively in LMA group, whereas, regarding postoperative sore throat, it was recorded to be slight higher in LMA group (07%). But following removal of tube, the difference of laryngeal complications in between both group suggests less significant result.

Conclusion:

In summary, the result of this study is highly suggestive of the effectiveness and safety of LMA in terms of haemodynamic and laryngeal complications in comparison to endotracheal tube. In addition, LMA insertion causes less changes of haemodynamic parameters when compared with that of ET intubation. Our finding suggests that LMA can be safe and beneficial alternative to ETT in laparoscopic cholicystectomy .

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