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ORIGINAL ARTICLE

Contrast of Laryngeal Mask Airway Versus Endotracheal Tube for Early Postoperative Recovery Following Laparoscopic Cholecystectomy

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ABSTRACT

Aim: To assess the difference between laryngeal mask airway versus endotracheal tube for early postoperative recovery following laparoscopic cholecystectomy

Study design: A randomized controlled trial

Place and Duration: This study was conducted in Liaquat National Hospital and Medical College Karachi from June 2020 to June 2021

Methodology: Overall, 60 individuals were assigned to airway management utilizing either the laryngeal mask airway(LMA) group or endotracheal tube (ETT) group. All the patients went under sevoflurane-based general anesthesia and all of them had a laparoscopic cholecystectomy. Three things were recorded before and after carbo peritoneum that was blood pressure, heart rate and peak airway pressure. The first hour after surgery and the first postoperative day were used to assess postoperative pain and analgesic needs, as well as hoarseness, nausea, sore throat, and dysphonia.

Results: Two attempts were made to have a successful Laryngeal mask airway or endotracheal tube placement. During carbo peritoneum, both of the groups, LMA and ETT had similar highest average peak airway pressure (LMA: 17.8 [2.9], ETT: 18.2 [4.1], with a p-value of 0.159). The incidence of bradycardia and elevated systolic blood pressure was higher in the LMA group. The LMA group had lower pain scores one hour postoperatively and on a postoperative day 1 than the ETT group (LMA: 3.9 [2.0], ETT: 5.4 [2.3], with a p-value of 0.017 and LMA: 5.6 [1.9], ETT: 6.7 [1.7], with a p-value of 0.042). Both the groups had the same analgesic requirements. Until postoperative day 1, the LMA group had a lower incidence of nausea than the ETT group (LMA: 4/28 [14%], ETT: 12/28 [43%], with a p-value of 0.032).

Conclusion: The Laryngeal Mask Airway Protector proved to be a successful ventilator device which showed lesser intraoperative hemodynamic stress responses. It also enhanced the early recovery standard following laparoscopic cholecystectomy.

Keywords: Endotracheal tube, laparoscopic cholecystectomy, Laryngeal mask airway

INTRODUCTION

The most minimally encroaching surgical approach for benign biliary illness is laparoscopic cholecystectomy. The surgery is performed on an outpatient or inpatient procedure with a brief stay. This surgery is conducted in such a way because of the changes in postoperative care as well as improvements made in anesthetic and surgical procedures. The factors that lead to a long stay in hospitals or readmissions are nausea or vomiting, pain, pulmonary problems and other things [1, 2].

Lower anesthetic requirements, less restricted mucociliary clearance, and improved stability in terms of respiratory and hemodynamics, are the results of the use of LMA [3, 4]. When set side by sidewith the use of an endotracheal tube (ETT), lesser incidences of coughing and laryngospasm were seen as a result of airway devices. Lesser incidence of postoperative nausea, hoarseness and sore throat were also seen [5, 6].

Enabling the use of possible drainage of regurgitated material and use of greater respiratory pressure or the insertion of a stomach piping through desegregated gastric access is recently started due to a second-generation supraglottic airway device. In order to uncover the surgical field appropriately, the gastric drainage channel aids in reducing aspiration of gastrointestinal contents together with air [7, 8]. The number of unfavorable events reported, such as aspiration, that is linked with the usage of LMA in laparoscopic surgery is low [9]. Regardless of the use of laparoscopic procedures, LMA ventilation could be regarded as an effective alternative to endotracheal intubation [10, 11]. However, it is still not known what are the benefits of using LMA during laparoscopic cholecystectomy. Hence, the impact of using LMA Protector Airway, a second-generation supraglottic airway, in the early stages of recovery after laparoscopic cholecystectomy was evaluated. The LMA showed lesser intraoperative hemodynamic stress responses and enhanced intraoperative hemodynamic stability.

METHODOLOGY

The Institutional Review Board approved this randomized controlled trial. The written consent of all patients involved in this study was taken. All individuals were aged from 19 to 79 years old. All the patients went under sevoflurane-based general anesthesia and all of them had a laparoscopic cholecystectomy. Those individuals who had creatinine levels greater than 1.9 milligram/dL, arrhythmia, difficult airway and those who refused to take part were not included in the study. Moreover, those patients whose LMA or ETT could not be properly positioned after two attempts were also excluded from the study.

Computer-generated random numbers with a 1:1 ratio and a 4 block size were used to choose the sample. The allotment was secure in a non-transparent envelope. The LMA or ETT were provided by a corresponding author, according to the group assignment, who unlocked the envelope just before anesthesia. The intraoperative data was recorded by an attending anesthesiologist who was not a part of the research. Data related to the postoperative results and analysis were collected by the coauthor who was not aware of the group allocation.

Anesthesia and pain management: Individuals were observed in the operating room using a noninvasive arterial pressure measurement, an electrocardiogram, bispectral index (BIS), pulse oximetry, and surgical plex index. Next, anesthetic induction was conducted using rocuronium 0.9 milligram/kg with sevoflurane, fentanyl 25 milligrams, and 1.4 to 2 milligram/kg propofol. The individuals were given either LMA or ETT. In order to obtain a successful airway, a maximum of two attempts were made. If any attempt failed, the device was removed from the mouth. The Protector LMA permitted constant cuff pressure monitoring and air

inflation until the cuff pressure indication was inside the green zone which is from 31 to 45 mm Hg. A cuff manometer was utilized to fill the air with ETT cuff pressure of 19 to 29 cmH_2O. The mechanical ventilation was started at a tidal volume of 7.9 millilitres/kg per average body weight with a combination of oxygen and air with a fragment of FiO_2. The mechanical ventilation was adjusted in such a way that an end-tidal pressure of CO2 of 34 to 44 millimeters was maintained. The surgical plex index was just observed and the bispectral index was kept between 39 and 59. There were cases where Nicardipine 300 milligram was supplied. Those were the cases where the systolic blood pressure was increased by 30 percent of baseline or to greater than 160 mmHg. In some cases where the systolic blood pressure fell below 80 mmHg, ephedrine was supplied. In some cases, the heart rate increased to more than 120 beats per minute and esmolol 20 milligrams was supplied here. However, if the heart rate was dropped to less than 45 beats per minute, glycopyrrolate 0.2 milligrams was supplied. After the induction, palonosetron 0.075 milligrams was supplied which is a prophylactic antiemetic. At the start of peritoneal closure, ketorolac 30 milligrams and fentanyl 50 milligrams were given. The systolic blood pressure, heart rate, peak airway pressure, and surgical plex index were measured at five different points. Those points were: (1) before anesthesia, (2) when the airway device was inserted, (3) when carbo peritoneum was started, (4) when carbo peritoneum was stopped, and (5) at the end of the surgery. The surgeon was asked about the severity of stomach distension during the operation.

In order to undo muscle relaxants, pyridostigmine 15 milligrams and glycopyrrolate 0.4 milligrams were supplied. After the removal of the airway device, the individuals were shifted to the recovery room. The pain was evaluated, after the examination of orientation related to place and person, by using a numerical rating scale (NRS). Patients with NRS greater than and equal to 4 complained of pain and were given 0.01 milligram/kg hydromorphone inserted in the vein. The level of pain was managed and measured every 10 minutes. During the 1st hour postoperatively in the recovery room, vomiting, aspiration, dysphonia, hoarseness, nausea, coughing, and sore throat were examined. When the patients were getting discharged from the recovery room, an interview was conducted along with a survey to get a review of satisfaction derived from the surgery and anesthetic management. The pain was examined more than or equal to four times each day when the patients stayed in the hospital. Those patients who complained of pain, having NRS greater than or equal to 4 were injected with pethidine 50 milligrams through a vein. Patients were discharged the next day after surgery if they did not have a fever or dietary issues.

Statistical analysis: A prior study found that morphine intake differed between the ETT and LMA groups, with the LMA group consuming 17 (7.2) milligrams versus the ETT group consuming 12.1 (4.9) milligrams during laparoscopic gynecological surgery [5]. The starting sample size estimate resulted in thirty patients in each group, with a five percent error and an eighty percent power.

Kolmogorov-Smirnov test was performed for the normal distribution of the data. The data was demonstrated in the form of the mean (standard deviation) or median. The chi-square test was performed for both groups' perioperative data, demographic data, and clinical outcomes. For categorical variables, the Fisher test was performed. Constant variables were examined using the Mann-Whitney U test and independent variables were examined using the t-test. In order to examine the intergroup differences overtime, ANOVA was performed. By using the Bonferroni method, a number of comparisons of results at specific intervals were rectified. The Cochran-Armitage test was performed to test the original data. SPSS version 24 was used to conduct all statistical analyses with a significance level of 0.05 for all tests.

RESULTS

There were a total of 60 patients,who were randomly assigned to airway management using LMA or ETT. The LMA group had 30 patients and the ETT group had 30 patients. Among these 60 patients, there was not even a single case where the placement of the airway device was not successful within 2 attempts. All patients in both groups were provided with optimal ventilation and oxygenation before and after carbo peritoneum. Each of 60 patients were examined for the analysis. Table number 1 shows that no significant differences were seen in the patients' surgical data or characteristics.

Compared to the ETT group, the LMA group experienced less discomfort an hour after surgery and on the first postoperative day. (LMA: 3.9 [2.0], ETT: 5.4 [2.3], with a p-value of 0.017 and LMA: 5.6 [1.9], ETT: 6.7 [1.7], with a p-value of 0.042). Figure 1 shows that there was no notable dissimilarity seen between the 2 groups associated with the requirements for analgesics. Moreover, the differences in pain scores vanished six hours postoperatively.

Coughing was experienced more frequently in the ETT group instead of the LMA group during the anesthetic emergence. A total of 84 percent of the patients experienced coughing in the ETT group and only 12 percent of patients experienced coughing in the LMA group. Table no 2 shows postoperative outcomes. Hoarseness and dysphonia were seen as less common in the LMA group, 1 hour postoperatively, than in the ETT group. Nevertheless, these symptoms recovered the next day in the patients.

After the airway device was inserted and the carbo peritoneum was inducted, the peak airway pressure was seen lesser in the ETT group rather than in the LMA group, but it was not much different (LMA: 17.8 [2.9], ETT: 18.2 [4.9], with a p-value of 0.159). Figure 2 shows the recorded surgical plex index and hemodynamic in these 2 groups.

It was seen that almost the same hemodynamic values were found in both the groups when the airway device was inserted and at the end of the surgery but the hemodynamic fluctuation was higher in the ETT group's patients. It was found through repeated measures ANOVA that the ETT group had the notable group in time interconnection as contrast with the LMA group. The values of systolic blood pressure were also high in the ETT group with a p-value of 0.007. At the time of inducing carbo peritoneum, patients of the ETT group showed a higher incidence of bradycardias than the patients in the LMA group. About 12 percent of patients showed the incidence of bradycardias in the LMA group and 24 percent were seen in the ETT group. The LMA group showed a low frequency of using ephedrine and Nicardipine during the surgery (1 percent in LMA and 3 percent in ETT). The two groups had no difference in the surgical plex index scores.

Table 1: patients' surgical data and characteristics.

	LMA group	ETT group	P-value
	n=30	n=30	
Age (years)	50	53	0.296
Gender (male/female)	19/9	16/12	
Height (cm)	159.3	163.3	0.081
Weight (kilogram)	67.2	64.6	0.066
Body Mass Index (kg/m2)	23.3	24.3	0.036
ASA grade (I/II)	19/9	18/10	
Insertion Attempt			
First	25	24	
Second	5	6	
Single port surgery	5	4	
Peak airway pressure after intubation	12.3	12.7	0.256
Peak airway pressure in carbo peritoneum	17.7	18.6	0.412
Change of peak airway pressure	5.4	6.1	0.354
Intraoperative crystalloid	245	281	0.217
Duration of surgery in minutes	45	43	0.510
Duration of anesthesia in minutes	77	74	0.401

There were notable dissimilarities seen between the 2

groups regarding satisfaction scores which were recorded at the time of recovery room discharge (4 [3.4] vs 3 [2.3]). The surgeon was unaware of the dissimilarities in airway devices and they did not record gastric distention.

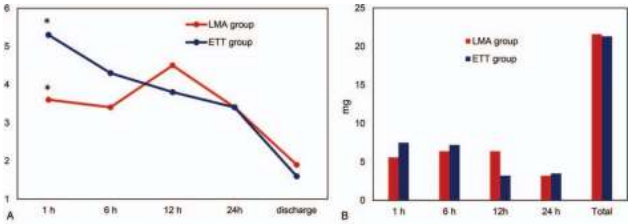

Figure 1,2: groups associated with the requirements for analgesics

Table 2: postoperative outcomes

	LMA group	ETT group	P-value
PACU time (minutes)	53	53	0.127
Hospital stay from surgery day(days)	3	3	0.144
Postoperative 1 hour			
Nausea	3	11	0.014
Vomiting	0	0	
Sore throat	4	9	0.051
Hoarseness and dysphonia	2	9	0.005
Postoperative day 1			
Nausea	4	12	0.031
Vomiting	0	0	
Sore throat	1	1	
Hoarseness and dysphonia	0	0	
The pain score on discharge	2	2	0.504

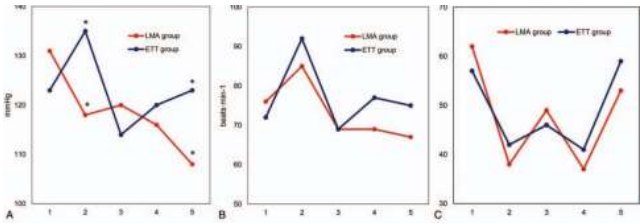

Figure 2: surgical plex index and hemodynamic in these 2 groups

DISCUSSION

The LMA Protector was found to be a successful device. It was as successful as an ETT in sustaining pulmonary ventilation without causing any disruption in peak airway pressure. It was found that during the 1st hour postoperatively, postoperative nausea and pain were reduced, which supported our hypothesis that the LMA Protector would provide benefits for early recovery. It was also seen that the hoarseness and dysphonia were lower in the LMA group. However, these symptoms vanished by postoperative day 1 at discharge.

The difference in the quantity of morphine consumption was not confirmed because the pain score was lower than what we expected. In our opinion, it was the management of ketorolac and fentanyl before arousal that interpreted these results. The surgical stress response can include sympathetic nervous system activation [12, 13]. Therefore, the reduction in intraoperative stress acts as a key factor for improving early recovery. Although it produces stress responses at the initial stage, to maintain the airway during anesthesia and surgery, the gold method is tracheal intubation. It was found in prior research that the placement of LMA induces lesser stress responses and is less encroaching [3, 12]. In our study, we found that at the initial stages and at the stages where pneumoperitoneum was discontinued, hemodynamic variations are caused due to stimulation from ETT.

When it comes to the use of LMA in lowering the frequency of postoperative vomiting, nausea, and analgesic requirements, prior research has yielded conflicting results [14]. We have noticed that postoperative pain, dysphonia, and nausea have reduced using the LMA Protector. After surgery, after the airway device is removed, there may arise certain unpleasant outcomes such as coughing, breath holding, straining, and gross purposeful movement related to increased abdominal pressure. As a result, the LMA group's immediate postoperative recovery was improved.

Pulmonary aspiration of gastric contents, gastric distension, and inadequate ventilation arecommon problems faced during laparoscopic surgery while using LMA. A rise in intra-abdominal pressure is known to induce a reflex increase in lower esophageal sphincter tone [15]. Peak airway pressure ranged from 3 to 8 cmH2O before and after pneumoperitoneum establishment. Moreover, the surgeons did not observe the clinical relevant gastric distension. No cases of pulmonary aspiration or vomiting were seen. Because the Protector LMA was built with a high capacity conduit with stomach access and a fixed curved structure to aid insertion, these results were attained. The LMA Protector device has a bulky shape relatively to perform these functions as compared to the other airway devices. In our study, the corresponding author had the role of performing insertion of all LMA Protector Devices and ETT. The insertion did not feel complicated with the increase in the experience and then it was using the tip of a finger to work on and make a curved end. However, the LMA Protector is likely to raise failure rates at the first time insertion. No disturbing events such as bleeding were led when the LMA was removed. The incidence of sore throat was comparable to that of other LMA devices [6, 16]. Though they are bulky, the silicone cuffs may lower the risk of sore throat and attain higher seal pressures. Furthermore, continual cuff pressure monitoring may prevent the occurrence of sore throat and dysphonia [17, 18].

However, the benefits of LMA insertion did not last for the entire 6-hour postoperative period. Several recommendations have been made to improve the standard of recovery after laparoscopic surgery [19, 20]. To reduce pain and nausea or vomiting in laparoscopic surgery, dexamethasone is recommended. The impacts of dexamethasone were seen for 48 hours after the surgery. Thus, combining LMA and dexamethasone may result in sustained effects that expand throughout ward recovery and yield significant clinical outcomes.

A few limitations were also seen in our study. First is the interview and survey conducted at the time of discharge from the recovery room. A number of patients got discharged earlier or the day after the surgery which makes it difficult to record the status of every patient at the time of discharge. Therefore, we were not able to confirm whether the postoperative recovery improved or not. Although the same device and same surgical procedure were used in all patients, the measurement of aspiration of pneumoperitoneum and CO2 insufflation after the surgery was not performed. This is the second limitation of our study. The third limitation is that we involved parents in this study who hadno cardiovascular disease and were otherwise healthy. As a result, the effects of hemodynamic stress response and breathing on all patients were not adjusted.

CONCLUSION

The Laryngeal Mask Airway Protector proved to be a successful ventilator device which showed lesser intraoperative hemodynamic stress responses. It also enhances the early recovery standard following laparoscopic cholecystectomy. Its frequency was lower in the LMA group than the ETT group. However, the symptoms vanished 6-hours postoperatively. As a result, adopting an LMA as part of a multimodal approach may help to establish early postoperative recovery from laparoscopic cholecystectomy.

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Conflict of interest: None

Permission: Permission was taken from the ethical review committee of the Institute

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