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A COMPARATIVE STUDY OF PROSEAL LARYNGEAL MASK AIRWAY AND LARYNGEAL TUBE SUCTION II IN LAPAROSCOPIC SURGERY; HAEMODYNAMIC RESPONSE, DEVICE TOLERANCE AND COMPLICATIONS

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ABSTRACT

Background: In this study, we compared Proseal LMA and LTS II for haemodynamic responses and airway morbidity.
Material and Methods: We randomly allocated 100 patients, scheduled for laparoscopic procedure, into two groups. In Group A, Proseal LMA and in Group B, Laryngeal Tube Suction II was used. Both the groups were compared for haemodynamic changes with device insertion, device tolerance, complications and postoperative pharyngeal morbidity. **Results:** Heart rate measurements were comparable in both groups. The difference of Systolic blood pressure, Diastolic blood pressure and Mean arterial pressure readings at various time intervals between the groups was statistically significant with higher values for LTS II. Both groups were comparable in terms of device tolerance during removal. 94% (47) patients in PLMA group and 88% (44) patients in LTS II group had Good device tolerance. The difference in inspection findings on device removal was not significant. 4 patients (8%) and 10 patients (20%) complained of sore throat at 1 hour in PLMA group and LTS II group respectively. 2 patients (4%) and 5 patients (10%) complained of sore throat at 24 hours in PLMA and LTS II group respectively. The difference in incidence of postoperative complications at 1hour and 24hours, for both the groups, was not significant. **Conclusion:** LTS II causes a greater haemodynamic response at the time of insertion. Also, LTS II showed increased trend of airway trauma. Our study suggests that clinical performance of PLMA is superior to LTS II, with respect to haemodynamic response and airway morbidity.

KEYWORDS

Proseal Laryngeal Mask Airway (PLMA), Laryngeal Tube Suction II (LTS II), Haemodynamic responses, Pharyngeal morbidity

INTRODUCTION

Supraglottic Airway devices are a missing link between face mask and endotracheal tube. These devices overcome certain disadvantages of endotracheal tubes such as soft tissue, tooth, vocal cords, laryngeal and tracheal damage; exaggerated haemodynamic response[1,2], barotrauma[3] etc.

The Proseal Laryngeal Mask Airway overcomes most of the drawbacks of Classic Laryngeal Mask Airway associated with positive pressure ventilation[4], making it an alternative device for airway management in laparoscopic procedures[5].

The Laryngeal Tube (VBM) was designed by Volker Bertram in Germany[6]. A double lumen Laryngeal Tube, the Laryngeal Tube Suction incorporates a second (esophageal) lumen posterior to the respiratory lumen[7], making it useful for laparoscopic procedures as well. In 2005, the LTS was replaced by the LTS mark II.

We compared Proseal LMA and LTS II with respect to haemodynamic changes with device insertion, device tolerance, complications and postoperative pharyngeal morbidity.

MATERIAL AND METHODS

After approval of Institutional Ethics Committee and written informed consent from patients, 100 patients of either sex, 18-60 years of age, ASA grade I and II, scheduled for laparoscopic surgery were randomly allocated to one of the two groups:

Group A- Use of Proseal Laryngeal Mask Airway
Group B- Use of Laryngeal Tube Suction II

Patients with BMI>35 kg/m2, known or predicted difficult airway, upper respiratory tract infection in previous 10 days, preoperative increased risk of aspiration and pathological conditions of upper respiratory tract or upper gastrointestinal tract were excluded from the study.

After preanaesthetic evaluation, written informed consent was obtained. Patients were kept fasting overnight and received Tablet Alprazolam 0.25mg and Tablet Ranitidine 150mg, night before surgery. On the morning of surgery, intravenous line was secured. Patients received IV Metoclopramide 10mg and IV Ranitidine 50mg, 45minutes before surgery.

In the operation theatre, standard anaesthesia monitors, including electrocardiograph, pulse oximeter and noninvasive blood pressure, were attached and baseline vital signs recorded. Patients received IV Ondansetron 0.1mg/kg and IV Tramadol 1mg/kg. After preoxygenation for 3mins, anaesthesia was induced intravenously with Propofol 2-2.5mg/kg. Neuromuscular blockade was achieved with Succinylcholine 1.5mg/kg. Manual facemask ventilation was performed until conditions were suitable for insertion of the airway.

In Group A, size of Proseal LMA was selected according to patient's weight. Proseal LMA was inspected for any tear, cuts or kinking and any blockage in the tube. The cuff was inflated and examined for any leaks. Once checked, the cuff was deflated and water soluble lubricant was applied on dorsal surface of the cuff. The device was inserted using an introducer tool, with the patient's head in the 'sniffing position'. The cuff was inflated with air and the cuff pressure was adjusted to 60cmH2O using a cuff pressure manometer.

In Group B, size of LTS II was selected according to patient's height. LTS II underwent inspection for any damage or blockage in the tube. The cuffs were inflated and checked for any leak. Once checked, the cuffs were deflated. After applying a water soluble lubricant, the LTS II was inserted with the subject's head in the 'sniffing position'. The device was introduced in the oropharynx against the hard palate and slid down until a resistance was felt or the second bold black line on the tube passed between the upper and lower incisors. Both the cuffs were inflated with air using a pre-prepared syringe through the single inflation line. The cuff pressure was adjusted to 60cmH2O using a cuff pressure manometer.

Correct placement for both devices was confirmed using:

- Bilateral chest excursion on manual ventilation and auscultation over both lungs
- A square-wave capnography and normal value of partial pressure of end tidal CO2
- No audible leak from the drain tube with peak airway pressure at 20cmH2O.

The device was connected to the anaesthesia machine and fixed by taping it over the chin.

Haemodynamic parameters including Heart Rate and Blood pressure (systolic, diastolic and mean arterial pressure) were recorded 1 minute

before and 1, 2, 3, 5, 10 minutes after insertion of the device.

In case of an ineffective airway, intervention such as jaw lift, adjusting the head and neck position and changing the depth of device insertion were performed.

In the event of failure to establish an effective airway after three attempts, intubation with endotracheal tube was performed. An effective airway was defined as SpO2≥95%, ETCO2≤45mmHg and minimal air leak (the difference between inspiratory and expiratory tidal volume less than 15%).

A lubricated 16F or 14F gauge gastric tube was inserted.

Anaesthesia was maintained with N2O:O2 in a ratio of 66:33% with Isoflurane and Atracurium 0.5mg/kg bolus and 0.1mg/kg maintenance doses were used to maintain neuromuscular blockade.

The initial mode of ventilation was started using volume control with a starting tidal volume (VT) of 9ml/kg, RR of 12/min, I:E ratio of 1:2 and PEEP of 5.

During capnoperitoneum, insufflation pressure was kept between 12-14mmHg and SpO2>95% and ETCO2≤45mmHg was maintained by adjusting the FiO2, Respiratory rate and Tidal volume.

At the end of surgery, anaesthesia was discontinued. Muscle paralysis was reversed using Neostigmine 50µg/kg and Glycopyrrolate 10µg/kg. Patients were given 100% Oxygen during emergence. Before removal of the device, stomach was emptied and nasogastric tube removed. Airway device was removed when the patient was awake and responded to verbal commands.

Tolerance during removal of device was assessed using a scale as:
- Good: comfortable patients
- Moderate: minor sign of intolerance such as coughing, retching, hiccups or biting of the airway
- Poor: major sign of intolerance such as vomiting or vagal reaction rendering it necessary to remove the device immediately

Following removal of the device, any traces of gastric fluid or blood on the device was documented. The mouth, lips and tongue were inspected for evidence of trauma.

Patients were asked about sore throat, dysphonia, dysphagia and hoarseness; 1hour and 24hours after device removal.

At the end of the study, all the data collected was compiled and analysed using appropriate statistical tests.

RESULTS

A total of 100 patients were included in the study.

Table 1 shows the demographic profile. Both the groups were comparable with respect to age, weight, height, BMI and sex distribution.

Table 1: Demographic Profile

Parameter	Group A	Group B	p-value
Age (years)	40.48 ± 12.38	39.28 ± 11.24	0.61
Weight (Kg)	60.6 ± 7.76	63.08 ± 7.83	0.11
Height (cms)	155.58 ± 4.34	156.46 ± 5.02	0.06
BMI (Kg/m2)	25.008 ± 2.79	24.75 ± 2.39	0.63
Sex (Male/Female)	7/43	14/36	0.085
Values expressed as either Mean ± Standard deviation or by absolute numbers.			

Table 2 and 3 show haemodynamic parameters at various time intervals. Heart rate measurements were comparable in both the groups. Systolic blood pressure, Diastolic blood pressure and Mean arterial pressure were different at various time intervals after the device use in both the groups. The difference was statistically significant with higher values for LTS II.

Table 2: Haemodynamic parameters (Heart Rate)

Time	Heart Rate (beats/minute)		
	Group A	Group B	p-value
Baseline	87.2±10.859	85.44±9.472	0.38
1min before insertion	89.16±8.949	83.32±9.168	0.01*
1min after insertion	92.5±8.548	90.72±9.102	0.31
2mins after insertion	90.58±7.874	90.9±8.91	0.84
3mins after insertion	87.04±6.14	87.08±9.169	0.97
5mins after insertion	83.68±6.25	82.36±9.209	0.4
10mins after insertion	82.02±6.94	80.22±8.28	0.24
Values expressed as Mean ± Standard deviation *=significant(p<0.05)			

Table 3: Haemodynamic parameters (Blood pressure)

Time	Systolic BP (mmHg)			Diastolic BP (mmHg)			Mean Arterial Pressure (mmHg)		
	Group A	Group B	p- value	Group A	Group B	p- value	Group A	Group B	p- value
Baseline	125.24 ± 12.52	131.28 ± 14.37	0.05	75.14 ± 9.602	77.98 ± 8.98	0.12	91.84 ± 9.85	95.74 ± 9.86	0.05
1min before insertion	124.7 ± 12.585	121.08 ± 12.52	0.15	76.64 ± 9.84	74.62 ± 10.34	0.32	92.66 ± 9.99	90.107 ± 10.19	0.21
1min after insertion	131.9 ± 16.67	139.88 ±15.21	0.01*	82.7 ± 12.306	85.94 ± 10.43	0.16	99.1 ± 12.98	103.92 ± 11.37	0.05
2mins after insertion	129.64 ± 16.02	141.48 ± 15.51	0.0002**	81.28 ±11.702	84.84 ± 12.13	0.14	97.4 ± 12.33	103.72 ± 12.64	0.01*
3mins after insertion	122.96 ± 13.82	134.6 ±14.51	0.0008**	76.14 ± 10.58	80.6 ± 11.18	0.04*	91.74 ± 10.8	98.6 ± 11.42	0.002**
5mins after insertion	117.96 ± 14.94	127.78 ± 15.33	0.001**	72.3 ± 10.53	76.68 ± 10.67	0.04*	87.52 ± 10.79	93.71 ± 11.39	0.006*
10mins after insertion	116.24 ± 14.26	124.72 ± 14.52	0.003**	72.66 ± 9.74	75 ± 8.95	0.2	87.18 ± 10.53	91.57 ± 9.83	0.03*
Values are expressed as Mean ± Standard deviation *=significant (p<0.05), **=highly significant (p<0.005)									

Both the groups were comparable in terms of device tolerance during removal. 94% (47) patients in PLMA group and 88% (44) patients in LTS II group had a Good tolerance. 6% (3) patients in PLMA group and 12% (6) patients in LTS II group were categorized into Moderate tolerance. None of the patients in either group had Poor tolerance.

On inspection after removal, blood stain on the device was found in 7 patients (14%) in PLMA group and 10 patients (20%) in LTS II group. No patient had presence of gastric fluid on the device. Lips/ tongue/ mouth trauma was present in 2 patients (4%) in PLMA group and 4 patients (8%) in LTS II group. The difference in inspection findings on device removal was not significant statistically.

On questioning about postoperative pharyngeal symptoms, 4 patients (8%) and 10 patients (20%) complained of sore throat at 1 hour in PLMA group and LTS II group respectively. 2 patients (4%) and 5 patients (10%) complained of sore throat at 24 hours in PLMA and LTS II group respectively. There were no complaints of dysphagia, dysphonia and hoarseness in any group at 1 hour and 24 hours. The incidence of post operative complications at 1hour and 24hours, for both the groups, was not statistically significant.

Discussion

One of the main disadvantage associated with tracheal intubation has been the exaggerated or enhanced pressor response which may be deleterious in patients with hypertension, coronary artery disease, increased intracranial pressure etc. The modification of supraglottic airway devices to add a second lumen (drain tube), makes these devices an alternative for use in patients who require high airway pressures for ventilation, as in laparoscopic procedures[5].

Esa et al[8] compared the performance of LTS II and PLMA during laparoscopic surgery. Haemodynamic parameters were noted before induction, post induction, after device insertion and after capnoperitoneum. The results were comparable for both devices. There were no major airway incidences/ complications in the study. Incidence of sore throat was comparable.

In our study, the heart rate measurements were comparable for both the devices. Systolic blood pressure, Diastolic blood pressure and Mean

arterial pressure difference was significant at various time intervals after the device insertion with higher values for LTS II.

Our results are similar to the study by Dahaba et al[9], who obtained a greater haemodynamic response with the use of LTS. They compared the haemodynamic and catecholamine stress responses to the LTS and the PLMA during their insertion and removal. MAP, HR, epinephrine and norepinephrine levels increased to preinduction levels with the insertion of the LTS; whereas the levels remained significantly lower than preinduction values following the insertion of the PLMA. Removal of the airway device resulted in a significant increase in MAP, HR, epinephrine and norepinephrine levels with greater increase in the LTS group. According to the authors the results probably reflect greater pharyngeal stimulation from the LTS cuff. Other factors that may have contributed were longer time and frequent readjustments required to produce an effective airway in the LTS group. The authors also stated that the higher stress response seen with the LTS was a result of genuine high mucosal pressure. The pharyngeal mucosal pressures were measured in two separate studies using strain gauge silicone microchip sensors attached on the LTS[10] and the PLMA[11].

However, other studies by Esa et al[8] and Figueredo et al[12] on haemodynamic changes with device use did not show any significant difference.

Tolerance during device removal, inspection findings after removal of the device and postoperative complications at 1 and 24hours, were all comparable for both the devices, but with a higher trend of airway morbidity with LTS II. Our results are consistent with those obtained by Kikuchi et al[13], and Esa et al[8].

Kikuchi et al[13] compared LTS II and PLMA. There was no difference in the incidence of traumatic insertion as indicated by presence of blood on the device. The incidence of postoperative dysphagia and sore throat was not significantly different between the two groups.

Zand et al[14] stated that upper airway trauma was not different between two devices, PLMA and LTS. However they observed a significantly more frequent incidence of hoarseness after the use of the LTS, 1 hour after termination of the surgical procedures. This phenomenon could be explained by the larger tip of the LTS.

Bein et al[15] conducted a study on PLMA, LTS and OTC and the results showed the incidence of sore throat and dysphagia was significantly higher in LTS as compared to PLMA.

Limitation of this study

- We did not assess the changes in haemodynamic variables and ventilatory parameters with respect to time of capnoperitoneum.
- All the users had less experience with the LTS II than with the PLMA.
- All postoperative complications, although asked by a blinded investigator, are subjective.

CONCLUSION

The LTS II causes a greater haemodynamic response at the time of insertion. Also, LTS II showed increased trend of airway trauma and complications. Our study suggests that clinical performance of PLMA is superior as compared to LTS II, with respect to haemodynamic response and airway morbidity.

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