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Original Research Article

Effectiveness of LMA Protector in Non-Paralyzed Patients for Laparoscopic Surgeries

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Abstract

Background: Laryngeal mask airway LMA protector is a second generation perilaryngeal sealer type supraglottic airway device possessing functional separation of the respiratory and digestive tract. This study comprises the ease of insertion, fibrotic assessment, oropharyngeal leak and complications associated.

Methods: We conducted this study using LMA protector in 30 ASA grade 1 and 2 patients undergoing laparoscopic surgeries by assessing the ease of insertion considering the number of attempts, oropharyngeal leak pressure, fiberoptic inspection of airway for vocal cord visibility, successful gastric tube placement, blood staining on the device after removal. Incidence of postoperative sore throat and complications if any were noted.

Results: Insertion was successful in the first attempt. Mild resistance was associated with insertion with median insertion time 16.8 (6-30) seconds. Airway leak pressure was 29.5cm H_2O (20-30). On fibrotic examination, vocal cords were visible in all 30 patients. No alternative airway or manipulations was required during the maintenance of anaesthesia. Two patients had sore throat 24 hours after the procedure. Blood traces were present on LMA after removal. There was no dysphasia or hoarseness.

Conclusion: This study proves LMA protector to be safe, and has high first attempt and overall insertion success rate. rapid achievement of effective ventilation and reliable airway seal and low rates of complications. Potentially can be considered for use in laparoscopic surgeries.

Keywords: Laryngeal Mask, Airway Management, Laparoscopy

Introduction

In spite of tremendous advances in contemporary anesthetic practice, airway management continues to be of paramount importance to anesthesiologists. Till date, the cuffed tracheal tube was considered as the gold standard for providing a glottic seal, especially in laparoscopic procedures under general anesthesia [1]. The disadvantages of endotracheal intubation, which involves the laryngoscopy, leading to altered hemodynamic responses for intubation. Damage to the oropharyngeal structures during laryngoscopy and intubation. Postoperative sore throat is also a serious

concern. This precludes the global utility of the tracheal tube and requires a better alternative [2]. Over a period of time, new airway devices like supraglottic airway devices have been added to the anesthesiologist's armamentarium.

The use of laparoscopy has revolutionized the surgical field with its advantages of reduced morbidity with early recovery, less hospital stay and economical. Laparoscopic procedures have been traditionally performed under general anesthesia (GA) with endotracheal tube due to the respiratory changes caused by pneumoperitoneum, which is an integral part of laparoscopy. The precise control of ventilation under controlled conditions in GA has proven it to be ideal for such procedures [3].

Supraglottic airway device (SADs) have been widely popular in the past three decades ever since the prototypical laryngeal mask airway (LMA) Classic was used in 1981 [4]. LMA protector is a novel Single use, latex free silicone made Laryngeal mask airway (LMA) which consists of pharyngeal chamber with dual gastric drainage channel and allows insertion without the need for digital or introducer tool guidance.

The anatomically shaped airway tube is elliptical in cross-section, and ends distally at the laryngeal mask which makes it unique from other supraglottic airway devices [5].

It contains two drain channels which emerges as separate ports proximally. The drainage channel continues distally and enters the chamber located behind the cuff bowl. The chambers further narrows distally into an orifice located at the end of the cuff to communicate distally with the upper esophageal sphincter. The suction tube may be attached to the male drainage port around the laryngeal region. The gastric tube maybe passed to the female port which leads to stomach [5].

Similar to the LMA supreme, it has integral bite block reducing tendency for tube damage and obstruction by biting. the device has got a fixation system which prevents proximal displacement during use, ensuring the distal end seals around the upper oesophagal sphincter [6]. Specially designed channels for separating gastric contents away from the airway, and produces proper seal around the airway. Hence it can be used in laparoscopic surgeries without any risk of aspiration [5].

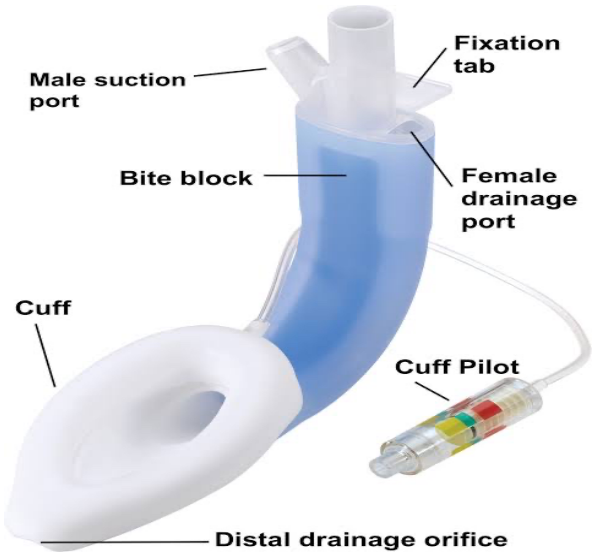

Figure 1

Aim and objective

Till date there were no large number of studies which have assessed the clinical performance of the LMA protector, so the aim of our study is to evaluate the efficacy of LMA protector in sealing the airway properly in laparoscopic surgeries.

The primary objective of our study is

- Ease and successful insertion of LMA.
- Resistance to insertion of LMA (minimal or moderate).
- Oropharyngeal leak pressure (OLP) test.
- Time taken for insertion of LMA.
- Volume of air to achieve intra cuff pressure of 60cm H_2O.
- Successful insertion of nasogastric tube.
- Vocal cord visibility under fiberoptic inspection (%)

Secondary objective

- Blood staining of LMA after removal,
- Postoperative sore throat and dysphagia were assessed
- Hemodynamic parameters like heart rate, mean arterial pressure were also assessed.

Materials and Methods

This prospective cross-sectional study was conducted in 30 Adult patients between 18 - 70 years of ASA Grade 1 and 2 posted for elective laparoscopic surgeries. After obtaining ethical committee clearance. Patients were recruited for study, evaluated preanesthetically, on the day prior to surgery. Patients were instructed to fast for solids 6 hours and clear liquids for 2 hours, given tablet Anxiet 0.5mg and tablet Ranitidine 150mg previous night of surgery.

On the day of surgery in OR after connecting multi parameter monitor(dragger), IV Line was secured. Patient was premedicated with injection Midazolam 1mg, Inj. fentanyl 2 mcg/kg, Inj. glycopyrrolate 0.2 mg, Inj. dexamethasone 8 mg and Inj. ondansetron 4 mg IV.

Patients were induced with Inj. xylocard 1.5 mg/kg and Inj. propofol 2 mg/kg. Patients were ventilated with oxygen and Nitrous oxide and 0.5% Isoflurane for 30 seconds. LMA protector of appropriate size based on the weight was introduced, cuff inflated with air to achieve cuff pressure of 60 cmH2O by using cuff pressure manometer.

Proper placement of LMA was confirmed by fiberoptic bronchoscope (depending on the view, grading was given). LMA was fixed and connected to closed circuit and patients were given muscle relaxant Inj. vecuronium 0.1mg / kg. Oropharyngeal leak pressure was tested as per standard method explained in previous studies. Ease of device insertion was recorded as 'no resistance, minimal resistance' And 'moderate resistance', and 'impossible to pass without excessive force'. We allowed maximum of 3 attempts For LMA Protector insertion. The number of attempts at insertion and the time to achieve airway (time from pickup of the LMA Protector to the presence of CO2 trace on capnography) were recorded.

Failed insertion of LMA protector was defined by any of the following criteria:

1. Failed passage into the pharynx;
2. Malposition (air leaks, negative tap test results, and failed gastric tube insertion if pharyngeal placement was successful); and (3) ineffective ventilation (maximum expired tidal volume < 8 ml/kg or end-tidal carbon dioxide > 45 mmHg if correctly positioned) [7].

A well lubricated 14 F gastric tube was then passed through the female port into the gastric access channel. Successful insertion into the stomach was confirmed by auscultation over the stomach during injection of 10 ml air into the gastric tube, application of silicone spray reduced

resistance while inserting the gastric tube via female port. After the completion of surgery, patients were reversed with neostigmine 0.05-0.07mg/kg and gycopyrrolate 0.01 mg/kg body weight the LMA Protector was removed when the patient completely emerged from Anesthesia. After removal, airway visible blood stain on the device was noted. On Postoperative Day 1 subjects were interviewed for the presence or absence of sore throat, dysphagia and hoarseness of voice and recorded same.

Inclusion Criteria:

- Patients aged between 18-70 years of both sexes.
- ASA physical status grade I and ll.
- BMI 18.5- 30/kg/m^2.
- Patients undergoing laparoscopic surgeries

Exclusion Criteria:

- Patients with BMI more than 30/kg/m^2
- Known gastro esophageal reflux
- Increased risk of aspiration
- Upper airway pathology
- Mouth opening less than 2cm
- Patients refusal

Definition

oropharyngeal leak pressure test- Oropharyngeal leak pressure (OLP), measured by closing the expiratory valve of the anesthetic circle system at a fixed gas flow rate and noting the equilibrium airway pressure, is used to quantify the efficacy of airway sealing in SGA devices [8].

Importantly, OLP indicates airway protection, successful SGA placement, and PPV [8,9]. Several methods are used to quantify OLP, including audible noise detection by stethoscopic noise [8,9].

Fiberoptic Assessment

The anatomical airway position of the LMA Protector was assessed by fiberoptic examination via the airway channel. The view via the airway was scored as follows: Grade 1, clear view of the vocal cords;

Grade 2, view of the arytenoids only

Grade 3, view of the epiglottis only

Grade 4, no laryngeal structures visible[10]

Results

LMA was inserted in first attempt in 26 patients (86.7%) and in second attempt in 4 patients(13.3%)[p=0.00]. Mean time taken for insertion of LMA protector is 16.80±5.365 seconds Mild resistance while inserting LMA was encountered in 10 patients (33.3%) and moderate resistance in 4 patients (13.3%)The mean OLP measured in all patients was 29.533±1.87052.

Gastric tube insertion was in a single attempt in 22(73.3%) patients and in 8 (26.7%) patients it was in second attempt. After removal of LMA, it was inspected for blood stain. We have noticed that in 25 (83.3%) patients LMA was blood stained. 3 (10%) of our patients had sore throat and 1(3.3%) had dysphagia but all were manageable. None of our patient showed any deviation in the hemodynamic parameters.

Demographic characteristics

Table 1

Parameters	No. of patients	Mean (SD)/Median [Range]/ Percentage
Sex		
Male	14	41.7143+-11.67791
Female	16	41.6875 +-9.86387
Body Mass Index; kg/m^2	30	26.93+_2.973

ASA Status: Grade 1 Grade 2	 13 17	 43.3% 56.7 %
Modified Mallampati Classification 1 2 3	 13 16 1	 43.3 % 53.3 % 3.3 %

P>0.5 which is statistically not significant

The data represented as mean (SD), median[range] or number (%)

Airway and ventilation assessment

Table 2

Successful insertion LMA, n (%) 1st attempt; 2nd attempt;	 26 4	 86.7 % 13.3 %
Resistance on insertion of airway, n (%) None Minimal Moderate	 16 10 4	 53.3 % 33.3 % 13.3 %
Time to successful airway placement(seconds)	30	16.80 +-5.63 Range [6-30]
Volume of air to achieve intra-cuff pressure of 60 cm H_2O ml)	30	15 Range[10-18]
Vocal cord visibility under fibre-optic inspection n (%); Grade 1 Grade 2 Grade 3	 30 0 0	 100 %
Successful gastric tube insertion, n (%) 1st attempt; 2nd attempt; Not possible	 20 8 2	 6.66 % 26.66 % 6.6 %
Oropharyngeal leak pressure; cm H2O(OLP)	30	29.533±1.87052 Range [20-30]

The data represented as number (%) or median[range]

Assessment of complications

Table 3

Sore throat		
Present	3	10 %
Absent	27	90 %
Dysphasia		
Present	1	3.3%
Absent	29	96.7 %
Blood stain after removal		
Present	25	83.3 %
Absent	5	16.7 %

The data represented as number (%)

Discussion

Airway management is crucial part of general Anesthesia. LMA protector is a novel supraglottic airway devices which is primarily made of silicon, latex free, which allows the insertion of LMA without need of digital or introducer tool guidance. The LMA protector has got integral bite block which reduces the tube damage and tube obstruction by biting. The device has got fixation system which avoids the proximal displacement of device and ensure proper seal around upper oesophagal spinchter [6]. LMA protector is anatomically shaped airway which make the separation of the respiratory and digestive tract, which is different from other supraglottic airway devices. It has got 2 drainage channel, male and female which ends distally into the orifice located at the end of the cuff to communicate distally with the upper oesophageal spinchter. The suction tube may be attached to the male drainage port around the laryngeal region. Well lubricated gastric tube may be passed through female drainage port. Using silicone spray makes gastric tube insertion easier through female port than using water soluble lubricant

We have studied 30 patients of either sex between the age group of 18-70 years of ASA 1 and 2 class, were posted for laparoscopic surgeries under general anesthesia which includes laparoscopic cholecystectomy, laparoscopic appendicectomy, laparoscopic hernia repair. The demographic data of our study includes age, sex, BMI, duration of surgery were statistically not significant (p>0.5). Our primary objectives like ease of insertion in that we have achieved 86.7% in first attempt (26), 13.3% (4) achieved in second attempt. Our study can be comparable with Sng *et al*. they have achieved 88.5% (23) in first attempt and 11.5% (3) in second attempt. 86.6% (26) showed none or mild resistance for insertion of the device and 13.3% (4) showed moderate resistance on insertion of the device. Our study can be comparable with the Sng *et al*. they faced minimal or none resistance 96.2% (25) and moderate resistance in 3.8% (1)

In our study time to successful airway placement 6 to 30 seconds can be comparable with Sng *et al*. Study 19 (17- 21). Volume of air to achieve intra cuff pressure of 60 cm of water is 10 to 18 ml in our study. It can be comparable with Sng *et al* study they achieved 15(15-17 ml.). In our study Vocal cord visibility under fibre optic inspection was grade 1, 100% (30 patients) even Sng *et al* also got similar results. In our study successful gastric tube was inserted in first attempt in 66.66% (20) patients. Second attempt in 26.6%(8) and in 6.6% (2) it was not possible. This can be comparable with Sng *et al*. they have got 92.4% (24) in first attempt, 3.8% (1) in second attempt, 3.8% (1) not possible. MA Supreme TM is made of

PVC, hence it has less resistance as compared to LMA Protector TM Cuff Pilot TM, which is made of silicon. In our clinical practice, a large amount of water-soluble lubricant had to be applied to lubricate the LMA Protector TM Cuff PilotTM's gastric channel in order to facilitate smoother gastric tube passage. LMA Protector TM Cuff Pilot TM also has a reservoir in its gastric outlet (31-42 ml depending on size), which we thought was a potential space for coiling of the gastric tube. We suggest that modifications should be made to better facilitate gastric tube insertion. Alternatively, a gastric tube should be inserted with the tip protruding out from the gastric channel outlet prior to SGA insertion [11]. In our study for last 3 cases we had an opportunity to use silicone spray for gastric tube insertion. We felt insertion was easier with silicon spray when compare to water soluble lubricants. In our study Oropharyngeal leak pressure in cm of water was achieved between 20 to 30 cm of water in all patients, it can be comparable with Sng *et al* they achieved 25.2 (23- 29). Hemodynamic parameters like MAP and heart rate significantly reduced in after insertion when compared to baseline readings (p= 0.000). Adverse effects like blood stained device after extubation seen in 93.3%, sore throat in 10%, in this regard our study can be comparable with Weng Ken Chan *et al*, our study can also be comparable with Zaballos they also reported an incidence of blood stain, sore throat in 25% and 24% respectively. None of our patients had dysphasia and hoarseness of voice.

Conclusion

To conclude LMA protector is a new and suitable supraglottic airway device(SAD) with high success rate of insertion, providing a highly effective seal with very minimal postoperative complications, without any hemodynamic derangement. Hence it is a better SAD for any laparoscopic surgeries with an ideal separation of airway from gastric contents.

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