ORIGINAL ARTICLE

Comparative Study of Intracuff Pressure Changes in Laryngeal Mask Airway Proseal and Supreme in Patients Undergoing Laparoscopic Cholecystectomy

Ashwani Kumar, Heena Gupta, Mukta Jitendra

Abstract

Background : Second generation Supraglottic airway devices (SADs) made of silicone or polyvinyl chloride (PVC) have improved airway seal enabling the use of higher airway pressures during positive pressure ventilation (PPV) in surgeries requiring pneumoperitoneum. **Aims:** To compare intracuff pressure changes and postoperative complications in laryngeal mask airway (LMA) Proseal and LMA Supreme in patients undergoing laparoscopic cholecystectomy. **Material and Methods:** Eighty patients (18 - 60 years) of American Society of Anesthesiologists grade 1 & 2, scheduled for elective laparoscopic cholecystectomy were randomly allocated into two groups. After induction of general anaesthesia, LMA Supreme or LMA Proseal of appropriate size was then inserted randomly and their cuff was inflated with air of adequate volume to achieve an intracuff pressure of 60 cmH?O using a cuff pressure manometer. Intracuff pressure was measured at the end of LMA insertion and thereafter at 20 minutes interval. Any traces of visible gastric fluid, blood staining, trauma on the LMAs and postoperative complications were noted. **Results:** Intracuff pressure increased significantly in LMA Proseal from 60 cmH2O to 81.35± 7.25 cmH2O as compared to LMA Supreme (60 cmH2O to 61.95 ± 2.74 cmH2O). There was more blood staining and sore throat in LMA Proseal than LMA Supreme.**Conclusion:** LMA Supreme is a good alternative to LMA Proseal in laparoscopic cholecystectomy.

Key Words

Laryngeal Mask Airway, Proseal, Supreme, Intracuff pressure, Postoperative Complications.

Introduction

Since the introduction of laryngeal mask airway (LMA) Classic, newer SADs have been introduced like disposable LMA (LMA Unique), Flexible LMA, Intubating LMA, LMA C-Trach, LMA Proseal, LMA Supreme.[1,2] The different materials used (typically silicone for reusable and polyvinyl chloride for single use LMAs) and the changes in design features may change their function. The Proseal Laryngeal Mask Airway- PLMA is a reusable device with an additional dorsal cuff that improves the seal. [3] LMA Supreme is a disposable supraglottic device that has combined features of LMA Proseal, Fastrach and Unique and is made up of polyvinyl chloride (PVC). New characters unique to it are that it has a semirigid elliptical airway tube shaped at 900 angle to facilitate insertion; a drain tube running along the posterior midline through the airway tube to facilitate the passage of a gastric tube; the strengthened inner cuff to prevent airway obstruction from epiglottic infolding and epiglottic fins have been added to prevent epiglottic downfolding.[4] Nitrous oxide may diffuse into Proseal and Supreme laryngeal mask airway (LMA) cuffs,

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potentially increasing intracuff pressure leading to pressure related injury to pharyngeal soft tissue. [5-7]

We carried out this study to compare intracuff pressure changes and postoperative complications in LMA Proseal and LMA Supreme in patients undergoing laparoscopic cholecystectomy.

Materials and Methods

After approval from the Institutional Ethical Committee (Government Medical College, Jammu IEC/2015/195, dated 21/05/2015), this prospective, randomized, comparative study was carried out in 80 patients of ASA Grade 1 and 2 scheduled for elective laparoscopic cholecystectomy under general anaesthesia. Patients who had known or suspected difficult airway, Body Mass Index > 35 kg/m2, cervical spine pathology, increased risk of aspiration and respiratory tract pathology were excluded from the study.

Using a computer generated random number table, patients were randomly and prospectively assigned into two groups (Group P and Group S) of 40 each. Allocation concealment was done using sequentially numbered, coded, and sealed envelopes. Patients were premedicated with Tab Alprazolam 0.25 mg and Tab Ranitidine 150 mg orally the night before surgery. Patients then received inj Pantoprazole 40 mg I/V and inj Diclofenac 75 mg I/V in 100 ml of normal saline. All baseline parameters like heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure and oxygen saturation were recorded. Patients then received inj Palanosetron 0.075 mg I/V and inj Tramadol 1 mg/kg I/V. Size of the airway device was chosen according to the patient's body weight and manufacturer's instructions i.e. Size 3 for 30-50 kg, Size 4 for 50-70 kg, Size 5 for > 70 kg. Preoxygenation with 100% oxygen was done for 3 minutes. Anaesthesia was induced with inj Propofol 2-2.5 mg/kg I/V till the loss of verbal contact and Inj. Atracurium 0.5 mg/ kg I/V was administered. Patients were ventilated manually for 3 minutes with 50% N?O, 50 % 0? and halothane (to achieve MAC 1). LMA Supreme (SLMA) or LMA Proseal (PLMA) of appropriate size was then inserted randomly, with the patient's head in the 'sniffing position'. Cuff was inflated with air of adequate volume to achieve an intracuff pressure of 60 cmHg O using a cuff pressure manometer (Rusch Endotest, Cuff Pressure Gauge). A 14 French orogastric tube was then inserted into the LMA. Intracuff pressure was measured immediately and thereafter at 20 minutes interval. The mean operating time was 46.43 ± 6.92 minutes. The pneumoperitoneum at a pressure of ?12 mm Hg was created using carbon dioxide insufflations after the induction of anaesthesia. At the end of surgery, any traces of visible gastric fluid or blood staining on the LMAs were noted. The mouth, lips and tongue were inspected for any evidence of trauma. Patients were questioned for the incidence of postoperative complications including sore throat, dysphagia, dysphonia and hoarseness at 30 minutes, 2 hours and 24 hours after the device removal.

Statistical Analysis - Our primary comparison parameter was intracuff pressure changes. To detect a difference of 10%, power analysis at 80% power and the 0.05 level of significance, a sample size of 31 patients would be required. We recruited 40 patients for each group keeping in mind the possibility of failed SAD insertion. All statistical tests were two sided and were performed at a significance level of ?=0.05. The two groups were compared using student t-test. Proportions were compared using chi-square test or Fisher's exact test, whichever test was applicable. A value of $p < 0.005$ was considered significant.

Results

Demographic data in Group P and Group S such as age (42.50 ± 11.82 vs 38.18 ± 10.30 years), weight (54.33 ± 3.92 vs 54.95 ± 4.23 kgs) and BMI (24.52± 3.31 vs 24.15 ± 3.37 kg/m2) were comparable. Iintracuff pressure of LMA Proseal recorded at 20 minutes was 64.0±5.89 cmH2O which increased to 81.35 ± 7.25 cmH2O at 40 minutes whereas in case of LMA Supreme it remained 61.0±1.81 cmH2O at 20 minutes and 61.95 ± 2.74 cmH2O at 40 minutes which was significant statistically ($p<0.05$) [Table 1]. On inspection after device removal, blood stain on the device was found in 7 patients in Group P and 2 patients in Group S. No traces of gastric fluid were found on either of the devices. Lips/tongue/mouth trauma was not observed in any of the groups. There were no complaints of dysphagia, dysphonia and hoarseness in either of the groups. However, in Group P, 11 patients and 9 patients complained of sore throat at 30 minutes and 2 hours, respectively, whereas, in Group S, 5 patients

Table 1 - LMA Intracuff Pressure Changes

Time interval	Mean ± Standard Deviation		p value
	Group P (n=40)	Group S (n=40)	
End of LMA Insertion	60.00 ± 0.00	60.00 ± 0.00	-
At 20 minutes	64.00 ± 5.89	61.00 ± 1.81	0.003
At 40 minutes	81.35 ± 7.25	61.95 ± 2.74	0.001

Table - 2 Postoperative Complications

Postoperative complications		Group P (n=40)	Group S(n=40)	P value
Blood stain		7(17.5%)	2(5%)	0.011
Gastric stain		0(0%)	0(%)	0
Trauma(lip, mouth, mucosal injury)		0(0%)	0(0%)	0
Sore throat	30 minutes	11(27.5%)	5(12.5%)	0.013
	2 hours	9(22.5%)	4(10%)	0.021
	24 hours	0(0%)	0(0%)	0.184
Dysphagia		0(0%)	0(0%)	0
Dysphonia		0(0%)	0(0%)	0
Hoarseness		0(0%)	0(0%)	0

and 4 patients complained of sore throat at 30 minutes and 2 hours, respectively. The difference in the incidence of postoperative sore throat was statistically significant at 30 minutes (p= 0.013) and 2 hours (p= 0.021), with higher value for Group P [*Table 2*].

Discussion

The main finding in our study was a significant increase in intracuff pressure in LMA Proseal than in LMA Supreme which seems dependent on the material of the cuff. LMA Supreme is made of polyvinyl chloride, in contrast to LMA Proseal, which is made of silicone. Silicone cuffs are more permeable to nitrous oxide leading to significant rise in intracuff pressure changes than PVC cuffs. Increase in cuff pressure due to nitrous oxide inflow mainly depends on the partial pressure difference across the cuff membrane, the cuff volume, the area provided for gas exchange, and the permeability coefficient of the cuff membrane, which is a result of cuff material and cuff membrane thickness.8 Another possible explanation to our findings can be the plasticiser added to soften the PVC which makes the cuff less permeable to nitrous oxide.

Our findings were in accordance to studies of Sood S *et al* and Anand LK *et al* who recorded significantly higher intracuff pressures and observed a linear increase in intracuff pressure in LMA Proseal when using nitrous oxide (PLMA 97.43 ± 11.03 cm of H2O; 76.9 to 111.7 cmH2O between 15 and 60 minutes respectively) but it remained stable for LMA Supreme (SLMA 75.17 ± 8.95 cm of H2O; 60.5 to 61.5 cmH2O respectively).9, 10 Similarly, higher intracuff pressures in LMA Proseal were observed in other studies. [11] They suggested the higher intracuff pressures for LMA Proseal were related to the properties of the cuff. Following removal of the LMA, patients were enquired about postoperative complications. None of the patients had dysphagia or dysphonia in our study. However, sore throat was significantly higher in PLMA group at 30 minutes (27.5% vs 12.5%) and 2 hours (22.5% vs 10%) but insignificant at 24 hours. Unlike our study, Sood S et al found higher incidence in SLMA whereas Belena JM *et al* found no difference between SLMA and PLMA with respect to incidence of postoperative sore throat. [9, 12] Similarly, none of the patients reported dysphagia or dysphonia in their studies. The results of our study were in contrast to the study conducted by Liew GH *et al* who, in an evaluative study using LMA Supreme reported higher incidence of sore throat in LMA Supreme.[13] On inspection after removal

of the device, blood stain on the device was found in 7 patients (17.5%) in PLMA group and 2 patients (5%) in SLMA group. No patient showed presence of gastric fluid on the device. Lips/ tongue/ mouth trauma was not present in either of the groups. Similar results were seen in different studies conducted by Singh A *et al* and Mukadder S *et al* who noted more blood staining and sore throat in LMA Proseal than LMA Supreme but with variable incidence.[14, 15]

Limitations - Our study had certain limitations also. Head up and left side tilted position would probably lessen the effects of pneumoperitoneum on LMA cuff. Secondly, shorter anaesthesia time may also have influenced the results of the present study.

Conclusion

LMA Supreme is a good alternative to LMA Proseal as an airway device in laparoscopic cholecystectomy due to less intracuff pressure changes and postoperative complications.

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Conflicts of Interest
There are no conflicts of interest.

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