A left-side channel design improving insertion of gastric tube via the supraglottic airway device

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To the Editor: The supraglottic airway device (SAD) with an additional gastric drainage channel may be beneficial for patients needing gastric decompression during surgery, such as laparoscopic cholecystectomy and cesarean delivery.[1] Furthermore, addition of gastric drainage channel is a typical feature of second-generation SAD. However, all of second-generation SADs have a gastric tube channel opening at the center of the distal tip.[2] Such a design may cause some difficulty for insertion of the gastric tube if there is an inadequate position of the device tip in the upper esophageal aperture.[3] In normal anatomy, the upper esophageal aperture is actually inclined to the left side of the trachea.[4] Thus, we inferred that it should be much easier to insert a gastric tube into the esophagus, if the gastric drainage channel is placed at the left side of the SAD tip. To test this hypothesis, this pilot randomized controlled study was designed to assess the performances of gastric tube insertion via the modified Oro-Pharyngo-Laryngeal Airway Cap (OPLAC) (Xu Bang Corporation, Taiwan, China) by comparing with the laryngeal mask airway (LMA) Supreme (Teleflex Medical, Dublin Road, Athlone, Ireland) in the anesthetized adult patients by an experienced operator.

After the study protocol was approved by the Ethical Committee of Beijing Friendship Hospital (No. 2011-041) and registered in Chinese Clinical Trial Registry (ChiCTR-TRC-11001337), patients undergoing elective laparoscopic cholecystectomy with general anesthesia were recruited. Exclusion criteria were as follows: patients refusing to sign the informed consents or those with head and neck tumor or abnormalities. After obtaining the written informed consents, patients were randomly allocated to receive the LMA Supreme (LMA Supreme group) or modified OPLAC device (OPLAC group). The modified OPLAC device was obtained by attaching a silicone tube with 5 mm internal diameter and 20 cm long by silicone glue to the left side of the tip of the expandable silicone membranous cap of the original version [Figure 1]. The attached silicone tube was used as a conduit for insertion of the gastric tube.

Anesthesia was induced with fentanyl 3 μg/kg, propofol 2 mg/kg, and atracurium 0.8 mg/kg. The patient's head was placed at the neutral position and an LMA Supreme or modified OPLAC device was inserted by an experienced operator. Both the selection of device size and the technique of insertion followed the manufacturer's recommendations. Then, the device was connected to the anesthesia ventilator for volume-controlled ventilation. The ventilation was adjusted to maintain end-tidal carbon dioxide levels in the range of 35 to 40 mmHg (1 mmHg = 0.133 kPa).

The time required for device insertion was recorded as the time between the operator picking up the device and the establishment of adequate ventilation via the device. Correct positioning of the device was confirmed by bilateral chest movements and capnography. Three attempts were allowed for successful placement of the device.[5] During mechanical ventilation, the peak airway pressures and the expired tidal volumes were measured.

A size F14 gastric tube was inserted through the drainage channel of the LMA Supreme or the conduit added to the modified OPLAC device. The ease of gastric tube insertion was assessed and scored as 1 (easy), 2 (difficulty, needing the force to overcome resistance), or 3 (very difficulty, needing adjustment of the device position to overcome resistance). Correct placement of the gastric tube was confirmed by aspiration of gastric fluid or detection of injected air by auscultation over the epigastrium.[6]

Before and during pneumoperitoneum, at head up position and end of surgery, both airway sealing pressure and peak airway pressure were recorded in the two groups. Airway sealing pressure was detected by closing the adjustable pressure limiting valve against 5 L/min fresh gas flow, and recording the airway pressure at equilibrium or when an air leak was heard in the oropharynx, to a maximum airway pressure of 40 cmH_2O (1 cmH_2O = 0.098 kPa).[7]

Access this article online

Quick Response Code:

Website: www.cmj.org

DOI: 10.1097/CM9.0000000000000222

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Chinese Medical Journal 2019;132(11)

Received: 14-02-2019 **Edited by:** Xin Chen

Figure 1: A silicone tubing was added to the left side of the expandable silicone membranous cap of original Oro-Pharyngo-Laryngeal Airway Cap device as a conduit for insertion of gastric tube. (A) Modified version. (B) Original version.

The primary endpoint of this study was the ease of gastric tube insertion. The sample size was calculated to detect a 10% difference in the rate of easy gastric tube insertion between devices with a type-1 error of 0.05 and a power of 90%, requiring 25 patients per group. We recruited 30 patients for each group to accommodate dropouts. Data distribution was analyzed using the Kolmogorov-Smirnov test. Normally distributed data were analyzed using the paired *t* test, with other data analyzed by the Chi-squared test or Mann-Whitney *U* test. Data were analyzed using SPSS version 20 (SPSS Inc., Chicago, IL, USA). A $P < 0.05$ was considered statistically significant.

The demographic data including age, weight, height, gender ratio, and operating time were not significantly different between the two groups (all $P > 0.05$). The rates of smooth device insertion were similar between the two groups, but the OPLAC device took a significantly shorter insertion time than the LMA Supreme. The ease of gastric tube insertion was significantly improved with the modified OPLAC device ($P = 0.038$). There was no any significant difficulty encountered during gastric tube insertion via the modified OPLAC device, but there were one case of difficult insertion and seven cases of very difficult insertion in the LMA Supreme group. Both the airway sealing pressure and peak airway pressure were not significantly different between the two devices. All the other ventilation profiles during the operation were similar for both the devices [Table 1].

In this study, both the LMA Supreme and modified OPLAC device could be successfully inserted on the first attempt. It indicated that the addition of a gastric tube insertion accessory on the left side of expandable silicone membranous cap did not interfere with the insertion of the OPLAC device. As we had assumed, moreover, the ease of gastric tube insertion via the modified OPLAC device compared with the LMA Supreme was better, with a 100% success rate and without any difficulty. It indicated that gastric tube insertion channel placed at the left side of the ventilation mask could indeed facilitate the gastric tube insertion via the second-generation SAD. This might not be due to the better anatomical fit of ventilation mask design as the similar device, such as the I-gel, has behaved inferiorly to the LMA Supreme for gastric tube insertion in other studies.[2,8]

Our results showed that both the airway seal pressure and peak airway pressure were similar for the LMA Supreme and modified OPLAC device in all observed points. Furthermore, the incidence of gastric insufflation was not significantly different between the two devices. However, the incidence of gastric insufflation was higher in this study than in the previous study with the original OPLAC device.[9] In fact, the airway sealing of the OPLAC device is mainly dependent on the accommodation of the external contour of its expandable silicone membranous cap to the pharyngeal wall. Thus, addition of a gastric tube insertion channel on the left side of the expandable silicone membranous cap may have interfered with the mechanism

Table 1: Comparisons of device insertion, gastric tube insertion, gastric insufflation, airway sealing pressure, and peak airway pressure between two groups.

Items	LMA Supreme ($n = 30$)	OPLAC ($n = 30$)	*P*
Device insertion, *n*			0.260
Smooth	27	30	
Need adjustment	3	0	
Need second attempt	0	0	
Failure	0	0	
Device insertion time (s), mean ± SD	8.5 ± 2.1	5.5 ± 1.7	<0.001
Ease of gastric tube insertion, *n*			0.038
Easy	22	30	
Difficulty	1	0	
Very difficulty	7	0	
Gastric insufflation, *n*			0.140
Positive	11	5	
Negative	19	25	
Airway sealing pressure (cmH_2O), mean ± SD			
Before pneumoperitoneum	25.0 ± 4.9	23.6 ± 7.2	0.370
During pneumoperitoneum	25.4 ± 4.5	24.8 ± 6.9	0.710
Head up position	25.8 ± 4.4	25.4 ± 6.8	0.810
End of surgery	25.7 ± 4.9	25.7 ± 7.1	0.970
Peak airway pressure (cmH_2O), mean ± SD			
Before pneumoperitoneum	18.0 ± 4.5	16.1 ± 2.9	0.060
During pneumoperitoneum	21.4 ± 3.7	20.6 ± 2.9	0.390
Head up position	20.7 ± 3.3	20.3 ± 2.4	0.630
End of surgery	18.7 ± 3.1	18.3 ± 4.1	0.620

LMA: Laryngeal mask airway; OPLAC: Oro-Pharyngo-Laryngeal Airway Cap; SD: Standard deviation; 1 cmH_2O = 0.098 kPa.

of its airway sealing. This suggested that additional structure of the gastric tube insertion channel should be designed not to interfere with the fitness of the ventilation mask of the device.

In conclusion, this study demonstrates that both the LMA Supreme and modified OPLAC device can be successfully inserted by an experienced operator on the first attempt, but gastric tube insertion channel placed at the left side of the modified OPLAC device provides an easier gastric tube insertion compared to the LMA Supreme with a gastric tube channel opening at the center of the distal tip.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflicts of interest

None.

References

1. Li SY, Yao WY, Yuan YJ, Tay WS, Han NR, Sultana R, *et al*. Supreme™ laryngeal mask airway use in general anesthesia for category 2 and 3 cesarean delivery: a prospective cohort study. BMC Anesthesiol 2017;17:169. doi: 10.1186/s12871-017-0460-x.
2. Chauhan G, Nayar P, Seth A, Gupta K, Panwar M, Agrawal N. Comparison of clinical performance of the I-gel with LMA proseal. J Anaesthesiol Clin Pharmacol 2013;29:56–60. doi: 10.4103/0970-9185.105798.
3. Metterlein T, Dintenfelder A, Plank C, Graf B, Roth G. A comparison of various supraglottic airway devices for fiberoptical guided tracheal intubation. Braz J Anesthesiol 2017;67:166–171. doi: 10.1016/j.bjane.2015.09.007.
4. Gray H. Splanchnology. In: Warren H. Lewis, 1st ed. Anatomy of the Human Body. Philadelphia: Lea & Febiger; 1918: 1446.
5. Lopez AM, Agusti M, Gambus P, Pons M, Anglada T, Valero R. A randomized comparison of the Ambu AuraGain versus the LMA supreme in patients undergoing gynaecologic laparoscopic surgery. J Clin Monit Comput 2017;31:1255–1262. doi: 10.1007/s10877-016-9963-0.
6. Damodaran S, Sethi S, Malhotra SK, Samra T, Maitra S, Saini V. Comparison of oropharyngeal leak pressure of air-Q™, i-gel™, and laryngeal mask airway supreme™ in adult patients during general anesthesia: a randomized controlled trial. Saudi J Anaesth 2017;11:390–395. doi: 10.4103/sja.SJA_149_17.
7. Wong DT, Ooi A, Singh KP, Dallaire A, Meliana V, Lau J, *et al*. Comparison of oropharyngeal leak pressure between the Ambu® AuraGain™ and the LMA® Supreme™ supraglottic airways: a randomized-controlled trial. Can J Anaesth 2018;65:797–805. doi: 10.1007/s12630-018-1120-4.
8. Wang F, Zhang R. Application of the LMA-Supreme™ and i-gel™ laryngeal masks during pelvic operations in adults. Asian J Surg 2016;39:1–5. doi: 10.1016/j.asjsur.2015.01.011.
9. Lin BC, Wu RS, Chen KB, Yang MH, Lo YC, Chiang YY. A comparison of the classic and a modified laryngeal mask airway (OPLAC™) in adult patients. Anesth Analg 2011;112:539–544. doi: 10.1213/ANE.0b013e31820a5626.

How to cite this article: Ke JD, Hou HJ, Wang M, Xue FS. A left-side channel design improving insertion of gastric tube via the supraglottic airway device. Chin Med J 2019;132:1365–1367. doi: 10.1097/CM9.0000000000000222