Original Article

Comparison of the LMA-ProSeal and LMA-Classic in Children

Md Raihan Uddin[1], Abdul Jabbar[2], Md Shafiqur Rahman[3], MA Salam Khan[4]

Abstract

Background: *The LMA-ProSeal is a new laryngeal mask airway with a rear cuff and drainage tube that allows a higher seal pressure than the LMA-Classic for the same intra-cuff pressure and it permits drainage of gastric secretions and access to the alimentary tract.* ***Objective:*** *This study compared the LMA-ProSeal and LMA-Classic in children for ease of insertion, airway sealing pressure and maintenance of airway.* ***Materials and method:*** *This comparative study was done during the period of January 2015 to December 2015 in BIRDEM Hospital, Dhaka, Bangladesh. Forty ASA 1-2 children undergoing circumcision, herniotomy and orchiopexy were included. The patients were randomly assigned to size 2.5 LMA-ProSeal or 2.5 LMA-Classic groups for airway management. We assessed success rates at first attempt of insertion, airway sealing pressure, maintenance of airway and postoperative complications.* ***Results:*** *There was no statistical difference between two groups for the success rates at first attempt of insertion and maintenance of airway but sealing pressure was significantly high in the LMA-ProSeal group. Regarding postoperative complication like injury to lip-teeth-tongue, blood staining and cough or laryngospasm were also not significant.* ***Conclusion:*** *We concluded that ease of insertion, maintenance of airway and risk of injury are similar between the LMA-ProSeal and the LMA-Classic in children.*

Keywords: *Paediatric anaesthesia; equipment; laryngeal mask airway.*

Delta Med Col J. Jan 2018;6(1):18 – 21

Introduction

The LMA-ProSeal is a new laryngeal mask airway with a rear cuff and drainage tube that allows a higher seal pressure than the LMA-Classic for the same intra cuff pressure and permits drainage of gastric secretions and access to the alimentary tract.[1] These characteristics may contribute to protection against gastro-oesophageal regurgitation and reduction in the risk of gastric insufflations. Recent studies showed that the LMA-ProSeal provided effective ventilation during laparoscopic cholecystectomy without severe complications.[2,3] On the other hand the

1. Assistant professor, Dept. of Anaesthesiology & SICU, BIRDEM Hospital, Dhaka, Bangladesh.
2. Medical Officer, Dept. of Anaesthesiology & SICU, BIRDEM Hospital, Dhaka, Bangladesh.
3. Assistant professor, Dept. of Anaesthesiology, Analgesia & ICU, BSMMU, Dhaka, Bangladesh.
4. Professor, Dept. of Anaesthesiology & SICU, BIRDEM Hospital, Dhaka, Bangladesh.

Correspondence: Md. Raihan Uddin. e-mail: dr.raihanuddin393@gmail.com

LMA-ProSeal has a larger and more flaccid cuff compared with the LMA-Classic and difficulty of insertion has also been pointed out.[4-6]

An LMA-ProSeal specially designed for children (size 1.5, 2, 2.5) is now available. One of its features is the lack of rear cuff, which is different from the adult ones. We hypothesized that the absence of the rear cuff in the LMA-ProSeal for the children may not produce a superior seal pressure or more difficult insertion compared with the LMA-Classic. We therefore compared the LMA-ProSeal and the LMA-Classic in children concerning ease of insertion and airway maintenance.

Materials and method

This comparative study was done during the period of January 2015 to December 2015 in BIRDEM Hospital, Dhaka, Bangladesh, after approval by institutional human studies committee and parental consent 40 ASA physical status 1-2 paediatric patients (aged 3-6 yr, weight 20-30 kg) undergoing circumcision, herniotomy and orchiopexy were included in the study. Patient with lung disease, known airway problems, upper respiratory tract symptoms or any condition that increases the risk of gastro-oesophageal regurgitation were excluded from the study. After enrolment, the patients were randomly assigned to a size 2.5 LMA-ProSeal group or a 2.5 LMA-Classic group for airway management using the sealed envelope method with 20 subjects in each group.

All patients were premedicated with oral diazepam 0.5 mg/kg or midazolam 0.3 mg/kg 1 hour before induction of anaesthesia. After standard monitoring devices had been applied anaesthesia was induced by inhalation of nitrous oxide, oxygen and halothane. Once an adequate depth of anaesthesia had been achieved, each device was inserted by an experienced anaesthetist who had used the LMA-Classic more than 100 times and the LMA-ProSeal more than 20 times with the index finger insertion technique as per manufacturer's instructions. Both devices were fixed by taping the tube over chin and the cuff was inflated with air according to size. An effective airway was judged by a square-wave capnograph trace, normal thoraco-abdominal movement and inaudibility of stridor. If an effective airway could not be achieved, the device was removed and three attempts were permitted before failure of insertion was recorded. If the three attempts were unsuccessful, either an alternative device was inserted or the trachea was intubated. The number of insertion attempts were recorded. The sealing pressure was determined by closing the expiratory valve of the breathing system at a fixed gas flow of 3 Litre/min noting the airway pressure (maximum allowed was 40 cm of H2O) at which equilibrium was reached.[7] At this time, gas leakage was determined at mouth (audible), the stomach (epigastric auscultation), or the drainage tube (bubbling of the lubricant placed on the proximal end of the drainage tube). In the LMA-ProSeal group only a lubricated 10-French gastric tube was inserted through the drainage tube. Adequate depth was maintained throughout the surgical period. At the end of the surgical period anaesthesia was discontinued and the device was removed. Postoperative blood staining of the LMA, injury to surrounding structure and cough or laryngospasm was recorded after removal of the device.

Results

There was apparently no difference between the two groups with respect to demographic variables and regarding types of surgery same number of subjects were allocated in two groups for three different categories (Table I & II).

Table I: Distribution of demography (N=40)

Characteristics	LMA–Classic (n=20)	LMA-ProSeal (n=20)
Age (3-6 yrs.)	4	5
Weight (kg)	24	25
Height (cm)	95	96

Table II: Distribution of clinical data (N=40)

Type of surgery	LMA–Classic (n=20) Frequency	LMA-ProSeal (n=20) Frequency
Circumcision	15	15
Herniotomy	3	3
Orchiopexy	2	2

In all patients an LMA was inserted within three attempts. The success rate at first attempt of insertion were 19/20 (95%) for the LMA-Classic and 18/20 (90%) for the LMA-ProSeal. Regarding maintenance of airway partial obstruction is slightly more in the LMA-Classic than the LMA-ProSeal but which was not significant (Table III). Among complications cough or laryngospasm is slightly more in the LMA-ProSeal than the LMA-Classic but which was not significant (Table III). Injuries to lip, tongue or blood staining were not detected in either group. But airway sealing pressure differed between two groups (Table III).

Table III: Comparison between LMA-Classic and LMA-ProSeal

Variables	LMA-Classic (n=20)	LMA-ProSeal (n=20)	p-value
Attempt at insertion			
1st	19 (95%)	18 (90%)	0.999**
2nd or 3rd	1(5%)	2 (10%)	
Seal pressure (cm H_2O)			
Mean ± SD	19.0 ± 1.26	20.0 ± 1.26	0.016*
Range	(17-21)	(18-22)	
Airway maintenance			
Clear	18 (90%)	19 (95%)	0.999**
Partial obstruction	2 (10%)	1 (5%)	
Complete obstruction	-	-	
Complication			
Cough or laryngospasm	1 (5%)	2 (10%)	0.999**
Blood staining	-	-	
Injury to lip & tongue	-	-	

*Unpaired t test was done to measure the level of significance.

**Fisher's Exact test was done to measure the level of significance.

In comparison between the two groups data were analyzed with the unpaired t-test. Unless otherwise stated data are presented as mean (SD). Significance was taken as $p<0.05$.

Discussion

The most important finding in our study was that ease of insertion and airway maintenance was similar between the LMA-ProSeal and the LMA-Classic in children. These findings contrast with those described in adults.

Several reports suggest that insertion of the LMA-Classic is easier and quicker than that of the LMA-ProSeal in adults. Brimacombe and colleagues presumed that the difficulties were caused by the larger cuff impeding digital intra-oral positioning and propulsion into the pharynx.[4,6] In our study, there was no difference in case of insertion. Several factors may have contributed to these findings. The main factor is probably the lack of rear cuff. In practice, when we deflate the cuff of the LMA-ProSeal completely, a fold occurs which may prevent smooth insertion of the device. The LMA-ProSeal of size 2.5 does not have a rear cuff; therefore no fold occurs. Another factor may be due to the airway tube and the drainage tube linings being side by side. This prevents rotation of the airway tube during insertion, especially in the narrow oral space in children, impeding digital positioning.

On the other hand, we must also consider the possibility that our lower success rate at the first insertion attempt for the LMA-ProSeal contributes no difference between the two devices in case of insertion. Previous studies have reported success rates of LMA insertion in children of 67-99%,[8-12] which are comparable with our studies of 90-95%. The difference in the rates may result from the different definitions of successful insertion and insertion technique.

As it has been reported that the LMA-ProSeal provides a better airway seal than the LMA-Classic in adults, similar observation has been made in this study regarding the usage of two devices in children. Though the paediatric LMA-ProSeal lacks a rear cuff, we found that seal pressure was statistically higher in LMA-ProSeal group which might be due to our small sample size. Airway maintenance was similar in both the groups. Several reports suggested that better

sealing pressure in LMA-ProSeal is mainly due the back cuff.[4-6] The lack of back cuff in 2.5 LMA-ProSeal means that it could not form a better seal than the LMA-Classic. In 1999, Lopez-Gil and colleagues studied a prototype of the LMA-ProSeal for children, which had a rear cuff.[13] They stated that sealing pressure was over 40 cm H_2O in all cases. This confirms the importance of rear cuff in airway seal pressure.

In our study, the sealing pressure was measured by closing the expiratory valve of the circle system at a fixed fresh gas flow of 3 L/min until airway pressure reached a steady value. Lopez-Gil and colleagues compared four kinds of measurements of the airway sealing pressure which involved detection of an audible noise by listening over the mouth, detection of an exhaled carbon dioxide by placing a gas sampling line for the capnograph inside the mouth, detection of a steady value airway pressure while occluding the expiratory valve of the circle system and detection of an audible noise using a stethoscope placed just lateral to the thyroid cartilage.[14]

A limitation of our study is that the data were collected by an unblinded observer. We concluded that there is no difference between the LMA-Classic and the LMA-ProSeal concerning case of insertion and airway maintenance in children.

References

1. Brain Al, Verghese C, Strube PJ. The LMA-ProSeal - a Laryngeal Mask with an Esophageal Vent. Br J Anaesth. 2000;84:650-54.
2. Lu PP, Brimacombe J, Yang C, Shyr M. ProSeal Versus the Classic Laryngeal Mask Airway for Positive Pressure Ventilation during Laparoscopic Cholecystectomy. Br J Anaesth. 2002;8:824-27.
3. Maltby JR, Beriault MT, Watson NC, Liepert D, Fich GH. The LMA-ProSeal Is an Effective Alternative to Tracheal Intubation for Laparoscopic Cholecystectomy. Can J Anaesth. 2002;49:857-62.
4. Brimacombe J, Keller C. The ProSeal Laryngeal Mask Airway: A Randomized, Crossover Study with the Standard Laryngeal Mask Airway in Paralyzed, Anaesthetized Patients. Anesthesiology. 2000;93:104-109.
5. Cook TM, Nolan JP, Verghese C, Strube PJ, Lees M, Millar JM, et al. Randomized Crossover Comparison of the Proseal with the Classic Laryngeal Mask Airway in Unparalyzed Anaesthetized Patients. Br J Anaesth. 2002;88:527-33.
6. Brimacombe J, Keller C, Fullekrug B, Agrò F, Rosenblatt W, Dierdorf SF, et al. A Multicenter Study Comparing the ProSeal and Classic Laryngeal Mask Airway in Anesthetized, Nonparalyzed Patients. Anesthesiology. 2002;96:289-95.
7. Keller C, Brimacombe JR, Keller K, Morris R. Comparison of Four Methods of Assessing Airway Sealing with the Laryngeal Mask Airway in Adult Patients. Br J Anaesth. 1999;82:286-87.
8. Efrat R, Kadari A, Katz S. The Laryngeal Mask Airway in Pediatric Anesthesia: Experience with 120 Patients Undergoing Elective Groin Surgery. J pediatric Surg. 994;29:206-208.
9. Nakayama S, Osaka Y, Yamashita M. The Rotational Technique with a Partially Inflated Laryngeal Mask Airway Improves the Ease of Insertion in Children. Pediatric Anaesth. 2002;12:416-19.
10. O'Neill B, Templeton JJ, Caramico L, Schreiner MS. The Laryngeal Mask Airway in Pediatric Patients Factor Affecting Ease of Insertion and Emergence. Anesth Analg. 1994;78:559-62.
11. Lopez-Gil M, Brimacombe J, Alvarez M. Safety and Efficacy of the Laryngeal Mask Airway. A Prospective Survey of 1400 Children. Aanaesth. 1996;51:969-72.
12. Johnston DF, Wrigley SR, Robb PJ, Jones HE. The Laryngeal Mask Airway in Pediatric Anesthesia. Anaesthesia. 1990;45:924-27.
13. Lopez-Gil M, Brimacombe J. Pulmonary Evaluation of a New Prototype Laryngeal Mask Airway in Children. Br J Anaesthe. 1999;82:132-34.
14. Lopez-Gil M, Brimacombe J, Keller C. A Comparison of Four Methods for Assessing Oropharyngeal Leak Pressure with the Laryngeal Mask Airway in Pediatric Patients. Pediatric Anaesth. 2001;11:319-21.