Comparison of the Laryngeal Mask Airways: Laryngeal Mask Airway-classic and Laryngeal Mask Airway-proseal in Children

Chetan B. Bhat, Kiran A. Honnannavar, Mallanna B. Patil, Mahantesh S. Mudakanagoudar

Consultant Anesthesiologist, Christuraj Hospital, Kannur, Kerala, 1Department of Anesthesiology, SDM College of Medical Sciences, Dharwad, 2Department of Anesthesiology, DNB District Hospital, Ballari, Karnataka, India

Abstract

Introduction: In the past 25 years with the development of various supraglottic airway devices, the armamentarium for airway management has increased. In our study, the laryngeal mask airway (LMA)-ProSeal is compared with the LMA-Classic with respect to as follows: (a) Ease of insertion and number of insertion attempts, (b) Device positional stability and possible oropharyngeal leak, (c) Airway trauma, and (d) Hemodynamic changes; in children aged 3–15 years undergoing elective surgery under general anesthesia, hypothesizing that these would be different. Materials and Methods: Sixty consecutive American Society of Anesthesiologists Physical Status Classes I and II children aged 3–15 years and weighing 5–45 kg undergoing elective surgery in the supine position were randomized for airway management with the LMA-Classic or LMA-ProSeal. Results: Size of the LMA used in both LMA-Classic and LMA-ProSeal was 1.5, 2, and 2.5 and was statistically nonsignificant. There was no difference between LMA-Classic and LMA-ProSeal with regard to ease of insertion, number of attempts for insertion, device positional stability, airway trauma and hemodynamic changes. Conclusions: The complications of usage of the LMA are minimal and similar in both the devices. The LMA-ProSeal has advantages over LMA-classic such as the placement of gastric tube, adequate ventilation, and oxygenation without any gastric distension.

Keywords: Airway, classic laryngeal mask airway, complications. ProSeal laryngeal mask airway

Introduction

The laryngeal mask airway (LMA) is a supraglottic airway device designed to maintain a clear airway, which sits outside of and creates a seal around the larynx. It is relatively noninvasive as compared to endotracheal intubation and in scenarios where endotracheal intubation is not mandatory, LMA has emerged as a formidable choice over endotracheal intubation. Compared with the face mask, the LMA allows for a more “hands-free approach” to airway management. In difficult airway management, LMA can bypass obstruction at supraglottic level and allow rescue oxygenation and ventilation provided that mouth opening is sufficient.

The LMA-Classic is a first-generation supraglottic airway device with largest evidence base for efficacy and safety and is considered benchmark against which newer LMA are judged. However, use of positive pressure ventilation and the associated gastric insufflations are a limitation of its use.

The LMA-ProSeal is a second-generation supraglottic airway device with modified cuff and drainage tube, designed for better seal with both the respiratory and gastrointestinal tracts, notwithstanding the access to the alimentary tract. There are less data available to compare ProSeal and classic LMA. Hence, the study was planned to compare efficacy of the LMA-Classic and LMA-ProSeal in children undergoing elective surgery under general anesthesia.

Materials and Methods

Methodology of collecting data

After obtaining the Institutional Ethical Committee’s approval, written informed consent from the parent/guardian was taken for all the subjects participating in the study. This randomized,
prospective, and comparative study was conducted among sixty patients of the American Society of anesthesiologists Physical Status Classes I and II children aged 3–15 years and weighing 5–45 kg undergoing elective surgery in the supine position were randomized for airway management with the LMA-classic or LMA-ProSeal by computer-generated random assignments. Exclusion criteria were refusal by the parent/guardian for the consent for study; the American Society of Anesthesiologists Physical Status class III and above; patient at specific risk of aspiration and anticipated difficult airway; and head and neck procedures.

A thorough preanesthetic evaluation was performed before the day of procedure. Patients were fasted for at least 6 h for solids and 4 h for liquids. Premedication, oral triclofos 75 mg/kg was given 2 h before surgery. A standard general anesthesia protocol was followed, and routine monitoring was applied in all patients, including an electrocardiogram, precordial stethoscope, pulse oximeter, and noninvasive blood pressure monitor. Patients were preoxygenated for 3 min. Anesthesia was induced with fentanyl 2 mg/kg intravenous (IV) and propofol 2 mg/kg IV and maintained with propofol infusion 100 µg/kg/min, nitrous oxide 66% in oxygen, and sevoflurane 0.5%–1%. Facemask ventilation was performed until conditions were suitable for the insertion of the LMA (loss of eyelash reflex, jaw relaxation, and absent rhythmic respiration) was met, and then, the LMA-Classic or the LMA-ProSeal was inserted. A size 1.5, 2, or 2.5 LMA-Classic/LMA-ProSeal was chosen depending on the weight of the patient. The cuff was fully deflated before insertion. A clear water-based gel was used for lubricating the posterior aspect of the cuff. Both devices were inserted and fixed according to the manufacturer’s instructions. The gastric tube was inserted in the LMA-ProSeal Group and gastric decompression was done, if indicated. The propofol infusion was terminated before the start of skin suture. The LMA was removed after completion of procedure with the patient fully awake. Further, the patients received oxygen supplementation as needed.

Study parameters
Hemodynamic parameters, such as, heart rate, systolic, and diastolic blood pressure as well as SpO2 was recorded before induction, during induction, LMA insertion, later every 5, 10, 15, 20, 30 min during the course of surgery, during removal, and in the postoperative period. The ease of insertion, number of insertion attempts, displacement of the device and associated oropharyngeal leak, esophageal regurgitation, pulmonary aspiration, bronchospasm, airway obstruction, and tongue-lip-dental trauma were observed. A failed attempt was defined as removal of the device from the mouth. The ease of insertion was judged by time taken and number of attempts to provide an effective airway. Other complications including laryngospasm, oropharyngeal trauma, if any, were also recorded. All the observations were recorded in a pilot-tested pro forma.

Statistics
Descriptive statistics was done for all data and suitable statistical tests of comparison were done. Continuous variables were analyzed with the unpaired t-test, and categorical variables were analyzed with the Chi-square test. Variables with equal variance and normal distribution were analyzed using equal variance t-test. Variables with unequal variance but normal distribution were analyzed with Mann–Whitney U- or Wilcoxon Rank-Sum test. Variables with nonnormal distribution with unequal variances were analyzed with Kolmogorov–Smirnov test. Significance was taken as P < 0.05. The data were analyzed using NCSS software (07.1.21 version; NCSS, LLC., Utah, USA), EpInfo software (7.1.0.6 version; Center for disease control, GA, USA) and Microsoft Excel 2007.

RESULTS
There were no significant differences between both groups with respect to demographic data as shown in Table 1.

Size of the LMA used in both groups was 1.5, 2, and 2.5. There was no statistically significant difference between both groups with respect to the size of LMA (P = 0.8270) [Table 2].

LMA insertions were successful in the first attempts in 21 patients in group LMA-classic as compared to 20 in group ProSeal LMA (PLMA) and it was not statistically significant (P = 0.7813) as shown in Table 3. Ease of insertion was statistically insignificant between both groups with P = 0.2597 [Table 4].

Oropharyngeal trauma was found in 5 patients in each groups and it was not statistically significant [Table 5].

Table 1: Demographic data

|                        | Mean±SD | P   |
|------------------------|---------|-----|
| Age                    | 4.4±1.24| 0.9625 |
| Sex (male±female)      | 24±6    | 0.7386 |

SD=Standard deviation, LMA=Laryngeal mask airway

Table 2: Comparison of laryngeal mask airway size

|       | 1.5 | 2   | 2.5 | Test         | P       |
|-------|-----|-----|-----|--------------|---------|
| LMA-classic | 13  | 15  | 2   | Chi-square   | 0.827003|
| LMA-ProSeal | 14  | 13  | 3   |              |         |

LMA=Laryngeal mask airway

Table 3: Comparison of number of attempts of laryngeal mask airway insertion

| Number of attempts | 1 | 2 | Test  | χ²  | P    | Conclusion      |
|--------------------|---|---|-------|-----|------|-----------------|
| LMA classic        | 21| 9 | Chi-square | 0.0770 | 0.7813 | Not statistically significant |
| LMA-ProSeal        | 20| 10| test     |      |      |                 |

LMA=Laryngeal mask airway
Positional stability of both the devices [Table 6] was not statistically significant ($P = 0.51860$).

Hemodynamic parameters such as heart rate, systolic, and diastolic blood pressures were comparable between both groups. They were not statistically significant [Figures 1-4].

None of the patients in both the groups had any events of laryngospasm, esophageal regurgitation, aspiration, bronchospasm, and airway obstruction.

### Discussion

Before the introduction of LMA-Classic by Dr. Brain, the choices of airway management were either facemask or tracheal tube. In the past 25 years with the development of various supraglottic airway devices, the armamentarium for airway management has increased. The best evidence requires a randomized controlled trial comparing a new device against an established alternative, properly powered to detect clinically relevant differences in clinically important outcomes. Such studies in children are very rare. Safety data are even harder to establish particularly for rare events such as aspiration. Therefore, most safety data come from extended use rather than high-quality evidence which inevitably biases against newer devices. For reason of these factors, claims of efficacy and particularly safety must be interpreted cautiously.[1]

The LMA-Classic and the LMA-ProSeal have an established record of safety and efficacy for routine cases in pediatric patients. The LMA-ProSeal may provide a better airway seal and protection against aspiration than the LMA-Classic.[9] In our study, we did not find any complications as mentioned in secondary outcomes.

LMA-ProSeal is easy to insert whichever technique is chosen and has yet to be outperformed by any other supraglottic airway device and there are many techniques of insertion. Aghdashi et al. compared the success rate of laryngeal mask airway insertion in classic and rotatory methods in pediatric patients undergoing general anesthesia. They concluded no significant difference between the two groups in blood staining on the cuff or any other complications.[9]

---

**Table 4**: Comparison of laryngeal mask airway ease of insertion

| LMA ease of insertion | Yes | No | Test      | $P$ |
|-----------------------|-----|----|-----------|----|
| LMA classic           | 23  | 7  | Chi-square| 0.2597 |
| LMA-proseal           | 19  | 11 |           |     |

LMA=Laryngeal mask airway

**Table 5**: Comparison of oropharyngeal trauma

| Yes | No | Test      | $P$ |
|-----|----|-----------|----|
| LMA classic | 5  | 25 | Chi-square | 1.0000 |
| LMA proseal | 5  | 25 |           |     |

LMA=Laryngeal mask airway

**Table 6**: Comparison of device positional stability

| Device positional stability | Yes | No | Test      | $P$ |
|-----------------------------|-----|----|-----------|----|
| LMA classic                 | 25  | 5  | Chi-square| 0.5186 |
| LMA-Proseal                 | 23  | 7  |           |     |

LMA=Laryngeal mask airway

---

**Figure 1**: Comparison of heart rate

**Figure 2**: Comparison of SpO₂

**Figure 3**: Comparison of systolic blood pressure

**Figure 4**: Comparison of diastolic blood pressure
With the added safety feature of the esophageal drain tube, LMA-ProSeal is the optimum pediatric supraglottic airway device available for use in routine anesthesia. However, the evidence base for the LMA-ProSeal is smaller than the LMA Classic as it is a newer device.[1]

In our study, the LMA-ProSeal is compared with the LMA-Classic with respect to as follows: (a) Ease of insertion and number of insertion attempts, (b) Device positional stability and possible oropharyngeal leak, (c) Airway trauma, and (d) Hemodynamic changes; in children aged 3–15 years undergoing elective surgery under general anesthesia, hypothesizing that these would be different.

Various randomized controlled trials comparing LMA-Classic and LMA-ProSeal in children have demonstrated no differences in ease of LMA insertion, and number of attempts of LMA insertion.

SM Asida and SS Ahmed on studied the ease of insertion and predictors of failure in 500 children and they reported that the first trial success was seen in 85.2% patients than of the second trial success (9.2%) which was statistically significant. In our study, we got first attempt success in 70% in both groups. Factors influencing failure of the first attempt of LMA insertion includes abnormal airway anatomy (91%), body weight <16 kg and age below 5 years (44%), the use of LMA size of 1 and 1.5 (3.8%), the intraoperative lateral position (3.8%).[5]

Lopez-Gil et al.[5] in a noncrossover study of 60 children showed that LMA-ProSeal offered no advantages over the LMA-Classic, other than a lower frequency of mucosal trauma, and that gastric tube insertion was possible in 90%. In contrast, we found equal incidence of mucosal trauma in both groups. Goldmann and Jakob[6] in a cross-over study of 30 children showed that the LMA-ProSeal was a better ventilatory device and had a lower frequency of gastric insufflation than the LMA=Classic, and gastric tube placement was possible in 100%.

The frequency of mucosal trauma is similar between LMA-Classic and LMA-Proseal. This is a similar finding to the other studies, but contrasts with the noncrossover study in children,[5] which showed more blood-staining for the LMA-Classic.

Saran et al. compared i-gel and PLMA in children aged 1–12 years. They found no critical incident in both the groups except for one case of oropharyngeal air leakage and two cases of tube displacement in PLMA group during positioning for caudal anesthesia. Incidence of postoperative sore throat and hoarseness was similar in both the groups.[11]

Das et al. compared i-gel, PLMA and classic LMA in children undergoing surgeries. They found that the success rates for the first attempt of insertion were similar among the three devices, and there were no differences in the incidence of postoperative airway trauma, sore throat, or hoarse cry in the three groups.[12]

Our study also found the similar incidence of success rate for the first attempts in both groups.

Patki suggested that the LMA has got one disadvantage of placement failure, provides lesser perioperative airway complications, in comparison to the conventional tracheal tube. The common apprehension of an ineffective airway seal by the LMA requires reconsideration.[13] In our study we found positional instability in few patients in both groups. This difference was statistically insignificant.

The LMA-Proseal has yet to be outperformed by any other supraglottic airway device making it the benchmark by which newer second-generation devices should now be compared.

Sharma, et al. reported that the anesthesia community is still waiting for the ideal EAD which has simple design, excellent seal, high success rate of insertion on the first attempt even in the hands of novices, reliable drainage mechanism, zero aspiration, use in a full-stomach patient with a difficult airway in the emergent situation, low incidence of postoperative discomfort, affordable. It should have desirable features of an endotracheal tube.[14]

Lardner et al. studied airway leak during intermittent positive pressure ventilation and adequacy of fiberoptic laryngeal view in children using ProSeal and classic LMA. They reported PLMA was associated with a higher leak pressure by auscultation and less gastric insufflation compared to the Classic LMA. They also used fiberoptic bronchoscopy to visualize the larynx.[15] We did not check the leak pressure and did not use the fiberoptic to visualize the larynx as they could have helped to know the positional stability better.

Hemodynamic parameters such as pulse rate, systolic, and diastolic blood pressures were comparable in both groups and they were not significant similar to the study conducted by Dwivedi et al.[16]

Limitations
There was no blinding in the data collection, which is a possible source of bias and all three different sizes of the mask have not been compared separately.

Conclusions
The ease of insertion, number of attempts of insertion, the device positional stability, airway trauma, and hemodynamic changes during usage of LMA-Classic and LMA-ProSeal are similar in children. The complications of usage of the LMA are minimal and similar in both the devices. The LMA-Proseal has advantages over LMA-Classic such as the placement of gastric tube, adequate ventilation, and oxygenation without any gastric distension.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.
REFERENCES

1. White MC, Cook TM, Stoddart PA. A critique of elective pediatric supraglottic airway devices. Paediatr Anaesth 2009;19 Suppl 1:55-65.
2. Efrat R, Kadari A, Katz S. The laryngeal mask airway in pediatric anesthesia: Experience with 120 patients undergoing elective groin surgery. J Pediatr Surg 1994;29:206-8.
3. Patel B, Bingham R. Laryngeal mask airway and other supraglottic airway devices in paediatric practice. Contin Educ Anaesth Crit Care Pain 2009;9:6-9.
4. Goldmann K, Jakob C. A randomized crossover comparison of the size 2 1/2 laryngeal mask airway ProSeal versus laryngeal mask airway-classic in pediatric patients. Anesth Analg 2005;100:1605-10.
5. Lopez-Gil M, Brimacombe J, Garcia G. A randomized non-crossover study comparing the ProSeal and classic laryngeal mask airway in anaesthetized children. Br J Anaesth 2005;95:827-30.
6. Brain AI, Verghese C, Strube PJ. The LMA ‘ProSeal’ – A laryngeal mask with an oesophageal vent. Br J Anaesth 2000;84:650-4.
7. Kanthed P, Sharma B, Sood J, Kumra VP. Comparison of LMA-ProSeal™ with LMA Classic™ in anaesthetised paralysed children. Indian J Anaesth 2008;52:44.
8. Ramesh S, Jayanth R. Supraglottic airway devices in children. Indian J Anaesth 2011;55:476-82.
9. Aghdashi MM, Valizade Hasanloei MA, Abbasivash R, Shokouhi S, Salehi Gharehvaran S. Comparison of the success rate of laryngeal mask airway insertion in classic: Rotatory methods in pediatric patients undergoing general anesthesia. Anesth Pain Med 2017;7:e38899.
10. Asida SM, Ahmed SS. Ease of insertion of the laryngeal mask airway in pediatric surgical patients: Predictors of failure and outcome. Saudi J Anaesth 2016;10:295-300.
11. Saran S, Mishra SK, Badhe AS, Vasudevan A, Elakkumanan LB, Mishra G, et al. Comparison of i-gel supraglottic airway and LMA-ProSeal™ in pediatric patients under controlled ventilation. J Anaesthesiol Clin Pharmacol 2014;30:195-8.
12. Das B, Jamil SN, Mitra S, Varshney RK. A prospective, randomized, single-blinded, comparative study of classic laryngeal mask airway and ProSeal laryngeal mask airway in pediatric patients. J Anaesthesiol Clin Pharmacol 2012;28:318-21.
13. Patki A. Laryngeal mask airway vs. The endotracheal tube in paediatric airway management: A meta-analysis of prospective randomised controlled trials. Indian J Anaesth 2011;55:537-41.
14. Sharma B, Sahai C, Sood J. Extraglottic airway devices: Technology update. Med Devices (Auckl) 2017;10:189-205.
15. Lardner DR, Cox RG, Ewen A, Dickinson D. Comparison of laryngeal mask airway (LMA)-Proseal™ and the LMA-Classic™ in ventilated children receiving neuromuscular blockade. Can J Anesth 2008;55:29.
16. Dwivedi Y, Gupta A, Srivastava U, Jagar KD, Mohan A, Mangla S. Comparison of i-gel™, LMA ProSeal™ and LMA Classic™ in spontaneously breathing pediatric patients. Anaesth Pain Intensive Care 2016;20:176-81.