

A new maneuver for classical laryngeal mask airway insertion: Prospective randomized study

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Ethics Committee Approval

Ethics committee approval was taken from the Bezmialem Vakif University ethics committee (19.12.2012, 28/4).

All procedures in this study involving human participants were performed in accordance with the 1964 Helsinki Declaration and its later amendments.

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Conflict of Interest

No conflict of interest was declared by the authors.

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Abstract

Background/Aim: Laryngeal mask airway (LMA) has been frequently used for airway management. But the satisfaction of the insertion and trauma at insertion remain problems. We present a new insertion maneuver for classical LMA (cLMA) with a partially inflated cuff and examine its success and complication rate.

Methods: In 4 months, 158 patients who were classified as ASA I–III and older than 18 years old and were planned for LMA were included in this study consecutively (according to the study design, one patient was excluded during the study). Emergency cases, patients with any contraindications with LMA, patients who were expected to undergo surgery for more than 2 h, patients with preoperative respiratory tract infection or sore throat, patients undergoing oral or nasal surgery, and patients with aspirated oropharyngeal secretions after removal of LMA was excluded from the study. Age, gender, height, weight, ASA scores, comorbidities, and the duration of anesthesia and surgery of the patients were recorded. One-hundred-fifty-seven consecutive patients were randomized into two groups by a coin toss [control group (group C) and study group (group S)]. The groups were compared in terms of LMA insertion success, the number of insertion attempts, the presence of blood on the LMA or in secretions, and postoperative sore throat. Classical Laryngeal Mask Airway was inserted with Brain's standard technique in group C and with the new technique in group S. In the new technique, the head and neck of the patient were supported in a straight position, the mouth was opened, cLMA was held with a dominant hand from the tube part and inserted until the tip touches to the oropharynx. The index finger of the non-dominant hand was inserted into the mouth to pass by the cLMA and reach the tip of the cLMA. The tip of cLMA was directed to the caudal by the index finger. Then, cLMA was inserted by the guidance of the index finger until it reached the triangular base of the oropharynx.

Results: There was no statistically significant difference in terms of demographic data and placement success; placement success was better in the study group (100% versus 98.6% and $P = 0.45$). Similarly, the count of attempts was better in the study group. The mean attempt number was 1.11 in group S and 1.28 in group C ($P = 0.02$). Also, blood on LMA was seen to be more common in group C ($P = 0.04$). There were no statistical differences in sore throat, but it was less seen in group S.

Conclusion: The new maneuver was better than the standard technique and easy to use in daily practice.

Keywords: Airway management, Laryngeal mask airway, Complications

Introduction

Laryngeal mask airway (LMA) was designed by Archie Brain [1] in 1981 and has been in clinical use since 1988. Brain [2] also described an insertion technique later called the “standard technique”. LMA has been used as an important option in difficult airway conditions and cardiopulmonary resuscitation besides its use in many surgical procedures that do not require muscle relaxation and that are expected to continue for less than 2 h [2-12].

A few new LMA models have emerged to optimize the clinical use of the LMA, and Brain’s LMA is now called the classic LMA (cLMA). Although some new recommendations have been made regarding the placement technique to increase the placement success of cLMA, which has an important role in LMAs that are currently used in clinical practice and to reduce complications, the placement success is still not 100%, and complications such as trauma, mucosal bleeding in the pharyngeal mucosa, and postoperative sore throat may be encountered during placement [1-12]. The main problems with placement appear to be that the tip of the cLMA may be buckled towards the cranial during placement, and/or the cLMA folds the epiglottis downward [2, 13-18]. Based on these, we planned this study to test the new insertion maneuver that we thought would improve placement success and reduce complications by eliminating the problem of the cLMA tip from buckling towards the cranial.

The primary outcome of this study was the success of placement and whether the new method tested can be used and recommended, and the secondary outcome was to show the complication and side effect profile according to current methods.

Materials and methods

Approval of the ethical committee of Bezmialem Vakif University (19.12.2012, 28/4) and informed consent of the patients were obtained. The study was planned to be completed in 4 months. During this time, 158 patients classified in the American Society of Anesthesiologists (ASA) I–III and older than 18 years old and planned for LMA were included in this study consecutively (one patient was excluded during the study). Emergency cases, patients with any contraindications with LMA, patients who were expected to undergo surgery for more than 2 h, patients with preoperative respiratory tract infection or sore throat, patients undergoing oral or nasal surgery, and patients with aspirated oropharyngeal secretions after removal of LMA were excluded from the study. Age, gender, height, weight, ASA scores, comorbidities, and the duration of anesthesia and surgery of the patients were recorded. None of the patients received premedication. Patients were randomly divided into two groups by coin toss.

Preoperative analgesia treatment, anesthesia induction, and maintenance were kept under standard conditions. Electrocardiogram (ECG), non-invasive blood pressure (NIBP), and peripheral blood oxygen saturation (SpO₂) follow-up were performed before anesthesia induction. During the induction, patients were administered 2 mg of midazolam and 1–1.5 µg/kg of fentanyl; and after 2 min, 2.5–3 mg/kg of propofol. Anesthesia

was maintained with sevoflurane (MAC = 1.3–1.4) and 50:50% air-O₂. Patients received 500 mg of metamizole sodium in 100 ml of fluid and 1 g of paracetamol via intravenous infusion half an hour before the completion of the operation.

cLMA placements

It is stated in the standard technique of Brain [1, 3, 14] that the air of the cuff must be completely emptied so that a sharp line is obtained at the tip of the LMA, ensuring proper placement. However, some studies claim that partial or fully inflating of the cuff will provide a soft tip, resulting in less trauma and better placement success. In studies testing the cases where the cLMA cuff is fully deflated, half inflated, and fully inflated; conflicting results have been obtained for placement success, while complication rates seem to favor partially or fully inflated cLMAs [2, 9, 16-20]. In our study, we preferred to use half-inflated cLMA for both groups considering these studies. In addition, in this study, all cLMA placements were conducted by researchers with more than 8 years of experience working as staff anesthesiologists.

The cLMA (LMA North America, Inc.) size was determined for both groups according to the manufacturer’s recommendations. In all patients, cLMA cuffs were half or fully inflated based on manufacturer recommendations

Control group (Group C): Brain’s standard technique [3] was used as the placement method. However, contrary to Brain’s description, the cuff was half-inflated. The patient’s head was brought to the sniffing position (neck flexion, head extension), and the head was held in this position with the non-dominant hand. The cLMA was held at the junction point of the cuff and the tube, using the dominant hand just as holding a pen, and after the cuff was placed in the mouth, the cuff was pushed from the junction point towards the hypopharynx by pressing on the hard palate with the index finger. When the laryngeal mask was felt on the triangular base, the hand was removed from the mouth, the cLMA was released, and the cuff was inflated with air.

Study group (Group S): In this group, cLMAs with half-inflated cuffs were used. The patient’s head was slightly extended, and the head and neck supported this position. The mouth was opened by the non-dominant hand, the cLMA was held by the dominant hand from the tube part, the cuff was inserted into the mouth, and the cLMA was advanced in the mouth until the tip reached the oropharynx (Figure 1). The index finger of the non-dominant hand was inserted into the mouth, passing by the ipsilateral side and slightly behind the cuff, and the tip of the cLMA in the mouth was detected and directed caudally (Figures 2 and 3). While the index finger of the non-dominant hand was in the mouth and the pulp of the finger was in contact with the posterior wall of the oropharynx at the lowest possible portion, the cLMA was advanced to the hypopharynx with the dominant hand while the tip of the cLMA was oriented caudally (Figure 4). When the laryngeal mask was felt on the triangular base, the hand was removed from the mouth, cLMA was released, and the cuff was inflated with the air.

Figure 1: Insertion of the cLMA into the oropharynx with the dominant hand



Figure 2: Putting the index finger of the non-dominant hand in the mouth passing by the cLMA



Figure 3: Directing the tip of the cLMA to caudally by the index finger of the non-dominant hand



Figure 4: Advancing the cLMA over the index finger to its final position



The success of laryngeal mask placement was clinically confirmed in both groups. After placement, the cLMA-ventilator connection was achieved, and the patients were manually ventilated. Chest movement, capnography, SpO₂, airway resistance, and refilling of the reservoir bag were used to assess the success of cLMA placement. When these evaluations showed adequate ventilation, the patient was mechanically ventilated, and air leakage was evaluated. If the leakage during mechanical ventilation was less than 10% of the adjusted tidal volume, successful placement was considered, and if more than 10% leakage was observed, the placement was considered unsuccessful.

The number of placement attempts was recorded. One attempt was defined as the one-time advancing of the cLMA in the mouth. The maximum number of attempts is limited to three. The other placement method was tried if the cLMA failed in three attempts. If the other method was also unsuccessful in three attempts, orotracheal intubation was performed.

The data obtained up to this stage were recorded, and further evaluations were made by another anesthesiologist who was blind to the group distribution and the details of the cLMA placement. At the end of the surgery, the cLMA was removed, and cLMA and secretion were checked for the presence of blood. Patients were questioned for sore throat 30 min after being taken to the recovery unit and/or when the Aldrete score was ≥ 8 . If the patient had a sore throat, the severity of the pain was assessed by a numerical analog scale (NAS). In this evaluation, patients were asked to score their pain between 0 and 10 (0 = no pain, 10 = the most severe pain they could imagine).

Statistical analysis

Frequency and descriptive analyses of cases were recorded. Qualitative data were analyzed using Fisher’s exact test, and quantitative data were analyzed using Mann Whitney-U test. A logistic regression test was used for the subgroup analysis. The data analysis was performed using SPSS version 17 software (SPSS, Inc., Chicago, IL, USA). *P*-values < 0.05 were judged statistically significant.

Results

In a total of 158 patients, there were 22 female and 51 male patients (*n* = 73) in group C, and 27 female and 58 male patients (*n* = 85) in group S (*P* = 0.72). The median age, height, and body weights of the groups were similar (*P* = 0.14, *P* = 0.68 and *P* = 0.27, respectively) (Table 1). ASA scores, duration of operation, and anesthesia were also similar (Table 2).

One patient in group C was intubated due to insufficient ventilation emerging in the 55th min of surgery and was excluded from the study. This patient’s surgery was completed without any complications.

Table 1: Comparisons of patient characteristics between the groups

| Parameter | Number of patients | Mean (SD) | <i>P</i> -value |
|--------------------------|--------------------|----------------|-----------------|
| Sex | | | |
| Group C (<i>n</i> = 72) | 21 female/51 male | | 0.72 |
| Group S (<i>n</i> = 85) | 27 female/58 male | | |
| Age (y) | | | |
| Group C | | 51.78 (17.81) | 0.14 |
| Group S | | 47.48 (18.27) | |
| Height (cm) | | | |
| Group C | | 170.07 (8.71) | 0.68 |
| Group S | | 169.26 (15.03) | |
| Weight (kg) | | | |
| Group C | | 76.47 (14.39) | 0.27 |
| Group S | | 74.05 (13.27) | |

SD: standard deviation

Table 2: Comparisons between the groups for ASA* statuses, comorbidities, operation durations, and anesthesia durations

| | Number of patients group C/Group S | Minutes mean (SD) | P-value |
|---------------------|---------------------------------------|----------------------|---------|
| ASA status | | | |
| ASA I | 35/51 | | 0.205 |
| ASA II | 31/25 | | |
| ASA III | 6/9 | | |
| Operation duration | | | |
| Group C | | 59.83 (36.48) | 0.95 |
| Group S | | 60.21 (44.75) | |
| Anesthesia duration | | | |
| Group C | | 79.01 (38.49) | 0.83 |
| Group S | | 77.55 (46.35) | |

ASA: American Society of Anesthesiologists, SD: standard deviation

The success rate of cLMA placement was 100% (85/85) in the study group and 98.6% (71/72) in the control group ($P = 0.45$). In 89.4% (76/85) of the patients in the study group, LMA was placed in the first attempt, it was placed in the second attempt in 10.6% (9/85) of the patients, and the third attempt was not needed in any patient. On the other hand, in the control group, LMA was placed at the first attempt in 79.2% (57/72) of the patients and in 13.9% (10/72) and 5.5% (4/72) at the second and third attempts, respectively. In one patient in the control group, cLMA could not be placed in all three attempts. Following the study plan, the other method (a new method tested in the study group) was tried, and cLMA was placed on the first attempt with this method.

The mean of the number of placement attempts in group S (1.11 [0.31]) was significantly lower than the group C (1.28 [0.58]) ($P = 0.02$). The incidence of blood on LMA was 1.2% (one patient) in the study group and 8.3% (6 patients) in the control group ($P = 0.04$). In the study group, the incidence of sore throat was 11.9% (ten patients), and in the control group, this incidence was 19.4% (14 patients) ($P = 0.19$).

Also, NAS values of patients with sore throats were obtained according to the study plan. The median NAS score in the Group S was (4.20 [2.34]) (min = 1, max = 8), while it was (3.93 [1.53]) (min = 1, max = 7) in group C ($P = 0.73$). Table 3 indicates the success rates, number of attempts, complication rates, and NAS scores between the two methods.

Table 3: Success of the techniques, numbers of attempts, complication rates, and VAS* scores between the groups

| | n (%) | | | P-value |
|--------------------------------|-------------------------|-------------------------|-------------------------|---------|
| | 1 st Attempt | 2 nd attempt | 3 rd attempt | |
| Number of attempts | | | | |
| Group C | 57 (79.2%) | 10 (13.9%) | 5 (6.9%) | 0.02 |
| Group S | 76 (89.4%) | 9 (10.6%) | 0 (0%) | |
| Successful insertion rates | | | | |
| Group C | 71 (98.6%) | | | 0.45 |
| Group S | 85 (100%) | | | |
| Blood on the LMA/in secretions | | | | |
| Group C | 6 (8.3%) | | | 0.04 |
| Group S | 1 (1.2%) | | | |
| Sore Throat | | | | |
| Group C | 14 (19.4%) | | | 0.19 |
| Group S | 10 (11.9%) | | | |
| VAS scores for sore throat | | | | |
| Group C (14/72) | 3.93 (1.53) | | | 0.73 |
| Group S (10/72) | 4.20 (2.34) | | | |

Discussion

In this study, we compared the standard technique of Brain with the new insertion method described above for the placement of the half-inflated cLMA. The new insertion method tested was better than the standard technique in terms of placement success and complications. Therefore, it seems to be a viable and recommendable placement method.

Although many LMA models and placement techniques have been proposed after the initial LMA model (cLMA) and placement technique (standard technique) introduced by Dr.

Archie Brain, several problems for patients and anesthesiologists are still present.

Different than Brian's [1] claim in his study published in 1983, more emphasis has been put on "the placement success on the first attempt" in later studies. According to the literature, the placement success rate in the first attempt ranged between 75% and 98% [2, 8-11, 19-24]. In our study, the success rates of placement at the first attempt was 79.2% and at the end of the third attempt 98.6% in Group C, while the first attempt success was 89.4% and at the second attempt was 100% in Group S. This results seems to be compatible with the literature. In their study, Matta et al. [20] placed fully deflated and half-inflated cLMA by applying the standard technique, and the first attempt success rate was 75% in the fully deflated group, and the success rate increased to 92% at the end of three attempts, while with the half-inflated cLMA these values were 88% and 97.7% respectively. The study conducted to investigate the use of cLMA in Pakistan by Khan et al. [12] revealed that the success rate using the standard technique of Brain at the first attempt was 84%, and the third attempt was performed successfully in all patients. With Brain's standard technique, McCrerrick et al. [21] reported first attempt success and total placement success rates of 76% and 94%, respectively. Brimacombe et al. [24] reported 96% success in the first attempt and 100% in the second attempt.

In our study, the mean number of attempts of Group S (1.11 [0.31]) was significantly lower than Group C (1.28 [0.58]). Goyal et al. [25], in their study including 40 patients in total on which half inflated cLMA was applied, compared the standard Brain technique with the thumb technique. In this study, the mean number of attempts was 1.20 (0.51) with the standard technique and 1.25 (0.5) with the thumb technique. In the study conducted by Jiwon et al. [26], it was observed that in the fully deflated and half-inflated cLMA applied to a total of 172 patients, the mean number of attempts was 1.1 (0.2) and 1.1 (0.3), respectively.

In our study, we evaluated the trauma related to cLMA by investigating the presence of blood on LMA and/or in the secretion and the sore throat complaints. In addition, we questioned the severity of pain in patients with sore throats. According to our study, the new method is safer regarding these side effects. One patient (1.2%) had blood on the LMA in group S, and six patients (8.3%) had blood in Group C. On the other hand, the rate of sore throat was 11.9% (ten patients) in Group S and 19.4% (14 patients) in Group C.

Following the study plan, the NAS values of patients with sore throats were also evaluated. The median NAS score in the group S was 4.20 (2.34) (min = 1, max = 8), while in group C this value was 3.93 (1.53) (min = 1, max = 7). Although there was no difference in the statistical significance between the two groups, the pain scores were higher in the study group.

Trauma due to placement has been mostly evaluated with blood and sore throat previously. Besides these parameters, odynophagia and hoarseness were also investigated in some studies. The incidence of the presence of blood varies between 1.7% and 32% in the studies in which the standard technique was applied, while the incidence of postoperative sore throat varied between 2.9% and 28% [2, 11, 15, 18, 19, 21-23, 25-28]. Similar to our study, the prevalence of the presence of blood found in

these publications is lower than sore throat rates. Therefore, it can be concluded that there is no direct connection between physical trauma and sore throat. However, in the user manual, cLMA sizes and the inflating quantities are fixed, but the pharynx anatomy may show natural variations among individuals. This may cause the pressure applied by the LMA on the pharynx wall to be relatively different and may cause differences in the perfusion of the mucosa. This reminds us that we have to consider ischemic pain, and LMAs should be inflated to a level that does not exceed the mucosal perfusion pressure or to a minimum amount to prevent air leakage.

Another point that we think is important is that sometimes it may be difficult to bring the patient's head to the sniffing position due to the patient's anatomical characteristics, and sometimes it may not be appropriate due to cervical disc problems. In the tested method, keeping the head in a normal position, except for a slight extension, could save us from problems such as head-on bringing sniffing position and holding in the air.

There were some limitations to our study. One of them is that the group in which the patient was involved and the number of attempts were known by the researcher who placed the cLMA. However, this awareness is inevitable. This bias was minimized by preventing the researchers, who collected and evaluated the data after the placement, from knowing which group the patient was from.

Another limitation was that fiberoptic observations did not evaluate the cLMA placement status. In many studies, cLMA was clinically checked for proper placement [2, 8-10, 13-15, 19-23, 25, 26, 28, 29]. The first paper that compares clinical findings and fiberoptic evaluations were published by J Payne [13]. It was concluded that the only reason for airway obstruction was failed down folding of the epiglottis. In the paper where Brain [14] comments on Payne's publication, he stated that the clinically good patients ventilated were evaluated with fiberoptic, and some observed that the epiglottis was folded down. He speculated that, despite this folding, the gap on the sides of folded-down epiglottis allows good ventilation. Rowbottom et al.'s study [10] placed cLMA with standard technique in a group of 100 pediatric patients and evaluated the cLMA position fiberoptically. In this study, it was seen that cLMAs were located in the appropriate position on only 49 patients, although there was no clinical problem in the ventilation of 98 patients. Similarly, Jiwon and colleagues [26] compared the placement of fully deflated and half-inflated cLMAs in their study, and they found that despite the difference in the number of attempts, the duration of the placement and the leakage around the cuff did not differ significantly, yet the fiberoptic scoring was statistically different between the groups. Considering these studies, we thought that it would be sufficient to evaluate the clinical findings of cLMA.

Conclusion

Based on our findings, the placement of the half-inflated cLMA with the new insertion maneuver is superior with regards to both the placement success and the complication rates when compared to the standard method of half-inflated cLMA and seems to be and viable and recommendable method.

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