Journal of Clinical Monitoring and Computing (2022) 36:1249–1255
https://doi.org/10.1007/s10877-022-00841-1

ORIGINAL RESEARCH

Blind vs. video-laryngoscope-guided laryngeal mask insertion: A prospective randomized comparison of oropharyngeal leak pressure and fiberoptic grading

Tahsin Simsek[1] · Ayten Saracoglu[2] · Ozlem Sezen[1] · Gul Cakmak[2] · Kemal Tolga Saracoglu[1]

Received: 22 November 2021 / Accepted: 2 March 2022 / Published online: 26 May 2022

Abstract

Purpose Laryngeal Mask Airway (LMA) insertion may not always be smooth without complications. Controversial results of several studies evaluating ideal insertion conditions have been published. This study compared the oropharyngeal leak pressure values and fiberoptic grading scores between blind and video-laryngoscope-guided LMA insertion.

Methods Patients were randomly assigned into blind insertion (n = 50) and video-laryngoscope guided insertion (n = 50) groups. The oropharyngeal leak pressure, peak airway pressure, fiberoptic grading score, first attempt success rate, hemodynamic parameters, and complications were recorded.

Results All laryngeal mask airways were successfully inserted in both groups at the first attempt. The fiberoptic staging scores were: grade 1 in 8.2% of patients, grade 2 in 24.4% of patients, grade 3 in 44.8% of patients, grade 4 in 22.4% of patients in the control group. On the other hand, grade 1 in 2.2% of patients, grade 2 in 28.6% of patients, grade 3 in 51% of patients, grade 4 in 8.2% of patients in the VL group (p = 0.260). The peak airway pressure and LMA insertion time were similar between groups. However, the oropharyngeal leak pressure before extubation was significantly higher in the video-laryngoscope-guided insertion than blind insertion (36.29 ± 7.09 vs. 33.79 ± 8.84 cmH2O respectively, p = 0.04).

Conclusions The findings of our study suggest that the video-laryngoscope-guided LMA-Classic insertion with a standard blade technique may be a helpful alternative to blind insertion.

Keywords Blind insertion · Laryngeal mask airway · Video-laryngoscope

1 Introduction

Laryngeal Mask (LMA) provides an intact airway for many surgical procedures during general anesthesia [1, 2]. The LMA insertion technique was described by Archie Brain when first produced [3]. Accordingly, it is suggested to blindly advance the device to the level where resistance is felt. However, LMA insertion may not always be smooth and without complications. The failure of LMA insertion is associated with a sore throat, hoarseness, dysphagia, dysphonia, airway obstruction, gas leaks, and increased intragastric pressure due to gastric insufflation [4, 5]. Several studies described placing the LMA under direct vision using a laryngoscope to overcome these difficulties [6–8]. It has been shown that the reliability of the laryngeal mask could be demonstrated by the oropharyngeal cuff leak test [9, 10].

Fiberoptic imaging is the gold standard method for LMA placement confirmation [11]. Fiberoptic scoring during imaging is used as a measure of airway anatomical position in laryngeal mask placement. A frequently used scoring system stages the visibility as follows; stage 4, only vocal cords visible; stage 3, vocal cords and posterior epiglottis visible; stage 2, vocal cords and anterior epiglottis visible; stage 1, vocal cords not visible. High scores are associated with less oropharyngeal leak and easier intubation [12].

Besides, fiberoptic imaging of the laryngeal structures and vocal cords through the LMA gives us information

✉ Gul CakmakMD
drgulcakmak@gmail.com

[1] Department of Anesthesiology and Intensive Care, Health University Kartal Dr. Lutfi Kirdar Training and Research Hospital, Istanbul, Turkey

[2] Department of Anesthesiology and Intensive Care, Marmara University Medical School, Istanbul, Turkey

about the availability of adequate positive pressure ventilation [13].

In case of difficult laryngeal mask insertion, a direct laryngoscope or video-laryngoscope can be used. Kim et al. [8] investigated LMA insertion with a direct laryngoscope. However, video-laryngoscopes are increasingly available and gained popularity providing a wide field of view [14]. Hence, we hypothesized that video-laryngoscopes might be advantageous to place a laryngeal mask. This study's primary outcome was to compare the oropharyngeal leak pressure (OLP) values between blind and video-laryngoscope-guided inserted LMA. The secondary outcome was the comparison of fiberoptic grading scores.

2 Methods

This study was conducted in a randomized, prospective, and double-blind manner. The Ethics Committee of our university approved the study (date: 27/03/2019, no: 2019/514/150/21). The study protocol was registered at clinicaltrails.gov before patient enrollment (NCT04311775). Written informed consent was obtained from all participating patients.

2.1 Patient selection

We enrolled 100 patients with the American Society of Anesthesiologists (ASA) I-II score, between 18 and 65 years of age, undergoing ambulatory surgery or elective minor surgery under general anesthesia with a classical laryngeal mask airway (LMA Classic™, Teleflex Medical, Ireland). Patients undergoing abdominal surgery, head and neck surgery, patients with a difficult airway history, anticipated difficult airway findings, a history of upper respiratory tract infection in the last two weeks, and a body mass index (BMI) of ≥ 35 kg/m^2 were excluded from the study.

2.2 Preoperative airway evaluation and monitoring

The Modified Mallampati scores, thyromental distance, mouth opening, and head extension were assessed during the preoperative evaluation. Patients were monitored with an electrocardiogram, peripheral oxygen saturation, non-invasive blood pressure, and temperature in the operating room. Readings before anesthesia induction and immediately after LMA insertion (0 min) were recorded.

2.3 Anesthesia induction and LMA insertion

Propofol 2 mg/kg; fentanyl 2 mcg/kg; lidocaine 1 mg/kg iv were administered during general anesthesia induction. Neuromuscular blocking agents were not used. The depth of anesthesia was determined by the absence of eyelash reflex and relaxation of the jaw. After the patients were ventilated with a face mask, a LMA-Classic suitable for the patient's weight was chosen and lubricated with water-soluble gel before the insertion. The LMA-Classic was checked for leaks. Maintenance of anaesthesia was with 1–2%sevoflurane in N_2O/O_2 (FiO_2-0.5) using a fresh gas flow of 2 L/min. The patients were randomly divided into two groups. We generated randomized sequences of integers using the website: www.random.org. In the control group (n = 50), LMA-Classic was inserted blindly without using any laryngoscopes described in the Instruction Manual [15]. The size of LMA was chosen according to the weight of the patients. In the video-laryngoscope group (n = 50), after viewing the epiglottis and vocal cords with an Endolarynx video-laryngoscope, the epiglottis was lifted, and the LMA-Classic was placed until resistance was met. Encountering resistance was accepted as the end point. Proper placement was achieved with optimization maneuvers in case of LMA malposition. LMA rotation, jaw thrust, head extension, and flexion were used as optimization maneuvers.

Then the cuff was inflated to the appropriate volume. Mac blade no. 3 was used in female patients and no. 4 in male patients. The same researcher inserted all of the laryngeal masks (T.S.). A cuff manometer set the cuff pressure to 60 cmH_2O. For correct LMA insertion, OLP measurement and grading were performed by fiberoptic bronchoscopic imaging through the LMA.

2.4 The fiberoptic staging [12]

Stage 1 was regarded as the vocal cords were not visible,

Stage 2 was regarded as the visualization of the vocal cords and anterior epiglottis,

Stage 3 was regarded as the visualization of the vocal cords and posterior epiglottis,

Stage 4 was regarded as seeing only the vocal cords.

2.5 Oropharyngeal Leak pressure measurement [16]

After the placement of LMA, the fresh gas flow was adjusted to 3 L/min. When the APL (Adjustable pressure limiting) valve was closed, the airway pressure displayed on the anesthesia machine was recorded as OLP when audible noise inside the mouth occurred. The maximum allowable pressure was 40 cmH_2O. OLP, peak airway pressure, and inspiratory volume were measured again after LMA insertion and at the end of the surgery before LMA removal. The same researcher (K.T.S.), who was blind to the groups, performed OLP measurement and fiberoptic imaging.

The age, gender, weight, body mass index, ASA, thyromental distance, Mallampati, type of surgery, surgery and duration of anesthesia, LMA insertion duration, number of interventions, and the need for optimization maneuvers, were recorded. LMA rotation, jaw thrust, head extension, and flexion were used as optimization maneuvers.

2.6 Statistical Analysis

Statistical analysis was performed by using IBM SPSS Statistics 25. In the paired comparison of numerical data groups, the Independent Samples T-test was used for those who complied with the normal distribution, the Mann Whitney-U test, and the One Way Anova test was used for those who did not. The Chi-Square test was used to examine discrete variables. Results were evaluated at the 95% confidence interval and the significance level of $p < 0.05$.

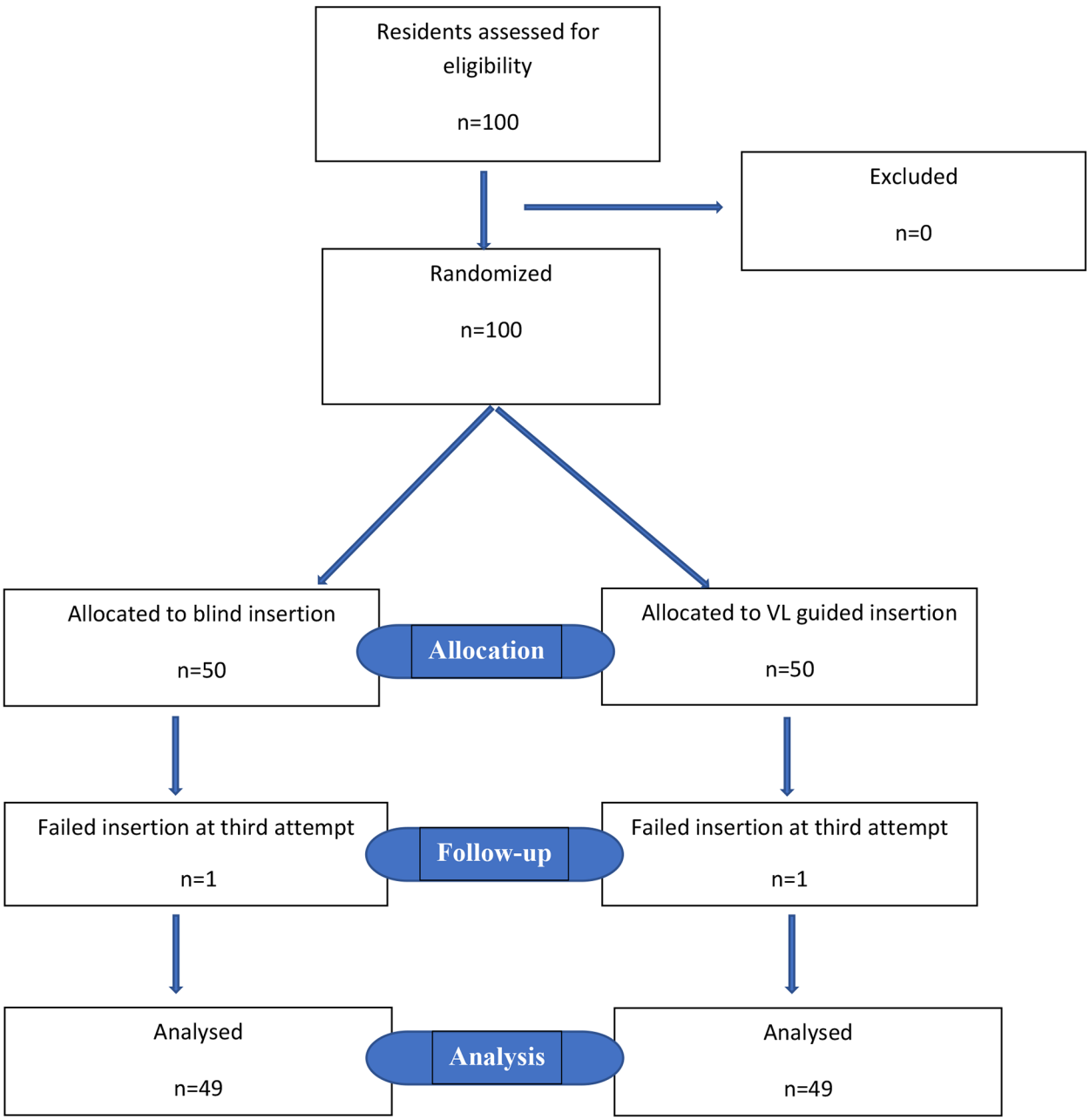

Fig. 1 Flow chart of the participants

2.7 Sample size calculation

When the difference between the groups in terms of OLP is 20%, the standard effect size is 0.67, 5% margin of error, with the power of 90%; thus, 48 cases should be included in each group.

3 Results

A total of 100 patients were included in the study. The laryngeal mask could not be inserted in one patient from each group, excluding them from the study as tracheal intubation was performed (Fig. 1). Data analysis of a total of 98 patients was performed. Forty-nine patients were included in the group where LMA was inserted using a video-laryngoscope, while 49 patients were in the blindly inserted group. The ages of the patients ranged between 18 and 65 years (47.96 ± 13.99 years). Fifty-six patients were female (56.1%), and 43.9% were male. Both demographic data (Table 1) and hemodynamic data (Table 2) of the patients were similar.

The fiberoptic staging scores were: grade 1 in 8.2% of patients, grade 2 in 24.4% of patients, grade 3 in 44.8% of patients, grade 4 in 22.4% of patients in the control group. On the other hand, they were grade 1 in 2.2% of patients, grade 2 in 28.6% of patients, grade 3 in 51% of patients, grade 4 in 8.2% of patients in the VL group (p = 0.260) (Table 1). Peak airway pressures were similar within groups (Table 2). All laryngeal mask airways were successfully inserted in both groups at the first attempt. "Pre-extubation OLP" values were found to be significantly higher in the VL group (p < 0.05) (Table 2). Pre-extubation peak airway pressure values were found to be similar in both groups. The LMA-Classic insertion times were comparable between groups (16.60 ± 13.58 vs. 14.22 ± 6.21 s, p = 0.643, Table 2).

The Modified Mallampati Scoring system was found to be statistically similar (Table 3). While the optimization maneuver was required in 16 patients (33.3%) in the control group, this requirement was limited to 11 patients (22.4%) in the VL (Video-laryngoscope) group (p = 0.232, Table 3).

Table 1 Demographic characteristics of the groups

	Control Group	VL Group	
	(n = 49)	**(n = 49)**	**p**
Age (years)	50.06 ± 13.46(53)	45.86 ± 14.34(51)	0.117[m]
Gender	26(53.1%)	29(59.2%)	0.541[k]
Female55 (56.1%)			
Male43(43.8%)	23(46.9%)	20(40.8%)	
BMI	28.04 ± 3.03(28)	27.18 ± 3.13(27)	0.068[m]
Duration for surgery (min)	49.63 ± 19.5(45)	50.24 ± 24.76(45)	0.503[m]
Duration for anesthesia (min)	53.96 ± 19.97(50)	55.67 ± 25.26(50)	0.935[m]
Thyromental distance (cm)	6.76 ± 0.66(7)	6.65 ± 0.93(7)	0.679[m]
Number of interventions	1.27 ± 0.61(1)	1.20 ± 0.46(1)	0.764[m]
Duration of insertion (sec)	16.60 ± 13.58(13)	14.22 ± 6.21(12)	0.643[m]
Fiberoptic staging	4(8.2%)	6(12.2%)	0.260[k]
1			
2	12(24.4%)	14(28.6%)	
3	22(44.8%)	25(51.0%)	
4	11(22.4%)	4(8.2%)	

[m] Mann Whitney U test: values are given as mean ± standard deviation (median)

[k] Chi-square test: values are given as frequency (percentage)

*p < 0.05: statistically significant difference

VL: Video-laryngoscope

BMI: Body Mass Index

4 Discussion

In this prospective, randomized, double-blind study, LMA insertion was evaluated in adult patients. The number of attempts, success rate, fiberoptic staging scores, and peak airway pressures was found to be similar. Before extubation, OLP was significantly higher in the VL group.

Difficult insertion may result in suboptimal LMA positioning. Controversial results of several studies evaluating ideal insertion conditions have been published. Campbell et al. [6] compared fiberoptic imaging between blind insertion and direct laryngoscopy. While insertion within the ideal position was achieved with a direct laryngoscope in 91.5% of cases, this rate was 42% in the blind group. Patil et al. [17] have shown that blind insertion is comparable to laryngoscopic insertion in terms of hemodynamic parameters, and fiberoptic scores in proseal LMA insertion. In this study, a direct laryngoscope was used, and no significant difference was found in terms of accuracy of positioning, and hemodynamic parameters. In another study where direct laryngoscopy was compared with a blind insertion, according to the Campbell category, the percentage of epiglottis covering glottic opening similar [7]. Similar to the mentioned studies, no difference was found between the groups in terms of fiberoptic scores and hemodynamic data in our study. In a study by Joshi S. et al., it was reported that fiberoptic grade 2, 3 and 4 images obtained after LMA placement were suitable for adequate ventilation [18]. In our study, it was found that fiberoptic evaluation was 2 or higher in 87% of the patients in the VL group and 91% of the patients in the blind group. However, in case of LMA placement malposition, optimization maneuvers were used in 22.4% of the patients in the VL group, while this rate was 33.3% in the blind group. Therefore, although the fiberoptic rating was

similar between the groups, it was seen that higher optimization was required to achieve a better fiberoptic image in the blind group.

Video-laryngoscopes are widely used in routine and difficult airway management today. A prospective study including one hundred and nineteen patients revealed that video-laryngoscopes increase the first attempt success rate of LMA insertion [19]. However, the authors used Storz CMAC D blade for Proseal™ laryngeal mask airway placement in this study. D blade is a non-standard blade and is preferred in difficult intubation [14]. Our study used a video-laryngoscope with a standard Mac blade, which we use more frequently in our daily clinical practice. We believe it can guide clinicians as a rescue technique when LMA insertion is difficult.

OLP is used to evaluate appropriate LMA placement and a value of 25 cmH_2O or higher is recommended [20]. In addition to ensuring adequate ventilation, increased OLP also prevents the aspiration of gastric contents into the airway due to high-pressure ventilation. OLP is a reliable method for predicting successful and correct LMA placement [21]. In our study, OLP was above 30 cmH2O in both groups after LMA placement and there was no difference between the groups. However, while the OLP value before extubation was 36.29 ± 7.09 in the VL group, it was 33.79 ± 8.84 in the blind group, and there was a significant difference between the two groups. Therefore; we predict that obtaining higher oropharyngeal leak pressure values with VL can benefit surgeries requiring prolonged positive pressure ventilation.

Laryngeal mask insertion is associated with fewer upper airway complications than tracheal intubation [22]. However, LMA may cause lacerations in the upper airway due to trauma. One advantage of using the VL is that it can be detected instantly and intervened if trauma develops during insertion. Moreover, laryngoscopy can be performed without applying extra power through a video camera, preventing sympathetic discharge. Our study's lack of a significant increase in mean arterial pressure and heart rate values supports this. Due to such advantages, we believe that VL-guided LMA insertion may enter our clinical practice more in the future. However, it is clear that further studies are required. Besides, with the VL-guided technique, the insertion time was not prolonged. Contrary to our results, Kim et al. [8] reported a prolongation in insertion time in their study comparing direct laryngoscopic insertion with blind insertion. Moreover, the direct laryngoscopy group obtained an increase in oropharyngeal cuff pressure. However, higher leak-tightness pressures were achieved when using VL in our study.

Table 2 The comparison of hemodynamic parameters, SpO_2 and oropharyngeal leak pressures between groups

	Control Group	VL Group	
	(n = 49)	**(n = 49)**	**P**
Pre-induction MAP (mmHg)	98.82 ± 14.01	100.73 ± 14.55	0.508[s]
Post-insertion MAP (mmHg)	81.76 ± 16.30	85.72 ± 17.26	0.250[s]
Pre-induction HR (beat/min)	81.63 ± 15.15	79.76 ± 13.33	0.520[s]
Post-insertion HR (beat/min)	77.98 ± 13.50	75.45 ± 12.56	0.342[s]
Pre-induction SpO_2(%)	98.79 ± 0.88(99)	98.71 ± 2.87(99)	0.081[m]
Post-insertion SpO_2(%)	99.23 ± 0.81(99)	99.61 ± 0.64(100)	0.07*[m]
Pre-extubation OLP (cmH_2O)	33.79 ± 8.84(32)	36.29 ± 7.09(36)	0.042*[m]
Post-insertion OLP (cmH_2O)	32.45 ± 8.68(30)	35.55 ± 8.66(35)	0.064[m]
Pre-extubation peak pressure (cmH_2O)	14.79 ± 3.35(15)	15.22 ± 3.08(14)	0.486[m]
Post-insertion peak pressure (cmH_2O)	14.23 ± 3.34(14)	14.18 ± 2.57(14)	0.771[m]

[s] Independent Samples T-test: values are given as mean ± standard deviation

[m] Mann Whitney U test: values are given as mean ± standard deviation (median)

*P < 0.05: statistically significant difference

VL: Video-laryngoscope

OLP: Oropharyngeal leak pressure

MAP: Mean Arterial Pressure

HR: Heart Rate

SpO_2: Peripheral oxygen saturation

4.1 Limitations

One limitation of our study was the small sample size. We assume that the significance rate may change in studies comparing the higher number of patients. Another limitation was that this study was performed only in patients with normal airway examination. The LMA is recommended as a rescue technique in unexpected difficult airway management. The next step, fiberoptic intubation through supraglottic airway devices, was defined in the DAS (Difficult Airway Society) difficult airway guide [23]. Therefore, comparative studies on LMA insertion in difficult airways are needed. Another limitation is the fact that we used 1st generation SGAD in our study. Some guidelines recommend the use of the 2nd generation SGAD, which has a ventilation port as well as a gastric channel. Further comparative studies are needed on the subject.

Table 3 Intergroup comparison of Modified Mallampati Scores and optimization maneuver

	Control Group	VL Group	
	(n = 49)	**(n = 49)**	**P**
Mallampati	12(24.5%)	19(38.8%)	0.302[k]
1			
2	34(69.4%)	26(53.1%)	
3	3(6.1%)	3(6.1%)	
4	0(0.0%)	1(2.0%)	
The need for Optimization Maneuver	16(33.3%)	11(22.4%)	0.232[k]

[k] Chi-square test: values are given as frequency (percentage)

VL: Video-laryngoscope

5 Conclusions

In conclusion, when the VL-guided technique was used in LMA insertion, the fiberoptic position score, peak airway pressure, and hemodynamic parameters were found to be similar between the groups. An increase in oropharyngeal cuff leak pressures was observed without a prolonged insertion time or a decrease in insertion success. The findings of our study suggest that the VL-guided LMA insertion with a standard blade technique may be a helpful alternative to blind insertion.

Acknowledgments.

Author contributions Ayten Saracoglu: data curation, conceptualization, methodology, writing reviewing & editing. Tahsin Simsek: data curation, writing- original draft preparation, software, validation, investigation. Ozlem Sezen: writing- original draft preparation, conceptualization, methodology. Gul Cakmak: corresponding author, visualization, writing - reviewing & editing. Kemal Tolga Saracoglu: supervision, visualization.

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

The authors have no conflicts of interest to declare relevant to this article's content.

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of Marmara University Faculty of Medicine (Date 02.02.2018/ No 09.2018.134).

References

1. Seet E, Rajeev S, Firoz T, Yousaf F, Wong J, Wong DT, et al. Safety and efficacy of laryngeal mask airway supreme versus laryngeal mask airway ProSeal: a randomized controlled trial. Eur J Anaesthesiol. 2010;27:602–7.
2. Francksen H, Bein B, Cavus E, Renner J, Scholz J, Steinfath M, et al. Comparison of LMA Unique, Ambu laryngeal mask and soft seal laryngeal mask during routine surgical procedures. Eur J Anaesthesiol. 2007;24:134–40.
3. Brain AI. The laryngeal mask-a a new concept in airway management. Br J Anaesth. 1983;55:801–5.
4. Van Zundert AAJ, Gatt SP, Van Zundert TCRV, Kumar CM, Pandit JJ. Features of new vision-incorporated third-generation video laryngeal mask airways. J Clin Mon Comp. 2021. https://doi.org/10.1007/s10877-021-00780-3.
5. Van Zundert AAJ, Gatt SP, Kumar CM, Van Zundert TCRV, Pandit JJ. 'Failed supraglottic airway': an algorithm for suboptimally placed supraglottic airway devices based on videolaryngoscopy. Br J Anaesth. 2017;118:645–9.
6. Campbell RL, Biddle C, Assudmi N, Campbell JR, Hotchkiss M. Fiberoptic assessment of laryngeal mask airway placement: blind insertion versus direct visual epiglottoscopy. J Oral Maxillofac Surg. 2004;62:1108–13.
7. Chandan SN, Sharma SM, Raveendra US, Rajendra Prasad B. Fiberoptic assessment of laryngeal mask airway placement: a comparison of blind insertion and insertion with the use of a laryngoscope. J Maxillofac Oral Surg. 2009;8:95–8.
8. Kim GW, Kim JY, Kim SJ, Moon YR, Park EJ, Park SY. Conditions for laryngeal mask airway placement in terms of oropharyngeal leak pressure: a comparison between blind insertion and laryngoscope-guided insertion. BMC Anesthesiol. 2019;19:4.
9. Beleña JM, Núñez M, Anta D, Carnero M, Gracia JL, Ayala JL, et al. Comparison of laryngeal mask airway supreme and laryngeal mask airway Proseal with respect to oropharyngeal leak pressure during laparoscopic cholecystectomy: a randomised controlled trial. Eur J Anaesthesiol. 2013;30:119–23.
10. Kim HJ, Lee K, Bai S, Kim MH, Oh E, Yoo YC. Influence of head and neck position on ventilation using the air-Q® SP airway in anaesthetized paralysed patients: a prospective randomized cross-over study. Br J Anaesth. 2017;118:452–7.
11. Van Zundert AA, Kumar CM, Van Zundert TC. Malpositioning of supraglottic airway devices: preventive and corrective strategies. Br J Anaesth. 2016;116:579–82.
12. Keller C, Brimacombe J, Pühringer F. A fibreoptic scoring system to assess the position of laryngeal mask airway devices. Interobserver variability and a comparison between the standard, flexible and intubating laryngeal mask airways. Anaesthesiol Intensivmed Notfallmed Schmerzther. 2000;35(11):692–4. doi:https://doi.org/10.1055/s-2000-8164.
13. Saracoglu KT, Demir A, Pehlivan G, Saracoglu A, Eti Z. Analysing the efficacy of the I-gel supraglottic airway device in the supine and lateral decubitus positions. Anaesthesiol Intensive Ther. 2018;50:259–62.
14. Saracoglu A, Saracoglu KT, Kafali IH. I have only D-blade: Is it enough? J Clin Anesth. 2016;34:68–9.
15. LMA. LMA Proseal™ Instruction Manual. 1st ed. San Diego: LMA North America Inc; 2000.
16. Zhang L, Seet E, Mehta V, Subramanyam R, Ankichetty SP, Wong DT, Chung F. Oropharyngeal leak pressure with the laryngeal mask airway Supreme™ at different intracuff pressures: a randomized controlled trial. Can J Anaesth. 2011 Jul;58:624–9.
17. Patil PC, Chikkapillappa MA, Pujara VS, Anandswamy TC, Parate LH, Bevinaguddaiah Y. ProSeal Laryngeal Mask Airway Placement: A Comparison of Blind versus Direct Laryngoscopic Insertion Techniques. Anesth Essays Res. 2017 Apr-Jun;11:380–4.
18. Joshi S, Sciacca RR, Solanki DR, Young WL, Mathru MM. A prospective evaluation of clinical tests for placement of laryngeal mask airways. Anesthesiology. 1998 Nov;89(5):1141 6. doi:https://doi.org/10.1097/00000542-199811000-00014.
19. Ozgul U, Erdil FA, Erdogan MA, Begec Z, Colak C, Yucel A, Durmus M. Comparison of video-laryngoscope-guided versus standard digital insertion techniques of the ProSeal™ laryngeal mask airway: a prospective randomized study. BMC Anesthesiol. 2019 Dec;30(1):244. 19).

20. Van Zundert AAJ, Kumar CM, Van Zundert TCRV, Gatt SP, Pandit JJ. The case for a 3rd generation supraglottic airway device facilitating direct vision placement. J Clin Monit Comput. 2020 Jun 15:1–8. doi: https://doi.org/10.1007/s10877-020-00537-4).
21. Kumar C, Van Zundert T, Seet E, Van Zundert A. Time to consider supraglottic airway device oropharyngeal leak pressure measurement more objectively. Acta Anaesthesiol Scand. 2021;65(2):142–5. https://doi.org/10.1111/aas.13727).
22. Van Esch BF, Stegeman I, Smit AL. Comparison of laryngeal mask airway vs tracheal intubation: a systematic review on airway complications. J Clin Anesth. 2017 Feb;36:142–50.
23. Frerk C, Mitchell VS, McNarry AF, Mendonca C, Bhagrath R, Patel A, O'Sullivan EP, Woodall NM, Ahmad I. Difficult Airway Society intubation guidelines working group. Difficult Airway Society 2015 guidelines for management of unanticipated difficult intubation in adults. Br J Anaesth. 2015 Dec;115:827–48.