ISSN: 1607-8322, e-ISSN: 2220-5799 **Anaesthesia, Pain & Intensive Care**
Vol 25(5); October 2021 DOI: 10.35975/apic.v25i5.1621

ORIGINAL RESEARCH **ANESTHESIOLOGY**

Comparison of standard versus a new technique for classic laryngeal mask insertion

Jasim M. Salman

Assistant professor of Anesthesiology, University of Basrah/ College of Medicine, Basrah, Iraq.

Correspondence: Dr. Jasim M. Salman {ORCID:0000-0003-3969-5017}; E-mail: jasim.salman@uobasrah.edu.iq; Phone: 009647801018133

Abstract

Background & Objective: With the extensive use of the laryngeal mask airway (LMA) for anesthesia as well as in emergency airway management, learning alternative techniques of insertion is essential for the safe and quick use of the device in some cases. The smooth and quick insertion of LMA leads without repeated attempts reduce the consequent complications. We compared standard technique with 180° rotation with inflated cuff technique for LMA Classic insertion.

Methodology: This study was done in Basrah University Medical Center from 1st January 2019 to 31st December 2019. During this period, in 397 patients LMA was used for general anesthesia. Out of these, in 197 patients we used 180° rotation technique of insertion of LMA with fully inflated cuff and in 200 patients the standard method was used as a control group. The patients' ages ranged between 15 and 45 y, and they were scheduled to undergo short surgical procedures and to require general anesthesia.

Results: Three hundred and ninety-seven (397) participants were enrolled in this study with a mean age of 35.7 ± 14 y. Of those, 154 (38.8%) were males. The new method showed higher sensitivity and accuracy rate (97.4%, 95.9%, respectively) compared to the standard method.

Conclusion: The new method is a suitable technique that enhanced the ease of LMA insertion and successfully placed the device within a shorter time without complications compared to the standard method of insertion.

Key words: Laryngeal mask airway; LMA; BMI; Mallampati grading system; Airway management; Anesthesia, general.

Citation: Salman JM. Comparison of standard versus a new technique for classic laryngeal mask insertion. Anaesth. pain intensive care 2021;25(5):569-574: **DOI:** 10.35975/apic.v25i5.1621

Received: May 21, 2021, **Reviewed:** August 25, 2021, **Accepted:** September 5, 2021

1. Introduction

Laryngeal mask airway (LMA) is a supraglottic airway device used to control the airway during the administration of anesthesia in the operating room and for emergency airway management. The device is frequently used by anesthesiologists in a variety of operations.[1-10] Many techniques have been used for its insertion other than the classic one, including thumb finger directed, and 90º rotation.[11, 12] Conventionally, during insertion, the cuff of the LMA is usually completely,[13] or partially inflated.[14, 15] However, Brimacombe and Berry (1993) used a fully inflated cuff with a standard approach and a fully deflated cuff with 180º rotation.[16] The laryngoscope was used by some authors to aid LMA insertion.[17,18] Some authors tried different types of LMA.[19]

Besides a skill of successfully insertion of an LMA, the anesthesiologists need to know the appropriate size selection; both are learnt through a learning curve. The LMA size can be determined using different criteria; the gender-based LMA size selection was used by some authors.[16] Others used a tongue–width based formula,[20,21] or a weight based formula.[22] In clinical practice, anesthesiologists use clinical tests to judge the correct anatomic placement of the LMA.[23] A fiberoptic scoring system for standardized evaluation of the LMA position

following its insertion into the hypopharynx was proposed previously by a researcher [24] and was considered in this study.

A review of the literature regarding validation and clinical application of a new LMA insertion technique involving a fully inflated cuff with 180° rotation revealed only few publications. Thus, we conducted this study to validate this new method for correct anatomic placement of the LMA and to compare it with the standard technique.

2. Methodology

This study was conducted in Basrah University Medical Center, from 1st January to 31st December 2019. The Research and Ethical Institutional Review Committee of the University of Basrah / College of Medicine granted the ethical approval for this study. During the study period, 397 LMA insertions were done for patients aged between 15 and 45 y for administration of general anesthesia (GA). They underwent short surgical procedures requiring GA. Written informed consent was obtained from all the patients or their first-degree relatives before anesthesia. The patients were generally in good physical health (ASA Grades I and II). Exclusion criteria included body mass index (BMI) greater than 25 kg/m^2, Mallampati class IV, cervical spine problems, upper airway pathology, and mouth opening less than three finger breadths. To ensure safety, patients were asked to remove any chewing gum or any other foreign materials from their mouth to reduce the risk of slipping along with the LMA during insertion. For determining the degree of difficulty of a direct laryngoscopy or intubation risk, each patient's tongue size to pharyngeal size was scored according to the Mallampati grading system.[25] All patients were fasting as a routine recommendation before GA to reduce the risk of regurgitation and aspiration. Routine laboratory investigations were requested, including fasting blood sugar, renal function, and complete blood count. Routinely, each patient was subjected to standard clinical monitoring. Induction of anesthesia was carried out with propofol 1.5–2.5 mg/kg IV. After the loss of eyelash reflex, suxamethonium chloride 0.5 mg/kg of was given to produce relaxation of the jaw muscles. An assistant performed the jaw thrust and mouth opening maneuver. The size of LMA was determined according to the weight-based formula; LMA size = 1 + BW/20, where BW indicates body weight (in kg) rounded up at the first digit.[22]

Patients were randomly assigned and categorized into two groups; Group I – the study group, and Group II – the standard (control) group.

The procedure included two steps. In the control group, the standard method was used for insertion with the cuff fully deflated using index finger directing the device along the palate and downwards, then the cuff was inflated to the recommended volume, and upward movement of the device was observed indicating final placement. While in the study group, the cuff was fully inflated as recommended by the manufacturer to 20 ml and 30 ml for sizes 3 and 4, respectively, and the LMA was inserted backward, sliding over the hard palate. Once it passed the oral cavity and the laryngeal mobility was seen, the device was rotated in 180° until a black line on the LMA was observed in the midline of the incisors. This maneuver produced an audible click, which indicated proper placement. The devices were then connected to the breathing system to assess the primary outcome. The expiratory valve was adjusted to 15 cmH_2O, and two manual ventilations were given to observe chest movement. This was followed by another four ventilations to auscultate and ensure bilateral air entry. Other features that helped to judge acceptable placement included the absence of gurgling, no resistance to manual ventilation, good oxygen saturation, and a reasonable capnography trace.

The stopwatch was used to monitor the time for insertion and final placement. Each LMA insertion procedure was recorded from placing the device at the incisors until satisfactory auscultation ensured bilateral air entry without an audible leak. Absent leak indicated high orolaryngeal pressure and device fitness. If a leak presented, the device was manipulated or the cuff inflated to the additional volume. On the other hand, if there was a gurgle, the attempt was considered failed, and the device removed to try another one; additional 0.5 mg/kg of suxamethonium was given for the third trial. Only three attempts were allowed.

For inspection of the device, a Reister flexible endoscope mounted to a camera, and a screen was used to evaluate the anatomic position using Brimacombe and Berry, (1993) scoring system.[24] The proper mounting of LMA needs to achieve an anterior displacement of the epiglottis, thus supplying a direct view of the vocal cords by a fiberoptic endoscope. True positive results were considered with grades 4, 3, and 2, while grade 1 was considered false positive. Ten minutes after fiberoptic evaluation, the stability of the device was assessed by an absent leak on manual ventilation.

Statistical analysis: IBM SPSS software was used for statistical analysis. Results were expressed as frequencies or means ± standard deviations. Frequencies or means were compared using X2 and t-test, respectively. Sensitivity, specificity, and accuracy rates were calculated. Moreover, linear regression analysis was done to determine the predictors for full-time insertion of the laryngeal mask. A $p < 0.05$ was considered statistically significant.

3. Results

Three hundred and ninety-seven participants were enrolled in this study with a mean age of 35.7 ± 14 y. Out of these, 154 (38.8%) were males (Table 1). The new method was used in 197 patients, while the standard group consisted of 200 patients as a control group. There were no significant differences between the two groups concerning mean age, sex, Mallampati score, inter-incisor distance, device size, and the mean blood pressure at the baseline. The mean pulse rate was significantly lower at the baseline, after 5 min, and after 10 min in the study than in the control group. The BMI was significantly higher in the new method group than that in the control group. No complications were reported in the new method group (Table 1).

The mean of full-insertion time was short in the new method (study group) than in the standard group (22.5 ± 3.1 vs. 25.5 ± 7.8 sec; $p < 0.001$). The insertion success rate in the 1st attempt was 98% for the new method group compared to 92.5% for the standard group (Table.2). In the 2nd attempt, the success rates were 2.0% and 6.5% for the new and standard methods, respectively.

Table 1: Demographic data and clinical characteristics

Character	Study group (n= 197)	Standard group (n= 200)	*p*-value
Male sex	76 (38.2)	78 (39.0)	0.828
Age (y), Mean ± SD	35.2 ± 13.7	36.2 ± 14.3	0.455
BMI (Kg/m^2), Mean ± SD	22.0 ± 2.1	21.4 ± 2.3	0.010
Mallampati test			
Class 1	180 (91.4)	179 (89.5)	0.749
Class 2	12 (6.1)	13 (6.5)	
Class 3	5 (2.5)	8 (4.0)	
Pulse rate (beats/min) Mean ± SD			
Baseline	81.8 ± 3.9	82.9 ± 4.3	0.010
After 5 min	76.8 ± 4.7	81.6 ± 5.5	< 0.001
After 10 min	71.2 ± 5.3	81.2 ± 6.2	< 0.001
Inter-incisor distance			
3 fingers	17 (8.6)	28 (14.0)	0.091
> 3 fingers	180 (91.4)	172 (86)	
Device size			
Size 3	89 (45.2)	105 (52.5)	0.160
Size 4	108 (54.8)	95 (47.5)	
OLP range, cm			
< 15	8 (4.1)	36 (18)	< 0.001
≥ 15	189 (95.9)	164 (8.2)	
Mean BP (mmHg) (Mean ± SD)			
Baseline	93.3 ± 7.4	93.2 ± 6.8	0.885
After 5 min	90.7 ± 4.1	94.6 ± 7.0	0.003
After 10 min	86.1 ± 7.5	88.8 ± 10.1	< 0.001
Oropharyngeal pressure (Mean ± SD)	20.1 ± 1.7	16.3 ± 2.6	< 0.001
Complications			
No complication	197 (100)	178 (89.0)	< 0.001
Blood stained device	0 (0)	19 (9.5)	
Sore throat	0 (0)	3 (1.5)	

Data presented as n (%), unless described otherwise.

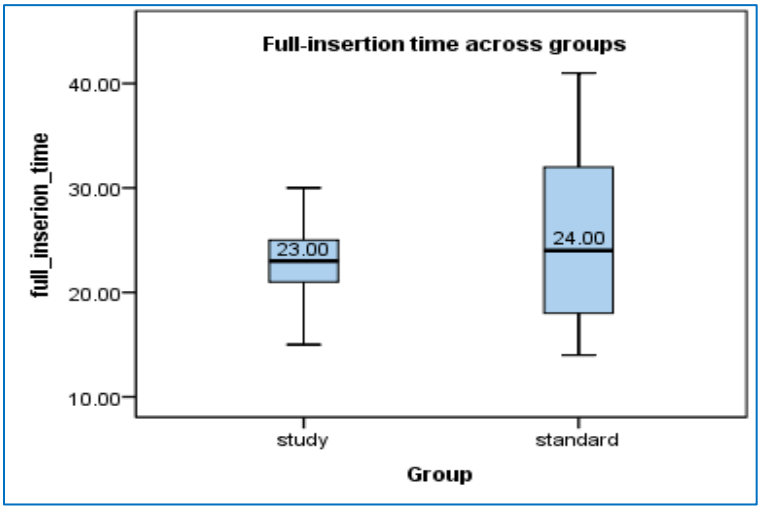

Figure 1: Full-insertion time by study groups

The 3rd insertion attempt was only required for the standard group with a success rate of 1%.

In the new method (study) group, the median full-insertion time was significantly shorter, at 23 seconds [Interquartile range (IQR) 21–25], while the median time in the standard group was 24 seconds (IQR 18-32) (Figure 1).

Table 2: Full-insertion time and success rate by groups

Character	Study group	Standard group	p-value
Full-insertion time, Mean ± SD	22.5 ± 3.1	25.5 ± 7.8	< 0.001
Success rate, n (%)			
1st attempt	193 (98.0)	185 (92.5)	0.042
2nd attempt	4 (2.0)	13 (6.5)	
3rd attempt	0 (0)	2 (1.0)	
Time given in seconds			

Table 3: Linear regression analysis

Variable	Beta	R2	p-value
New method	0.262	0.060	< 0.001
OLP range	0.114	0.074	0.02
Inter-incisor distance	- 0.116	0.086	0.025

Table 4: Validity of the groups judged by fiberoptic evaluation

Group	Sensitivity	Specificity	Accuracy rate
Study (New method)	97.4%	0%	95.9%
Standard	91.8%	6.7%	79%

The independent effects of the studied variables on full-insertion time were examined using multivariate linear logistic regression analysis. The new method of insertion, OLP range, and inter-incisor distance were found to be significant independent predictors of full-insertion time. They explained 8.6% of the variability in the time of insertion. The new method appears to be the strongest predictor that explained 6.0% of the variability (Table 3).

The new method showed higher sensitivity and accuracy rate (97.4%, 95.9% respectively) compared to the standard method (91.8%, 79% respectively) as shown in Table 4.

4. Discussion

Anesthesiologists may require alternative techniques for LMA insertion if the insertion is difficult or fails. They usually choose a technique based on their training and familiarity so that airway maintenance can be accomplished safely and comfortably. Most common technique depend on a finger guide for insertion with risk of contamination or finger trauma, and this concept needs some attention.[26] Also, most methods require cuff inflation after insertion, which might result in device movement even when the attempt was successful. Effective, safe insertion and correct placement to ensure adequate ventilation and oxygenation representing proper function are two main outcomes to be considered. These outcomes depend on familiarity with each technique, adequate training, and optimum conditions provided to the anesthesiologist. Aghamohammadi et al. used mini dose suxamethonium chloride, while Aoyama et al. used triple maneuvers to enhance the technique. [27,28]

Our study conducted a new technique in which the device is inserted easily without digital manipulation during insertion. It will be appropriate for the anesthesiologists and medical personnel who use LMA as there is less risk of contamination or trauma to their fingers. The

technique utilizes fully inflated device with back to the front followed by 180° rotation with the reflection of click and corresponding proper anatomical placement judged by the fiberoptic view that was proposed by Brimacombe and Berry in 1993.[24] The click was found to be 97.4% sensitive as an indicator of successfully positioned LMA and is related to compact adherence to the larynx with corresponding sealing that enhanced positive pressure ventilation and prevents any leak providing higher oro-laryngeal pressure. This feature is considered a valuable sign of correct placement.[29] It is well known that conventional techniques which employ a deflated cuff depend upon an upward movement of the device after inflation; this observation has been reported in literature to be only 92% sensitive,[23] which is comparable to findings in this study with the standard group. There is no significant difference in the demographic characters of the patients in the two groups except body mass index, although it is within the normal range. In terms of insertion time, the meantime for final placement was significantly shorter than in the standard group, and this difference is attributed to the difficulty encountered by tongue impedance, additional time required for cuff inflation, and device manipulation until final placement. The current study demonstrated different time intervals required for insertion and placement in techniques using deflated cuff; Goyal et al.[11] mentioned that the meantime in the thumb insertion group was (34 ± 17 sec), which was longer than the index finger group (29 ± 28 sec). Other researchers showed that the mean interval of placement with the Proseal laryngeal mask airway was longer (23.67 ± 1.83 s) in contrast to the supreme laryngeal mask airway (20.58 ± 1.73 s).[13,18,19,26] This fluctuation in time is due to different definitions of time measurement. In the current study, the time was measured from the beginning of insertion till six manual breathings in comparison with the previous studies that calculated the time from the beginning of insertion until satisfactory first ventilation. The first attempt was 98 % successful in the new technique compared to 95% with the standard one. The results are attributed to the proper approach.

Furthermore, stability was considerable in the study group as seen by higher oro-laryngeal pressure and absent leak 10 min after fiberoptic evaluation. This is attributed to compact adherence of the cuff to the larynx. Higher orolaryngeal pressure was recorded in other studies when insertion was directed by laryngoscopy or the position of the cuff adjusted by head position.[18, 29, 30]

Although the same lubricant technique was used in both methods, unlike the standard technique, no blood staining was noticed in the new one, and this is due to the passage of the smooth surface of the inflated cuff over oro-laryngeal structures. In contrast, bloody tinged saliva in the standard group may have been caused by minor trauma by the wrinkled deflated cuff—authors utilizing standard techniques recorded such events.[31] No patient in whom the new maneuver was used suffered from sore throat. This is possibly due to better stability and less manipulation required for final placement.

5. Conclusion

The new technique of LMA insertion with fully inflated cuff rotated at 180o rotation during insertion offers a shorter time for successful anatomical placement, with minimum complications as a fully inflated cuff smoothly slides along the palate and is easily rotated to a 180o angle. The author recommends this technique to be used in anesthetic practice as a sole method, or as an alternative technique, whenever there is a difficulty.

6. Conflicts of interest

None

7. Authors' contribution

JMS is the sole researcher and the author of this manuscript.

8. References

1. Verghese C, Brimacombe JR. Survey of laryngeal mask airway usage in 11,910 patients: safety and efficacy for conventional and nonconventional usage. Anesth Analg. 1996;82(1):129-33. [PubMed] DOI: 10.1097/00000539-199601000-00023
2. Viira D, Myles PS. The use of the laryngeal mask in gynaecological laparoscopy. Anaesth Intensive Care. 2004;32(4):560-3. [PubMed] DOI: 10.1177/0310057X0403200414
3. Abdelaziz J, Husban A. Anesthesia using laryngeal mask airway for intra-nasal surgery; a comparative study. *Basrah J Surg. 2005;*11(1):43-49. DOI: 10.33762/bsurg.2005.55413
4. Naguib ML, Streetman DS, Clifton S, Nasr SZ. Use of laryngeal mask airway in flexible bronchoscopy in infants and children. Pediatr Pulmonol. 2005;39(1):56-63. [PubMed] DOI: 10.1002/ppul.20139
5. Beleña JM, Ochoa EJ, Núñez M, Gilsanz C, Vidal A. Role of laryngeal mask airway in laparoscopic cholecystectomy. World J Gastrointest Surg. 2015;7(11):319-25. [PubMed] DOI: 10.4240/wjgs.v7.i11.319
6. Dwivedi MB, Puri A, Dwivedi S, Singh G. Comparative assessment of the propofol-butorphanol with propofol-fentanyl combination for different insertion conditions of laryngeal mask airway in orthopedic surgery. J Orthop Allied Sci. 2018;6:69-73. Available from: https://www.joas.in/text.asp?2018/6/2/69/247962
7. Lamb K, James MF, Janicki PK. The laryngeal mask airway for intraocular surgery: effects on intraocular pressure and stress responses. Br J Anaesth. 1992;69(2):143-7. [PubMed] DOI: 10.1093/bja/69.2.143

8. Brimacombe J, Berry A. The laryngeal mask airway--the first ten years. Anaesth Intensive Care. 1993;21(2):225-6. [PubMed] DOI: 10.1177/0310057X9302100220
9. Hobbiger HE, Allen JG, Greatorex RG, Denny NM. The laryngeal mask airway for thyroid and parathyroid surgery. Anaesthesia. 1996;51(10):972-4. [PubMed] DOI: 10.1111/j.1365-2044.1996.tb14969.x
10. Sung A, Kalstein A, Radhakrishnan P, Yarmush J, Raoof S. Laryngeal mask airway: use and clinical applications. J Bronchol. 2007;14:181–8. DOI: 10.1097/LBR.0b013e3181132119
11. Goyal M, Dutt A, Khan Joad AS. Laryngeal mask airway insertion by classic and thumb insertion technique: a comparison. F1000Res. 2013;9(2):123. [PubMed] DOI: 10.12688/f1000research.2-123.v1
12. Park JH, Lee JS, Nam SB, Ju JW, Kim MS. Standard versus rotation technique for insertion of supraglottic airway devices: systematic review and meta-analysis. Yonsei Med J. 2016;57(4):987-97. [PubMed] DOI: 10.3349/ymj.2016.57.4.987
13. An J, Shin SK, Kim KJ. Laryngeal mask airway insertion in adults: comparison between fully deflated and partially inflated technique. Yonsei Med J. 2013 1;54(3):747-51. [PubMed] DOI: 10.3349/ymj.2013.54.3.747
14. Moon BE, Kim MS, Lee JR. A simple method of partial inflation of the LMA cuff before insertion in children to allow cuff pressure without adjustment after insertion. Korean J Anesthesiol. 2012;62(6):524-8. [PubMed] DOI: 10.4097/kjae.2012.62.6.524
15. Haghighi M, Mohammadzadeh A, Naderi B, Seddighinejad A, Movahedi H. Comparing two methods of LMA insertion; classic versus simplified (airway). Middle East J Anaesthesiol. 2010;20(4):509-14. [PubMed]
16. Brimacombe J, Berry A. Insertion of the laryngeal mask airway--a prospective study of four techniques. Anaesth Intensive Care. 1993 Feb;21(1):89-92. [PubMed] DOI: 10.1177/0310057X9302100121
17. Elwood T, Cox RG. Laryngeal mask insertion with a laryngoscope in paediatric patients. Can J Anaesth. 1996;43(5 Pt 1):435-7. [PubMed] DOI: 10.1007/BF03018102
18. 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(1):4. [PubMed] DOI: 10.1186/s12871-018-0674-6
19. Gill RK, Tarat A, Pathak D, Dutta S. Comparative study of two laryngeal mask airways: proseal laryngeal mask airway and supreme laryngeal mask airway in anesthetized paralyzed adults undergoing elective surgery. Anesth Essays Res. 2017;11(1):23-27. [PubMed] DOI: 10.4103/0259-1162.177184
20. Cherng CH. Tongue width-based laryngeal mask airway size selection in male adults: 19AP3-1. EJA. 2013;30:255-6.
21. Huang YH, Cherng CH. Optimal size selection of the classic laryngeal mask airway by tongue width-based method in male adults. J Chin Med Assoc. 2014;77(8):422-5. [PubMed] DOI: 10.1016/j.jcma.2014.05.009
22. Kagawa T, Obara H. An easy formula to remember the laryngeal mask airway size-patient weight relationship. Anesthesiology. 2000;92(2):631-2. [PubMed] DOI: 10.1097/00000542-200002000-00063
23. 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. [PubMed] DOI: 10.1097/00000542-199811000-00014
24. Brimacombe J, Berry A. A proposed fiber-optic scoring system to standardize the assessment of laryngeal mask airway position. Anesth Analg. 1993 Feb;76(2):457. [PubMed]
25. Mallampati SR, Gatt SP, Gugino LD, Desai SP, Waraksa B, Freiberger D, et al. A clinical sign to predict difficult tracheal intubation: a prospective study. Can Anaesth Soc J. 1985 Jul;32(4):429-34. [PubMed] DOI: 10.1007/BF03011357
26. Krishna HM, Kamath S, Shenoy L. Insertion of LMA Classic™ with and without digital intraoral manipulation in anesthetized unparalyzed patients. J Anaesthesiol Clin Pharmacol. 2012 Oct;28(4):481-5. [PubMed] DOI: 10.4103/0970-9185.101923
27. Aghamohammadi D, Eydi M, Hosseinzadeh H, Amiri Rahimi M, Golzari SE. Assessment of Mini-dose Succinylcholine effect on facilitating laryngeal mask airway insertion. J Cardiovasc Thorac Res. 2013;5(1):17-21. [PubMed] DOI: 10.5681/jcvtr.2013.004
28. Aoyama K, Takenaka I, Sata T, Shigematsu A. The triple airway manoeuvre for insertion of the laryngeal mask airway in paralyzed patients. Can J Anaesth. 1995 Nov;42(11):1010-6. [PubMed] DOI: 10.1007/BF03011074
29. Zhang L, Seet E, Mehta V, Subramanyam R, Ankichetty SP, Wong DT, et al. Oropharyngeal leak pressure with the laryngeal mask airway Supreme™ at different intracuff pressures: a randomized controlled trial. Can J Anaesth. 2011 Jul;58(7):624-629. [PubMed] DOI: 10.1007/s12630-011-9514-6
30. Mishra SK, Nawaz M, Satyapraksh MV, Parida S, Bidkar PU, Hemavathy B, et al. Influence of head and neck position on oropharyngeal leak pressure and cuff position with the ProSeal Laryngeal Mask Airway and the I-Gel: a randomized clinical trial. Anesthesiol Res Pract. 2015;2015:705869. [PubMed] DOI: 10.1155/2015/705869
31. Michalek P, Donaldson W, Vobrubova E, Hakl M. Complications associated with the use of supraglottic airway devices in perioperative medicine. Biomed Res Int. 2015;2015:746560. [PubMed] DOI: 10.1155/2015/746560