

Tracheal intubation through laryngeal mask airway CTrach™ with polyvinyl chloride tube: Comparison between two orientations of the tracheal tube

Karri Pavani, Handattu Mahabaleswara Krishna, Joseph Nandhini

Department of Anesthesiology, Kasturba Medical College, Manipal University, Manipal, Karnataka, India

Abstract

Background and Aims: Higher success rate of intubation is observed with the reverse orientation of polyvinyl chloride (PVC) tracheal tube while intubating through laryngeal mask airway (LMA) Fastrach™. It is not clear whether the same is true during intubation through LMA CTrach™ visualizing the process of intubation. The primary aim of this study was to compare the influence of the PVC tracheal tube orientation on the success rate of intubation while intubating through LMA CTrach™.

Material and Methods: One-hundred and fifty patients belonging to American Society of Anesthesiologists status I-II, undergoing elective surgery under general anesthesia were randomized to either group normal orientation or group reverse orientation. A maximum of 3 intubation attempts within a span of 3 min was allowed in each group before the change over to the other group. If intubation failed with the other orientation of the tube also, then intubation through LMA CTrach™ was abandoned and intubation done by direct laryngoscopy. The success of intubation, time, maneuvers, postoperative sore throat, and hoarseness were recorded.

Results: Tracheal intubation through LMA CTrach™ with PVC tube was successful in 94.5% of patients in group normal orientation and in 98.6% of patients in group reverse orientation. The first attempt success rate was 75.3% and 86.3% in group normal and group reverse orientation, respectively. The incidence of a sore throat was higher in the group normal orientation than in the reverse orientation (31.8% and 26.5%, respectively).

Conclusions: Overall success rate of intubation was comparable between the two groups. Though statistically insignificant, the first attempt success rate was higher in group reverse orientation.

Key words: Laryngeal mask airway CTrach™, orientation, polyvinyl chloride tube

Introduction

Laryngeal mask airway (LMA) CTrach™ (LMA North America, Inc., San Diego, CA, USA) is LMA™ device used for video-guided tracheal intubation introduced into clinical practice in 2005. It is similar to the intubating LMA (LMA Fastrach™) with an advantage of the ability to visualize in the viewer the passage of the tracheal tube through the

glottis during intubation.^[1-14] The main advantage of LMA CTrach™ is that with the help of the LMA CTrach™ viewer, the LMA CTrach™ outlet can be aligned in line with the laryngeal inlet that leads to high first intubation success rate.^[2-4] Cost effectiveness and comparable success rates are the main reasons to choose polyvinyl chloride (PVC) tracheal tubes over the dedicated silicone tubes used with LMA Fastrach™.^[15-22] Studies have compared the orientation of conventional PVC tracheal tubes using LMA Fastrach™ and have concluded that insertion of tracheal tube rotated

Address for correspondence: Dr. Handattu Mahabaleswara Krishna, Department of Anesthesiology, Kasturba Medical College, Manipal University, Manipal - 576 104, Karnataka, India.
E-mail: hmkrishna20032002@yahoo.com

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180° from the intrinsic curvature of LMA Fastrach™ makes a lesser emergence angle with LMA Fastrach™ outlet resulting in higher success rate of intubation and lesser incidence of airway trauma when compared to tracheal tube inserted with its curvature aligned with LMA Fastrach™.^[19-22] However, there are no studies in the literature comparing the influence of orientation of PVC tracheal tube during intubation through LMA CTrach™. The primary outcome measure in the study was the success rate of intubation (including the first attempt success rate). The secondary outcome measures were the number of manipulations required for intubation, time taken for intubation and the incidence of a postoperative sore throat and hoarseness of voice.

Material and Methods

Hospital Ethics Committee approval was obtained to conduct this prospective, randomized study, and written informed consent was taken from all the patients enrolled in the study. The study was registered at Clinical Trials Registry, India (CTRI/2013/03/003456) and was done over a period of 1 year at the tertiary care hospital. One-hundred and eighty patients were assessed for eligibility. Patients were evaluated 1 day before surgery by KP or JN. Exclusion criteria were mouth opening <2.5 cm, risk of regurgitation and pulmonary aspiration (inadequate fasting, pregnancy, morbid obesity, emergency surgeries requiring rapid sequence induction of anesthesia, history suggestive of acid peptic disease) and oral, maxillofacial, or laryngeal pathology where LMA CTrach™ insertion is contraindicated or difficult. One-hundred and fifty patients of either gender aged between 18 and 65 years, belonging to American Society of Anesthesiologists (ASA) physical status 1 or 2, who were scheduled for surgical procedures under general anesthesia requiring tracheal intubation were included.

Patients were randomized into 2 groups ($n = 75$) using computer generated random number table and group allocation concealment was ensured using sequentially numbered, opaque sealed envelopes. The envelopes were opened just before shifting the patient into the operation theater by HMK. The two groups were group normal orientation and group reverse orientation. In group normal orientation, tracheal tube was inserted in a conventional manner with the curvature of the tube aligned with the curvature of LMA CTrach™ [Figure 1]. In group reverse orientation, tracheal tube was inserted with a rotation of 180° to the intrinsic curvature of the LMA CTrach™ [Figure 2].

In the operating theater, standard monitors (electrocardiogram, noninvasive blood pressure, pulse oximetry) were connected, baseline values were recorded, and anesthetic management was standardized (fentanyl/propofol/vecuronium for induction and neuromuscular blockade). Ventilation was assisted with 2% isoflurane in 100% oxygen for 3 min following vecuronium injection. Pretested, completely deflated, and lubricated LMA CTrach™ of appropriate size according to manufacturer's guidelines was inserted using one handed rotational technique with head and neck in neutral position.^[1] After insertion, it was inflated with air as per the recommended maximum volume for the particular size of LMA CTrach™. The breathing circuit was connected to the LMA CTrach™ and adequacy of ventilation was assessed by the movement of the chest during ventilation, presence of square-wave capnogram during ventilation and absence of significant air leak at an airway pressure of 20 cm H₂O. If ventilation was not satisfactory, then manipulations of LMA CTrach™ (up-down maneuver, Chandy maneuver and side to side maneuver) and reinsertion of the same or different size LMA CTrach™ (if the operator felt that size discrepancy was the cause for inadequate ventilation) was tried. If that also failed, intubation through



Figure 1: Intubation through laryngeal mask airway CTrach™ with normal orientation of tracheal tube



Figure 2: Intubation through laryngeal mask airway CTrach™ with reverse orientation of tracheal tube

LMA CTrach™ was abandoned and tracheal intubation was done using direct laryngoscopy. Intubation attempt through LMA CTrach™ was also abandoned if there was any evidence of trauma (like bleeding) to the airway.

After confirming the adequacy of ventilation, viewer was attached to the connector and switched on. The glottic view obtained was optimized with brightness adjustment in the viewer to obtain an initial view that was graded as follows:

- Grade 1: Full view of arytenoids and glottis.
- Grade 2: Arytenoids and glottic opening are partly visible; the structure of cords was difficult to see.
- Grade 3: View includes dark areas indicating an open space.
 - a. View of arytenoids, glottis, or epiglottis is blurred because of excess light, poor focus, secretions, or lubricant.
 - b. Insufficient depth of insertion into the larynx (e.g., only the tip of the epiglottis visible).
- Grade 4: No part of the larynx can be identified.
 - a. White-out or red-out indicates epiglottis or other tissues are blocking the view or obstruction by secretions or lubricant.
 - b. Black-out indicates insufficient light to view tissue, insufficient depth of insertion into larynx or both.^[3]

If the initial laryngeal view obtained in the viewer was Grade 2 or worse, following manipulations were done to improve the view: Up-down maneuver - in case of epiglottic downfolding, partial withdrawal - if the view was centered on arytenoids, distal maneuver - (pushing the mask slightly further in) in case if only the proximal tip of the epiglottis was visible, Chandy maneuver, suctioning - if secretions were the cause for poor view. If maneuvers to obtain the best laryngeal view failed to improve the view, another attempt at reinsertion of LMA CTrach™ was done (cleaning the optics of LMA CTrach™). Despite reinsertion, if the best possible glottic view was Grade 3 or 4, with adequate ventilation then one blind intubation attempt was done. If such intubation through LMA CTrach™ failed, then intubation through LMA CTrach™ was abandoned and direct laryngoscopy was performed for tracheal intubation. The initial laryngeal view obtained and the best laryngeal view obtained after the manipulations were compared between the two groups.

After achieving the best possible glottic view with these maneuvers, tracheal intubation was done. A size 3 LMA CTrach™ and a 7.0 mm internal diameter (ID) PVC tracheal tube (Profile Soft Seal®, Portex) were used for patients weighing 30-50 kg, size 4 LMA CTrach™ and 8 mm ID tracheal tube were used for patients weighing 50-70 kg and a size 5 LMA CTrach™ and 8.5 mm ID tracheal tube were

used for patients weighing >70 kg. The operators (HMK and KP) had an experience of using LMA CTrach™ in at least 20 patients before participating in the study. In group normal orientation, lubricated tracheal tube was inserted in a conventional manner with the curvature of the tracheal tube aligned along the intrinsic curvature of LMA CTrach™. In group reverse orientation, it was inserted with 180° rotation to intrinsic curvature of LMA CTrach™. The passage of the tracheal tube into the glottis was visualized. In case of discrepancy in the alignment of the tracheal tube exiting from LMA CTrach™ and the glottis that prevented passage of the tracheal tube into the glottis, tracheal tube was withdrawn and manipulations (Chandy maneuver, pulling out or pushing in the LMA CTrach™ slightly, rotation of the tracheal tube, rotation of LMA CTrach™) were done in an attempt to align the glottis and tracheal tube tip to facilitate intubation. Such maneuvers if performed were recorded. An intubation attempt was defined as the tracheal tube exiting from the cuff of LMA CTrach™ and passing into the glottic opening or hitching against any of the laryngeal structures necessitating withdrawal of the tracheal tube through LMA CTrach™ and requiring manipulations. A maximum of 3 attempts within a span of 3 min was allowed in each group before the change over to the other group. In case of failed tracheal intubation (maximum 3 attempts within a span of 3 min) in any group due to inability to pass the tracheal tube into the glottis despite manipulations to bring the tracheal tube and glottis in same alignment, then change over to the other orientation of the tracheal tube was done and intubation tried without any maneuvers. If intubation failed even with the other orientation of the tube also then intubation through LMA CTrach™ was abandoned and direct laryngoscopy was performed for tracheal intubation. Following intubation, LMA CTrach™ Viewer was removed, the tracheal tube cuff inflated and ventilation was confirmed by chest movements and capnogram. The cuff of the LMA CTrach™ was then deflated. Stabilizing the tracheal tube with the stabilizing rod, the LMA CTrach™ was removed. After adjusting the tube position (with cuff deflated) to ensure bilateral equal movements of the chest, the tracheal tube cuff was reinflated and the tube secured with adhesive plasters. Subsequently, anesthesia and surgery proceeded as per the requirement. Whenever possible, lungs were ventilated through LMA CTrach™ with 2% isoflurane in 100% oxygen. Anesthesia was deepened during the process of intubation by boluses of intravenous propofol.

The success rate of intubation was the primary outcome measured. Number of attempts taken for intubation, number of maneuvers and the type of maneuvers performed to get adequate ventilation, adequate view of glottis and for intubation, time taken for intubation (T1: Time taken from

the beginning of insertion of LMA CTrach™ until obtaining CO₂ waveform capnography following ventilation, T2: Time taken from the attachment of LMA CTrach™ Viewer till obtaining a best possible glottic view and T3: Time taken from the beginning of insertion of tracheal tube till obtaining CO₂ waveform capnography following ventilation), incidence of blood on LMA CTrach™ or tracheal tube, incidence of postoperative sore throat and hoarseness of voice were recorded. Sample size estimation was based on the success rate of intubation. Based on the pilot study, with 89% success rate for normal orientation and considering a difference in success rate of 10% as significant, for a power of 80% at 95% confidence interval, minimum of 73 patients were required in each group. Statistical analysis was done using SPSS for Windows, Version 16.0. Chicago, SPSS Inc. for Windows in consultation with the Department of Medical Statistics of the university. Parametric data (age, weight, timings) were analyzed using Independent samples *t*-test. Nonparametric data were analyzed using Chi-square test or Fisher's exact test. *P* < 0.05 was considered significant.

Results

The CONSORT flow diagram for the study is given in Figure 3. Patient characteristics are given in Table 1. Seventy-three patients in each group were analyzed for the success of intubation. Intubation was successful in 69 patients (94.5%) in group normal orientation and 72 patients (98.6%) in group reverse orientation [Table 2]. In group normal orientation four patients had failed intubation. In these patients, even with a glottic view of Grade 1, the tracheal tube could not be aligned with glottis even after the maximum permissible (as per the study protocol) three attempts. During all these three

Table 1: Patient characteristics

Patient characteristics	Group normal orientation	Group reverse orientation
Age (in years)	40.41 (14.07)	42.59 (11.92)
Weight (in kg)	61.01 (11.58)	59.64 (11.48)
Gender (male/female)	50/24	41/33

Data are mean (SD) for age and weight and absolute numbers for gender; SD = Standard deviation

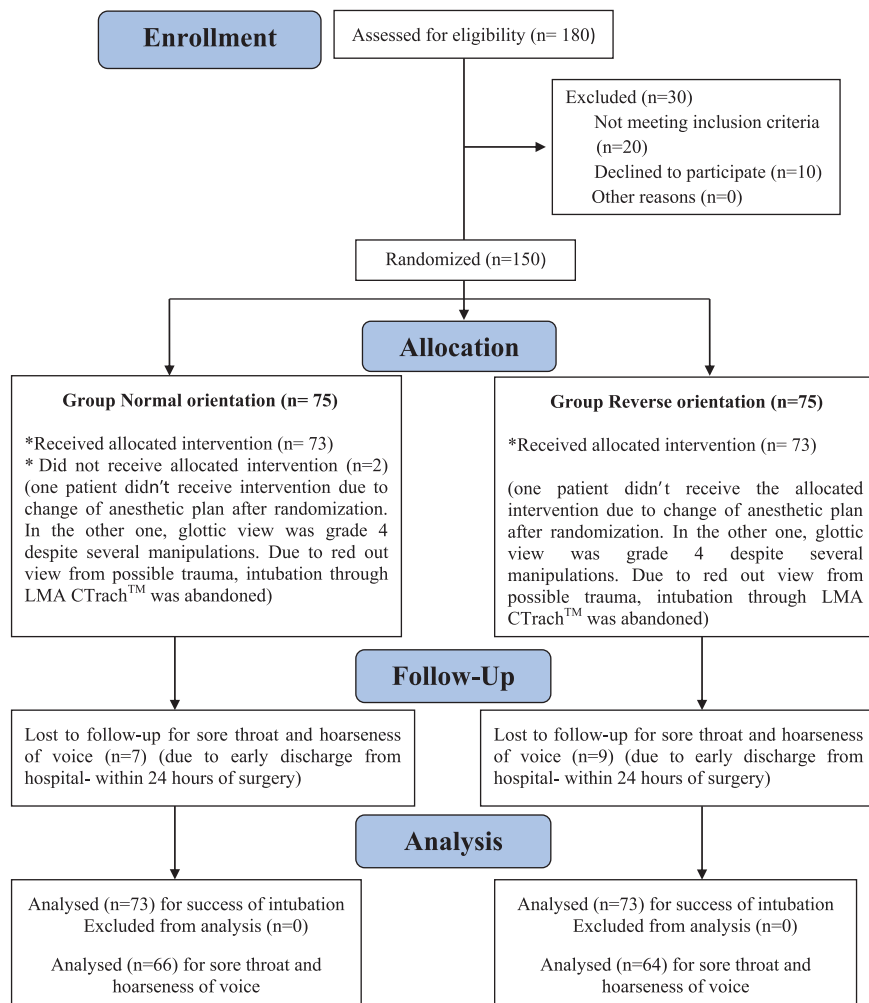


Figure 3: CONSORT flow diagram

attempts, the tube was seen to be hinging against laryngeal structures preventing its passage into the glottis. In these patients, intubation was successful with the reverse orientation of the tube in the first attempt. In group reverse orientation, one patient had failed intubation. In this case, despite a glottic view of Grade 1, during intubation attempt, tracheal tube hinged against vocal cords. On withdrawal of the tube, there was a white-out view, which did not improve with suctioning. Hence, LMA was removed, cleaned, and reinserted. Four manipulations of the LMA were required to obtain adequate ventilation. However, then there was a red out the view. Hence, further attempts at intubation through LMA CTrach™ were abandoned and direct laryngoscopy was done to intubate.

Table 3 shows the number of attempts taken and manipulations done for successful intubation in the two groups. Among the successful intubations, first attempt success rate was 79.7% in group normal orientation and 87.5% in group reverse orientation. Although the first attempt success rate was considerably higher in group reverse orientation, it was statistically comparable to that of group normal orientation. When all the 146 patients who received the allocated intervention (intubation through LMA CTrach™) were considered (irrespective of successful or failed intubation) the first attempt success rate was 75.3% in group normal orientation and 86.3% in group reverse orientation.

One patient in group normal orientation and two patients in group reverse orientation were intubated blindly through LMA CTrach™. In group reverse orientation, in one case, best possible glottic view obtained was Grade 1. However, as the tube exited from LMA there was white-out view, which didn't improve even with manipulations. Since the best possible glottic view was Grade 1 before the white-out (possibly due to lubricant), blind attempt was done and was successful. In the other case, even with manipulations, best possible glottic view obtained was Grade 4, so one blind attempt was tried, and it was successful. In group normal orientation, one patient had Grade 3 view that did not improve with manipulations; hence, blind attempt was done for intubation and was successful. Intubation was successful in the first attempt despite a Grade 3 or 4 view through the viewer in all these patients. A number of manipulations, type of maneuvers for intubation and time taken for intubation were also comparable between the two groups [Tables 3 and 4].

The incidence of a sore throat and hoarseness of voice was comparable between the two groups [Table 5]. To analyze whether the best grade of view that was obtained influenced the success rate of intubation we compared the initial glottic view that was obtained and the best glottic view that was obtained after manipulations [Table 6]. There was no significant

difference in the best view of the glottis between the two groups that could have influenced the success rate of intubation. The incidence of blood on LMA of LMA CTrach™ and tracheal tube were compared as a surrogate marker of any injury during LMA insertion or intubation. The two groups were comparable with respect to blood on LMA and tracheal tube.

Discussion

In this study, the influence of two orientations (normal orientation and reverse orientation) of the PVC tracheal tube during intubation through LMA CTrach™ on the success rate of intubation was compared. Both the orientations were found to be comparable. Although the overall success rate of

Table 2: Success of intubation

Group	Success of intubation		P*
	Yes	No	
Group normal orientation (number of patients=73)	69	4	0.366
Group reverse orientation (number of patients =73)	72	1	

*Fisher's exact test

Table 3: Number of attempts and manipulations for successful intubation

Number of attempts and manipulations	Group normal orientation (number of patients)	Group reverse orientation (number of patients)	P*
Number of attempts for successful intubation			
1	55	63	0.211
2	14	9	
Number of manipulations for successful intubation			
0	54	63	0.257
1	14	9	
2	1	0	

*Chi-square test

Table 4: Time taken for intubation

Time (s)	Group normal orientation	Group reverse orientation	P*
T1	26.73±9.59	28.43±11.22	0.323
T2	23.54±29.20	23.57±51.70	0.997
T3	35.04±17.86	32.97±15.98	0.469

*Independent samples t-test. Data are mean (SD); SD = Standard deviation

Table 5: Incidence of sore throat and hoarseness of voice

Sore throat and hoarseness	Group normal orientation	Group reverse orientation	P*
Sore throat present	21	17	0.51
Hoarseness of voice present	13	11	0.71

*Chi-square test

Table 6: Initial and the final glottic view through the viewer

Group	Grade of initial glottic view				P*	Grade of final glottic view				P*
	1	2	3	4		1	2	3	4	
Group normal orientation (number of patients)	21	4	12	36	0.194	66	6	1	1	0.648
Group reverse orientation (number of patients)	33	4	7	30		64	8	0	2	

*Chi-square test

intubation and the first attempt success rate were higher with the reverse orientation of the PVC tube during intubation compared to normal orientation, it was statistically comparable. The experience from LMA Fastrach™, where PVC tube has been found to be a comparable alternative to silicone tube, was extrapolated to LMA CTrach™ in this study. Since the entire process of intubation is done under vision with LMA CTrach™ (unlike with LMA Fastrach™ where intubation is blind) it was not clear whether the orientation of the PVC tube during intubation would influence the success rate of intubation.

Review of literature revealed that there are no studies evaluating the performance of PVC tracheal tube with LMA CTrach™. Our study has shown results comparable with preliminary studies done on LMA CTrach™ with silicone wire-reinforced tubes.^[2-4] Studies conducted on LMA Fastrach™ have shown equivocal success rates with PVC tracheal tubes. Kundra *et al.* demonstrated an overall success rate of 96% and first attempt success rate of 86% with both PVC tracheal tube and Fastrach™ silicone wire-reinforced tube.^[15] Sharma *et al.* demonstrated an overall success rate of 96%, with a first attempt success rate of 90% with PVC tubes.^[17] In the present study, the success rate with PVC tracheal tube in normal orientation was comparable with these studies and higher with reverse orientation. However, an isolated study conducted by Kanazi *et al.* had shown a success rate of only 57% with PVC tubes using LMA Fastrach™.^[16] The concept of alteration in the orientation of the PVC tube for intubation through LMA Fastrach™ was first studied by Joo and Rose.^[19] In their pioneer study, they reported a success rate of 96.7% with reverse orientation and a first attempt success rate of 87%. Nonetheless, a comparative study with the two orientations done by Lu *et al.* on 240 patients had shown a comparable success rate of 96.7% and 94.2% in normal and reverse groups, respectively.^[20] A significant difference in the first attempt success rate was seen in the two groups with a success rate of 75% and 86.7% in normal and reverse groups, respectively. This success rate was not different from the study conducted by Ye *et al.*^[22] They studied intubation in patients with Mallampati class 3 and 4, observed a success rate of 90% and 93% in normal and reverse orientations, with the first attempt success rate of 72% and 85%, respectively.^[22]

We found that reverse orientation was successful in four patients where normal orientation failed. However in the

case where reverse orientation failed, we could not attempt normal orientation as the intubation attempt resulted in white-out view which did not improve much even with a change of LMA CTrach™. We also found that in addition to the usual maneuvers used to get adequate ventilation, partial withdrawal of the LMA CTrach™ is helpful in quite a few number of cases.

We compared the time taken for intubation between the two groups which was found to be comparable in the two groups. This was not evaluated in the previous studies on the influence of orientation of the tube, possibly because of its less importance as there is a facility to ventilate during intubation attempts. Maneuvers found to be useful during intubation include Chandy maneuver (anterior displacement of the LMA CTrach™ to lift the cuff away from the posterior pharyngeal wall), rotating the LMA CTrach™ and rotating the endotracheal tube either clockwise or anticlockwise. The incidence of a sore throat in the previous studies on the influence of orientation of the tracheal tube on intubation using intubating LMA ranged between 19% and 26% with normal orientation and 9.2-19% with reverse orientation.^[20-22] In all these studies, incidence of a sore throat was higher in the normal group than in the reverse group, which they attributed to the requirement of more intubation attempts with normal orientation. Similar to previous studies, incidence of a sore throat was higher in group normal orientation compared to group reverse orientation in our study (statistically not significant). This could be because of more number of intubation attempts in normal orientation group (statistically not significant). Since sore throat and hoarseness of voice can also be influenced by the manipulations done on the LMA of LMA CTrach™/tracheal tube, the number of manipulations done with the LMA to get adequate ventilation, best possible glottis view and intubation were compared and found to be comparable between the two groups.^[23]

Higher incidence of sore throat in our study may be attributed to the use of glycopyrrolate at the time of induction of anesthesia and use of different scale for assessment of sore throat (Visual Analog Scale was used in previous studies).

There are some limitations to our study. First, the LMA CTrach™ was designed to assist intubation even in difficult airway scenarios while maintaining ventilation. In our study,

we had excluded morbidly obese patients in view of the risk of aspiration. These subsets of the population with potential difficult airways were not included. Second, we failed to limit or standardize the maximum time taken for the best possible glottic view and the maximum number of manipulations to achieve the same. Third, in a number of cases, it was noticed that the poor glottic view was a result of the lubricating jelly obscuring the view. This could have been rectified if we had used a more standardized approach for the same. Fourth, our assessment of postoperative sore throat and hoarseness was subjective, and a number of factors could have contributed to the same. Some cases were also lost to follow-up.

To conclude, we found that the two orientations had a comparable success rate of intubation. Though statistically not significant, the first attempt success rate was higher with the reverse orientation of the tracheal tube.

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Conflicts of interest

There are no conflicts of interest.

References

1. LMA CTrach™. Instruction Manual. Singapore: The Laryngeal Mask Company Limited; 2006.
2. Liu EH, Goy RW, Chen FG. The LMA CTrach, a new laryngeal mask airway for endotracheal intubation under vision: Evaluation in 100 patients. *Br J Anaesth* 2006;96:396-400.
3. Timmermann A, Russo S, Graf BM. Evaluation of the CTrach — An intubating LMA with integrated fibreoptic system. *Br J Anaesth* 2006;96:516-21.
4. Swadia VN, Patel MG. Our preliminary experience with LMA C-Trach. *Indian J Anaesth* 2009;53:312-7.
5. Liu EH, Goy RW, Chen FG. An evaluation of poor LMA CTrach views with a fibreoptic laryngoscope and the effectiveness of corrective measures. *Br J Anaesth* 2006;97:878-82.
6. Brain AI, Verghese C, Addy EV, Kapila A. The intubating laryngeal mask. I: Development of a new device for intubation of the trachea. *Br J Anaesth* 1997;79:699-703.
7. Brain AI, Verghese C, Addy EV, Kapila A, Brimacombe J. The intubating laryngeal mask. II: A preliminary clinical report of a new means of intubating the trachea. *Br J Anaesth* 1997;79:704-9.
8. Pandit JJ, MacLachlan K, Dravid RM, Papat MT. Comparison of times to achieve tracheal intubation with three techniques using the laryngeal or intubating laryngeal mask airway. *Anaesthesia* 2002;57:128-32.
9. Sreevathsa S, Nathan PL, John B, Danha RF, Mendonca C. Comparison of fibreoptic-guided intubation through ILMA versus intubation through LMA-CTrach. *Anaesthesia* 2008;63:734-7.
10. Bilgin H, Bozkurt M. Tracheal intubation using the ILMA, C-Trach or McCoy laryngoscope in patients with simulated cervical spine injury. *Anaesthesia* 2006;61:685-91.
11. Ng BS, Goy RW, Bain JA, Chen FG, Liu EH. The impact of manual in-line stabilisation on ventilation and visualisation of the glottis with the LMA CTrach: A randomised crossover trial. *Anaesthesia* 2009;64:894-8.
12. Arslan ZI, Yildiz T, Baykara ZN, Solak M, Toker K. Tracheal intubation in patients with rigid collar immobilisation of the cervical spine: A comparison of Airtraq and LMA CTrach devices. *Anaesthesia* 2009;64:1332-6.
13. Dhonneur G, Ndoko SK, Yavchitz A, Focrier A, Fessenmeyer C, Pollian C, et al. Tracheal intubation of morbidly obese patients: LMA CTrach vs direct laryngoscopy. *Br J Anaesth* 2006;97:742-5.
14. López AM, Valero R, Pons M, Anglada T. Awake intubation using the LMA-CTrach in patients with difficult airways. *Anaesthesia* 2009;64:387-91.
15. Kundra P, Sujata N, Ravishankar M. Conventional tracheal tubes for intubation through the intubating laryngeal mask airway. *Anesth Analg* 2005;100:284-8.
16. Kanazi GE, El-Khatib M, Nasr VG, Kaddoum R, Al-Alami A, Baraka AS, et al. A comparison of a silicone wire-reinforced tube with the Parker and polyvinyl chloride tubes for tracheal intubation through an intubating laryngeal mask airway in patients with normal airways undergoing general anesthesia. *Anesth Analg* 2008;107:994-7.
17. Sharma MU, Gombar S, Gombar KK, Singh B, Bhatia N. Endotracheal intubation through the intubating laryngeal mask airway (LMA-Fastrach™): A randomized study of LMA-Fastrach™ wire-reinforced silicone endotracheal tube versus conventional polyvinyl chloride tracheal tube. *Indian J Anaesth* 2013;57:19-24.
18. Kihara S, Watanabe S, Taguchi N, Suga A, Brimacombe JR. Tracheal intubation with the Macintosh laryngoscope versus intubating laryngeal mask airway in adults with normal airways. *Anaesth Intensive Care* 2000;28:281-6.
19. Joo HS, Rose DK. The intubating laryngeal mask airway with and without fiberoptic guidance. *Anesth Analg* 1999;88:662-6.
20. Lu PP, Yang CH, Ho AC, Shyr MH. The intubating LMA: A comparison of insertion techniques with conventional tracheal tubes. *Can J Anaesth* 2000;47:849-53.
21. Zhu T. Conventional endotracheal tubes for intubation through the intubating laryngeal mask airway. *Anesth Analg* 2007;104:213.
22. Ye L, Liu J, Wong DT, Zhu T. Effects of tracheal tube orientation on the success of intubation through an intubating laryngeal mask airway: Study in Mallampati class 3 or 4 patients. *Br J Anaesth* 2009;102:269-72.
23. Sumathi PA, Shenoy T, Ambareesha M, Krishna HM. Controlled comparison between betamethasone gel and lidocaine jelly applied over tracheal tube to reduce postoperative sore throat, cough, and hoarseness of voice. *Br J Anaesth* 2008;100:215-8.