

Comparative evaluation of two techniques of LMA CTrach™ insertion on manoeuvres required to obtain optimal laryngeal view

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Background: LMA CTrach™ is a laryngeal mask airway (LMA™) device used for tracheal intubation under vision. A new technique of LMA CTrach™ insertion was evaluated with respect to number of manoeuvres of airway required to obtain grade 1 or 2 view of glottis when compared to standard recommended insertion technique.

Methods: One hundred and ten patients were randomized to either standard technique group (LMA CTrach™ inserted according to manufacturer's recommendations) or modified technique group (LMA CTrach™ inserted with the viewer assembled and visualizing the process of insertion). The number of manoeuvres used before successful intubation were compared. Manoeuvres used to get adequate ventilation/good glottic view were the up-down manoeuvre, partial withdrawal, distal maneuver, Chandy manoeuvre and suctioning. Total number of manoeuvres and ease of LMA CTrach™ insertion were recorded.

Results: Patient characteristics were comparable. Among 50 patients in each group 37 patients required 43 manipulations in modified technique group compared to 41 patients who required 65 manipulations in standard technique group before getting a good glottic view (P=0.013). The number of maneuvers required for successful insertion was significantly higher in the standard technique group compared to modified technique group. Modified insertion technique was significantly difficult (23/50 patients) compared to standard technique (6/50 patients); P<0.001. Time required to obtain the best possible glottic view and the incidence of sore throat was significantly lower with modified technique (P<0.001 and 0.046 respectively).

Conclusion: Number of manoeuvres for getting good glottic view was significantly less with the modified technique of inserting LMA CTrach™. However, this technique was perceived to be more difficult.

Key words: equipment; LMA CTrach™; methods; modified technique; lateral insertion; glottis; optimal view

Introduction

LMA CTrach™ is a laryngeal mask airway (LMA) device used for tracheal intubation under vision and enables ventilation during the process of intubation.^{1,2} The recommended technique of insertion involves one-handed rotational insertion of the airway of LMA CTrach™.

This is followed by checking for adequate ventilation. Then the viewer is attached to visualize the glottis. With this standard method of insertion, adjustment manoeuvres may be required at two-time points. One, to obtain adequate ventilation and another to obtain optimal or good laryngeal view (Grade 1 or 2 according to the grading system of Timmermann A et al).²

However, we have observed that LMA C Trach™ viewer, switched on, may be attached in the beginning itself. This aims to obtain a good glottic view in the beginning itself and not after obtaining adequate ventilation. Thus, adjustment manoeuvres would be required only to obtain the good glottic view. No studies in the literature have evaluated this technique.

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Received: 14/12/2017

Accepted: 30/04/2018

DOI: <http://doi.org/10.4038/slja.v26i2.8303>



We conducted this study to compare the two techniques of insertion with respect to (a) number of airway manoeuvres required to obtain optimal glottic view (b) time required to obtain optimal glottic view (c) difficulty encountered during LMA CTrach™ insertion and (d) grade of sore throat and hoarseness of voice after 24 hours of surgery.

Methods

After obtaining approval from the Institutional Ethics Committee and written informed consent from the patients, this prospective, randomized, single-blinded study was conducted enrolling 110 patients. The inclusion criteria were American Society of Anesthesiologists (ASA) physical status 1 and 2 adult patients of either gender, aged 18 to 65 years, with body mass index of 18.5 to 34.9kgm⁻², scheduled for elective surgical procedures under general anaesthesia requiring tracheal intubation. Patients were excluded if there was risk of regurgitation and pulmonary aspiration, anticipated difficult intubation (mouth opening < 2.5cm, oral maxillofacial or laryngeal pathology) where LMA CTrach™ insertion is contraindicated or difficult.

Patients were randomized to 2 groups utilizing a computer-generated random number table and group allocation was concealed using sequentially numbered opaque sealed envelopes. The two groups were, standard technique group and modified technique group. The head and neck was placed in the neutral position during the insertion of LMA CTrach™. The authors inserted the LMA CTrach™ in all the cases and had an experience of using LMA CTrach™ in at least 20 patients before the study.

In the operating room standard monitors were connected to the patient and intravenous (i.v.) access was secured. Induction of anaesthesia was done with i.v. fentanyl 2µg/kg, glycopyrrolate 0.2mg and propofol 1-3mg/kg. Vecuronium was used for neuromuscular blockade. Ventilation was assisted with 2% isoflurane in 100% oxygen for 3 minutes after injection of vecuronium. Manufacturer's guidelines were followed to choose the size of LMA CTrach™ and silicon reinforced tracheal tube.³

In standard technique group, pretested, completely deflated and lubricated LMA CTrach™ was inserted using the one-handed rotational technique. After cuff inflation LMA CTrach™ was connected to the breathing system and adequacy of ventilation was assessed based on adequate chest rise, auscultation of breath sounds, the presence of square wave capnogram and absence of audible air leak at airway pressures of 20cmH₂O.

In the absence of satisfactory ventilation up-down manoeuvre, Chandy manoeuvre and side to side manoeuvres were tried.⁵ After confirming ventilation adequacy, the viewer was attached to the connector and switched on. The glottic view obtained was optimized with brightness adjustment in the viewer. If the initial laryngeal view obtained in the viewer was grade 2 or worse, the following manoeuvres like up-down manoeuvre (in case of epiglottic downfolding), partial withdrawal (if the view is centered on arytenoids), distal manoeuvre (pushing the mask slightly further in if only the proximal tip of the epiglottis is visible), Chandy manoeuvre, suctioning (if secretions are the cause for the poor view), were done to improve the view.^{1,2,7} If these manoeuvres failed to provide either adequate ventilation or optimal glottic view within a period of 120secs then intubation through LMA CTrach™ was abandoned and tracheal intubation was done with conventional laryngoscopy.

In modified technique group, the pretested, lubricated LMA CTrach™ airway was attached to the viewer and turned on. This assembly was inserted by one-handed rotational technique to visualize and identify the anatomy during the insertion (Figure1).

If the operator felt difficulty to insert the LMA CTrach™ in this manner, then the assembly was inserted with lateral orientation into the oral cavity, rotated to its anatomical curvature and proceeded or LMA CTrach™ viewer was attached immediately after inserting the airway into the oral cavity and then performed the insertion and manipulations under vision.

Figure 1: Modified technique of insertion of LMA CTrach™ and lateral technique of insertion of LMA CTrach™



After insertion, the airway was inflated with the recommended volume of air for that particular size. If the initial laryngeal view obtained in the viewer was Grade 2 or worse, the above-mentioned manoeuvres were done to improve the view. The ease of insertion in both the groups was assessed and graded as *easy* if insertion is smooth without hinging on any of the oropharyngeal structures and *difficult* if lateral insertion was required or there was difficulty in insertion due to bulk of the assembly causing misalignment or excessive pressure as felt by the observer.

In both the groups the following time intervals were recorded -

T1: beginning of insertion of LMA CTrach™ till obtaining capnogram after ventilation through LMA CTrach™

T2: attachment of LMA CTrach™ viewer till obtaining a best possible glottic view

T3: beginning of insertion of LMA CTrach™ with viewer till obtaining a best possible glottic view

T4: beginning of insertion of tracheal tube till obtaining capnogram after connecting the tracheal tube to the ventilator.

T1 and T2 are applicable only to standard technique group. The sum of T1 and T2 is taken as T3 in standard technique.

In both the groups following intubation, LMA CTrach™ was removed as per standard protocol after confirming the tracheal tube position. Subsequently, anaesthesia and surgery proceeded as per requirement. If required, anaesthesia was deepened during the process of intubation by i.v. propofol bolus. Twenty-four hours following intubation patients were enquired for presence of sore throat or hoarseness of voice by a blinded observer. Patients complaining of sore throat were treated with intramuscular diclofenac 75mg. Those having hoarseness of voice were reassured and offered specialist consultation if a need arose.

Sample size estimation was based on the average number of manoeuvres required to obtain Grade 1 or 2 glottic view. The pilot study showed that the average number of manoeuvres for standard technique of insertion was 2.2 with a standard deviation of 1.2. The same pilot study showed that the average number of manoeuvres required for modified technique was 0.7. Considering a difference of 20% in the requirement of manoeuvres to obtain good glottis view as significant, for a power of 80% and 5% level of significance, minimum of 46 patients were required in each group. 55 patients were randomized to each group in this study to account for attrition and loss to follow-up. Statistical analysis was done using SPSS version 20 for Windows. Independent sample t test, Mann Whitney U test and Chi-square test were applied as considered appropriate. $P < 0.05$ was considered as statistically significant.

RESULTS

Out of 110 patients randomized only 50 patients in each group received the intervention. The others were excluded due to change of anaesthetic plan. Intubation was successful in all the patients and optimal glottic view could be obtained in all the patients. Patient characteristics are given in Table 1.

Table 1: Patient characteristics

Parameters	Standard technique group	Modified technique group
Age (years)	42.28 (12.19)	38.92 (11.99)
Gender (M/F)	25/25	21/29
ASAPS (1/2)	35/15	33/17
BMI (kg/m²)	23.92 (3.32)	24.92 (4.52)

Data are mean (standard deviation) for age and body mass index (BMI), absolute numbers for gender, American Society of Anesthesiologists physical status (ASAPS).

The grade of initial glottic view and best possible glottic view after manoeuvres were comparable between the two groups. Total number of manoeuvres required to get optimal glottic view was found to be higher among the patients in standard group (65 manoeuvres; average 1.3 manoeuvres per patient) than modified technique group (43 manoeuvres; 0.86 manoeuvres per patient).

In our study 82% of patients (41 out of 50) in standard technique group and 74% (37 out of 50) in modified technique group needed manoeuvres to obtain a good glottic view (Table 2). Twenty-seven patients out of fifty patients required additional manoeuvres to obtain adequate ventilation in the standard technique group.

The incidence of difficulty in insertion of LMA CTrach™ was significantly higher in modified technique group (23/50 patients) compared to standard technique group (6/50 patients); P<0.001.

The modified technique provided good glottic view in shorter time (though the time required for subsequent intubation through LMA CTrach™ was comparable between the groups), with less incidence of postoperative sore throat and hoarseness of voice (Table 3).

Table 2: Airway management data with LMA CTrach™

Parameters		standard technique (n)	modified technique (n)	P Value*
Grade of initial glottic view	Grade 1	22	13	0.27
	Grade 2	2	4	
	Grade 3	4	3	
	Grade 4	22	30	
Grade of glottic view after manoeuvres (Best glottic view)	Grade 1	46	48	0.22
	Grade 2	4	2	
Number of manoeuvres required before getting good glottic view	0	9	13	
	1	22	32	
	2	14	4	
	3	5	1	

Data are absolute numbers, n= number of patients. *Chi-square test

Table 3: Comparison of time to intubate and sore throat incidence

Parameter		standard technique	modified technique	P value
Time intervals for LMA CTrach™ insertion and intubation (sec)	T ₁	22(18,28)	-	<0.001#
	T ₂	8.5(5,18)	-	
	T ₃	33(25,45)	18.5(12,33)	
	T ₄	24.84 (10.65)	25.68 (11.85)	
Sore throat (n)	Yes	14	6	0.046*
	No	36	44	

Data are reported as median (inter quartile range) for T₃, mean (standard deviation) for T₄ and absolute numbers for incidence of sore throat. # Mann Whitney U test, ## Independent sample t-test, *Chi-square test

One patient in modified technique group and 5 patients in standard technique group had mild hoarseness of voice.

Discussion

Modified technique of insertion of LMA CTrach™ reduces the number of airway manoeuvres required before tracheal intubation compared to standard technique of insertion. This is because the modified technique directly aims at obtaining a good glottic view rather than first obtaining adequate ventilation and then the good glottic view. Since in majority of the cases adequate ventilation can be obtained even without the optimal glottic view, airway manoeuvres would still be required after getting adequate ventilation with the standard technique of insertion.

Our experience with LMA CTrach™ and other video laryngoscopes formed the basis to try this modified technique of insertion. This novel technique has not been evaluated so far. One could argue that obtaining ventilation should be a priority with intubation conduits. We do not refute this utility of intubation conduits. But the added advantage of visualization with LMA CTrach™ can be utilized to establish optimal glottic view first with which adequate ventilation can also be obtained.

Studies have assessed the initial and best possible glottic view after manoeuvres with the standard technique of insertion.^{1,2,6,8} In our study the grading of best possible glottic view after manoeuvres and success of intubation was comparable to that of previous studies. However, the grade of glottic view in our study was significantly better. Previous studies have also shown that silicon reinforced tracheal tubes are better than polyvinylchloride tubes for intubation through LMA CTrach™.¹⁰⁻¹³

Lopez AM et al studied 21 patients in which 12 patients required 24 manoeuvres for getting the good laryngeal view with the standard technique of insertion. Each patient required between 1 and 4 manoeuvres on an average.⁹

The median time to achieve good laryngeal view in standard technique group was found to be longer than the modified technique group. This

may not be clinically significant because LMA CTrach™ is an intubation conduit. Liu EHC et al found median time interval with IQR to achieve good laryngeal view after manoeuvres to be 65 seconds (30- 141 seconds).⁶

Modified technique was reported to be more difficult compared to standard technique. This was a subjective evaluation. Most of the patients required lateral insertion in modified technique because of the bulk of the assembly of the LMA CTrach™ Airway and the connected viewer. The lateral technique of insertion was always tried when the assembly could not be introduced into the mouth with the conventional orientation of the LMA cuff. So, even though lateral insertion was graded as difficult, technique wise it was easy to insert the assembly by lateral technique.

The incidence of a sore throat was higher in standard technique group than modified technique. The incidence of hoarseness of voice though higher in standard technique was comparable. Increased number of manoeuvres for getting glottic view has a positive correlation with increased incidence of a sore throat and hoarseness. Lu PP et al stated that incidence and degree of a sore throat and hoarseness are more in patients who require more number of attempts and manoeuvres before intubation.¹⁴ Confounding factors which could influence the sore throat and hoarseness were analyzed and found to be comparable.¹⁵

The results of this study are applicable to patients with normal airway and cannot be directly extrapolated to patients with difficult airway. Secondly, the assessment of ease of insertion of LMA CTrach™ was subjective. Thirdly, we had used a muscle relaxant in this study which may not always be possible in difficult airway situations.

In conclusion, though modified technique requires lateral insertion most of the time it provides good glottic view with lesser number of manoeuvres, lesser time duration and less incidence of postoperative sore throat compared to the standard technique.

Trial Registry Number: Clinical Trials Registry-India CTRI/2017/03/008036

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