

A STUDY OF THE LMA C-TRACH™ GUIDED INTUBATION WITH SPECIAL REFERENCE TO THE CONVENTIONAL LARYNGOSCOPIC CORMACK AND LEHANE GRADING SYSTEM

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ABSTRACT: BACKGROUND AND AIMS: Laryngeal Mask Airway (LMA), one of the supraglottic airway devices, has become a standard fixture in airway management, filling a niche between the face mask and tracheal tube in terms of both anatomical position and invasiveness. Here we tried to correlate between the Cormack and Lehane view grading achieved by rigid laryngoscopy and the view of larynx achieved by the LMA CTrach™ system, the success rates of LMA CTrach™ insertion and of endotracheal intubation with this system, a modification of the original LMA with integrated fiberoptic system. **SETTINGS AND DESIGN:** A randomized, controlled study. **MATERIALS AND METHODS:** The study comprised 100 consenting patients of ASA class I(95) and II(5), posted for elective surgical and gynecological procedures under general anesthesia after having institutional ethics committee approval. After achieving optimum anesthesia and muscle relaxation, an anesthesiologist with more than 5 years of experience did the Cormack and Lehane grading by rigid laryngoscopy but did not reveal that to the second anesthesiologist who carried out the CTrach™ procedure and graded laryngeal view as per Endoscopic View Grading System (EVGS). The success rates of ventilation and intubation using CTrach™ were determined. Adjusting maneuvers were undertaken to improve the laryngeal view. **STATISTICAL ANALYSIS AND RESULTS:** Inter-rater agreement between the 2 procedures was found to be 0.107 using Cohen's Kappa statistics with a 95% Confidence Interval of (-) 0.0475-0.262, which signifies minimal agreement or correlation between the 2 procedures. We found statistically significant difference present in the Initial view & Final view group (p <0.0001). **CONCLUSION:** There was minimal correlation between Cormack and Lehane (C-L) grading achieved by direct laryngoscopy and the view of larynx achieved by the LMA CTrach™ system, thereby aiding successful ventilation and intubation.

KEYWORDS: LMA CTrach™ system, Cormack and Lehane grading system, Endoscopic View Grading System, endotracheal intubation.

INTRODUCTION: Laryngoscopy and endotracheal intubation is an essential skill to be acquired by an anesthesiologist. The prime responsibility of an anesthesiologist is proper maintenance of a patent airway during surgical procedures. Since the earliest days of anesthesia, every endeavor has been made of dispelling the potential problems associated with airway management.

It was in the year 1981, that Dr. A.I.G.Brain¹ designed the prototype of modern laryngeal mask airway (LMA). Supraglottic airway devices such as ILMA, Igel and LMA Ctrach are designed to create a dedicated airway which safely allows both spontaneous and controlled ventilation ensuring uninterrupted oxygenation.

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The LMA CTrach™ system (The Laryngeal Mask Company, Singapore), a new modification of the LMA Fastrach™, with integrated fiberoptic system and a detachable liquid crystal display (LCD) viewer to enable a real time viewing of the glottis to guide tracheal intubation via the laryngeal mask conduit.² The LMA C Trach™ mask enables ventilation during intubation attempts. It is safe and effective for tracheal intubation in anaesthetised patients.³

Our objectives were to correlate between the Cormack and Lehane view grading achieved by rigid laryngoscopy and the view of larynx achieved by the LMA CTrach™ system, to find out the time taken to maintain adequate oxygenation and to complete the process of CTrach™ guided successful intubation in patients who required general anaesthesia with endotracheal intubation for general surgery. We basically compared the view of larynx by the two procedures.

MATERIALS AND METHODS: After getting institutional ethics committee clearance and written informed consent, the study was conducted in 100 patients, of either sex, aged between 20-60 years and ASA class I and II for one year. Patients with severe respiratory diseases, morbid obesity (BMI>35kg/m²), mouth opening <3.5cm and loose or poor dentition were excluded from the study.

After confirming the fasting NPM status and attaching ASA standard monitors, each patient was premedicated with inj glycopyrrilate 0.004mg/kg, with inj glycopyrrolate 0.004mg/kg, midazolam 0.03mg/kg, fentanyl 2µg/kg and pantoprazole 40 mg intravenously (IV) 5 minutes before induction. Before insertion, LMA CTrach™ was prepared and the CTrach size was chosen according to the patients' body weight, following the manufacturer's recommendations. Flexible, cuffed, wire reinforced silicone Fastrach endotracheal tubes (ETTs) (The Laryngeal Mask Company, Singapore) were used for all patients. The viewer was attached to the CTrach before insertion and focused by having a sharp image of a sheet of text held 1 cm in front of the fiberoptic channel port. Only the posterior surface of the CTrach was lubricated after detaching the viewer.

Patients were preoxygenated for 5minutes and then, induced with propofol 2mg/kg iv. After confirming face mask ventilation, muscle relaxant atracurium besylate 0.5mg/kg iv was given and the patients were ventilated for 150seconds. The first anesthesiologist, with at least 5 years of experience, performed Cormack and Lehane grade without revealing it to the investigator carrying out the CTrach procedure. Then, keeping the patient in neutral position the LMA Ctrach™ was introduced by the second anaesthesiologist who had carried at least 20 successful endotracheal intubations via the CTrach system before this evaluation and graded laryngeal view as per Endoscopic View Grading System (EVGS). After inflating the cuff with recommended air (Size 3-20 ml, size 4-30 ml, size 5-40 ml),⁴ Bain's circuit was connected and ventilation was confirmed by bilateral equal air entry and capnography. After attaching the LCD viewer to the CTrach, initial laryngeal view, and the time and attempt required for insertion of CTrach were noted down.

Laryngeal view scoring⁵ ranged from grade I (Full view of arytenoids and glottis), II (Arytenoids and glottis partly visible), III (View of arytenoids, glottis or epiglottis blurred, or view clear with only epiglottis visible) to IV (No part of larynx identifiable). In case of initial view grade II or more, various maneuvers were tried to get the optimized view. During this whole procedure, anaesthesia via CTrach was maintained with oxygen, nitrous oxide, sevoflurane and required information noted down. After achieving optimized view endotracheal tube was introduced under vision, cuff of the tube inflated, position was confirmed by capnography and chest auscultation. Then, the viewer was detached and CTrach was removed with the use of a stabilizer rod. ETT connector was then replaced and Bain's circuit connected and position again confirmed.

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Changes in vital parameters before and after the procedure and any complication, if occurred, were noted. In case of failed intubation in 3 attempts or within 3 minutes, direct laryngoscopic intubation was performed. Patients were reversed with injection neostigmine 0.05mg/kg and glycopyrrolate 10µg/kg iv.

Various maneuvers done:⁶

1. Chandy maneuver.
2. Down-Up-Down maneuver.
3. Medial-Lateral-Medial maneuver.

The population agreement between the two procedures was considered 0.5.⁷ We attempted to see an agreement of 0.16 between the procedures in our sample. The prevalence of difficult intubation in the general population was considered 2%. Considering the power of the study and α -error 90% and 5% respectively, the calculated sample size was 100 patients [Software n Master (Copyright CMC Vellore, Biostatistics department)].

RESULTS: Table 1 shows the demographic data of 100 patients in the form of male female ratio, mean and standard deviation of age, body weight and BMI. It also shows the percentages of patients distributed in ASA class I and II and Mallampati grade 1, 2 and 3.

The inter-rater agreement between the 2 procedures was calculated using Cohen's Kappa statistics and found to be 0.107 with a 95% Confidence Interval of (-) 0.0475-0.262, which signifies minimal agreement or correlation between the 2 procedures (Table 2). The effects of adjusting maneuvers to laryngeal view was tested by paired 't'-test, with 'p' value <0.05 considered statistically significant.

A contingency table (Table 3) shows how maneuvers affected view grade. In 36 patients, the view improved and in 1 patient the view worsened. No maneuvers were performed in the 42 patients with a grade 1 view. P value < 0.0001, so, there is statistically significant difference present in the Initial view and Final view groups. The numbers marked with '#' indicate the number of patients whose laryngeal view improved after manipulation and the numbers marked with '*' indicate the patient whose laryngeal view worsened after manipulation.

Table 4 shows number of attempts to achieve optimum view of larynx through LMA viewer and also show the number of attempts to insert the endotracheal tube through the LMA after achieving optimum view. For achieving view among 100 patients, even after 3 attempts laryngeal view remained grade IV (EVGS) in 4 patients. So, they were considered for laryngoscope guided endotracheal intubation. Among rest of the 96 patients, 2 patients could not be intubated via LMA even after 3 attempts and were considered for laryngoscopic intubation.

DISCUSSION: A number of devices for intubation and artificial ventilation have been developed over the past few years for managing difficult airway scenarios. The LMA Fastrach™ is such a supraglottic device to provide the patient ventilation as well as for securing definitive airway via blind intubation. However, it is criticized as blind intubation through it has the potential for causing arytenoid trauma or oesophageal placement. The LMA CTrach™ system, introduced in April 2005, with integrated fiberoptic system and a LCD viewer, enables viewing of the glottis to guide tracheal intubation via the laryngeal mask conduit.⁵

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The aim of this study was to assess the clinical efficacy and performance of CTrach in viewing laryngeal structures, the number of attempts required and the time to successful intubation through the LMA CTrach™, and to evaluate any correlation between the Cormack and Lehane laryngoscopic grading.

Initial direct laryngoscopy was difficult in 10 patients (C-L grading 3), with limited head and neck movement, and anterior placed larynx, being the contributing factors; however, the view improved in 7 of them. We did not find any correlation between Cormack and Lehane laryngoscopic grading and the EVGS through LMA CTrach™ in our study (Table 2) that corroborated with the study conducted by Liu EHC et al.⁸ In another study by Liu EHC et al.,⁷ they found no meaningful correlation between the Cormack and Lehane laryngoscopy grade in the LMA Fastrach™ and LMA CTrach™ groups.

Table 3 shows the number of patients in different EVGS grades after initial placement of the CTrach and respective numbers in final view after manipulation of the CTrach and also the comparison of percentages of patients in each grade in initial and final view. Eleven patients improved to grade I, 18 to grade II and 7 to grade III, i.e. manipulations improved view in 36 patients whereas view worsened in 1 patient. No manipulation was performed in 42 patients who were in grade I in initial view. The 'p' value is <0.0001 so, there is statistically significant difference present in the Initial view and Final view group. The different maneuvers attempted for initial grade II or more EVGS score explained for the improvement of gradations. For initial grade II and III, Chandy step one and step two Chandy maneuver were attempted maximum number of times and for initial grade 4, DUD maneuver was attempted maximum times. For some patient's more than one maneuver were applied.

Liu EHC et al.⁸ were able to view the larynx in 84 patients in their study, although unable to distinguish structures in 40 patients after attaching the viewer; the view improved in 24 patients by adapting various manipulations. Liu EHC et al.⁷ in another study found difficult or impossible view of the larynx in 48% of the patients; however, by applying maneuvers to counteract the down-folding of the epiglottis, the view improved and successful intubation was done in 94% of patients. Again from the studies of Timmermann et al.⁵ and Dhonneur G et al.⁹ it is evident that various maneuvers can improve the EVGS grading as had been found in our study (Table 5).

In our study, we successfully viewed the larynx in 42% of patients and 94.8% of the patients were intubated successfully in the 1st attempt. Among the rest, in 54% of patients, view improved in the 2nd or 3rd attempts; 3.12% of the remaining patients were also intubated by applying various maneuvers (Table 4). Liu EHC et al.,⁷ similarly, performed successful tracheal intubation in 94 patients at the 1st attempt, whose glottis could be seen fully or partially. In the remaining 6 patients, 3 could be successfully intubated blindly through the CTrach at the 1st attempt but rest of the 3 patients was intubated conventionally with the Macintosh laryngoscope after 3 failed attempts. Again, in the study by Timmermann et al.⁵ tracheal intubation was successful at the 1st attempt with all grade I and II views and 7 of the 9 patients in grade III and IV views. Rest of the grade IV view patients were successfully intubated at the 2nd attempt. Tracheal intubation was successful at the 1st/2nd attempt in 95% of the patients in their study. According to them CTrach™ provided high success rate for both ventilation and intubation with patients without anticipated difficult airway. They also suggested that inspite of correct positioning of the CTrach, grade III/IV view could occur due to secretions or epiglottic structures obscuring the lens.

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Table 6 shows the comparison between the time taken for insertion of CTrach with achievement of adequate oxygenation or ventilation via the conduit (T O₂) and the time taken for achieving adequate view of larynx through CTrach viewer(T1) and to introduce endotracheal tube through the CTrach(T2) in our study with the related other studies. We measured the total time to view the larynx and intubate successfully whereas in the studies by Liu EHC et al.⁸ and Swadia VN et al.¹⁰ they measured the times separately. However, the cumulative time in our study was 111.36 secs whereas that in the above-mentioned studies were 110secs and 300.7secs respectively. In our study, we measured T LMA after intubation without removal of CTrach conduit but in the above studies T LMA or end point of T2 was measured after removal of the CTrach conduit.

The CTrach LMA is actually intended to use mainly in difficult airway scenarios, however, this study did not evaluate many such situations, neither, any evaluation was done in un-paralyzed patients, which were the main limitations of this study. The main problems with the CTrach were the unpredictable success of obtaining a view and the variable quality of the laryngeal images.

Finally, we can conclude that there is minimal correlation between the Cormack and Lehane view grading achieved by direct rigid laryngoscopy and the view of larynx achieved by the LMA CTrach™ system. The LMA CTrach™ system may have a role in difficult airway management by facilitating ventilation and enabling viewing of the glottis and successful tracheal intubation despite grade III & IV views. CTrach™ may provide high success rate for both ventilation and intubation in patients without anticipated difficult airway. But we must keep our expectations moderate for the quality of laryngeal view achieved by CTrach in respect to view achieved by direct rigid laryngoscopy.

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Total no of patients :	100
Male: Female :	17:83
Age (In years) :	38.22±9.03(21-57)
Weight (In kgs) :	54.94±7.83(43-77)
BMI (kg/m ²) :	22.2±1.71(19.11-27.9)
ASA I :	95[95%]
II :	5[5%]
Mallampati 1 :	44[44%]
2 :	40[40%]
3 :	16[16%]
4 :	0[0%]

Table 1: Patient Characteristics

EVGS:	I	II	III	IV
C-L:				
1	33	22	2	1
2	17	8	5	2
3	3	4	2	1
4	0	0	0	0

Final view:	(I)	(II)	(III)	(IV)
Initial View(%):				
(I) 42(42%)	42	0	0	0
(II) 26(26%)	9#	16	1*	0
(III) 15(15%)	2#	12#	1	0
(IV) 17(17%)	0	6#	7#	4
Final View(%)	53%	34%	9%	4%

No. of attempt	1(%)	2(%)	3(%)
View attempt	42(42)	17(17)	37(37)
ETT attempt	91(94.8)	1(1.04)	2(2.08)

Table 4: No. of attempts to achieve laryngeal view and to introduce endotracheal tube through LMA CTrach system

	Liu EHC et al³ [Median (IQR)]	Swadia VN et al¹⁰ [Mean ± SD]
TO ₂ (sec)	26(20-33)	36.75±2.12
T LMA (Sec)	T1-65(30-141)	240.2±10.05
(T1+T2)	T2-55(48-65)	60.5±5.15

Table 5: Comparison of time for achieving ventilation and adequate view of larynx in other

TO₂ = Time for achieving adequate ventilation via LMA CTrach™.

T LMA = Time for achieving adequate view of larynx via LMA and to introduce endotracheal tube through CTrach™ system.

T1= Time to achieve view of larynx (sec);

T2= Time to successfully intubate the larynx (sec).

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