ORIGINAL ARTICLE

OUR EXPERIENCES WITH INTUBATING LARYNGEAL MASK AIRWAY FOR ENDOTRACHEAL INTUBATION

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ABSTRACT: OBJECTIVE: A Prospective study was carried out to evaluate the clinical efficacy of ILMA for endotracheal intubation in patients with normal airway in terms of technical feasibility, problems encountered, hemodynamic responses and pharyngo-laryngeal complications and also to get acquainted with the technique. **METHODS:** Seventy patients of either sex, ASA grade 1 and 2, MPG grade I and II posted for various elective orthopedic, general surgical and ENT surgeries under general anesthesia were included in the study. Method used for insertion of ILMA and endotracheal intubation were as per the standard guidelines. **RESULTS:** The time required for insertion of ILMA and intubation, number of attempts required for successful insertion and intubation, manipulations required and success rate for ILMA insertion and intubation, along with hemodynamic changes and postoperative pharyngo-laryngeal complications were recorded. **Conclusions:** The ILMA can be used as a mean of endotracheal intubation with high success rate, good hemodynamic stability and minimal incidence of pharyngo-laryngeal complications.
KEYWORDS: Intubating Laryngeal Mask Airway (ILMA), Endotracheal Intubation, Laryngeal Mask Airway (LMA).
MESHTERMS: Intubating Laryngeal Mask Airway (ILMA), Intubation, LMA.

INTRODUCTION: Direct laryngoscopy and endotracheal intubation are essential skills for a range of health care practitioners expected to serve as first responders in emergency cases requiring advanced airway management. Endotracheal intubation is indicated in several clinical situations including acute hypoxemic or hypercapnic respiratory failure, impending respiratory failure and also used to protect the airway in conditions of upper airway obstruction either mechanical or due to airway pathology and commonly used for administering general anesthesia.[1-2]

Conventional method of laryngoscopy requires sniffing position which distorts normal anatomy in order to bring the glottis into line of sight.[3] It is not always easy or possible to have sufficient anatomical distortion and can lead to intubation difficulties or failure of intubation in 0.05-0.2% of cases.[4] Hence unanticipated difficult airway remains a challenge to the anesthesiologist irrespective of various methods available for assessing the airway as none of them are 100% proof. As majority of these events are preventable, a continuous effort has been made to develop some new methods and tools to facilitate endotracheal intubation in difficult airway.

Various supraglottic devices like LMA, I-gel LMA and Proseal LMA, Fibreoptic scope, Light wand and different designs of the laryngoscope blades like McCoy blade, the Bullard laryngoscope, the WuScope and Upsher Scope are the examples. Most of these equipment's are

expensive, and not readily available. These equipment's depend on some means of ventilation like face mask and simultaneous ventilation during intubation attempt is not possible. The standard laryngeal mask airway, first described in 1985 by Brain[5] plays an important role for rescue ventilation[6] in difficult airway management but its role in facilitating tracheal intubation is limited. Intubating laryngeal mask airway (ILMA) is a device, specially designed to guide blind intubation[3] with various advantages like compatibility with anatomy of oro-pharynx, no diameter-length limitations and facility of continuous oxygenation/ventilation during intubation minimising chances of desaturation.[3, 6-7]

Various studies[7-8] were carried out evaluating use of ILMA in patients with normal airway, difficult airway and in patients with cervical trauma with varied success rate and hemodynamic changes. Authors have compared intubation using ILMA with either conventional laryngoscopy[9-10] or with various other intubating devices like C-Trach,[11] Fibreoptic scope[12, 13] Glidescope[14] etc. with varied success rate.

The purpose of present study was to evaluate the clinical efficacy of ILMA for endotracheal intubation in patients with normal airway (Mallampati Grading [MPG] I, II) in terms of technical feasibility, hemodynamic responses and pharyngo-laryngeal complications and also to get acquainted with the technique.

MATERIALS AND METHODS: The study was approved by the institutional ethical committee and written consent was obtained from all patients. 70 adult patients of either sex, ASA grade 1 and 2, MPG grade 1 and 2 posted for various elective surgeries under general anaesthesia with the age group of 20–60 year (yrs) and weight between 35-70 kilograms (kg). The study was conducted in the department of anesthesiology at tertiary care hospital. A detailed pre anaesthetic evaluation including history, general examination, systemic examination & thorough airway assessment was carried out in each patient. Exclusion criteria included patient's refusal to participate in the study, age less than 20yrs and greater than 60yrs, anticipated difficult intubation, gastro oesophageal reflux disease, ASA III/IV, cerebro-cardio-vascular diseases like hypertension, CVA & IHD, gross obesity and pathological airway abnormality. All patients were kept fasting overnight and tab. Diazepam 5 mg and tab. Ranitidine 150mg were given previous night of surgery. In the operation theater, Philips Intelli-Vue MP20 multipara monitor was applied to the patient and vital parameters like heart rate, blood pressure, SPO_2 and respiratory rate were recorded. Intravenous line secured and ringer's lactate solution was started.

Patients were premedicated with intravenous ranitidine 50mg and glycopyrrolate 0.04mg/kg followed by sedation with midazolam 0.02mg/kg and fentanyl 2μg/kg.Patients were preoxygenated with 100% oxygen on mask for 3 minutes. Induction of general anaesthesia was done with intravenous propofol 2mg/kg followed by vecuronium 0.1mg/kg.After 3 minutes, when patient was fully relaxed ILMA of size 4 for patient weighing between 50- 70 kg or of size 3 for patient weighing between 30 -50 kg was introduced as per the standard technique of insertion described by Brain.

Method of insertion of ILMA[15]: The person performing the procedure was same in all the cases.

Preparation: Before insertion cuffs of ILMA and endotracheal tube (ETT) were checked for leak. ILMA and ETT were properly lubricated with water soluble jelly.

Technique of ILMA insertion: Head was kept in neutral position during insertion of ILMA. The handle of ILMA was held in the dominant hand, the tip of mask was introduced pressing against the hard palate, starting behind the upper incisors. Once the mask was flattened against the hard palate then the handle was pressed firmly in the cranio-caudal direction, and the device inserted with a rotational movement along the hard palate and posterior pharyngeal wall till the tip of mask became wedged in the hypopharynx and resistance felt for further advancement.

Figure 1

Cuff of the mask was inflated with 30ml air and connected to breathing circuit. A slight outward movement of metal shaft may take place. Optimal ILMA position was judged by chest wall movements, auscultation of breath sounds and capnographic tracing during manual ventilation.

If ventilation was not satisfactory, the Chandy's maneuver step-I was done which consists of slightly rotating the device in the sagittal plane using the metal handle until the least resistance to bag ventilation is achieved. Additional maneuvers like leftward or rightward movement were also followed if Chandy's maneuver was not helpful to obtain optimal seal. If ILMA could not be inserted successfully even after 3 attempts it was considered as FAILURE.

Technique o**f Intubation:** The well lubricated proper sized straight silicon ETT was inserted into the metal shaft of ILMA keeping longitudinal black line cephalad, i.e. towards the intubator till transverse mark corresponds to the outer rim of connector of ILMA. Chandy's maneuver step-II i.e; lifting up of metal handle of ILMA away from posterior pharyngeal wall was carried out in all the patients before intubation as advised by Brain. Any resistance encountered and the level at which the resistance occurred for advancement of the tube was noted. During the attempt of intubation, patients were ventilated and maintained with 100%Oxygen and 1%Sevoflurane through Bain's circuit connected to ETT. Successful tracheal intubation was confirmed by chest wall movements, auscultation of breath sounds and capnographic tracing on monitor.

When expired CO_2 tracing was absent, esophageal placement of tube was suspected and the tube was removed immediately and reinserted.

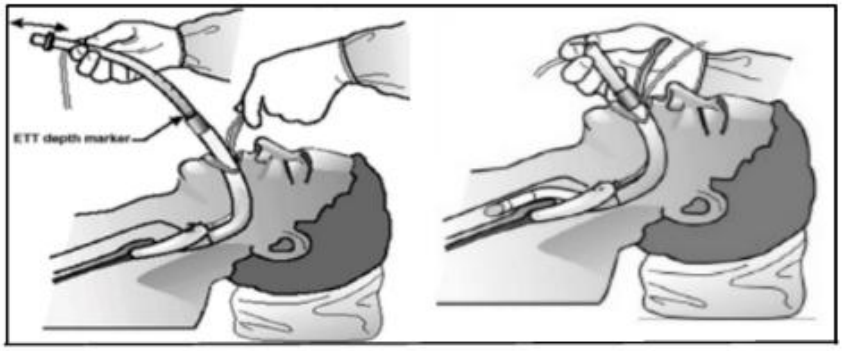

Figure 2

Figure 3

If the first attempt failed, then the following maneuvers were tried sequentially to facilitate endotracheal intubation:

1. Extension maneuver i.e; pulling back of the metal handle of the ILMA towards the intubator
2. Up-down maneuver i.e; slight (5cm) withdrawal of ILMA with cuff inflated and then reinsertion.

Failure to intubate was defined as inability to place the tracheal tube even after applying these maneuvers. In such situation, the procedure was abandoned and tracheal intubation was performed using direct laryngoscopy.

Removal of ILMA over the ETT: Once the position of ETT was confirmed, the cuff of ILMA was deflated.Anesthesia circuit was disconnected from ETT. The connector of ETT was removed. The stabilizing rod was used for stabilization of ETT to avoid accidental extubation & ILMA was gradually removed over the ETT. After removing the ILMA and stabilizing rod position of ETT was again confirmed by auscultation.

Figure 4

Figure 5

Time required for insertion of ILMA, number of attempts required for insertion of ILMA, time required for successful intubation, number of attempts required for blind endotracheal

intubation were recorded as follow. The problems encountered during insertion of ILMA and ETT were noted.

Time required for insertion of ILMA – Time from removal of facemask to the time where adequate ventilation was established through ILMA with capnographic confirmation (A). Time required for blind endotracheal intubation – Time from disconnection of the breathing circuit of the ILMA to confirmation of ETT placement as confirmed by auscultation and capnographic trace (B). Total time required from ILMA insertion to endotracheal intubation confirmation (A+B).

Hemodynamic parameters like Heart rate, Mean arterial pressure, Oxygen saturation (SPO_2) were monitored accordingly. Various time intervals for monitoring vitals were baseline, after induction, immediately after ILMA insertion, immediately after intubation, at 1minute interval upto 5 minutes after intubation and last at 10minute after intubation. Evidence of mucosal trauma, bleeding intra operatively& any occurrence of sore throat or hoarseness postoperatively were noted.

STATISTICAL ANALYSIS: All the observations done in the study were subjected to statistical analysis. Continuous parameters (age, weight and haemodynamic parameters) in the study were presented as mean and SD (standard deviation) and categorical variables were expressed in percentages. Haemodynamic parameters were compared at different intervals from baseline (after induction) value by paired t-test. P- Value<0.05 was considered as statistically significant. All data analysis was performed on statistical software STATA version 10.0.

RESULTS: Demographic data and type of surgeries are presented in Table 1. Mean age and weight were 38.77±11.26 (20–60) year and 53.27±10.67 (50-70) kg respectively. The ILMA was successfully inserted in all patients (100% success rate). The successful insertion in first attempt was 63 patients (90%) while in second attempt were 7 patients (10%). None of the patient required 3rd attempt for insertion of ILMA and there was no failure for insertion of ILMA **(**Table 2). The mean time required for insertion of ILMA in 1st and 2nd attempt was 32.60+5.49 and 45.43+3.46 respectively, with a range of 20-50 seconds. Overall mean time required for insertion of ILMA was found to be 33.89+6.57 (Table 3).

Endotracheal intubation through ILMA was successful in (68)97.14% patients, out of them (56)80% patients were intubated in 1stattempt and (11)15.71% and (1) 1.56% of patients required 2nd attempt and 3rd attempt for intubation respectively. Two patients (2.86%) could not be intubated with this technique and were intubated with conventional laryngoscopy (Table 2). The mean time required for endotracheal intubation in 1st and 2nd attempt was 18.77+3.10 and 30.00+4.45 respectively, with a range of 15-48 seconds and only 1 patient required 3 attempts for intubation. Mean time required for endotracheal intubation was 21.01+6.26. However total time required for insertion of ILMA and endotracheal intubation in the present study was 54.62+10.62 (Table 3).

In 63 patients (90%) ILMA was successfully inserted in 1st attempt without any manipulation whereas 7 patients (10%) required some maneuvers for proper placement of ILMA Chandy's step-I was found to be most helpful maneuver for ILMA insetion (Table 4). While in 56 patients (80%) intubation through ILMA was successful in 1st attempt by using Chandy's step-II

maneuver only. However11 patients (15.71%) required extension maneuver for intubation through ILMA. Chandy's step-II was found to be most helpful maneuver for intubation through ILMA (Table 5). Thus, Chandy's maneuver both step I and II were found to be very helpful in maximum number of patients. The minor problems like difficulty encountered during removal of connector of ETT and replacement were encountered in 4 patients (5.71%). Accidental extubation was noted in 1patient (1.43%) and endobronchial intubation was seen in 2 patients (2.86%) (Table 6).

When haemodynamic parameters such as heart rate, mean arterial pressure and oxygen saturation (SpO_2) were monitored at the different time intervals, it was observed that statistically significant rise ($p<0.05$) in heart rate and mean arterial pressure occurred immediately after insertion of ILMA and intubation which persisted up to 3 minutes as compared to baseline (after induction). But this rise was not clinically significant. However, fall in oxygen saturation ($Spo_2<95\%$) did not occur in any of the patients in the present study throughout the procedure of insertion of ILMA and intubation.

Pharyngo-laryngeal complications such as mucosal trauma and bleeding were seen in 10% (7) while sore throat in 8.57% (6) of patients during the procedure. Change in voice or hoarseness was not observed in any of the patients. All these complications were mild and subsided within 48 hours without any active treatment (Table 7).

DISCUSSION: Dr. Archie Brain, a British Anaesthesiologist in 1997 by applying his inventory and engineering skills introduced Intubating Laryngeal Mask Airway (ILMA)[3] into clinical practice with certain modifications in classic LMA. These modifications helped to overcome the limitations of classic LMA while retaining its advantages. Major difference between standard LMA and ILMA lies in the design and function of the shaft. Unlike the soft silicone shaft of classic LMA, the ILMA shaft is rigid, which permits the insertion of ILMA without placing one's fingers into the patients mouth thereby minimizing the risk of injury and transmission of infection.[7,16] Furthermore, if the optimal position of ILMA is not achieved after insertion, the rigid shaft facilitates adjusting maneuvers to align the mask's aperture against the glottic opening and provides a conduit for smooth and a traumatic intubation with a larger ETT. There are various reports of successful use of ILMA for blind endotracheal intubation in with normal airway[7,16,8] as well as suspected difficult airways.[15-17]

The standard technique of insertion of ILMA and endotracheal intubation through ILMA as described by Brain et al.[7] was found to be useful in the present study as well as in other studies.[7,16,8,15-17] Mean time for insertion of ILMA in the present study was almost same as observed by Timmerman et al.[18] However MS Avidan et al (1999)[9] required very short time (19.58 seconds) for ILMA insertion as the person performing the technique in this study was already trained on Manikins.

Amongst different adjusting maneuvers tried for proper ILMA placement Chandy's step-I was found to be very helpful in the present study as also observed by other authors.[19, 20, 21]

The overall success rate for successful ILMA insertion irrespective of attempts in the present study was 100% which correlates with the results of Brain et al (1997),[7] Kapila et al

(1997),[16] Chan et al (1998),[8] Nakazawa et al (1997),[22] Ferson et al (2001),[15] Baskett et al (1998)[23], Lu PP et al (2002)[24] and Kundra et al (2005).[21]

Kapila et al (1997)[16] and Chan et al (1998)[8] described 100% success rate of ILMA insertion in 1stattempt. However in the present study it was only 90% as observed in the study of Ferson et al (2001).[15] Personal variation and inexperience in the initial phase of study with the method of insertion may be the cause for observed difference. Success rate for ILMA insertion in 1st attempt observed by Nakazawa et al (1999)[22] and Shetty AN et al (2006)[25] was quite low i.e; 75% and 76% respectively but they carried out their study in difficult airway patients and present study was carried out in patients with Mallampati class I and II.

In the present study mean time required for endotracheal intubation through ILMA was observed to be 21.01+6.26 which was comparable with others.[12,25] Nakazawa et al (1999),[22] Ferson et al (2001),[15] Ye et al (2009),[17] Liu et al (2008)[11] and Joo et al (1999)[12] used various adjusting maneuvers as described by Dr. Brain. According to Brain whenever resistance was felt at about 1.5 cm after the ETT was passed through the aperture, it meant that epiglottis was down folded during insertion of ILMA, and Chandy's step-II maneuver should be applied to help correct this situation. If resistance was felt about 3 cm past the aperture, it suggests that ILMA was small and a larger ILMA should be used. If the resistance was felt as soon as the tip emerges from the aperture or at a depth of 4 to 6 cms the ILMA was considered to be large and a smaller ILMA should be used. Various other maneuvers like extension, head and neck maneuver and filing the cuff with additional air were also used by Brain et al(1998)[7] and Shetty AN et al(2006).[25]

In the present study, we selected patients weighing between 30-70kilograms as only size 3 and 4 ILMA were available in our institution. In none of the patients, we experienced resistance to advancement of the tube between 3 – 6 centimeters; this may be because the size of the ILMA chosen was appropriate for the weight of the patients included in the study.

In 56 patients from present study ETT was inserted successfully in 1st attempt using 2nd step of Chandy's maneuver. Out of remaining 14 patients, Extension maneuver helped to negotiate the tube into the trachea successfully in 11 patients. In 1 patient, up-down maneuver helped to negotiate the tube into the trachea. Whereas in 2 patients, even after applying all the 3 maneuvers, the ETT could not be advanced into the trachea. In these patients, ILMA was removed and conventional laryngoscopy was done which revealed Cormack and Lehane Grade 3 and they were intubated under direct vision like other authors.[12,17,26] Flexion maneuver was not employed in the present study as the studies of Kapila et al (1997)[16] demonstrated that flexion maneuver deteriorates the ILMA-larynx alignment. Difference in the selection of patient for the study, technique and adjusting maneuvers adopted and also personal variation and experience in technique can be the reasons for observed difference between present and various other studies.[8, 23, 24, 27]

The overall success rate of endotracheal intubation irrespective of attempt was 97.14% in our study which correlates well with the studies of Brain et al,[7] Chan et al,[8] Ferson et al,[15] Bharti et al, [26] and Shetty AN et al.[25]

There was an increase in mean heart rate and mean arterial pressure from baseline immediately after insertion of ILMA. This was present up to 3 minutes which was statistically

significant but clinically insignificant. There was also a statistically significant increase in mean heart rate and mean arterial pressure immediately after intubation and upto 3 minutes after intubation. This observation correlates with the finding of Baskett et al,[23] Asai et al[28] and Shetty et al.[25]

In the present study taking out the ETT connector during removal of ILMA was troublesome. Hence we advocate confirming easy removal of ETT connector before attempt of endotracheal intubation.

The limitation of our study is that the present study is not a comparative study hence the hemodynamic stability observed with the technique cannot be claimed as an advantage over conventional technique of laryngoscopy and results of our study are not applicable to patients with difficult airway.

CONCLUSION: The study concluded that ILMA can be used as a means of endotracheal intubation with higher success rate, better hemodynamic stability and minimal incidence of pharyngo-laryngeal complications. The technique has a unique advantage that patient can be ventilated/oxygenated throughout the procedure thus eliminating the risk of hypoxia. Experience from present study definitely helped us to get acquainted with the technique of intubation through ILMA in patients with normal airway before using it in patients with difficult airway.

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Variables		**No. of patients**	**Percentage %**
Age (Yrs)	11-60	70	100%
	Mean+SD	38.77+11.26	
Weight (Kg)	41-70	70	100%
	Mean+SD	53.27+ 10.67	
Sex	Male	33	47%
	Female	37	53%
Mallampati Class	Mallampati class I	27	38.6%
	Mallampati class II	43	61.4%
Type of surgeries	General surgery	39	55.7%
	Orthopaedic surgery	9	12.9%
	ENT surgery	22	31.4%
Total		**70**	**100%**

Table 1: Demographic data and Type of surgeries

No. of Attempts	**No. of patients for ILMA insertion (%)**	**No. of patients for endotracheal intubation through ILMA (%)**
First	63 (90%)	56 (80%)
Second	7 (10%)	11 (15.71%)
Third	0 (0%)	1(1.43%)
Failed	0 (0%)	2 (2.86)
Total	70 (100 %)	70 (100%)

Table 2: Number of attempts for ILMA insertion and endotracheal intubation through ILMA

Parameter	Total patients	Successful No. of patients (%)	Failed No. of patients (%)	Mean time required
Insertion of ILMA	70	70 (100%)	0	33.89+6.57
Endotracheal intubation through ILMA	70	68 (97.15%)	2(2.86%)	21.01+6.26
Total time required for procedure	-	-	-	54.62±10.62

Table 3: Success rate and Mean time required for insertion of ILMA and Endotrachael intubation through ILMA

Type of maneuver	No. of patients	Percentage %
No maneuver required	63	90%
Chandy's step- I	4	5.72%
Right ward movement	2	2.86%
Left ward movement	1	1.42%
Total	70	100%

Table 4: Type of Maneuver required for ILMA insertion

Type of maneuver	No. of patients	Percentage %
Chandy's step- II	56	80%
Extension maneuver	11	15.71%
Up-Down maneuver	1	1.43%
Failed	2	2.86%
Total	70	100%

Table 5: Type of maneuver required for Endotracheal Intubation through ILMA

Other problems encountered	No. of patients (%)
No problems encountered	63 (90%)
Problem related to connector of ETT removal and replacement	4 (5.71%)
Endo bronchial intubation	2 (2.86%)
Accidental extubation	1(1.43%)
Total	**70 (100%)**

Table 6: Other problems encountered

Pharyngo-laryngeal complications	No. of patients (%)
No complications	57 (81.43%)
Trauma and Bleeding	7 (10%)
Sore throat	6 (8.57%)
Change in voice	0%
Total	70 (100%)

Table 7: Pharyngo-laryngeal Complications

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