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Original Research Article.

Intubating Laryngeal Mask Airway as an Independent Ventilatory and Intubating Device in Lateral Position: A Fibreoptic Study

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ABSTRACT

Sudden airway loss during surgery in a laterally positioned patient may have hazardous consequences. We studied whether the intubating laryngeal mask airway (ILMA) facilitates fibreoptic guided tracheal intubation in patients positioned in the lateral position. Anesthesia was induced with propofol, fentanyl, and rocuronium in 90 consenting patients of either sex, weighing 50-70 Kg undergoing surgery. Patients were randomized to three groups (n=30 each); Group 1 (Control group) Supine position, or positioned on their right or left sides (Group 2 and Group 3 respectively) before induction of general anesthesia. ILMA insertion and fibreoptic guided intubation was performed in that position. The grade of the glottic view, time required for intubation and number of adjusting maneuvers used were recorded. Data were compared by ANOVA, multiple 't' test and chi(2) test. Demographic and airway measures were similar in the three groups. The time required for ILMA insertion (<30 secs) and success rate was similar in three groups. The time to intubation was also similar in each group (15.24±3.4719.68±17.29 secs, 19.35±11.83 secs in Groups 1, 2, 3 respectively; p = > 0.05), as was intubation success (97.7%). Hence ILMA offers a frequent success rate and a clinically acceptable intubation time (<1 min) even in the lateral position.

Keywords: Intubating Laryngeal Mask Airway (ILMA), Fibreoptic Intubation, Fentanyl, Propofol, Rocuronium.

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INTRODUCTION

Airway management often requires precedence over other treatment modalities in any emergency situation. The technique of endotracheal intubation has become the gold standard for airway management of patients who are unconscious.[1-4]

Conventional laryngoscopically guided tracheal intubation is performed from behind the patient's head in supine position, however, it may be occasionally desirable to perform intubation in the lateral position e.g. if there is sudden loss of airway control in the middle of the surgery in the lateral position.[5] This may also be required in victims trapped in lateral position under rubble due to house collapse caused by earthquakes or in train accident victims awaiting extrication, where neither the patient can be moved to supine position nor the intubator can position himself behind the patient's head.[6]

Lateral position results in deterioration of the laryngoscopic view, causing difficulty in mask ventilation and laryngoscopically guided tracheal intubation.[5]

Brain et al[2] developed Intubating Laryngeal mask airway (ILMA), a new version of Laryngeal mask airway with superior ventilatory and intubation characteristics. There are very few reports of successful use of ILMA for airway management of ILMA in lateral position and for facilitating blind tracheal intubation through it. There is no literature available on fibreoptic assisted tracheal intubation through ILMA in lateral position to the best of our knowledge.

A study was therefore conducted to evaluate feasibility of ILMA in simulated conditions of accidental loss of airway and also assess the effectiveness of fibreoptic guided intubation through it.

MATERIALS & METHODS

Study Design

Hospital based observational Prospective study.

Type of Study

Controlled Randomized Double Blind Study.

Source of Data

Adult patients undergoing elective surgery under general anesthesia requiring tracheal intubation at operation theatres of Mahatma Gandhi Medical College and Hospital, Jaipur.

Sample Size

90 patients (N=90).

With the approval of the institute's ethics committee and informed written consent of the patients in Mahatma Gandhi Medical College and Hospital, 90 adult patients (ASA I and II) of both sexes, aged 18-55 years, weight 50-70 kg undergoing elective major surgery requiring tracheal intubation were enrolled in this prospective randomised controlled study.

Patients were excluded from the study if they had inadequate mouth opening (< 2.5 cms), cardio-respiratory disease (hypertension, chronic obstructive airway disease, ischaemic heart disease), cerebro-vascular disease, reflux oesophagitis, a history of sore throat within the past 10 days or complaints regarding difficulty in opening the mouth. Patients with a known history of difficult intubation were also excluded.

A detailed preoperative assessment was done a day before surgery with special attention to airway indices including Mouth opening, Mallampatti scoring, measurement of the thyromental distance, sternomental distance.

On the day of surgery on arrival in the operation room, monitoring was setup: including ECG, non-invasive blood pressure, end-tidal carbon dioxide ($E'CO_2$) measurement and pulse oximetry.

Intravenous line was secured and patients were premedicated with Inj. midazolam 0.02 mg/Kg, Inj fentanyl 1mcg/kg, inj. glycopyrrolate 0.2 mg intravenously.

Before the induction of anaesthesia, patients were randomized using a computer generated random numbers for group assignment (Group 1, 2 or 3; n=30 each).

A) Insertion of ILMA:

Insertion of ILMA (Fastrach, Laryngeal Mask Company Ltd) was done with the patients placed either in Supine position (Group-1, control group, n=30) or in right lateral position (group -2, n=30) or the left lateral position (group- 3, n=30).

The head of the patient was supported on a pad 5-10 cm thick (with added padding, if needed to prevent any undue bending of the neck because of the lateral position) to maintain neutral position of head and pre-oxygenation with 100% oxygen was done via a facemask for 3 min.

Anaesthesia was induced with intravenous propofol 2.5 mg/kg iv. 60 seconds after I.V. bolus of Inj. Xylocard 1.0 mg/Kg. ILMA was inserted when the eyelash reflex was lost and jaw was relaxed. Additional bolus of propofol 10-20 mg was administered if required.

For the patients in Group-1 (control group, n=30), the patients were placed in supine position with investigator positioned conventionally i.e. behind the patient's head. Suitable sized pre prepared ILMA was inserted into the hypopharynx with one hand, using a single handed rotational movement in the sagittal plane, while supporting the head from the occipital side with the other hand to keep it straight as per recommendations of the manufacturer.

After insertion, the cuff was inflated with 30 ml of air. Successful insertion of the ILMA was judged by the ease of ventilation without any audible leak together with an airway pressure of up to 20 cm H_2O, good chest expansion and normal capnogram ($E'CO_2$ >30 mm Hg with a rectangular curve).

The time taken for insertion of ILMA was measured from the time ILMA is picked up to the appearance of the capnographic waveform after the first manual breath after ILMA insertion.

In the case of an absent waveform, the time of the first manual ventilation was taken as the endpoint of insertion. If ventilation through the ILMA produced resistance, leakage and/or an abnormal capnograph (non-rectangular capnograph with $E'CO_2$ <30 mm Hg), Chandy's manoeuvre[7], extension or flexion manoeuvre was carried out in that sequence.

Failure of insertion: maximum three attempts were allowed. In between the attempts, patients were oxygenated with face mask. After 3 attempts or desaturation <92%, patients were moved to supine position and intubated via conventional laryngoscopy. Such cases were classified as failure of insertion. Failure to achieve a normal capnograph and major leak/resistance-free ventilation were also treated as improper placement of the intubating laryngeal mask and tracheal intubation was performed with direct laryngoscopy in the supine position.

After achieving satisfactory ILMA placement, Inj Rocuronium 0.6 mg/ Kg IV was given and IPPV with nitrous oxide + oxygen and MAC doses of Isoflurane be continued for 3 minutes.

Patients in Gr 2 or Gr 3 were positioned in lateral position as per the randomization and induction of anaesthesia and insertion of ILMA was done in that position only, using appropriate size of pillow to support the head of the patient to provide the neural position. Suitable modification in the finger grip on the ILMA handle was done to make the mask insertion smooth.

B) Fibreoptic Assessment of Glottis View:

Ventilation through the ILMA was interrupted to allow assessment of glottic view and fibreoptic guided intubation. The fibreoptic assessment of glottis view was done by an independent investigator using Olympus flexible intubating fibrescope preloaded with well lubricated special cuffed flexometallic tracheal tube of 7.0/7.5 mm size with its connector removed; the main investigator remaining blinded to the view of the glottis view.

The glottis view was assessed as follows[8]:

Grade 1: Complete view of glottis

Grade 2: View of glottis + anterior surface of epiglottis seen

Grade 3: Part of the glottis + anterior border of epiglottis seen

Grade 4: Part of glottis + posterior surface of the glottis is seen

Grade 5: Other structures seen

If needed, any manoeuvre needed to improve the glottis view under fibreoptic vision was performed and noted by the independent investigator.

C) Fibreoptic Guided Intubation:

On achieving optimum glottis view, fibreoptic guided tracheal intubation was done with the preloaded tracheal tube as per the recommendation of the manufacturer. Tracheal tube connector was reconnected and further ventilation and with N2O+Oxygen and Isoflurane was done. If intubation via the ILMA failed, tracheal intubation with direct laryngoscopy was performed in the supine position. The Time taken in intubation will be defined as the time from insertion of the tip of fibreoptic bronchoscope into the metallic end of the intubating laryngeal mask to the appearance of the capnographic waveform after the first manual ventilation via the flexometallic tube following its final placement through the ILMA after reconnection of tracheal tube connector.

D) Removal of ILMA Over the Tracheal Tube:

After the successful placement of the tracheal tube, the intubating laryngeal mask was removed using the stabilizing rod for railroading the ILMA over it, holding the tracheal tube by other hand to prevent accidental extubation. Proper tracheal placement of the tracheal tube was confirmed and tube secured with tape. Thereafter, the patient was turned to supine position in Gr 2 and Gr 3 only. This was the endpoint of study.

Time taken in removal of ILMA was recorded as time from disconnection of ventilation till recommencing of ventilation after successful ILMA removal.

Further ventilation was continued with maintenance anaesthetics (N2O + Oxygen + isoflurane + Rocuronium). Anaesthetics were stopped at the end of surgery. Reversal of neuromuscular block was done and extubation was done in the standard manner.

Data were recorded, using standardized data collection sheet and analyzed using Microsoft Excel spreadsheet, coded appropriately and later cleaned for any possible errors in SPSS (Statistical Package for Social Studies) for windows version 2.10. Analysis was carried out using SPSS (Statistical Package for Social Studies for Windows 20.0. Quantitative data were expressed in the form of mean and SD. Significance of difference in mean was inferred by unpaired T test /ANOVA. Further, significance $p>0.05$ was taken as not significant

Table 1: Demographics

Parameters	Group 1 (supine) n=30	Group 2 (right lateral) n=30	Group3 (left lateral) n=30	P value
Weight(kg)	61.87(5.03)	62.30(5.21)	64.63(5.67)	0.114
Height (cm)	160.40(6.15)	160.50(6.37)	163.70(6.19)	0.072
Gender (M/F)	12/18	12/18	19/11	0.101
Mallampatti grade	29/1/0	28/2/0	29/1/0	0.770
Thyromental distance(cm)	6.42(0.74)	6.85(1.84)	6.53(0.57)	0.35
Sternomental distance(cm)	17.24(1.28)	17.62(1.60)	17.67(1.18)	0.389
Interdental distance(cm)	4.16(0.60)	4.20(0.59)	4.05(0.45)	0.413

Table 2: ILMA insertion and fibreoptic guided intubation data

Parameters	Supine	Right lateral	Left lateral	P value
ILMA insertion time(s)	26(12.35)	25.47(11.07)	24.98(11.88)	0.94
ILMA insertion attempts (n)				
1	28	28	26	
2	2	2	3	4.18
3	0	0	1	
Successful ILMA insertion (n)	30	30	30	4.11
Fibreoptic intubation attempts (n)				
1	28	28	27	
2	1	1	1	0.90
3	0	1	1	
Overall fibreoptic intubation success(n)	29	30	29	0.60
Time taken in fibreoptic intubation(s)	15.24(3.47)	19.35(11.8)	19.68(17.2)	0.32
Time taken in ILMA removal (s)	21.55(4.2)	21.4(4.4)	21.1(4.6)	0.415

Table 3: Time taken in fibre optic tracheal intubation through LMA Fastrach™(AF)

Time (in seconds)	No. of cases
≤10	14
11-20	63
>21	11
Total	88

Data presented in number of cases

Fig 1: Changes in heart rate in different groups:

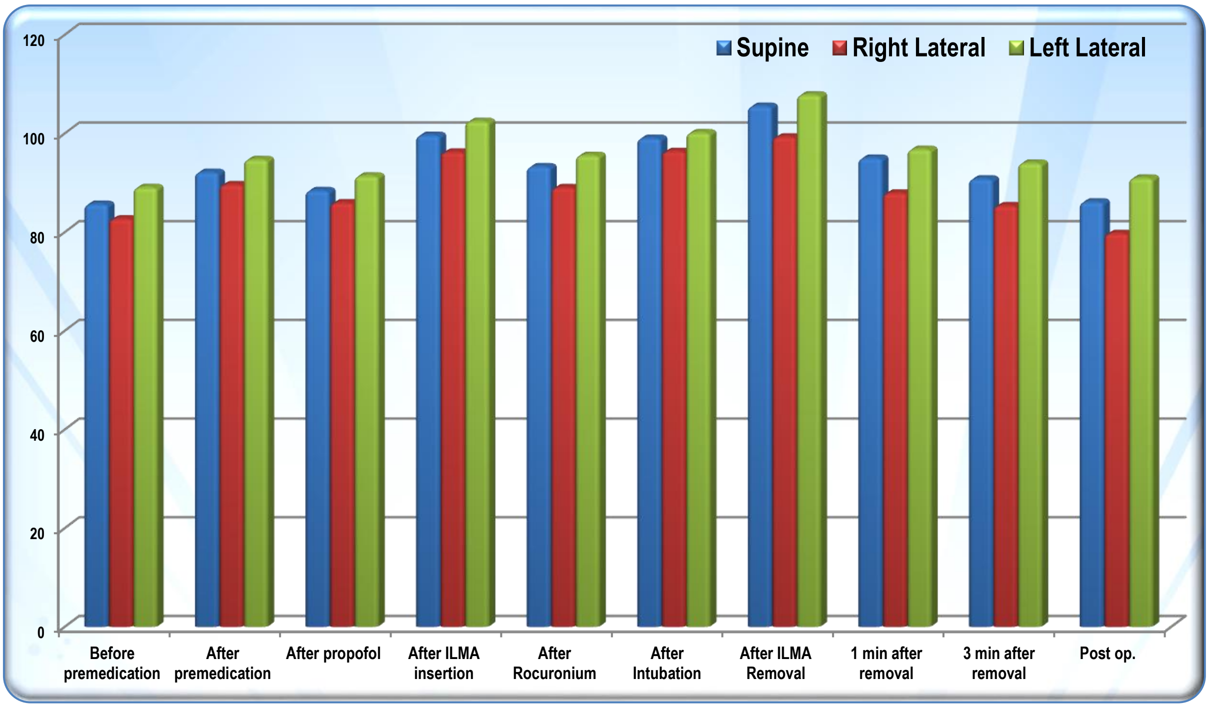
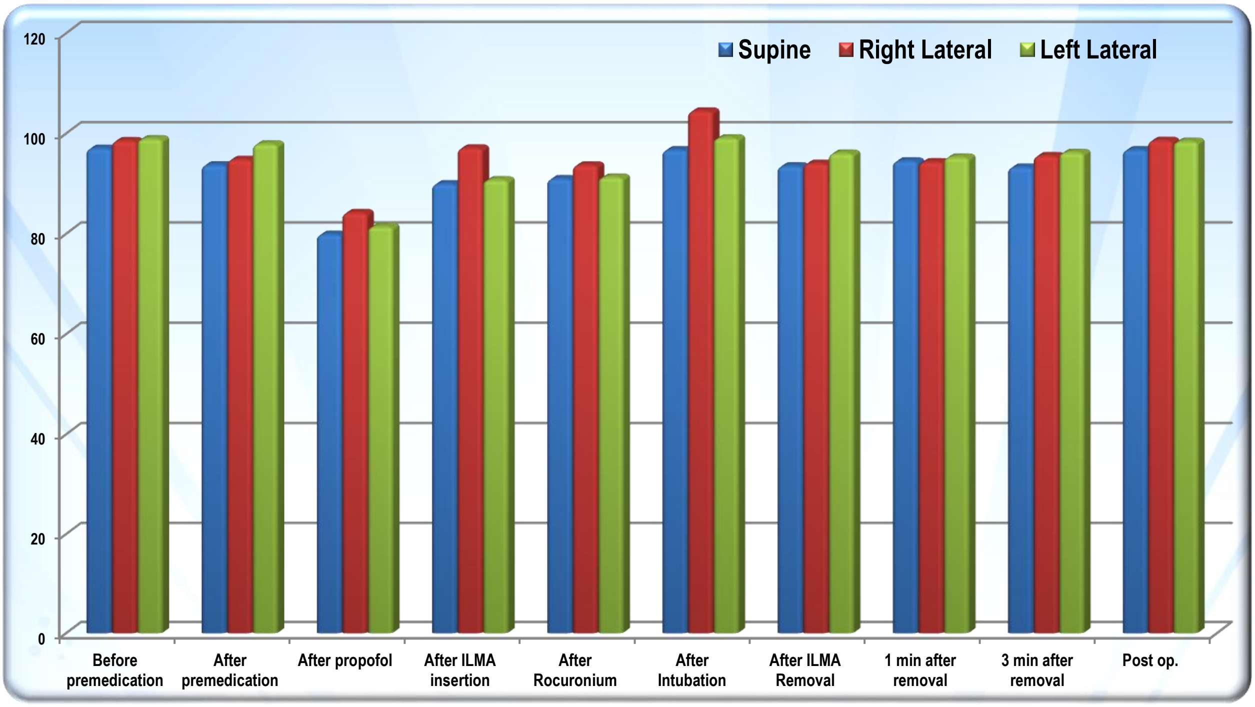


Fig 2: Changes in mean blood pressure in different groups:



RESULTS

Table 1 represents the demographic data. Each group comprised of 30 patients. We were successful in ILMA insertion in 90/90 i.e in 100% of the patients .82/90 required one attempt (91.1% patients), 7/90(7.7%) required a second attempt and only 1/90(1.1%) required a third attempt at ILMA insertion.

Out of these 90 patients, adequacy of ventilation was present in 82. Further maneuvers were used to acquire adequate ventilation in the rest. Chandy's maneuver was the most frequently used maneuver. Despite all attempts, intubation was successful in 88/90 patients. Fibreoptic intubation through ILMA could not be performed in 2 out of 90 patients. In majority of the patients, successful intubation was performed in 11-20 seconds.83/88 patients required only one attempt in intubation. 3/88 required second attempt and 2/88 required 3 attempts at intubation.

The ILMA insertion, fibreoptic tracheal intubation and ILMA removal results in increase in heart rate. The changes are though statistically significant were transient and were within clinically acceptable limits, fairly tolerated well by patients of ASA status I and II. Highly significant decrease in mean blood pressure has been observed in all the three groups after propofol insertion when compared to baseline values. The values increased in all the three groups post ILMA insertion, intubation and ILMA removal. These changes were within acceptable range and returned to baseline within the 3 minutes of ILMA removal.

DISCUSSION

The basic aim to conduct this study was to evaluate the feasibility of using ILMA in unconventional position i.e. lateral position to simulate the airway management in unconventional position in emergency scenario.

We must remember that immediate airway management is also required even in operation theatres if an accidental extubation occurs in a patient undergoing an operation in general anaesthesia in lateral position with muscle relaxants due to which suddenly control of airway is lost. Even in prone position, a sudden loss of airway control can occur.

In our study, the time required for LMA Fastrach insertion in supine position is found to be26.00±12.35 seconds, in right lateral position, it was 25.47 ±11.07 seconds and in left lateral position, it was 24.98±10.88 seconds (p value >0.05). We analysed that the difference in time taken in ILMA insertion was not significantly different in all the three groups. The P value for 1 way ANOVA test between the groups was>0.05 indicating that there arise not significant difference in between the groups. Hence this clearly highlights the importance and versatility of ILMA to effectively and quickly secure airway while doing airway management in with patients in unconventional lateral positions

In, 97.7% patients (88 out of 90) patients, we were able to successfully perform fibreoptic guided tracheal intubation. In group I i.e. supine group, we intubated 29 out of 30 patients (96.67%). In group II i.e. right lateral group, 100% of patients i.e. 30 out of 30 patients were intubated, while in group III, i.e. left lateral group, we were not able to perform fibreoptic guided intubation in one patient through the ILMA i.e. 29 out of 30 patients (96.67%) could be intubated. The results of mean time taken in all the groups were comparable to studies by Malhotra et al[9], Sharma et al[10], Gazsyanka et al.[11]

In both of the cases where we failed to perform fibreoptic guided intubation, we performed laryngoscopic assisted endotracheal intubations. From these two cases, one case belong to the group1 i.e. supine group in which we performed ILMA Fastrach insertion at second attempt and we found that still ventilation through it as not satisfactory. The second case in which the intubation could not be performed successfully belonged to the left lateral group in which the ILMA insertion was performed in the third attempt.

The success rate of intubation was not significantly different among the three groups (p>0.5). Our observations correlate with those of Brain et al[2] in which 99.3% of cases could be intubated successfully.

Kapila et al[1] also had 95% success rate at intubation but 7 failed intubations among first 20 patients and they attributed this to the learning curve. But since in our study, patients no 27 in group I and patient no 78 in group III were the failed intubation cases, we cannot attribute this failure to the learning curve

Most of the investigators have used blind technique for intubation through the ILMA but there have been complications viz oesophageal intubation as reported by Braithwaite[12] in his study. It has been therefore recommended to use visualizing techniques like a lightwand or flexible fibreoptic bronchoscope. Hence we conducted fibreoptically guided tracheal intubations to ensure safe and faster intubations with a higher success rate of intubations.

The time taken in our study is comparable to the time taken in intubation in the study by Dimitriou.[13] They used a light guide for intubation and we have used a fibreoptic guided intubation. Hence visualizing techniques provide better and faster intubations.

Joo and Rose[14] compared the tracheal intubations using ILMA via fibreoptic guidance and inserted blindly without fibreoptic guidance. He reported that the success rate of intubation in both the groups was equal but the total intubation time was longer in ILMA-FOB group in which fibreoptic assistance was done. (77 sec v.s 53 sec for blind)

Kapila et al[1] reported 3 cases of oesophageal intubations. Panwar et al[6] also found a case of oesophageal intubation in the supine group. We did not find any case of oesophageal intubation. We attributed this to the use of fibreoptic bronchoscope assisted intubations. Visualizing the glottis helped prevent oesophageal intubations. The most important cause for sore throat remains the practice of leaving the ILMA insitu during the entire procedure.[15] It is due to this reason that it is often recommended to remove the ILMA once intubation is complete. 3 patients also complained of sore throat in the post-operative period. These patients were the ones in whom we took more than one attempt at fibreoptic intubation.

To conclude, ILMA has proved to be an effective ventilatory device and a suitable conduit for fibre optic guided intubation in patients lying in lateral position. The ILMA is fairly suitable as a ventilatory device in lateral position in unconscious patients in the hands of inexperienced personnel. Fibre optic guided intubation through ILMA is feasible in a high percentage of patients irrespective of unconventional position. The learning curve of ILMA as a ventilatory device and an intubation tool is fairly flat. ILMA appears to have an important role to play in emergency management of airway in patients in lateral position where other conventional methods of airway management may be difficult or have failed

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