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COMPARISON OF ILMA GUIDED TRACHEAL INTUBATION IN THE LATERAL POSITION WITH THE SUPINE POSITION

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"Due to paucity of published literature, and also of actual clinical opportunities, most practitioners would admit unfamiliarity at intubating in any position other than supine. Also, when required, direct laryngoscopy is the technique most anaesthesiologists are comfortable with, and shall resort to, for intubating laterally placed subjects."

ABSTRACT

Background: The ILMA has been established as a valuable airway management device in the supine position, in both elective and emergency situations, for both ventilation and intubation. Intubation in lateral position might be necessary in some congenital syndromes, morbid obesity, or after accidental extubation in laterally positioned patients. This study was undertaken to evaluate the ILMA for intubation of patients in the lateral position and compare it with intubation in the supine position.

Aims: To determine and compare the success rate, time taken, and complications of intubation with the ILMA in the lateral versus supine position.

Settings and Design: Prospective, clinical investigation, in a tertiary level, multi-specialty hospital.

Methods and Material: Seventy ASA I-II patients scheduled for elective surgeries were randomly allocated into two groups of 35 patients each. The groups F1 and F2 consisted of patients who were intubated with the ILMA in the supine and lateral positions, respectively. The comparison of the two positions was based on: success of intubation, success at first attempt, number of attempts, intubation time, and incidences of oesophageal intubation, oxygen desaturation, mucosal injury and postoperative sore throat.

Statistical Analysis used: The data was analysed, and for comparison of mean between two groups, unpaired student "t"-test was applied. χ^2-test or Fischer exact test were applied for categorical variables like number of attempts, incidence of mucosal injury etc.

Results: The intubation success rate was 100% in both positions. The success rate of intubation in the first attempt was 97.1% in supine, and 94.3% in the lateral position, and was comparable. The average intubation time was significantly more in the lateral, as compared to the supine position (45.82 versus 38.51 seconds). The incidence of intra, and post-operative complications was low in both the positions.

Conclusion: These results suggest that the ILMA is a useful device for tracheal intubation in the lateral position. The difference in intubation time, though significantly more (statistically) in the lateral as compared to the supine position, had little clinical relevance.

KEYWORDS: Airway management; Intubation, intratracheal; Laryngeal masks; Patient positioning, lateral.

INTRODUCTION

Airway management is a core skill for anaesthesiologists, which must be practiced in a variety of scenarios. Tracheal intubation might be required with the patient lying in the lateral position, where a significantly deteriorated laryngoscopic view maybe expected.[1] Some planned situations where lateral is preferred over supine position for intubation are- morbidly obese patients[2], congenital syndromes like Freeman-Sheldon (whistling face) syndrome[3], or patients with a large tumour on the back. Accidental extubation in patients being operated in the lateral position may lead to an urgent requirement to intubate in the same position[4]. Similarly, in full stomach patients, it seems logical to induce anaesthesia in the lateral position for the ease of clearing the airway if the patient vomits.

On average, more attempts are required for intubation in laterally placed patients as compared to supine, due to unfamiliar airway orientation, and the uncomfortable posture of the anaesthesiologist required.[1,5]

Due to paucity of published literature, and also of actual clinical opportunities, most practitioners would admit unfamiliarity at intubating in any position other than supine. Also, when required, direct laryngoscopy is the technique most anaesthesiologists are comfortable with, and shall resort to, for intubating laterally placed subjects.

Strongly feeling the need to explore the use of more airway devices in the lateral position, we undertook this study to compare tracheal intubation with the ILMA in the supine and lateral positions; a scenario evaluated by just one author previously (Komatsu and colleagues[6]).

MATERIALS AND METHODS

After approval by the Institutional Review Board of our hospital, this study included 70 ASA I-II patients, aged 18-60 years, for whom general anaesthesia with endotracheal intubation was being planned for various elective surgeries. Patients with increased risk of pulmonary aspiration, coexisting cardiovascular and respiratory disorders, and anticipated airway difficulty were excluded from the study. The criteria for difficult intubation were taken as: BMI > 30, Mallampati class III- IV, Inter-Incisor Gap < 4cm, previous history of difficult intubation, previous history of laryngeal or pharyngeal surgery, and cervical spine pathology. These patients were randomly allocated to two groups F1 and F2, each consisting of 35 patients. All patients were made to fast for at least 8 hours preoperatively and a written informed consent was taken.

In the operation theatre, standard monitors were applied to the patients. After intravenous canulation, midazolam 20 $mcg.kg^{-1}$, ranitidine 1 $mg.kg^{-1}$, and metoclopramide 0.2 $mg.kg^{-1}$, were given as pre-medication 5 minutes before induction. All patients were pre-oxygenated with 100% oxygen for 3 minutes before induction of anaesthesia.

Anaesthesia was induced with fentanyl 2 $mcg.kg^{-1}$ and propofol 2 $mg.kg^{-1}$. Vecuronium 0.1 $mg.kg^{-1}$ was given for neuro-muscular blockade, following which, bag-and-mask ventilation (BMV) was provided at a frequency of about 10-12 min^{-1}, with adequate tidal volume to achieve an $etCO_2$ level of 35-40 mm Hg. Anaesthesia was maintained with isoflurane 1.6%, and nitrous oxide 66%, in oxygen.

Patients in group F1 were placed in supine position with a 7 cm high hollow ring beneath their head. Patients in F2 were placed in the left lateral position before induction of anaesthesia. An extra pillow was used to maintain the axial alignment, and both arms were placed perpendicular to the torso over the armrest. A simple jaw-thrust manoeuver was applied in both groups to aid in insertion of the device.

The tracheal tube and the dorsum of the ILMA were adequately lubricated with a water-

-soluble gel before use. The 'LMA Fastrach (Fastrach™, Intavent Ltd, Berkshire, UK) endotracheal tube' (ETT) was preloaded into the ILMA till the tip lay just beneath the epiglottis elevator bar (15 cm mark), and the cuff of the tube was inflated to form a tight seal inside the ILMA shaft [Figure 1].

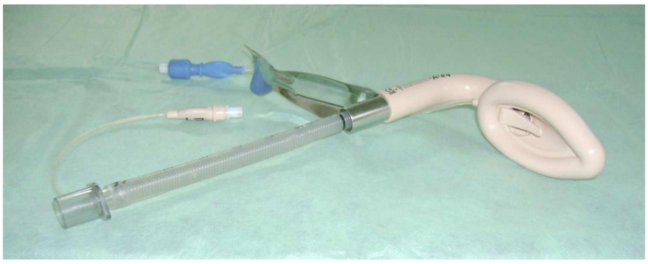

Figure 1: The ILMA pre-loaded with the Fastrach flexo-metallic endotracheal tube in its shaft.

A size 8 mm ID tube was used for men and size 7 mm for women. To overcome bias due to the learning curve[7], the first author, who had sufficient practice of tracheal intubation with the ILMA in the lateral position on a manikin, as well as in clinical situations, did all procedures.

The ILMA size was selected according to the weight of the patient[8]. In both groups, the preloaded ILMA was inserted by the classical technique[8] with the investigator's right hand, after 3 minutes of BMV [Figure 2].

Figure 2: The pre-loaded ILMA being inserted inside the airway of a patient in left-lateral position.

This was followed by inflation of the ILMA cuff, and connecting the breathing circuit to the endotracheal tube for confirmation of adequate ventilation through the ILMA. Ventilation was considered adequate if a rectangular capnographic waveform was obtained. If ventilation through the ILMA was not adequate, one of the following adjusting manoeuvers[9] was attempted: pulling the handle of the ILMA backwards towards the introducer (extension manoeuver), adjusting the position of the ILMA until optimal seal was obtained (optimization manoeuver), withdrawing the ILMA by no more than 6 cm with the cuff inflated followed by reinsertion (up-down manoeuver), or changing the ILMA size.

After confirming ventilation, the breathing circuit was disconnected, the tube cuff deflated, and intubation attempted by gently advancing the tube beyond the epiglottis elevator bar. If resistance was felt, the tube was withdrawn till the 15 cm mark and one of the adjusting manoeuvres previously described was attempted.

If no resistance was felt after the tube was advanced 7 cm beyond the epiglottis elevator bar (i.e. 15+7 cm at the operator end), the tube cuff was inflated and the breathing circuit connected to confirm correct placement by auscultation and capnography. If oesophageal intubation was detected, the tube was withdrawn till the 15 cm mark and an adjusting manoeuver was performed before intubation was reattempted. Rescue ventilation was provided after reconnecting the circuit to the proximal end of the tube-ILMA assembly, if the oxygen saturation fell below 92%. After intubation was confirmed, the ILMA was deflated and removed with the help of the stabilizing rod.

Tracheal intubation was considered a failure if it could not be accomplished within three minutes, or if all the adjusting manoeuvres failed. The patients with failed intubation had their trachea intubated after direct laryngoscopy in supine position.

The comparison of the two positions was based on: successful intubation, success at first attempt, number of attempts, intubation time (time taken from the cessation of BMV to the appearance of capnographic trace through the tracheal tube with positive pressure ventilation after the ETT is introduced inside the trachea), frequency of oesophageal intubation, incidence of oxygen desaturation (a decrease in SpO_2 <92% on the pulse oximeter), and mucosal injury (blood staining of the device seen after withdrawal). Every time the device was taken out of the mouth or if there was oesophageal intubation, it was counted as an attempt. All time durations were measured on a stopwatch. All patients were followed up 24 hours after surgery for any complaints of sore throat.

STATISTICAL ANALYSIS: Assuming the overall intubation success rate in the supine group would be 95%,[9] we decided that a 25% difference in overall intubation success rate between the groups would be clinically important. Following the Power method for sample size calculation for comparison of two proportions, the calculated sample size for each arm was 35 with an alpha error of 0.05 and power of 80%.

The data was analysed, and for comparison of mean between two groups, unpaired student "t"-test was applied. χ^2-test or Fischer exact test were applied for categorical variables like number of attempts, incidence of mucosal injury etc.

RESULTS

Our study included 70 patients. There were two groups with 35 patients in each group. Group F1 acted as control for group F2. There were no statistically significant differences between the two groups with respect to mean age, BMI (Table 1), success of intubation, intubation in first attempt, average number of attempts (Table 2), and intra and post-operative complications (Table 3).

All patients in both groups could be successfully intubated. The percentage of successful intubation in the first attempt was 97.14% in supine and 94.28% in lateral position, which was comparable. The average number of intubation attempts (mean ± S.D.) was 1.03 ± 0.17 in supine, versus 1.09 ± 0.37 in the lateral position (95% C.I.- -0.194 to 0.080). The incidences of oesophageal intubation were 2.85% in supine and 5.71% in the lateral subjects. None of the patients in either group had either oxygen desaturation, or mucosal injury. The incidence of post-operative sore throat was 0% and 5.71%, in supine and lateral subjects respectively.

There was a significant difference in the average intubation time (Table 4): the average time (mean ± S.D.) taken for intubation in the supine position (38.51 ± 12.42 seconds) being less than the time taken in the lateral position (45.82 ± 11.92 seconds), (95% C.I.- -13.124 to -1.504).

DISCUSSIONS

The use of ILMA for ventilation and intubation in the supine position has been established in a large number of studies. In a study on 150 patients by Brain and co-workers[10], 99.3% success rate of intubation was achieved with the ILMA on subjects in the supine position. Only 1 patient required a direct laryngoscopy for tracheal intubation. Their study group included 13 patients with anticipated airway difficulties. Kapila and team[11] found a 93% success rate of intubation in 100 patients in the same position. Of the 7 failures, five occurred in the first 20 patients, thus indicating the importance of the learning curve in acquiring expertise in the use of the device.

Avidan and team[12] studied the use of ILMA by novice as well as trained staff. They found a success rate of 89% with the trained staff but just 43% with

Table 1: A comparison of patient characteristics of Groups F1 and F2

Parameters	F1(n=35)	F2(n=35)	Test used	P value
Mean age (years)	29.51 ± 4.16*	31.14 ± 6.43*	Student t-test	0.213
Mean BMI (kg.m $^{-2}$)	19.19 ± 3.25*	20.45 ± 3.04*	Student t-test	0.098

Table 2: A comparison of intubation characteristics of Groups F1 and F2

Parameters	F1(n=35)	F2(n=35)	Test used	P value
Successful intubation	100%	100%	Fischer's Exact	0.999
Success at first attempt	97.14%	94.28%	Fischer's Exact	0.999
Mean number of attempts	1.028 ± 0.17*	1.085 ± 0.37*	Student t-test	0.412

Table 3: A comparison of complications of Groups F1 and F2

Parameters	F1(n=35)	F2(n=35)	Test used	P value
Incidence of oesophageal intubation	2.85%	5.71%	Fischer's Exact	0.999
Incidence of desaturation	0%	0%	Fischer's Exact	0.999
Incidence of mucosal injury	0%	0%	Fischer's Exact	0.999
Incidence of post-op sore throat	0%	5.71%	Fischer's Exact	0.492

Table 4: A comparison of average intubation time of Groups F1 and F2

Parameters	F1 (n=35)	F2 (n=35)	Test used	P value
Mean intubation time (seconds)	38.51± 12.42*	45.82 ± 11.92*	Student t-test	0.0144

*- mean ± SD

the novice staff who had received just basic training in the use of the device. They concluded that training is essential for successful use of the ILMA. Better results in our study as compared to the study by Avidan and team[12] may be attributed to the fact that the latter study involves multiple investigators while in our study; a single investigator performed all intubations. A study done on 82 adult patients by Biswas and co-workers[13] in 2005, compared intubation with the ILMA in the right and left lateral positions, and found a 100% overall success rate of intubation in the right lateral group, and a 97.56% success rate in the left lateral position. The first attempt success rates were 85.3% and 87.8% in the right and left lateral positions respectively. One patient in the left lateral group could not be intubated at all with the ILMA. She was turned supine and her trachea intubated after direct laryngoscopy. She had a Mallampati Class III, Thyro-mental distance of 3.2 cm and a Cormack-Lehane Grade II. Our 100% success rate of intubation further strengthens the studies by Biswas and team[13].

The only study that compared intubation with the ILMA in the lateral with the supine position, by Komatsu and colleagues[6], gave a similar success rate (96%) in both the positions. 82% of their patients could be intubated in the first attempt and all except 2 patients could be intubated within 3 minutes in both groups.

Our study was different from that by Komatsu and colleagues[6], and Biswas and co-workers[13], due to the fact that we pre-loaded the tube into the shaft of the ILMA. Our results of a 100% success rate of intubation in both positions are consistent with the results of the above studies. The rate of success at first attempt in our study (97.14% in the supine position and 94.28% in the lateral position) is higher as compared to the study by Komatsu and colleagues[6], and Biswas and co-workers[13]. We attribute this to the fact that we used the pre-loaded tube assembly, as first described by Kapila and colleagues[11], instead of the sequential intubation procedure as introduced by Brain and team[10]. The tip of the pre-loaded tube presents a narrower aperture to the fresh gases as compared to the wide distal end of the ILMA, and hence, once optimal position of ventilation is achieved, the tube is generally better aligned with the larynx and intubation occurs more often in the first attempt.

Intubation took a longer time (45.82 seconds) in the lateral position, as compared to the supine position (38.51 seconds); the difference, though statistically significant, does not appear to be alarming for two reasons; firstly, intubation in both positions could be accomplished within 1 minute, which, from a clinical perspective, seems acceptable, and secondly, as ventilation is an additional strength of the ILMA, hypoxia and hypercarbia were never a concern. Komatsu and colleagues[6] found an average intubation time (from the removal of the face mask to the appearance of a capnographic waveform through the tracheal tube) of 50 seconds in the supine position and 44 seconds in the lateral position; which were comparable.

There were no significant differences in the two positions with respect to the incidence of oesophageal intubation, mucosal injury and post-op sore throat. Also, there was no case of oxygen desaturation in both the groups. This is probably due to the fact that the ILMA acted both as a ventilatory as well as an intubating device.

At the time of designing the study, we felt that having a single investigator was a potential source of bias, but realizing that multiple investigators with inadequate experience, especially in view of the challenging position, would also have affected the results predictably, we decided to persist with the former plan.

With this study, we sincerely hope to stir interest in exploring the use of different airway devices in lateral position to bring familiarity into this enigmatic intubating scenario.

CONCLUSION

Tracheal intubation in the lateral position might be required in a variety of circumstances, and the anaesthesiologist must be proficient in the art of airway management to cope with such situations. Practitioners must familiarize themselves with the use of a variety of airway devices in the testing intubating position. We used the ILMA for tracheal intubation in the lateral position, and found that it has a 100% success rate of intubation in supine and lateral subjects. The short average time required to intubate the trachea with the ILMA, along with the low intra-operative and post-operative complication rates, makes it a suitable alternative to direct laryngoscopy for tracheal intubation in the lateral position. We suggest pre-loading the tube into the ILMA as a method of improving the alignment of the tube with the larynx. This translates as higher success rate in the first attempt, and smaller number of attempts and intubation time.

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