ORIGINAL RESEARCH

To compare the intubating laryngeal mask airway following general anaesthetic induction to awake fiberoptic intubation in individuals with challenging airways

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ABSTRACT

Introduction: Establishing a secure airway while the patient is awake has been recommended in the past for patients who were expected to have difficult airways or who really did have difficult airways. As fiberoptic bronchoscopes (FOB) are now regularly accessible in the majority of hospitals, awake fiberoptic intubation (AFOI) has become the "gold standard" for patients who are suspected of having or have been shown to have difficult airways. **Aims and objectives:** To compare the intubating laryngeal mask airway following general anaesthetic induction to awake fiberoptic intubation in individuals with challenging airways. **Material and Methods:** 100 Patients with ASA physical status I-III were enrolled for the study and randomly allocated to one of two groups: either the AFOI or the TI with the ILMA. Patients were asked to participate in the research project if it was assessed by a noninvestigating anesthesiologist that the patient will need an AFOI due to clinical predictors or a history of previous problematic intubation. **Results:** Comparing the induction timings of the ILMA group (675±535 s) to those of the AFOI group (975±335 s), there was a tendency towards quicker induction times in the ILMA group (P=0.05). Patients in the ILMA group reported considerably greater levels of satisfaction on the VAS, with a median score of 10 compared to 9 in the AFOI group (P<0.01). Among the AFOI group, there was no correlation found between the satisfaction score and the dosage of midazolam or the frequency of recall. The AFOI group had a considerably higher rate of TI recall, at 40%, compared to the ILMA group, which had no recall at all (P<0.01). **Conclusion:** In conclusion, the ILMA has shown a good success rate for ventilation and TI in patients who have challenging airways. When it comes to treating patients who have problematic airways, the ILMA may be a beneficial device.

Keywords: Intubating laryngeal mask airway, General anaesthetic, Awake fiberoptic

INTRODUCTION

Establishing a secure airway while the patient is awake has been recommended in the past for patients who were expected to have difficult airways or who really did have difficult airways. As fiberoptic bronchoscopes (FOB) are now regularly accessible in the majority of hospitals, awake fiberoptic intubation (AFOI) has become the "gold standard" for patients who are suspected of having or have been shown to have difficult airways. The usefulness and safety of AFOI has been shown in a great number of research and case reports (1– 4). This viewpoint was reinforced by the problematic airway algorithm, which was developed in 1991 by the American Society of Anesthesiologists. This algorithm emphasised that patients with "difficult" airways should be intubated while they were conscious (5). On the other hand, AFOI has several limitations, such as the fact that it cannot be carried out on patients who are unwilling or unable to cooperate with the procedure. There has been a link shown between AFOI and oxygen desaturation (6), tachycardia, and hypertension (3). There have also been reports of instances in which AFOI has resulted in a life-threatening airway blockage that required immediate surgical airway treatment (7,8). Lastly, the use of AFOI has been linked to an incidence of patient discomfort that may reach up to 55%. (9).

The intubating laryngeal mask airway (ILMA) is a relatively new piece of equipment that has just been

developed for the control of airways. Prior to any effort at tracheal intubation (TI), the ILMA makes it possible to verify the patient's level of oxygenation and ventilation. Continuous ventilation can be maintained even while intubation is being attempted, and the ILMA can be used even if intubation is not performed. The ILMA has a success rate of between 99% and 100% for ventilation in patients who have normal airways, and it has a success rate of between 97% and 99% for TI (10 – 12). Several case studies have described the effective use of the ILMA for ventilation and subsequent TI in patients with restricted airways, after failed laryngoscopy, and after failed FOB intubation. These patients had previously tried other intubation methods, but were unsuccessful (13–17). Nevertheless, there have been no prospective controlled trials conducted especially on the use of the ILMA in individuals who have difficulty breathing via their airways.

After inducing general anaesthesia using the ILMA, the goal of this research was to do a comparison between AFOI and TI.

AIMS AND OBJECTIVES

After the administration of the anaesthetic, our main goal was to test the hypothesis that it would be possible to properly and securely intubate a subset of patients who had a recorded or anticipated difficult airway by using the ILMA. The secondary hypothesis stated that after the patient had been given anaesthesia, they would have a higher level of satisfaction with TI.

MATERIAL AND METHODS

After the receipt of permission from the institution's ethical committee, informed consent was acquired from each patient. Patients with ASA physical status I-III were enrolled for the study and randomly allocated to one of two groups: either the AFOI or the TI with the ILMA. Patients were asked to participate in the research project if it was assessed by a noninvestigating anesthesiologist that the patient will need an AFOI due to clinical predictors or a history of previous problematic intubation. Previous repeated or unsuccessful laryngoscopies, a Cormack score of more than three, a Mallampati score of more than three, retrognathia, a thyromental distance of less than six centimetres, and restricted c-spine mobility were some of these predictors (18 –21). Individuals who had a history of problematic breathing, a c-spine that was unstable, morbid obesity (a body mass index of more than 35), or who were at risk for aspiration of stomach contents were not included in the study. Individuals who did not have a mouth opening of at least 2.5 centimetres, which is necessary for ILMA insertion, as well as those who had pathological abnormalities of the airway, were not included in the study.

METHODOLOGY

Every patient was subjected to round-the-clock monitoring using pulse oximetry, a five-lead EKG, and a blood pressure monitor that did not need any intrusive procedures. For the course of the trial, each patient had access to a difficult airway cart that included a variety of laryngeal mask airways (LMA), Combitubes® (The Kendall Company, Mansfield, MA), and cricothyroidotomy set options. An anesthesiologist with extensive experience and education was assigned to act as the patient's main anesthesiologist throughout the surgical procedure. All of the patients that were part of the trial were overseen by a second anesthesiologist who was part of the research team and had expertise with both the AFOI and the ILMA (more than 50 instances for each). If a patient became hemodynamically unstable, if TI by the patient's main anesthesiologist was failed after 20 minutes using either approach, or if a fourth TI effort was necessary in the ILMA group, the investigator of the research stepped in to help.

As patients in the AFOI group entered the operation room, they received an antisialogue in the form of 0.2 milligrammes of intravenous glycopyrrolate. Oxygen was supplied through nasal prongs at 3 lpm. Sedation was achieved with the use of midazolam and fentanyl. The principal anesthesiologist was given free reign to choose the dosage as they saw fit. The method of lidocainetopicalization of the airway was also left up to the discretion of the main anesthesiologist. This method includes a variety of combinations of 4% lidocainepledgets, nebulized lidocaine, 10% lidocaine spray, superior laryngeal nerve blocks, and transtracheal injection. Oral TI was attempted using a standard FOB from Pentax (Mississauga, Ontario, Canada) measuring 5 mm and an endotracheal tube constructed of polyvinylchloride (PVC) measuring 7 mm in every case (ETT). When the diagnosis of TI was established using end-tidal CO2 (ETCo2) measurement, propofol was administered in order to bring on general anaesthesia. If the AFOI proved ineffective after the allotted time of twenty minutes had passed, the investigator of the research took over. The trial was considered a failure if TI was unable to be completed within the following ten minutes (for a total of thirty minutes).

Participants in the ILMA group took three deep breaths of oxygen at a concentration of 100 percent. A mixture of midazolam, fentanyl, and propofol was used in dosages that were established by the main anesthesiologist in order to produce general anaesthesia without the relaxing of the patient's muscles. As the patient lost consciousness and started relaxing their jaw, manual breathing was started. In the event that manual ventilation was unsuccessful, the trial was to be considered a failure, and the patient was to be awakened for an AFOI after receiving respiratory assistance from a standard LMA or some other airway adjunct. If the manual ventilation was effective, an ILMA of size 4 was administered to the

female patients, and an ILMA of size 5 was administered to the male patients. The experiment was considered a failure and the patient was awakened for an AFOI if more than two changes to the ILMA were necessary to achieve sufficient breathing. When enough breathing had been accomplished using the ILMA, the patient was rendered immobile by administering succinylcholine at a dose of one milligramme per kilogramme. A single effort at a blind TI was carried out using a normal 7-mm PVC ETT, which was inserted "backward" with the concave curve pointing downwards. This was the initial attempt (15). If resistance or esophageal intubation occurred, the ETT was withdrawn, and TI was reattempted (the second overall attempt at TI) with FOB guidance through the ILMA using a 5 mm Pentax FOB that was put into the ETT. This was the second effort at TI. Throughout each and every attempt at FOB, a bronchoscope-ETT adapter was used in order to provide continuous positive pressure breathing with one hundred percent oxygen, a tidal volume of 400 mL, and a rate of 12 breaths per minute. Propofol was used as a supplement whenever it was deemed necessary in order to keep the patient under general anaesthesia. If TI was still unsuccessful, the main anesthesiologist would re-insert the ILMA, and a second try with FOB guidance would be conducted (this would be the third overall effort at TI). If the TI was still unsuccessful after 20 minutes or if the time limit had passed, the investigator of the research took control. After reinserting the ILMA, TI was tried under the supervision of the FOB (fourth total attempt). When TI had been reached, the ILMA was eliminated by using a second 7-mm ETT as a pusher in the procedure (15). In the event that TI was not accomplished after a total of four attempts at TI or after a total of thirty minutes had passed, the experiment was considered a failure, and the patient was awakened for AFOI.

At regular intervals of one minute, measurements of hemodynamic variables and oxygen saturations were taken. In the AFOI group, the induction time was defined as the amount of time that passed between the beginning of airway topicalization and the detection of ETCo2 from the ETT. As a percentage of the total induction time, the tracheal intubation time was defined as the amount of time that passed between the beginning of FOB manipulation and the detection of ETCo2 from the ETT. For the ILMA group, the induction time was calculated as the amount of time that passed between the delivery of propofol and the detection of ETCo2 from the ETT. The duration of tracheal intubation was measured from the moment that the ILMA was detected for the first time till the time when ETCo2 was detected from the ETT. The main anesthesiologists of the patients were given a questionnaire immediately after TI to evaluate their experience, level of comfort, and level of risk associated with the randomised technique of TI. The VAS score was scaled from 0 to 10. On the first postoperative day, patients were given a questionnaire that measured patient satisfaction, sore throat, and hoarseness on a visual analogue scale (VAS) ranging from 0 to 10.

The randomization process was carried out with the use of computer-generated random numbers that were placed inside of sealed envelopes. The software programme Sigma Stat 2.0 was used for the statistical analysis (SPSS, Chicago, IL). The Mann-Whitney U-test was used in order to conduct an analysis on nonparametric indices. These indices included oxygen saturation, the experiences of anesthesiologists, and all visual analogue scale (VAS) ratings. A Fisher's exact test was used in order to do research on patient recollection. We used unpaired Student's t-tests to compare the demographics of the patients, the hemodynamic outcomes, and the amount of time it took for TI to occur.

RESULTS

There were no significant differences between the two groups in terms of patient demographics, including the reasons for participating in the research (Table 1). Both the AFOI group and the ILMA group each had a total of 50 patients recruited in the study.

Comparing the induction timings of the ILMA group (675±535 s) to those of the AFOI group (975±335 s), there was a tendency towards quicker induction times in the ILMA group (P=0.05). (Table 2). This was a reflection of the amount of time necessary for airway topicalization in the AFOI group. The duration of tracheal intubation was comparable across the two groups. All of the patients in the AFOI group were able to have their tracheas intubated effectively by the main anesthesiologist. The ILMA was able to effectively ventilate all of the patients (94 percent after the first effort, and 100 percent after the second try). In 52% of patients, the blind TI performed using the ILMA was effective. A additional 24% of the patients in the ILMA group were intubated with FOB guidance without the ILMA undergoing any changes or manipulations. After the reinsertion of the ILMA, the primary anesthesiologist intubated the remaining 16% of patients using FOB guidance. The main anesthesiologist attempted to intubate four patients from the ILMA group, but they were unsuccessful. The research investigator was able to successfully intubate all four patients. Both groups reached identical levels of maximum heart rate and maximal blood pressure while the anaesthesia was being administered. In the ILMA group, the minimum oxygen saturation was significantly greater than in the control group, coming in at 97.5% (94%–98%) as opposed to 95.5% (90%–96%) (P<0.01).

Four individuals in the AFOI group had their oxygen saturation drop to between 60 and 86 percent. The oxygen saturation level dropped to 80% in three patients who were part of the ILMA group. As compared to the ILMA, the main anesthesiologists had a considerably higher level of familiarity with

AFOI (P<0.01). (Table 3). Respondents reported a considerably higher level of comfort with the AFOI compared to the ILMA (P less than 0.01). Primary anesthesiologists expected that patients in the ILMA group would report greater levels of satisfaction than those in the AFOI group (P< 0.01).

Patients in the ILMA group reported considerably greater levels of satisfaction on the VAS, with a median score of 10 (10–10) compared to 9 (4–9) in the AFOI group (P<0.01). (Table 4). Among the AFOI group, there was no correlation found between the satisfaction score and the dosage of midazolam or the frequency of recall. The AFOI group had a considerably higher rate of TI recall, at 40%, compared to the ILMA group, which had no recall at all (P<0.01). On the first post-operative day, both groups had equal levels of hoarseness and throat pain.

Table1: Basic profile of the patients

Gender	AFOI Group (*n* = 50)	ILMA Group (*n* = 50)
Male	35	40
Female	15	10
Age (yr)	55.85±5.85	60.85±7.89
Weight (kg)	87.4 ± 17.8	81.7 ± 19.8
Height (cm)	171.1 ± 8.7	167.8 ± 9.9

Table 2: Induction and Tracheal Intubation

Induction and Tracheal Intubation	AFOI Group	ILMA Group
Dose of midazolam (mg)	5 (2–6)	3 (0–3)
Dose of fentanyl (µg)	76 (50–150)	156 (100–225)
Dose of propofol (mg)	141 (100–160) given after TI	251 (200–400) given before TI
Topical lidocaine (mg)	795 ± 470	0
Induction to TI time (s)	975 ± 335	675 ± 535
TI time (s)	205	145
Number of ILMA attempts for successful ventilation		
1 attempt	N/A	94%
2 attempts		6%
3 attempts		0
ILMA intubation		
Success with blind TI		52
First FOB attempt (without changing ILMA)		24
Second FOB attempt (after repositioning the ILMA)	N/A	16
Third FOB attempt (done by an experienced investigator after repositioning the ILMA again)		8
Maximum heart rate	97.4 ± 14.6	96.4 ± 17.9
Maximum systolic blood pressure during induction (mm Hg)	165 ± 27	159 ± 31
Maximum diastolic blood pressure during induction (mm Hg)	101 ± 15	95 ± 17
Minimum oxygen saturation during induction (%)	95.5 (90–96)	97.5 (94–98)
Oxygen desaturation (Spo_2< 90%)	5 (10%)	3 (6%)

Table 3: Primary Anesthesiologist Questionnaire

LMAs used previously	AFOI Group	%	ILMA Group	%
11–20	0		3	6
21–50	0		3	6
50–100	5	10	6	12
>100	45	90	38	76
LMAs used previously				
0	20	40	15	30
1–5	20	40	25	50
6–10	4	8	5	10
11–20	3	6	0	0
21–50	3	6	0	0

50–100	0	0	5	10
>100				
AFOIs used previously				
0	0	0	0	0
1–5	4	8	3	6
6–10	0	0	3	6
11–20	7	14	11	22
21–50	10	20	7	14
50–100	19	38	21	42
>100	10	20	5	10

Table 4: Postoperative Patient Questionnaire

	AFOI Group (*n* = 50)	**ILMA Group (*n* = 50)**
Sore throat (VAS 0–10, 10 worst)	0	1
Hoarseness (VAS 0–10, 10 worst)	2	1
Satisfaction with anesthetic induction (VAS 0–10, 10 best)	9	10
Recall of TI	40%	0%

DISCUSSION

According to the findings of this research, AFOI and ILMA are both linked to a significant amount of achievement to varying degrees. Each and every patient in both groups responded well to TI. In none of the two groups did any of the patients experience any adverse events or develop any morbidities. In both groups, the hemodynamic response to TI and the total amount of time needed to induce anaesthesia were comparable.

The ILMA was able to successfully ventilate all patients within two tries, even when performed by operators with just minimum ILMA expertise. Even though TI efforts in the ILMA group were kept going for a longer period of time, there was only one instance of transitory hypoxemia since breathing was always kept up. Based on these information, it seems that the ILMA might be an effective tool for the ventilation of patients who have challenging airways. There were some benefits to using tracheal intubation after inducing anaesthesia with the ILMA as opposed to using AFOI. Participants in the ILMA group reported greater levels of patient satisfaction, a lower frequency of recall, and no increase in morbidity such as sore throat or hoarseness.

As compared with silicone ETT, the use of PVC ETT in the present research may be subject to criticism due to the possibility that they are linked with a lower success rate, even when spun through 180 degrees (22). The silicone ETT is not only more comfortable to use, but it also causes less damage to the airway. PVC ETT, on the other hand, are more easily available, disposable, and cost far less than their silicone counterparts. The usage of FOB via the ILMA and the ETT would also be incompatible with the study's objectives, which may be improved by the use of a silicone ETT. We only attempted one blind PVC intubation via the trachea. In all of the following efforts, the FOB was used in order to lessen the likelihood of causing airway damage and to raise the success rate of the succeeding intubation procedures.

This research is constrained in two different ways. Secondly, there were a significant number of main anesthesiologists in both the AFOI and the ILMA groups that participated in TI despite having just a minimal amount of prior experience with the ILMA. It's possible that this had a role in the variable length of induction periods and success rates. On the other hand, the use of anesthesiologists with just a cursory amount of expertise may more accurately represent the anticipated clinical outcomes. In addition, a second, more seasoned anesthesiologist who had conducted more than 50 TIs with the ILMA in the past was always available to assist in the event that the TI could not be completed within the first three tries. The second drawback of this research is the small number of participants in the sample. Throughout the course of two years, we contacted all of the patients who were eligible. A very limited number of patients who gave their informed permission to participate in the trial did so because of the uncommon occurrence of individuals with difficult airways and the absence of exclusion criteria that required AFOI. A higher sample size would call for a research that was conducted at many centres.

All of the patients in the AFOI group were able to have a successful TI done by the main anesthesiologist. Nonetheless, the main anesthesiologist tried their best, but there were ten percent of patients in the ILMA group for whom TI was not a viable option. One of the research investigators, who had more prior expertise working with the ILMA, was the one who carried out the TI procedure, and it was completed without any complications. Because of the limited size of our sample, it would be implausible to propose that ILMA

can be consistently used for elective TI in patients who have problematic airways by users who have just a moderate amount of expertise with the procedure. It's possible that the fact that the main anesthesiologists were more at ease with the AFOI than they were with the ILMA is a reflection of their greater familiarity with the former than their lack of expertise with the latter.

There is no clear benefit, other than the increased patient comfort, to utilising the ILMA rather than the AFOI for the vast majority of patients, provided they are calm and compliant. Individuals who do not want to undergo AFOI or who are unable to participate during an AFOI procedure may be good candidates for TI with ILMA. Patients who, following the induction of general anaesthesia, are discovered to have difficult laryngoscopy but are simple to ventilate manually may be candidates for continuing the general anaesthetic and doing TI with the assistance of the ILMA. If the ILMA is going to be used on patients who have trouble breathing, it is probably a good idea to have at least two anesthesiologists on hand for the induction of anaesthesia. This is because there haven't been any large-scale studies done to determine whether or not the ILMA is safe to use on patients who have trouble breathing. The second alternative is to have an experienced nurse or respiratory technician assist the principal anesthesiologist in providing the anaesthesia. Nevertheless, prior to trying to produce general anaesthesia in patients who have challenging airways, one must first acquire expertise with the ILMA in any of these two circumstances.

CONCLUSION

In conclusion, the ILMA has shown a good success rate for ventilation and TI in patients who have challenging airways. When it comes to treating patients who have problematic airways, the ILMA may be a beneficial device. It may be particularly effective in situations when AFOI cannot be performed. Before trying to utilize the ILMA in patients with difficult airways, one should first develop expertise with other airway adjuncts, as is the case with all of these devices.

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