

**BLIND TRACHEAL INTUBATION THROUGH air-Q[®]
SUPRALARYNGEAL DEVICE:
COMPARISON WITH INTUBATING LARYNGEAL MASK AIRWAY**

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ABSTRACT

Background:

Supra glotic airway devices are increasingly used in anesthesia and emergency medicine as a rescue for intubation and / or ventilation. This study was designed to investigate the supralaryngeal device air-Q[®] in comparison with the ILMA-Fastrach[™] in order to facilitate a rescue airway and intubation.

Methods

The devices were inserted in 80 patients (40 patients in each group) according to manufacturer's instructions. An inspiratory pressure of 20 cm H₂O was applied through a ventilator in order to check air leaks. If no air leak was detected, we viewed the glottis using a pediatric Fiber Bronchoscope and then we attempted to introduce an endotracheal tube through the supraglottic device. If the first attempt was unsuccessful, we removed the device and tried a second attempt in the same manner. Primary outcome was an overall success rate for intubation. Other measurements were successful ventilation, Fiber Optic glottis view and adverse events.

Results:

The successful ventilation at the first attempt was better with the Fastrach than with the air-Q (90% vs. 60%, $P=0.0019$) and global success ventilation (first plus second attempts) was better with Fastrach as well (95 % versus 80 %, $p=0.04$). Vision of glottis according to Brimacombe Scale was better with air-Q (84.62% vs. 37.50%, $P=0.0017$) at the second, but not at the first attempt. There were no differences in the percentage of successful intubation between the two devices. The incidence of sore throat was similar with both devices. Two patients in the group of the air-Q suffered hoarseness and arterial desaturation, but the difference was not statistically significant.

Conclusions

Both the ILMA-Fastrach and the air-Q provided similar successful ventilation and intubation globally. The rate of adverse events was similar with both devices. Because no additional maneuver was used to facilitated intubation, further study was necessary to confirm these findings.

Introduction:

Failed or difficult tracheal intubation occurs infrequently but it remains the most important cause of mortality and morbidity in anesthesia (1). The extraglottic airway devices are increasingly used in anesthesia and emergency medicine as a rescue for intubation and / or ventilation or “Plan B” device in the event of a difficult airway. The intubating laryngeal mask airway Fastrach™ (ILMA), (The Laryngeal Mask Company Limited, Mahé, Seychelles), is a form of laryngeal mask airway designed to facilitate tracheal intubation. For patients with normal airways, the ILMA has a ventilation successful rate of 99-100 % and an overall tracheal intubation success rate of 97-100 % (2, 3). The air-Q Reusable Masked Laryngeal Airway (Cookgas LLC, St. Louis, MO, USA) is a novel device, specifically designed for intubation, which permits tracheal intubation by passing an endotracheal tube (ETT) either blindly or mounted on an elastic bougie or on a Fiber Optic Bronchoscope (FOB), to achieve endotracheal intubation. The Reusable air-Q is currently available in four sizes (2.0, 2.5, 3.5 and 4.5) and is designed to ventilate patients whose weights are between 17 and 100 Kg. This extraglottic device allows the insertion of tracheal tubes between 5.5 and 8.8 mm external diameter depending on the mask size.

This study was designed to investigate the air-Q in comparison with the ILMA in order to facilitate a rescue airway and intubation after the induction of general anesthesia in patients without difficult airways.

Methods:

After approval by the ethical committee of our institution, we obtained informed consent from all patients. We selected eighty elective ASA I-III adult patients admitted for elective surgery procedures. Exclusion criteria included Mallampati class >II, obesity (BMI index > 30 kg m⁻²), oropharynx or larynx pathology, limited mouth opening (interdental gap < 2,5 cm), thyromental distance < 6 cm, risk of regurgitation or aspiration (previous upper gastrointestinal tract surgery, known or symptomatic hiatus hernia, esophageal reflux, peptic ulceration or not fasted). Patients were assigned to either an ILMA or an air-Q group at their arrival at the operating room by sealed envelopes. Three senior anesthetists, with experience in the management of the airway and instructors in difficult airway courses, participated in the study.

Airway management procedures . . .

In the operating scenario, previously to the induction, all of the patients were monitored with electrocardiograph, pulse oximeter, capnograph and non-invasive blood pressure, and placed with the head and neck in a neutral position. After 4 minutes of face mask pre-oxygenation, and when expired oxygen concentration was > 90%, anesthesia was inducted intravenously with propofol 2 mg Kg⁻¹ (lean body mass), fentanyl 2 µg Kg⁻¹ and rocuronium bromide 0.6 mg Kg⁻¹. On loss of consciousness, manual 100 % oxygen face mask ventilation was initiated and after abolition of the train of four responses, the device was introduced. We followed the manufacturer's recommendations for each device about sizing and insertion technique. For the ILMA, size 3 was used when the patients' weight was < 50 Kg, size 4 for patients weighing between 50-70 Kg and size 5 for patients weighing < 70 Kg. For the air-Q, size 3.5 was used for patients weighing between 50-70 Kg and size 4.5 between 70-100 Kg. Both devices were lubricated with the water-soluble gel K-Y Jelly® (Johnson & Johnson, New Brunswick, NJ). We applied no additional maneuvers to resolve ventilation problems and unsatisfactory intubation. To check for air leaks, after the insertion of the

supralaryngeal airway, an inspiration pressure of 20 cm H₂O was applied. The absence of audible leak, capnography, and absence of leak in the pressure-volume loop confirmed the successful ventilation. The position of the airway device was assessed using a Fiberscope Pentax FI-10BS (Pentax Corporation, Tokyo, Japan). Failure to intubate was defined as inability to place the endotracheal tube successfully after two attempts. The algorithm of the procedure is resumed in figure 1. All of the devices were retired when the tube was correctly positioned in the trachea, using the LMATM Stabilizer Rod for ILMA, or with the specific stylette for the air-Q; when the intubation through the device was unsuccessful a conventional intubation with a Macintosh laryngoscope was performed.

Airway management data . . .

The following parameters were recorded: Successful ventilation at the first or second attempt, Successful advance of the tracheal tube at the first or second attempt and the quality of initial glottis view in each attempt using an endoscopic view grading system according to Brimacombe score⁷ (grade 4: only vocal cords visible; grade 3: vocal cords plus posterior epiglottis visible; grade 2: vocal cords plus anterior epiglottis visible; 1: vocal cords not visible but function adequately). Some safety parameters were also recorded: data regarding any oxygen saturation $\leq 92\%$ was collected, and 1 h after surgery patients were interviewed about a sore throat (0= no pain; 1= mild; 2= moderate; 3=severe) and hoarseness (0= no; 1= mild; 2= moderate; 3= severe).

Statistics . . .

We assumed an incidence of 97% of successful assisted tracheal intubation with ILMA, and that incidence was chosen to determine the sample size³. The aim of the study was to demonstrate that successful intubation with the air-Q was no more than 15 % less than that of ILMA. A total of 62 patients in two randomized groups was required to declare a significant difference with a $\beta=0.9$ and $\alpha=0.05$ in a two-sided test. Data from the study was performed with the G-Stat 2.0 Statistical Analysis Program (GlaxoSmithKline). Categorical data was analyzed using X^2 test or Fisher's exact test. Continuous data was analyzed using Student's t test or an appropriate non-parametric alternative test. The significance level was set at 0.05.

Results:

Mean age was 57.38 ± 15.79 years and the male/female ratio was 37/43. Mean weight, height and BMI were 66.38 ± 11.82 (36-95) Kg, 1.62 ± 0.09 (1.46-1.86) meters, and 24.92 ± 11.35 (14.81-29.79) Kg.m⁻² respectively. We did not find any significant difference between the two groups in respect to the demographical data and the American Society of Anesthesiology's physical status (Table I).

There were significant differences in the percentage of successful ventilation on the first try; we achieved an optimal ventilation in 90% of the patients with the ILMA and 60% with the air-Q ($p=0.0019$); global success ventilation (first plus second attempts) was better with Fastrach as well (95 % versus 80 %, $p=0.04$) (Table II).

The vision of the glottis (Brimacombe 4 and 3) was significantly better with the air-Q at the second attempt (84.62% vs. 37.50%, $p=0.0017$); at the first attempt, with the air-Q, the percentage of patients with Brimacombe grade 4 was double that of the ILMA, but overall, the difference do not reach statistics significance (Table III).

There were no differences in the percentage of successful blind intubation between both devices. Global intubation success rate was 70 % for the ILMA and 60 % for the air-Q, but if we only consider patients who could be ventilated these percentages (78.95 % versus 75 %) were similar (Table II).

The incidence of adverse events (sore throat, hoarseness and oxygen saturation below 92%) was similar in both groups. However, although there was no hoarseness or desaturation with the ILMA, there were 2 cases of each in the air-Q (5%) (Table IV). No cases of major soft tissue damage or dental trauma occurred as determined by a lack of blood on removal of the device and routine post-operative questioning.

Discussion:

Placement of an ILMA and subsequent blind intubation has been considered as a standard for rescue ventilation and tracheal intubation in both emergency and operating rooms when conventional direct laryngoscopy has failed (1).

In recent years, several supraglottic devices that allow tracheal intubation have been introduced. Some like the air-Q have been specifically designed for this indication, while others like i-gelTM airway (Intersurgical Ltd., Wokingham, UK) has been used by several authors (4) for this purpose, although its use in this situation has not been established.

Manufacturer's recommend that intubation through these devices be performed under Fiber Optic (FOB) visualization or with the help of an optical stylette, both of which are not normally available in small hospitals or in the field of emergency and, for that reason, the intubation in these situations is often performed blindly. Therefore, we designed this study to compare the effectiveness of the mask air-Q, in this special situation, compared with the gold standard (ILMA), a device widely tested and validated.

In this study, we achieved optimal ventilation in 95% of the patients with ILMA. That rate is slightly lower than the previously published (97.3-100 %) by other authors (3,5), although in our research we used a very strict criteria to consider that ventilation was effective (no leak in the pressure-volume loop and a normal capnography in our study versus chest wall movement and end-tidal CO₂ within the normal range in capnography in most previous studies). Besides, we used the maximum pressure recommended by the manufacturers for the use of both devices (20 cm H₂O), and probably with a less tight criteria, we would have been able to achieve a completely successful ventilation in a proportion of patients similar to other studies. Overall success in ventilation was achieved in 80 % of patients with air-Q, a percentage that is lower to the previously published by Klein (92.85 %) (6) Probably for the same reasons explained above but similar to the study of Morello (80 %) (7).

Although the air-Q allowed a better glottis view according to Brimacombe score (more than twice of patients with grade 4 under FOB), this finding did not translate into greater success in intubation as discussed later.

We achieved tracheal intubation with ILMA in 66.67 % and 28.57 % of patients at first and second attempts respectively. Although this success rate is similar to those reported in previous series (50-75 %) (3, 8), our overall success rate (70 %) was lower than those previously published (93-97 %) (3, 5). Several strategies that have been described to achieve intubation with ILMA: optimizing the airway, raising the mask upwards (Chandy maneuver), partial withdrawal, pull up or push down maneuver, rotating the tube bevel, adjusting head-neck position or adding air to the cuff; we did not employ any of these strategies and that fact could explain the lower success rates in our research. In a study of Morello (7), blind intubation success at first attempt with air-Q occurred in 71.66 % of patients without device manipulation and in 64.70 % at the second attempt after device and endotracheal manipulation. In a study conducted in gynecological patients, Klein and Jones (6) described a successful intubation at first attempt in 8 of 11 patients (72.72 %), although in 2 of them, a jaw lift maneuver was used in order to facilitate the passage of the endotracheal tube. The percentages of intubation to the first and second attempts were lower in our study, probably because our protocol was very strict (successful ventilation = absence of air leak with a pressure of 20 cm H₂O) and for that reason the rate of patients who underwent intubation was lower; if we only consider the patients in whom intubation was attempted, our success rate (75 %) was similar to other studies. Furthermore, we did not employ any of the repositioning maneuvers described by other authors (6) to avoid the epiglottis down folding and to improve the rate of intubation like jaw lift or the Klein maneuver (jaw lift and withdrawal of the air-Q, followed by reinsertion) and we might suppose that our rate of success would be higher if we had used them.

Although the vision of the glottis was better with air-Q, intubation through this device was less frequent in our study. We used conventional PVC tracheal tubes for air-Q and we employed a specific autoclavable and reusable cuffed silicone tube for ILMA; this ILMA tube has a rounded tip which may prevent the collision against the arytenoids or vocal cords and make intubation easier with ILMA. Because in most of patients we saw the glottis with the Fiberscope (only 4 patients in each group with Brimacombe score 1), it is very likely that we would be able to intubate a higher number of patients if we had used that device, especially with air-Q.

The causes of post-operative adverse events such as sore throat and dysphonia after general anesthesia using supraglottic devices are dependent on the depth of anesthesia, the method of insertion, the cuff volume with inflatable devices, the number of insertion attempts, and on the type of post-operative analgesia provided. We found a similar incidence of sore throat between both devices although two patients with air-Q reported moderate sore throat. Hoarseness appeared in 2 patients (5 %) with air-Q, but this difference is not statistically significant. We did not find any association between the number of attempts of intubation and this slightly higher incidence of moderate sore throat and hoarseness for the air-Q; because we used a conventional PVC tube for this device and the specific ILMA tube with a rounded tip, the increased incidence of hoarseness with air-Q may be caused more by this fact than with the use of the device itself.

Some limitations of our study should be noted. As we have commented above we only tried two intubations through the devices and both of them could be considered as a first attempt because we did not try additional maneuvers in order to achieve intubation. Other important limitations is the fact that we have considered only patients without difficult airways and, for this reason, we do not know how these devices behave in a real scenario with difficult airways.

So, we conclude that LMA-Fastrach provided a higher rate of successful ventilation than air-Q, but both are similar for intubation purposes. Because no additional maneuvers were used to facilitate intubation and our research was conducted in patients with normal airways, further studies, especially in patients with difficult airways are necessary to confirm these findings.

REFERENCES:

1. Caplan RA, Posner KL, Ward RJ, Cheney FW. Adverse respiratory events in anesthesia: a closed claim analysis. *Anesthesiology* 1990; 72: 828-833.
2. Baskett PJ, Parr MJ, Nolan JP. The intubating laryngeal mask. Results of a multicentre trial with experience of 500 cases. *Anaesthesia* 1998; 53: 1174 – 1179.
3. Brain AI, Verghese C, Addy EV, et al. The intubating laryngeal mask. II: A preliminary clinical report of a new means of intubating the trachea. *Br J Anaesth* 1997; 79: 704 –709.
4. López T, Sastre JA, Muriel C. Use of i-gel airway in an intermediate step toward intubating a difficult airway for thoracic surgery. *Rev Esp Anestesiol Reanim* 2008; 55: 380-381.
5. Kapila A, Addy EV, Verghese C, Brain AIJ. The intubating laryngeal mask airway: an initial assessment of performance. *Br J Anaesth* 1997; 79: 709-713.
6. Klein MT, Jones J. Utility of the Intubating Laryngeal Airway®: Report of an Observational Study. *Anesthesiology* 2005; 103: A846.
7. Morello G, Molino C, Sidoti M, Perrinello L, Rinzivillo D. Ventilation and fiberoptic evaluation of blind intubation through AirQ: experience on 60 patients. From Proceedings of the 2009 Annual Meeting of the American Society Anesthesiologists. New Orleans: Annual Meeting of the American Society Anesthesiologists 2009; A542.
8. Lu PP, Yang CH, Ho ACY, et al. The intubating LMA: a comparison of insertion techniques with conventional tracheal tubes. *Can J Anaesth* 2000; 47:849 –853.