Comparative Study of Orotracheal Intubation through Air Q Laryngeal Mask Airway: Blind Versus Fiberoptic Guided During General Anesthesia

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Abstract

This study was designed to compare the hemodynamic and arousal responses to blind orotracheal intubation through Air Q laryngeal mask airway versus flexible fiberoptic guided. 100 adult patients ASA I and II undergoing elective surgeries under general anesthesia with orotracheal intubation were divided into two groups according to the technique of intubation through Air-Q ILA Group I (n= 50) patients intubated blindly through Air-Q ILA Group II (n=50) patients intubated through Air-Q ILA guided by flexible fiberoptic bronchoscope. The following parameters were recorded: heart rate, systolic, diastolic and mean arterial blood pressure and Bispectral Index (BIS) values: preinduction, after induction of anesthesia, then at 1 and 5 minutes after intubation, arterial oxygen saturation (SpO_2): before, during and after intubation, time of insertion(in seconds) and number of attempts of insertion of the endotracheal tube and airway complications; injury to the gums or teeth damage, hoarseness of the voice, bleeding, sore throat. Systolic and mean arterial blood pressures were statistically significant lower in the fiberoptic group than the blind group. There was no statistically significant difference between the two groups in the heart rate and diastolic blood pressure.There was statistically significant lower time of intubation and less number of attempts in fiberoptic group than in blind group, the success rate of intubation in the fiberoptic group was 100% compared to 76% in blind group. There was statistically significant lower BIS value in the fiberoptic group 1 minute after intubation than in the blind group. Endotracheal intubation through the Air-Q ILA guided by flexible fiberoptic bronchoscope is associated with less hemodynamic and arousal responses than blind endotracheal intubation through the Air-Q ILA, the number of attempt and time of successful intubation were statistically significantly lower in the fiberoptic group than the blind group.

Key Words: Air Q Laryngeal Mask Airway, Fiberoptic bronchoscope, pressor response, arousable response

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Introduction

Inadequate experience in airway management during anesthesia leads to high morbidity and mortality [1], endotracheal intubation is the "gold standard" for securing the airway [2], in the recent years, airway management and devices showed a great development [3].

The classical laryngeal mask airway (LMA), is a supraglottic airway device which simplified airway management [4]. The intubating laryngeal mask airway (The LMA-Fastrach™) was designed to facilitate intubationwhich can be done either blindly or via fibreoptic assistance [5]. Air-Q ILA was invented by Daniel Cook gas, it provides efficient ventilation and endotracheal intubation [6].

Significant hemodynamic responses caused by laryngoscopy and tracheal intubation due to sympathetic activity caused by mechanical stimulation to oropharyngolaryngeal structures [7-9]. Laryngoscopey and endotracheal intubation produce an arousal response on the electroencephalograph (EEG) during induction of anesthesia [7,8].

The bispectral index (BIS), has been related to the hypnotic component of anesthesia, it identify the arousal response associated with noxious stimulation as endotracheal intubation and to detect depth of anesthesia [10]. BIS ≤60 is used as an endpoint of hypnosis during general anesthesia. BIS values after intubation increases above 60 (10-16 unites), which represents a risk for awareness [11].

The purpose of the present study was to compare the hemodynamic and arousal responses to blind orotracheal intubation through Air Q laryngeal mask airway versus flexible fiberoptic guided.

Methods

Patients and study design

This study was conducted at Beni-Suef University Hospital, Faculty of Medicine, Beni-Suef University after the approval of institutional review board and ethical commit and registered at www.ANZCTR.org.au, the ACTRN: 12614000405617 and obtaining written informed consent from the patients.

Inclusion Criteria

100 patients ASA (I–II) males & females with age ranged from 20-60 years old planned for elective surgical operations at Beni-Suef University Hospital from August 2012 to February 2014 under general anesthesia with oral endotracheal intubation.

Exclusion Criteria

Patients excluded if they had hypertension, neurological, cardiovascular, endocrine disease, risk of regurgitation and pulmonary aspiration, cervical spine lesion, patients undergoing cardiac and neurosurgical procedures, risk index of El-Ganzouri for difficult tracheal intubation ≥4, BMI >35 kg/m^2, oropharyngeal mass, respiratory pathology, or any history of allergy to drugs used in the protocol.

Patients were assessed preoperatively by El-Ganzouri risk index for difficult tracheal intubation [12].

Anesthesia

In the operating room, an intravenous cannula gauge 20 was inserted, Ringer lactate solution was started. Electrocardiogram, pulse oximetry, and non-invasive arterial blood pressure at 5 minutes intervals, BIS monitor strip (BIS Sensor®; Aspect Medical Systems, USA, Toll free 1-888-BIS Index applied to the forehead before induction of anesthesia) were connected. Preoxygenation for 3-5 minute with 100% oxygen by facemask, then induction of anesthesia was with the use of i.v fentanyl 2 μg/kg, propofol 2 mg/kg, atracurium (0.5 mg/kg) and were ventilated manually with isoflorane 1-2 volume %, oxygen 100% via a face mask. In both groups, insertion of air Q ILA and tracheal intubation were done by experienced personnel in the use of flexible fiberoptic bronchoscope and air Q ILA insertion. Insertion of Air-Q ILA was done when the BIS value reached (40-60) which indicate optimal hypnotic state [13]. Muscle relaxation was guided by nerve stimulator (Life-Tech EZstim II), a proper size reusable Air-Q ILA according to body weight referred to manufacture's guidelines size 3.5 is for 50-70 kg, size 4.5 is for 70-100 kg.

Patients were randomly assigned into two equal size groups by closed envelop technique, according to the used technique of endotracheal intubation as follows: In Group I (n=50)

patients were intubated blindly using air Q intubating laryngeal airway (Air-Q ILA): the cuff of the Air-Q ILA was deflated until two dimples appear at the back of Air-Q ILA as described by manufacturer and was lubricated with xylocain gel 2%, the Air-Q ILA was inserted into the patients mouth with the upper incisor of the patient opposite the lower landmark on the tube of the air Q ILA to prevent epiglottic folding with the cuff of the Air-Q ILA, the cuff then inflated with 10-15 ml air and connected to the circle system. After confirmation of ventilation by capnography, bilateral chest expansion, and bilateral auscultation of breath sounds the air Q ILA mask adaptor was disconnected, a well lubricated PVC endotracheal tube (ID 7 mm in females, 7.5 mm in males) was advanced through its shaft blindly then connected to the circle system, successful endotracheal intubation and ventilation was confirmed with capnography, then the cuffs of the Air-Q ILA and endotracheal tube were deflated, the ETT connector was removed then the Air-Q ILA was removed over a special stylet, Then, the ETT connector was placed into its position,the cuff reinflated and the ETT was connected to the circle system, any blood visible on the device indicative of trauma to the upper airway or bronchospasm were recorded (Figures 1,2,3).

Fig 1. The patient after insertion of Air-Q ILA

Fig 2. Blind insertion of the endotracheal tube through the Air-Q ILA

Fig 3. The patient after being intubated blindly through Air-Q ILA

If first attempt of intubation failed, the second attempt was done by maximal head extension and mandibular lift, if the second attempt failed, the third attempt was done by fiberoptic bronchoscope through Air-Q ILA

In Group II (n=50) patients were intubated through the Air-Q ILA from the start guided by flexible fiberoptic bronchoscope (KARL STORZ-Endoscope 5.2x65): a reusable Air-Q ILA use was lubricated with xylocain gel 2% and inserted into the patient mouth, the cuff then inflated with 10-15 ml and the Air-Q ILA was connected to the circle system, after confirmation of ventilation, a well lubricated fiberoptic bronchoscope loaded with a proper size well lubricated PVC ETT (ID 7 mm in females and 7.5 in males) was advanced through the Air-Q ILA shaft till visualization of the glottic area of the larynx and advancing into the trachea until visualization of the carina then the ETT was advanced into the trachea . The scope then was removed and the ETT cuff was inflated and connected to the circle system, successful endotracheal intubation was confirmed with capnography, adequate chest expansion and bilateral auscultation of breath sounds. The cuff of the Air-Q ILA was deflated then it was removed over a special stylet. Any blood visible on the device, indicative of trauma to the upper airway or bronchospasm was reported (Figures 4,5,6).

Fig 4. Insertion of the insertion cord of the flexible fiberoptic bronchoscope through the Air-Q ILA

Fig 5. Advancement of the ETT through Air-Q ILA over insertion cord of flexible fiberoptic bronchoscope.

Anesthesia was maintained with oxygen 100%, isoflorane 1-2% according to the depth of anesthesia measured by BIS to be between 40-60%, additional doses of atracuruim, controlled mechanical ventilation. At the end of surgery, neuromuscular blockade was reversed with IV neostigmine 0.04mg/kg and atropine 0.02 mg/kg, the trachea was extubated when the patient respond to commands, all patients was transferred to PACU, where they received oxygen via face mask 3-4 L/min and were monitored.

Fig 6. ETT in the Air-Q ILA

Data collection procedure: The following parameters were evaluated and recorded by a senior anesthetist;

1. Patients: age, sex, ASA, height, weight
2. Airway: risk index of El-Ganzouri for difficult tracheal intubation
3. Heart rate, systolic, diastolic and mean arterial blood pressure: preinduction, after induction of anesthesia, then at 1 and 5 minutes after intubation
4. Arterial oxygen saturation (SpO2): before, during and after intubation.
5. Time of insertion of the endotracheal tube: recorded by an observer using a stop watch, is the time in seconds from insertion of the endotracheal tube blindly or insertion of the flexible FOB through the Air-Q ILA until capnographic confirmation. Scoring of the trial according to the time it lasts until capnographic confirmation is either score 2: time less than 50 s, score 1: time more than 50 s [14]., If there was a second attempt, the insertion time was the sum of the 2 attempts, this did not include the gap time between the attempts.
6. Number of attempts of intubation
7. Number of patients who failed to be intubated with the device (after 2 attempts)
8. Bispectral Index (BIS) values measured before induction of anesthesia, after induction, immediately after intubation and after 5 minutes of endotracheal intubation
9. Airway complications: injury to the gums or teeth damage, hoarseness of the voice, bleeding, sore throat. Before leaving the PACU the patients was asked about sore throat and hoarseness. If noted, assessment for 48 hours was done.

Statistical analysis

Data are presented as mean ±SD, number and percentage, median and rang as appropriate. Unpaired Student t- test was used for comparison between means of the two groups. Mann-Whitney U test was used for comparison of nonparametric data. Chi-square test or Fisher's exact test were used for comparing categorical data as apropriate. P values ≤ 0.05 were considered statistically significant. Statistical package for social science (SPSS) software version 17 was used.

Results

All the cases completed the study, there were no statistically significant differences between the two groups in demographic data (age, sex, height and weight), in El Ganzouri score and ASA (Table 1).

Table 1. Demographic data. El Ganzouri Score for assessment of airway, ASA. Data are presented as mean ±SD, numbers or median and range.

Variables	Group I (n=50)	Group II (n=50)	p
Age (year)	40.0±14.2	36.8±10.6	0.200
Weight (kg)	76.0±11.8	73.8±10.2	0.320
Height (cm)	164.6± 7.2	163.1±6.4	0.275
Sex (male/female)	22/28	17/33	0.308
El Ganzouri score	2 (1-3)	2 (1-4)	0.836
ASA (I/II)	(27/23)	(26/24)	0.136

Group I: Blind group, Group II: Flexible Fiberoptic Group. No statistically significant difference between the study groups. P value> 0.05.

The heart rate shows no statistically significant difference between the two studied groups, the decrease in the systolic blood pressure was statistically significant in the fiberoptic group than the blind group at 5 minutes after endotracheal intubation

As regard to the diastolic blood pressure, there were no statistically significant difference between two groups. The mean arterial blood pressure showed no statistically significant difference between the two groups except 5 minutes after endotracheal intubation where it was statistically significantly lower in the fiberoptic group than that of the blind group. There was no statistically significantly difference in the SpO_2% between the 2 groups (Table 2).

The time of insertion of ETT was statistically significantly lower in fiberoptic group than the blind group (Table 3). As regards to the score of the time of intubation, 40 patients were intubated in less than 50 seconds (score 2) in the fiberoptic group, and 21 patients were intubated in less than 50 seconds (score 2) in the blind group, 10 patients were intubated in more than 50 seconds (score 1) in the fiberoptic group and 29 patients were intubated in more than 50 seconds (score 1) in the blind group, this difference was statistically significant (Table 3). The number of attempts of endotracheal tube insertion in the fiberoptic group was statistically significant less than that in the blind group, the endotracheal tube was inserted in the fiberoptic group in the first attempt in 44 patient (88%), 4 patients (8%) were intubated guided by fiberoptic bronchoscope in the 2nd attempt and 2 patients (4%) in the 3rd attempt. But in the blind group, 26 patient (52%) were intubated blindly in the first attempt, 12 patients (24%) intubated in the 2nd attempt blindly and 12 patients (24%) failed to be intubated blindly after 2 attempts and intubated by fiberoptic bronchoscope through the air Q ILA (Table 3). As regards to the success rate of intubation, in the fiberoptic group, the 50 patients (100%) were

successfully intubated, in the blind group, 38 (76%) patients were successfully intubated blindly through the device (Table 3).

Table 2. Heart Rate (Bpm), Systolic, diastolic and mean arterial blood pressure (mmHg), SpO_2% between study groups. Data are presented as mean±SD.

Time	Group I (n=50)	Group II (n=50)	p
Heart Rate			
Preoperative	88.2±15.6	88.5±12.4	0.899
After induction of Anesthesia	81.3±15.8	87.0±14.5	0.063
1 minute After ETT	95.4±18.0	97.6±13.3	0.506
5 min After ETT	85.4±16.1	84.3±13.0	0.727
Systolic arterial blood pressure			
Preoperative	133.6±13.5	132.3±9.9	0.590
After induction of Anesthesia	114.0±15.4	111.7±14.3	0.453
1 minute After ETT	129.8±16.6	125.3±13.8	0.142
5 min After ETT	115.3±15.8	107.5±15.8*	0.015
Diastolic arterial blood pressure			
Preoperative	82.6±10.9	85.0±7.9	0.227
After induction of Anesthesia	69.1±12.4	70.3±10.1	0.603
1 minute After ETT	82.0±13.4	80.7±10.4	0.583
5 min After ETT	69.8±14.2	65.3±11.2	0.079
Mean arterial blood pressure			
Preoperative	100.5±10.5	100.7±8.0	0.898
After induction of Anesthesia	84.8±13.4	83.9±11.5	0.701
1 minute After ETT	98.4±14.2	95.1±11.1	0.205
5 min After ETT	85.5±13.0	79.0±12.3*	0.012
SpO_2%			
Preoperative	98.2±0.8	97.9±0.8	0.127
After induction of Anesthesia	100.0±0.1	99.9±0.6	0.469
1 minute After ETT	99.9±0.7	99.5±2.3	0.317
5 min After ETT	100.0±0.1	99.9±0.3	0.413

Group I: Blind group, Group II: Fiberoptic group, Bpm=beat per minute
*Statistically significant compared to the blind group, p value ≤0.05

Table 3. Time of insertion, its score, number of attempts of insertion of ETT, Success rate of intubation in study groups. Data are expressed as mean ±SD, numbers and percentage

Variable	Group I (n=50)	Group II (n=50)	p
Time of ETT insertion	52.7±25.3	39.34±11.5*	0.0011
Score (1/2)	29/21	10/40*	0.0005
Attempt (1/2/3)	(26/12/12)	(44/4/2)*	0.001
Succeed	38 (76%)	50 (100%)*	0.03
Failed	12 (24%)	0 (0%)	

Group I: Blind group, Group II: Fiberoptic group
*Statistically highly significant compared to blind group, P value <0.05.

There was no statistically significant difference between the patients of the study groups in Bispectral index value except immediately after endotracheal intubation where the BIS value in the fiberoptic group was statistically significant less than that of the blind group (Table 4).

Table 4. BIS value (%).Data are presented as mean± SD.

Time	Group I (n=50)	Group II (n=50)	p
Preoperative	97± 1	97±1	1
After induction of Anesthesia	45.5±3.7	44.6±5.6	0.365
1 minute After ETT	52.5±3.8	50.1±5.3*	0.010
5 min After ETT	45.3±3.8	44.3±4.1	0.214

Group I: Blind group, Group II: Fiberoptic group, BIS=bispectral index
*Statistically significant compared to blind group, p value ≤ 0.05

As regards to the complications of both procedures, there were decrease incidence of complications in fiberoptic group compared to blind group. This might be due to decreased number of attempts of intubation in fiberoptic group where most of cases are intubated in the first attempt However, there were no statistically significant difference between the two groups in complications of intubations (Table 5).

Table 5. Complications. Data expressed as number and percentage.

Variable		Group I (n=50)	Group II (n=50)
Complications	No	39 (78%)	47 (94%)
	Blood visible on Air Q ILA	6 (12%)	2 (4%)
	Bronchospasm	5 (10%)	1 (2%)

Group I: Blind group, Group II: Fiberoptic group

No statistically significant difference between the study groups (p value ≥0.05).

Discussion

Supraglottic airway devices are important airway management devices, the Air-Q ILA is a new device with the following features: it has a short wide shaft, it allows the placement of a standard tracheal tube [15], it is available in six sizes (1-1.5-2-2.5-3.5 and 4.5) in disposable single use and in four sizes (2-2.5-3.5 and 4.5) for reusable use [14].

Previous study by Bashandy GM et al [16] showed that blind tracheal intubation through the air Q ILA has significantly longer duration of intubation than direct laryngoscope, but lesser

hemodynamic pressor responses compared to direct laryngoscope this is may be due to the fact that the Air-QILA has no epiglottic elevating bar. The epiglottic elevating bar of the ILMA, elevate the epiglottis and cause stimulation of the epiglottis and periepiglottic structures [17].

Talaat et al [18] found that there was no statistical significant difference in the heart rate between the air Q ILA and the fastrach ILMA at pre-induction and after insertion of both supraglottic devices, but they found a highly statistical significant lower heart rate in fiberoptic intubation through ILMA than through air Q ILA.

Badawi et al [19] concluded that insertion of air Q ILA was associated with no significant increase in heart rate or mean blood pressure.

In this study the Air-Q ILA was easily inserted, El-Ganzouri et al [20] compared between size 3.5 and size 4.5 of the Air-Q according to body weight. They found 100% first time ease of insertion in group inserted with air Q ILA size 3.5 and 93.3% in group ventilated with air Q ILA size 4.5.Bakker et al [21] reported that the air-Q™ ILA was successfully placed in all patients (100%), and the first attempt was successful in 88% of patients. The trachea was successfully intubated in 74%, and the first attempt was successful in 58% of patients,

In Pandit et al [22] study; 95% first attempt success rate of fibreoptic-assisted intubation was achieved, with an average intubation time of 74 s. El Ganzouri et al [23] states that the success rate of intubation with the flexible fiberoptic bronchoscope was higher and less traumatic compared to blind intubation.

In this study the BIS values, the fiberoptic group was statistically significant lower than that in the blind group immediately after intubation. Although BIS increases after intubation in both groups, it does not reach the arousal value (BIS more than 60%).

Because there are no studies detecting the effect of intubation through air Q ILA on BIS till the time of conduction of this study, we will discuss the effect of insertion of other supraglotic devices on BIS. Versichelen L et al [24] detected that BIS change after COPA or laryngeal mask insertion was similar, it increases slightly in relation to preinsertion value, but the increase is minor.

Limitations for the study: patients with suspected difficult tracheal intubation were excluded

Conclusion

The air Q ILA is a good surpaglottic device for ventilation, associated with no hemodynamic pressor response or arousal response nor desaturation when used for endotracheal intubation either blindly or fiberoptic guided. It is an effective conduit for endotracheal intubation guided by flexible fiberoptic bronchoscope.

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