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Research Article

Comparative study between fibro-optic bronchoscope and rigid laryngoscope in direct laryngoscopy with microlaryngosurgery

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KEYWORDS

Awake intubation;
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Microlaryngosurgery

Abstract *Objective:* Anesthesia of patient for direct laryngoscopy (DL) and microlaryngosurgery (MLS) was technically challenging. The anesthetist had usually concern about the loss of spontaneous ventilation and occurrence of obstruction after induction with IV drugs. *The aim of this study* was to compare between flexible fibro-optic bronchoscope and direct rigid laryngoscope during awake intubation in patients with laryngeal mass scheduled for direct laryngoscopic surgery (DL) and microlaryngosurgery (MLS). It was a study to assess the best way for intubation with the least side effects, discomfort to the patients and high success rate of intubation.

Methods: Fourty adult patients Malampati 1,2 and ASA I,II,III with small laryngeal mass or polyp scheduled for direct laryngoscope (DL) and microlaryngoscopic surgery. They were randomly computerized divided into two groups 20 patients in each group; Group FO; intubation with flexible fibro-optic bronchoscope. Group RL; intubation with rigid laryngoscope.

Results: The time of intubation was statistically significantly higher in fibro-optic group (group FO) (92 ± 34 s) than rigid laryngoscope group (group RL) (35 ± 5 s). There were two patients in group RL needed 2nd intubation attempt for better visualization of the view but there were six patients in group FO needed 2nd intubation attempt for suction of secretion and blood. According to modified six point scale the patients ranged between 1 and 3 in group FO while they range between 2 and 4 in group RL.

Conclusion: The study suggested that the flexible fibro-optic bronchoscope was very comfortable to the patients and less traumatic with less cardiovascular stress but it took longer time and had a higher incidence of 2nd attempt and failure rate. Accordingly, it recommend the use of flexible

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fibro-optic bronchoscope in expected small size and non-bloody mass with prepared rigid laryngoscope and tube with stylet to be ready to use if needed.

1. Introduction

Awake intubation is an established technique for management of potentially difficult airway passage. The key requirements of this procedure include adequate patient's preparation and maintaining patient safety. Awake intubation is uncomfortable and distressing to conscious patients. Struggling of the patient markedly reduces the chances of successful intubation; increase morbidity from cervical or cranial fractures, and accentuate the degree of dental and laryngeal trauma. Moreover, laryngoscope stimulation precipitates vomiting, breath holding and laryngospasm. The impact of awake intubation could be minimized with adequate use of conscious sedation with peripheral nerve block [1].

The difficult airway was defined by an ASA as the clinical situation in which a trained anesthesiologist experiences problems with face mask ventilation of the upper airway, tracheal intubation or both [2].

Anesthesia of patient for direct laryngoscopy (DL) and microlaryngosurgery (MLS) was technically challenging. The anesthetist had usually concern about the loss of spontaneous ventilation and occurrence of obstruction after induction with IV drugs. Complete obstruction of the airway may happen and produce an emergency situation due to rapid development of severe hypoxemia. Difficult tracheal intubation (DTI) increases the risk of perioperative morbidity and mortality [3,4].

Although the fiber-optic bronchoscope was very useful for awake tracheal intubation for patient with potentially difficult airway [5], it requires special equipment, need highly trained anesthetist and may be time consuming [6].

The ability to safely assess the patient airway by direct rigid laryngoscopy during microlaryngosurgery eliminates the need for fibro-optic intubation in some cases. It gives vulnerable information about the airway passage by global direct vision of the vocal cords and offer good visualization of the laryngeal cavity [1].

The aim of this study was to compare between flexible fibro-optic bronchoscope and direct rigid laryngoscope during awake intubation in patients with laryngeal mass scheduled for direct laryngoscopic surgery (DL) with microlaryngosurgery (MLS). It was a study to assess the best way for intubation with the least side effects, discomfort to the patients and high success rate of intubation.

2. Materials and methods

This study was done in kasr El Aini hospital ENT department, after approval of the local ethical committee and informed written consent of the patients was obtained, 40 adult patients Malampati 1,2 and ASA I,II,III with laryngeal mass scheduled for direct laryngoscope (DL) for microlaryngoscopic surgery. They were randomly computerized divided into two groups 20 patients in each group;

Group FO; intubation with flexible fibro-optic bronchoscope.

Group RL; intubation with rigid laryngoscope.

Inclusion criteria include a small lesion as polyps or nodules or leukoplaqia which causing voice changes without manifestation of stridor and required microlaryngosurgery.

Exclusive criteria include patient's refusal, inability to cooperate, large bloody laryngeal tumors invaded the wall of the larynx or epiglottis or base of tongue as it interfere with the identifying the landmark for local nerve blocks, high Malampati score [3,4], severe hypertension, severe cardiac problems as (severe ischemic heart disease and heart failure) and coagulation disorders.

Intravenous cannula (18 g) was fixed in cephalic vein in all patients; all patients were premedication with atropine 0.5–1 mg IV 20 min before procedure (as antisialagogue and to avoid undesired side effects such as bradycardia). Midazolam 1–3 mg/IV 20 min before the procedure was given to decrease the degree of anxiety associated with awake intubation. The patients were premeditated with Hydrocortisone 100 mg IV to decrease the incidence of edema due to surgical manipulations, antacid (Zantac 50 mg slowly IV) and antiemetic (Ondansetrone 8 mg IV) 20 min before intubation.

Standard monitors included pulse oximeter, non-invasive blood pressure and electrocardiogram (ECG) was fixed to all patients. The base line measurements of O2 saturation, systolic blood pressure (SPB) and heart rate (HR) were recorded. Then the patients were prepared for awake intubation by doing the peripheral nerve blocks.

The patient was positioned supine with the head and neck in the neutral position. The procedure was started by giving the patient gauze soaked with 2% lidocain + epinephrine (1:200.000) to put it in the oral cavity for 15 min and the patient was asked to suckle the local anesthetic solution [9].

The next step was blocking of bilateral superior laryngeal nerve by locating the hyoid bone and infiltrate 3 ml of 2% lidocain 1 cm below each greater horn through painless needle 2.5 cm syringe. The last step was transtracheal block; it was performed by identifying and penetrating the cricothyroid membrane while the neck is extended, after aspiration of air, 4 ml of 2% lidocain was injected into the trachea at the end of expiration. A deep inhalation and cough immediately following injection distributes the anesthetic throughout the trachea. All patients breathed 100% oxygen via a facemask at any interval of airway manipulation.

After performing the blocks, the patients were randomly divided into two groups (20 patients in each group). The randomization was performed using computer generated random numbers in sealed envelopes before start of anesthesia:

Group FO; The intubation was done with flexible fibro-optic bronchoscope (KARL STORZ size 3.5 mm). The patient asked to put the (ovassapian) airway in between teeth on the side of the mouth and then advance the bronchoscope until the epiglottis and vocal cords were seen then proceed underneath the vocal cords until the carina was seen, advance the *Rusch* endotracheal tube size 5.5–6.0 over the fibro-optic scope then remove the scope carefully under vision.

Table 1 Patient's reaction using modified six point scale [7].

1	No reaction	No change
2	Slight reaction	A single change in the facial expressions
3	Moderate reaction	Grimacing facial expressions
4	Severe reaction	Severe facial grimace but retained ability to follow verbal command and no reflex head movements
5	Very severe reaction	Severe facial grimace associated with head movements, but still able to obey verbal command
6	Uncooperative	Severe facial grimace associated with protective head and limb movements hindering the procedure and inability to obey any verbal command

Group RL; the intubation was done using the rigid laryngoscope (Flexicare) and the *Rusch* endotracheal tube size 5.5–6.0 with stylet was advanced in between the vocal cords.

The capnography was fixed after intubation and then induction of general anesthesia was started by using 1–2 mg/kg propofol, 2 μg/kg fentanyl and atracurium 0.5 mg/kg initially then incremental dose of 0.1 mg/kg every 20 min then maintained with isoflurane 1.5% inspired concentration in 100% oxygen.

After surgery the isofurane was discontinuated and the muscle relaxant was antagonized with neostigmin 0.05 mg/kg and atropine 0.02 mg/kg. The patient was extubated full awake and then transferred to the recovery room.

The procedure was done by two anesthetists, one highly trained anesthetist for performing the blocks and intubations, and the other for observation and data collection. Oxygen saturation and hemodynamic data (HR, SBP) were recorded just before the blocks and then every minute until tracheal intubation was achieved and thereafter for 5 min. Then, it was measured every 5 min until the end of surgery and in the recovery room.

The measuring data were; time to perform the blocks, the time of intubation by fibro-optic bronchoscope or direct laryngoscope was also measured (it was defined as the time from initial insertion of the bronchoscope to start of ventilation through the endotracheal tube and were measured using a stopwatch). The incidence of failure of intubation, number of intubation attempts and complications related to intubation procedure were recorded. The observatory anesthetist scored patients reaction using modified six point scale (Table 1) [7].

After 24 h of surgery, the researcher had short interview with the patients to establish how acceptable the procedure was to the patients and detect any postoperative side effects.

2.1. Statistical analysis

Obtained data were presented as mean ± SD, ranges, numbers and percentages as appropriate. Nominal variables were analyzed using Chi-squared (χ^2) test. Continuous variables were analyzed using unpaired Student's *t*-test or Univariate two-group repeated measures "mixed-design" analysis of variance (ANOVA) with post hoc Dunnett's test as appropriate. Nominal and non-normally distributed variables were analyzed using Mann-Whitney U test. Statistical calculations were performed using Microsoft® Office Excel 2010 and SPSS (Version 20, 2011). P value < 0.05 was considered statistically significant.

3. Results

All demographic data for patients included in this study were presented in (Table 2), variables such as age, sex, weight, height and duration of surgery were similar between the two groups.

The time to perform the block (s) in both groups was statistically insignificant as shown in Table 3, while the time of intubation was statistically significantly higher in fibro-optic group

Table 2 Demographic data.

	Group FO $N = 20$	Group RL $N = 20$
Age (yr)	52 ± 11.3	50 ± 9.6
Sex (M/F)	13/7	14/6
Weight (kg)	78 ± 6.7	75 ± 8.4
Height (cm)	163 ± 7.2	161 ± 9.3

Data is represents as mean ± SD. Number of patients (n) = 20 in each group.

Table 3 Technical measures.

	Group FO $N = 20$	Group RL $N = 20$
Time to perform the block (s)	124 ± 29.5	121 ± 33.4
Time of intubation (s)	92 ± 34.3*	35 ± 5.5
Duration of surgery (min)	43 ± 10.7	45 ± 12.5
Patients need 2nd intubation attempts	6*	2
Incidence of failure (%)	2 (10%)*	0%
After 24 h;		
– Patient acceptance to the procedure (% of patients)	85%	65%

Data is represents as mean ± SD. Number of patients (n) = 20 in each group.
$P < 0.05$ is considered statistically significant.
* Significant difference from the other group.

Table 4 Modified six point scale.

		Group FO $N = 20$	Group RL $N = 20$
1	No reaction	4 (20%)	0
2	Slight reaction	13 (65%)	5 (25%)
3	Moderate reaction	3 (15%)	8 (40%)
4	Severe reaction	0	7 (35%)
5	Very severe reaction	0	0
6	Uncooperative	0	0

N = number of patients. Data were expressed by number and percent of the patients.

(group FO) (92 ± 34 s) than rigid laryngoscope group (group RL) (35 ± 5 s).

There were two patients in group RL needed 2nd intubation attempt for better visualization of the view but there were six patients in group FO needed 2nd intubation attempt for suction of secretion and blood (Table 3). There were two patients failed to be intubated by fibro-optic laryngoscope and they were intubated by rigid laryngoscope for better vision of the vocal cords.

According to modified six point scale, the patients ranged from1 to 3 in group FO while they ranged between 2 and 4 in group RL. The patients never exceed 4 in both groups. (Table 4)

During the meeting with the patients after 24 h after surgery 85% of patients (17 patients) in group FO was satisfied with the procedure and may choose it again if they need the same kind of surgery, while 35% of patients (seven patients) in group RL preferred other procedure if possible (Table 3).

Fig. 1 represents the changes in O2 saturation at the baseline and during the first 5 min of intubation time. Figs. 2 and 3 represents the hemodynamic changes at the base line and in the first 5 min during intubation. The HR and SBP were statistically significantly higher in both groups during intubation time than gradually return to the baseline after that.

4. Discussion

Anesthesia for microlaryngeal surgery created many obstacles for the anesthesiologist and otolaryngologist. Evaluation of the location, size, extent, and mobility of any lesion is required as well as the airway patency must also be investigated [8].

An awake intubation requires a combination of adequate anesthesia of all the structures that will be encountered. The

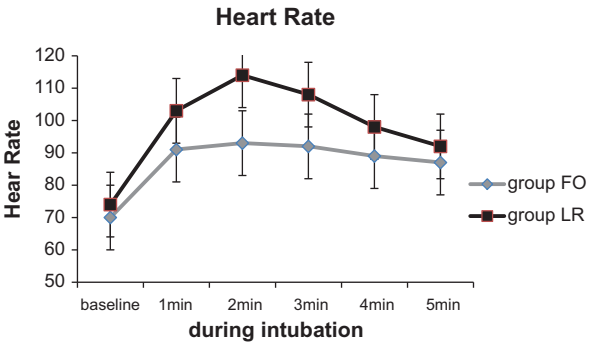

Figure 2 Heart rate.

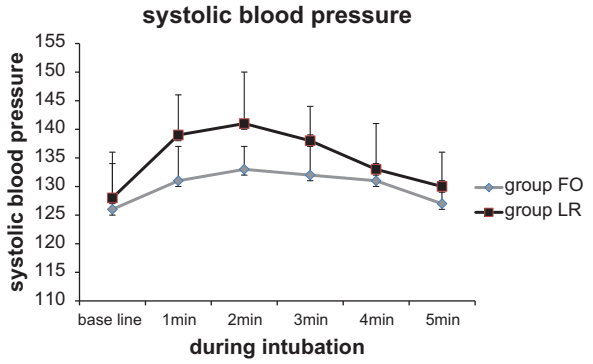

Figure 3 Systolic blood pressure.

specific nerve blocks are an excellent way to accomplish efficacious anesthesia for awake intubation [9]. Intubation of the vocal cords in cases with disturbed anatomy by large epiglottic or supraglottic mass need especial equipments so they were excluded from this study.

In this study, the comparison between intubation with direct rigid laryngoscope (RL) and flexible fibrooptic bronchoscope (FO) showed that the FO was longer in intubation time with more attempts of intubation but also more comfortable to the patients. While both of them increase the HR and SBP at the time of intubation in awake patients which gradually returned to normal after the patients want to sleep with general anesthesia.

As regard the time of intubation in this study, it was faster in group RL (35 ± 5) sec with no failure rate due to use of the small size tube with ID 5 or 6 with rigid stylet. While in FO

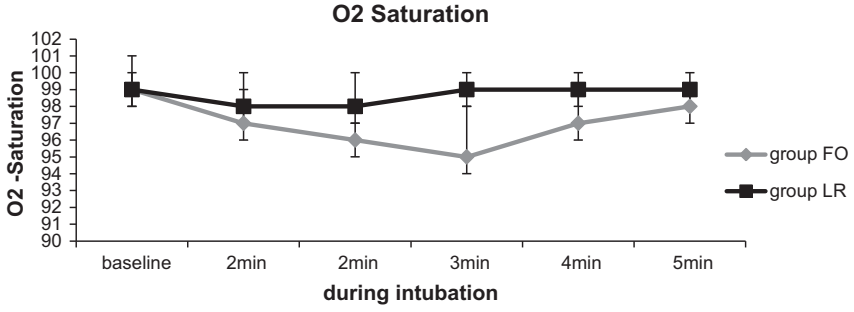

Figure 1 O2 saturation.

group the time of intubation was (92 ± 34) s. This can be explained by fine manipulation of FO due to insertion of the protective airway and the slow insertion of the flexible fibro-optic laryngoscope until viewing of the vocal cords and then the tube was inserted by using the shaft of the flexible FO as a stylet. Sometimes the tube could not be inserted and need rotation to pass through the vocal cord.

During this study, six patients in FO group need second attempts of intubation due to mucous or blood which obstruct the view and need washing the lens. It was impossible in two patients to continue with fibro-optic laryngoscope, in one case due to bleeding so we needed to use the rigid laryngoscope for better visualization and suction from the oral cavity to view the vocal cords. And in the other case it was difficult to thread the tube over the flexible bronchoscope and we need rigid laryngoscope and tube with hard stylet to overcome the obstruction by supraglottic polyp.

These results was similar to Johannes et al. [10] study which suggested that visual estimation of the severity of an airway obstruction may be difficult with fibro-optic bronchoscope due to augmentation of the structures by the lens of the bronchoscope. The structure appears larger than real size and it is not possible to visualize outside of the tube during intubation. In contrast, during direct rigid laryngoscope, it is easier to estimate if the tip of the tube can pass the obstruction due to the wide field of vision [10].

Meanwhile Wulf et al. [11] found that although, awake fibro-optic intubation was the gold standard for several patients with difficult airway; it had its limitation, due to loss of vision due to bleeding, mucous, tumor size or severe upper airway narrowing [11]. Previous studies' findings could explain the higher failure rate and second attempts in FO group in the current study when compared to RL group.

The modified six point scale during this study ranged between no reactions to slight reaction in FO group which was more comfortable to the patients due to small size of the insertion cord diameter (3.1 mm) of the flexible fibro-optic bronchoscope. Seventeen patients (85%) accepted the same technique to be used if they had ever needed the same kind of surgery when they were asked 24 h postoperatively versus only thirteen patients (65%) who accepted the rough RL manipulation in spite of good local anesthetic blocks in the oral cavity and laryngeal area in both groups.

Those finding was similar to Lechtzin et al. [12] who found that the mean patient complaints include sensation of passage of the instrument through the nose and larynx, pain and coughing [12]. Sethi et al. suggested that the patient's tolerance and the success of fibro-optic assisted intubation depend on the effectiveness of topical anesthesia and blocking of pharyngeal, laryngeal and trachea-bronchial reflexes [13].

Xue et al. [7] detected patient's reaction to awake FO using the spray as you go technique of the topical anesthesia 2% and 4% lidocaine solution and they found that all patients tolerated awake fibro-optic intubation. These finding corresponds to the patient's reaction in the current study in FO group.

Using the nasal route of intubation rather than the oral rout provides a straighter passage of the fiberscope but increases the risk of epistaxis [14]. The oral route was used during this study to avoid bleeding which interfere with the good vision of the vocal cord especially in presence of laryngeal mass.

HR and BL.P may give an indirect indication of the stress or discomfort of the procedure [15]. During the current study the HR and SBP increased gradually with each stage in the airway manipulations process. But they recovered rapidly to the baseline values after intubation. These slight cardiovascular responses may be due to tracheal stimulation caused by insertion of the rigid laryngoscope or flexible FO or due to patients' alerts or afraid.

These results were similar to Xue et al. [16], which compared the changes of HR and blood pressure in 100 patients who were randomly allocated into two groups; fibro-optic bronchoscope and direct laryngoscope intubation and he found that naso-tracheal intubation was accompanied by significant increases in BL.P and HR compared to baseline in both groups. They also found that fibro-optic naso-tracheal intubation may lead to more severe presser response and tachycardia than direct laryngoscope [16]. But during this study the elevation of the HR and SBP was less in FO group than the RL group at the time at intubation due to oral passage of the flexible FO scope which more comfortable to the patients.

This study was done on small non-bloody mass or polyp with low risk of obstruction. Further investigation was needed to assess the possibility of using the same techniques in the large masses.

5. Conclusion

This study assessed the best technique for awake intubation in patients with laryngeal mass scheduled for DL with microlaryngosurgery. The study suggested that the flexible fibro-optic bronchoscope was very comfortable to the patients and less traumatic but it took longer time and had a higher incidence of 2nd attempt and failure rate. Accordingly, we recommend the use of flexible fibro-optic bronchoscope in expected small size and non-bloody mass with prepared rigid laryngoscope and tube with stylet to be ready to use if needed.

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