GLIDESCOPE® VIDEOLARYNGOSCOPE VERSUS FLEXIBLE FIBEROPTIC BRONCHOSCOPE FOR AWAKE INTUBATION OF MORBIDLY OBESE PATIENT WITH PREDICTED DIFFICULT INTUBATION

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Abstract

Background: Awake fiberoptic intubation is the gold standard for management of predicted difficult intubation. The purpose of this study was to test whether Glide Scope video laryngoscopy (GVL) will provide significant advantages over fiberoptic bronchoscopy (FOB) for awake intubation in morbidly obese patients with predicted difficult intubation. We therefore tested the hypothesis that intubation using GVL is faster than intubation with FOB.

Methods: 64 morbidly obese patients with predicted difficult intubation undergoing laparoscopic bariatric surgery were enrolled in this study. Patients were randomly assigned to receive awake oral intubation by either GVL or FOB. After airway topical anesthesia and sedation using target controlled remifentanil infusion to a Ramsay sedation scale of 3, wee compared the two devices for time to intubate, successful intubation on first attempt, glottic view using Cormack and Lehane score system, response of the patient to scope, patients satisfaction and incidence of postoperative sore throat and hoarseness.

Results: Intubation time was 84±37.9 seconds and 73.6±31.1 seconds for FOB and GVL respectively. 75% of patients were successfully intubated on the first attempt with FOB compared to 80.6% with GVL. Grade I/II glottic view was reported with GVL in 96.7% of patients compared to 100% with FOB. The highest target concentration of remifentanil to maintain patients sedated during intubation was 2.4±0.6 ng/ml and 2.2±0.8 ng/ml in FOB and GVL respectively. No significant differences regarding maximum patient response to intubation, adverse effects or patient satisfaction were recorded between groups.

Conclusion: GVL can be used as a useful alternative to FOB in morbidly obese patients with predicted difficult intubation.

Keywords: Fiberoptic bronchoscope, Glidescope, Morbid obesity, Difficult airway, Awake intubation.

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Introduction

Anesthesia in obese patients is associated with difficult mask ventilation, rapid desaturation, and difficult intubation[1,2]. Practice guidelines for management of the difficult airway reported by the American Society of Anesthesiologists (ASA) advise that 'multiple airway features should be assessed'[3]. EL-Ganzori simplified risk index (EGRI) combines and stratifies seven variables derived from parameters and observations individually associated with difficult intubation, a score more than 4 has been used as the definition of difficult intubation in different populations[4].

In spite of the development of numerous airway devices in the past two decades, a recent British survey concluded that difficulty with tracheal intubation is the most common complication during anesthesia[5].

Fiberoptic bronchoscope (FOB) - assisted tracheal intubation, a commonly utilized method to perform awake tracheal intubations, has limitations. FOBs are expensive, and their proper use requires extensive training and practice. The presence of edema, excess airway tissue, secretions, or blood in the pharynx or larynx makes FOB assisted intubation of the trachea difficult, or even impossible[6].

The GlideScope® videolaryngoscope (GVL) has been in clinical use since 2003[7]. It has been shown to facilitate tracheal intubation by means of improving laryngeal view in several studies covering a wide spectrum of general surgical patients[7,8]. Furthermore, it has been proven superior to direct laryngoscopy in patients with predicted difficult intubation[9,10].

The aim of the present study is to compare the efficacy of awake tracheal intubation by GVL to FOB in morbidly obese patients with predicted difficult intubation scheduled for laparoscopic bariatric surgery.

Methods

Patient selection and randomization

The study was approved from the human research committee (Security Force hospital, Riyadh, KSA) and written informed consent was obtained from all subjects prior to inclusion. Over one year, 64 patients undergoing laparoscopic bariatric surgery were enrolled in this prospective clinical trial.

Patients were allocated into two equal groups for awake intubation with either FOB (Olympus medical systems COROP, Tokyo-Japan; 4.9 mm diameter) (FOB group) or GVL (Veraton Medical Inc, Burnaby, BC, Canada) (GVL group) according to computer generated randomization technique. It was not possible for patients, investigators, or care providers to be blinded for treatment groups.

Inclusion criteria were a body mass index (BMI) over 40 kg/m^2 and a potentially difficult airway as defined by El-Ganzori risk index (EGRI) score > 4[4].

Exclusion criteria were age younger than 18 years or more than 60 years, ASA physical status of greater than four, severe mental disorder (psychotic or considered incapable of understanding the information), mouth opening less than 15mm, poor dental status, contraindications to any of the drugs used in the study or patient refusal.

Anesthesia and sedation

All patients were premedicated with glycopyrrolate 4-5µg/kg (maximum dose 0.4mg) 15minutes before the procedure. The patient was taken to the OR, monitored using ECG, non-invasive blood pressure and pulse oximetry.

Topical anesthesia was applied using 5 mL of 2% lidocaine nebulized through a mouthpiece with oxygen at 8 l/minute given over 5 minutes, followed by 5 puffs of lidocaine 10% metered spray (10 mg per puff) applied directly on the mucosa of the oropharynx and fauces. The sufficiency of the pharyngeal and laryngeal analgesia was evaluated by the patients' acceptance of an oral airway placed 1-2 minutes before an attempt of intubation.

In FOB group the airway anesthesia was supplemented by 2 injections of 3 mL of lidocaine 2% through the fiberscope channel: one directly on the glottis and one below the vocal cords. While in the GVL group, once a good view of the glottis was obtained, additional 3ml of lidocaine 2% was

administered under direct vision, using a MADgic® atomizer (Wolfe Tory Medical, Salt Lake City, UT, USA). A maximum dose of 5 mg/kg lidocaine was allowed to avoid toxic reactions.

The patient was placed in the sniffing position, head elevated by a ramp positioned under the shoulders, and O2 was given through a nasal catheter at 4 l/min.

Remifentanil was administered using target-controlled infusions (TCI) (Orchestra® Base Primea, Fresenius Kabi, Brezins, France) with the Minto pharmacokinetic model [12] which adjusts for age, weight, and sex. Ramsay sedation scale (RSS) [13] was used to assess the level of sedation of the patient. The target RSS was a score of 3 (responsive to commands only). The initial target concentration for Remifentanil was 1.5 ng/mL and titrated in 0.5 ng/mL increments according to RSS.

The response of the patient to introduction of the scope was graded as follow; 0 = no coughing or gaging, 1 = mild coughing or gaging that did not hinder intubation, 2 = moderate coughing and /or gaging that interfere minimally with intubation, 3 = severe coughing and /or gaging that made intubation difficult. If severe gagging or coughing was observed, the scope was removed and remifentanil titrated upwards and a waiting period of 90 seconds was allowed before reattempting intubation.

Tracheas were intubated with Flex-Tip tracheal tubes (Parker Medical, Highlands Ranch CO, USA) size 7.0 for women and size 7.5 for men. The tube was loaded over FOB in FOB group or fitted over a 60º hockey stick stylet in GVL group.

To minimize the effect of operator inexperience, intubation was performed by one of the two investigators who had more than 100 times successful intubation with either FOB or GVL. Two anesthetists were present during the procedure: one responsible for performing the awake intubation and the other for observation and data collection.

Measurements

The primary end point was the duration of intubation (defined as the time from introduction of the scope till confirmation of correct endotracheal tube placement with three waves end tidal capnography). We also recorded the number of intubation attempts, the best glottic view obtained using the Cormack and Lehane scoring system[14], the response of the patient to intubating device and the lowest saturation registered during the intubation. On the first postoperative day, patients were asked if they had post-operative hoarseness and / or sore throat and patient satisfaction was assessed according to the following score (excellent =1, good =2 and fair = 3).

An intubation attempt was considered unsuccessful if the intubating device was removed from the oral cavity due to coughing, gagging, decrease oxygen saturation or inability to view the vocal cords. After three attempts the procedure was considered a failure, the study protocol was stopped and endotracheal intubation under inhalational induction with FOB without neuromuscular blockade (plan B) is carried out and patients were excluded from the study.

Statistical analysis

Distribution of baseline variables was assessed by the Shapiro-Wilk W tests. Previous study showed intubation time with awake FOB to be 80±59[15]. We calculated the sample size to be 60 patients in order to reach 80 % power at 0.05 level of significance to detect a difference of 45 seconds or greater in intubation time between the two techniques, assuming a standard deviation of 60 seconds. To allow for subject dropout or protocol noncompliance, we planned to enroll at least 64 subjects. By using Statistical program for social science (SPSS) software for Windows, version 11(SPSS Inc, Chicago, IL, USA), arithmetic mean and standard deviation values for different variables were calculated and statistical analyses were performed for each group. Independent sample t-test was used to compare continuous variables exhibiting normal distribution, and Chi-squared or Fisher exact test for non-continuous variables. $P<0.05$ is considered significant.

Results

A total of 64 patients were enrolled in the study. One patient in the GVL group was excluded from the

Table 1

Patient characteristics

	FOB group n=32	GVL group n=31	P-value
Age in years (mean±SD)	37±14	34±13	0.39
Sex (M/F) (n)	12/20	10/21	0.66
Weight in kg (mean±SD)	135.5±29.7	139.3±33.6	0.64
Height in cm (mean±SD)	165.2±12.9	169.4±14.7	0.23
BMI in kg/m2 (mean±SD)	47.3±6.5	49.2±7.1	0.27

Data are presented as mean±SD, number (n) or percent (%).

Table 2

Airway Assessment (EGRI score)

		FOB group n=32		GVL group n=31		P-value
		n	%	n	%	
Mouth opening:						
>4 cm	0	22	68.7%	25	80.6%	0.28
<4 cm	1	10	31.2%	6	19.4%	0.28
Thyromental distance:						
>6.5cm	0	12	37.5%	15	48.3%	0.38
6-6.5cm	1	11	34.3%	9	29.1%	0.65
<6cm	2	9	28.1%	7	22.6%	0.61
Modified Mallampati score:						
1(soft palate, fauces, uvula, and pillars seen)	0	6	18.75%	7	22.6%	0.71
2(soft palate, fauces, and uvula seen)	1	12	37.5%	8	25.8%	0.32
3(soft palate, base of uvula seen)	2	10	31.25%	13	41.9%	0.38
4(soft palate not visible)	2	4	12.5%	3	9.7%	0.72
Neck movement:						
>90Kg	0	22	68.75%	19	61.3%	0.53
80-90Kg	1	8	25%	10	32.2%	0.53
<80Kg	2	2	6.25%	2	6.5%	0.97
Ability to prognath:						
Yes	0	20	62.5%	22	70.97%	0.48
No	1	12	37.5%	9	29.03%	0.48
Body weight:						
<90	0	0	0%	0	0%	
90-110	1	12	37.5%	8	25.8%	0.32
>110	2	20	62.5%	23	74.2%	0.32
History of difficult intubation:						
No	0	22	68.75%	19	61.3%	0.53
Questionable	1	4	12.5%	2	6.5%	0.41
Definite	2	6	18.75%	10	32.2	0.22
Total score of EGRI	(mean±SD)	7.6±3.1		8.1±3.6		0.56

Data are presented as mean±SD, number (n) or percent (%).

Table 3

Time to intubation, number of attempts, laryngeal view, patient response to scope, remifentanil concentration, and complications in both groups.

		FOB group n=32		GVL group n=31		P-value
Intubation time in seconds	(mean±SD)	84±37.9		73.6±31.1		0.24
Number of attempts:	(n)					
First		24	75%	25	80.6%	0.59
Second		6	18.75%	5	16.1	0.78
Third		2	6.25%	1	3.2%	0.57
Cromack and Lehane score:	(n)					
I: entire glottic opening		18	56.25%	17	54.9%	0.91
II: partial view of the glottis, including arytenoids		14	43.75%	13	41.9%	0.88
III: only the epiglottis		0	0%	1	3.2%	0.31
IV: no part of the epiglottis or glottis		0	0%	0	0%	
Patient response to scope	(mean ±SD)	1.48±0.61		1.72± 0.63		0.13
Maximum remifentanil target concentration (ng/ml)	(mean ±SD)	2.4±0.6		2.2±0.8		0.26
Patients with O_2 saturation <90%	(n)	3	12.5%	1	9.67%	0.32
Postoperative hoarseness and /or sore throat	(n)	11	34.375%	13	41.9%	0.54
Patient satisfaction:	(n)					
Excellent		19	59.375%	18	58.07%	0.92
Good		10	31.25%	11	35.48%	0.72
Fair		3	9.375%	2	6.45%	0.67

Values are mean ±SD, number (n) or percent (%).

study due to severe gagging and coughing. After three attempts, this patient was successfully intubated by plan B.

There were no statistically significant differences between the patients' demographics in the two groups [Table 1]. The individual criteria and the total score of EGRI showed no significant difference between the two groups [Table 2].

There was no significant difference between the two groups in terms of intubation time. Intubation success on the first attempt was 75% and 80.6% for FOB and GVL respectively. Using GVL, operators reported a grade I/II glottic view for 30 of 31 (96.7%). For one subject, only a grade III glottic view was obtainable. Using FOB operators reported a grade I/II glottic view for 32 of 32 subjects (100%) with no grade III or IV glottic view (Table 3).

There was no difference between post-operative hoarseness and throat pain exhibited by the patients in the two groups. In three patients in FOB group and one patient in GVL group, oxygen saturation fell below 90%. In both groups, the maximum patient response to scope was similar. The highest target concentration of remifentanil to maintain patients sedated during

intubation was 2.4±0.6 ng/ml and 2.2±0.8ng/ml in FOB and GVL respectively. Patient satisfaction ranged between excellent and good and only three cases in FOB group and two cases in GVL group were recorded fair but no significant difference between groups was recoded [Table 3].

Discussion

This study showed that GVL and FOB are comparable methods for awake intubation of morbidly obese patients with predicted difficult intubation. Only one patient in the GVL group could not be intubated using this technique and was successfully intubated with plan B.

Intubation time was shorter in GVL group, however this was not statistically significant. To our knowledge the two scopes have not been previously compared for awake intubation in morbidly obese patients with predicted difficult intubation. However, one study[16] compared the two scopes with regard to their speed and efficacy in 75 obese patients for elective surgery after induction of general anesthesia and concluded that the intubation time was comparable and intubation required less than one min using either techniques. Xue et al.[17] reported similar results regarding intubation time in their study of 56 patients, although the patients were healthy and not obese.

Rosenstock et al.[15] in a randomized clinical trial showed no significant difference in time to awake intubation by experienced investigators using McGrath video laryngoscope (MVL), compared to FOB in difficult airway patients. Transtracheal injection of lidocaine was used in their study for airway anesthesia. This method carries more potential risk than topical anesthesia used in our study. More importantly, it can be difficult or even impossible to perform if the patient neck anatomy is troublesome to locate. In their study a total of seven patients were excluded because transtracheal injection was impossible.

Moore et al.[18] in a study of 40 morbidly obese patients with suspected difficult intubation for awake intubation using GVL, recorded an intubation time of 201±158 seconds. The longer intubation time may be due to the study design, with each anesthetist providing airway anesthesia and sedation based on their own routine practice.

These results did not support the claim that FOB intubation is a time-consuming technique[19,20]. Although FOB may be considered as a time consuming due to occasionally foggy view which is avoided with the technology of the camera of GVL, There is also a numerous reports for failed or delayed intubation with GVL related to positioning the tube in the trachea despite a good glottis view[10,21].

Intubation success rate on the first attempt was 80.6% and 75% in GVL and FOB respectively with no statistically difference between the two groups. Our choice of a Parker tube could have contributed to the high incidence of first attempts successful intubations with FOB. Brull et al.[22] reported that it can be difficult to advance conventional polyvinylchloride tubes over the FOB in up to 35% of patients undergoing FOB intubation, and others have reported even higher difficulty rates – up to 53%[23]. It is likely that an ordinary tube increases impingement on the laryngeal structures secondary to the gap between the external surface of the FOB and inner surface of the tracheal tube[22]. The use of styletted ETT with GVL increased first pass success rate. Van Zundert et al.[24] reported that using a styletted ETT with the GVL increased first pass success rates in healthy adult patients (from 53% to 76%). Sun et al.[25] found a first pass success rate of 94% when using the GVL with a styletted ETT.

Visualization of the larynx, either directly or indirectly, is the most important procedural step in the process of tracheal intubation. We chose to use the Cormack-Lehane grading score[14] because of its familiarity to most anesthesiologists.

The incidence of O_2 desaturation was not significantly different in the both groups. The lower incidence of desaturation in our study compared to the previous studies[15,26] may be attributed to the use of TCI remifentanil for sedation. TCI allows the user to achieve a chosen predicted concentration rapidly without overshooting[26]. By maintaining stable concentrations over time, TCI allows precise titration of drug in the narrow therapeutic window between agitation and excessive sedation. All patients were cooperative throughout the procedure, and were able to breathe on demand when spontaneous respiratory rate decreased.

The incidence of sore throat was comparable in both groups. This incidence coincides with minor and severe laryngeal trauma previously reported with FOB[23] and GVL[27].

A 2003 survey of anesthesiologist found that only 59% of anesthesiologists reported having skills in fiber-optic tracheal intubation[28] while GVL has proved to be easily learned by inexperienced operators[7,29]. Rai et al.[29] found that two investigators who did not have previous experience with intubation using the GVL, did not fail to intubate after the eighth patient. Therefore, inexperienced users may find awake GVL intubation easier than awake FOB in patients with a difficult airway.

To overcome bias in previous studies, we unify patient selection criteria, sedation technique and airway topical anesthesia. All patients were morbidly obese with predicted difficult intubation based on EGRI that has been used with high sensitivity and specificity. Awake intubation actually include two parts: airway topical anesthesia and subsequent intubation. When adequate airway anesthesia is obtained, subsequent intubation is usually easy.

This study had some limitations. There may have been bias, as it was impossible to blind the anesthesiologist to the device being used. Second, all intubations were performed by experienced anesthesiologists; therefore, results may differ in the hands of less experienced users.

In conclusion, there was no significant difference in time to awake tracheal intubation, number of intubation attempts and glottic view with the GVL compared to FOB in morbidly obese patients with predicted difficult airway. GVL can be used as a useful alternative to FOB in this group of patients.

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