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Research Article

Comparative study of awake endotracheal intubation with Glidescope video laryngoscope versus flexible fiber optic bronchoscope in patients with traumatic cervical spine injury

S.S. Wahba [a,*], T.F. Tammam [b], A.M. Saeed [a]

[a] *Department of Anesthesia and Intensive Care, Faculty of Medicine, Ain-Shams Universities, Egypt*
[b] *Department of Anesthesia and Intensive Care, Faculty of Medicine, Suez-Canal Universities, Egypt*

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KEYWORDS

Glidescope video laryngoscope;
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Cervical spine injury;
Remifentanil;
MILS

Abstract *Background:* The Gldiescope video laryngoscope (GVL) as a recent intubating device has gained much popularity in difficult intubation over the last decade. It can be used as a substitute to flexible fiber optic bronchoscope (FOB) in intubating challenges. The object of this study is to compare the utility of GVL and FOB for intubating time, attempts, effects on hemodynamics, adverse effects, patient satisfaction and post intubation neurological outcome during awake intubation in traumatic cervical spine injury.

Methods: Fifty patients undergoing post traumatic cervical spine fixation under general anesthesia were randomly allocated to two groups in a prospective, controlled non-blinded study. All patients were premedicated with glycopyrrolate 0.2 mg iv and midazolam 1 mg iv that be repeated up to 0.05 mg/kg followed with a bolus dose of remifentanil 1.5 μg/kg then a continuous remifentanil infusion of 0.15 μg/kg/min for 3 min before procedure. Each patient underwent a wake endotracheal intubation with either GVL (G group) or FOB (F group) with manual in line stabilization (MILS). Intubating time, intubating attempts, hear rate (HR), mean arterial pressure (MAP), oxygen desaturation (SO_2 < 90%), sore throat, patient satisfaction and postintubation neurological outcome were recorded.

Results: Intubating time was significantly lower in G group compared with F group (26 ± 5 versus 72 ± 11 respectively), while the percentage of the first successful intubating attempt was insignificantly higher in G group (88%) than in F group (72%). Both HR and MAP were significantly

* Corresponding author. Tel.: +201278560750.
E-mail address: sherifwahba2012@yahoo.com (S.S. Wahba).
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increased only in F group during intubation in comparison with the basal line values. Both devices were safe for post neurological outcome. No significant differences of adverse effects or patient satisfaction were recorded between groups.

Conclusion: The GVL is a safe surrogate for FOB during awake intubation for post traumatic cervical spine fixation.

1. Introduction

Cervical spine injury (CSI) constitutes 2% in all trauma cases and such incidence increases if the Glasgow Coma Scale score is $\leqslant 8$ [1]. Although advanced trauma life support guide lines emphasizes on immobilization of the spine after trauma, all airway interventions can cause cervical spine movement. Securing the airway without cervical spine movement to avoid any neurological catastrophe is always an anesthetic challenge. The use of flexible fiber optic bronchoscope (FOB) in awake endotracheal intubation after cervical spine injury is always preferred [2] since it minimizes the cervical movement and allows a feasible post intubation neurological assessment. Different airway devices have been compared with FOB, none of which guarantees immobility of cervical spine over FOB [3]. However, indirect laryngoscopy with Glidescope video laryngoscope (Saturn Biomedical System, Burnaby, BC, Canada) could be a proper alternative especially under emergent situations as its handling is easier, more convenient to anesthetist and less affected by secretion or blood as same as Macintosh laryngoscopy. The Glidescope video laryngoscope (GVL) usage is growing enormously for difficult airway [4–6] and in patients wearing cervical collar for cervical spine immobilization [7]. Since manual in line stabilization (MILS) is adopted as a standard care in CSI, we postulated that spinal movement could be negligible with a safe neurological outcome during GVL in comparison with FOB. We compared GVL with FOB as regard intubating time, intubating attempts, hemodynamic pressor response, adverse effects (oxygen desaturation, sore throat, and hoarseness of voice) and post intubation neurological outcome.

2. Methods

After approval of our scientific and research committee (AL-Jahra hospital, ministry of health of Kuwait), written informed consent was obtained from 50 ASA I-II patients (ages 26–44) undergoing a selective cervical spine fixation between January 2010 and December 2011. During the preoperative visit the details of procedures to each patient, demographic data recording and careful neurological and airway assessment were carried out by senior anesthetist who has more than 5 years' experience. Patient was excluded if he has body mass index (BMI) $\geqslant 35\ kg/m^2$, obstructive airway disease, cardiovascular disease, apparent airway difficulty or upon patient refusal. All patients were premedicated with glycopyrrolate 0.2 mg iv and midazolam 1 mg iv (and can be repeated up to 0.05 mg/kg) 15 min before the procedure and after giving 500 ml of lactated ringer solution 2 h earlier. All patients received standard clinical care monitoring including three lead ECG, noninvasive arterial blood pressure measurement and pulse oximeter. Patient administered oxygen 6 L/min through nasal prong. Patients were allocated into two equal groups (25 patients per group) for awake intubation with either FOB (F group) or GVL (G group) according to computer generated randomization technique. Each patient received nebulization with 5 ml of lidocaine 1% for 5 min followed by topicalization of soft palate and fauces with 5 puffs of lidocaine spray (10 mg/spray) immediately before the technique of endotracheal intubation (ID 6.5 mm for female and 7 mm in male, armored tube). For each patient in G group a cuffed endotracheal tube was made fitted over a 60° hockey stick stylet as advised by the manufacture. The blade of GVL or a William airway (Sun Med, Largo, FL, USA); in case of FOB (Olympus medical systems COROP, Tokyo-Japan; 4.9 mm diameter); were lubricated with a thin film of 2% lidocaine gel at both anterior and posterior wall. Before airway manipulation each patient received a bolus dose of remifentanil 1 μg/kg over 30 s followed by a continuous infusion of 0.15 μg/kg/min for 3 min before the technique and until successful awake intubation. Primary end points were intubating time (defined as the time from introduction of the scope till confirmation of correct endotracheal tube placement with three waves endtidal capnography) and intubating attempts per each patient (recorded by dedicated technician). Secondary end points include heart rate (HR), mean arterial blood pressure (MAP) and post intubation neurological assessment. Tertiary end points include oxygen desaturation (SPO2 < 90%), upper airway discomfort (sore throat and hoarseness of voice) and patient satisfaction (score; excellent = 1, good = 2 and fair = 3). During the procedure Philadelphia cervical collar was removed and MILS of cervical spine was carried out by trained assistant (senior registrar anesthetist, 5 years' experience). After successful intubation (by consultant anesthesia who had more than 100 times successful intubation with either FOB or GVL) and neurological assessment (by spinal surgeon), general anesthesia was induced with propofol 1.5 mg/kg, cisatracurium 0.1 mg/kg and remifentanil 0.5 μg/kg. Hypotension (decreased in MAP $\geqslant$ 20% of base line) was treated with ephedrine bolus 5–10 mg and 250 ml of lactated ringer solution. Only three attempts were permitted per each patient and if failed plan B was to carry out endotracheal intubation under inhalational induction with FOB without neuromuscular blockade and to exclude patients from the study. Attempt was held if O_2 saturation decreased below 90%. Nine patients in F group and 10 patients in G group were known to have motor power weakness of both upper and lower limbs.

3. Statistical analysis

EPI-INFO program was used for sample size calculation by using intubating time as the primary outcome of this study. The α-error level was fixed at 0.05 and power was set at 80% while the expected change to be detected was 10%. Analysis of data was done by IBM computer using SPSS (statistical program for social science version 12). Description

of quantitative variables is expressed as mean, SD and range while description of qualitative variables are expressed as number and percentage. Chi-square test was used to compare qualitative variables between groups. Fisher exact test was used instead of chi-square when one expected cell less than or equal 5. Unpaired *t*-test was to compare quantitative variables, in parametric data (SD < 50%mean).

P value > 0.05 is insignificant.

P < 0.05 is significant.

4. Results

All patients completed the study and had successful awake intubation. There were no statistically significant differences between the two groups as regard age, weight, BMI, and sex as shown in Table 1. Intubating time was significantly lower in G group than in F group (26 ± 5 versus 72 ± 11) while intubating success rate was higher in G group than in F group (88% versus 72%) but without significant difference between groups as shown in Table 2. Successful rate of 1st attempt was insignificantly higher in G group (88%) in comparison with F group (72%). Three patients in G group were intubated from 2nd attempt while in F group four patients intubated from 2nd attempt and three patients intubated from 3rd attempt because of lack of patient cooperation and cough reflex which necessitates increasing depth of sedation, as shown in Table 2. Both groups showed non-significant decrease in both HR (64 ± 5.4 versus 63 ± 3.9 beat/min) and MAP (77 ± 6.7 versus 76 ± 4.6 mmHg) for F and G group respectively after starting remifentanil infusion but during the technique immediately after intubation both HR and MAP were significantly increased in F group (83 ± 11 beat/min and 92 ± 7.6 mmHg) than in G group (72 ± 6.3 beat/min and 83 ± 7 mmHg) in comparison with the basal line values as shown in Tables 3 and 4. Two cases in F group had an episode of oxygen desaturation (SO_2 < 90%) because of plenty secretion but without significant difference between groups and the incidence of sore throat was higher in F group (16%) than in G group (8%) but without significant difference as shown in Table 5. Patient satisfaction ranged between excellent and good and only four cases in F group and two cases in G group were recorded fair but no significant difference between groups were recoded as shown in Table 5. No change in post intubation assessment was recorded in either group.

Table 1 Characteristics of patients.

Variables	F group (*N* = 25)	G group (*N* = 25)	*P*
Age (yr)	34 ± 7.6	37 ± 6.5	>0.05
Weight (kg)	83 ± 7.3	84 ± 9.5	>0.05
Height (cm)	176.7 ± 13	179 ± 8.5	>0.05
BMI (kg/m^2)	29 ± 3	26.9 ± 4.7	>0.05
Male/female	20/5	21/4	>0.05

Table 2 Comparison between the two groups as regard intubating time and frequency of attempt.

Variable	F group (*n* = 25)	G group (*n* = 25)	*P*
Intubating time (s)	72 ± 11	26 ± 5	<0.05
Intubating attempts			
First	18 (72%)	22 (88%)	>0.05
Second	4 (16%)	3 (12%)	
Third	3 (12%)	0 (0%)	

Table 3 Comparison between the two groups as regard HR.

HR (beat/min)	F group (*n* = 25)	G group (*n* = 25)	*P*
Basal	74 ± 13.4	71 ± 10.5	>0.05
After remifentanil	64 ± 5.4	63 ± 3.9	>0.05
Immediately after intubation	83 ± 11	72 ± 6.3	<0.05

Table 4 Comparison between the two groups as regard MAP.

MAP (mmHg)	F group (*n* = 25)	G group (*n* = 25)	*P*
Basal	83 ± 7	85 ± 5.4	>0.05
After remifentanil	77 ± 6.7	76 ± 4.6	>0.05
Immediately after intubation	92 ± 7.6	83 ± 7	<0.05

Table 5 Comparison of the two groups as regard SPO2, sore throat and patient satisfaction. Data are expressed as number (%).

Variale	F group (*n* = 25)	G group (*n* = 25)	*P*
SO_2 < 90%	2 (8)	0 (0)	>0.05
Sore throat	4(16)	2 (8)	>0.05
Patient satisfaction			
Excellent	16 (64)	18 (72)	>0.05
Good	5 (20)	5 (20)	>0.05
Fair	4 (16)	2 (8)	>0.05

5. Discussion

This study shows that the intubating time was shorter and the success rate of endotracheal intubation at 1st attempt was higher with GVL than FOB. Both devices were safe during awake intubation for patient with CSI with regard to post intubation neurological assessment. The advantage of minimal cervical movement during tracheal intubation with FOB had made the anesthetist always avid for its use. However, there are few reports debating its role in emergency management of the airway after trauma [8]. Moreover, it has been previously reported that the introduction of FOB required some degree of jaw thrust [9,10] which had been shown to cause cervical spine movement as well as during conventional laryngoscopy [11–13]. This changed our opinion to assess other devices more familial to anesthetist for traumatic cervical spine awake intubation. The blade of GVL is similar to Macintosh blade and the technique almost like direct laryngoscopy. Our results are convenient with that of Lim et al. who reported similar results in intubating time with GVL and successful intubation in simulated easy and difficult laryngoscopy [14]. Two recent studies did not support our claim that FOB is frequently, time consuming [15,16]. This time consumption is obviously crucial and annoying to patient. Part of this time

consumption is attributed to the quite cautiousness in performing the technique and occasionally the foggy view with FOB which is avoided in the technology of the camera of GVL besides its easy handling. In this study the hemodynamic stress response to endotracheal intubation was higher with FOB than with GVL. In contrast to our findings, Xue et al. reported no difference between both devices on hemodynamics [17]. The longer intubating time with FOB could explain the pressor response of endotracheal intubation on hemodynamics. The incidence of sore throat was higher in F group than G group. This incidence coincides with minor and severe laryngeal trauma previously reported with FOB [18,19] and GVL [20,21]. It is likely that tube impingement at laryngeal structure during FOB intubation attributed to difference in diameters between FOB and endotracheal tube rather than presence of William airway which was not approaching the oropharynx. The disadvantage of blind push of endotracheal tube with FOB is avoided with GVL since the latter allows full glottis visualization. Neither technique was superior to the other with respect patient satisfaction. This study has three limitations. First, the extent of cervical spine movement was not monitored during the procedure. Second, the potential for bias exists as it is obvious for anesthetist which device in his hand. Third, is that in GVL technique is similar to conventional laryngoscopy which is always mastered by anesthetist. Fourth, although removal of William airway prolonged intubating time in F group, it also hastened intubation so that its bias was almost negligible. In summary, GVL is as safe as FOB for awake endotracheal intubation in patients with traumatic CSI. The GVL was superior to FOB from intubating time, intubating attempt, hemodynamic press response to endotracheal intubation and less incidence of sore throat.

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