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Research article

GlideScope versus McCoy laryngoscope: Intubation profile for cervically unstable patients in critical care setting

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ABSTRACT

Background: Endotracheal intubation for cervically unstable patients remains a challenging procedure. We compared the utility of a relatively new promising airway tool "GlideScope" (GL) with the routinely used McCoy laryngoscope in our critical care unit.
Methods: Forty intubated patients with suspected or proved cervical spine injury who were scheduled for replacing a conventional endotracheal tube (ETT) by ETT with subglottic suction facility were enrolled in this randomized controlled trial. Patients were randomly intubated using either GL "G group" or McCoy laryngoscope "M group". The first attempt was performed by anesthetic residents inexperienced in using both scopes. In case of failure, a second attempt was done by a consultant anesthetist using these tools masterly. If these two attempts failed to intubate the trachea, a third one was attempted using a fiberoscope by the same consultant anesthetist. We compared the intubation profiles of both scopes.
Results: There was a higher success rate of primary intubation attempts among the G group population (85% versus 55% in the M group "P value 0.03"). Moreover, all secondary intubation attempts succeeded in intubating the trachea. The mean time for primary intubation attempts was statistically longer in the M group (27.6 ± 2.7 S versus 19.8 ± 5.2 S in the G group "P value < 0.001"). However, there was no statistical difference as regards the mean time of intubation among the study population during the secondary intubation attempts. The Cormack and Lehane score and the percentage of required optimization maneuvers were significantly higher in the M group for both attempts.
Conclusion: In critical care setting, GL is an excellent primary intubating tool for patients with potential cervical spine instability even if being performed by inexperienced users.

1. Introduction

Endotracheal intubation is frequently indicated among critically ill patients with cervical instability [1]. Cervical spine motion has been reported during this procedure [2]. Therefore, cervical immobilization while avoiding head extension and neck flexion is essential to prevent cord injury in those patients [3]. Unfortunately, this immobilization leads to poor laryngeal view and difficulty in intubation [4].

Awake fiberoptic intubation is the gold standard intubation technique for cervically unstable patients; however it is time consuming in this time pressure scenario. Moreover, it requires an excellent psychomotor skills and manual dexterity [5], it also requires patient cooperation and limited by the presence of blood, secretions, and vomitus in the airway [6]. This directed several investigators to extensively study the efficacy of alternative devices [7]. However, with the exception of the Airtraq, there was uncertainty of the usefulness of these alternatives [8]. On the other hand, GL has been characterized by easy manipulation, reduced time of intubation [9], optimized intubating conditions [10], and limited cervical spine movement [11]. In our critical care unit, McCoy laryngoscope has been used with the aid of a gum elastic bougie for intubating those populations.

We primarily hypothesized that for cervically unstable patients, more successful intubation attempts could be achieved using GL compared to McCOY laryngoscope when performed by anesthetists with limited experience in their use. Our secondary goals were to compare both scopes in terms of easiness of intubation and intubation time for experienced and inexperienced intubators.

2. Patient and methods

This randomized controlled study was conducted after approval from the local institutional review board. We recruited 40

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intubated patients with potential or actual cervical instability in a 25 beds Emergency ICU Zagazig university hospital from the beginning of November 2014 to the end of October 2015. As a part of the ventilator associated pneumonia care bundle implementation program, a PVC ETTs (Well lead Med Company LT) were extubated from the tracheas of these patients, and then ETTs with subglotic suction (Mallinckrod™ taperGuard™ covidien™ ETT) were inserted. We excluded patients with limited inter-incisor distance (less than 2.5 cm) from the study. Patients whom SPO2 less than 95% in spite of 100% O2 prior to scope manipulation and patients with any predictors of difficult intubation rather than limited cervical mobility were also excluded from the study.

Patients were randomly allocated into two equal groups (20 patients per group). In the first group, patients were intubated using GL "Verathon Medical Inc., Bothel, WA, USA" (G group), while those in the second group were intubated using McCoy laryngoscope (Maxlite, Flextip F.O, Invo Tech Excel Fzco, Dubai) (M group). The allocation sequence was generated by random number tables, and the sequence concealed in sealed envelopes.

Primary intubation attempts were done by anesthetic residents who were one year anesthetic experience and had no experience with both scopes. Those primary intuabtors attended two 30-min orientations included a video presentation of both scopes, and performed at least two successful intubation on an airway manikin before starting the study. Secondary intubation attempts were carried out by the same consultant anesthetist who was experienced in both intubation techniques "performed more than 30 intubations with each device".

A pre-intubation protocol was followed; enteral nutrition stopped 6 h before intubation if has been already started. Fractional inspired concentration was increased to 100% 5 min prior to intubation procedure. Fluid bolus (500 cc Ringer's lactate) and vasopressor (Dopamine with a starting of 5 uq/kg/min) if systolic blood pressure is <90 mmHg with a target to keep systolic blood pressure above 90 mmHg. The tube feeding was removed and then the oropharynx was suctioned carefully. After that, cervical collar was removed, and manual in line stabilization of cervical spine was carried out by a trained high nurse by holding the sides of the neck and the mastoid processes, thus preventing flexion/extension or rotational movement of the head and neck.

Beside the usual sedation protocol, Atropine 0.5 mg, Ketamine 2 mg/kg, and Esmeron 1 mg/kg were administered. When the train of four was zero at the ulnar nerve, the study scope was inserted immediately after removal of the PVC ETT and a (8.0 mm internal diameter for men and 7.0 mm for women) TaperGuard ETT was inserted with a possible aid of two adjustment maneuvers. The first is the Frova intubating catheter(William Cook Europe Ltd). The second is the external laryngeal manipulation with Backward, Upward, Rightward Pressure (BURP maneuver). For patients in G group if Frova intubating catheter was not, the TaperGuard was loaded over a 60 hockey stick styllet as advised by the manufacture.

The primary end point was the first attempt success rate for both scopes. Secondary end points included the modified Cormack-Lehane grade, duration of intubation attempts, the percentage of using the adjustment maneuvers, and traumatic airway complications encountered during the procedure. Intubation time (defined as the time from introduction of the scope into the oropharynx till confirmation of correct placement with three end tidal capnographic waves). Traumatic airway complications included lip, dental, or mucosal injuries (mucosal injuries defined as the presence of blood on the devices following intubation in a previously normal mucosa).

Tracheal intubation attempt was considered to be failed if lasted more than 30 s, If there was uncertainty about ETT placement, if there was an esophageal intubation, or if there was hypoxemia (SPO2 less than 90%). In the case of failed primary intubation attempt, a second tracheal intubation attempt was done by the anesthetic consultant using the same scope. If the anesthetic consultant failed to intubate the trachea, a third attempt was performed by the same consultant using a fiberoptic bronchoscope. Before the second and third attempts, bag valve mask ventilation with a reservoir was initiated to ensure an oxygen saturation of 95% or more on oximetry.

An unblinded high nurse was responsible for data collection. At the end of each intubation attempt, each intubator scored the degree of difficulty of use of each device on a visual analogue scale (from 0 = very easy to 10 = very difficult).

2.1. Statistical analysis

Before carrying out statistical inferential tests, variables were tested for normal distribution. Normal distribution was assumed based on graphical presentation of bar charts and values of skewness and kurtosis – according to descriptive data feature in SPSS program – between (+1) and (−1) for all variables. All the data collected was fed into Statistical Package for Social Sciences (SPSS version 19). Data were compared by using the *t*-test and expressed as mean ± standard deviation (Mean ± SD). Comparison of percentages was performed using the Fisher exact method. P-value of <0.05 was considered as significant, and P < 0.001 is highly significant.

3. Results

Patient's characteristics, hemodynamics, and SPO2 before intubation process were similar in both groups (Table 1).

As regards the primary intubation attempts, mean time of intubation was significantly shorter for patients intubated with GlideScope (19.8 ± 5.2) versus those intubated with McCoy laryngoscope (27.6 ± 2.7) (p < 0.001). The tracheas of 17patients (85%) in the G group versus 11 Patients (55%) in the M group were intubated which was statistically significant (P < 0.001). The mean Cormack-Lehane score was significantly lower in the G group (1.3 ± 0.47 versus 2.45 ± 0.82 in the M group) (p < 0.001). The percentage of adjustment maneuvers required were significantly higher when laryngoscopy was performed by the McCoy laryngoscope (55% versus 12.5% in the G group) (P < 0.001). The intubator reported a higher VAS difficulty score in the M group (6.95 ± 25) compared with those in the G group (3.37 ± 22.3) (p < 0.001) (Table 2).

In the second intubation attempt; the mean time for intubation was comparable in both groups (14.3 ± 0.57 S) in the G group versus (14.77 ± 0.97 S) in the McCoy laryngoscope (P 0.47). All patients were successfully intubated using both scopes. The mean Cormack-Lehane score was significantly higher in the M group (1.88 ± 0.33 versus 1.0 ± 0.0 in the G group) (P < 0.001). Also, the percentage of adjustment maneuvers required were significantly higher in the M group (50% versus 0% in the G group) (P < 0.001).

Table 1
Patient characteristics, hemodynamics, and SPO2 pre-intubation.

	GlideScope group (n = 20)	McCoy group (n = 20)	p
Age (y)	33.1 ± 10.1	35.5 ± 11.8	0.5
Sex (male/female)	17/3	18/2	0.63
Vitals pre-intbation			
MAP(mmHg)	69.05 ± 4.08	69.2 ± 4.4	0.88
Heart rate (b/min.)	65.9 ± 4.5	66.9 ± 5.1	0.49
SPO2 (%)	96.9 ± 1.2	96.8 ± 1.15	0.79

Data expressed as mean ± SD, and number.
MAP = Mean arterial pressure.

Table 2
Primary intubation profile.

	GlideScope group (n = 20)	McCoy group (n = 20)	p
Successful attempt	17/20(85%)	11/20 (55%)	0.03*
Duration (s)	19.8 ± 5.2	27.6 ± 2.7	<0.001**
Adjustment maneuvers (%)	5/40 (12.5%)	22/40 (55%)	<0.001**
Cormack-Lehane score (Mean)	1.3 ± 0.47	2.45 ± 0.82	<0.001**
VAS difficulty score	3.37 ± 2.2	6.95 ± 2.5	<0.001**
Complications (Lip, dental, or mucosal injuries)	2	3	0.63

Data expressed as mean ± SD, number, and %.
* $p < 0.05$.
** $p < 0.001$.

The intubator reported a comparable VAS difficulty score 2.16 ± 2.8 in the G group versus 2.22 ± 2.6 in the M group (p 0.76) (Table 3).

The incidence of complications was comparable in both groups for both primary (Table 2), and secondary intubation attempts (Table 3).

4. Discussion

There were many reports of neurologic deficits while dealing with the airway management of patients with cervical spine injury if cervical protection guidelines were not followed [12]. Therefore, airway management must be performed promptly and cautiously for those patients [13]. The optimal approach of endotracheal intubation for patients with potential cervical spine instability remains a matter of debate [14], in our ICU, we prefer intubating those patients awake using fiberoptic bronchoscope. If awake fiberoptic intubation if not feasible, then McCoy laryngoscope with the aid of Frova intubating catheter after induction of general anesthesia becomes the technique of choice.

The key finding of this study is that, the intubation profile among cervically immobilized populations was significantly better when GL was used compared to McCOY laryngoscope especially if being performed by anesthetist inexperienced in its use.

The McCoy laryngoscope was first introduced in 1993. It is based on the standard Macintosh blade with a hinged tip that is operated by a lever mechanism on its handle's back permitting epiglotic elevation with little force. It has been used primarily to aid intubation when the patient's head is immobilized [15]. This laryngoscope produced a favorable intubation profile, and optimal laryngeal view in several studies [16,17]. On the other hand, other trials revealed a lower efficacy when compared with indirect laryngoscopes, or video scopes [15,18–21].

The efficacy of GL as an intubating tool in a simulated, potential or actual cervical instability has been broadly evaluated in the literature. There was improved glotic visualization, successful primary intubation attempts among most of these studies either in a randomized [22–35] or observational studies [10,36] previous studies supported the use of GL in case of failed DL among inexperienced [37] and experienced operators [38], while a contradictory results were observed in others [39–42]. The marked heterogeneity among the study designs, electivity, degree of intubation difficulty, and level of training of the operators were the leading causes of these conflicting results.

Table 3
Secondary intubation profile.

	GlideScope group (n = 3)	McCoy group (n = 9)	P
Successful attempt	3/3 (100%)	9/9 (100%)	1.00
Duration (s)	14.3 ± 0.57	14.77 ± 0.97	0.47
Adjustment maneuvers (%)	0/6 (0%)	11/22 (50%)	<0.001**
Cormack-Lehane score (Mean)	1.0 ± 0.0	1.88 ± 0.33	<0.001**
VAS difficulty score	2.16 ± 2.8	2.22 ± 2.6	0.76
Complications (Lip, dental, or mucosal injuries)	0	0	1.00

Data expressed as mean ± SD, number, and %.
** $p < 0.001$.

Level of intubator experience has been considered as a potential indicator of a more difficult airway [43]. In the present study, the higher rate of successful glidescopic intubation attempts performed by inexperienced users denoted that this scope is easy to use and has a steep learning curve. Several previous researches compared GlideScopic and direct laryngoscopic intubation and included intubators experienced only to DL confirmed this finding [10,38,39,44]. For inexperienced intubators in both GL and DL, there was a lesser time to intubate using GL in many trials [9,32,45], and found the GL less difficult to use even in easy airways in another trial [46]. Moreover, there was significant improvement in the first pass success with GL when compared with the DL over a residency training program in another trial [47]. Powel et al. [33] also found that GL was considered preferable and easy to use in a simulated difficult airway model regardless of the operator experience when compared with CTrach and the Bonfils. Griesdale et al. confirmed also in their systematic review and meta-analysis that GL improved glottic views and improved first-attempt success either when performed by inexperienced operators or when used by experienced operators in the setting of difficult airway scenario [28]. Healy etal in another meta-analysis confirmed this latter finding [48].

GL had variable intubation times in the previous trials when compared with the conventional laryngoscope; it was faster in some of them [32,49], comparable in others [40,44,50,51] and slower in the rest of studies [9,22,24,27,23,33,52]. In the present study, the intubation time among intubated patients using the GL was shorter than those intubated with the McCoy laryngoscope for the less experienced operators. To the best of our knowledge, there were no previous trials compared these two scopes. The inexperienced investigators in the study were unfamiliar with both scopes indicating that GL is again easier to learn and handle than the McCoy laryngoscope.

Randomization represented one point of strength in this study. Another point of strength was that, we studied the intubation profiles of both scopes among anesthetists with variable experience creating more generalization of the results.

On the other hand, there were several limitations to the study; firstly, some bias might be created because it was impossible to blind our study. Secondly, it should be noted that, although the secondary intubator performed more than 30 intubations in both scopes, however, he was more experienced in McCoy laryngoscopic intubation. This and the routine use of intubating catheter could explain why there was comparable intubation time and subjective intubation difficult score inspite of the higher Cormack and Lehane score. Thirdly, we used Cormack and Lehane score that has an advantage of being used widely in clinical practice, the appropriateness of using this classification with indirect laryngoscopes is questionable, however still represents a subjective assessment of the laryngeal view. Fourthly, the results of the study cannot be generalized to all ICU population as it did not include either emergent or urgent intubations. Finally, the extent of cervical spine movement was not measured in this study. Therefore, the authors recommend measuring the degree of cervical movement during glidescopic intubation procedure in a future research.

In conclusion, GL provides excellent intubation profile for patients with suspected or proved cervical spine instability in critical care seeing even if intubator is inexperienced in its use. Therefore, it is advisable to use GL by intensive care residents as a primary intubating device for patient whose neck needs to be immobilized.

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