Routine Use of Glidescope and Macintosh Laryngoscope by Trainee Anesthetists

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ABSTRACT

Objective: To compare intubating conditions, success rate, and ease of intubation by anesthesia trainees using Glidescope videolaryngoscope (GVL) compared to Macintosh laryngoscope (MCL).

Study Design: Comparative study.

Place and Duration of Study: King Khalid University Hospital, Riyadh, Saudi Arabia, from January 2012 to February 2015.

Methodology: Eighty adult patients ASA I and II with normal airway, scheduled to undergo elective surgery requiring endotracheal (ET) intubation were enrolled. Patients were randomly divided into 2 groups: GVL and MCL. All intubations were performed by trainee residents having experience of more than 1 year and who had successfully performed more than 50 tracheal intubations with each device. Glottic view based on Cormack and Lehane’s (C&L’s) score and percentage of glottis opening (POGO) score, time to successful intubation, need of external pressure, and overall difficulty scores were compared using either GVL or MCL.

Results: View of glottis based on C&L’s classification was better (p < 0.001) and POGO score was higher (88.25 ±22.06 vs. 57.25 ±29.26, p = 0.001) with GVL compared to MCL. Time to intubate in seconds was (32.90 ±8.69 vs. 41.33 ±15.29, p = 0.004) and overall difficulty score was less 2.78 ±1.39 vs. 4.85 ±1.75 (p < 0.001) using GVL compared to MCL.

Conclusion: Residents found ET intubation to be faster and easier with superior glottic view using GVL compared to MCL in patients with normal airway.

prospective randomized cohort study. Exclusion criteria were: patients undergoing day case surgery, history of anticipated or previous difficult intubation or mask ventilation, history of gastroesophageal reflux, cervical spine injury or history of allergy to any anesthetic agent used in this study.

Online software was used to divide the patients into 2 groups, MCL and GVL, to ensure randomization (www.randomizer.org). Preoperative fasting period was 6-8 hours in all the patients. Before induction of anesthesia, the patient’s head was placed on a regular pillow. Standard noninvasive monitoring was used in this study. Before induction of anesthesia, all the patients received pre-oxygenation for 3 minutes with 100% oxygen (O2) and 0.2 mg intravenous (i.v.) glycopyrrolate. Anesthesia was induced with fentanyl 2 microgran kg-1 and propofol 2 mg.kg-1, administered i.v. and ability to ventilate the lungs was assessed by using intermittent positive pressure ventilation (IPPV) with face mask. After confirming the ability to ventilate the lungs, 0.15 mg.kg-1 cisatracurium was administered. Establishment of complete neuromuscular block was assessed by the absence of response to train of 4 stimulations of ulnar nerve, and during this period ventilation of the patient was gently assisted manually with IPPV using 2% sevoflurane in 100% O2. All the intubations were performed by trainee residents having more than 1 year experience. Cuffed polyvinyl chloride ET tube was used. After visualization of the glottis, the ETT was advanced into the trachea. External pressure on the front of the neck in backwards, upwards, rightwards and posteriorly (BURP) was applied by an assistant, if desired by the operator. Cuffed polyvinyl chloride ET tubes were used in this study and they were well lubricated with water soluble lubricant (KY Jelly* Johnson & Johnson Medical Limited, UK). Size 7.0 mm internal diameter (ID) ETT was used in females and 8.0 mm ID in male patients. Appearance of capnography tracing was used to confirm proper placement of the ET tube.

Data collection was done on a predefined sheet. The primary end point was IDS. The operator was asked to rank IDS ranging from 0-10. An IDS score of 0 represented ideal intubating conditions, and increasing scores represented progressively more difficult intubating conditions. Secondary end points were the view of the glottis according to Cormack and Lehane’s (C&L’s) classification (grade 1 = most of the glottis visible, grade 2 = only posterior extremity of glottis seen, grade 3 = no part of the glottis seen, only epiglottis seen, and grade 4 = neither glottis nor epiglottis seen) and percentage of glottic opening (POGO score).10 For POGO scoring, the operator was asked to score the percentage of visibility of the glottis during endotracheal intubation ranging from 0% to 100%. Additional end points were time to intubation (TTI) required for successful intubation, which was calculated from the time of entry of the instrument into patient’s oral cavity till detection of end-tidal carbon dioxide tracing on the monitor after onset of IPPV. TTI, required for successful intubation, was recorded by an independent observer. Further outcome measurements were number of intubation attempts, lowest SPO2 during intubation, and presence of blood on the intubating device.

The present data was analyzed by SPSS statistical software (SPSS Inc, Chicago, IL) version 21. Continuous data was analyzed by 2-tailed students’ t-test. Mann-Whitney U test was used to analyze ordinal data. Pearson’s chi-square test was used to analyze categorical variables. The quantitative data was expressed as mean ± standard deviation (SD). A value of p < 0.05 was considered statistically significant. The sample size estimation was based on the IDS score. On the basis of a prior study,11 clinically important reduction in mean IDS score was considered as 2.0. Given an expected standard deviation of 3.0 from the prior study,11 36 patients were estimated to be required per group for a type I error of 0.05, and type II error of 0.2. However, considering possible dropout, 40 patients were recruited in each group.

RESULTS

Eighty patients were recruited in the study. There was no statistically significant difference between the groups in patients’ characteristics and preoperative assessment airway data, as shown in Table I.

All patients were successfully intubated in the specified time and no patient was excluded from the study. Table II shows that there was no statistically significant difference in the level of experience of the trainees between the groups (p = 1.00). View of the glottis based on C&L’s classification was significantly better with GVL in comparison to MCL (p < 0.001) as 28 patients in GVL group had grade 1 view while in MCL group, only 8 patients had grade 1 view (Table II).

Comparison of view of the glottis based on POGO scores with both the scopes is shown in Table II. The mean POGO scores were 88.25 ±22.06 with GVL versus (vs.) 57.25 ±29.26 with MCL, and was significantly
higher (p < 0.001) with GVL. The average TTI was significantly more with MCL (p = 0.004) compared to GVL (41.33 ±15.29 seconds vs. 32.90 ±8.69 seconds, Table II). The trainees found ET intubation to be easier with GVL as overall IDS was 2.78 ±1.39 with GVL, and 4.85 ±1.75 with MCL (p < 0.001). There was no difference in number of attempts for successful intubation, requirement of external pressure in BURP direction for successful intubation, lowest SPO2 during ETT placement, and presence of blood on intubation device in both the groups (Table II).

**DISCUSSION**

The results showed that C&L’s view of the glottis and POGO scores were better; and TTI was shorter with GVL as compared to MCL. The overall IDS was also less with GVL.

View of the glottis is of paramount importance for successful endotracheal intubation. Numerous studies show that videolaryngoscopes provide superior view of the glottis and high POGO score compared to MCL due to presence of camera near the end of the blade.6,12-14 These results also confirm that view of the glottis, based on C&L’s classification, was better; and POGO score was higher with GVL compared to MCL. Similar to this study, Hsiao et al. compared C&L’s laryngoscopic view using GVL and MCLs in the same patients and their outcomes were superior laryngoscopic view with GVL compared to MCL. Additionally, their results showed that the C&L’s grade decreased by 1 score with GVL compared to MCL in patients with normal and anticipated difficult intubation.15 Likewise, Xue compared laryngeal view in 90 patients with normal and anticipated difficult airway undergoing orotracheal intubation and found that GVL provided improved view of glottis with 100% success rate in all cases with 97% success rate in the first attempt.16 Moreover, C&L’s laryngoscopic view in patients with predicted difficult intubation showed superior view with lower grades using GVL compared to MCL.17 Ankylosing spondylitis of the neck leads to poor glottic visualization and is a known cause of difficult intubation. In such patients, Lili and colleagues noted superior view of the glottis with shorter intubation time and high success rate using GVL compared to MCL.10 Similarly, other researchers noted superior view of glottis with GVL compared to MCL in patients with other causes of difficult intubation, e.g. limited mouth opening,18 obese patients,19 and patients with cervical spine immobilization.1 In multiple manikin studies, in which medical students were tested in different scenarios of simulated easy and difficult airways, improved view of the glottis in GVL in comparison with MCL was noted.20 Analogous to these results, emergency physicians who have had limited experience in ET intubation, noted superior laryngoscopic view with GVL compared to MCL in different scenarios of normal and difficult intubation like cervical spine immobilization, tongue swelling, combined tongue swelling, and cervical spine immobilization.14

This data showed that TTI leading to control of airway was less with GVL compared to MCL. Similar to these results, Nouruzi and colleagues studied untrained medical personnel who were working in emergency room and had experience of intubation on manikin only. Their TTI was less with GVL compared to MCL and the success rate was 91% with GVL compared to 51% with MCL within a time period of 120 seconds.7 The TTI in this study was much less compared to that of the above researchers because the included anesthesia residents were those who were comparatively more experienced. GVL has been found to be a useful device for ET intubation in situations when less experienced health personnel are exposed to a situation of difficult intubation. In multiple manikin studies where anesthesia nurses, technicians and other staff were involved, Wang and co-workers compared different scenarios of difficult intubation and found greater TTI and high failure rate with MCL compared to GVL.20 Contrary to these results, there are some studies showing greater TTI with GVL than MCL.17,21 The reason of longer TTI was due to difficulty in advancement of the ET tube towards the

**Table I:** Patient characteristics and preoperative airway assessment data.

<table>
<thead>
<tr>
<th></th>
<th>Glidescope (n=40)</th>
<th>Macintosh (n=40)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>36.53 ± 10.77</td>
<td>37.38 ± 11.28</td>
<td>0.73</td>
</tr>
<tr>
<td>Sex (M/F)</td>
<td>19/21</td>
<td>17/23</td>
<td>0.65</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>72.98 ± 8.80</td>
<td>72.10 ± 9.93</td>
<td>0.68</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>165.48 ± 6.04</td>
<td>165.28 ± 7.17</td>
<td>0.89</td>
</tr>
<tr>
<td>BMI (kg m⁻²)</td>
<td>26.61 ± 2.52</td>
<td>26.36 ± 2.95</td>
<td>0.68</td>
</tr>
<tr>
<td>Mouth opening (mm)</td>
<td>48.95 ± 8.77</td>
<td>49.95 ± 10.43</td>
<td>0.64</td>
</tr>
<tr>
<td>Thyromental distance (mm)</td>
<td>87.03 ± 13.51</td>
<td>88.38 ± 12.06</td>
<td>0.64</td>
</tr>
<tr>
<td>Mallampatti class (I/II)</td>
<td>17/23</td>
<td>19/21</td>
<td>0.66</td>
</tr>
</tbody>
</table>

Values expressed as mean ± SD.

**Table II:** Trainees’ level of experience and intubation metrics.

<table>
<thead>
<tr>
<th></th>
<th>Glidescope (n=40)</th>
<th>Macintosh (n=40)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trainees’ level of experience in years (2nd /3rd /4th /5th )</td>
<td>12/9/11/8</td>
<td>13/7/14/6</td>
<td>1.00</td>
</tr>
<tr>
<td>Cormack and Lehane's score (1/2/3)</td>
<td>27/12/01</td>
<td>8/28/04</td>
<td>&lt;0.001†</td>
</tr>
<tr>
<td>POGO (%)</td>
<td>88.25 ±22.06</td>
<td>57.25 ±29.26</td>
<td>&lt;0.001*†</td>
</tr>
<tr>
<td>External pressure on neck in backwards, upwards, rightwards and posteriorly (BURP) required (Yes/ No)</td>
<td>12/28</td>
<td>14/26</td>
<td>0.63§</td>
</tr>
<tr>
<td>Time to intubate(s)</td>
<td>32.90 ±8.69</td>
<td>41.33 ±15.29</td>
<td>&lt;0.001*†</td>
</tr>
<tr>
<td>Number of attempts (1/2)</td>
<td>34/6</td>
<td>33/7</td>
<td>0.762§</td>
</tr>
<tr>
<td>Blood on intubation instruments (Yes / No)</td>
<td>6/34</td>
<td>9/31</td>
<td>0.39§</td>
</tr>
<tr>
<td>Overall intubation difficulty score (IDS)</td>
<td>2.78 ±1.39</td>
<td>4.85 ±1.75</td>
<td>&lt;0.001*†</td>
</tr>
<tr>
<td>Lowest SPO2</td>
<td>95.18 ±1.45</td>
<td>94.95 ±1.55</td>
<td>0.51†</td>
</tr>
</tbody>
</table>

Values expressed as mean ± SD, POGO = percentage of glottic opening.

* = P-value < 0.05; † = independent sample t-test; ‡ = Mann-Whitney U-test; § = Pearson's chi-square test.

glottis despite appropriate glottic visualisation.4 The cause of inability of advancement of ETT was due to a fixed curvature of the GlideRite leading the tube getting snagged on the anterior wall of the trachea,22,23 requiring more manipulation and application of external pressure of the neck in BURP direction.24 Although minor difficulties were encountered in advancement of ET tube in GVL group due to the above mentioned factors, however, in the current study, there was no difference in TTI between the two groups. The reason was a relatively longer TTI in MCL group also because the operators were trainee residents with variable experience and additionally, C&L’s laryngoscopic grades were also higher while using MCL.

Difficulty in ETT placement may lead to delay in control of airway, institution of artificial ventilation, and is likely to be deleterious to the patient. This data shows that IDS was lower with GVL compared with MCL. Similar to these results, numerous studies showed lesser IDS with GVL compared with MCL in patients with normal airway5,6 and with anticipated difficult intubation.1

Likewise, in a study in which emergency physicians were examined in different scenarios of normal and difficult intubations, e.g. cervical spine immobilization, tongue swelling, combined tongue swelling, and cervical spine immobilization, IDS was found to be lower and subjective ease of intubation was more with GVL compared to MCL.14

BURP is required during laryngoscopy to improve the view of the glottis.25 Patients in both the groups required external pressure on the neck, but, the timings were different in both the groups. In the MCL, it was required during laryngoscopy to improve the glottic view, and was maintained during advancement of ETT into the trachea. On the contrary, with GVL, BURP was required only during advancement of ETT into the trachea in an attempt to align the tip of ETT with glottic opening as the fixed curvature of the stylet (GlideRite) directed the ETT posteriorly.26

There are certain limitations of this study. Firstly, those anesthesia residents were included who were having limited and variable experience. Therefore, these results cannot be extrapolated to more experienced anesthetists, as expertise might affect proficiency in using these devices. Secondly, the videolaryngoscope used in this study was GVL; and these results may be different when using other types of videolaryngoscopes.1

CONCLUSION

Anesthesia trainee residents found ET intubation to be faster and easier with superior glottic view using GVL compared to MCL, in patients with normal airway. Due to the small number of patients in this study, it is early to recommend routine use of GVL. However, there appears to be a probable paradigm shift towards use of GVL, as a primary intubating device.

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REFERENCES


14. Kim HJ, Chung SP, Park IC, Cho J, Lee HS, Park YS. Comparison of the Glidescope video laryngoscope and


