The Superiority Of Mcgrath Videolaryngoscope After Failed Conventional Laryngoscopy

S Karaman, S Arici, S Dogru, T Karaman, H Tapar, A Sahin, Z Kaya, M Suren

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Abstract

Background

Failure in tracheal intubation is still remaining the leading cause of anesthesia-related morbidity and mortality, which has not been concluded as a solved problem for anesthesiologists in securing airway. The present study is aimed to assessed the effectiveness of McGarth Series 5 videolaryngoscope after failed Macintosh laryngoscope.

Materials and Methods

A total of 50 patients those intubated using McGrath videolaryngoscope after two unsuccessful attempts of Macintosh laryngoscope were included in the study. The demographic data, percentage of glottic opening and Cormack-Lehane grade of the patients were recorded.

Results

Fifty-five patients, in which were intubated with McGrath videolaryngoscope after a maximum number of two unsuccessfull attempts with Macintosh laryngoscope. The percentage of glottic opening is improved by 80% with McGrath videolaryngoscope compared to Macintosh laryngoscope ($p < 0.01$). The success rate by using McGrath videolaryngoscope for tracheal intubation was 98%.

Conclusion

The McGrath Series 5 videolaryngoscope improves the glottic view, and proves its effectiveness after failed direct laryngoscopy.

INTRODUCTION

Difficult intubation has been the challenging part of the airway management for anesthesiologists and associated with substantial morbidity and mortality (1, 2). Currently, it is well practiced and documented that direct laryngoscopy has several limitations to cope with securing difficult airway during orotracheal intubation (3). Videolaryngoscopy, which may provide a better view of the tracheal aperture with failed direct laryngoscopy, creates a potential cure to this problem (4). Videolaryngoscopes are now commonly acknowledged and accepted airway management technique that may be easy to use for inexperienced anesthesiologists (5).

The McGrath Series 5 videolaryngoscope is one of these devices, consisting of a small colour digital camera and a light source at the cone end of the blade (4, 5). A display screen is mounted on the top of the laryngoscope handle, with a sterile, transparent, acrylic single use 60° angled blade (4).

In contrast to a Macintosh laryngoscope, the McGrath Series 5 videolaryngoscope provides a view of the glottis without requirement of lifting the tongue (6). There has been limited systematic comparisons between the McGrath Series 5 videolaryngoscope and the Macintosh laryngoscope in difficult orotracheal intubation conditions (4, 7). According to the technical properties of the McGrath Series 5 videolaryngoscope, we hypothesised that the glottic view with McGrath videolaryngoscope is better compared to Macintosh blade.

MATERIALS AND METHODS

After approval of Gaziosmanpasa University Ethics Comittee, patients were included in the departments of general surgery, ear-nose-throat, urology, orthopedics, neurosurgery. Fifty patients with an American Society of Anesthesiologists score (ASA) of I, II and III who were scheduled for elective surgery under general anesthesia were included during the study period of 18 months. A history of difficult mask ventilation, a history of previous difficult direct laryngoscopy and required awake tracheal intubation, below 18 years of age, and emergency surgery were the exclusion criteria. Additionally, patients, who had at least one of the following criteria were excluded: a Mallampati score of III or more, maximal mouth-opening capacity below 35 mm, thyromental distance below 65 mm. Patient characteristics including age, gender, ASA physical status were recorded during preoperative anesthetic examination.

Before introduction of anesthesia, a McGrath Series 5 videolaryngoscope with the camera stick positioned at a same length as the size-3 or 4 Macintosh blade, and size 3 and 4 Macintosh laryngoscope were prepared. A size 7.0 mm and 7.5 mm endotracheal tube were used to intubate the trachea in female and male patients, respectively. A malleable stylet was always inserted into the tracheal tube and the distal tip was angled upwards by 60 - 70° just proximal to the cuff for the McGrath videolaryngoscope and no more than 30° for the Macintosh laryngoscope, to achieve a successful intubation of the trachea. All anesthesiologists involved in the study had previously trained in the use of McGrath videolaryngoscope.

In the operating room, patients were monitored with a pulse oximeter, 3-lead electrocrdiogram (ECG) and a non-invasive blood pressure cuff. Preoxygenation was performed within 3 min before the induction of anesthesia.

Induction of anesthesia was conducted using pethotal 5 mg/kg intravenous (iv) or propofol 2 mg/kg iv and neuromuscular blockade using rocuronium 0.5 mg/kg iv. Thereafter, direct laryngoscopy was performed using a conventional Macintosh blade of size 3 or 4. The glottic view was evaluated by Cormack-Lehane classification and the Percentage of Glottic Opening (POGO). After a maximum of two failed intubation attempts (according to our institution's clinical airway protocol) by an anesthesiologist, the McGrath videolaryngoscope was used to achieve the tracheal intubation.

The number of intubation attempts, number of succesful intubations and complications were recorded on a standardized sheet.

The sample size was calculated by assuming a one-sided type I error of 0.05 and a width of 0.07 and a probability of 0.90 on the improvement of the glottic view; 50 patients were required to conduct the study.

Satistical analysis

Normality and variance were tested using the one-sample Kolmogorov-Smirnov test, skewness, kurtosis, and histograms for each variable. Quantitative data were presented as means and standard deviation, and qualitative data as frequency and percentage. Depending on these results, non-parametric analysis was undertaken for each variable. Percentage of glottic opening value differences among groups were analyzed using the Mann-Whitney U test, and Cormack-Lehane grade value differences between groups were analyzed using the Fisher's exact test. Analyses were conducted using the Statistical Package for Social Sciences program (SPSS Inc., Chicago, IL, USA), version 20.0. Statistical significance for all analyses was set at $p < 0.05$.

RESULTS

A total of 55 patients were included in this study. Five patients did not match with the inclusion criteria, and were removed from the analysis. A total of 50 patients including 34 (68%) males and 16 (32%) females were included, and the mean age of the patients was 49.92±12.43.

The Macintosh laryngoscope showed Cormack-Lehane grade of 3 in 33 (66%) and Cormack-Lehane grade of 4 in 15 (30%) patients. The POGO value was revealed 80% of improvement in McGrath videolaryngoscope compared to Macintosh laryngoscope. The mean POGO value was significantly higher in McGrath videolaryngoscope than in Macintosh laryngoscope ($p < 0.01$, Table 1).

Table 1

Airway characteristics

		Macintosh laryngoscope	McGrath Series 5 videolaryngoscope	p
Cormack-Lehane grade	**I**	–	28 (56%)	–
	II	–	15 (30%)	
	III	35 (70%)	7 (14%)	**< 0.01**†*
	IV	15 (30%)	–	
POGO		16.80±15.83	86.80±16.71	**< 0.01**‡*

*p < 0.01, †: Mann-Whitney U test, ‡: Fisher's exact test; POGO, Percentage of Glottic Opening.

Successfull intubation was achieved in 49 of 50 patients using the McGrath videolaryngoscope (98%). However, in one case with a Cormack-Lehane grade of 4 and a POGO value of 10% with the McGrath videolaryngoscope, tracheal intubation was failed using the videolaryngoscope, therefore the patient was intubated by using a flexible bronchoscope.

Tracheal tube placement was performed in 40 of 50 patients (80%) at the first attempt, 9 patients (18%) at the second attempt using the McGrath videolaryngoscope.

DISCUSSION

The present study showed that McGrath Series 5 videolaryngoscopy improved the glottic view in all patients compared to Macintosh laryngoscope. The successful tracheal intubation rate was %98, after failed tracheal placement of the tube using Macintosh laryngoscope.

The Macintosh laryngoscope is still the most common device for tracheal intubation, until first entered in clinical use. However, failed to achieve an adequate glottic view with traditional laryngoscopes described as difficult intubation (8, 9). Nevertheless, difficult laryngoscopy occurs at a rate of 2-8% in all general anesthetic procedures. Currently, several techniques and devices have been used to intubate the trachea while the tracheal aperture can not be seen (10, 11).

In addition, the gold standard method remains placing the tracheal tube under direct vision using a flexible bronchoscope. However, a sterile bronchoscope may not always be available in urgent situations and these devices are relatively expensive (3, 12). As mentioned above, videolaryngoscope is one of these intubation devices in which has taken place in the recent difficult airway guideline of The American Society of Anesthesiologists in 2013 (13).

In relation, videolaryngoscopes have been rapidly becoming an acceptable technique which can provide a good view of the glottis when traditional laryngoscopy has failed (3, 6, 14-18).

The present study revealed that the McGrath Series 5 videolaryngoscope improves glottic view and achieves a successful tracheal intubation in patients who have a Cormack-Lehane grade 3 or 4 laryngoscopic view with Macintosh laryngoscope. Several studies reported that videolaryngoscopes enable better intubating conditions compared to conventional laryngoscopy (5-7, 11, 19). Ray et al. demonstrated that the McGrath videolaryngoscope had a successful tracheal intubation rate of 97% compared to Macintosh laryngoscope in novice users (5). In contrast, Piepho et al. showed that the McGrath Series 5 and the GlideScope Ranger videolaryngoscopes have similar success rates compared to the Macintosh laryngoscope (7).

Furthermore, Shippey et al. showed that the McGrath videolaryngoscope achived a Cormack-Lehane grade 1 glottic view in 95% of cases in unselected patients, where Noppens et al. concluded that the McGrath videolaryngoscope improved the view in all patients with a Cormack-Lehane grade of 3 or 4 (4, 6). Our data showed that a Cormack-Lehane grade 1 in 52% of cases was achieved with using the McGrath Series 5 videolaryngoscope and improved the glottic view with a Cormack-Lehane grade of 3 or 4.

Despite a superior view of the glottis provided with videolaryngoscopes, a good laryngeal view does not guarantee the success of the tracheal intubation (4, 20). The present study revealed that failed tracheal intubation in 2% of patients was encountered with McGrath Series 5 videolaryngoscope. Although the underlying reasons for failed tracheal intubation with any device using indirect vision of the glottis can be fogging, blood, gastric contents or secretions which was associated with an obstructed view of the glottis (6). However, these reasons were not occured in this study. In addition, Shippey et al. reported three cases of difficult and failed tracheal intubation using a conventional Macintosh laryngoscope in which tracheal intubation was successfully performed with the McGrath Series 5 videolaryngoscope in all three cases (3). Moreover, O'Leary et al. showed that the McGrath Series 5 videolaryngoscope provided a clear view in 28 patients of 30, nevertheless, a failure rate of 16.6% (5 of 30 patients) was accounted for tracheal intubation (20). In a clinical evaluation of the McGrath videolaryngoscope in 150 patients, 98% of patients were successfully intubated using the McGrath videolaryngoscope (4). Therefore, previosuly mentioned studies suggested that a good view of the glottis did not always mean an easy intubation.

While conducting a tracheal intubation with the McGrath Series 5 videolaryngoscope and to achieve a successful intubation, it is highly recommended that a malleable stylet is always be inserted into the tracheal tube to shape the tracheal tube similarly with the blade of the videolaryngoscope (30° angled upwards at the distal tip of the tracheal tube) (6).

Despite direct laryngoscopy, the indirect vision with the McGrath Series 5 videolaryngoscope in intubation process can be resulted as soft tissue damage. Therefore, a high level of training is a priority to prevent complications while performing tracheal intubation under indirect vision using the McGrath Series 5 videolaryngoscope. A systematic search of the literature revealed that only one case report describing palatopharyngeal arch injury is available and no dental trauma exists (21). The low incidence of injury suggested that the McGrath videolaryngoscope is relatively safe in the hands of the experienced users.

CONCLUSION

The use of the McGrath Series 5 videolaryngoscope substantially improved the glottic view in previously unselected difficult intubation using the Macintosh laryngoscope. Furthermore, the McGrath Series 5 videolaryngoscope showed an acceptable success rate in tracheal intubation and can be the second option for failed tracheal intubation with Macintosh laryngoscope.

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Author Information

Serkan Karaman, Assistant Professor
Gaziosmanpasa University School of Medicine, Department of Anesthesiology and Reanimation
Tokat, Turkey
serkankaraman52@yahoo.com

Semih Arici, Assistant Professor
Gaziosmanpasa University School of Medicine, Department of Anesthesiology and Reanimation
Tokat, Turkey
semiharici@gmail.com

Serkan Dogru, Assistant Professor
Gaziosmanpasa University School of Medicine, Department of Anesthesiology and Reanimation
Tokat, Turkey
srkdgr1@yahoo.com

Tugba Karaman, Assistant Professor
Gaziosmanpasa University School of Medicine, Department of Anesthesiology and Reanimation
Tokat, Turkey
drtugbaguler@hotmail.com

Hakan Tapar, Assistant Professor
Gaziosmanpasa University School of Medicine, Department of Anesthesiology and Reanimation
Tokat, Turkey
hakantapar@hotmail.com

Aynur Sahin, Assistant Professor
Gaziosmanpasa University School of Medicine, Department of Anesthesiology and Reanimation
Tokat, Turkey
draynursahin66@hotmail.com

Ziya Kaya, Associate Professor
Gaziosmanpasa University School of Medicine, Department of Anesthesiology and Reanimation
Tokat, Turkey
zkayaahz@gmail.com

Mustafa Suren, Associate Professor
Gaziosmanpasa University School of Medicine, Department of Anesthesiology and Reanimation
Tokat, Turkey
mustafasuren@yahoo.com