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The Effects Mcgrath® Mac Video Laryngoscope Assisted Education On The Endotracheal Intubation Practices of Undergraduate Anesthesia Medicine Students: A Randomized, Controlled Attempt

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ABSTRACT

Endotracheal intubation is an important step in maintaining the open status of the airway and in controlling breathing. Every doctor should have the ability to manage the airway; and this skill should be taught to doctors in their medical training. In the present study, the effect of the training on medical students with video laryngoscope and direct laryngoscope on endotracheal intubation success was examined.

A total of 66 students who had no previous endotracheal intubation experience and who received anesthesiology internship were included in the study. The students were randomly divided into 2 groups. The intubation with video laryngoscope was applied after intubation with direct laryngoscope in Group D, and the intubation with direct laryngoscope was applied after intubation with video laryngoscope in Group V. The intubation times and success rates were recorded in all attempts.

The time between the first and second attempts of students in Group V decreased significantly ($p<0.001$). The first attempt times between the direct laryngoscope and video laryngoscope groups were very close to each other.

Our study showed that training medical students using the McGrath® MAC video laryngoscope yields better results than using direct laryngoscopy.

Key Words: Intubation, laryngoscopy, student, training

Introduction

Endotracheal intubation is an ideal way to provide a safe airway during general anesthesia, to avoid aspiration formation and for airway control in unconscious patients. Many studies showed that early intubation can improve outcomes in critical patients (1-2). For this reason, a fast, mistake-free, and successful intubation must be a priority for all doctors, especially for anesthesiologists. Each doctor must have the ability to manage the airway, and this skill should be taught to doctors in medical training.

Preparation of serious the pharmacological (i.e. the sedatives, neuromuscular blockers, analgesics) and the equipment (i.e. the laryngoscopy, stile, tube, aspirator, detection material) is needed before endotracheal intubation. In addition to this preparation, psychological preparation is also needed. Because inserting the tube in line with the oral cavity, pharynx and larynx axes is a technical skill requiring mastery (3). After undergoing various modifications and improvements throughout the historical process, direct laryngoscopes have a great importance in endotracheal intubation. Although years have passed, the reason why direct laryngoscopes are still popular is because they are widely used, available, and cost-effective. The adaptation of video technology for laryngoscopy after 2002 seems to be an interesting and promising option in the field of airway management. Recently, it is considered as a method that even novices and inexperienced people can use easily (4-5). Although video laryngoscopes are different in terms of image transfer technique, they are similar to traditional laryngoscopes, and have a video chip embedded within the tip of the laryngoscope knife. Their main advantages are that the structures on the road leading to glottis are easily

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taken, allowing for intubation in a short time (6-7). This method can also be used as means of training besides its characteristics of better viewing the glottis and structures in the oral cavity, and magnifying and transmitting them to a screen [8]. The fact that they are costly compared to traditional laryngoscopes, have limited portability, and need technical support because of its video technology are among their disadvantages. McGrath® MAC (Aircraft Medical, Edinburgh, Scotland) has a Macintosh-type knife integrated with video technology. It has come to the forefront because it is completely portable, resistant to infection with its disposable blades, can be used directly and indirectly and have relatively low cost (9-10).

In our study, the purpose was to examine the effects of endotracheal intubation training in case of a technical change with video laryngoscope and direct laryngoscope in medical faculty anesthesia training students who had not performed intubation previously.

Materials and Methods

This study was conducted in the seminar hall of the Anesthesiology and Reanimation Department of Van Yuzuncu Yil University, Faculty of Medicine after obtaining permission from Van Yuzuncu Yil University, Faculty of Medicine Ethic Board on 28.09.2018 with the decision number 05.

For this purpose, 5th Grade students, who had never performed endotracheal intubation before and who received anesthesiology internships between November 2018 and May 2019 at Van Yuzuncu Yil University Faculty of Medicine, were included in the study. The age and gender of the students who participated in the study and who signed the consent forms were recorded. Firstly, 20-question test was applied to the students who were trained on airway management and airway evaluation by an experienced (min 5 years) anesthesiologist, who did not participate in the study. Among those with success rates at and above 60%, 66 students were recruited and divided into two groups randomly as direct laryngoscopy (Group D) and video laryngoscopy (Group V).

The students were provided with practical and theoretical endotracheal intubation classes on a mannequin by the same anesthesia specialist by identifying the epiglottis and vocal cords to Group D students, and by identifying the uvula, epiglottis, pyriform fossa, and vocal cords to Group V students. Direct laryngoscope with Macintosh number 3 blade was used for direct laryngoscopy practice training, and McGrath® MAC video laringoskope was used for videos laryngoscopy. The students who completed the training performed their intubations privately without seeing the intubations of others. All parts were inserted into the laryngoscope handle in Group D (n=34), and the intubation was performed by checking whether the blade light was on. Then, video laringoskope training was provided, and the intubation process was requested again. In Group V (n=32), the working status of the integrated system with optical, digital camera and blade light in one single device, and intubation was performed. The students were then asked to perform intubation again after giving direct laryngoscope training. The intubation times and scores were recorded for each student.

For determining the time for successful intubation, tracking time was started when the laryngoscope was passed through mannequin's teeth and stopped when we observed that mannequin's lungs were ventilated using the bag valve mask system. When intubation could not be performed within 90 seconds or esophageal intubation was carried out, it was considered as an unsuccessful attempt. The number of the attempts the intubation was performed was also recorded. A 7.0 mm tracheal tube was used in all applications. Those who refused to participate in the study, and those who wanted to discontinue during the study were excluded from the study.

Statistical Analysis: The data were analyzed by using the SPSS 25.0 (SPSS Inc., Chicago, IL, USA) statistical computer program. The findings were presented as numbers, averages, standard deviations, median and range values. The fitness of numeric variables to normal distribution was checked with the Shapiro-Wilk Test. In comparing the categorical variables, the Chi-Square Analysis (Fisher's Exact Test when needed) was used. The comparisons of the numerical variables between independent groups were made with the Mann-Whitney U-test, and the comparisons between dependent measurements were made with the Wilcoxon Test. Statistical significance level was taken as $p<0.05$.

Results

A total of 37 (56.1%) participants were female, and 29 (43.9%) were male. Thirty-four participants (51.2%) were trained with the direct laryngoscope, and 32 were trained with video laryngoscope firstly (48.5%).

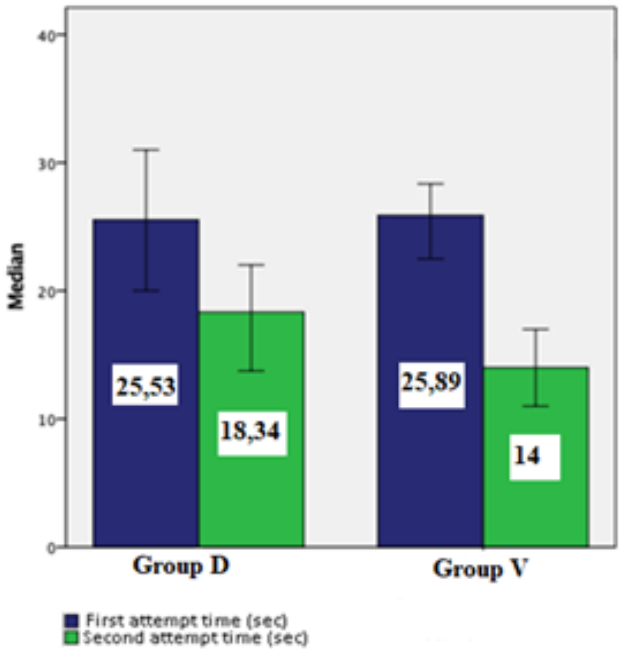

Fig. 1. Comparison of the median values of the participants in first and second attempt times by the technique used in the first application
Group D; Group that intubated with video laryngoscope after intubation with directly laryngoscopy
Group V; Group that intubated with directly laryngoscope after intubation with video laryngoscopy

A total of 57 (86.4%) of the students were successful in their first attempts, and 7 (10.6%) succeeded in the second attempt, and 2 (3.0%) in the third attempt.

The average first attempt time was 29.54±15.35 seconds (min 6, max 72), and the average second attempt time was 18.61±15.00 seconds (min 4, max 61).

The first attempt times between the direct laryngoscope and video laryngoscope groups were very close to each other (Figure 1); and the difference was not statistically significant (Table 1). On the other hand, although the second attempt times were less in the Group V than the Group D (Figure 1), this difference was not statistically significant (Table 1).

When the first and second attempt times of those who had their first attempt in direct laryngoscope, and the second application was video laryngoscope, in other words, Group D, were compared, it was found that the time shortened, but did not reach the statistical significance limit ($Z=1.867$; $p=0.062$). However, the times between the first and second attempts of the students in Group V that used video laryngoscopy in first attempt and the direct laryngoscope in second attempt decreased significantly ($Z=3.586$, $p<0.001$).

The vast majority of the participants were successful in their first attempts. No significant differences were detected between the groups in terms of achievement status based on the initial application type. Also, there were no significant differences in the achievement status between females and males (Table 2).

No significant differences were detected between the female and male students in terms of first (females: median 25,86 sec, min 13, max 72; males: median 25.35 sec, min 6, max 67) and second (females: median 15.00 sec, min 8, max 56; males: median 16.97 sec, min 4, max 61) attempt times (Mann-Whitney U Z and p 0.627 vs. 0.531and 0.69 vs. 0.485, respectively).

Discussion

Based on the results, it was found that the intubation time with McGrath® MAC in the first attempt was 25.9 sec in Group V, and the intubation time with direct laryngoscope in the second attempt was 14 seconds, and this shortening in the second attempt was found to be lower at a statistically significant level. In both groups, although the technique changed in the second attempts, the fact that those who performed intubation with direct laryngoscopy after video laryngoscopy successfully in a shorter time suggests that McGrath® MAC can help training in direct laryngoscopy.

It was shown that the endotracheal intubation success rate of inexperienced individuals was 35-65% with direct laryngoscopy. To increase this rate up to 90%, it was shown that endotracheal intubation should be performed with approximately 50 direct laryngoscopies (11). Previous studies showed that these success percentages can be increased in less time with video laryngoscopy training (12). In recent years, various video laryngoscopes have been designed with developments in medical devices, and their use has become increasingly common. These tools, which are seen to have achieved high success rates even in inexperienced hands, have a common feature, which is showing the oral cavity, larynx and, more importantly, its success in showing glottic cavity. Many studies showed that McGrath's video laryngoscope is superior to Macintosh Conventional Laryngoscope in viewing glottic cavity (12-13). In this way, the procedure is performed with fewer complications and higher successful intubation rates (14-15). With the help of these characteristics, video laryngoscopes achieved important success rates in intubation training of anesthesiologists, paramedic students, and emergency medical technicians, especially medical students. The most important

Table 1. Comparison of First and Second Attempt Times of Participants By The Technique Used In First Application

	Group D			Group V				
Attempt (sec)	Mean ± SD)	Median	Min-Max	Mean ± SD)	Median	Min-Max	Z*	P
First	28.00±13.52	25.25	14.91-72.00	31.19±17.16	26.41	6.28-68.00	0.577	0.564
Second	21.47±14.01	18.34	7.21-61.00	16.03±8.32	14.00	3.50-40.00	0.564	0.125

*Mann-Whitney U test
Group D; Group that intubated with video laryngoscope after intubation with directly laryngoscopy
Group V; Group that intubated with directly laryngoscope after intubation with video laryngoscopy

Table 2. Comparison of Achievement Status by Groups and Genders

Which application was performed first?	Success was achieved at which attempt? First attempt n(%)	2nd or 3rd attempt n(%)	Total n(%)	χ2*	p
Direct laryngoscope	30(88.2)	4(11.8)	34(100.0)	0.209	0.730
Video laryngoscope	27(84.4)	5(15.6)	32(100.0)		
Total	57(86.4)	9(13.6)	66(100.0)		
Gender					
Female	32(86.5)	5(13.5)	37(100.0)	0.001	1.000
Male	25(86.2)	4(13.8)	29(100.0)		
Total	57(86.4)	9(13.6)	66(100.0)		

*Fischer's exact test

reason why this method is using in training is that it allows the instructor and the student to communicate. Contrary to the traditional direct laryngoscopy, the instructor and student see anatomical structures simultaneously, and create shorter and more effective solutions to potential problems and achieve success. It was concluded in many compilations and studies that video laryngoscopy is effective in education by reducing the intubation times and increasing the success rates, and it is recommended to disseminate its use (13).

Studies conducted with video laryngoscopes were mostly in the same group, comparing recurrent experiments of the same technique. Similar to our method in our study, Dr. D. C. Ray et al. designed a study comparing McGrath® MAC and Macintosh laryngoscopy. Their results showed that average intubation times were similar in both groups, and McGrath® MAC was superior in terms of success rates and dental traumas. In addition, the main remarkable result was that the direct laryngoscopy intubation time was decreased at a significant level in the application made with Macintosh laryngoscope after McGrath® MAC application (12). Based on this conclusion, the researchers argued that the role of the video laryngoscope was important in student training.

In a study conducted by Ali Peirovifar et al. with students in anesthesia rotation, the successful intubation time was reported to be 37.55 seconds with video laryngoscopy, and was 31.50 seconds with conventional Macintosh Laryngoscopy. Although their intubation times were longer than ours, significantly successful results were achieved in favor of the video laryngoscopy in video laryngoscopy compared to direct laryngoscopy (16). In the study conducted by Myungju Shin et al. on human mannequins with students, McGrath® MAC and C-MAC® video laryngoscopies did not differ in terms of intubation times in first attempts compared to Macintosh direct laryngoscopy, and there was a significant decrease in intubation times in the 2nd and 3rd attempts, and intubation success rates were found to be higher (17). In another study conducted on human mannequins video laryngoscopy was found to be 19% more successful compared to direct laryngoscope, and the intubation was performed in 11 seconds less [18]. Similar results were reported in studies with GlideScope® (19).

The vast majority of the students were successful in their first attempts in our study. The success rate in Group V was 84.4%, and 88.2% in Group D. Although compatible with literature data in general, video laryngoscopy success rates were determined at

higher rates in some studies (17). In a study conducted on students who had not previously had intubation experience by Alan Tung et al., the intubation success rate was 88% in direct laryngoscopy and 100% in video laryngoscopy in the first attempt (20). High success rates were found in favor of video laryngoscope in applications made with different types of video laryngoscopes in many studies (12-17-19).

Intubation times and success rates might vary depending on the brand of the video laryngoscope, the medical degree of the practitioner, and on performing the application on the patient or model. In addition to positive results in favor of video laryngoscopes reported in most studies, some studies might argue otherwise in the literature. For example, a study conducted by 45 students on a normal airway scenario with mannequins did not report differences between video laryngoscopy and direct laryngoscopy in terms of intubation times (21). In a training study on students, GlideScope®, McGrath® MAC and direct laryngoscope were compared, and Kim et al. reported that there were no significant differences between the groups in terms of intubation times and intubation success rates (22).

The present study had some limitations. The most important one was that the application was made on an airway simulated mannequin. Because an airway mannequin cannot create possible intubation conditions like saliva, secretion, bleeding, steaming on the image exactly, that may occur in patients. Another limitation was that all intubation attempts were made on normal airway scenario. For this reason, it might not be right to use our findings for potentially difficult airway scenarios.

In this simulated model study, it was found that novice medical students who used the McGrath® MAC video laryngoscope performed successful intubation in less time. Based on this, it was concluded that the use of direct video laryngoscope as a means of education is an effective way of teaching intubation to inexperienced people.

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Compliance with ethical standards

Conflict of interest All authors have no conflict of interest to disclose

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