

Comparison of the Speed and Success of Endotracheal Intubation between BOUGIE and Flexible Video Laryngoscope on the CPR on Manikin by Emergency Residents

Reza Yazdani, Mehrdad Vosough Rouhani, Seyed Ashkan Tabibzadeh Dezfuli*

Trauma and Emergency Medicine Research Center, Hormozgan University of Medical Sciences, Bandar Abbas, Iran

ABSTRACT

Aim: The present study aimed to compare the speed and success of endotracheal intubation between BOUGIE and flexible video laryngoscope on the CPR on manikin by emergency residents.

Methods: All emergency medicine residents of Hormozgan medical school (18 individuals) were involved in this interventional study to compare flexible video laryngoscopes with BOUGIE. The results were recorded and evaluated by SPSS 22 software and statistical descriptive tests (average, standard deviation, frequency, chi-squared and t-test).

Results: 38.9%, 33.3% and 27.8% out of 18 emergency medicine residents were freshman, sophomore and junior respectively and the time needed for intubation by video laryngoscope was 32.69 seconds for fresh men, 19.35 ± 5.760 seconds for sophomore and 16.33 ± 7.59 seconds for junior residents on average which revealed a significant difference among different students based on their entrance year to the hospital. In addition, this time for BOUGIE method was 19.56 ± 3.619 seconds for freshman residents, 15.65 ± 3.411 seconds for sophomore residents and 12.78 ± 2.48 seconds for junior residents which shows a significant difference for residents with different entrance years ($p < 0.05$). Furthermore, the comparison of Bougie laryngoscope, freshman with 94.3%, sophomore and junior with 100% success and 97.8% as total success while the success for freshman was 57.1%, 90% was for sophomore and 82% was for junior residents and total success was 76.7% for the advantage of video laryngoscope over Bougie in this research.

Conclusion: Both of these intubation devices are so beneficial, which help the therapist with opening reliable airways. It seems BOUGIE with high rate of success and availability can be a good auxiliary device in hard intubation cases in emergency.

Key words: Bougie, Video laryngoscope, Emergency Medical Services, Hormozgan

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Corresponding author: Seyed Ashkan Tabibzadeh Dezfuli

e-mail ✉: dr.tabib52@gmail.com

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INTRODUCTION

The permanent brain damage starts after 4 minutes oxygen deprivation and if this time prolongs to 5 minutes, heart failure also will happen [1]. The evaluation of airways is the first action and maybe it is the most important part of the emergency patient's recovery and there would be a need for intubation in many cases [2]. Intubation is not an easy and safe task and it is one of the most stressful medical tasks even for expert anesthesiologists and it imposes high levels of stress to them [3].

The anesthesiologists encounter with hard intubation cases in 1%-5% to 8% of general anesthesia [4]. John Bis

invented the first video laryngoscope according to Pott et al. [5]. Video laryngoscopes have a tiny special camera on their pier, which provides the possibility of indirect monitoring of glut on screen by entering into mouth or nose. Since video laryngoscopy systems allow for easier intubation in more complicated cases, ambulatory surgery centers can increase their patient base.

Clinical studies show that video laryngoscopy improves intubation success rate. Video laryngoscopy has significant advantages for treating more complicated cases, but also benefits average patients with less trauma and quicker intubation times. Their application has expanded during intubation or laryngoscopy since early 21st century [6]. Since the invention of video laryngoscope, many of them have introduced into market which most of them are not available due to public acceptance. Some of them, which gained attention by anesthesiologists and emergency specialists, can be divided into major groups: the first

group of video laryngoscopes which remained loyal to their ancestors such as C-MAC and McGrath. The second group has a rod shape pier for adjusting to the airway which variety of flexible and rigid video laryngoscopes are counted as the members of this group.

The third group is the video laryngoscopes, which have a channel for inserting ETT tube, which include Pentax and airtraq types [7]. One of other auxiliary devices in intubation is Bougie or plastic flexible tube. This device is a semi-rigid guide tool in different forms that helps the piping inside the chip by crossing the vocal cord and allowing the ETT tube to slip over itself. Its application was explained by Mackintosh about 60 years ago [8].

Although training the piping into chip is carried out by numerous intubations for the patients who demand reliable airways theoretically and practically, application of educational moulages and mannequins has also increased significantly which seems to be a suitable alternative because of lowering the educations risks and practice on the real patients [7]. Considering the need for an auxiliary device in these intubation condition and different access to video laryngoscope and Bougie in different emergency centers of the country and lack of budget and educational potential for preventing the awful consequences because of delay in opening reliable airway, this research was carried out to compare the speed and success of intubation on educational moulage by video laryngoscope with the help of Bougie.

The video laryngoscope is applied newly in Iran emergency centers and lack of sufficient articles for investigating their abilities for serving the patients, is another aims of this study.

MATERIALS AND METHODS

This study was approved by the ethics committee of Hormozgan University of Medical Science (Ethics Code: A-10-3434-1). The participants in this interventional study were a non-homogeneous group comprised of all residents of Hormozghan medical school (18 residents) who finished their one-month medical training course with different experiences from managing airways.

Research protocol

At first and before intubation, the training course was carried out by medicine professors and also specialists

who are expert in working with flexible video laryngoscope. The theoretical and practical intubations were thought to all residents by this device and after one practice intubation course, all residents were transferred to skill lab.

After this stage, they practiced intubation on the educational moulages by recording it by the project executive. All records were calculated in hundredth of a second. About Bougie in another session after displaying the related educational film and practical description on moulage, the intubation was done and the results were recorded by project executive. If the intubation prolonged more than 30 seconds, it did not end up due to risks but that case was recorded as a failed case. Each resident performed 5 intubation by each one of the investigated devices in the project.

In both researches, one practice moulage with standard airway Mallampati grade I and tube 7.5. The intubation time was considered since the positioning of laryngoscopes in the patients mouth until the observation of ventilated lungs.

Statistical analysis

The collected data were analyzed by SPSS21 software. The data were reported as mean \pm standard deviation (Mean \pm SD). The analysis of variance (ANOVA) and Tukey post-hoc test was used to compare difference between the groups. A level of $p < 0.05$ was considered as significant.

RESULTS

After investigating the data, the results revealed that 55.6% of the participants were female and 44.4% were male and 38.9% of them were fresh man residents, 33.3% were sophomore residents and 27.8% were junior residents. To compare the essential time for intubation with video laryngoscope for the residents in different entrance years, variance analysis was used. The results of this test are showed in Table 1.

Table 1: Statistical indexes for the time needed for intubation by video laryngoscope for the residents in different entrance year

Entrance year	Standard deviation \pm average	F	p-value
Freshman	32.69 \pm 11.696	29.66	0.001
Sophomore	19.35 \pm 5.760		
Junior	16.33 \pm 7.529		

The results of variance analysis in Table 1 present that there is a significant difference between the average required time for intubation by video laryngoscope for the residents with different entrance year to the hospital.

By Tukey test, the results presented that the average required time for intubation by video laryngoscope is the longest for the fresh man residents and the average time

for the sophomore and junior residents did not reveal a significant difference ($p > 0.05$).

Table 2: The statistical indexes of the required time for intubation by Bougie for the residents with different entrance year

Entrance year	Standard deviation \pm average	F	p-value
Freshman	19.56 \pm 3.619	32.386	0.001
Sophomore	15.65 \pm 3.411		
Junior	12.78 \pm 2.490		

The results of the variance analysis in Table 2 present that there is a significant difference between the required time for intubation by Bougie for the residents with different entrance year to the hospital. In the following, in order to understand these differences, Tukey test was applied. The results show that the essential required time for intubation by Bougie is the longest for the freshman residents and it has a significant difference with other residents ($p < 0.05$). The average time for the sophomore

residents has a remarkable difference with other residents and it stands in the second rank ($p < 0.05$). In addition, the average time for the junior residents is the shortest among all others and it stands in the third rank ($p < 0.05$). To compare the required time for intubation by video laryngoscope and Bougie for the residents with different entrance year, the paired t-test was used. The results of this test are shown in Table 3.

Table 3: The statistical indexes of the required time for intubation by Bougie and video laryngoscope for the residents with different entrance year

Method	Video laryngoscope	Bougie	The results of paired t-test
Entrance year	Standard deviation \pm average	Standard deviation \pm average	
Fresh man	32.69 \pm 11.696	19.56 \pm 3.619	t=7.809, df=34, p-value=0.001
Sophomore	19.35 \pm 5.760	15.65 \pm 3.411	t=4.09, df=29, p-value=0.001
Junior	16.33 \pm 7.529	12.78 \pm 2.490	t=2.649, df=24, p-value=0.014
Total	23.70 \pm 11.479	16.37 \pm 4.273	t=7.791, df=89, p-value=0.001

The findings of paired t-test in Table 4 indicate that p-value is less than 0.05 for each 3 different entrance years and in total which shows a significant difference between the average required time of intubation for the residents

with different entrance years by video laryngoscope and Bougie. Figure 1 represents this significant difference clearly.

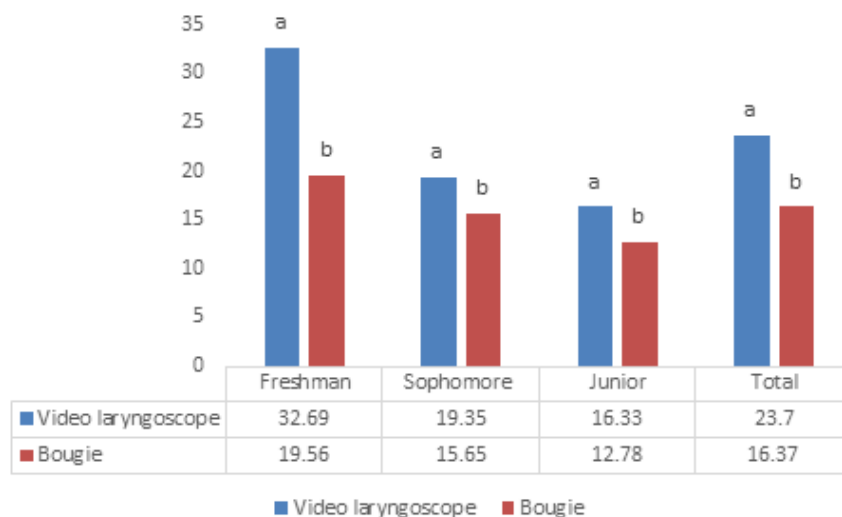


Figure 1: The average required time for comparing intubation by video laryngoscope and Bougie for the residents with different entrance year

To compare the successful intubation times by video laryngoscope and Bougie for the residents with different

entrance year, the ratio test was applied. The results of this test are presented in Table 4.

Table 4: The statistical indexes of the successful intubation times by Bougie and video laryngoscope for the residents with different entrance year

Entrance year	Result	Video laryngoscope	Bougie	The results of the ratio test
		Frequency (%)	Frequency (%)	
Freshman	Successful	20 (57.1)	33 (94.3)	p-value=0.001
	Unsuccessful	15 (42.9)	2 (5.7)	
Sophomore	Successful	27 (90)	30 (100)	p-value=0.001
	Unsuccessful	3 (10)	0 (-)	
Junior	Successful	22 (88)	25 (100)	p-value=0.001
	Unsuccessful	3 (12)	0 (-)	
Total	Successful	69 (76.7)	88 (97.8)	p-value=0.001
	Unsuccessful	21 (23.3)	2 (2.2)	

The findings of the ratio test in Table 4 reveal that p-value in each 3 different entrance years and total are less than 0.05 which indicate for the significant difference between the successful intubation times by video laryngoscope and Bougie for the residents with different entrance years. Considering the frequency percentage of successful intubation, it was clarified that Bougie method is much more successful than the video laryngoscope method.

DISCUSSION

There are numerous articles about the application of different video laryngoscope types for piping inside the chip [9]. In a study done by Lim *et al.* on educational Mannequins with Mallampati grade III which only epiglottis was visible, two rigid video laryngoscope and Macintosh laryngoscope methods were compared with each other. Anesthesiologist observed that rigid video laryngoscope needs less time for intubation. 23.5 seconds versus 70.5 seconds ($p=0.001$) [10]. Furthermore, another research by Jungbauer *et al.* was carried out to compare video laryngoscopy and direct laryngoscopy on 200 patients with Mallampati grade 3 to 4. In this article also the required intubation time by video laryngoscope was shorter obviously. 40 seconds versus 60 seconds ($p=0.017$) [11]. In the present study, the average total times were 23.75 seconds and 16.37 seconds for video laryngoscope and Bougie among all residents respectively which present intubation by Bougie takes less time. Contrary to these results, there are also some other studies that did not discover any advantage for video laryngoscope in front of conventional laryngoscope. For example, in a study done by Kim *et al.* on practice and educational Moulage for comparing rigid video laryngoscope and conventional laryngoscope, 4 scenarios were evaluated; the first one: normal shape of airways, second: Moulage, imitating the physical constraints of cervical vertebrae, third: simulation of tongue edema and then combinational model of tongue edema and physical constraints of cervical vertebrae. In all 4 models, the research of video laryngoscope could not have a clear advantage on laryngoscopes regarding

speed and position [12]. The researches have revealed that video laryngoscope can create a better gothic image [11]. However, having a clear gothic image does not guarantee for fast and successful intubation because transmitting the ETT tube throw vocal cords needs stereoscopic and psychomotor skills which will increase by practice for sure [10,13]. Furthermore, Curtis carried out a study on awake overweight patients by flexible video laryngoscope in 2012. He found out that the presence of blood and mucus along the respiratory makes the application of this scope for piping inside the chip so hard or even impossible [14]. In contrast, those researches which have done on the Bougie's potentials in patients intubation who have problems in their airways, have mentioned the advantage of this method over other methods such as direct laryngoscopy mostly. For example: A research done by Noguchi *et al.* which was published in *Insenoil* journal, application of Bougie by means of stylet in the patients who feel pressure on Cricoid cartilage while intubation was compared for the convenience of these patients. He observed that pressure on Cricoid cartilage can make the intubation too hard and application of Bougie can make it more convenient while it is not true for stylet. In that research, the required time for intubation by Bougie was measured 33 seconds [15] while this time is low with 16.37 seconds as the total average but it was in agreement regarding the increased speed and success rate. In addition, another research was done by Komatsu *et al.*, which was entitled "comparing the rigid scope of airway and Bougie for intubation of the patients with cervical vertebrae complications". The average intubation speed by Bougie was measured 49 seconds [16] which was longer than our findings but it was shorter than the time required for rigid scope. In this research, the success of intubation by Bougie was calculated 95.8% which this amount was 97.8% in our research. Another research by Messa *et al.* which was entitled "the success of conventional and Bougie laryngoscopy by educational Moulage and simulation of difficult airways" [17]. The success of intubation by Bougie was 94% and it was much higher than conventional laryngoscopy [15,16]. The average required

time for intubation by Bougie was calculated 20.4 seconds [17].

CONCLUSION

Considering the results of this research, it can be concluded that both video laryngoscope and Bougie devices have been shown as a reliable and effective auxiliary devices. Due to the availability, fast education and safety, it is a unique device which is one of the best devices and it is suggestible in emergency unit for opening reliable airways during hard intubations. It seems BOUGIE with high rate of success and availability can be a good auxiliary device in hard intubation cases in emergency.

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AUTHOR CONTRIBUTIONS

All authors contributed toward data analysis, drafting and revising the paper and agreed to be responsible for all the aspects of this work.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this manuscript.

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