ORIGINAL ARTICLE

Video Laryngoscopy Versus Direct Laryngoscopy in Novices: A Randomized Clinical Trial

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Abstract- Intubating the trachea is a challenging task, especially for novice intubators. Successful intubation, in the shortest possible time, prevents hypoxia and hemodynamic disturbances. During the last few decades, video laryngoscopy has proven to be a helpful tool for intubating patients successfully, especially in difficult cases. However, novices must be proficient with a video laryngoscopy. It is not entirely clear which method, direct laryngoscopy or video laryngoscopy, is more successful for tracheal intubation in individuals who have recently started their airway management training. In this study, we aim to investigate this issue. 150 patients were randomly assigned to either direct laryngoscopy or video laryngoscopy by first-year anesthesia assistants. Intubation time, intubation success rate, Cormack-Lehane score, and instances of using the Optimal external laryngeal manipulation (OELM) maneuver, were recorded. The rate of successful intubation was higher in the direct laryngoscopy group, and the time taken was less. The direct laryngoscopy provided a better view of the glottis than the video laryngoscopy, although this difference was not statistically significant. Direct laryngoscopy resulted in a higher frequency of OELM. Based on our study, the success rate and speed of intubation in novices were higher with direct laryngoscopy compared to video laryngoscopy.

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Keywords: Tracheal intubation; Direct laryngoscopy; Video laryngoscopy; Airway management; Novice intubators; Anesthesia assistants

Introduction

Tracheal intubation is essential for maintaining the airway and preventing aspiration during general anesthesia. Tracheal intubation may be performed using a variety of techniques. The traditional method is direct laryngoscopy which is conventionally done with a Macintosh blade. There are alternative methods such as indirect laryngoscopy using a video laryngoscope, fiberoptic visualization of the vocal cords via the nasal or oral cavity, and also direct cricothyrotomy placement of the endotracheal tube (1-5).

Video laryngoscopy has become increasingly popular over the past three decades. The initial use of video laryngoscopy was intended to facilitate intubation in cases where direct laryngoscopy was not successful. Currently, based on the newly recognized benefits, video laryngoscopy is used as a primary method rather than as an alternative to tracheal intubation. Different studies have compared the success rate, time required, and complications associated with direct versus video laryngoscopy. Studies showed that the success rate of intubation with video laryngoscopy was generally higher. The time required to intubate a patient in different clinical settings was shorter. Video laryngoscopy intubations were less likely to cause

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complications such as increased blood pressure, bradycardia, hypoxemia, and death (6-9).

The experience level of the individual performing the intubation is less considered when comparing these two methods. There have been few studies comparing direct laryngoscopy with video laryngoscopy in inexperienced patients. Therefore, we designed this study to compare the video laryngoscopy and direct laryngoscopy for tracheal intubation in first-year assistants of anesthesiology. We tried to find which method can reach a secure airway faster, and whether the instances of using the Optimal external laryngeal manipulation (OELM) maneuver and Cormack-Lehane grade score correlate with the type of intubation method or not.

Materials and Methods

After obtaining approval from the Tehran University of Medical Sciences ethics committee with approval code [IR.TUMS.IKHC.REC.1400.056], the sample size for the study was calculated using Cochran's formula. From 2022 September to 2023 August, at the Cancer Institute of Imam Khomeini Hospital in Tehran, 150 elective surgery patients were randomly selected and divided into two groups. The intubation of 75 patients was performed by direct laryngoscopy and 75 patients by video laryngoscope. Laryngoscopy methods were selected based on block randomization. The study involved 17- to 65-year-old patients who consented to participate. We excluded patients in class higher than II according to the classification of the American Society of Anesthesiologists, and patients with a history of previous surgery on the head and neck or recent diagnosis of head and neck or mediastinal mass. In addition, patients with neck instability, mouth opening less than 3 cm, and thyromental distance less than 6 cm were not included in this study. Monitoring in the operating room included pulse oximetry, noninvasive arterial blood pressure, electrocardiography, and capnography. Preoxygenation was performed with an oxygen flow of 10 liters per minute using a face mask connected to the anesthesia machine's Y-piece. Midazolam was prescribed at 1 to 2 mg and then fentanyl was used to control laryngoscopy pain with a dose of 3 to 5 mcg/kg. After 3 minutes, propofol was administered at 2-3 mg/kg. After ensuring that the patient could be ventilated with a mask and bag, atracurium was administered at a dose of 0.5 mg/kg. Following positive pressure ventilation for three minutes, the patient underwent oral laryngoscopy by a first-year anesthesia assistant who had completed at least two months of training. Depending on whether the patient was in the direct laryngoscopy group or the video laryngoscopy group, Macintosh blade 3 or Glidescope blade 3 (Verathon brand) was used for intubation. The intubator acted based on his/her decision to use the OELM maneuver in difficult intubation cases. The supervising anesthesiologist attempted intubation when the intubation had not been completed within 60 seconds, the SpO2 was less than 92%, or the initial attempt failed. Lung auscultation and capnography confirmed successful intubation. In case this was not confirmed, the supervising anesthesiologist would try to intubate the patient again. As long as the intubation was finally performed by the anesthesiologist based on the protocol described, it was considered to be included among the cases with a first unsuccessful attempt. All other cases that intubated with assistants, were recorded as successful first attempts. We only recorded intubation times for successful initial intubations. Intubation time was measured from the time the laryngoscope entered the mouth to the time it left.

Results

Each group included 75 patients. Both groups had similar demographic characteristics. Intubation lasted 16.49±7.915 seconds in the DL group and 29.69±13.848 seconds in the VL group which was statistically significant (P<0.001). In the DL group, 67 (89.3%) patients were intubated on the first attempt by the first-year anesthesia assistant, and 8 (10.7%) patients were unsuccessful. In the VL group there were 54 (72.0%) successful first attempts and 21 (28.0%) resulted in patient intubation by the supervising anesthesiologist. The success rate in the first attempt was significantly higher in the DL group (P=0.007). Regardless of the intubation method, we found a significant difference in male intubation success. Among 54 male patients, 48 (88.9%) were intubated on the first attempt. Among 96 female patients, 73 (76.0%) were intubated at the first attempt. This difference was statistically significant (P=0.05).

Direct laryngoscopy made a better visualization of the glottis, and more OELM maneuvers were done in this method. 67 patients in the DL group had a Cormack-Lehane score of 1 or 2a, versus 60 in the VL group. 15 patients in the VL group revealed a Cormack-Lehane score of 2b, 3, or 4, versus 8 in the DL group. The intubation of 22 patients needed the OELM maneuver in the DL group, but this maneuver was used only 15 times in the VL group. Despite better visualization rate and more OELM maneuver application in the DL group, there was no significant difference between the frequency of Cormack-Lehane grades in the DL and VL groups, nor in the use of the OELM maneuver.

Table 1. Patients' characteristics and outcomes of intubation; DL: direct laryngoscopy; VL: video laryngoscopy; NS: not significant; CL: Cormack-Lehane Scale

		DL	VL	*P*
Number of patients		75	75	NS
Age (years)		49.85±11.31	53.42±9.81	NS
Sex (female: male)		50(66.6%):25(33.3%)	46(61.3%):29(38.6%)	NS
Cormack-Lehane grade	**CL1**	44 (58.6%)	39 (52.0%)	NS
	CL2a	23 (30.6%)	21 (28.0%)	
	CL2b	7 (9.3%)	9 (12.0%)	
	CL3	1 (1.3%)	4 (5.3%)	
	CL4	0 (0.0%)	2 (2.6%)	
Intubation time *(s)*		16.49±7.915	29.69±13.848	P<0.001
First attempt success		67 (89.3%)	54 (72.0%)	0.007
Male		25 (37.3%)	23 (42.5%)	
Female		42 (62.6%)	31 (57.4%)	
OELM maneuver		22 (29.3%)	15 (20.0%)	0.185

Discussion

In our study, successful first-attempt intubation was chosen as the primary outcome because several studies showed a strong correlation between the frequency of complications such as hypoxemia, cardiac arrest, and death and multiple attempts for tracheal intubation (10,11). According to our results, the successful first attempt rate was significantly higher in cases of direct laryngoscopy. The secondary outcome was the time it took to intubate a patient successfully. A delay in intubation could worsen hypoxemia and could be clinically relevant in patients who are profoundly hypoxic or have preexisting intracranial disease. In our study, the time taken for successful intubation in direct laryngoscopy was less than in video laryngoscopy.

Some previous studies have shown that the intubation time is shorter or the success rate is higher in direct laryngoscopy (4,12,13). Some studies showed the number of successful first attempts, using video laryngoscopy was higher, and or the time it took to intubate a patient was lower (6,14-17). Some meta-analyses confirmed these results (7,18,19). On the other hand, there are studies that have not mentioned the meaningful difference between DL and VL methods (20,21). One study showed that the success rate of direct tracheal intubation is higher in medical students, but not significantly different in assistants who are novices to intubation (7).

There are two possible reasons for the difference in the results of the studies: the greater skill of the intubator in using the conventional laryngoscope compared to the video laryngoscope, as well as the type of video laryngoscope (with or without channels). Even though the intubators in our study were first-year assistants in anesthesiology and were considered novices in both laryngoscopy methods, it is important to note that the training of these individuals began with the Macintosh blade and they did not have much experience using the video laryngoscope. Video laryngoscopes usually allow a better view of the glottis, but this does not necessarily translate into a higher intubation success rate. There is evidence to suggest that even intubators who have experience with conventional laryngoscopy will have a lower success rate with video laryngoscopy if they are inexperienced with it. In this context, special attention should be given to hand-eye coordination, and the impact of practice and experience in enhancing this coordination. There is a critical role for the laryngoscope type. Compared to channel-less video laryngoscopes, channeled video laryngoscopes increase intubation success rates and decrease intubation time. To use a channel-less video laryngoscope requires hand-eye coordination, and navigating the tracheal tube to reach the glottis requires skill to be performed quickly (13,22).

We found that the Cormack Lehane view was higher, albeit not statistically significant, indirect laryngoscopy. The video laryngoscope used in this study has the same curvature as the Mackintosh 3 blade, and the intubator's lack of skill in using the video laryngoscope can influence the outcome. Many studies have shown that video laryngoscopy provides a better view of the glottis. These studies, however, did not consider the intubator's skill level. This is likely the most substantial contributor to understanding the effect of skill level on video laryngoscope efficiency.

Although only 8 patients in the direct laryngoscopy group had Cormack-Lehane IIb or higher, the OELM maneuver was performed 22 times (7 times more than in the video laryngoscopy group). Meanwhile, successful intubation in the direct laryngoscopy group took a shorter time (about 13 seconds less than the video laryngoscopy group), and the successful intubation rate was higher in this group. Although more OELM maneuvers were reported as non-significant in the direct laryngoscopy group compared to the video laryngoscopy group, we interpreted this as evidence that the intubator's lack of experience may influence the intubator's clinical judgment regarding whether to use an OELM maneuver. Additionally, the reason may be the habituation of using this maneuver when positioned for the direct laryngoscopy.

Although video laryngoscopy facilitates intubation, especially in difficult situations, success in using a video laryngoscope requires training and practice. Proficiency in performing conventional laryngoscopy does not mean the ability to successfully use a video laryngoscope, and this problem is exacerbated in novices. Based on our study, the success rate and speed of intubation in novices were higher with direct laryngoscopy compared to video laryngoscopy. Intubators should be trained with a video laryngoscope from the beginning. After acquiring sufficient proficiency, the video laryngoscope, without head and neck maneuvers, probably allows intubation to be performed in a shorter time and with greater success.

Limitations

This study has several limitations. It assessed a single type of video laryngoscope, which has a curved blade similar to the direct laryngoscope. Other video laryngoscopes with a hyperangulated blade or specific intubation channel might have produced different results. Furthermore, conducting multicentric studies with larger populations, especially in centers where airway management training, and particularly early and more extensive video laryngoscopy training for anesthesia assistants, compared to our center, could lead to different outcomes.

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