Comparative Study of the Ease of the Technique Between Direct Laryngoscopy versus Videolaryngoscopy Among Clinical Clerks

Zharmaine L. Antenor, MD, Nicole F. Avenido, MD and Kristine Marie C. Ilo-Ramos, MD, DPBA

ABSTRACT

Background: Recent studies have shown that inexperienced anesthesiologists have a higher first attempt success rate when using a video laryngoscope. However, existing local studies are limited. This study aimed to investigate which method of laryngoscopy would result in a higher success rate among inexperienced clinical clerks.

Objective: The goal of this study was to compare the ease of use of video laryngoscopy versus direct laryngoscopy by clinical clerks on an intubating mannequin.

Methods: Participants were divided into two groups and were asked to perform either video laryngoscopy or direct laryngoscopy. The time from blade insertion until successful intubation was recorded. They were asked to answer a post-intubation questionnaire where they indicated the difficulty experienced such as head positioning, mouth opening, visualization and tube insertion.

Results: The success rate in the video laryngoscopy group (n=31) were as follows: 86.7% in first attempt, 90.3% in second attempt, and 100.0% in the third attempt. The success rate in the direct laryngoscopy group (n=31) were as follows: 90.3% in first attempt, 93.6% in second attempt, and 90.3% in the third attempt. Although success rate was higher in the video laryngoscopy group, the difference with direct laryngoscopy was not statistically significant (p=0.076). The total duration of orotracheal intubation was shorter in the direct laryngoscopy group than in the video laryngoscopy group in all three attempts. However, the differences were not statistically significant (p>0.05).

Key words: Anesthesiology, intubation, video laryngoscopy, direct laryngoscopy, laryngoscopy

Airway management and the techniques involved are the cornerstone of anesthesia, these are the set-skill an anesthesiologist must have and all physicians should at least be familiar with. Securing an airway and maintaining airway patency are the requirements to ensure adequate oxygenation and ventilation upon induction of general anesthesia. The most common method of intubation is direct laryngoscopy, hence it is the most commonly taught technique among medical students.

The use of advanced instruments such as fiberoptic bronchoscopy and video laryngoscopy are constantly gaining traction in the field of Anesthesiology to aid in airway management especially in dealing with difficult airways for better visualization of the glottic opening during intubation.

There has been limited study on the use of video laryngoscopes locally. This study can aid in determining whether video laryngoscopy can result in a higher first - attempt intubation success rate over that achieved using conventional direct laryngoscopy.

Review of Related Literature

Endotracheal intubation (ETI), defined as placement of an endotracheal tube (ET) into the trachea, is the primary technique in securing the airway and providing effective and adequate ventilation, and one of the cornerstones of Anesthesiology practice. This skill-set is not just exclusive to anesthesia practice because the ability to secure a patient's airway is a

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matter of life and death and staving off harm from the patient is a shared responsibility amongst physicians. Laryngoscopy may come as a complex technique to learn, and to be competent, a trainee would require more than 47 laryngoscopic endotracheal intubations in a controlled non-difficult patient (Mulcaster, et al, 2003). Teaching this technical skill to clinical clerks or junior interns may provide leverage towards an earlier adeptness to the laryngoscopy technique and create a good ground in understanding advanced airway management leading to better patient care and outcome.

Direct laryngoscopy (DL) requires the intubator in uncomplicated cases to align the oral, pharyngeal and laryngeal axes and directly visualize the glottis and passage of the endotracheal tube through the glottic opening. However, there are circumstances wherein direct laryngoscopy is difficult and intubation is rendered challenging and even unfeasible. This critical event may be due to the inability of the intubator to visualize the glottic opening. To circumvent this limitation, videolaryngoscope was introduced more than 2 decades ago.

Videolaryngoscope (VL) is a laryngoscopic device to which a camera has been integrated to the tip of the blade and features a display monitor providing indirect visualization of the upper airway and placement of ET. The exaggerated curvature of the blade improves optics providing better view of glottis with minimal airway manipulation (Maharaj, et al, 2006). There are even current models that do not require alignment of the 3 aforementioned axes, obviating the need to displace upper airway soft tissue and permitting the operator to helpfully inspect the corners and navigate the ET tube into the glottic opening successfully (Natt, et al, 2016). In a study of Dupanovic, et al (2006) where GlideScope was utilized, they arrived in a consensus that there is ease in the visualization of the glottis and there is difficulty in the delivery of the endotracheal tube (ETT) to the glottis and placement into the trachea. Dupanovic, et al (2006) proposed to bend the malleable stylet to 90-degree angle for an easier insertion of ETT into the glottic opening when using GlideScope Videolarngoscopy (GSVL). But the angulation of the stylet may create difficulties in passing the ETT into the trachea. In line with the study of Natt, et al (2016), VL improves human factor in airway management and VL entails a favorable learning curve than the conventional laryngoscopy. The continuous pursuit and innovation of techniques and devices for airway management developed common goals - higher first-attempt intubation success rate with shorter duration of intubation, reduced application of force for increased tissue respect, and reduction of complications.

In a prospective randomized crossover study by Marahaj, et al (2006), 40 medical students with no previous experience in airway management underwent short didactic instruction and participated to do intubation trials using Macintosh and Airtraq devices in intubation mannequins simulating normal airway and difficult laryngoscopy scenarios. Participants were taught both techniques and the following endpoints were assessed - primary endpoints used were the duration of tracheal intubation attempts and the success rate of tracheal tube placement. Additional endpoints included the gross number of intubation attempts, the number of optimization maneuvers required (e.g. readjustment of head position, use of a bougie, second assistant) and severity of dental trauma. The study concluded that Airtraq had a favorable remark over Macintosh wherein participants had lesser duration of attempt, lesser number of optimization maneuvers, reduced dental trauma and participants also claimed of easier use. The learning curve for Airtraq device was found to be rapid and resulted in increased success rate in intubation particularly in difficult airway scenarios. There is a similar and more current study by Singh, et al (2022) where the result is in contrast to the aforementioned study. In the randomized observational study, 80 medical interns were grouped into 2 - a group where direct laryngoscopy using macintosh blade was exclusively taught and a group where DL was taught with additional videolaryngoscopy-based sessions to further teach anatomical landmarks. Both groups did direct laryngoscopy in a mannequin. The mean time to intubate was 48.58 seconds and 48.65 seconds for the DL and VL groups, respectively. This concluded that additional VL-based training did not affect intubation success rate or time, and that success rate of intubation is independent of the technique used. The non-significance of VL as an additional teaching aid was ascribed to the students' perceived extraneous or impertinent sensory overload. The favorable results of VL in the randomized crossover of Maharaj, et al could be attributed to the exposure to both techniques (DL and VL) and may have an interdependent effect on the participants. The role of cognitive load and perceptual integration in VL versus DL is insufficiently explored. While VL may

offer imroved visualization, it also introduces an indirect view and additional sensory inputes that may overwhelm novice users or be perceived as extraneous. The impact of such factors on learning, decision-making, and execution in real-time clinical settings has not been adequately theorized, leaving a gap in educational and procedural frameworks for airway management training.

Zou, et al (2022) conducted a randomized prospective study comparing the effectivity of case-based learning (CBL) teaching, where visual laryngoscopy using VL was inculcated, versus traditional lecture combined with conventional laryngoscope in teaching interns. Thirty seven (37) anesthesia interns were divided into control group receiving traditional training and observation group receiving CBL. Intubation success and failure rate (inadvertent esophageal intubation), duration of intubation, incidence of overall complications, and post-procedural theoretical assessment were recorded. The success rate of initial intubation and overall intubation were significantly higher in the observation group. The observation group was also analyzed to have a significantly higher operation intelligibility, comprehension, learning interest and satisfaction rate. There was no incidence of esophageal intubation in the observation group. The overall complication rate was significantly lesser in the observation group. The study concluded that CBL with videolaryngoscopy teaching strategy can help in a faster and germane learning process, this was because the interns were able to proficiently understand anatomical landmarks and operation points of endotracheal intubation. This research exposed both DL and VL groups in a comprehensive preceptive, to allow the entire population of participants to have equal footing and be able to minimize confounding biases by putting the groups in separate didactics.

In a local study conducted by Carillo, et al (2017), a comparison of the effectiveness of teaching strategies among 251 clinical clerks in developing their intubation adeptness. The learning methods were the following: 1) Video-assisted learning (V), 2) Video-assisted learning with experiential learning (self learning) (VEL), and 3) Video-assisted learning with instructor guided simulation (VGL). Post-procedural, the students were assessed utilizing a non-graded 11 point objective structured clinical examination. The standard deviations were as follows - V: 5.76 (2.16), VEL: 7.21 (2.16), and VGL: 7.60 (1.72). Meanwhile the rate of failure of intubation were - V: 21%, VEL: 2% and VGL: 0%. The study concluded that VEL and VGL enhanced the clinical clerks' intubation skill development with a failure of intubation reduction of 27-30%. The study did not delve around the teaching method's effectiveness. The study focused on how inexperienced clinical clerks found direct laryngoscopy or videolaryngoscopy easy or difficult. Although the researchers' teaching method was similar to this local study's VGL - wherein the participants watched a 5-minute instructional video and were lectured, this was followed by an actual demonstration by the researchers of the VL or DL proper.

Based among the available literature, there is a growing consensus that videolaryngoscopy (VL) is potentially a superior alternative to direct laryngoscopy (DL), but further studies are needed to fill in the theoretical gap in understanding the cognitive aspect and procedural system or mechanisms that put videolaryngoscopy in advantage over direct laryngoscopy.

The literature also presents conflicting findings regarding the advantage as a technique and as a teaching tool of videolaryngoscopy (VL) versus direct laryngoscopy (DL). Due to the variability and specificity of the teaching method, set-up, training and learning load, and cross-technique exposure, the true comparative results of VL and DL are obscured. This indicates a need for a refined standardized methodologies that take into consideration operator experience, learning environment and possible interactive effects of blended learning.

The aim of this study was to compare the ease of use of video laryngoscopy versus direct laryngoscopy by clinical clerks on an intubating mannequin.

MATERIALS AND METHODS

Research Design

This was a prospective, randomized study to compare the ease of use of video laryngoscope and direct laryngoscope by clinical clerks with no prior experience in airway management on an intubating mannequin

Target Population

Clinical clerks from Far Eastern University - Nicanor Reyes Medical Foundation rotating in the Department of Anesthesiology between March 2024

to August 2024 who have signed an informed consent were enrolled for the study.

Methodology Proper

Clinical clerks without prior experience of any type of intubation were invited to participate and asked to sign an informed consent. The investigators showed the participants a 5-minute instructional video on the process of intubation using both direct and video laryngoscope. Then a short lecture were presented to discuss laryngoscopy further, and also to explain the procedure, nature and purpose of the study to the subjects.

Using sequentially numbered randomization cards, the students per batch were randomly allocated to Group A or the video laryngoscopy (VL) group and Group B or the direct laryngoscopy (DL) group. An assigned researcher demonstrated either VL or DL to the respective groups.

All subjects performed the intubation at the operating room and table height was adjusted in accordance to the participant's height. The intubating dummy was positioned in a sniffing position to mimic an actual patient. The first attempt of intubation was performed by the subjects once proper head position was achieved. On Group A, videolaryngoscope was used to visualize the glottis and attempt orotracheal intubation. On Group B, orotracheal intubation was performed using direct laryngoscopy. An endotracheal tube with stylet and an internal diameter of 6.5mm were used by both groups. Lubricating jelly was placed on the endotracheal tube prior to each attempt to avoid friction with the mannequins. Once the tube wasinserted, the endotracheal tube was cuffed with 3 mL of air. Each attempt was limited to a duration of two minutes and the total intubation time and vocal cords visualization time were recorded. Three attempts regardless of the success or failure were given per subject. The study ended with confirmation of orotracheal intubation with visible lung expansion of the intubating mannequin. Each subject performed the intubation three times in both groups.

Sampling Size

Clinical clerks who signed the informed consent were selected based on simple random sampling. A minimum of 50 subjects were included, with Group A and Group B having 25 subjects each to detect a medium effect size (0.5) using two-tailed independent t-test with 80% power and 95% confidence interval.

Data Management and Analysis

Data was encoded using Microsoft Excel. Data was analyzed using the Statistical Package for the Social Science (SPSS) version 25.0. Categorical variables were presented as number (percentage). Continuous variable (total intubation time) were presented as mean (standard deviation). Differences among categorized groups were compared using Chi-square test, and data for continuous variable were compared using independent students' test. A p-value<0.05 was considered statistically significant.

RESULTS

A total of 66 participants were included in the study wherein 33 each were assigned in the video laryngoscopy and 33 in the direct laryngoscopy. In the video laryngoscopy group, 48.5% had previous experience while in the direct laryngoscopy, 63.6% had previous experience (p=0.215). Significant difference in difficulties experienced were reported between the two groups (p<0.001). In the video laryngoscopy group, most had difficulties in the placement of the laryngoscope (51.5%) and in insertion of the endotracheal tube (45.5%). In the direct laryngoscopy group, most had difficulties in lifting (66.7%).

In the video laryngoscopy scope, most (54.5%) reported a POGO Scoring of 85 to 90.

In the actual blade insertion, 31 participants performed direct laryngoscopy using a standard Heine laryngoscope with Macintosh blade 3, and another 31 participants performed video laryngoscopy using the SunnyMed video laryngoscopy with Macintosh blade 3. The success rate in the video laryngoscopy group were as follows: 86.7% in first attempt, 90.3% in second attempt, and 100.0% in third attempt. The success rate in the direct laryngoscopy group were as follows: 90.3% in first attempt, 93.6% in second attempt, and 90.3% in third attempt. Although success rate was higher in the video laryngoscopy group, the difference with direct laryngoscopy was not statistically significant (p=0.076).

The total duration of orotracheal intubation was shorter in the direct laryngoscopy group than in the video laryngoscopy group in all three attempts. However, the differences were not statistically significant (p>0.05).

Table 1. Previous experience, direct laryngoscopy and difficulties of clinical clerks.

	Video laryngoscope (n=33)	Direct laryngoscope (n=33)	Chi^2 value	p-value
With previous experience	16 (48.5%)	21 (63.6%)	1.538	0.215
Difficulties				
a. Positioning	6 (18.2%)	2 (6.1%)	5.210	<0.001
b. Mouth opening / scissor technique	7 (21.2%)	3 (9.1%)		
c. Placement of the laryngoscope	17 (51.5%)	3 (9.1%)		
d. Visualization of the structures	5 (15.2%)	3 (9.1%)		
e. Identification of structures	4 (12.1%)	1 (6.1%)		
f. Lifting	8 (24.2%)	22 (66.7%)		
g. Insertion of the endotracheal tube	15 (45.5%)	0 (0.0%)		
h. None	0 (0.0%)	4 (12.1%)		

In the direct laryngoscopy scope, 90.9% reported a Cormack Lehane Scoring of 1.

Table 2. Cormack Lehane Scoring for direct laryngoscopy.

	Direct laryngoscope (n=33)
1	30 (90.9%)
2a	3 (9.1%)

Table 3. POGO Scoring for video laryngoscopy.

	Direct laryngoscope (n=33)
60-80	13 (39.4%)
85-90	18 (54.5%)
100	13 (39.4%)

Table 4. Intubation success rate of the use of video laryngoscope and direct laryngoscope.

	Video laryngoscope (n=31)	Direct laryngoscope (n=31)	Chi^2 value	p-value
First attempt	26 (86.7%)	28 (90.3%)	0.201	0.654
Second attempt	28 (90.3%)	29 (93.6%)	0.218	0.641
Third attempt	31 (100.0%)	28 (90.3%)	3.500	0.076

Table 5. Total duration of orotracheal intubation between video laryngoscopy versus direct laryngoscopy.

	Video laryngoscope (n=31)	Direct laryngoscope (n=31)	Mean Difference	p-value
First attempt	54.3±22.9	49.0±17.2	5.3±26.9	0.330
Second attempt	42.3±25.6	32.4±9.0	9.9±24.5	0.050
Third attempt	30.6±16.4	28.6±8.7	2.0±17.8	0.557

DISCUSSION

Airway management is a crucial skill in anesthetic practice, ensuring an airway is secure for ventilation and oxygenation. Tracheal intubation is the gold standard for airway management, ensuring a stable airway, reducing stomach contents aspiration, and allowing positive pressure breathing. Direct laryngoscopy is commonly used for tracheal intubation, but alternative techniques have been developed for challenging situations. While direct laryngoscopy is a reliable technique for skilled medical specialists, it can be devastating for emergency healthcare practitioners, especially those who don't have enough prior experiences (Healy, et al, 2012). Video laryngoscopy aims to improve the effectiveness of tracheal intubation by using smaller, portable flat-screen displays and higher-resolution micro cameras, improving success rates and visual field compared to direct laryngoscopy (Hodd, et al, 2011). The study included a total of 62 participants, divided into 2 groups (direct versus video laryngoscopy) with equal number of participants.

Results showed that no significant differences between video laryngoscopy and direct laryngoscopy were seen in the findings in relation to the success rate and duration. Similar results were observed in an earlier trial of Ray and colleagues (2009) including first-year medical students, when both laryngoscopes required the comparable amount of time to intubate participants. There was no difference in the time to intubation between the use of the two techniques, according to the meta-analysis of Arulkumaran, et al (2018) analyzing 3,050 intubations. Another study by Narang, et al (2009) showed that in both the normal and neck immobility conditions, participants were able to intubate the mannequin more quickly while utilizing the direct laryngoscope ($p=0.01$). Video laryngoscopy, on the other hand, provided better cord visibility, a higher success rate of cord visualization at the time of intubation (50% vs. 12%), and a higher rate of successful intubations (83% vs. 23%) in the tongue edema scenario. They concluded that the video laryngoscope provided better visibility of the vocal cords with less time, higher intubation success rates, and shorter intubation duration in the most difficult airway scenario—tongue edema. One study showed that in majority of the situations, direct and video laryngoscopy had comparable time of intubation and adverse effects, but in more difficult situations, direct laryngoscope lead to lesser number of attempts and higher success rates (Maartens & de Waal, 2017). Although video laryngoscopy offers visual comfort, more practice is still needed to guarantee usability. When using video laryngoscopy instead of direct laryngoscopy to pass the endotracheal tube, a higher learning curve should be maintained (Asan, et al, 2024).

Although not significant, the results demonstrated that the third attempt at intubation with the video laryngoscope had lower failure rates. Novices find intubation easier because the airway features are clearly visible. Better visibility of challenging airways is made possible by the video laryngoscope, which may also increase the success rate of intubation. Furthermore, Muhamed, et al (2024) indicated that the video laryngoscope may lessen the possibility of intubation-related problems such soft tissue trauma or tooth damage. When handling difficult airways, video-assisted intubation methods have proven to be more effective than direct laryngoscopy (Sun, et al, 2005; Clarke, et al, 2008).

On the other hand, one limitation of the use of video laryngoscopy in emergency situation is that even small amounts of blood, vomitus, and secretions in the airway may obstruct the camera at the end of the laryngoscope blade hindering direct vision (Thoeni, et al, 2015). Furthermore, some users may find it difficult to maintain good hand-eye coordination when using video laryngoscopes. Because it's more complicated than a traditional laryngoscope, users can't see the larynx directly with it; instead, they have to learn how to precisely move the endotracheal tube while watching the screen. Technical difficulties like low battery power, a malfunctioning monitor, or other problems could also make the treatment less successful and take longer (Alwan, et al, 2024). Learning a video laryngoscopy also has its pros and cons. Using this technique frequently requires learning a new intubation technique, which presents a barrier to their initial learning; the process is therefore made more difficult by the requirement that clinicians master both methodologies (Wamg, et al 2005). On the other hand, in certain situations where video laryngoscopy is available, the learner's chances of a successful intubation may be increased and the learning curve may be lowered by allowing both the trainer and the student to visualize the larynx simultaneously while the intubation is ongoing (Alwan, et al, 2024).

The results of the study also indicate that direct laryngoscopy was associated with a shorter intubation

time, although not significant, which could be related to the procedure's widespread and familiar use by medical professionals. familiarity with direct laryngoscopy techniques may contribute to faster and more efficient intubation times compared to the new video laryngoscopy method. Also, direct intubation is more advantageous than video laryngoscopes since it is less expensive and requires no extra equipment or technology, which makes it more practical in environments with limited resources (Muhamed, et al, 2024). More so, direct laryngoscopy may also be preferred in emergency situations where time is of the essence and simplicity is key for successful intubation. However, Muhamed and colleagues (2024) also showed that the traditional direct laryngoscope required a significantly greater number of attempts from medical students. A previous study found that a mean of 57 trials were required to achieve a 90% success rate for intubation using direct laryngoscopy.

The findings suggest that when it comes to success rate and length of intubation, the results of the 2 techniques were not significantly different. However, similar to previous studies, it was demonstrated that the video laryngoscope may be better than the direct laryngoscope in a number of ways, including a more precise imaging of airway structures and a simpler intubation procedure for inexperienced users. Overall, both techniques are effective for intubation, but video laryngoscopy may offer advantages in certain situations. It is important to consider the specific needs and resources available when deciding which technique to use for intubation, such as in situations where resources are limited, direct laryngoscopy may be more practical.

Limitations still exist in the study. The study involved all participants who did not directly perform any intubation but received standardized training in intubation. Despite this, factors like observation frequency may vary among participants, which were not recorded in the study, potentially affecting their capability and/or skill. More so, other outcomes of measurements, like user satisfaction, should be considered in future studies. Inconsistent information regarding this measurement can be found in the literature. According to Pieters, et al (2016), the use of direct laryngoscope devices had the highest user satisfaction ratings, while video laryngoscopes considerably improved operator satisfaction, according to Rendeki, et al (2017). It is also recommended th that more research be done to confirm these results and determine the effects of teaching beginners, airway management through virtual reality simulation. Given the importance of the topic, it was suggested that more research be done on medical professionals' use of modern technology, such as virtual reality in training to determine the kind and extent of impact it has on their efficacy and performance.

CONCLUSION

The overall time of procedure and success rate of intubation does not show significant differences between video and direct laryngoscopy. However, direct laryngoscopy may allow for quicker intubation, while video laryngoscopy provides a safety net for subsequent attempts given its higher success rate. This is particularly important in emergency settings where rapid and effective airway management is crucial. The ability of video laryngoscopy to provide a virtual view of the airway enhances glottic visualization. In conclusion, while direct laryngoscopy may yield faster intubation times, the advantages of video laryngoscopy, particularly in terms of reduced failure rates at the third attempt, cannot be overlooked.

RECOMMENDATIONS

The integration of video laryngoscopy into clinical practice not only improves the success of intubation but also enhances the training and confidence of healthcare providers in managing difficult airways. As such, the choice of intubation technique should consider both speed and the likelihood of success across multiple attempts, especially in high-stakes emergency situations. It is recommended that practitioners consider using video laryngoscopy as a first-line approach for intubation to improve success rates and reduce complications. Additionally, ongoing training and proficiency in both direct and video laryngoscopy techniques are essential for all healthcare providers performing intubations.

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