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**Final Project Report for Students Graduating in May 2024**

Efficacy of Video Laryngoscopy versus Direct Laryngoscopy

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## **Abstract**

**Background and Review of Literature:** Laryngoscopy is one of the most important skills that an airway provider performs, and recent technological advances through video laryngoscopes have changed the canvas for performing this skill. Video laryngoscopes have been regarded to offer improved outcomes when conducting laryngoscopy. The current research is inconclusive as to if these newly perceived benefits of video laryngoscopes are maximized in the hands of inexperienced providers.

**Purpose:** This project was developed to obtain data about the results of laryngoscopy in the hands of inexperienced airway providers when comparing direct laryngoscopy to video laryngoscopy and to gain insight into the effectiveness of video laryngoscopes in this population.

**Methods:** This project collected data through Qualtrics surveys and quantitative data by the project designer during the conduction of the project in the simulation lab. This data was analyzed with Excel and paired t-testing through SPSS software. Qualtrics survey questions were created by the project designer in collaboration with the project Chair member.

**Implementation Plan/Procedure:** Eighteen first year anesthesia students participated in this project by conducting laryngoscopy in the simulation lab with the project designer and completing the Qualtrics survey.

**Implications/Conclusion:** In the hands of inexperienced first year anesthesia students, laryngoscopy was able to obtain faster times to intubation, improved glottic views, decreased perceived manipulation of airway and damage, and improved ease of laryngoscopy when compared to direct laryngoscopy. Continued research into this area is warranted.

## **Efficacy of Video laryngoscopy versus Direct Laryngoscopy**

This project is submitted to the faculty of Marian University Leighton School of Nursing as partial fulfillment of degree requirements for the Doctor of Nursing Practice, Nurse Anesthesia track. The management of a patient's airway is one of the most essential, common, and difficult skills required of anesthesia providers. Effective and timely management of a patient's airway is of utmost importance for their safety and outcomes. In the operating room setting, endotracheal intubation through direct laryngoscopy (DL) is one of the most common and traditional techniques for securing a patient's airway, yet has an incidence of difficulty in up to 7.5% of patients (Lee et al., 2020). These difficulties in securing the airway can contribute to significant patient harm and result in devastating consequences. Multiple laryngoscopy attempts and delays in securing the airway are associated with increased complications of hypoxemia, hypotension, cardiac arrest, and death (Higgs et al., 2018). Furthermore, in the ICU where anesthesia providers also provide care, failure to secure the airway in the first-attempt occurs in up to 30% of intubations (Higgs et al., 2018). It is evident that securing the airway during laryngoscopy can prove to be challenging and carries significant potential harm to the patient.

In recent years, advances in technology have created new opportunities for improvement in laryngoscopy through the use of video laryngoscopes (VL). Indirect laryngoscopy with the use of video laryngoscopes such as the McGrath VL or Glidescope have introduced the potential for creating better intubating conditions and outcomes during laryngoscopy. The current evidence comparing DL and VL remains somewhat conflicting, as the technology and research is relatively new, but there is strong evidence and anecdotal experience that VL is the superior technique. The current practice and tradition is direct laryngoscopy, and it remains controversial at this time if laryngoscopy should be adopted as the gold standard best practice. Student

anesthesia providers are inexperienced and typically struggle with the new skill of laryngoscopy, which raises the question does VL improve their outcomes compared to direct laryngoscopy? This project followed first year nurse anesthesia residents in simulation laboratory and compared their laryngoscopy outcomes with VL and DL.

## **Background**

The recent technological advances with video laryngoscopy are changing the canvas of airway management and laryngoscopy. Although the outcomes of video laryngoscopy seem promising, extensive research is still being conducted to solidify these ideas, as it is relatively new technology. Currently, there are some conflicting results and the evidence of video laryngoscopy's supremacy remains in question. For example, one systematic review finds that the current meta-analyses on this topic inconclusively indicate the advantages of video laryngoscopy, so they focused on comparing results of specific measurements such as first-time success, time to intubation, and adverse outcomes and found comparable outcomes between VL and DL (Karczekwska et al., 2021). This finding brings uncertainty to the supremacy of video laryngoscopy over DL. Furthermore, another review found no benefit of VL in regards to failed intubation rates in inexperienced practitioners (Lewis et al., 2017). There are certainly shortcomings in the strength of evidence supporting VL, but there is unquestionably solid evidence indicating benefits of VL. Conversely, one systematic review found that VL is increasingly being recommended in practice due to the literature supporting VL's ability to improve glottic view, intubation success, and reduce complications. They found that much of the research has varying outcome measurements, and recommends future focus to be on specific results such as first-time success or patient harm (Downey et al., 2021). One weakness in the research of video laryngoscopy is uniformity in addressing specific key measurements to be able

to confidently track a pattern. Another systematic review found video laryngoscopy superior to direct laryngoscopy for all measures including success rate, intubation time, and glottic visualization (Hoshijima, 2018). The research needs uniformity to address specific outcomes and show that VL consistently improves these measures over direct laryngoscopy. When the research achieves that goal, the recommendation to change the standard of practice to VL can be more confidently supported.

### **Problem Statement**

The varying evidence comparing VL and DL outcomes is clear. There is also some evidence that shows the benefits of VL in the hands of inexperienced practitioners are questionable. This quality improvement project followed inexperienced student nurse anesthetists in the simulation laboratory and compared their laryngoscopy results with VL and DL. The students' time to intubation was documented and compared with the VL and DL approaches. This addressed two specific measures, a measurement of time to intubation in VL vs DL, and the results produced in the hands of inexperienced student anesthesia providers. This raised the question; "Do first year student nurse anesthetists (SRNAs) have shortened time to intubation with the McGrath VL over traditional DL?"

### **Needs Assessment & Gap Analysis**

Laryngoscopy is a technical and difficult skill to perform, especially for inexperienced practitioners. Laryngoscopy carries many risks such as dental damage and soft tissue damage, and these risks are higher in the inexperienced provider. Providers complete an assessment of the mouth and airway to assess these risks, and then make decisions on the safest airway device and ways to navigate placing such device. It is an important skill for anesthesia providers to be proficient with many different types of equipment and ways to accomplish their goals in the

operating room setting. This is due to the nature of anesthesia and that there are always a multitude of changing variables and problems that arise. If there is a problem with a videoscope, then it is imperative that the provider can secure the airway with another device, such as utilizing direct laryngoscopy, and vice versa. It is also important to understand that a grade four Cormack-Lehane view necessitates use of a video laryngoscope on the second attempt at securing the airway. The research indicates that even with the increased benefits of video laryngoscopy, the inexperienced provider struggles to maximize these benefits and obtain improved outcomes. First year student nurse anesthetists are perfect examples, and their results while using traditional direct laryngoscopy compared to VL can help ascertain information about transitioning VL to best practice. If the results show marked improvement of outcomes with the VL in the hands of inexperienced SRNAs, this could help support the change in practice. The new and state of the art simulation lab at Marian University provides the perfect environment to learn more with the school's nurse anesthesia students.

### **Review of Literature**

This literature review was conducted to evaluate the research in regards to outcomes and advantages between video laryngoscopy and direct laryngoscopy. Databases that were used to collect research included MEDLINE: EBSCO and PubMed. Search terms included: *video laryngoscopy, direct laryngoscopy, rapid sequence intubation, McGrath video-laryngoscope, and Covid-19*. The search was conducted August 2022 to December 2022. Inclusion criteria required research within the past five years. The number of articles were reduced from 2,512 to 22 with this requirement.

### **Support of Video laryngoscopy**

The advances in technology with video laryngoscopy have introduced a new player into the world of laryngoscopy. This young and promising technology offers new advantages and outcomes when compared to traditional direct laryngoscopy. This was especially evident during the Covid-19 pandemic where video laryngoscopy use increased due to advantages it offered. These advantages include improved first-attempt success, improved visibility, and improved protection ability (Davies & Hodzovic, 2021). The currently published meta-analyses support superiority to video laryngoscopy when compared to traditional direct laryngoscopy (Downey et al., 2021). Video laryngoscopy has been shown to offer shorter intubation time, better glottic view using Cormack-Lehane grading, lower need for external laryngeal manipulation, but comparable first-time success rate to Macintosh direct laryngoscopy (Evrin, 2022; Karczewska et al., 2021; Lee et al., 2020). Video laryngoscopes were shown to be superior for securing endotracheal intubation over Macintosh direct laryngoscopy when comparing intubation rate success during the first-attempt and at reducing risk of difficult intubation (Evrin, 2022; Hoshijima et al., 2018; Rombey, 2018; Vargas et al., 2021) Video laryngoscopy affords reducing the risk of difficult intubation, improving glottic view, and decreasing need for external laryngeal manipulation. For these reasons, it would serve inexperienced providers greatly when attempting to secure endotracheal intubation. Securing a clear view of the glottic opening is the major difficulty of endotracheal intubation, and video laryngoscopy increasing the ease and view is invaluable to inexperienced providers. Novices of airway management have higher initial success rates and faster intubation times with video laryngoscopy (Nalubola, 2022). Video laryngoscopes showed improvement in reducing esophageal intubations when compared to direct laryngoscopy (Bhattacharjee, 2018; Nalubola, 2022; Rombey, 2018). Esophageal intubation can result in devastating outcomes and inexperienced providers are at especially high risk of missing

the trachea and intubating the esophagus. This reduction in esophageal intubations is likely attributed to the improved view of the glottic opening provided by the video laryngoscope. Video laryngoscopy has been shown to carry significantly reduced forces on the maxillary incisors and may decrease rate of dental damage (Schieren et al., 2019). The improved outcomes created by the video laryngoscope can help reduce harm and increase desirable results for patients.

### **Weakness of Video laryngoscopy**

There is some pushback about the proposed advantages of the video laryngoscope when compared to direct laryngoscopy. This is due to some evidence not supporting the claims of improved outcomes associated with video laryngoscopy. Ba et al., states that there is no significant evidence of efficiency in video laryngoscopy when compared to direct laryngoscopy with the current available data (2022). Some evidence states that the improved outcomes of video laryngoscopy are only producible in inexperienced providers, and does not translate to experienced practitioners (Nalubola, 2022). This may be due to the ability of experienced providers to create the advantages of video laryngoscopy that novices are unable to achieve. Furthermore, some evidence suggests that video laryngoscopy offers no advantage over direct laryngoscopy for intubation success or time to intubation (Bhattacharjee, 2018; Huang, 2017; Rombey, 2018; Jia Jiang, 2017). One claim of the benefit of video laryngoscopy is that it reduces trauma, but a randomized control trial of 155 patients showed no difference in injuries when comparing Glidescope video laryngoscopy and traditional direct laryngoscopy (Scholtis, 2017) These limitations in the ability of video laryngoscopy to produce its benefits over direct laryngoscopy have contributed to the slowed adoption of video laryngoscopy as the gold standard for endotracheal intubation.

Video laryngoscopy is a promising advancement that continues to offer new and improved results. This relatively novel technology and technique continues to remain under close examination and scrutiny to ensure its contributions are undeniable. Currently, there is some conflicting evidence about how well the benefits of video laryngoscopy are reproducible and translatable into clinical practice. Overall, the currently available evidence suggests that video laryngoscopy does indeed offer improved benefits and outcomes, but its authority must continue to be established and proven.

### **Theoretical/Conceptual Framework**

Jeffries/NLN Simulation Framework for Simulated Participant Methodology is the theoretical framework that supports this DNP project (Appendix D). This framework provides structure and support for simulation education through six core elements. The six core elements include: context, background, design, educational practices, simulation experience, and outcomes (Cowperthwait, 2020). The element of context includes the purpose and evaluation criteria of the learning experience. Background identifies expectations of the student learner and the simulation. The simulation design identifies specific learning objectives, flow, and strategies to improve the learning experience. The experience is the interaction between the participants, facilitator, and environment. The outcomes are divided into three areas: participant, patient, and system. This framework provides structure and helps guide an effective learning experience in the simulation setting. This framework helped structure this project by implementing a proven strategy for simulation education. This DNP project utilized the six core elements of the Jeffries framework into its implementation to maximize project results.

### **Project Aims & Objectives**

The aim of this project was to determine if the use of the McGrath VL, compared to DL, decreases time to intubation in inexperienced first year SRNAs conducting RSI in the simulation laboratory. Over four weeks, the participants in the simulation laboratory conducted RSI utilizing DL and then VL, and their time to intubation by ETCO<sub>2</sub> and auscultation confirmation for each was documented and compared. An RSI skills checklist rubric from the anesthesia program's simulation course was utilized to guide the students. The expected outcomes were that the times to intubation with VL would be shorter than DL. These values were documented and compared with t-tests to evaluate the relationship between VL and DL. The students also completed a survey afterwards describing the Cormack-Lehane views they obtained, their experience with each device, ease of use, manipulation of the airway, and other data.

### **SWOT Analysis**

Strengths of this project were the state of the art simulation lab at Marian University and its eager new nurse anesthesia students. The new simulation lab was perfect for conducting this quality improvement project with the help of a new cohort of students. This also leads to a potential weakness being the limited sample size and sample pool, as this project utilized a small portion of first year Marian SRNA students. Another potential limitation was the ability to utilize the simulation lab due to availability. Coordination with faculty and other activities in the lab were a priority. Potential threats to the project included student participation and simulation lab times. If equipment became unavailable or broken this could have been a potential threat to the project. Opportunities for this project included open lab times for students who were in the simulation lab learning and practicing.

<u>Strengths</u>	<u>Weaknesses</u>
<ul style="list-style-type: none"> <li>• State of the art simulation lab</li> </ul>	<ul style="list-style-type: none"> <li>• Sample size</li> </ul>

<ul style="list-style-type: none"> <li>• Eager new students</li> <li>• Covid-19 pandemic need for quick intubation time</li> </ul>	<ul style="list-style-type: none"> <li>• Sample pool</li> <li>• Simulation lab availability</li> </ul>
<p><u>Opportunities</u></p> <ul style="list-style-type: none"> <li>• Open laboratory opportunities</li> <li>• Airway education for new providers</li> <li>• Increased exposure to video laryngoscopy equipment and RSI technique</li> </ul>	<p><u>Threats</u></p> <ul style="list-style-type: none"> <li>• Student availability/participation</li> <li>• Limited/broken equipment</li> <li>• Lab time availability</li> <li>• Student participation</li> </ul>

### **Project Design/Methods**

This quality improvement project invited 32 first year SRNA students of the class of 2025 to participate in the Marian University simulation lab. The project measured the participant's times to intubation when conducting rapid sequence intubation. First, the students conducted RSI utilizing direct laryngoscopy, and then the students did the same, but utilizing the McGrath video laryngoscope. Their times to intubation were documented and compared. Time to intubation was measured from the time of administration of paralytic to the time of EtCO<sub>2</sub> measurement confirmation and bilateral auscultated breath sounds. These results indicated that video laryngoscopes, in the hands of novice airway providers, reduced time to intubation when compared with the traditional technique of direct laryngoscopy. The students also completed a post-questionnaire regarding the ease and use of VL and DL.

### **Project Evaluation Plan**

The most valuable information was the quantitative results of the time to intubation between the VL and DL groups. These values helped explain the time required of inexperienced anesthesia providers to complete endotracheal intubation through video laryngoscopy as well as direct laryngoscopy. The post-questionnaire provided insight into the hands of the providers and how the two pieces of equipment differ in use.

### **Project Site and Population**

Marian University has a high fidelity simulation lab used to train its nursing and medical students. The lab has state of the art machines, mannequins, and equipment to provide quality training for its students. The lab provides McGrath video laryngoscopes, Macintosh and Miller metal blades, which can be used on the lifelike mannequins. The first year nurse anesthesia students are novice airway providers who are beginning their anesthesia training. The project utilized eighteen first year participants of the class of 2025.

### **Measurement Instruments & Data Collection**

The Marian University SRNA students were recruited by verbal invitation and communication to attend the simulation lab if they wished to be a participant of the project. The participants were guided with the NSG607S Simulation course rubric checklist for RSI skill listed in Appendix D. The recording of time to intubation was added to the rubric. This data was then evaluated with t-test pairing through SPSS software. After completion, students then also completed a Qualtrics survey (Appendix E) evaluating other data with seven questions about Cormack-Lehane views obtained, ease of use, airway manipulation and more.

The first year students were briefed that their time to intubation will be documented beginning with the administration of paralytic to the time of EtCO<sub>2</sub> and bilateral breath sound confirmation. The project evaluator measured the time. A t-test compared the values to assess if

there was statistical difference. After the students completed both video and direct laryngoscopy, they completed a post-questionnaire, answering questions about ease of use between VL and DL, confidence in using the equipment, and other considerations. The posttest was administered through Qualtrics. The time to intubation value serves as quantitative data, while the questionnaire provides qualitative data about the two techniques.

### **Ethical Considerations**

Internal Review Board (IRB) approval was obtained prior to initiating this DNP project. Participants provided implied consent in their Qualtrics survey and before participation. Participation in the project remained confidential. Participants were documented by the last four numbers of their student ID number. The data obtained was securely kept in Qualtrics for two years.

### **Data Analysis & Results**

Eighteen first year anesthesia students from Marian University participated in this project. The participants attended the high fidelity simulation lab and conducted RSI utilizing VL and DL and completed a Qualtrics survey following completion for qualitative data analysis. The participant's time to intubation with VL and DL were recorded and the two values were compared with paired t-testing to determine statistical significance between the two groups for quantitative data analysis. Information obtained from the Qualtrics survey (Appendix E) reported that 83% of the participants were inexperienced with <10 intubations utilizing direct laryngoscopy and 88% inexperienced with <10 intubations utilizing video laryngoscopy. The videoscope group was able to obtain improved glottic views, reporting a Grade 1 Cormack-Lehane view for 76% of the participants, compared to 76% of the participants obtaining Grade 2 views when utilizing direct laryngoscopy. Over 90% of the participants reported that they felt

they had manipulated the airway less while conducting video laryngoscopy when compared to direct laryngoscopy. Similarly, 83% of participants reported that video laryngoscopy felt safer and less likely to cause harm such as dental damage. In comparison of times to intubation, the mean time to intubation in the VL group was 24.9 seconds, whereas the mean time in the DL group was 29.1 seconds (Table 1). The values were entered into SPSS software for paired t-test comparison and were found to have statistical significance  $p < .05$ .

**Table 1**

*Times to Intubation Comparing Direct Laryngoscopy (DL) and Video Laryngoscopy (VL)*

	DL	VL
Mean	29.1 seconds	24.9 seconds
SD	2.05	2.04
n	18	18

## **Discussion**

In this project, the inexperienced airway participants were found to have more favorable results conducting intubation with video laryngoscopy when compared to direct laryngoscopy. These values included reduced time to intubations, improved glottic views, reduced perceived airway manipulation and harm, and ease of use of the equipment. These findings may help support the utilization of video laryngoscopy even for the inexperienced provider, but further interest and research into this topic is imperative. This project had a relatively smaller sample size of 18, which correlates closely with the class sizes at Marian University's nurse anesthesia program. This sample size may be one limitation in the strength of the findings, and further research that can obtain data from more participants would be essential.

## **Conclusion**

Laryngoscopy remains one of the most important and critical skills that an airway provider conducts. Laryngoscopy carries great potential risks and harm to the patient and effectiveness must be maximized to ensure patient safety. The newer technology and advances with video laryngoscopes brings a new element into this skill that must be evaluated. The pursuit of best practice through the guidance of evidenced based practice is unending and must continue to be researched and implemented. This project found improved results during laryngoscopy for inexperienced providers when utilizing video laryngoscopes. If video laryngoscopes continue to show promise and improve outcomes, especially in inexperienced providers, it may be sensible to regard video laryngoscopy as the gold standard practice for placing endotracheal tubes.

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