Spring 5-7-2021

Improving Patient Outcomes by Preventing Airway Injuries Associated with Video Laryngoscopes

Alexis Jones
Southern Illinois University Edwardsville

Kay Williamson
Southern Illinois University Edwardsville

Executive Summary

Introduction

Video laryngoscopes have been increasing in popularity as the intubation device of choice for patients who present as difficult intubations and for those with known difficult airways. Due to this increase in popularity, our implementation site had a desire for a new education related to technology with video laryngoscopy. Along with their increased use, there has been a recent rise in published case studies describing the risk of airway trauma associated with video laryngoscopes (Mennenga, 2013). The literature shows a statistically significant difference in rates of airway injury with video laryngoscopy, having a higher rate when compared to direct laryngoscopy (Greer et al., 2016). Specifically, injury to the soft palate has been found to be the most common video laryngoscope-associated injury (Williams & Ball, 2009).

The purpose of this project was to provide awareness to anesthesia providers regarding the risk of airway injury that is affiliated with video laryngoscope use. The project primarily focused on two video laryngoscopes, the GlideScope and McGRATH MAC Video Laryngoscope. Another intended goal of the project was to provide education and simulation training to providers regarding proper utilization techniques for both video laryngoscopes with the intent of preventing injury. The simulation experience allowed providers to assess their current intubating technique, gain knowledge on manufacturer guidelines, and adopt safe techniques into their anesthesia practice. The overall expectation for the implementation of this project was for the anesthesia providers to report and demonstrate an increased understanding of safe video laryngoscope utilization in the management of difficult intubations and anticipated difficult airway situations.

Literature Review

When video laryngoscopy is used correctly, providers can obtain better glottic visualization which allows for improved first-pass success rates of endotracheal intubation (Akbas, Ozkan, & Karaaslan, 2019). Other benefits include eliminating the need for complete alignment of airway axes to achieve a direct line of sight of airway structures, along with providing indirect visualization with less force, less neck flexion, and less laryngeal manipulation (Chemsian, Bhananker, & Ramaiah, 2014).

While video laryngoscopes have many beneficial properties, their use is not without complications. A review conducted by Williams and Ball (2009) revealed nine reports of soft palate injuries that resulted from the use of the GlideScope or McGRATH MAC Video Laryngoscope. These injuries were attributed to a blind spot that occurs once the endotracheal tube passes the oral cavity but isn't yet visible on the video laryngoscope screen (Williams & Ball, 2009). Less common injuries associated with video laryngoscopy include injury to the lateral walls of the oropharynx and tonsillar pillars (Pham, Lentner, & Hu, 2017). Sequala of intubation-related airway injury include a 1-day increase in the length of hospital stay, as well as a 20% increase in hospital costs (Pacheco-Lopez, Berkow, Hillel, & Akst, 2014). Providers need to understand these risks and take actions to minimize their occurrence. Education and practice to reinforce safe intubation skills are vital to improving efficacy and safety when using video laryngoscopes. Therefore, a combination of didactic education and simulation training was chosen for project implementation. Simulation has been successfully used to aid providers in the self-assessment of their current knowledge and help teach new skills specifically related to preventing injury during airway management with video laryngoscopy (Green et al., 2016).

Project Methods

This project served to provide awareness and education to anesthesia providers regarding the potential risk of airway injury associated with the use of video laryngoscopes, specifically the GlideScope and McGRATH MAC Video Laryngoscope. An educational session was delivered by the authors via a PowerPoint presentation. A guided simulation experience was also provided using a task trainer manikin. This hands-on experience allowed providers to assess their current intubating technique and compare it to the manufacturer's guidelines and recommendations. All participants were given a pocket-sized reference tool to be carried for ongoing utilization.

A pretest and posttest were administered to anesthesia staff to compare baseline knowledge to new knowledge gained following an educational presentation and simulation on video laryngoscope-assisted airway management. The educational session was also evaluated by participants using an optional survey to collect perceptions on how well the material was presented and if the education tools were beneficial. The pre-and post-test results along with the survey results were used to evaluate the project's overall effectiveness. The project was considered a quality improvement project by the Institutional Review Board.

Evaluation

The effectiveness of the project was evaluated via a 10-question pretest and posttest assessment. The questions were presented in the form of multiple-choice and true or false items. Both tests were comprised of the same questions, allowing a more accurate reflection of the effect of the educational session. The benchmark set by the investigators was a 10% increase in scores which would indicate a better understanding of the subject material following the educational session.

A 13-question post-implementation survey was also administered to evaluate the project leaders on how well the information was presented and if the educational tools were considered

beneficial. This survey included 5-point Likert-type items and two open-ended questions. Responses from the survey were analyzed using the mean score for each question on the Likert Scale and by examining the answers to the open-ended questions to find a recurring theme in the responses.

Outcomes.

The educational module was provided to 30 healthcare providers at a mid-sized, suburban, Level II Trauma Center in the Midwest. Of these thirty, eighteen (60%) were certified registered nurse anesthetists (CRNA), four (14%) were medical doctors of anesthesiology (MDA), six (20%) were student registered nurse anesthetists (SRNA), one (3%) was a medical resident, and one (3%) was a critical care advanced practice nurse.

Pretest and posttest results.

The comparison of overall pretest scores to overall posttest scores revealed an increase in provider knowledge after participating in the presentation and simulation portions of the project. Following the presentation, the majority of participants (93.3%; n=28) were able to identify video laryngoscopy as having a higher rate of airway injury when compared to direct laryngoscopy. The posttest score increased significantly when compared to the overall pretest score (20%; n=6). Following the presentation, 83.3% of participants (n=25) were aware that the glottic view should be in the upper one-third of the screen when using the GlideScope system. All participants (100%; n=30) were able to note the most common area injured from video laryngoscopy was the soft palate. Additionally, 93% of the participants (n=28) were able to identify that the ASA (American Society of Anesthesiologists) Difficult Airway Algorithm does not recommend the use of video laryngoscopy for difficult intubations. All participants (100%; n=30) knew that current literature recommends completing a preoperative airway assessment,

having necessary equipment in the room, and completing proper training on the video laryngoscopy equipment to reduce the risk of injury upon induction with video laryngoscopy.

The average pretest score was found to be 53% while the average posttest score was 87%, showing a 64.15% increase in results. This well exceeded our benchmark of a 10% increase. Each question was also individually assessed. Out of ten questions, nine questions increased in score on the posttest. Only one question scored the same on the posttest as it did on the pretest, indicating inadequate coverage of the topic during the educational presentation. This was question 4, which asked where the anesthesia provider should be looking while inserting the GlideScope into a patient's oropharynx.

Likert Scale results.

The overall results of the post-implementation survey were positive. For example, after the educational presentation, 100% of the participants (n=30) either strongly agreed or agreed they learned something new from the educational experience, resulting in an average score of 4.83 out of 5. Furthermore, most participants (93.3%; n=28) strongly agreed or agreed that they plan to apply the knowledge gained from this presentation into their anesthesia practice (mean=4.66). Sixty-three percent strongly agreed or agreed (n=19), while 17% disagreed (n=5), that they were following manufacturer guidelines for the use of the GlideScope (mean=3.63). Likewise, 70% of participants (n=21) strongly agreed or agreed that they were following the manufacturer guidelines for the McGRATH MAC Video Laryngoscope before the presentation, while 6.6% of the participants (n=2) disagreed, resulting in a mean score of 3.63. All participants (100%; n=30) strongly agreed or agreed that the presenters were knowledgeable of the content presented (mean=4.83).

Results further showed that 93% of participants (n=28) either strongly agreed or agreed the PowerPoint enhanced their knowledge on airway injury and utilization of video laryngoscopes (mean=4.7). Forty-seven percent strongly agreed (n=14), and 20% agreed (n=6) that the simulation experience enhanced their technique when using video laryngoscopes (mean=3.6). Seventy-six percent of participants (n=23) strongly agreed or agreed that the reference tool supplied will be useful for future use of the GlideScope and/or McGRATH MAC (mean=3.87). Sixty percent (n=18) strongly agreed, and 23% (n=7) agreed that they would recommend this presentation to other anesthesia providers (mean=3.93). On average, 83.3% (n=25) were either very satisfied or satisfied with the overall presentation's quality and the simulation experience (mean=4.0). Similarly, 83.3% (n=25) were either very satisfied or satisfied with the effectiveness of this presentation and simulation (mean=4.0).

The participants were also asked to respond to two open-ended questions on the survey. Twelve participants responded to question twelve which asked what the participants perceived to be the most impactful component of the training session. The increased risk of injury to the soft palate using a video laryngoscope and how to avoid injury by using the proper technique was documented as a learning point from 66.7% of the participants. Thirty-three percent of the participants documented they perceived the mannikin simulation portion as the most impactful component by having the ability to practice and refine their intubation technique with the video laryngoscope.

Thirteen participants responded to question thirteen which asked the participants to provide one thing they learned which they are most likely to adapt into their practice. Forty-six percent of the participants' responses stated they would begin to position the glottic opening view in the upper one-third of the GlideScope screen when intubating with the GlideScope.

Thirty-one percent of the participants documented they learned the use of video laryngoscopy is better than direct laryngoscopy for difficult intubations. These participants also documented they left with a better understanding of the manufacturer guidelines and recommendations on how to avoid injury when using their respective video laryngoscope. Choosing the appropriate stylet and ensuring it has a 90-degree bend for intubation with the GlideScope and having the option to intubate without a stylet using the McGRATH MAC Video Laryngoscope, was documented by 23% of the participants as a new technique they planned to adapt into their practice.

Limitations.

The COVID-19 pandemic proved to be a limitation to the project by prompting a revision to the format in which the presentation was delivered and restricting the number of participants allowed to be present at one time. This forced the project leaders to improvise how the presentation was delivered by presenting in smaller groups instead of one large group. A larger group presentation would have allowed us to go through the PowerPoint information together and initiate a more in-depth conversation of video laryngoscope use between the participants as one unit. There was also the limited time between each group for the participants to enhance their learning with each video laryngoscope during the simulation experience.

Impact on Practice

The results of this quality improvement project demonstrated an immediate impact on the participants' level of knowledge related to proper use of video laryngoscopes to avoid injury to the patient as supported by an increase in posttest scores. The item that had the largest score increase on the posttest was the awareness that the correct position of the glottic view on the GlideScope screen should be in the upper one-third of the screen compared to the center of the screen. Other items that showed a marked increase in posttest scores were the participants'

awareness of the ASA (American Society of Anesthesiologists) Difficult Airway Algorithm recommendations for the use of video laryngoscopy, along with the rate of injury being higher on intubation with the use of video laryngoscopes compared to direct laryngoscopy.

The predicted long-term impact is that the providers will continue to use the knowledge presented during the presentation to improve their technique with video laryngoscopy, enhance airway assessment skills, better identify patients at risk of airway injuries, and prevent airway injuries. A secondary long-term impact includes utilizing the knowledge of manufacturer guidelines and evidence-based practice to improve patient safety and quality care when presented with a difficult intubation situation. Regarding ongoing implementation, continued provider use of the pocket-sized reference tool is recommended. Along with staying current with evidence-based practice and manufacturer guidelines.

Conclusion

The project's results allowed us to meet and exceed our benchmark by 10% as shown by the pretest to posttest score comparison, as well as Likert Scale responses. Providers expressed their satisfaction with the content presented, which was indicated by their responses on the post-implementation survey. The posttest scores demonstrated that the presented information improved the participants' awareness to the ASA Difficult Airway Algorithm recommendations for use of video laryngoscope on difficult intubations. Providers are now equipped with new ways to further adapt their intubation technique, such as stylet use and using the appropriate curvature degree based on the posttest results. Recommendations of this project would be to continue to provide awareness to anesthesia providers of the potential airway injury risk associated with video laryngoscopy with further educational research and routine simulation experiences. The literature supports simulation and reenactment to prevent future errors and help

teach new skills in the effort to prevent injury with video laryngoscopes during airway management. Other future efforts could include evaluating and researching other brands of video laryngoscopes and their association with airway injury.

Contact Information

Alexis Jones and Kay Williamson are the project investigators and can be reached at alexis.tewell@gmail.com and kwilliamson@live.maryville.edu, respectively.