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NARRATIVE REVIEW AIRWAY MANAGEMENT

Video laryngoscopy: a double-edged sword

Taizoon Q. Dhoon, MD[1], Linsey Wilson, MD[2], Govind RC Rajan, MBBS, FAACD, FASA[3]

Author affiliations:

1. Taizoon Q. Dhoon, MD, Associate Clinical Professor, Department of Anesthesiology Intensive Care, The University of California, Irvine Medical Center, 101 The City Dr S, Orange, CA 92868, United States; E-mail: tdhoon@uci.edu
2. Linsey Wilson, MD, Resident Physician, The University of California, San Francisco, United States; E-mail: wilsonlm@uci.edu
3. Govind R.C. Rajan MBBS, FAACD, FASA, Professor of Anesthesiology, The University of California, Irvine Medical Center, 101 The City Dr S, Orange, CA 92868, United States; E-mail: grajan@uci.edu

Correspondence: Taizoon Q Dhoon; E-mail: tdhoon@uci.edu

ABSTRACT

Endotracheal intubation revolutionized anesthesia and allowed prolonged surgical procedures to be performed. It also made positive pressure ventilation possible in patients in respiratory insufficiency and being managed in intensive care units. But successful intubation required the development of laryngoscopes. A variety of blades were developed to be used in different sets of patients. A laryngoscope came to be known as a symbol of the specialty of anesthesiology. But it was not always safe, nor successful, necessitating more sophisticated instruments. Video laryngoscopes were introduced with a sigh of relief for the anesthesiologists in difficult airway cases. Many variations of video laryngoscopes with slight differences have been marketed. But cases of video laryngoscope related injuries have been reported. This paper gives an over-view of the possible mechanism and preventive measures.

Abbreviations: DL - Direct laryngoscopy; ETT – Endotracheal intubation; IDL - indirect laryngoscopy; VL - Video laryngoscopy;

Key words: Airway management; Instrumentation; Intubation, endotracheal; Laryngoscope; Laryngoscopy

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1. INTRODUCTION

Direct laryngoscopy (DL) relies on a direct line-of-sight from the oral cavity to the glottic opening, through the alignment of the oral, pharyngeal, and laryngeal axes. However, DL may be difficult due to patient characteristics such as a narrow mouth opening, enlarged tongue, facial trauma, obesity, limited neck mobility, cervical instability, poor soft oropharyngeal tissue mobility, radiation-related neck changes, or anterior larynx etc.[1,2] The development of video laryngoscopy (VL) has helped to circumvent many of these challenges. It is particularly useful in scenarios such as an anticipated difficult airway, unstable cervical spine, failed direct laryngoscopy, and rescue intubation during an unanticipated difficult airway.[3]

VL utilizes a high-resolution digital camera with an LED light at the distal end that transmits its view to a video monitor; these modalities are categorized as indirect laryngoscopy (IDL).[4]

Many of the video laryngoscopy systems are equipped with a hyper-angulated blade (60-degrees up from the horizontal). Despite the benefits of VL and its widespread adoption, a variety of complications have been reported with its use. These complications can be divided into those associated with insertion of the video laryngoscope blade, insertion of the endotracheal tube (ETT) using a rigid stylet, and failure to intubate despite adequate glottic visualization.

2. Video Laryngoscope Blade Insertion

Inserting the VL blade into the mouth and advancing it into the oropharynx can be challenging in certain circumstances. This is particularly true among patients who have an enlarged tongue, narrow mouth opening, limited neck mobility, cervical spine instability, or who are morbidly obese.[1,2]

Patients with these anatomic characteristics often have a more limited oropharyngeal space and as result, VL blade insertion into the oropharynx may be more difficult and result in unintentional harm. The most reported injuries are damage to the lips, teeth, lingual frenulum, and oropharyngeal soft tissue.[1,2,5]

Techniques to reduce the risk of trauma with VL use include optimization of patient position and blade orientation during insertion. Placing the patient in the "sniffing position" and/or reverse Trendelenburg position, in addition to pharyngeal axis alignment, decreases the likelihood that the patient's chest and accompanying soft tissue will impede the VL handle and electrical cord when inserting the blade into the mouth. In addition, insertion of the blade into the mouth at an angle of 90 degrees to the right or left from the midline, is a useful technique. A lesser angle results in a reduction of VL blade width, allowing for easier entry into the mouth opening and advancement beyond the body of the tongue. Once the VL blade is advanced beyond the body of the tongue and soft palate, the VL handle can be rotated back to its standard orientation (Figure 1A−D). In addition, VL blade shapes resembling standard Macintosh and Miller direct laryngoscopy blade shapes (such as the low profile (LoPro) GlideScope®) are also an option in patients with a limited oropharyngeal space. These blades are physically smaller than the traditional Glidescope®, offering enhanced maneuverability in tighter spaces.[5]

Figure 1 (A−D): Demonstration of video laryngoscope starting position

(A) Insertion with the blade at 90 degrees to the right (B) or left (C), and rotation of the blade to the standard position (D).

3. ETT placement with a rigid stylet

The manufacturers of various VLs recommend that it be used with a rigid stylet (e.g., GlideScope® and the GlideRite® stylet).[6]

The rigid stylet features enhanced rigidity for improved ETT control, a hyper-angulated tip, and a stylet handle that permits improved maneuverability and easier stylet removal.[3] Unfortunately, any stylet, particularly a rigid stylet, may increase the risk of soft tissue injury by magnifying the stiffness of the ETT bevel distally (Figures 2−4).[7,8.9] Alternatively, a malleable stylet may be used by employing a 60−90 degree bend approximately 8 cm proximal from the ETT tip.[6]

Some of the most frequent complications of VL use involve perforation of the right soft palate, palatopharyngeal arch, tonsillar pillar, or retromolar trigone (Figures 2).[7] VL generates upward forces that stretch these at-risk tissues during manipulation. If a provider watches the video monitor rather than directly viewing the ETT as it passes into the oropharynx, they may inadvertently damage these vulnerable tissues during ETT placement.[8] The right sided structures are more predictably injured as the standard approach ETT insertion occurs from the right. Such injuries commonly require evaluation and repair by an otolaryngologist (Figure 2−3). These injuries can be avoided by

Figure 2: Perforation of the right-sided palatopharyngeal arch lateral to the uvula following GlideScope® orotracheal intubation

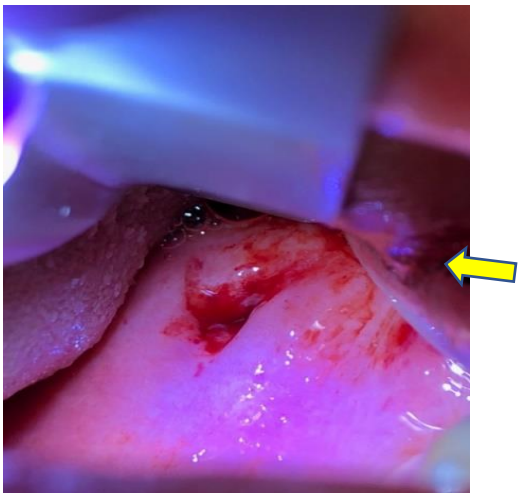

Figure 3: Perforation of the right-sided soft palate above the uvula during video laryngoscopic orotracheal intubation.

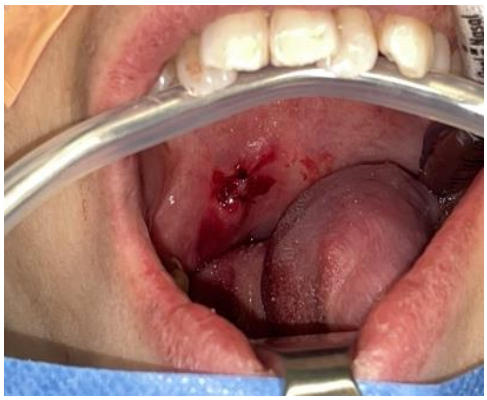

Figure 4: Right-sided soft palate injury requiring suture repair by otolaryngology

maintaining direct visualization of the ETT tip until it passes beyond the soft palate, palatopharyngeal arch, tonsillar pillars, and retromolar trigone. At this point, the focus can shift to the VL video monitor. This approach mitigates the risk of soft tissue injury.

The midline laryngoscopic approach is also an option to reduce tissue injury with ETT insertion. With this technique, VL blade followed by the ETT are both inserted with a midline approach. The ETT hugs the right side of the VL blade, avoiding the right palatopharyngeal arch and right tonsillar pillars.[9] Nevertheless, a risk of soft palate and tissue trauma still exists. Additionally, the left-sided approach may be beneficial when intubating patients with smaller oral cavities. Inserting the VL on the left side may allow for increased physical space for ETT passage and reduced risk of oropharyngeal trauma.[10]

Despite these approaches if there is still trouble inserting the ETT with the VL blade in place, one helpful technique is to remove the VL blade completely and gently insert the ETT into the oropharynx under direct visualization and then reinsert the VL blade.[11] This approach minimizes the challenges of limited spacing space within the oropharynx that can occur when the VL blade is inserted initially.[8] Whether the ETT is advanced before or after VL blade, providers should always directly visualize advancement of the ETT into the oropharynx rather than rely on the video monitor.[8]

4. Failure to intubate despite glottic visualization

The technique for obtaining an optimal view of the glottis with VL varies slightly from that using DL. With DL, the tip of the curved blade sits in the epiglottic vallecula. In comparison, the VL blade tip should reside 1−2 centimeters back from the vallecula for a complete laryngeal view. This blade location results in a larger field of view to make ETT adjustments, better alignment of the ETT with the glottis, and reduces vertical lifting forces that may result in trauma.[9] While advancing the VL further into the pharynx may provide an unobstructed view with full glottic exposure, it may be associated with increased difficulty of ETT insertion due to reduced alignment of the ETT and the glottis; With this approach the glottis resides more anteriorly and can result in a more challenging tracheal intubation.[3]

While a 60- or 90-degree bend on the stylet may help with glottic entry, this shape can cause the ETT to become hindered by the anterior commissure or cartilaginous tracheal rings upon glottic entry. In this scenario, the ETT can be carefully withdrawn (approximately 1 cm), allowing the ETT tip to rest on the glottis while the stylet is removed, followed by gentle forward advancement and a clockwise rotation of the

ETT. This maneuver allows the ETT tip to smoothly pass through the glottis and enter the trachea with a more posterior-lateral trajectory.

In the scenario where the glottis resides anteriorly in the field of view and the angle of the approach with the ETT and stylet remains too posterior; the provider has several options to facilitate intubation. These options include withdrawing the VL blade tip so that it resides 1−2 cm back from the vallecula, allowing for improved ETT and glottic alignment; increasing the bend on stylet (greater than 90 degrees); utilizing a standard stylet or gum elastic bougie and shaping it into a "J" or "U" shape; or sliding the ETT off the stylet in the oropharynx (rather than at the glottis), resulting in an more anterior trajectory that may enable the ETT to reach the glottis.[9,10]

5. CONCLUSION

Video laryngoscopy is a valuable tool, providing better glottic visualization and timelier intubation compared with DL in many patients with challenging airway features. Despite these advantages, VL use can be associated with a risk of injury. As airway management professionals it is important to gain a deeper understanding of optimal VL technique and anticipate potential complications, which will result in enhanced patient care.

6. Conflict of interest

The authors have no conflicts of interest.

7. Authors' contribution

1. TD- Concept, manuscript writing

2. LW- Manuscript writing

3. GR- Concept, manuscript editing

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