VIDEO LARYNGOSCOPES AND VIDEO-ASSISTED AIRWAY MANAGEMENT

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Introduction

Difficulty with tracheal intubation, particularly in patients with an unanticipated difficult airway remains a frequent cause of anesthesia-related morbidity and mortality [1]. While it has been emphasized that adherence to a precomplied strategy such as the ASA Difficult Airway Algorithm would likely decrease respiratory-related morbidity and mortality, this fact has also motivated the development of a variety of laryngoscope designs (Table 1) as well as a number of supraglottic airway devices such as the Laryngeal Mask Airway. In particular, video-assisted airway management using various forms of video laryngoscope design has recently been employed to help ameliorate this problem. This article will briefly review the major video laryngoscopic techniques that are available to anesthesiologists today, with a special emphasis on the GlideScope Video Laryngoscope (GLV).

Weiss Video Assisted Laryngoscope

Weiss et al. [2] describe the design of an angulated video-intubation laryngoscope incorporating a fiberoptic imaging bundle (Figure 1). In a study in children undergoing manual in-line neck stabilization they noted that the technique produced laryngeal views "which were as good or better than those observed during direct laryngoscopy alone" [2]. Success was also obtained in intubating children with Morquio syndrome [3].

Table 1: Some Popular and Specialty Laryngoscopes

"Conventional" Laryngoscopes

- Macintosh type laryngoscopes (curved blades)
- Miller type laryngoscopes and other straight blade designs
- McCoy laryngoscope and variants (articulating tip)

Rigid Fiberoptic Laryngoscopes

- Bullard laryngoscope
- Upsher laryngoscope
- Wu laryngoscope (WuScope)

Video Laryngoscopes (with microminiature TV camera)

- GlideScope Video Laryngoscope
- Storz Video Laryngoscope (Video Macintosh System)
- Weiss Video Laryngoscope

Flexible Fiberoptic Laryngoscopes (Bronchoscopes)

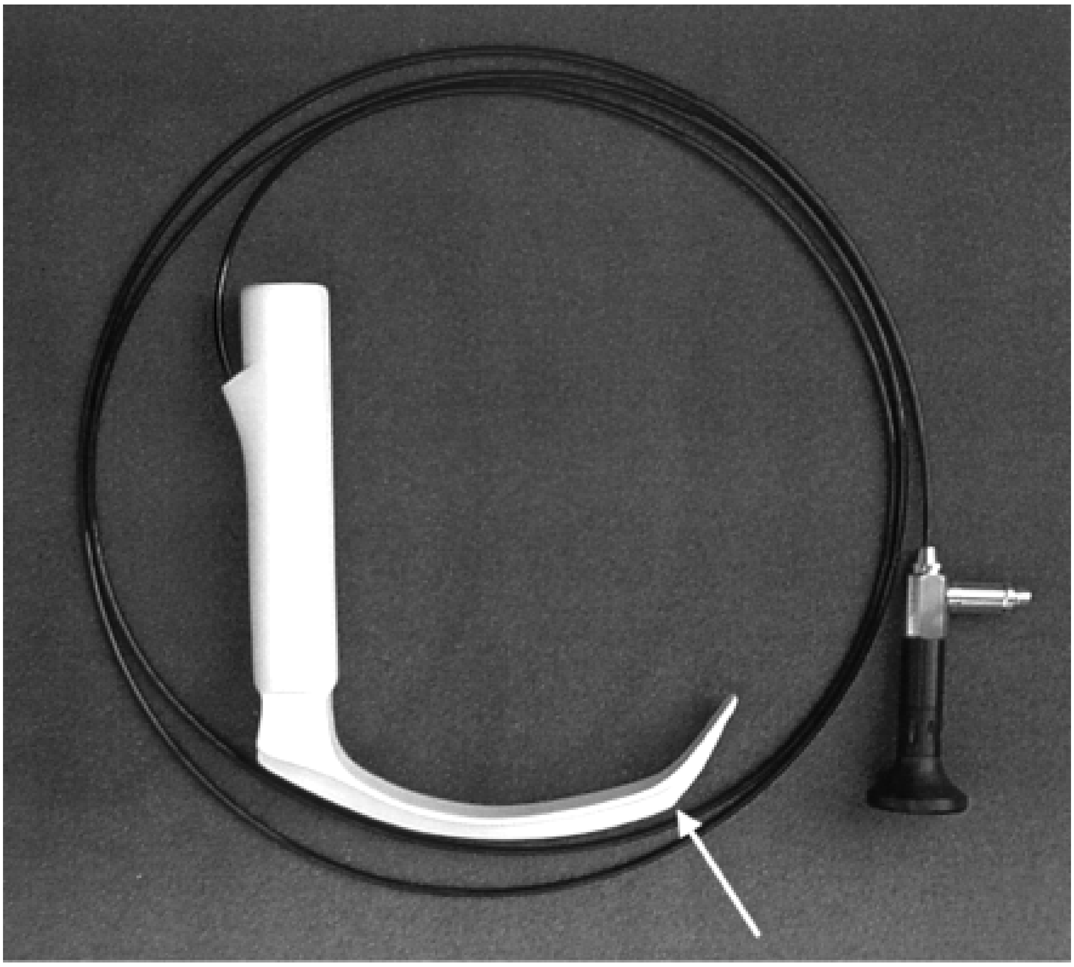

FIGURE 1. The angulated video-intubating laryngoscope consists of a cast plastic laryngoscope with an integrated fibreoptic endoscope (1.8 m long, OD 2.8 mm, 70° viewing angle, VOLPI AG Schlieren, Switzerland). The distal blade tip is angulated at about 25° to provide an unrestricted viewing angle for the fibreoptic endoscope lens, positioned at the site of angulation (arrow). The endoscope carries optic fibres for image transmission and light transmitting fibres for airway illumination. The proximal viewing ocular is attached to a conventional video-endoscope camera and the standard Storz light adaptor is connected to a light source using a light cable.

(Figure and figure legend from Dullenkopf et al. Canadian Journal of Anesthesia 49:198-202)

Video Assisted Bullard Laryngoscope

Dullenkopf et al. [4] reported on the design of a video-assisted Bullard laryngoscope utilizing a thin fiberoptic imaging bundle inserted into the working channel of the Bullard laryngoscope. The eyepiece of the imaging bundle was then attached to a video-camera system. Such an arrangement allows the operator to use the eyepiece while a supervisor follows the procedure on a video monitor (Figure 2).

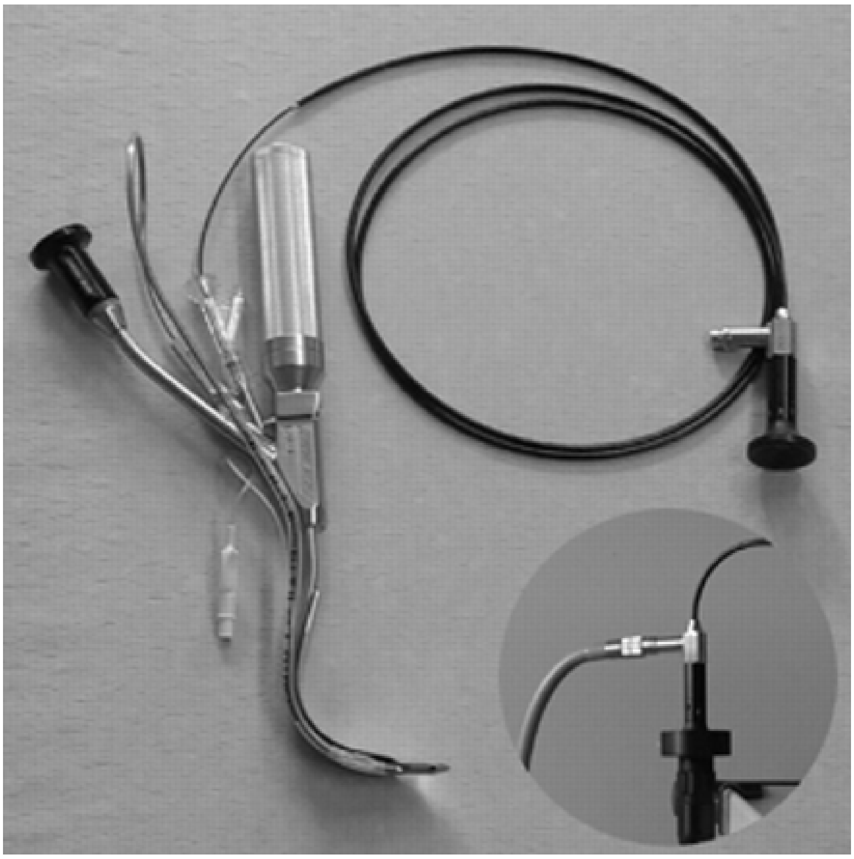

FIGURE 2. Bullard laryngoscope (adult version) with non-malleable stylet and mounted endotracheal tube. A small fibreoptic endoscope (OD 1.9 mm) is inserted into the working channel and locked with a screwing mechanism attached to the proximal opening of the suction channel. The view from the blade tip is transmitted to the endoscope viewing ocular, which is attached to a video endoscopy camera and a light source cable.

(Figure and figure legend from Dullenkopf et al. Can J Anesth. 2003;50:507-510.)

The Macintosh Video Laryngoscope

Kaplan et al [5] have described their experience with the Macintosh Video Laryngoscope (Karl Storz Endoscopy Inc., Culver City, CA, USA). This system employs a standard Macintosh blade and laryngoscope handle and is designed to allow multiperson visualization of the airway by projecting an enlarged video image of the laryngeal structures onto a monitor. The authors explain the advantages of the system: “The displayed anatomy is magnified. Recognition of the anatomical structures and anomalies is easier, and manipulation of airway devices is facilitated. When assistance is required, the operator and assistant can coordinate their movements because each sees exactly the same image on the video monitor.”

Kaplan et al also studied the Macintosh Video Laryngoscope in a series of 235 patients divided into two groups: Group A (n = 217), in whom intubation was thought unlikely to be difficult, and Group B (n = 18), in whom difficulty with intubation was anticipated. All intubations but one in Group A were successful. In the second group all 18 cases were successfully intubated using the system. The authors noted that “the improved coordination afforded by an image on a video monitor seen by both the assistant providing laryngeal manipulation and the anesthesiologist handling the laryngoscope results in a significant advantage over the conventional laryngoscope technique” and that “as a consequence, the learning curve is short”.

The Res-Q-Scope

The Res-Q-Scope is a particularly inexpensive (well under $1000) video intubation device intended for use in the field. It features a 2.75” adjustable color LCD screen used to visualize the intubation as well as a channel where a standard endotracheal tube can be pre-loaded into the device. The unit is powered with a rechargeable battery, although an emergency dry cell pack is also available. Clinical experience with the device is limited. Additional information is available at the manufacturer’s Web site at www.res-q-tech-na.com.

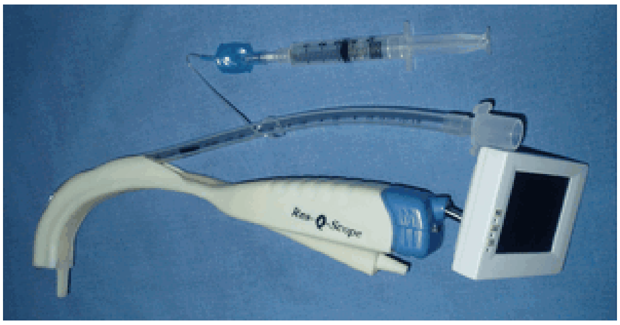

FIGURE 3. Photographs of the complete Res-Q-Scope (left) and the disposable portion (right). From the manufacturer's Web site.

The GlideScope Video Laryngoscope

The GlideScope® Video Laryngoscope is a novel system for tracheal intubation that utilizes a video camera embedded into a plastic laryngoscope blade. The blade is 18 mm at its maximum width, and bends 60 degrees at the mid-line. This configuration provides a view that is usually superior to that obtained with a conventional laryngoscope. The video image is displayed on a Liquid Crystal Display (LCD) monitor, and can also be recorded electronically.

Clinical experience with the GlideScope has shown that the unit is easy to use, even in some patients who are ordinarily very difficult to intubate [6-9]. In fact, the principal limitation in using the GlideScope is not in getting a good view of the glottis, but rather in manipulating the endotracheal tube (ETT) through the vocal cords, since the ETT tip often tends to hit against the anterior tracheal wall. Also, using an ordinary ETT without a stylet results in a floppy ETT that is very hard to direct through the cords, and successful oral ETT placement always requires some form of stylet, such as a Mallinckrodt Satin-Slip® Intubating Stylet bent in the shape of a "hockey stick".

FIGURE 4. Top: Close-up views of the GlideScope handle (Courtesy Saturn Biomedical). Bottom: View of the LCD monitor component of the GlideScope.

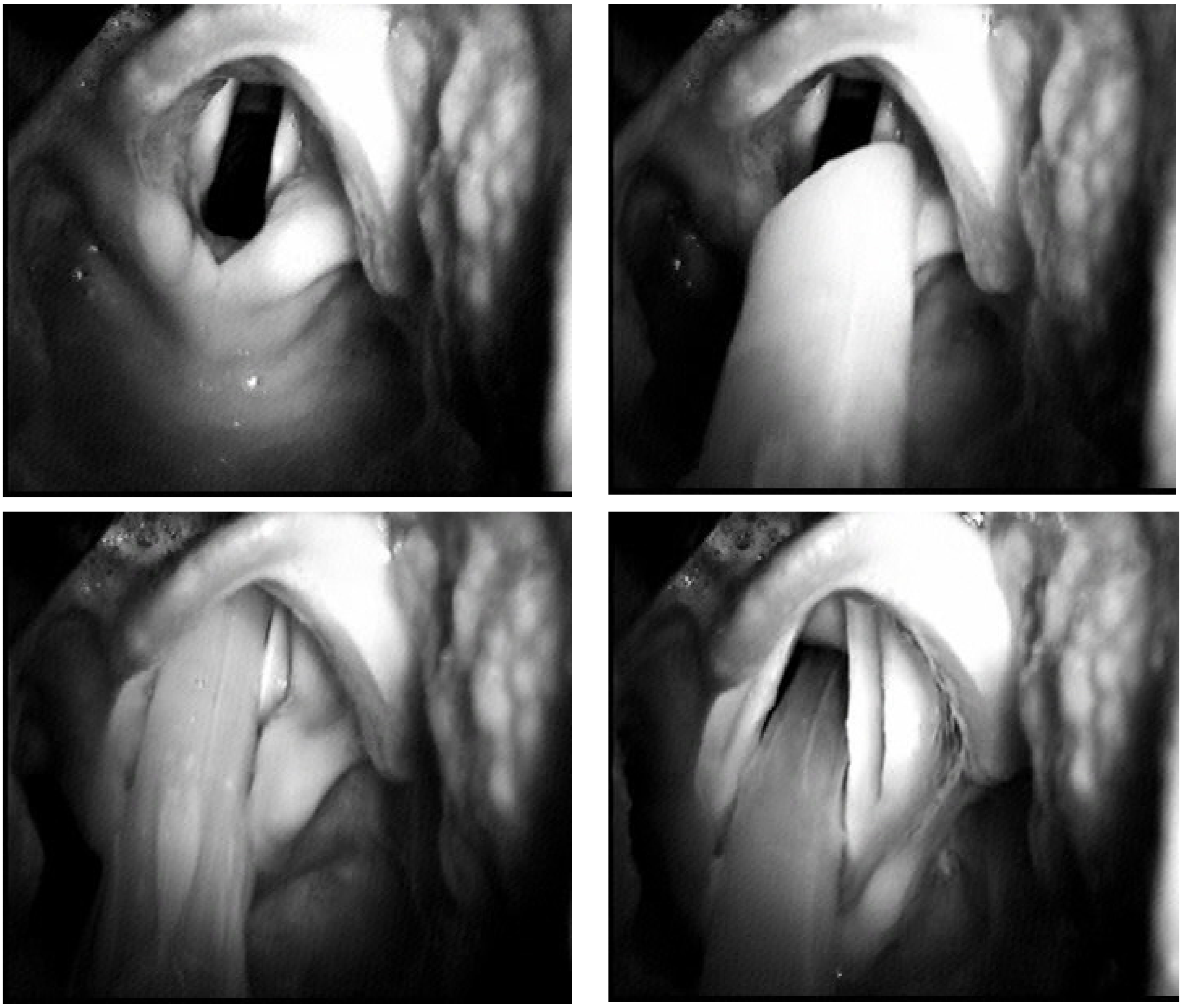

FIGURE 5. Close-up views from the GlideScope, as the endotracheal tube (ETT) passes through the vocal cords, from case 112 of the author's personal series. Note that during ETT placement the tube tip often tends to hit against the anterior tracheal wall. This problem is easily handled by pulling back the stylet by about 3 cm and then advancing the ETT. Sometimes it also helps to rotate the ETT 180 degrees to direct the ETT tip more posteriorally (once the stylet has been removed).

While clinical experience to date using the Glidescope in anesthetized and paralyzed patients has been excellent [6-9], experience in using the Glidescope in awake patients has been limited. Doyle [10] described the use of the Glidescope in four cases of awake intubation where the airway was anesthetized with gargled and atomized 4% lidocaine, and where superior laryngeal and transtracheal blocks were not employed. Of note, The GlideScope can be particularly helpful in ensuring that topical anesthesia is sprayed directly on the vocal cords under direct vision. As with any awake intubation method, judicious sedation is usually also administered.

There are several potential advantages of using the GlideScope for awake intubation. First, the view is excellent. Second, the method appears to be less affected by the presence of secretions or blood as compared to the use of fiberoptic intubation. (It has not been my practice to administer glycopyrrolate when using the GlideScope for awake intubation, while it is when performing awake intubation using the fiberoptic bronchoscope.) Third, everyone can see what is going on, while this is the case only with fiberoptic intubation carts with a video option. (This is an important point for teaching.) Fourth, with the GlideScope the whole process can be recorded electronically using a regular camcorder. Fifth, it is possible to add a spray device to the GlideScope to spray additional topical anesthesia into the glottis under direct vision. Sixth, there are no special restrictions on the type of ETT that can be placed when using the GlideScope, while this is not the case for fiberoptic methods. Seventh, the GlideScope is much more rugged than a fiberoptic bronchoscope, and is far less likely to be damaged with use. Eighth, the GlideScope is much more easily cleaned than a fiberoptic bronchoscope. Finally, while it is well known that advancing the ETT into the trachea over the fiberoptic bronchoscope often fails as a result of the ETT impinging on the arytenoid cartilages [11], this is not a problem with the GlideScope.

The GlideScope can also be used to assist in fiberoptic intubation (FOI), either for teaching purposes, or in difficult cases [12]. The technique is simple. Following anesthetic induction (or in an awake topicalized patient), the GlideScope is introduced in the usual manner, followed by introduction of the fiberoptic bronchoscope (FOB). While the resident manipulates the FOB into position, the supervisor monitors the GlideScope display to see where the tip of the FOB is located. (The resident looks only through the FOB and does not look at the GlideScope display.) The supervisor then provides verbal feedback to the resident as to the location of the tip of the FOB. Once the FOB has entered well into the trachea, the endotracheal tube is then passed over the FOB into the glottis. Here, use of the GlideScope can again be helpful, since should the endotracheal tube get caught on the arytenoids [11] or other laryngeal structures, it becomes evident on the GlideScope display, and appropriate corrective action (such as twisting the endotracheal tube) can easily be taken.

It should also be pointed out that under general anesthesia, the lumen of the pharynx and the larynx usually becomes smaller as a result of reduced muscle tone. Insertion of the GlideScope lifts the tongue and the jaw to “open up” these structures and facilitates the identification of anatomical landmarks by the user of the FOB. Finally, it should be emphasized that this technique would be expected to be useful for other purposes, as in situations where FOI is difficult even for experienced operators, as may occur, for instance, in the case of airways soiled by blood.

Based on using this technique in a number of anesthetized patients to date, I have found it to be particularly valuable, especially in averting lengthy detours to peripheral structures such as the piriform fossae. It was also my experience that this technique offers a “macro view” that is helpful even when a video bronchoscope is available.

Conclusion

While the use of video laryngoscopes such as the GlideScope is not yet ubiquitous, their ease of use is likely to change this situation in the next few years, and we are likely to see them used frequently in both routine cases as well as in more complex cases, such as in patients requiring awake intubation.

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