Videolaryngoscopes

Do They Truly Have Roles in Difficult Airways?

DIFFICULTY in tracheal intubation is still a major problem in anesthesia practice. Failure to intubate the trachea is not in itself life-threatening, but it is frequently associated with serious complications, such as pulmonary aspiration and difficult mask ventilation. In addition, repeated attempts at tracheal intubation may damage the upper airway and make mask ventilation more difficult. In fact, difficulty in tracheal intubation is the most common factor related to serious complications during anesthesia.1

Much effort has been taken to reduce the incidence of difficult intubation with a conventional Macintosh laryngoscope, but the incidence seems to remain the same. Meanwhile, alternative devices for tracheal intubation have been developed. The fiberoptic bronchoscope is regarded as the most reliable tool in patients with difficult airways, but considerable skill and knowledge are required to achieve a smooth tracheal intubation. Recently, increasing interest has been shown in the use of rigid indirect-optical laryngoscopes, or “videolaryngoscopes.” In this issue of Anesthesiology, Aziz et al.2 report the usefulness of a videolaryngoscope in patients with predicted difficult tracheal intubation, and Fiadjoe et al.3 report the efficacy of another videolaryngoscope in infants.

The indirect-optical laryngoscopes are recently often called “videolaryngoscopes” because these laryngoscopes generally use videotechnology, so the image of the glottis is captured by a camera “eye” positioned near the tip of the blade and then transmitted to a video screen. The Bullard laryngoscope, in the late 1980s, was the first commercially available device, but it was the late 1990s when several new indirect-optical laryngoscopes, mainly videolaryngoscopes, started to become available.

Aziz et al.2 performed a randomized, controlled study, assessing the efficacy of a videolaryngoscope (C-MAC videolaryngoscope) in 300 patients with predicted difficult tracheal intubation, and have found that the success rate of tracheal intubation at the first attempt with the videolaryngoscope was significantly higher (93%) than with a conventional Macintosh laryngoscope (84%). The view of the glottis at laryngoscopy was significantly better, and the use of an endotracheal tube introducer (a gum elastic bougie) and pressure to the larynx (to obtain a better view of the glottis) were significantly less frequently required for the videolaryngoscope. Nevertheless, time to intubate the trachea took slightly, but significantly, longer with the videolaryngoscope.

Fiadjoe et al.3 compared the efficacy of another videolaryngoscope (Glidescope) with a Miller laryngoscope in 60 infants without airways known to be difficult. They have found that the view of the glottis at laryngoscopy with the videolaryngoscope was significantly better than the view with the Miller laryngoscope, but the time required to intubate the trachea was significantly longer with the videolaryngoscope. The success rate of tracheal intubation was similar between the groups.

Do Videolaryngoscopes Truly Have Roles in Patients with Difficult Airways?

Based on the studies by Aziz et al.2 and Fiadjoe et al.3 and previous studies, it is reasonable to conclude that videolaryngoscopes are useful for tracheal intubation, with several advantages over direct laryngoscopy. Videolaryngoscopes provide a clearer view of the glottis, reducing the time required for intubation, and improving the success rate. However, the use of videolaryngoscopes should be considered based on the specific needs and circumstances of each patient, as the time required for intubation may be longer compared to conventional laryngoscopy.

“...In the era of evidence-based medicine, the efficacy and safety of each videolaryngoscope should be compared with a conventional direct laryngoscope, with the other videolaryngoscopes, and with the other types of intubation devices ....”

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Accepted for publication October 6, 2011. The author has received an honorarium from the manufacturer of a videolaryngoscope (Pentax-AWS; Hoya, Tokyo, Japan) for giving a lecture.

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vantages over the conventional direct laryngoscopes, such as a Macintosh or Miller type. What we need to do next is to judge whether or not videolaryngoscopes truly have roles in patients with difficult airways. To do this, two major factors need to be taken into consideration: whether or not a videolaryngoscope can reduce repeated attempts at tracheal intubation, and if it is less likely to be stressful and traumatic.

Do Videolaryngoscopes Increase the Success Rate of Tracheal Intubation?

With a direct laryngoscope, it is necessary to obtain a line of sight from the maxillary teeth to the glottis, by placing the patient’s head on a pillow and extending the head on the neck (sniffing position) to displace the tongue and epiglottis, which frequently obstruct the line of sight. In addition, an assistant is frequently required to apply pressure to the thyroid cartilage to obtain a clear view of the glottis, and it is often difficult for the assistant to adjust the direction and the degree of the pressure. With a videolaryngoscope, because the image of the glottis is captured near the tip of the blade, only a few centimeters of line of sight will be required. In addition, an assistant can adjust the direction and degree of pressure on the neck by confirming the improvement of the view of the glottis on a video screen. Therefore, theoretically, a videolaryngoscope would provide a better view of the glottis, and would increase the success rate of tracheal intubation.

There have been anecdotal reports of successful use of a videolaryngoscope in patients with difficult airways, in whom tracheal intubation with a Macintosh laryngoscope had failed. In a case series of 270 adult patients in whom direct laryngoscopy using a Macintosh laryngoscope had been difficult and in 23 patients with predicted difficult intubation and difficult mask ventilation, tracheal intubation with a videolaryngoscope (Airway scope) was successful in 290 of 293 patients. In addition, randomized, controlled studies (including the study of Aziz et al.) comparing different videolaryngoscopes with the Macintosh laryngoscope in adult patients unanimously have shown a higher success rate of intubation with the videolaryngoscopes. Therefore, it is clear that, compared with a direct laryngoscope, videolaryngoscopes studied increase the success rate of tracheal intubation in adult patients with difficult airways.

For children, only a limited number of videolaryngoscope blades are available, and although Fiadjoe et al. have shown the efficacy of a videolaryngoscope in infants without known difficult airways, its efficacy in children with difficult airways is not clear.

Are Videolaryngoscopes Less Stressful and Less Traumatic?

Compared with a conventional laryngoscope, a videolaryngoscope would be less stressful to the patient, because the videolaryngoscope is less likely to require extension and flexion of the head and neck, pressure on the neck, and distortion of the upper airway.

A few studies have shown that movement of the cervical spine during laryngoscopy with a videolaryngoscope is less than with a Macintosh laryngoscope. Aziz et al. and others have shown that a tube introducer and pressure to the larynx were less frequently required. These studies support theoretical advantages of videolaryngoscopes, but there is not enough evidence to judge whether or not videolaryngoscopes are truly less stressful and less traumatic. In particular, no data are available as to whether tracheal intubation using a videolaryngoscope (in comparison with a direct laryngoscope) is less likely to obstruct the airway, by traumatizing the upper airway.

Previous reports are inconsistent as to whether the time required to intubate the trachea with a videolaryngoscope is shorter or longer than the time required with a conventional laryngoscope. Both Aziz et al. and Fiadjoe et al. report that intubation time was significantly longer with a videolaryngoscope. Prolonged apnea time, rather than intubation method, is known to further increase the blood pressure and heart rate, and thus this prolonged apnea with a videolaryngoscope may be more stressful to the patient. In addition, a prolonged apnea time with a videolaryngoscope may cause hypoxia in patients with reduced oxygen stores, such as obese patients, obstetric women and children, and those who already have desaturated during difficult airway management.

Current Task to Establish the Role of Videolaryngoscopes

Based on the current state of knowledge, it is clear that we need to carry out randomized, controlled studies to assess whether or not videolaryngoscopes are truly less stressful and less traumatic than a conventional laryngoscope, to establish their roles in patients with difficult airways. In addition, there may be another two major factors that we need to look at: the efficacies of different videolaryngoscopes and elucidation of difficulty in their use.

Efficacies of Different Videolaryngoscopes

Currently, several different indirect-optical laryngoscope and videolaryngoscopes are available, but the efficacies are likely to be different between these devices. They may be categorized to three major categories, with possible advantages and disadvantages.

Macintosh type: The videolaryngoscopes of this category have Macintosh-type blades. The insertion method is basically the same as the conventional Macintosh laryngoscope, and thus it is possible to see the glottis either directly or on a video screen. As the study of Aziz et al. has shown, the success rate of tracheal intubation with this type of videolaryngoscope is generally higher than with a Macintosh laryngoscope, but the use of a tube introducer and external pressure to the larynx may still frequently required to obtain a clear view of the glottis.

Anatomically shaped blade without a tube guide: The blade of this category is generally anatomically shaped, so that a clear
view of the glottis can be obtained without flexing or extending the head and neck. One major limitation of this type is that it is no longer possible to directly see the glottis, and thus there is a moment when the position of the tip of an endotracheal tube cannot be confirmed during its insertion. Therefore, even when a clear view of the glottis is obtained on a video screen, it can often be difficult to direct a tube toward the glottis, and may traumatize the upper airway during this blind moment.

Anatomically shaped blade with a tube guide: The videolaryngoscope of this category has an anatomically shaped blade with a tube guide, and the tube is designed to be guided toward the glottis. Because the tip of the tube is captured on the video screen even before insertion of the device, the location of the tube tip can continuously be confirmed during the entire course of tracheal intubation.

There are only a few studies that compared different videolaryngoscopes in patients with predicted or simulated difficult airways. Therefore, formal randomized studies would be required to establish which laryngoscope is the most effective in reducing the number of repeated attempts at intubation and least traumatic in patients with difficult airways.

**Elucidation of Difficulty**

Even when we have concluded that videolaryngoscopes have roles in patients with difficult airways, they may fail in some patients. We need to know as much as possible the causes of difficulties in tracheal intubation with a videolaryngoscope, to establish the true role of each device in patients with difficult airways. A few causes of difficulties have been elucidated, such as blurred vision (by fogging, secretion, blood, or vomitus) or difficulty in insertion of a blade in patients with limited mouth opening. It is not known whether or not the causes of difficulty in intubation with a videolaryngoscope differ from the causes for Macintosh blade. For example, for a videolaryngoscope with anatomically shaped blade without a tube guide, even when a clear view of the glottis is obtained it may frequently be difficult to drive a tube toward the glottis. It is also not known whether or not preoperative tests to predict difficult tracheal intubation with the Macintosh laryngoscope can be applicable to predict difficult intubation with a videolaryngoscope.

**Conclusions**

Compared with direct laryngoscopes, indirect-optical laryngoscopes or videolaryngoscopes generally provide a better view of the glottis and a higher success rate of tracheal intubation in patients with difficult airways, and thus videolaryngoscopes have potential roles in patients with difficult airways. Nevertheless, there is still insufficient evidence to judge whether tracheal intubation using a videolaryngoscope is less likely to traumatize the airway or to prolong apnea time, both of which may lead to serious airway complications. It is also not clear when each videolaryngoscope may fail, and how such a difficulty can be predicted preoperatively. In the era of evidence-based medicine, the efficacy and the safety of each videolaryngoscope should be compared with a conventional direct laryngoscope, with the other videolaryngoscopes, and with the other types of intubation devices (e.g., a fiberoptic bronchoscope) to establish true role of videolaryngoscopes in patients with difficult airways.

**References**