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USE OF A FLEXIBLE INTUBATING SCOPE IN COMBINATION WITH A CHANNELED VIDEO LARYNGOSCOPE FOR MANAGING A DIFFICULT AIRWAY IN THE EMERGENCY DEPARTMENT

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□ **Abstract—Background: Difficulty with intubation is not uncommon in the emergency setting. Video laryngoscopes (VLs) are commonly used to manage the difficult airway in the emergency department (ED). Intubation using a flexible bronchoscope, while considered the gold standard for managing the anticipated difficult airway in the operating room, is not commonly used in the ED. Case: We present a case describing VL-assisted flexible scope intubation performed in the ED as a novel feasible approach to managing the difficult airway. A 65-year-old male, post cardiac arrest, with multiple unsuccessful attempts at prehospital intubation had rapid sequence intubation (RSI) performed and, despite obtaining a view with a King Vision™ VL, the skilled operator was unable to advance the endotracheal tube (ETT). An Ambu™ aScope3 flexible intubating scope (FIS) was placed through the ETT loaded in the channel of the King Vision and advanced through the cords to a position proximal to the carina. The ETT was then advanced easily over the FIS and down the trachea. Why Should an Emergency Physician Be Aware of This?: Although video laryngoscopy is commonly used in the ED, intubation can prove difficult, despite having an adequate view of the glottis. Use of an FIS, however, through a channeled VL makes navigation of the ETT easier and facilitates tube advancement, which can be difficult with VL. Channeled VL-assisted use of an FIS is a viable option for managing the difficult airway.** © **2015 Elsevier Inc.**

□ **Keywords—airway management; intubation; video laryngoscope; flexible intubating scope**

George Kovacs was listed as a co-inventor in an airway device patent filing that was acquired by King Systems in 2013. He has otherwise had no relationship with King Systems or Ambu and receives no royalties from either company. The authors report no other conflicts.

INTRODUCTION

Difficult airway is an all-encompassing term that includes difficult laryngoscopy, intubation, mask and supra-glottic ventilation, and surgical access. The true incidence in emergency medicine is unknown, but estimates suggest difficulty may be encountered in as much as 10%–30% of cases (1). Safe and effective emergency airway management requires competent decision making and skill in managing both the anticipated and unanticipated difficult airway. Fiberoptic intubation with a flexible bronchoscope has traditionally been considered the gold standard for managing the anticipated difficult airway in the operating room setting (2). Cost and issues of skill acquisition and maintenance have made the use of bronchoscopes impractical in many settings, including emergency medicine (3). With the advent of lower-cost, camera-based, indirect-intubating devices, the options available for managing the difficult airway have expanded significantly. Fiberoptic bronchoscopes are also being replaced by video-based CMOS chip-on-the-tip systems, and,

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when used in managing the difficult airway to access the trachea, are more accurately termed *flexible intubating scopes* (FIS). Successful use of an FIS is ideally performed in a patent airway, allowing navigation through recognizable landmarks. Recent reports in the anesthesia literature have suggested using video laryngoscopy as a method of maintaining airway patency for intubation with a flexible bronchoscope in patients with difficult airways (4). The case we describe represents what we believe is the first published video laryngoscopy–assisted FIS (VL/FIS) use by emergency medicine staff in an emergency department (ED) setting. Additionally, we will discuss anatomic considerations and the clinical context for this approach in managing the difficult airway.

CASE

A 65-year-old male sustained a witnessed cardiac arrest. Return of spontaneous circulation was achieved by Emergency Medical Services, and the decision was made to intubate for transport to hospital. Although there were no obvious predictors of difficultly, several attempts at intubation failed and a #4 King LTS-D was placed. On arrival to the ED, the patient remained at a Glasgow Coma Scale score of 3, with spontaneous respirations and an oxygen saturation of 88%. There was clinical suspicion of a cuff leak. The decision was made to remove the King LTS-D and replace it with an endotracheal tube (ETT). The emergency physician was experienced with both the King Vision™ (King Systems, Indianapolis, IN) video laryngoscope (KVVL) and the Ambu aScope 3™ (Ambu, Ballerup, Denmark), a new disposable FIS. High-flow oxygen was delivered throughout via nasal prongs and rapid sequence intubation (RSI) (clenched teeth around King LT) was completed with etomidate and rocuronium. A channeled KVVL loaded with an 8.0 ETT was placed in the patient's mouth and a view of the glottis was obtained (75% percentage of glottic opening), however, there was difficulty advancing the ETT. The KVVL was held and the view maintained by an ED critical care paramedic and the FIS was introduced via the ETT. On exiting the ETT, the glottic inlet was visible on the FIS monitor and the FIS was advanced through the cords and down the trachea until proximal to the carina. The ETT was then observed on the KVVL monitor and advanced through the vocal cords to the desired depth. The KVVL was then removed from the patient and ETT placement was confirmed directly with the FIS as it was slowly withdrawn from the trachea and removed from the patient.

DISCUSSION

Airway management and endotracheal intubation in the ED patient requires an approach for managing both the anticipated and unanticipated difficult airway. The first attempt at intubation with video laryngoscopy can fail in upwards of 30% of difficult airway emergency cases, and successful execution of a plan B approach, assuming the patient can be oxygenated between attempts, typically mandates some change in personnel or equipment (5,6). Whether the first attempt involved optimal direct or video laryngoscopy, all clinicians involved in emergent airway management must be competent in the use of alternative intubation equipment.

Video laryngoscope (VL) use is increasing as a primary and alternative approach to intubation (7). These devices are intended to "look around the corner" and therefore do not require optimization of the oral, pharyngeal, and tracheal axes, which makes them attractive instruments for laryngoscopy. VLs consistently provide better views of the glottic inlet for patients with and without significant predictors of difficulty (8). Despite this apparent advantage, these devices present a new challenge whereby an adequate view of the glottis is obtained but the operator has difficulty with ETT access to the glottic inlet and subsequent advancement of the ETT down the trachea. As opposed to aligning axes, as required for direct laryngoscopy, indirect techniques must manage two opposing curves (9,10). Although using a channeled VL or an appropriately curved stylet is helpful for addressing the glottic access challenge of the oropharyngeal curve, the second opposing pharyngo-glotto-tracheal curve may become unmanageable. The ETT that travels in a posterior to anterior direction as it traverses the vocal cords may now become caught on anterior laryngeal and tracheal structures (e.g., cricoid and tracheal rings), preventing advancement of the tube. Although modifying laryngoscopy technique and tube delivery might successfully manage these challenges, a viable option is to use a VL combined with an FIS to facilitate both obtaining a view of the glottis and advancement of the ETT.

Although combined use of a VL and FIS has been described, there have only been two case reports on using a channeled VL (11–13). FISs are best used in a patent airway through the patient's oropharynx or nasopharynx, allowing orientation and identification of structures. This patency is typically maintained by an awake, cooperative patient; a clinical scenario that is relatively uncommon in emergency medicine. By using a VL for soft-tissue control in the obtunded or critically ill patient, the leading edge of the flexible scope can be seen in a wider field of vision as it is navigated to the glottic inlet by a second operator. The clinician can then transfer visualization from the VL screen to the FIS screen as it enters the trachea and travels to its position proximal to the carina. Finally, the preloaded ETT is maneuvered over the FIS and observed on the VL screen as it crosses the vocal cords to its position in the distal trachea, at which

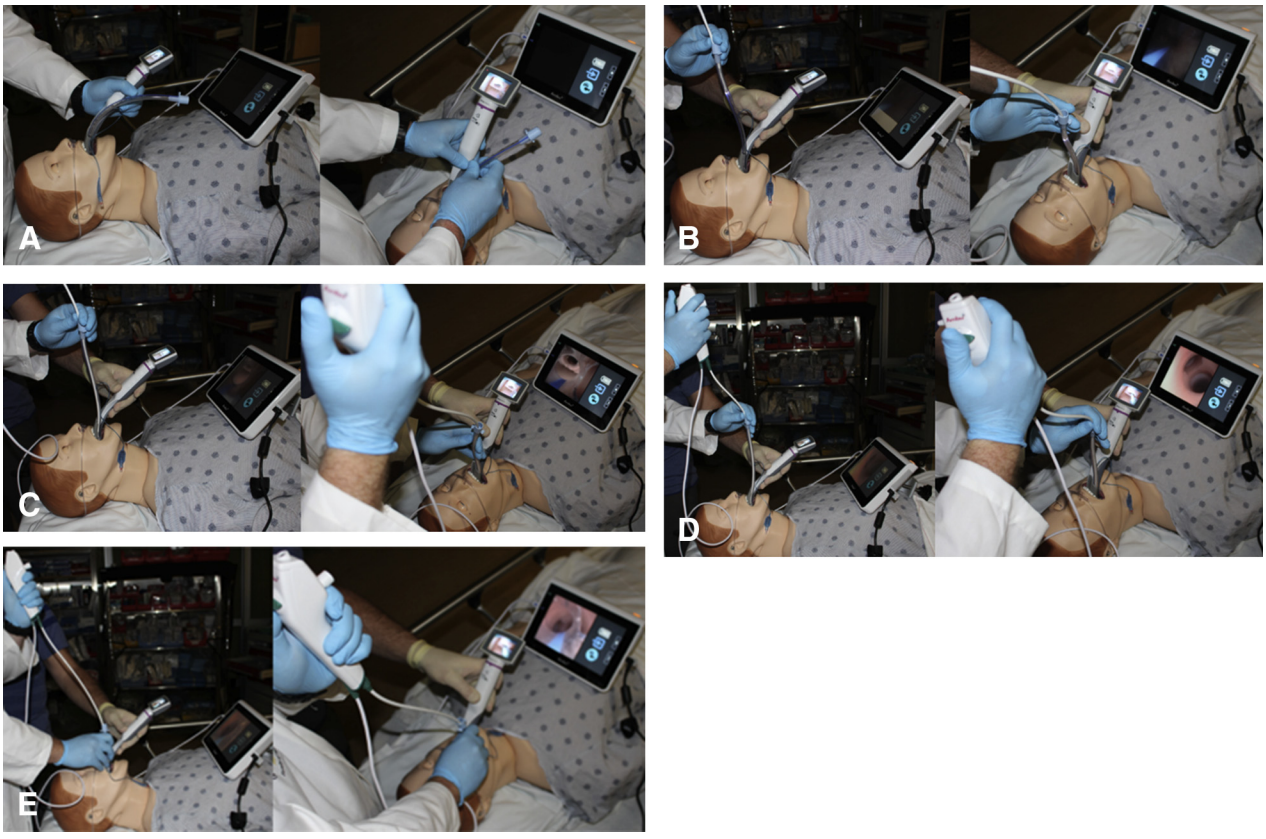

Figure 1. (A) The preloaded channeled King Vision video laryngoscope (KVVL) is used to obtain a view of the vocal cords and glottic inlet by the primary skilled operator (blue gloves). (B) The KVVL is held in place with view maintained by an assistant (white gloves). The Ambu aScope3 flexible intubation scope (FIS) is introduced via the preloaded endotracheal tube within the channeled KVVL. (C) The FIS is advanced by the primary operator through the glottic inlet under visualization via the KVVL screen. (D) The FIS is advanced to the carina allowing inspection of the airway via the FIS screen. (E) The endotracheal tube is advanced over the FIS visualizing passage through the vocal cords via the KVVL screen. The KVVL is then removed and the FIS slowly withdrawn to confirm tube placement.

point the FIS and VL are removed (Figure 1A–E). The VL/FIS approach described in the literature requires two skilled clinicians, one operating the VL and the other managing the FIS. In the case we describe, the use of a channeled VL simplifies the procedure and makes it feasible to be performed by a single skilled operator with a potentially unskilled assistant maintaining the position of the VL once the desired view is obtained (Table 1, steps in procedure). Using a channeled VL to achieve a view of the glottis with the ETT aimed in the direction of the glottic inlet, the initial navigation of the FIS around the first curve (posterior to anterior) is achieved through the KVVL channel within the ETT. Now the second curve (anterior to posterior) can be managed using the flexible distal end of the intubating scope, allowing a degree of maneuverability that is not possible with devices such as stylets or a bougie.

Table 1. Steps for Emergency Department Video Laryngoscope/Flexible Intubation Scope Intubation of the Difficult Airway

Step 1	Channeled KVVL loaded with ETT is introduced into patient's mouth
Step 2	Glottic view is obtained by primary operator
Step 3	VL handed to assistant, primary operator ensures VL view is maintained
Step 4	FIS is introduced into ETT and advanced to end of ETT and KVVL is adjusted for best view on FIS monitor
Step 6	FIS advanced through vocal cords guided by the view on the KVVL screen The view on the FIS monitor is then used for trachea advancement to position proximal to carina
Step 7	ETT is advanced through glottic inlet guided by the view on the KVVL screen If needed ETT bevel reorientation (1/4 turn to left) can be managed if there is hold on right-sided glottic structures
Step 8	ETT advanced to desired depth, ETT removed from KVVL channel and KVVL removed from patient
Step 9	FIS slowly withdrawn to confirm ETT position within trachea and removed from patient

ETT = endotracheal tube; FIS = flexible intubation scope; KVVL = King Vision video laryngoscope; VL = video laryngoscope.

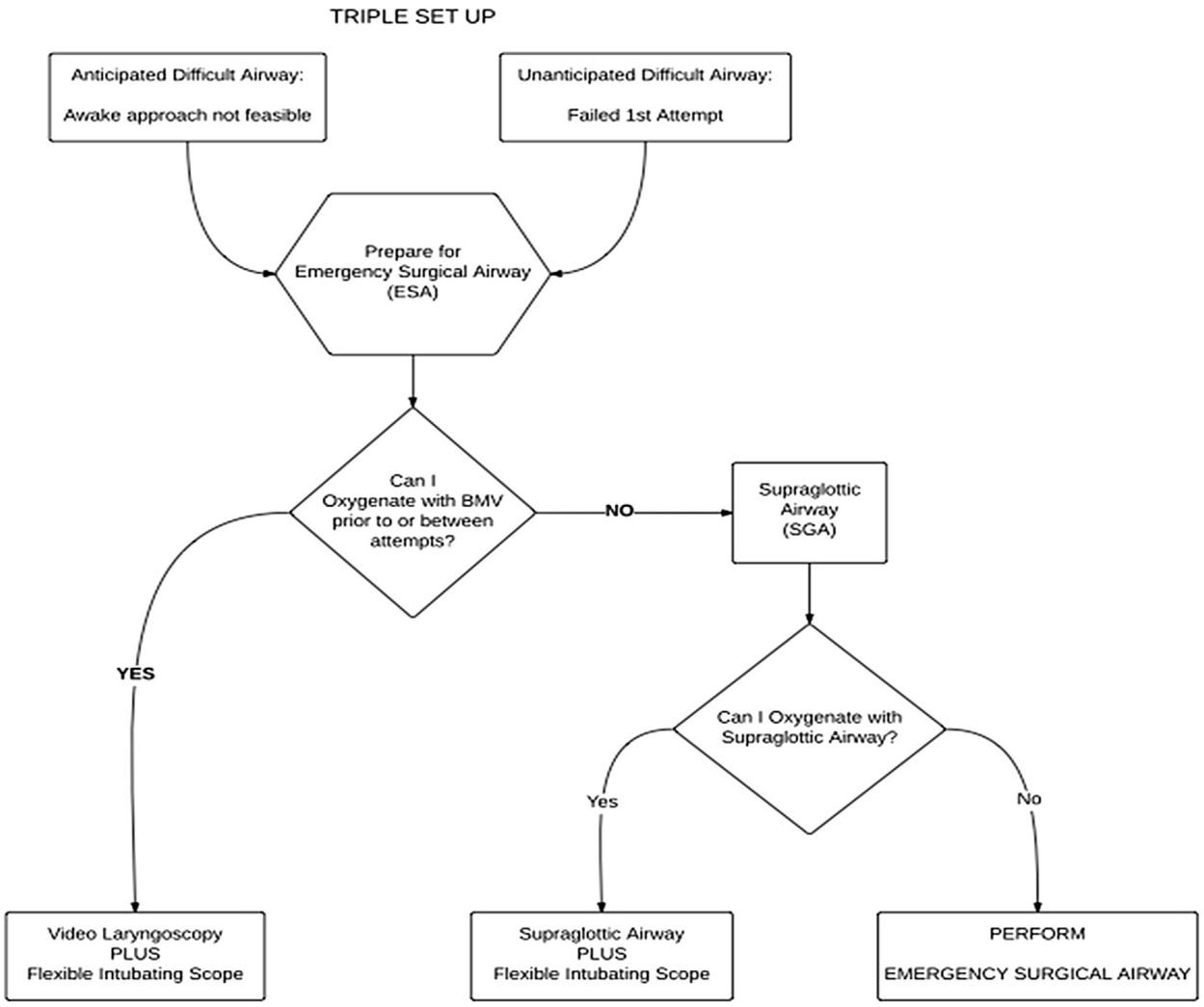

Figure 2. Proposed difficult airway algorithm including option for video-assisted flexible scope intubation. BMV = bag mask ventilation.

Learning and maintaining skill in the use of FISs and flexible bronchoscopy has proved enough of a challenge that, in a survey of almost 1,000 practicing anesthesiologists, only 2% would select an FIS as their initial device in an unanticipated difficult airway (14). Emergency medicine access to new airway management technologies has increased significantly during the past 10 years for a number of reasons, including decreasing equipment costs and expectations of increased "in-house" accountability for airway management. The combined use of VL with FIS not only helps solve difficult VL tube delivery, but expands our skill set to help identify and manage pathology where use of am FIS may be the preferred device.

For the anticipated difficult airway where an awake approach is not feasible and an RSI is the chosen approach, a "double setup" is often recommended, where the neck is marked and prepped for immediate access if intubation fails and oxygenation is compromised. With increasing availability and skill in using newer airway equipment, including VL, FIS, and second-generation intubating laryngeal mask airways, options for managing the difficult airway are expanding. Although the use of FIS as a primary independent device for managing the difficult airway in the ED might not be feasible for reasons described previously, it might be an option as part of a "triple setup," where in addition to preparing for an emergency surgical airway, an FIS is used in conjunction with a VL or a second-generation intubating laryngeal mask airway depending on the patients state of oxygenation (Figure 2).

WHY SHOULD AN EMERGENCY PHYSICIAN BE AWARE OF THIS?

The historical gold standard of using a flexible bronchoscope for management of the difficult airway has been challenged with the advent of newer indirect

technologies, such as video laryngoscopy (15). However the use of video laryngoscopy alone has not significantly decreased the incidence of difficult intubation (5). The use of a channeled VL in combination with FIS may provide practitioners another option for managing the difficult airway in the emergency setting.

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