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## COMPARISON OF THE KING VISION VIDEO LARYNGOSCOPE WITH THE MACINTOSH LARYNGOSCOPE

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**Abstract—Background:** Endotracheal intubation is a common procedure in the emergency department, and new devices may improve intubation time, success, or view. **Objective:** We compared the King Vision video laryngoscope (KVVL; King Systems, Noblesville, IN) to the Macintosh direct laryngoscope (DL) in simulated normal and difficult airways. **Methods:** Using manikins and clinical-grade cadavers, difficult airway scenarios were simulated using head movement restriction or a cervical spine collar. Four scenarios were studied using the KVVL and DL: normal manikin airway, difficult manikin airway, normal cadaver airway, and difficult cadaver airway. Primary outcomes were time to intubation and rate of successful intubation. Secondary outcomes were the percent of glottic opening and Cormack-Lehane grade visualized. **Results:** Thirty-two paramedics participated in the study. In the normal manikin airway scenario, time to intubation was 3.4 s (99% confidence interval [CI] 0.1–6.6) faster with the KVVL compared with DL. Time to intubation was 11.3 s (99% CI 2.4–20.2) faster with the KVVL in the difficult cadaver airway scenario. There was no difference in time to intubation in the other 2 scenarios. In the difficult cadaver airway, 10 of 32 participants failed to successfully intubate the trachea using DL, whereas all KVVL intubations were successful. All scenarios found a lower Cormack-Lehane grade and higher percentage of glottic opening with the KVVL compared to DL. **Conclusion:** The KVVL was slightly faster than Macintosh DL in two of

four studied airway scenarios, and had a higher success rate in the difficult cadaver airway scenario. Further study is required in the clinical setting. © 2014 Elsevier Inc.

**Keywords—**airway management; video laryngoscope; manikin study; cadaver study

### INTRODUCTION

#### *Background*

Emergency airway management is a critical skill in the practice of emergency medicine and prehospital medicine. Tracheal intubation is considered the gold standard in definitive airway management, and direct laryngoscopy remains a commonly taught and practiced method of achieving this goal. The limitations of direct laryngoscopy for emergency airway practitioners are well known and include significant time to become competent with the direct laryngoscope, skill deterioration with time, and poor first-attempt tracheal intubation success rates (1–7).

Numerous alternative devices, many of them video laryngoscopes, have been developed to combat these limitations. It is tempting to assume that newer equates to better, however, these devices are often brought to market without supporting clinical evidence of effectiveness (8,9). One randomized study comparing the use of direct laryngoscopy to video laryngoscopy in critically ill patients found that although video laryngoscopy

Ethics approval for this research was obtained through the Capital Health Research Ethics Board.

improved glottis visualization, there was no improvement in intubation time, and a higher incidence of significant hypoxemia (10). Two meta-analyses of studies comparing direct laryngoscopy to video laryngoscopy found improved glottis visualization but no improvement in time to intubation with video laryngoscopy (11,12). Therefore, prior to adopting a new video laryngoscope, it is imperative that device performance be compared to direct laryngoscopy in a controlled manner.

We chose to study the King Vision video laryngoscope (KVVL; King Systems, Noblesville, IN; Figure 1) because it is a portable and relatively inexpensive device, thus making it ideal for use in the emergency department (ED) and prehospital setting.

### Objectives

We examined the KVVL and the Macintosh direct laryngoscope in simulated normal and difficult airways. Both manikins and clinical-grade cadavers were used as models. The primary outcomes were time to intubation and rate of successful intubation. With reference to previous studies, we predicted a time of 20 s to perform successful intubation using Macintosh direct laryngoscopy (DL), with a standard deviation of 10 s (13,14). With an



Figure 1. King Vision video laryngoscope (channeled model).

alpha of 0.05 and a beta of 0.2, we had a power of 80% to detect a 5-s difference in time to intubation.

## MATERIALS AND METHODS

### Study Design

This was a simulation study using manikin and cadaver models. Ethics approval was obtained from the Capital Health Research Ethics Board, and written consent was obtained from all participants.

### Participant Selection and Setting

The study was performed in the ED simulation laboratory at the QEII Health Sciences Center in Halifax, Nova Scotia. Paramedics with airway management skills within their scope of practice were recruited as study participants. Subjects included Intermediate Care Paramedics, Advanced Care Paramedics, and Critical Care Paramedics. Those with prior experience using the KVVL were excluded. No financial incentive was offered. Participants did receive credit for time spent completing the study that counted towards the annual paramedic educational quota. Participants were recruited by advertisements placed in both the ED and the online paramedic newsletter.

### Interventions

After informed consent, each participant viewed two short videos made by the study investigators. The first video reviewed tracheal intubation using best-look Macintosh DL, including the role of patient positioning, and use of a malleable stylet and tracheal tube introducer (bougie). The second video demonstrated the use of the KVVL on both manikin and cadaver models.

Participants then performed 10 practice intubations on a manikin: five using DL, followed by five using the KVVL. The Laerdal Deluxe Difficult Airway Trainer manikin (Laerdal Medical, Stavanger, Norway) was used for all practice and subsequent intubations for the manikin portion of the study. All practice and study intubations occurred using either a size 3 Macintosh DL blade or channeled version of the KVVL blade, with an uncut 7.5-mm internal diameter endotracheal tube (Smiths Medical, St. Paul, MN). Both blades and endotracheal tubes were lubricated prior to use, and the KVVL when used was preloaded with the endotracheal tube. An investigator was available to assist with equipment, stylet removal, or external laryngeal manipulation on request.

During the five practice intubations using DL, participants were required to demonstrate tracheal intubation on at least one occasion with each of an unstyleted tube, a styleted tube, and adjuvant use of a tracheal tube

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