
Brief Reports

A RANDOMIZED TRIAL COMPARING TWO CUFFED EMERGENCY CRICOTHYROTOMY DEVICES USING A WIRE-GUIDED AND A CATHETER-OVER-NEEDLE TECHNIQUE

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□ **Abstract—Background:** According to different algorithms of airway management, emergency cricothyrotomy is the final step in managing the otherwise inaccessible airway. As an alternative to an open surgical procedure, minimally invasive approaches exist. Various sets for different methods are commercially available. QuickTrach™ (VBM Medizintechnik GmbH, Sulz am Neckar, Germany) contains a plastic cannula over a metal needle for direct placement in the trachea, whereas a guide-wire is used for the actual placement of the cannula in the Melker Set™ (Cook Group Incorporated, Bloomington, IN). **Objective:** We hypothesize that the direct puncture involving less discrete steps is faster to perform. However, it will lead to more complications due to the higher force needed to place the relatively thick needle. **Method:** After approval of the local ethics committee, the study was performed on cadavers of 16 adult sheep. A wire-guided cricothyrotomy was compared with a catheter-over-needle technique. Successful placement and performance time were compared. Complication rate and maximal achieved airway pressure were evaluated. Data is given as mean and interquartile range, and Mann-Whitney U-test ($p < 0.05$) for significant differences. **Results:** With the wire-guided technique, successful placement was possible in all attempts. The catheter-over-needle method was successful in 63% and had a higher complication rate (75% vs. 13%). The cannula-over-needle method allowed a

faster cricothyrotomy (32 [2–34] vs. 53 [52–56] s). Both methods allowed the delivery of similar maximal airway pressures (50 [44–51] vs. 48 [43–53] mbar). **Conclusion:** The wire-guided method proved to be the more reliable technique, leading to fewer complications. However, the direct puncture was faster to perform. Placed accurately, both devices allowed sufficient ventilation. © 2011 Elsevier Inc.

□ **Keywords—**cricothyrotomy; tracheotomy; emergency airway management; QuickTrach™; Melker Set™

INTRODUCTION

The difficult airway algorithm of the American Society of Anesthesiologists recommends the approach of a surgical airway as a final step (1). Cricothyrotomy is a surgical procedure intended to gain control of an otherwise not manageable airway (2,3). It is an easy, quick, and potentially life-saving intervention. If performed correctly, the complication rate should be very low because the technique per se is straightforward and is known from other fields of medical management (e.g., inserting central venous catheters). However, most physicians, even those regularly involved in airway management, have limited experience with this technique. Due to its emergency character, it is rarely used and always takes place in a crisis situation.

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Compared to an open surgical procedure, two less invasive techniques have been introduced as alternatives to a conventional open surgical procedure. One approach makes use of the Seldinger method using a guide-wire to insert the cannula. Studies have not yet demonstrated significant differences for procedure time and complication rate between the open surgical and the wire-guided technique (4,5). Another approach uses a catheter-over-needle technique for direct puncture to secure the airway. This method also is fast and easy to perform (6,7). Previous investigations compared the wire-guided technique with the cannula-over-needle method and demonstrated a significant difference in procedure time, easiness, and complication rate, favoring the direct puncture method (8). However, a response to this study indicated a potential limitation due to the setup using prepared porcine larynges that were stapled on wooden boards. A higher potential for traumatic complications using the cannula-over-needle technique in a more real-life situation was suggested (9).

This study again compared two non-surgical cricothyrotomy techniques: the wire-guided (Melker Set™; Cook Group Incorporated, Bloomington, IN) and the cannula-over-needle (QuickTrach™; VBM Medizintechnik GmbH, Sulz am Neckar, Germany) approach with respect to insertion time, success rate, complications, and functional quality of the established airway. However, in contrast to previous investigations, a model with cadavers of full-grown sheep was chosen. Recently developed cannulas with inflatable cuffs also allowed the comparison of maximal achieved airway pressure and pressure of the inflated cuff.

METHODS

With approval of the local ethics committee, two anesthesiologists (a third-year resident and a senior anesthesiologist)



Figure 1. QuickTrach Set™ (VBM Medizintechnik GmbH, Sulz am Neckar, Germany).



Figure 2. Melker Set™ (Cook Group Incorporated, Bloomington, IN).

performed this randomized trial in a standard operation theatre. The two participants were familiar with both sets and had the chance to practice each insertion technique for 1 h on manikins a month before the investigation. For the study, cadavers of 16 female 9-month-old sheep were used. We compared a wire-guided cricothyrotomy set with a catheter-over-needle set. Both devices have an inflatable cuff and are commercially available (Figures 1, 2).

The sheep were fully heparinized and euthanized with T61 (Intervet, Wiesbaden, Germany) while under deep anesthesia. After their deaths, the whole anterior neck region was shaved and the animals were placed in a supine position. The weight of the sheep was documented. For each of the participants, the sheep were randomly allocated to the performed technique.

The guide-wire group used the Melker Set™ (Cook Medical Inc., Bloomington, IN) consisting of a needle, a syringe, a guide wire, a scalpel, a dilatator, a 5-mm (inner diameter) cannula with an inflatable cuff, and a syringe for blocking the cuff. The catheter-over-needle group used the QuickTrach II™ (VBM Medizintechnik GmbH, Sulz am Neckar, Germany), consisting of a syringe, a conical-shaped needle, a plastic 4-mm (inner diameter) cannula with an inflatable cuff, and a stopper. The stopper is intended to prevent the needle from being inserted too deeply. The risk of a posterior wall perforation is supposed to be reduced with this device. In the second group, a separate number 11 stab scalpel (Feather Safety Razor Co., Osaka, Japan) was used for a 3-mm stab to incision before puncture with the catheter-over-needle because this is not included within the set.

For both approaches, two time intervals were defined. The first time interval was started with the “decision” to gain a surgical airway up to the actual start of the

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