

## Melker Cricothyrotomy Kit: An Alternative to the Surgical Technique

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Emergent cricothyrotomy is a potentially lifesaving procedure central to acute airway algorithms. In most cases in which cricothyrotomy is indicated, the acuteness of the airway precludes subspecialty consultation before performance of the procedure. The academic environment is an exception, in which the responsibility of securing a "difficult" cricothyroid airway may fall upon junior otolaryngology residents. Described here is the use of the Melker Emergency Cricothyrotomy Kit, a prepackaged kit that uses a wire-guided percutaneous dilational technique (the Seldinger technique) and a procedure-specific polyvinylchloride airway catheter. The wire-guided technique may add a margin of safety for a relatively inexperienced resident performing cricothyrotomy. Furthermore, a newly released version of the kit includes instrumentation for insertion of the Melker airway catheter by the classic surgical technique in addition to that required for the Seldinger technique, which may enable even a seasoned surgeon to secure the airway faster and more safely.

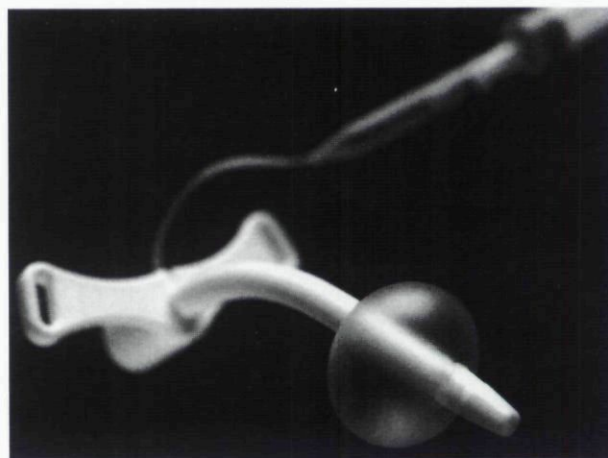
**Key Words:** alternative, cricothyrotomy, technique.

Emergent cricothyrotomy is a potentially lifesaving procedure central to acute airway algorithms. In most cases in which cricothyrotomy is indicated, the acuteness of the airway precludes subspecialty consultation before performance of the procedure. Instead, the otolaryngologist may be consulted only after the airway has been secured, for conversion to tracheostomy. The academic environment is an exception, in which the responsibility of securing a "difficult" cricothyroid airway may fall upon junior residents. What results is a unique situation in which relatively inexperienced surgeons are called upon to perform a critical procedure that they have had little opportunity to practice.

As an otolaryngology resident, the first author has found that a prepackaged cricothyrotomy kit that involves a wire-guided percutaneous dilational technique (Melker Emergency Cricothyrotomy Kit, Cook Critical Care, Bloomington, Indiana) has been useful on four occasions in rapidly and successfully establishing a cricothyroid airway. The kit has also been used by two other current otolaryngology residents in the same department on three separate occasions with success. Central to the kit is a procedure-specific polyvinylchloride airway catheter, now available in a cuffed version (Fig 1). Although initially developed to decrease complications associated with

paramedics' attempts at cricothyrotomy, the kit uses the familiar Seldinger technique, which has made it increasingly popular among emergency department and critical care physicians, anesthesiologists, and military personnel worldwide. However, in the fields of otolaryngology and general surgery, in which the principles of surgical cricothyrotomy are ingrained, few are aware of the wire-guided technique.

The steps involved in wire-guided insertion of the

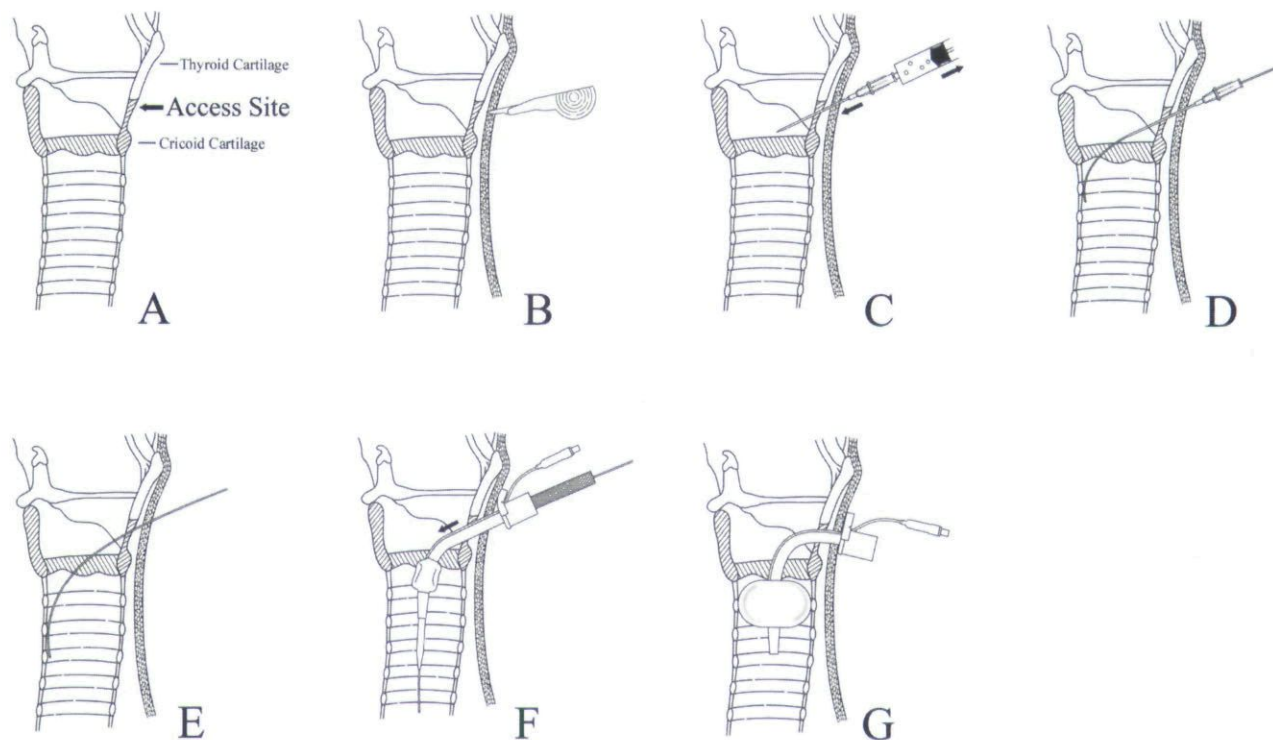


**Fig 1.** Melker Emergency Cricothyrotomy Kit's polyvinylchloride airway catheter, shown in its cuffed version. (Reproduced with permission from Cook Critical Care, Bloomington, Indiana.)

From the Departments of Otolaryngology (Melker), Anesthesiology (Gabrielli), and Surgery (Gabrielli), University of Florida College of Medicine, Gainesville, Florida. The first author's familiarity with the technique presented comes from the fact that his father, Richard J. Melker, MD, PhD, is the inventor of the kit. The University of Florida assigned rights to the technology to Cook Critical Care, Bloomington, Indiana. Although his father receives royalties from the sale of the device, the author has no direct financial relationship with Cook Critical Care.

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**Fig 2.** Schematic representation of steps involved in wire-guided insertion of cuffed Melker airway catheter. **A)** Anatomic landmarks. **B)** Limited skin incision. **C)** Advancement of 18-gauge needle through incision and cricothyroid membrane until free air return is encountered on suction. **D)** Placement of guidewire through 18-gauge needle. **E)** Removal of 18-gauge needle, leaving guidewire in place. **F)** Advancement of dilator-airway catheter assembly over guidewire. **G)** Inflation of catheter cuff after removal of guidewire and dilator. (Reproduced with permission from Cook Critical Care.)

cuffed Melker airway catheter (Fig 2) are presented, together with a representative case report. Our purpose is to present the technique as a relatively safe and effective alternative to standard surgical cricothyrotomy.

#### CASE REPORT

A 67-year-old man had a history of recurrent T1N2a squamous cell carcinoma of the right retro-molar trigone after radiotherapy. After uneventful salvage surgery including composite resection, right modified radical neck dissection, and right pectoralis major flap reconstruction, the patient was discharged home on postoperative day 7. At the time of discharge, the patient continued to receive nutrition via a nasogastric tube. The patient returned to the emergency department on postoperative day 10 in respiratory distress. At the time of presentation, intra-oral examination demonstrated tenacious, peanut butter-like secretions filling the oral cavity and adherent to the nasogastric tube and pectoralis flap suture line. Before attempts at debridement of the oral cavity could be initiated, acute decompensation occurred with complete upper airway obstruction.

Attempts to establish mask ventilation were unsuccessful, and a precipitous decline in oxygen saturation to approximately 15% was noted. At the onset

of the episode, a Melker kit was obtained and a wire-guided cricothyrotomy was performed in less than 1 minute. This procedure was uneventful despite significant postsurgical edema and the presence of the pectoralis major flap. The patient briefly became unresponsive, but demonstrated no bradycardia, hypotension, or arrhythmia. His oxygen saturation quickly returned to 100% while he was breathing room air after the procedure, and he immediately became responsive with a nonfocal neurologic examination.

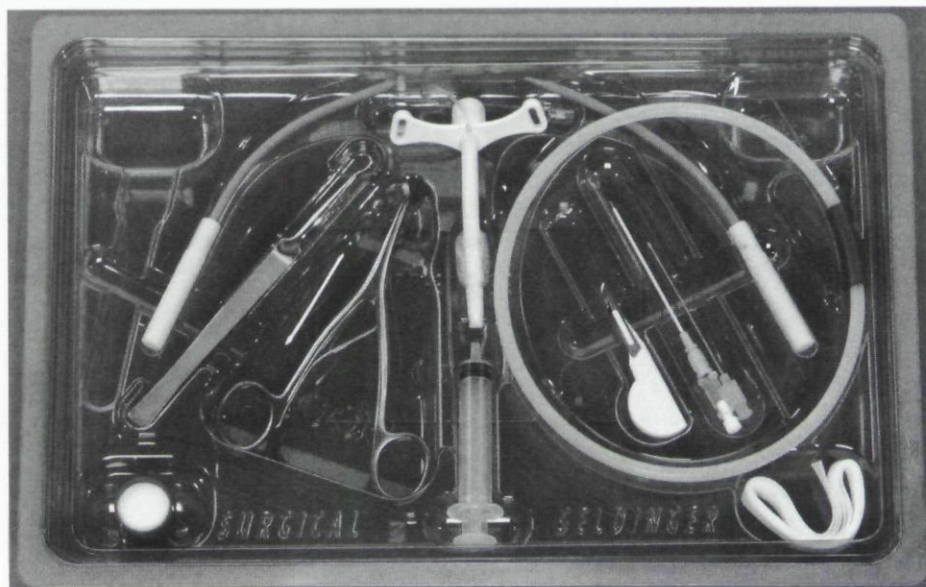
The patient was taken emergently to the operating room for debridement of the upper airway and conversion to tracheostomy, at which time placement of the airway catheter through the cricothyroid membrane without cartilaginous injury was confirmed and the pectoralis flap was noted to be intact. The patient did well after the procedure and was discharged home after conversion to a fenestrated tracheostomy tube.

#### DISCUSSION

Emergent cricothyrotomy, when performed in the appropriate clinical setting, can be a lifesaving procedure. Even though a scalpel and an endotracheal tube may be all that is required to establish a cricothyroid airway, the number of alternative techniques that have been proposed is testament to the fact that



**Fig 3.** Newly released Melker Universal Cricothyrotomy Catheter Set contains cuffed airway catheter and instrumentation for both wire-guided and surgical techniques. (Reproduced with permission from Cook Critical Care.)



the surgical technique may not always be easy.

In the only published study to specifically compare the Melker kit to surgical cricothyrotomy, Chan et al<sup>1</sup> examined the performance of 15 emergency department physicians in a randomized crossover trial using a fresh cadaver model. No statistically significant differences were noted between the two techniques for accuracy of airway placement, mean time to completion of procedure, or complication rate. The mean skin incision length was statistically shorter with the Melker kit: 0.53 cm (95% confidence interval, 0.46 to 0.60 cm), as compared to 2.53 cm (95% confidence interval, 2.04 to 3.01 cm) for the surgical technique ( $p < .001$ ). Whether this is a clinically significant difference with regard to bleeding could not be determined from this cadaver study. Notably, at the conclusion of the study, 14 of 15 participants (93.3%) stated that they preferred the Melker kit to the standard surgical technique.

In another study, which compared the Melker kit and three other prepackaged emergency airway access devices in a human patient simulator, the investigators judged both the Melker kit and the Quicktrach device to be 100% successful in achieving an adequate airway within their acceptable time limits.<sup>2</sup> In 10 trials, the mean time to achieve a patent airway with the Melker kit was 38 seconds (range, 30 to 54 seconds) and the mean time taken to achieve a partial pressure of oxygen in the simulator "lung" of  $>13.3$  kPa was 130 seconds (range, 111 to 180 seconds). With the Quicktrach device, the times were 51 seconds (range, 42 to 73 seconds) and 58 seconds (range, 50 to 86 seconds), respectively. Two cases of trauma to the posterior tracheal wall, as evidenced by puncture marks or tears in the simulator, were noted with all four kits tested. The authors concluded

that both the Melker kit and the Quicktrach device were technically reliable in the human patient simulator, and that the Quicktrach provided the fastest and most effective means of reestablishing oxygenation. Notably, the study used the uncuffed version of the Melker kit, leaving unanswered the question of whether the cuffed version of the airway catheter significantly reduces the time to restore oxygenation.

Since its release in the early 1990s, the Melker kit has been successfully used by the United States and Israeli armies, among others. A "special operations" version is packaged without a guidewire and with the airway catheter preloaded on the dilator. Because of the success of the military version, and cognizant of differences in surgeon preference, Cook Critical Care has recently released the Melker Universal Cricothyrotomy Catheter Set. The set includes a cuffed airway catheter flanked by instruments needed to perform both the Seldinger and the surgical techniques (Fig 3). The kit adds a curved blunt dilator, a tracheal hook, and a Trousseau tracheal dilator for those who prefer the surgical technique.

For the relatively inexperienced physician, the Seldinger technique may add a margin of safety by allowing confirmation of intra-airway placement before advancement of the airway catheter. Furthermore, the guidewire ensures that the vector of force applied during airway catheter insertion remains centered in the cricothyroid membrane, potentially decreasing the risk of extra-airway placement. Again, the added step of guidewire placement did not prolong the time to securing the airway in the cadaver model.<sup>1</sup>

The kit's tailored dilator-airway catheter assembly may offer advantages over standard tracheostomy

or endotracheal tubes. The dilator's tip is smaller than the obturators of tracheostomy tubes, and the airway catheter is softer than the tubes themselves. This feature may lead to less traumatic insertion; in the fresh cadaver model, even tracheostomy tubes that had been properly placed through the cricothyroid membrane sometimes caused cartilaginous injury.<sup>1</sup> At the same time, the dilator-airway catheter assembly is more robust than soft endotracheal tubes, which may

buckle on attempts at placement.

With the recent release of the Universal Catheter Set, the Melker Emergency Cricothyrotomy Kit has been further refined for its specific application. With all instruments immediately at hand, even the seasoned surgeon who prefers to forgo the Seldinger technique may be able to secure the airway faster and more safely using the kit.

#### REFERENCES

1. Chan TC, Vilke GM, Bramwell KJ, Davis DP, Hamilton RS, Rosen P. Comparison of wire-guided cricothyrotomy versus standard surgical cricothyrotomy technique. *J Emerg Med* 1999;17:957-62.

2. Vadodaria BS, Gandhi SD, McIndoe AK. Comparison of four different emergency airway access equipment sets on a human patient simulator. *Anaesthesia* 2004;59:73-9.



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