

## **Cadaveric emergency cricothyrotomy training for non-surgeons using a bronchoscopy-enhanced curriculum**

Caterina Zagona-Prizio<sup>1</sup>, Michael A. Pascoe<sup>1</sup>, Michaele Francesco Corbisiero<sup>1</sup>, Violette C. Simon<sup>1</sup>, Scott E. Mann<sup>2,3</sup>, Katherine A. Mayer<sup>4</sup>, James P. Maloney<sup>5</sup>

<sup>1</sup> School of Medicine, University of Colorado Anschutz Medical Campus, Aurora, CO, USA

<sup>2</sup> Department of Otolaryngology Head and Neck Surgery, University of Colorado, Aurora, CO, USA

<sup>3</sup> Department of Surgery, Denver Health Medical Center, Denver, CO, USA

<sup>4</sup> Department of Emergency Medicine, University of Colorado Anschutz Medical Campus, Aurora, CO, USA

<sup>5</sup> Pulmonary Sciences and Critical Care Medicine, University of Colorado Anschutz Medical Campus, Aurora, CO, USA

### **ABSTRACT**

**Background:** Emergency cricothyrotomy training for non-surgeons is important as rare “cannot intubate or oxygenate events” may occur multiple times in a provider’s career when surgical expertise is not immediately available. However, such training is highly variable and often infrequent, therefore, enhancing these experiences is important.

**Research Question:** Is bronchoscopy-enhanced cricothyrotomy training in cadavers feasible, and what are the potential benefits provided by this innovation for trainees?

**Methods:** This study was performed after implementing a program to train non-surgeon providers on cadaveric donors. Standard training with an instructional video and live coaching was enhanced by bronchoscopic visualization of the trachea allowing participants to review their technique after performing scalpel and Seldinger-technique procedures, and to review their colleagues’ technique on live video. Feasibility was measured through assessing helpfulness for trainees, cost, setup time, quality of images, and operator needs. Footage from the bronchoscopy recordings was analyzed to assess puncture-to-tube time and errors. Participants submitted pre- and post-session surveys assessing their levels of experience and gauging their confidence and anxiety with cricothyrotomies.

**Results:** The training program met feasibility criteria for low costs (<200 USD/donor), setup time (<30 minutes/donor), and operator needs (1/donor). Furthermore, all participants rated the cadaveric session as helpful. Participants demonstrated efficient technique, with a median puncture-to-tube time of 48.5 seconds. Bronchoscopy recordings from 24 analyzed videos revealed eight instances of sharp instruments puncturing the posterior tracheal wall (33% rate), and two instances of improper tube placement (8% rate). Sharp instruments reached potentially dangerous insertion depths beyond the midpoint of the anterior-posterior diameter of the trachea in 58.3% of videos. Bronchoscopic enhancement was rated as quite or extremely helpful for visualizing the trachea (83.3%) and to assess depth of instrumentation (91.7%). There was a significant average increase in confidence (64.4%,  $P<0.001$ ) and average decrease in performance anxiety (-11.6%,  $P=0.0328$ ) after the session.

**Interpretation:** Supplementing cadaveric emergent cricothyrotomy training programs with tracheal bronchoscopy is feasible, helpful to trainees, and meets prior documented times for efficient technique. Furthermore, it was successful in detecting technical errors that would have been missed in a standard training program. Bronchoscopic enhancement is a valuable addition to cricothyrotomy cadaveric training programs and may help avoid real-life complications.