**ACS 2025 Surgeons and Engineers: A Dialogue on Surgical Simulation Meeting**

**O-01**

**Promoting Technology and Collaboration**

# BRAETH: A Low-Cost Tool to Assist the Performance of Cricothyroidotomies

Varun Gopal; Hailey Warman; Claudia Agustin; Serena Chiasson; Isabella MacNaughton; and Tovy H. Kamine, MD, MBA, FACS.

*Carle Illinois College of Medicine, Urbana, IL; University of Massachusetts, Amherst, MA; University of Massachusetts Chan Medical School, Baystate, Springfield, MA*

**Background:** The cricothyroidotomy is a life-saving emergent procedure to establish a surgical airway in a “Cannot Oxygenate, Cannot Intubate” patient. The current procedure involves location of the cricothyroid membrane by palpation, creation of an incision through the cricothyroid membrane, and placement and securement of an endotracheal tube through the incision. The procedure needs to be performed in under five minutes to prevent brain damage from hypoxia. Cricothyroidotomies make up only 0.23% of tracheal intubations which, paired with minimal exposure to the procedure during training, can lead providers to have diminished confidence performing cricothyroidotomies.

**Technology Overview:** The Biomedical Recognizer of Anatomy and Endotracheal Tube Holder (BRAETH) is a 3D printed, low-cost device with three main design components. The first is a cup-shape that allows BRAETH to quickly anchor upon the laryngeal prominence and orient providers to the cricothyroid membrane. The second is a removable knife guide that guides a scalpel to the cricothyroid membrane while blocking the scalpel from creating too deep of an incision. The knife guide can be removed and used as a dilator. The last is a cantilever snap-fit joint that secures the endotracheal tube. BRAETH can then be secured for transport with Velcro.

**Potential Application in Surgical Simulation and Education:** BRAETH has significant potential in the education of providers for performing cricothyroidotomies. BRAETH can be used in proactive education on simulation mannequins by assisting providers with each step of the procedure. BRAETH's ability to be used in real-time procedures would allow for skills acquired in simulation training to be easily translated to procedures.

**Potential Opportunities to Collaborate:** Collaborations between BRAETH and surgical models could amplify the educational potential of both. By optimizing BRAETH with surgical mannequins, providers would be to get translatable real-time feedback and guidance performing cricothyroidotomies allowing them improve their procedural confidence.

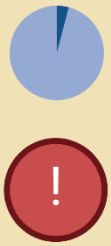
# BRAETH: A low-cost tool to assist the performance of cricothyroidotomies

Varun Gopal[1,2], Hailey Warman[2], Claudia Agustin[2], Serena Chiasson[2], Isabella MacNaughton[2], Tovy Kamine M.D.[3]
[1]Carle Illinois College of Medicine, [2]University of Massachusetts Amherst, Biomedical Engineering, [3]University of Massachusetts Chan Medical School, Baystate

## Background

The cricothyroidotomy is a high acuity procedure to establish an emergency surgical airway in a patient.

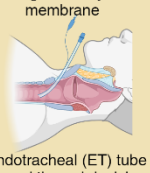
5 min



Cricothyroidotomies make up a small fraction of tracheal intubations, and must be performed rapidly to prevent brain damage from hypoxia

Location of cricothyroid membrane by palpation

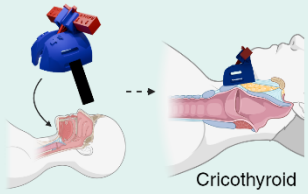
Incision made through cricothyroid membrane



Endotracheal (ET) tube placed through incision and secured with tape

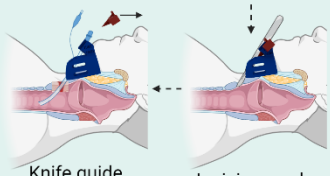
High-stakes and uncommon → **Diminished provider confidence** ← Multi-step and involved procedure

## Technology



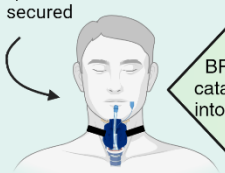
Patient needing surgical airway identified

Cricothyroid membrane identified using BRAETH



Knife guide removed, ET tube placed and secured

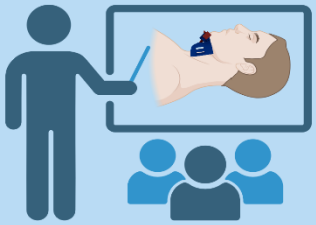
Incision made using knife guide



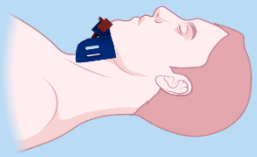
Patient airway is established and secure for transport

BRAETH serves as a catalyst to transfer skills into real-time procedure

## Use in Education/ Simulation



Provider training centered around usage of BRAETH for cricothyroidotomies



Provider training for cricothyroidotomies using simulation mannequins with BRAETH for skills development