Project Overview

Rescue cricothyrotomies may be performed by non-surgeons in “can’t intubate, can’t oxygenate situations.” Inexperience can lead to increased complications, resulting in lower confidence and willingness to perform a cricothyrotomy when necessary.1-3 Cadaveric training is superior to simulation training (landmark and tissue fidelity),4 thus it’s critical to provide robust curricula when cadaveric training is available. We developed the first cadaveric cricothyrotomy training program at CUSOM enhanced with live bronchoscopic visualization, allowing trainees to review technique and visualize posterior tracheal wall injuries.

Hypothesis

Bronchoscopic enhancement in cadaveric cricothyrotomy training for non-surgeons will:
1. Be a feasible addition while meeting accepted times for achieving an effective technique (primary objective)
2. Provide a useful means to detect intra-tracheal complications (secondary objective)
3. Be a high-quality program (secondary objective)
4. Provide a detectable training effect (secondary objective)

Methods

Utilized CU Anschutz Physical Therapy and Modern Human Anatomy programs donors with undissected necks for sessions and training video5

Primary objective measurements:
1. Feasibility: assessed whether enhanced program was feasible (reasonable cost, set up-time, operator skill)
2. Efficient technique: analyzed videos’ puncture-to-tube times (PTTs) for scalpel and Seldinger techniques and compared to published PTs

Secondary objectives measurements:
1. Intra-tracheal complication detection: analyzed videos for complications [potentially dangerous sharp instrument depths, posterior tracheal wall punctures (PTWs), other]
2. Program quality: used Kirkpatrick model to assess pre- and post-survey responses measuring helpfulness, confidence, anxiety
3. Training effect: assessed PTW injury rates between sequences of 3 participants rotating together (trio)

Results

Three training sessions, 24 total participants (13 attendings, 11 fellows)

Primary objective outcomes:
1. Feasibility: bronchoscope cost $160/scope (reusable 1-2x), 5-15 min prep/donor, one operator/donor (medical student volunteer)
   Bronchoscopy generated high quality images

Secondary objective outcomes:
1. Intra-tracheal complication detection
   • 8 instruments punctured PTW (38% injury rate)
   • 3 scalps (20% of scalpel recordings)
   • 5 needles (56% of Seldinger recordings)
   • 58.3% of sharp instruments went beyond tracheal midpoint
   • 2 unanticipated complications (bougie inserted adjacent to the trachea, non-advancing ET tube)

Table 1. Published cricothyrotomy training programs using human cadavers: characteristics and data. If designates number of cadavers, PTI, puncture-to-tube time, N/A, not applicable or not available; only English language articles are listed

Table 2. Quantitative pre- and post-session survey results.

Conclusion

Bronchoscopic enhancement of cadaveric cricothyrotomy training programs may be feasibly applied at other institutions to maximize sessions and may result in fewer complications for trainees performing cricothyrotomies.

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References
[5] https://www.youtube.com/watch?v=hGI8MJNWJoc

Figure 2. Bronchoscopic capture of complications (A) Scalpel puncture of posterior tracheal wall at 4 o'clock position (B) Scalloped posterior tracheal wound at 6 o'clock position (C) Needle puncture of posterior tracheal wall at 7 o'clock position (D) Needle puncture of posterior tracheal wall at 1 o'clock position (E) Needle puncture of posterior tracheal wall at 9 o'clock position (F) Needle puncture of posterior tracheal wall at 3 o'clock position (G) Needle puncture of posterior tracheal wall at 8 o'clock position. Absence of bours in trachea after being placed externally.