The Impact of Cricothyrotomy Simulation on Anesthesia Provider Airway Crisis Management

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INTRODUCTION

- Perioperative airway crises including "can't intubate, can't ventilate" (CICV) scenarios are rare but high-stakes occurrences (Apfelbaum et al., 2021).
- Simulation training may improve skill confidence and competence that impacts the time to establish ventilation through emergency cricothyrotomy (Hubert et al., 2014; Silverio et al., 2021).
- Project purpose: To determine if low-fidelity simulation improves anesthesia provider confidence and technical skills in attaining an emergency front of neck airway.

BACKGROUND & PURPOSE

LOW FREQUENCY HIGH STAKES EVENT:

- Surgical airway access is rarely performed, but a critical, definitive last step in the DAA (Apfelbaum et al., 2021).
- Half of adverse anesthesia events are attributable to human error. The leading cause is airway loss. There is no standardized continuing education for anesthesia providers in surgical airway management (Kremer et al., 2019; Hranchook et al., 2018).
- A closed claims analysis by the AANA of anesthesia related deaths revealed airway loss as the leading cause, accounting for 26.5% of deaths (Hranchook et al., 2018).

MODIFIABLE RISK FACTOR:

- Inadequate anesthesia provider continuing education in perioperative airway crisis management is a modifiable risk factor for patient morbidity and mortality related to adverse airway events.
- Psychological distress and hesitancy of anesthesia providers in performing an emergent cricothyrotomy can be attributed to a lack of confidence and competence (Silverio et al., 2021).

SIMULATION BASED LEARNING:

- Prior research and quality improvement showcases simulation as an effective tool in improving clinician confidence, functional knowledge, and technical skill performance (Scott-Herring et al., 2020; Hubert et al., 2014).
- The Difficult Airway Society advocates regular training of critical airway management skills to minimize skill decay (Freck et al., 2015; Hubert et al., 2014; Berwick et al., 2019).

METHODOLOGY

DESIGN: Quality improvement project utilizing a pre and post intervention design.

SETTING: Department of Anesthesiology and Critical Care Medicine at a large academic medical center in the mid-atlantic region of the United States.

SAMPLE: 33 credentialed anesthesia providers; 20 physician anesthesiologist, 13 Certified Registered Nurse Anesthetists

IMPLEMENTATION:

- Mobile simulation cart equipped with low fidelity cricothyrotomy task trainers, scalpels, bougies, syringes, endotracheal tubes, and a bag-valve mask
- Participants completed a three question pre-intervention confidence survey and were given a pre-brief.
- Participants completed an initial simulated cricothyrotomy and were scored using the rapid four step technique (RFST) validated tool and timed in seconds.
- Verbal and hands-on deliberate simulation education was conducted between attempts by the project team.
- Participants completed a final simulated cricothyrotomy attempt scored with the RFST tool and timed again.
- Three question post intervention confidence survey and optional Simulation Effectiveness Tool-Modified (SET-M) to evaluate their simulation continuing education experience.

MEASUREMENT TOOLS:

- Validated 3 item pre and post intervention confidence survey using a 5 point likert scale
- RFST Tool on a scale from 0 to 16
- Time in seconds
- SET-M Survey

Figure 1: Rapid Four Step Technique (RFST) Validated Tool

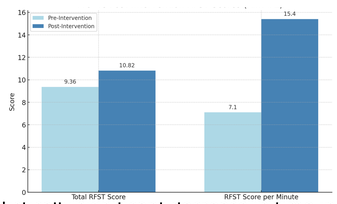
Score	0	1	2	3	4
Parameter					
Positioning of Head	Fail to perform		Performed insufficiently		Performed Successfully
Palpation	Fail to perform		Performed insufficiently		Performed with Determination
Appropriate Employment of instruments	Incorrect/clumsy		Correct, but insecure		Correct, determined
Stepwise progression/flow	Chaotic/Hesitant		Non-linear,but deliberate		Linear and Deliberate

RESULTS

AIM 1: Statistically significant increase in pre vs. post intervention confidence sum score ($t = -4.548$, $p < 0.001$). Mean sum score increased from 5.50 to 8.48 after the intervention.

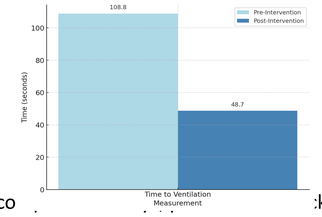
AIM 2: Statistically significant decrease in RFST total score and RFST score per minute pre vs. post intervention ($t = -2.067$, $p = 0.045$); ($t = -5.795$, $p < 0.001$)

Figure 2: Pre vs. Post Intervention Mean RFST Total Score & Score Per Minute



AIM 3: Statistically significant decrease in time in seconds pre vs. post intervention ($t = 6.443$, $p < 0.001$)

Figure 3: Mean Time in Seconds Pre vs. Post Intervention



AIM 4: 11 co :k included: "great refresher", "would be helpful to repeat at regular intervals"

DISCUSSION

- Mobile design increased accessibility
- Enhanced preparedness with the opportunity to learn readily accessible items to perform a cricothyrotomy
- Improved knowledge, confidence, and skill application

RECOMMENDATIONS:

- Evaluate long term skill retention to explore frequency of optimal interval for cricothyrotomy continued simulation-based education
- Expansion to other departments and rural areas with limited access to specialized airway expertise

CONCLUSIONS & LIMITATIONS

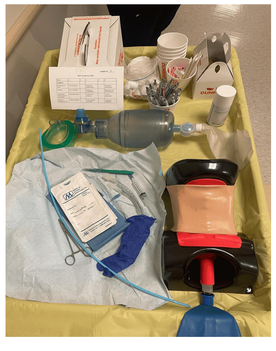
CONCLUSIONS:

- A lack of continuing education in cricothyrotomy poses a significant risk to patients where timely intervention is critical.
- This study showed that task trainers with targeted education is a cost effective, practical method that improved confidence, skill proficiency, and speed in acquiring a front of neck airway.
- Supports a growing body of evidence that stimulation enhances provider readiness for rare, high-stakes emergencies.

LIMITATIONS:

- Does not replicate the stress and complexity of real life scenarios - lacks environmental, communication, and other stressors
- Only the scalpel method was addressed
- Survey fatigue limited assessment of the simulation
- Small sample size, scheduling and participant availability challenges
- Equipment availability

Figure 4a & 4b: Implementation



CONTACTS & REFERENCES