Emergent Airway Using Bougie-Assisted Cricothyrotomy

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OMS, PGY-2

Overview
- Difficult airway algorithm
- Application to OMS office-based sedation
- Emergent airway using bougie-assisted cricothyrotomy
  - Equipment
  - Anatomy
  - Technique
  - Pearls and alternative techniques
- Pediatric emergent surgical airway
ASA Difficult Airway Algorithm 2022 vs. 2013

ASA 2022 emphasizes:
- Oxygenation
- Attempts
- Help
- Time

OMS Airway Algorithm

- **OMS sedation:**
  - Prevention
  - Bag-mask ventilation
  - Supraglottic airway

  Treat airway obstruction, consider reversal

- Intubation
- Emergency invasive airway

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- **Prevention**
  - Case selection
  - Airway evaluation
  - Monitoring and dosing
  - Early intervention
  - Airway protection

- **Bag-mask ventilation**
  - Jaw thrust, tongue pull, OPA, NPA, 2-provider ventilation

- **Diagnosing and treating cause of obstruction and airway decline**
  - Bronchospasm
  - Laryngospasm
  - Respiratory depression / obstruction
  - Foreign body obstruction
OMS Airway Algorithm

- OMS sedation:
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- Bronchospasm
  - Albuterol
  - Epi (0.3-0.5 mg IM/SQ)

- Laryngospasm
  - Jaw thrust, PPV
  - Deepen anesthesia
  - Succinylcholine (0.3-1.5mg/kg IV, 4mg/kg IM)

- Respiratory depression, obstruction
  - Jaw thrust, PPV
  - Naloxone 0.4mg IV/IM/SQ

- Foreign body obstruction
  - Suction and remove foreign body
  - Laryngoscopy and intubation

Albuterol administration via BVM in sedated patient
Albuterol administration via BVM in sedated patient

OMS Airway Algorithm
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  \{ Treat airway obstruction, consider reversal \}

- Intubation
- Emergency invasive airway
Emergency Invasive Airway Options
- Cricothyrotomy
  - Traditional cricothyrotomy
  - Bougie-Assisted Cricoptyrotomy
  - Needle cricothyrotomy
- Tracheostomy
Cricothyrotomy Technique Using Gum Elastic Bougie Is Faster Than Standard Technique: A Study of Emergency Medicine Residents and Medical Students in an Animal Lab

Chandler Hill, MD, Robert Reardon, MD, Scott Joing, MD, Dan Falvey, and James Miner, MD

The Bougie-assisted Cricothyrotomy Technique

**Instruments**
- Scalpel with No. 20 blade, tracheal hook, 70-cm gum elastic bougie (Sun-Med Endotracheal Introducer, Sun-Med, Largo, FL), and 6-0 endotracheal tube

**Steps**
1. Standing on the left side of the patient, stabilize the larynx with the thumb and middle finger of your left hand, and identify the cricothyroid membrane.
2. Using a No. 20 scalpel blade make a transverse stabbing incision through the skin and cricothyroid membrane.
3. Place a tracheal hook at the inferior margin of the incision and pull up on the trachea.
4. Insert the bougie through the incision.
5. Place 6-0 endotracheal tube over the bougie and into the trachea.

Standard Technique

**Instruments**
- Scalpel with No. 11 blade, curved hemostat, Trousseau dilator, tracheal hook, and No. 5 Shiley tracheostomy tube

**Steps**
1. Standing on the right side of the patient, stabilize the larynx with thumb and index finger of the left hand, and identify the cricothyroid membrane.
2. Make a 2.5-cm midline incision over the cricothyroid membrane using a No. 11 blade.
3. Use the curved hemostat to dissect through the subcutaneous tissue to the cricothyroid membrane.
4. Use the scalpel to make an incision into the trachea.
5. Extend the incision laterally in both directions.
6. Insert a tracheal hook on the caudal aspect of the larynx.
7. Insert a Trousseau dilator and open the membrane vertically.
8. Insert a No. 5 tracheostomy tube.
9. Remove the inner cannula and insert the adaptor.


- Bougie-assisted cricothyrotomy technique vs. standard technique
  - Faster (67s vs. 149s)
  - Easier (2/5 difficulty vs. 3/5)
  - More successful (9/10 vs. 8/11)

Bougie-Assisted Cricothyrotomy

- High Acuity Low Occurrence procedure
- Similar complication rates to tracheostomy
  - Hemorrhage 5.6%
  - Failure to obtain airway 1.6%
- Simple and rapid
- No special equipment

Bougie-Assisted Cricothyrotomy

- Palpate thyroid cartilage
- Palpate cricoid cartilage
- Cricothyroid membrane/ligament: a slight depression between
Finger in Hole

Bougie
Endotracheal Tube (6.0 to 6.5)

Don’t Feed ETT Too Far
Bougie-Assisted Cricothyrotomy

- Alternative techniques:
  - Horizontal incision through skin and cricothyroid membrane
  - less ideal to convert to tracheostomy
  - Scalpel-bougie Technique

DAS 2015: Scalpel-Bougie

- If cricothyroid membrane is palpable, horizontal incision, “stab, twist, bougie, tube”
- Impalpable cricothyroid membrane: vertical incision, finger dissection, bougie

Scalpel-Bougie Technique and Bougie-Trapping

- Scalpel-bougie technique can lead to bougie trapping
  - Lacerated bougie gets caught on ETT, resists removal and can break and fall into airway
  - Scalpel may also limit visualization
- Scalpel-finger-bougie avoids damage to bougie and bougie-trapping


Bougie-Assisted Cricothyrotomy

- Disclaimer: I’ve never done this before
- Pearls of experience from attendings:
  - Patient positioning
  - Value of finger to confirm and to dilate
  - Confirmatory whistle of air and spray of blood
- Equipment considerations:
  - 15fr bougie and 6-0 ETT
  - 14fr cook catheter and 5-0 ETT
  - Know your equipment
Pediatric Emergent Surgical Airway

- What about kids?
- Challenges in the pediatric patient
  - Small cricothyroid membrane (3mm)
  - Needle cricothyrotomy
    - Small space
    - Difficult angle
  - Posterior tracheal puncture, esophageal perforation


Pediatric Emergent Surgical Airway

- At what age should pediatric patients be managed differently than adult patients?
  - DAS 2015 pediatric guidelines: 8 years old (expert opinion)

The guidelines were developed for children from 1 to 8 years as there was strong consensus from the Delphi Group for this age banding and against including advice for those above 16 years. There was no clear consensus for the need for a separate guideline for the ages in-between.

- Uptodate: Surgical cricothyrotomy should be avoided in children <10 years old (no sources)
- Many say <12 years old
- Consider the anatomy

Pediatric Emergent Surgical Airway

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- Uptodate: Surgical cricothyroidotomy should be avoided in children <10 years old (no sources)
- Weiss 2010: cannula cricothyrotomy should not be used in children <5-6 years of age
  - Small, elastic, mobile trachea will collapse with puncture, leading to high risk of posterior tracheal and esophageal perforation


- Can’t intubate, can’t ventilate/oxygenate in pediatric patients, a rare situation
  - NAP4 report (Cook et. al. 2011):
    - 5 cases of patients <10 years old requiring emergency surgical airway
      - 2 had predictable airway difficulties
      - 3 were under 1 year of age
  - “NAP4 has found a high rate of failure for needle cricothyroidotomy in adults (60%) and it is likely the procedure in children will be even more demanding.”

Pediatric Emergent Surgical Airway

- **Options:**
  - Surgical cricothyrotomy
  - Rigid bronchoscopy and jet ventilation
  - Needle cricothyrotomy
  - Surgical tracheostomy
Pediatric Emergent Surgical Airway
- Options:
  - Surgical cricothyrotomy
  - Rigid bronchoscopy and jet ventilation
  - Needle cricothyrotomy
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Pediatric Emergent Surgical Airway
- Options:
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Needle Cricothyrotomy

- 14 gauge angiocatheter, 3cc syringe, 7-0 ETT connector
- 14 gauge angiocatheter, 3-0 ETT connector
- O2 via BVM, anesthesia circuit, or jet ventilator

Concluding remarks

- Know your equipment
- Know your algorithm
- Practice for preparedness
Pediatric Tracheostomy

- Horizontal incision between sternal notch and cricoid cartilage
- Strap muscles retracted laterally
- Tracheal incision between 2nd and 3rd rings

Supplies

- 3mL syringe
- 14-gauge angiocath

Technique

- Insert the needle angled caudally, aspirate to ensure you are in the trachea
- Remove plunger from syringe, connect to BVM, circuit or jet ventilator

Percutaneous Needle Cricothyrotomy

Supplies

- 3mL syringe
- 14-gauge angiocath

Technique

- Insert the needle angled caudally, aspirate to ensure you are in the trachea
- Remove plunger from syringe, connect to BVM, circuit or jet ventilator
**Ventilating with BVM or Anesthesia Machine Circuit**

- 14G angiocatheter
- 3-way stop cock (end tidal CO2)
- 3mL syringe
- Remove plunger
- Connector of a #7 ETT
- Flush oxygen at a rate of 15 L/min

**Ventilating with Manual Jet Ventilator**

- Connect to 14G angiocath
- 20-50 PSI (chest rise)
- Ventilate for 1s
- Wait 3-5s to allow for exhalation
- Avoid hyperinflation
  - Barotrauma
  - Pneumothorax
TTJV buys time in an emergency “can’t ventilate, can’t intubate situation”

Must establish definitive airway
- Tracheostomy
- Endotracheal intubation
- Wake-up

In 1992, the American Heart Association changed their recommendations for emergency airway management in children to a percutaneous needle cricothyrotomy in place of a surgical cricothyrotomy because it was felt that there is less risk of injury to vital structures, particularly in the hands of nonsurgically trained practitioners (35)
References


References (continued)

- [https://rebelem.com/bougie-assisted-cricothyrotomy/](https://rebelem.com/bougie-assisted-cricothyrotomy/)
- [https://www.youtube.com/watch?v=iftbUm3Ywv4](https://www.youtube.com/watch?v=iftbUm3Ywv4)
Other resources

Emergency Airway: Rescuing a Patient from an Adverse Anesthetic Event

Overview Speaker(s) CE Credit Contents (5)

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Dr. Eric Dierks is a graduate in both medicine and dentistry from the University of Louisville. His OMS residency was done at the Christiana Medical Center of Delaware, and his ENT residency was completed at the University of Texas Southwestern Medical Center at Dallas. He is board-certified in both specialties. Dr. Dierks practices within the Head and Neck Institute in Portland, Oregon where his academically-affiliated practice consists of head and neck oncologic surgery and associated reconstruction, craniofacial trauma, as well as traditional oral surgery. He is an Affiliate Professor of Oral and Maxillofacial Surgery at Oregon Health and Science University. Although now retired from clinical practice, he remains actively involved in educational activities locally, nationally and internationally.

Thank you!