

# Surgical Cricothyroidotomy

by Chris Nickson, Last updated October 9, 2017

*Reviewed and revised 4 April 2016*

## OVERVIEW

- open procedure performed to secure the airway via an incision in the cricothyroid membrane
- aka emergency surgical airway (ESA)
- distinct from needle cricothyroidotomy (aka emergency cannula cricothyroidotomy), which is an alternative approach to 'front of neck access' (FONA)

## INDICATIONS

- can't intubate, can't ventilate (CICV) scenario

## CONTRA-INDICATIONS

- ability to secure an airway with less invasive means
- airway trauma that renders access via the cricothyroid membrane futile
  - e.g. laryngeal fracture, tracheal transection
  - tracheostomy should be performed, or access achieved via the traumatic airway opening
- Children < 10 years of age
  - young children are prone to laryngeal trauma and they have a higher incidence of postoperative complications)
  - perform needle cricothyrotomy is generally advised, however life-saving surgical cricothyroidotomy has been successfully performed in children

## DESCRIPTION

- Numerous techniques have been described, my preferred approach is the 'knife-finger-bougie' approach (Described below)
- in an anticipated difficult airway requiring emergency intubation a 'double set up' approach should be used if possible
  - one person attempts intubation
  - another person prepares to perform the ESA
    - dons mask, visor, gown and gloves
    - marks the skin marked with surgical pen to identify cricothyroid membrane
    - locates cricothyroid membrane area and infiltrate skin and fascia with lignocaine with adrenaline (can be done while patient is awake if cooperative)
    - Has equipment opened and ready to procedure with the procedure when advised by the team leader
- in a true emergency there may not be time for sterile preparation of the skin
- consider sedation (e.g. IV ketamine 20 mg prn) – there may not be time in a true emergency and the patient will become obtunded as hypoxia supervenes
- ESA is a tactile procedure and must be able to be performed without visual cues

Knife-finger-bougie approach

## Equipment

- scalpel blade (e.g. size 10)
- artery forceps
- bougie
- size 6-0 ETT (or tracheostomy tube)

- once decision made to proceed with ESA extend neck in supine position to make anatomy more accessible by palpation (aka the 'laryngeal handshake') +/- ultrasound (if time and available); note that airway has priority over suspected c-spine injury
- stabilise the thyroid cartilage with the non-dominant hand
- dominant hand holds scalpel and rests on the patients sternum for stability and support
- 4 cm vertical incision through skin over cricothyroid membrane, may need to extend from mandible to sternum if impalpable anatomy (step may not be necessary if easily palpable anatomy – can go straight to the horizontal incision)
- Once skin incised, palpate cricothyroid membrane position and blunt dissect with fingers (some prefer forceps) through subcutaneous tissue until the membrane is readily identifiable. Ignore bleeding until airway is secure (ETT placement usually has a tamponade effect)
- Horizontal incision through membrane, drag scalpel blade from one side to the other then turn knife through 180 degrees and extend to the other side (some prefer to extend the membrane with forceps). The cricothyroid membrane is bound by a 'cartilagenous cage' so resistance will be felt at the margins of the membrane when the scalpel blade abuts cartilage.
- Dilate with gloved little finger and palpate tracheal lumen, ideally identifying the cartilage of the posterior wall of the trachea/ cricoid ring
- Pass bougie alongside little finger into trachea
- Confirm bougie position with finger, ensuring it passes through membrane
- Bougie usually holds up at carina <10cm from the skin (may feel tracheal rings as the bougie advances), do not force if hold up as may perforate carina
- Pass ETT over bougie and intubate trachea. Ensure the ETT balloon is fully deflated and twist ETT as it passes the skin (hold up here is common). Only advance the ETT until the balloon is within the airway and no longer visible (if advanced further then endobronchial intubation is likely).
- Ensure ETT is held secure while bougie is removed and ETT is connected to BVM
- Confirm ETT placement with ETCO2 (also adjunctive measures: auscultation, bilateral rise and fall of chest, fogging of tube and subsequent CXR)

## COMPLICATIONS

- failure
- bleeding
- infection
- damage to local structures — e.g. larynx, vessels, nerves, esophagus, cartilage, muscle
- cricoid fracture
- fistula formation
- scarring
- hypoxia
- death

## OTHER INFORMATION

### Incision

- An initial horizontal incision can be used if palpable anatomical landmarks allow easy identification of the cricothyroid membrane

- In patients where the anatomy cannot be easily palpated (e.g. obesity, short neck, neck swelling), a long midline longitudinal incision should be made to facilitate accurate identification of the cricothyroid membrane
- Landmark identification of the cricothyroid membrane is often unreliable, in a small study only 30% attempts by anaesthetists accurately marked the skin area over the cricothyroid membrane and only 10% marked over the centre point of the membrane (Elliot et al, 2010)

### **Surgical cricothyroidotomy versus cannula cricothyroidotomy**

- The NAP4 audit in the UK found a ~60% failure rate for emergency cannula cricothyroidotomy, whereas surgical cricothyroidotomy was almost universally successful
- It is not clear if the cannula approach is intrinsically inferior, or whether other factors may have contributed to the low success rate
- Nevertheless, this data supports the use of surgical cricothyroidotomy

### **Speed of surgical cricothyroidotomy**

- Most traditional surgical cricothyrotomy procedures are faster than percutaneous techniques, with the average speed  $83 \pm 44$ s (range, 28–149s) (Paix and Griggs, 2011)
- Hill et al (2010) found that a bougie-assisted technique is even faster than standard open cricothyroidotomy techniques in a sheep model (median time of 67s (interquartile range [IQR] = 55-82) versus 149s (IQR = 111-201) for the standard technique ( $p = 0.002$ )
- The CricKey is a novel surgical cricothyroidotomy device combining the functions of a tracheal hook, stylet, dilator, and bougie incorporated with a Melker airway cannula. Mabry et al (2014) found that first-attempt success was 100% (15/15) for CricKey surgical cricothyroidotomy and 66% (10/15) for open surgical cricothyroidotomy (odds ratio 16.0; 95% CI 0.8 to 326). Surgical cricothyroidotomy insertion was faster for CricKey than open technique (34 versus 65s; median time difference 28s; 95% CI 16 to 48s).