

Airway management in trauma

By Dr Minh Le Cong

Objectives :

1. Outline key issues in airway management in trauma
2. Develop a practical simple approach to airway decision making in trauma
3. Basic airway management
4. Describe emergency anaesthesia techniques for securing airway
5. Orotracheal intubation in trauma airways
6. Post intubation care
7. Understand role of supraglottic airways
8. Appreciate role of Surgical airway management

Key Issues in airway management in trauma

Like anything in life and medicine that is crucial, airway intervention in trauma care is all about timing and necessity. Whilst the traditional ATLS/EMST mantra is Airway with cervical spine immobilisation, Breathing with oxygen and Circulation, in severe trauma sometimes the priorities out of necessity, must be reordered. There is no point bleeding to death with a secure airway. Similarly there is no point dying from a failed airway with a well immobilised cervical spine.

Securing the airway in severe trauma can be divided into three main goals:

1. Direct airway threats – airway burn, laryngeal fracture, tracheal transection etc
2. Indirect airway threats – traumatic brain injury with comatose state, gastric regurgitation into airway, bleeding from facial fractures into airway
3. Need for ventilatory control and emergency anaesthesia – respiratory failure due to pulmonary or cervical spine injuries, severe agitation and pain, emergency surgery/procedures i.e fracture or joint reduction, fasciotomy, escharotomy

The first two groups can be immediate priorities in trauma care whereas the third group is often not an immediate priority for resuscitation.

Once you have decided as to when you need to secure the airway in a trauma resuscitation the next key issue to address is how to do this safely!

On the issue of safe intubation in a severe trauma patient the following factors need to be borne in mind:

1. Protect the neck – one should assume cervical spine injury
2. Prepare for blood and soiling of the airway – it is common to find blood and vomitus in the airway

3. Anticipate haemodynamic collapse peri-intubation – intubation drugs and endotracheal intubation with positive pressure ventilation can precipitate severe hypotension in the bleeding trauma patient
4. Role of capnography in airway and ventilatory monitoring – its not enough to intubate correctly. Appropriate ventilation is just as important for improved outcomes
5. Role of lung protective strategies – injured lungs and the shocked patient will need lung protection

Team work and human factors are vital in any emergency airway case but more so in the severe trauma patient. The need for manual inline neck stabilisation during intubation, the need for emergency department double setup approach in the predicted difficult airway in the multitrauma patient, the need for simultaneous resuscitative efforts in Airway, breathing and circulation, all these things need a well drilled team approach with clear understanding of roles, responsibilities and decision making process.

1. Have and use a standard checklist for airway management

ED Intubation Checklist

Team	Patient	IVI/Drugs
<ul style="list-style-type: none"> <input type="checkbox"/> ED Consultant aware of RSI? <input type="checkbox"/> Out-of-hours, if difficulty anticipated, anaesthetics contacted? <input type="checkbox"/> All members introduced by name & role and each briefed in turn by TL <input type="checkbox"/> Difficult intubation plan briefed? <input type="checkbox"/> Difficult airway trolley at hand? <input type="checkbox"/> Anticipated problems – does anyone have questions or concerns? 	<ul style="list-style-type: none"> <input type="checkbox"/> Pre-oxygenation optimal? <ul style="list-style-type: none"> <input type="checkbox"/> Add nasal prongs or NIV <input type="checkbox"/> Patient position optimal? <input type="checkbox"/> Patient haemodynamics optimal? <ul style="list-style-type: none"> <input type="checkbox"/> Fluid bolus? <input type="checkbox"/> Pressor? <input type="checkbox"/> Does it look like it might be difficult: <ul style="list-style-type: none"> <input type="checkbox"/> Difficult BVM? <input type="checkbox"/> Difficult laryngoscopy? <input type="checkbox"/> Difficult cricothyroidotomy? 	<ul style="list-style-type: none"> <input type="checkbox"/> Fluids connected, runs easily? <input type="checkbox"/> Spare IVC? <input type="checkbox"/> Monitor: ECG, BP, SaO₂. <input type="checkbox"/> RSI drugs drawn up, doses chosen? <input type="checkbox"/> Post-intubation anaesthesia plan - drugs drawn up? <p style="text-align: center;">Equipment</p> <ul style="list-style-type: none"> <input type="checkbox"/> Suction working? <input type="checkbox"/> BVM with ET/CO₂ connected <input type="checkbox"/> OPA and NPA available? <input type="checkbox"/> 2 x laryngoscopes working? Correct blade size? <input type="checkbox"/> Tubes chosen, cuff tested <input type="checkbox"/> Bougie or stylet in tube? <input type="checkbox"/> Tube tie or tapes ready? <input type="checkbox"/> Ventilator circuit available? <input type="checkbox"/> LMA sized & available?

Version 1.2
Developed by T Fogg, J Kennedy and J Vasiliadis, RNSH ED 20/04/2012

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2. Appoint a team leader (does not have to be intubator!)
3. Appoint a pulse oximeter and capnography steward
4. Appoint a suction and airway assistant
5. Appoint a drug administration steward
6. Direct a neck care steward (provides neck immobilisation and monitoring of neck care)
7. Decide and communicate on a primary, secondary and tertiary airway plan

Practical airway decision making strategy in trauma management

1. **Orotracheal intubation with RSI is the quickest and generally most successful airway intervention in trauma = default strategy**
2. **If oro-tracheal intubation looks difficult but urgent priority = ED double setup strategy with RSI primary plan, SGA secondary plan and surgical airway tertiary plan**
3. **If oro-tracheal intubation looks difficult but non urgent priority = awake oro-tracheal intubation**
4. **If oro-tracheal intubation looks impossible or high risk = awake primary surgical airway.**

Basic airway management

Basic airway skills will always be your fall back technique when trouble is encountered with patient oxygenation and ventilation.

1. Positioning should be optimal to open airway – positioning the patient’s head to place their auditory meatus in the same plane as their sternal notch will assist this. Jaw thrust may be needed. Sitting the patient if safe to do so will usually improve airway and ventilation issues. If spinal precautions then lateral tilt of the patient supine on a spinal board will help improve airway management
2. Suctioning of airway should be performed if required
3. Combined Oropharyngeal and nasopharyngeal airway devices (unless contraindicated e.g. basal skull fracture) can be useful to maximise airway patency, especially when bag/mask ventilation is being delivered
4. The addition of nasal cannula oxygen at 15 L/min to mask oxygenation will improve oxygenation by reducing dead space in the nasopharynx and increasing oxygen concentration in the upper airways(15)

Bag/mask ventilation should be done with two operators using four hands for optimal performance. Emphasis should be on controlled ventilation at 6-8 breaths a minute using only half the capacity of the reservoir bag as to minimise gastric insufflation

Emergency anaesthesia techniques for securing airway

a. Rapid sequence intubation (RSI)

The principle is more important than the actual specific technique adopted.

“Maximise first pass intubation success with minimal time airway is left unprotected”

Fundamentals of RSI :

-preoxygenation

-rapid acting intubation drugs to maximise first pass success

-Backup plan

Preoxygenation is vital as RSI is akin to pushing your patient off a cliff. Adequate preoxygenation makes this safer.



Used with permission from Dr Rob Bryant, Salt Lake City, Utah

PREOXYGENATION GOAL = OXYGEN SATURATION >94%

Use as many techniques of oxygenation as necessary to achieve this if possible!

1. Face mask oxygen at highest flow rate of oxygen possible (>15L/min if possible!)
2. Face mask oxygen with combined nasal cannula oxygen (4L/min whilst patient awake, 15L/min when patient anaesthetised)



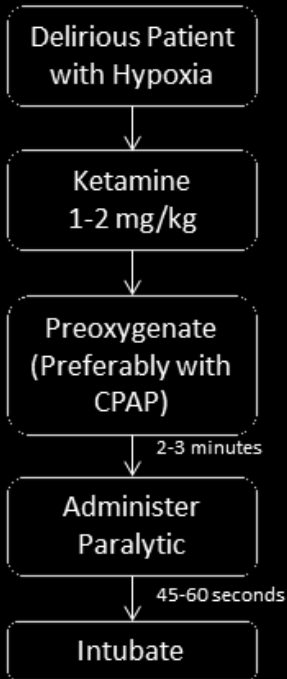
Used with permission from Dr Richard Levitan, AirwayCam.com

3. Non invasive positive pressure mask ventilation (CPAP +/- pressure support breaths) +/- nasal cannula oxygen
4. Needle cannulation of trachea with low flow oxygenation

Delayed sequence intubation (DSI) to allow preoxygenation

Difficulty with patient agitation and preoxygenation = use IV ketamine 10-20mg every 10 min as needed to control agitation and allow adequate preoxygenation

DELAYED SEQUENCE INTUBATION (DSI)



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Trauma specific issues with preoxygenation:

1. Immediate airway threats e.g heavy airway bleeding or vomitus soiled airway , airway injury – adequate preoxygenation can be very difficult or impossible in these settings. Try to avoid paralysis as first option. Maintain spontaneous breathing and consider awake surgical airway if airway injury. Consider RSA (see below) or ED double setup approach(see below).
2. High spinal cord injury with respiratory failure – need for passive oxygenation techniques like nasal cannula high flow and face mask oxygen, positive pressure assistance with bag/valve/mask or ventilator
3. Pulmonary injuries e.g contusions, haemopneumothoraces, flail chest – decompress pleural space as needed to expand lung (Breathing sometimes comes before Airway!), positive pressure assistance with BVM or ventilator as preoxygenation with PEEP.
4. Gastric decompression – important in paediatric trauma but helpful prior to any trauma intubation. Will improve ventilation and preoxygenation if distended stomach impairing diaphragmatic function

Rapid acting intubation drugs

1. IV Ketamine 1-2mg/kg (other induction/sedative agents can be used depending upon experience of intubator but ketamine is preferred)
2. IV suxamethonium 1.5mg/kg or rocuronium 1.5mg/kg

Trauma specific issues with intubation drugs

1. Hypovolaemia/haemorrhagic shocked patient – the key here is to give small doses of standard induction agents and allow adequate time to onset given shocked /low flow output state . IV fluid resuscitation pre –RSI makes sense but must be balanced with current thinking on deleterious effects of IV crystalloid fluids in setting of uncontrolled haemorrhagic shock in trauma. Ideally giving blood products to resuscitate the bleeding patient is optimal prior to any anaesthesia but not always available. AS a temporising measure , small doses of vasoactive support agents like phenylephrine, metaraminol or ephedrine may help the peri RSI period. If these are unavailable in the ED, then small doses of adrenaline or noradrenaline will suffice and maybe appropriate in trauma conditions like neurogenic shock.
2. Ensure adequate neurologic exam prior to paralysis, especially if suspected cervical spine injury and decision to proceed with orotracheal intubation

ED double setup strategy with RSI primary plan, SGA secondary plan and surgical airway tertiary plan

This is the default strategy for the predicted difficult airway that requires urgent attention. It retains the speed of RSI but carries higher risk of failed orotracheal intubation.

- Setup for RSI as standard
- Need two providers , one for orotracheal airway techniques, second for surgical airway techniques
- Optimal setup and technique for each provider (i.e bougie assisted first attempt DL with scalpel bougie technique prepared and ready to start)
- Agreed plan between team as to when to start the surgical airway. Ideally first pass best attempt by oral intubator then if fails, immediate Face mask ventilation rescue with initiation of surgical airway by second provider. LMA/SGA insertion rapidly if face mask ventilation failing.
- This is a picture of a ED double setup from [Dr Reuben Strayer's website](#). Please read his article on this strategy.



Backup plan in RSI

1. The default secondary airway plan after a failed orotracheal intubation attempt with RSI should always be either BVM ventilation, or preferably insertion of a Supraglottic airway (SGA). This may be a first generation LMA Classic /Unique airway. Ideally it should be a second or third generation SGA with oesophageal drain port +/- oesophageal blocker device.
2. The tertiary airway plan can be executed simultaneously with the secondary plan or in rapid succession depending on the airway staff setup. It must be a surgical airway technique either to rapidly reoxygenate or to secure a reliable airway via the transtracheal route. In high risk airways with expected difficulty in intubation/mask ventilation/ SGA insertion or all three combined , then preparation of the neck should be undertaken. Anatomy should be clearly examined and outlined with surgical penmark. Ultrasound mapping of the cricoid, thyroid cartilages and their connecting membrane as well as tracheal rings and depth from skin should be assessed and marked if possible. The tracheal position in the neck should be determined.
3. [VORTEX unexpected difficult airway algorithm by Dr Nicholas Chrimes & Dr Peter Fritz](#) (ClinicalCred.com)

The Vortex Approach



NO MORE THAN THREE ATTEMPTS AT EACH NSA TECHNIQUE

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This simple cognitive aid is an efficient manner to visualise the key life saving steps in managing an unexpectedly difficult airway in a trauma case. Its power is in its easy to remember design and cross disciplinary nature. A green zone encircling the 4 major emergency airway techniques of LMA, ETT, FMV & Surgical Airway, is a novel addition to previous difficult airway pathways. The green zone is defined as a state of relative patient safety in which confirmed alveolar oxygen delivery is occurring (for example confirmed end tidal capnography tracing and maintenance of adequate pulse oximetry readings). The green zone allows a stressed trauma resuscitation team time to think and plan the next step carefully rather than rush into a poorly defined action. It also allows all team members an opportunity to voice concerns and suggest ideas. The other vital feature of the VORTEX is the central placement of the Emergency Surgical airway , which assists a novice provider into making the cognitive step to initiate the surgical airway when the surrounding three non surgical airway (NSA) techniques have failed despite 3 optimal attempts at each.

b. RAPID SEQUENCE AIRWAY (CONSIDER USE IF PREOXYGENATION <94% DESPITE BEST EFFORTS)

Described by Dr Darren Braude of New Mexico, this is the technique of use of RSI drugs to facilitate rapid placement of a SGA as the primary airway device in a trauma patient. A blind insertion technique it is quick and establishes effective ventilation and oxygenation. This is best done if a second generation SGA is available that allows effective oesophageal drainage. Some SGAs allow intubation with a cuffed ETT to occur via the device lumen.

c. Awake airway techniques – these are not truly awake techniques but involve a combination of sedation and local anaesthesia. Essentially they are solely characterised by goal of maintaining a spontaneously breathing patient with adequate oxygenation.

Practical approach to awake orotracheal intubation

-if possible have the patient upright or semi upright. This is helpful in facial trauma, airway burns etc, where need for cervical spine immobilisation is less important than securing airway.

-Setup for full RSI with paralytics

- suction as much of fluids and secretions as possible

- IV atropine 0.01mg/kg or glycopyrolate 0.2mg 15 min prior to procedure.

- Nebulise lignocaine 5 mls of whatever safe dose and concentration

-use direct laryngoscope or preferably a video laryngoscope to visualise posterior pharynx.

Spray as you go, over tongue and uvula, posterior pharyngeal wall. Use dedicated lignocaine spray or make your own with 18 G IV cannula, 3 way tap on 5 ml syringe, IV extension tubing and oxygen tubing. Cannula connects to IV extension tubing which connects to distal end of 3 way tap. The syringe with premeasured lignocaine connects to side port of tap and oxygen tubing connects to proximal end of 3 way tap. Run 4 L/min via oxygen tubing and squirt small boluses of lignocaine into the 3 way tap system. The gas flow creates a jet mist that can be directed via the cannula. The oxygen flow, helps maintain some extra oxygenation whilst in airway as well as dry mucous membranes it is directed against prior to the lignocaine mist being applied. The cannula can be introduced into the mouth carefully along the paraglossal route and controlled with a pair of Magill's forceps under laryngoscope guidance.

- you must visualise epiglottis and topically anaesthetise that.

- IV ketamine 20mg boluses at this point will assist control of the epiglottis with laryngoscope and spraying of vocal cords with lignocaine.

-IV ketamine bolus, wait a minute and carefully pass bougie through cords.

Practical approach to awake surgical airway technique

-setup for full RSI with paralytics

-if possible extend neck to allow better palpation of anatomy. Upright or semiupright position is optimal in the spontaneously breathing patient if possible i.e airway burn, facial injuries, tongue haematoma with obstruction

- If you have a Seldinger surgical airway kit, use that

- If no formal surgical airway kit then gather scalpel blade, artery forceps, bougie, small cuffed ETT or tracheostomy tube

- identify as much of the anatomy as possible using palpation and/or Ultrasound

-explain the procedure as much as possible to patient and emphasise the need to perform for life saving measures

- locate cricothyroid membrane area and infiltrate skin and fascia with lignocaine with adrenaline. Ensure you have outlined the membrane location clearly with surgical marker or similar marker pen.

-give IV ketamine 20 mg as needed to make patient comfortable for procedure

- vertical incision over membrane, initially 4cm but may need to extend

-once through skin, reassess membrane position and keep incising. If bleeding, can use direct pressure /suction to assist dissection

- IV ketamine to deepen sedation and analgesia

- horizontal incision through membrane, use forceps to spread wound apart for better exposure
- dilate with gloved little finger and palpate tracheal lumen
- pass bougie down along finger into trachea
- check bougie position with finger ensuring it passes through membrane
- give RSI drugs to fully anaesthetise
- railroad ETT over bougie and intubate trachea

Orotracheal intubation in trauma airways

1. Manual inline stabilisation of neck during oral intubation – considered standard of care this does not totally immobilise neck and is a compromise between intubation with semi-rigid cervical splint on neck versus allowing full neck movement for optimal oral intubation positioning. Whilst it is recommended as routine in all trauma oral intubations, it should be considered a lower priority to maintain if difficulty in intubation is encountered.
2. Cricoid pressure – many still regard this as standard of RSI care/technique to minimise aspiration risk. Many also consider it ineffective and obstructive a technique. It might be appropriate to compromise and apply it routinely but remove it judiciously if difficulty in intubation occurs. If it is to be applied then standard technique should be used. 30N or 3 kg force is applied directly posterior onto the cricoid ring using two fingers, thumb and index finger. This should be done when patient is sufficiently sedated and prior to paralysis. If the intubator encounters difficulty with intubation the first action should be to remove cricoid pressure. Many now disregard application of cricoid pressure completely and this may well become standard of care in future. It is the author's personal view that cricoid pressure be applied for trauma cases due to unfasted status, likely full stomach with possible large amounts of food , possible blood and intoxicating liquor.
3. Intubating bougie should be used on all oro-tracheal attempts for trauma airway management.

Post intubation care

1. Confirm airway position within trachea with objective methods (capnography, real time USS)
2. Secure airway using tape, commercial holders. Record position of airway relative to mouth , nose or neck incision
3. Establish controlled ventilation and measure response with end tidal capnography
4. Establish maintenance sedation and analgesia (morphine or fentanyl + midazolam infusion cocktail, ketamine infusion)
5. Consider further paralysis to allow improved ventilation
6. If possible decompress stomach with drainage catheter
7. Consider reinserting oral airway as bite block
8. Check baseline post intubation blood gases
9. Plan disposition from ED/ call in other teams.

Supraglottic airway management

In recent years a plethora of supraglottic airway devices(SGA) have been developed and first generation devices such as the Classic Laryngeal Mask Airway(LMA) have evolved .

Some devices were originally designed for the prehospital setting such as the original CombiTube and now the latest King Laryngeal Tube airway. Other SGAs whilst originally designed for elective operative anaesthesia have been readily adopted into emergency airway management and published research into their efficacy in such a role has provided some evidence base to support use of one device over another. The emergency airway provider should become familiar with one SGA and train with it on manikins as well as elective anaesthesia patients or cadaveric lab training. Their major advantage is they are inserted blindly and require only brief training to become reasonably successful with their use.

The role of Supraglottic airways in trauma care is either as primary airway or secondary rescue airway. IN the critically hypoxic patient with facial injuries and difficulty with oxygenation via mask, it would be better to insert a supraglottic airway, using RSI drugs if needed and rapidly restore optimal oxygenation. Clearly if there is obvious or likely airway injury and upper airway obstruction then supraglottic airways are contraindicated as primary devices.

The Fastrach Intubation Laryngeal Mask Airway(ILMA)



is carried by RFDS Queensland and Western Australian sections and is highly recommended for prehospital and emergency settings. Several published prospective studies from French prehospital systems certainly support its efficacy both as a rescue ventilation and intubation device. It can also be used as your primary intubation tool if chosen and research in the elective anaesthesia setting has found it to be similar success to gold standard flexible fibre optic bronchoscopy in the predicted difficult intubation patient, with a success rate in one study of 99% intubation within 2 attempts. Disposable versions are recommended in the prehospital setting as well as the specially designed wire reinforced, soft tip endotracheal tube that accompanies the device. This specially designed

endotracheal tube has excellent characteristics for general emergency airway use, including a soft tip which makes it preferable for bougie assisted intubations and tube exchanges.



(Fastrach special tracheal tube on left and normal tube on right)

It is recommended that if it is used as a primary or secondary rescue airway for intubation, that once achieved no attempt is made to remove the ILMA as per manufacturer' instructions. Unless one is very experienced in doing this, it offers little advantage and risks losing the airway you have worked hard to gain!



This does create a unique problem if the ILMA and tracheal tube are left in situ during transport : how to best secure both?

RFDS experience is that using two separate lengths of ribbon tape is best. One is used to tie around the patient's neck and around the shaft and handle of the ILMA (see pictures below).



The second tape is used to tie around the tracheal tube.



Generally it does not matter if you leave air in the ILMA mask or aspirate it during aeromedical transport to altitude. RFDS experience of flights up to 2 hrs in duration with the ILMA sitting in the oropharynx with the air it was originally inflated with, has found no issues in regard to pressure induced trauma or loss of adequate airway positioning. If there is a concern for flights of longer

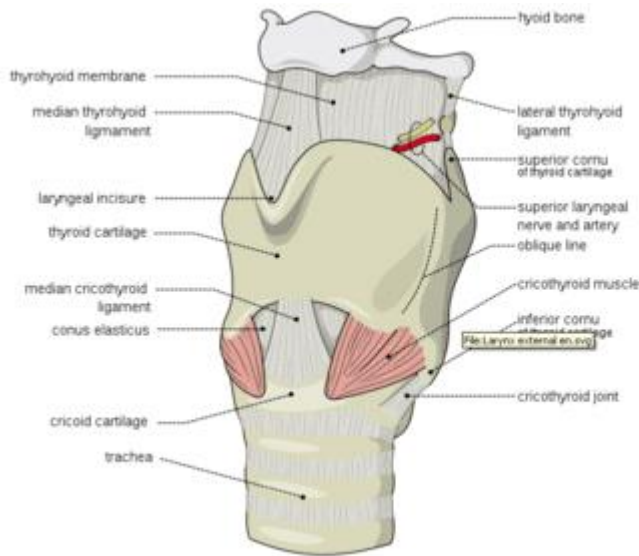
duration then deflating the ILMA mask is reasonable. Certainly it is not advised to fill the ILMA mask with saline as is sometimes the practice for tracheal tube cuffs. One disadvantage is it only comes in 3 sizes for adults.

The original Classic LMA from which all others have originated or been inspired by, has over 1000 published studies supporting its use in emergency airway management. In RFDS experience it has been used as a rescue airway device with some patients being aeromedically transported using positive pressure ventilation via the LMA alone. It provides some degree of airway protection as well. There is now the second generation LMA called the LMA Supreme which has a pre formed curve similar to the Fastrach, a gastric drainage port at the tip of the mask and higher acceptable inflation pressures allowing a better mask seal. It is also disposable and comes in paediatric and adult sizes.



Surgical airway management

Every airway provider needs to have a basic understanding and competency in surgical airway techniques. As Levitan describes, some cases are “surgically inevitable” airways, whilst many cases will require surgical airway as a result of a cannot intubate, cannot ventilate scenario. Faced with a high risk airway, the astute airway provider may elect to prepare a so called double setup RSI in which two providers plan to secure the airway orally or via the neck using standard RSI drugs and process. Such a setup provides the speed and familiarity of RSI orotracheal intubation but with the immediate backup of a surgical airway technique such as needle or open cricothyroidotomy.



(Image taken from

Cricothyrotomy , <http://en.wikipedia.org/wiki/Cricothyrotomy>)

Open cricothyroidotomy technique : tricks of the trade

1. Essential equipment : a sharp blade, preferably a surgical scalpel, disposable surgical gloves, a cuffed airway (tracheostomy tube Size 4 or 5 or endotracheal tube Size 6 for adults)
2. Other equipment that will improve success rates : a bougie used for intubation, a tracheal hook or one made from a 21 G needle and Luer Lok 5 ml syringe(see image below), using a needle holder or artery forceps to bend the needle into a hook!



3. Knowing where to cut : using Ultrasound with a linear high frequency probe to identify the position of the trachea within the neck, ensuring if its midline or not and then marking the position of the cricoid cartilage may improve success rates



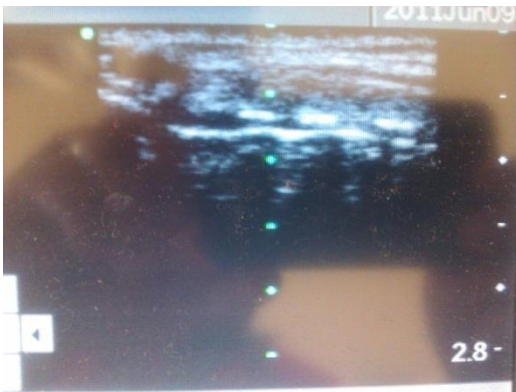
(Author with linear ultrasound probe positioned transversely over cricoid)



(transverse ultrasound image of cricoid cartilage in midline)

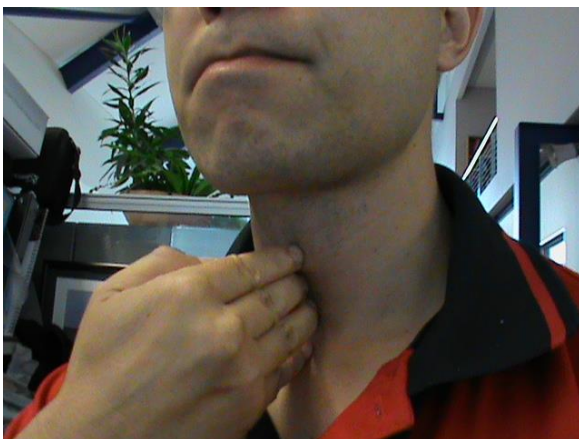


(longitudinal probe placement)



(longitudinal ultrasound image of cricoid cartilage on left upper field and tracheal rings with echo shadows to right of cricoid)

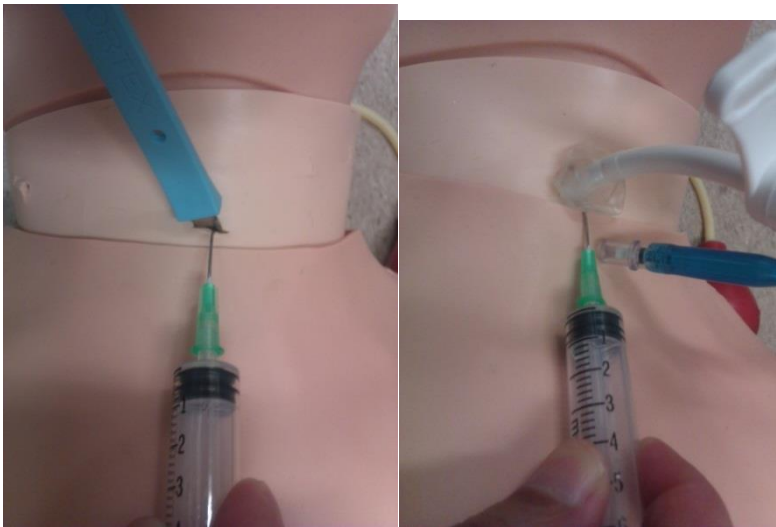
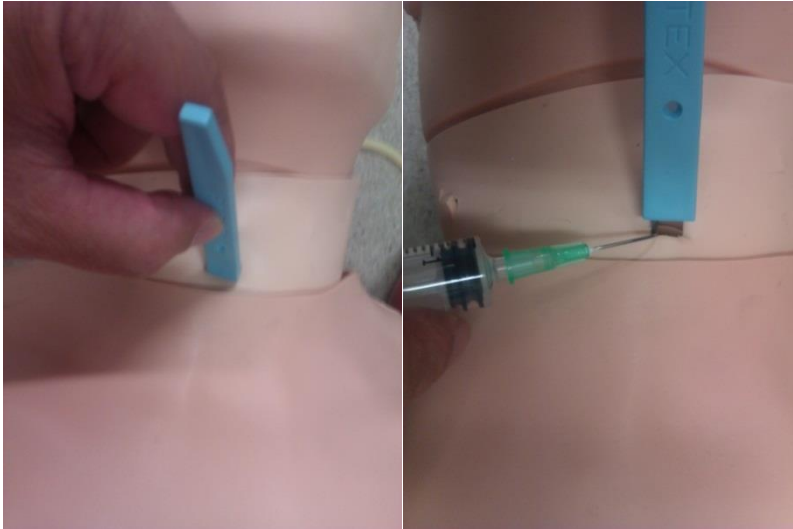
Alternatively if anatomy cannot be felt then estimating the position of the cricothyroid membrane by measuring 4 fingerbreadths (the patient's fingerbreadths!) up from the sternal notch will provide a reasonable initial incision point



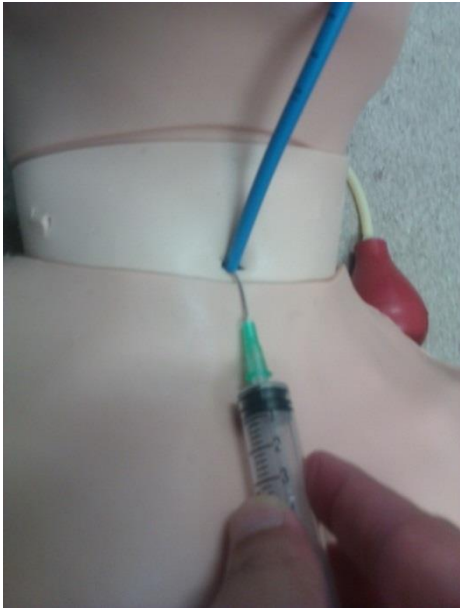
4. Horizontal or vertical skin incision?: This does not matter too much as long as you are aware of the pros and cons of each. With easily felt anatomy then it does not matter really. With

difficult to feel anatomy then vertical incision is advisable as you are able to extend it in either direction easily. It also helps avoid the lateral blood vessels in the neck.

5. Prepare for bleeding that will obscure your vision. Training on manikins or cadavers using blindfolds may help prepare you.
6. The key to success is identifying the cricoid cartilage and securing its position before passing the airway. Using a tracheal hook or the self-fashioned needle hook mounted on a syringe (idea from Dr John Love, USC Essentials conference 2010), the cricoid cartilage can be secured with caudal traction. Now the hook pulling on the cricoid can be used as an excellent guide to direct the passage of the airway!



7. An alternative method is called the scalpel bougie technique attributable to Dr Andrew Heard, Perth Anaesthetist, Western Australia. In this method the cricothyroid membrane is incised horizontally, the scalpel blade turned slightly to create a larger opening in the membrane incision and a bougie passed. The advantage is now you can remove the scalpel blade without losing the tract into the trachea and an endotracheal tube can be passed over the bougie



Needle cricothyroidotomy: tricks of the trade

1. This technique can be used in children and adults
2. It only provides rescue oxygenation
3. Essential equipment : 5ml syringe, needle cannula 14G preferable (can be specially designed airway catheter or standard intravenous catheter), oxygen supply at 15 L/min (portable compressed cylinder is adequate)



(15L/min oxygen via portable cylinder)

4. Equipment that will improve success : 3 way luer lok connector, dedicated needle cricothyroidotomy kit such as ENK , Cook Critical, Melker 5 mm cuffed Seldinger cricothyroidotomy kit

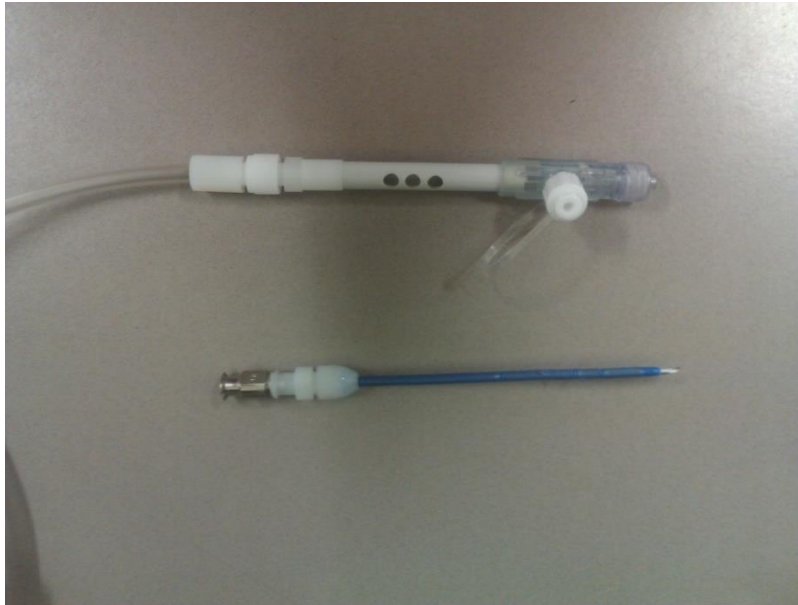


(5mm cuffed Melker kit)



(5 mm cuffed Melker catheter

and smaller 4 mm uncuffed Melker catheter)



(ENK needle

cricothyroidotomy kit)

5. As per open cricothyroidotomy advice, using USS can help mark your best site of needle insertion. Once the direction of the trachea is determined and the cricoid cartilage is identified and marked, the needle can be inserted just above the cartilage at a 45 degree angle to the skin, aiming towards the patient's feet
6. Confirmation of tracheal entry is made by freely aspirating air and then the cannula is positioned in the trachea



7. Ideally the 3 way connector would have been prepared by inserting the proximal end into oxygen tubing connected to the oxygen supply. It is now connected securely to the cannula hub. If you do not have a connector then simply holding the oxygen tubing end onto the hub of the cannula will be sufficient but this increases risks of decannulation.



8. Oxygen should be delivered at 15L/min in an adult or 1L/min per year of age of child, occluding the side port of the 3 way connector to deliver oxygen for 2 seconds and then releasing for 4-6 seconds. One must carefully observe the neck and upper chest for signs of barotrauma and swelling. If chest wall rise occurs with each inflation but there is insufficient falling of the chest wall then reducing the number of inflations per minute is mandatory to reduce risk of barotrauma
9. There is no requirement to see chest wall rise with delivery of oxygen via the needle cricothyroidotomy. The phenomenon of apnoeic oxygenation will cause an improvement patient oxygenation within 30-60 seconds
10. With luck and good technique oxygenation via this technique can be maintained for at least 20-30 minutes or more. Carbon dioxide tension will increase but this is of little issue in the emergency rescue airway scenario.

For a definitive airway, there are options. If Seldinger cricothyroidotomy kit is available like the Melker then its wire can be passed down the cannula and percutaneous insertion of a cuffed airway can occur. Alternatively if oxygenation is stable now, a more careful repeat attempt at oral intubation may succeed. An open cricothyroidotomy can still be performed using the cannula as a guide to incise and open a tract to the membrane then continuing with the open technique described above

Recommended reading:

R Levitan. The Airway Cam Guide to Intubation and Practical Emergency Airway Management. Airway Cam Technologies Inc., 2004.

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