

Emergency Care Skills - Needle Cricothyroidotomy

Airway management and effective oxygenation is a priority in the resuscitation of the critically ill or injured patient. In general, airway management can be achieved by either basic or advanced airway manoeuvres. Basic airway manoeuvres are widely taught and are as simple as performing a head-tilt-chin-lift or jaw-thrust to relieve obstruction by the tongue.

Advanced airway manoeuvres require a higher level of skill and training and include endotracheal intubation and laryngeal mask airway insertion.

The 'can't intubate, can't ventilate' scenario is a nightmare for all emergency care providers. Needle Cricothyroidotomy is one of several emergency airway management techniques that, although not regularly performed, may buy valuable time until a definitive airway can be achieved. It is a short-term solution which provides oxygenation and not ventilation.

Needle cricothyroidotomy involves puncturing the cricothyroid membrane with an over-the-needle IV cannula and providing jet insufflation by means of a specialised device attached to a high flow oxygen source.

Surgical cricothyroidotomy on the other hand is achieved by making a small incision in the cricothyroid membrane and passing an endotracheal tube through the incision into the trachea. The endotracheal tube is then attached to a bag-valve-resuscitator and the patient ventilated.

In Southern Africa, the use of either of these techniques is largely determined by the healthcare professional's skills level and professional registration.

Indications for needle cricothyroidotomy

- Inability to maintain a patient's airway with non-invasive standard airway procedures
- Can't intubate and can't ventilate
- Unable to secure airway with additional airway adjuncts e.g. laryngeal mask airway
- Severe facial trauma
- Extensive midfacial trauma
- Laryngeal oedema from airway burns
- Laryngeal foreign body that cannot be removed by manual techniques

Contraindications for needle cricothyroidotomy

- Laryngeal injury where there is known damage to the cricoid cartilage (laryngeal fracture)
- Rupture of the trachea
- There are no contraindications in the 'can't intubate, can't ventilate' scenario. However, it may be extremely difficult to perform needle cricothyroidotomy when the anatomy is distorted due to injury or disease and the landmarks cannot be readily identified.

Precautions to be considered

In routine use of jet insufflation through an over-the-needle IV cannula, the majority of the expired air exits through the patient's nose and mouth. In complete airway obstruction this poses a significant problem as expired air can no longer exit through these structures.

Earlier studies conducted on animals suggested that jet insufflation in the presence of complete airway obstruction resulted in lung engorgement, barotrauma and death. However subsequent studies showed that by modifying jet insufflation techniques to include a longer expiratory time, larger diameter cannula or lower oxygen flow rates, effective jet insufflation could be achieved with little or no ill effects.

So, in essence, the key is in making sure that the patient is continuously assessed for the development of barotrauma. Remember that the rupturing of lung tissue can lead to pneumothorax, which can further lead to a tension pneumothorax. A tension pneumothorax on top of an airway obstruction is a very dismal situation.

If you suspect that your patient's lungs are becoming hyperinflated, extend your expiratory time and watch the patient very carefully.

Landmarks

As the name implies, the cricothyroid membrane is bound superiorly by the thyroid cartilage and inferiorly by the cricoid cartilage.

The main anatomical landmarks from head to feet are the hyoid cartilage, thyroid cartilage, cricothyroid membrane, cricoid cartilage and tracheal rings.

Defining a slightly more expanded set of anatomical landmarks becomes important especially when dealing with the younger patient where the laryngeal prominence may not be well developed. As such it is difficult to palpate the thyroid cartilage. In this case a better technique is to follow the tracheal rings upward to locate the prominence of the cricoid cartilage followed by the indentation of the cricothyroid membrane.



Equipment

- A 14 - 16G over-the-needle IV cannula (14G for adults and 16G for the paediatric patient)
- Disinfecting swabs
- 10-20ml syringe
- A jet insufflation device. Be Safe Paramedical have developed the CritiJet Jet Insufflation Device, which is secure, safe and cost effective.
- Oxygen tubing
- Oxygen source with regulator that can deliver up to 50 psi pressure
- Plastic tape for securing IV cannula in place
- Surgical gloves



Preparation

- Remove the flash chamber cap at the rear of the 14G IV cannula
- Attach the 14G IV cannula to the syringe with plunger depressed
- Attach your jet insufflation device to your oxygen tubing
- Attach your oxygen tubing to the outlet on your oxygen regulator

Technique

1. Position patient supine with head slightly extended (provided there is no suspicion of cervical spine injury)



2. Locate the cricothyroid membrane by palpating the thyroid cartilage (superiorly) and cricoid cartilage (inferiorly). I like to use three fingers. Index finger on the thyroid cartilage, middle finger on the cricothyroid membrane and ring finger on the cricoid cartilage with non-dominant hand.

(If you are a little jittery about locating the landmarks prior to puncturing the cricothyroid membrane, you could consider making a dot on the planned puncture site with a surgical marker.)



3. Disinfect the area thoroughly with your swabs. Don't be shy here. Use 3 to 4 swabs if required to clean the area as thoroughly as possible.



4. With your non-dominant hand, stabilise the thyroid cartilage. Try and pull the skin taut. This makes for far easier puncturing of the cricothyroid membrane. Take the IV cannula with attached syringe, aim it slightly towards the patient's feet (at about 30°) and puncture the cricothyroid membrane while drawing back on the syringe plunger. You should feel a reduction in resistance as you enter the cricothyroid membrane and air will be pulled back into the syringe. Carefully advance the needle a further 5mm or thereabouts.



5. Stop, aim the IV needle towards the patient's feet, hold the stylet still and slide the cannula into the cricothyroid membrane. Be careful not to kink the cannula as you slide it in. Stabilize the IV cannula with non-dominant hand and withdraw the stylet



6. Attach the IV cannula to the jet insufflation device. Turn up the oxygen regular flow rate to 10 - 15l/min and jet insufflate the lungs by closing the thumb port for 1 second (inspiratory) and opening for 4 seconds (expiratory). Check for surgical emphysema in the area around the larynx.



7. Using plastic tape, secure the IV cannula in place by means of goal-post strapping.



8. Monitor the patient closely for signs of lung hyperinflation and barotrauma. In the case of complete airway obstruction, consider increasing expiratory time to 8 - 10 seconds. i.e. ratio of 1 second (inspiratory time): 8 seconds (expiratory time).



Complications associated with needle cricothyroidotomy

- Subcutaneous or mediasternal emphysema
- Needle displacement or kinking causing respiratory obstruction
- Embolus, from insufflation into a vessel
- Haemorrhage
- Oesophageal or mediasternal puncture
- Pneumothorax
- Vocal cord injury
- Infection

In Conclusion

There is much debate about the efficacy of needle cricothyroidotomy. There are also numerous studies that show high success rates in patients who would otherwise have had a very poor outcome. Needle cricothyroidotomy with jet insufflation is considered life-saving in 'can't intubate, can't ventilate' situations.

An extremely important point to remember is that needle cricothyroidotomy is only a temporary measure and should be replaced with a definitive airway as soon as possible.

Be Safe Paramedical have a range of quality pre-packed disposable kits for all pre-hospital skills, including needle cricothyroidotomy. They are marketed under the Be Safe Paramedical CritiPack™ trademark and provide a safe, reliable and very cost-effective approach to performing skills in the most adverse of environments. Please feel free to contact us to find out how CritiPack™ may benefit your emergency care service.

Well, that's it on needle cricothyroidotomy. I hope you found the article informative and useful. Please keep an eye out for the next edition of The Responder, where we will be discussing surgical cricothyroidotomy.

Thanks to our very own Rhoda Williams for playing model for the pictures and Monica Wolmarans for doing the picture editing for this article.

Take Care ...and Be Safe!

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