Royal Flying Doctor Service
WESTERN OPERATIONS

Clinical Manual

Part 3
Procedures

Version 7.1
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Clinical Manual - Part 3 - Procedures
Version 7.1
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Part 3 - Procedures

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1 AIRWAY & BREATHING

1.1 Oropharyngeal Airway Insertion - Adults

This procedure is to assist temporary ventilation of the unconscious patient while preparing to intubate the patient.

1. Select the proper-sized airway:
   - The correctly sized airway will extend from ***the corner of the patient's mouth to the external auditory canal***. Slightly too big will be more beneficial than slightly too small.
2. Open the patient's mouth with either the chin-lift manoeuvre or the crossed-finger technique (scissor technique).
3. Insert a tongue blade on top of the patient's tongue far enough back to depress the tongue adequately. Be careful not to cause the patient to gag.
4. Insert the airway posteriorly, gently sliding the airway over the curvature of the tongue until the device's flange rests on top of the patient's lips. The airway must not push the tongue backward and block the airway. Remove the tongue blade.
5. An alternative method is to insert the airway between the patient's teeth with the convexity pointing towards the patient's feet. As the airway passes the back of the tongue, it is rotated around to its resting position with the concavity pointing toward the feet (see fig 1.1).
6. Ventilate the patient with a bag-valve-mask device if required.

   NB If unable to ventilate patient, **remove** airway and try again.

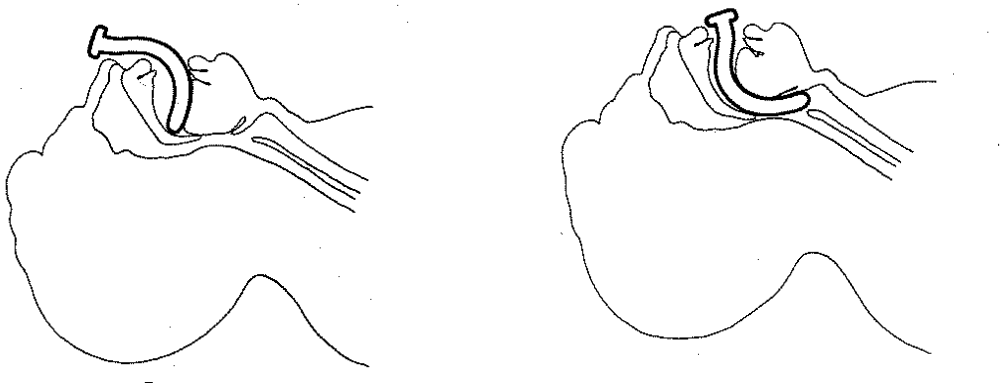


Fig 1.1 The oropharyngeal airway is inserted between the patient's teeth, convex surface towards the patient's feet. The airway is rotated and inserted until the device's flange rests on top of the patient's lips. This method should not be used in children.

References

American College of Surgeons Committee on Trauma, *Advanced Trauma Life Support for Doctors: Student Course Manual*, 8th Ed, American College of Surgeons, Chicago, 2008.

Advanced Life Support- Australian Resuscitation Edition, 6th Edition, Australasian College of Surgeons, Melbourne , 2011

1.2 Oropharyngeal Airway Insertion – Children

If the gag reflex is present, it may be best to avoid the use of the oropharyngeal airway as it may cause choking, laryngospasm or vomiting.

1. Select the proper-sized airway:
   - The correctly sized airway will extend from the ***centre of the incisors to the angle of the mandible*** when laid on the face with the concave side up and the flange at the incisors.
2. Open the patient's mouth using the chin lift, taking care not to move the neck if trauma has occurred.
3. Using a tongue depressor or a laryngoscope blade, insert the airway 'the right way up' (the convex surface cephalic).
4. Re-check airway patency and look for improvement.
5. If necessary, consider a different size from the original estimate.
6. Ventilate the patient with a bag-valve-mask device.

Fig 1.2.1 Sizing of Oropharyngeal Airway

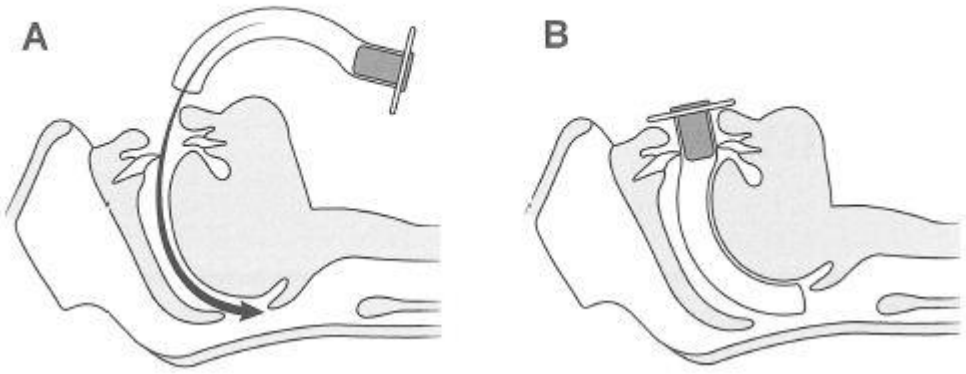


Fig 1.2.2 "Right way up" insertion of the Guedel airway

References

Advanced Life Support Group. *Advanced Paediatric Life Support 5th* Ed, BMJ Publishing Group, 2005.

1.3 Nasopharyngeal Airway Insertion

Theory

These soft plastic airways are useful for patients with trismus (jaw clenching) or other oral trauma. They may be better tolerated in more alert patients than oropharyngeal airways. If not available an un-cuffed ET tube may be cut short and used.

Contraindications

Usually contraindicated in the presence of nasal fractures. Patients with significant upper airway problems or depressed conscious state may require more invasive management (intubation) for transport.

Technique

1. Select an appropriate sized airway, usually the largest which will fit in the patient's nostril.
2. Check each nostril for septal deviation, polyps and select the nostril with least obstruction.
3. Lubricate the airway with a water-soluble lubricant or tap water.
4. Pass the airway, with bevel facing the nasal septum, along the floor of the nose.
5. Rotate tube as it reaches the hypopharynx so it sits as shown.

Figure 1.3 Insertion of the nasopharyngeal airway.

Complications

Nasal bleeding. Usually subsides without specific treatment.

References

Simon, R & Brenner B. *Emergency Procedures and Techniques.* 3rd Ed. Williams & Wilkins, 1994.

1.4 Bag-Valve-Mask Ventilation – Two-Person

Technique

1. Select the appropriately sized mask to fit the patient's face.
2. Connect the oxygen tubing to the bag-valve device, and adjust the flow of oxygen to 12 L/minute.
3. Ensure that the patient's airway is patent and secured.
4. The **first person** applies the mask to the patient's face, ascertaining a tight seal with both hands.
5. The **second person** ventilates the patient by squeezing the bag with both hands.
6. Assess the adequacy of ventilation by observing the patient's chest movement.
7. The patient should be ventilated in this manner once every five seconds.

References

American College of Surgeons Committee on Trauma, *Advanced Trauma Life Support for Doctors: Student Course Manual*, 8th Ed, American College of Surgeons Chicago, 2008.

1.5 Adult Orotracheal Intubation

Technique

1. Ensure that adequate ventilation and oxygenation are in progress and that suctioning equipment is immediately available in the event that the patient vomits.
2. Attach a pulse oximeter device to one of the patient's fingers (adequate peripheral perfusion must exist) to measure and monitor the patient's oxygen saturation levels. Pulse oximetry monitors oxygen saturation levels continuously and provides an immediate assessment of therapeutic interventions. Commence monitoring ECG & NIBP.
3. Choose the appropriate sized endotracheal tube and inflate the cuff of the tube to ascertain that the balloon does not leak, then deflate the cuff. (Size 9.0 = large adult, size 8.0 =medium adult and size 7.0 = small adult).
4. Connect the laryngoscope blade to the handle, and check the bulb for brightness and security. Check there is a second working laryngoscope available as back up.
5. Position the patient
   - If there is no suspicion of cervical injury, flex the neck and extend the head ('sniffing the morning air' position) by placing a pillow or head ring under patient's head.
   - If the cervical spine has not been cleared, have an assistant manually immobilise the head and neck in line. Ideally the patient's neck must not be hyper-extended or hyper-flexed during this procedure, but the neck must be moved if there is inability to oxygenate the patient. Again a flat pillow or head ring should be placed under patient's head.
6. Hold the laryngoscope in the left hand.
7. Insert the laryngoscope blade into the right side of the patient's mouth, displacing the tongue to the left. Avoid applying pressure to teeth or lips.
8. Visually identify the epiglottis and then the vocal cords.
9. Gently insert the endotracheal tube through the cords, into the trachea, stopping at approximately 21 cm at the lips in an adult female, 23 cm in an adult male.
10. Inflate the cuff with enough air to provide an adequate seal. Do not over-inflate the cuff.
11. Check the placement of the endotracheal tube by bag-valve-to-tube ventilation and observe chest excursion with ventilation. Auscultate chest and abdomen with stethoscope. Confirm with capnography if available.
12. Secure the tube with cotton tape +/- adhesive tape and recheck the position in centimetres at the lips. If the patient is moved, the tube placement should be reassessed.
13. Placement of the tube must be checked carefully. A chest x-ray is helpful to assess the position of the tube, but it cannot exclude oesophageal intubation.
14. If endotracheal intubation is not accomplished within seconds or in the same time required to hold your breath before exhaling, discontinue attempts, ventilate the patient with a bag-valve-mask device, and try again using gum elastic bougie.

Complications

1. Oesophageal intubation, leading to hypoxia and death.
2. Right mainstem bronchus intubation, resulting in ventilation of the right lung only and collapse of the left lung.

Adult Orotracheal Intubation (Continued)

3. Inability to intubate or ventilate leading to hypoxia and death.
4. Induction of vomiting, leading to aspiration, hypoxia and death.
5. Trauma to the airway, resulting in haemorrhage and potential aspiration.
6. Chipping or loosening of the teeth (caused by levering of the laryngoscope blade against the teeth).
7. Rupture/leak of the endotracheal tube cuff, resulting in loss of seal during ventilation, and necessitating reintubation.
8. Conversion of a cervical vertebral injury without neurologic deficit to a cervical cord injury with neurologic deficit.

References

American College of Surgeons Committee on Trauma, *Advanced Trauma Life Support for Doctors: Student Course Manual*, 8th Ed, American College of Surgeons Chicago, 2008

1.6 Infant Orotracheal Intubation

Technique

1. Ensure that adequate ventilation and oxygenation are in progress.
2. Attach a pulse oximeter device to one of the patient's fingers (adequate peripheral perfusion must exist) to measure and monitor the patient's oxygen saturation levels. Pulse oximetry monitors oxygen saturation levels continuously and provides an immediate assessment of therapeutic interventions. Monitor ECG & BP also.
3. Select the proper sized uncuffed tube, which should be the same size as the infant's nostril or little finger. (Age/4 + 4=ETT size) Have available a range of sizes including the size above and below your best estimate.
4. Connect the laryngoscope blade (straight or curved) and handle; check the light bulb for brilliance and security.
5. Position the patient. Infants and neonates have comparatively large heads and a small pillow under the shoulders may assist to bring the glottis into the ideal position.
6. Hold the laryngoscope in the left hand.
7. Insert the laryngoscope blade in the right side of the mouth, moving the tongue to the left.
8. Observe the epiglottis, then the vocal cords.
9. Insert the endotracheal tube not more than 2cms past the cords.(Lip length =Age/2 + 12)
10. Attach an $ETCO_2$ monitor to the endotracheal tube, between the adaptor and the ventilating device. The use of this device provides a reliable means (the gold standard) of confirming the position of the endotracheal tube in the trachea.
11. Confirm the placement of the tube by bag-valve-to-tube ventilation, observing lung inflations and auscultating the chest and abdomen with a stethoscope.
12. Secure the tube. If the patient is moved, the tube placement should be reassessed.
13. If endotracheal intubation is not accomplished within 30 seconds or in the same time required to hold your breath before exhaling, discontinue attempts, ventilate the patient with a bag-valve-mask device, and try again.
14. Placement of the tube must be checked carefully. A chest x-ray may be helpful to assess the position of the tube, but it cannot exclude oesophageal intubation.

References

American College of Surgeons Committee on Trauma, *Advanced Trauma Life Support for Doctors: Student Course Manual*, 8th Ed, American College of Surgeons Chicago, 2008.

1.7 Laryngeal Mask Airway

Definition

Insertion of a laryngeal mask is an option for management of a difficult airway, when endotracheal intubation is not possible.

Theory

1. The Laryngeal Mask is a cuffed tube that can be placed in the pharynx and inflated to form a seal around the larynx.
2. Patients may be ventilated through a laryngeal mask although it does not seal the airway from soiling with gastric contents.
3. The laryngeal mask is a useful option in a difficult airway.
4. RFDSWO stocks a range of laryngeal mask airways: LMA Unique (smaller sizes), LMA Supreme (with gastric drain tube), and Fastrach (intubating LMA)

Table 7.1 LMA Size Selection

LMA Size	Patient Weight (kg)	Max Size Orogastric Tube	Max Recommended Inflation Volume	Optimum Intra-Cuff Pressure
1	<5	-	10ml	60cm H_2O
2	10-20	-	20ml	
3	30-50	14 Fr	30ml	
4	50-70	14 Fr	45ml	
5	70-100	14 Fr	45ml	

Technique

1. Check the cuff and then deflate it. Lubricate.
2. Place the patient's head in the intubating position.
3. Hold the tube in the right hand with the cuff concavity facing anteriorly and the MA opening over the tongue.
4. Introduce the tube into the mouth and advance it blindly along the palatopharyngeal curve until resistance is felt as it reaches the hypopharynx.
5. Inflate the cuff with the correct volume of air, as indicated on the shaft of the LMA.
6. Check the patency of the airway. If necessary inflate the lungs gently to test patency, by bag-valve-tube ventialtion.
7. If the airway is not patent consider laryngeal spasm, wrong size LMA, cuff not fully inflated or the epiglottis trapped and pushed down. Reposition or remove and replace.
8. A gastric drain tube can be passed through the drain tube into the stomach once the LMA Supreme is in place. Refer to table for maximum gastric tube sizes. Suction should not be applied until the gastric tube is in the stomach, and should not be applied directly to the drain tube of the LMA.

Complications

1. Laryngeal spasm may occur.

   The airway is not protected against soiling and should only be used for positive pressure ventilation if the stomach is empty.

Notes

1. The LMA is not generally recommended for positive pressure ventilation or aeromedical transport and if possible should be replaced with a more secure airway.
2. It is possible to pass a smaller (up to and including size 6.0 mm) ET tube through the LMA, although generally the intubating LMA (LMA Fastrach) should be used to convert to an endotracheal tube.

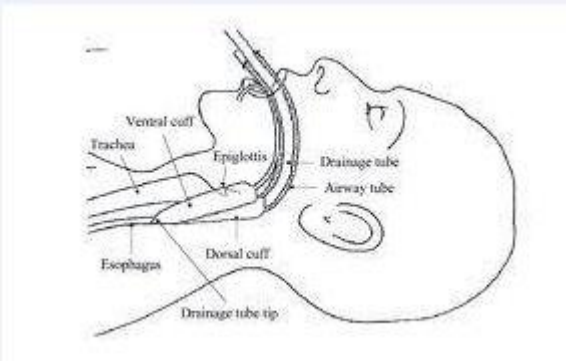


Fig 1.7.1 The laryngeal mask in situ. Note that the mask lies over the larynx sealing it off from both the oesophagus and the pharynx. The tip of the tube lies at the entrance to the oesophagus. (Dr A Brain and Intavent.)

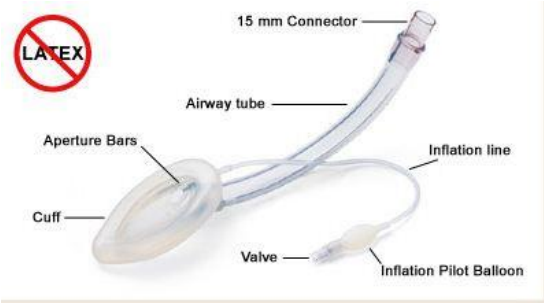


Fig 1.7.2 LMA Unique

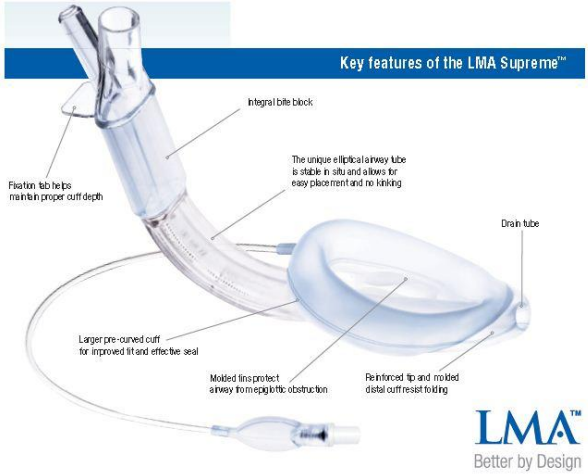


Fig 1.7.3 LMA Supreme

References

Instructions for Use- LMA Supreme, The Laryngeal Mask Company Limited, 2011.

1.8 Intubating Laryngeal Mask Airway

Theory

The blind intubation technique using the intubating laryngeal mask airway (LMA Fastrach) is an option in a difficult airway, in particular the traumatic or soiled airway where video laryngoscopy may be impossible due to blood, secretions or vomit.

Equipment

- LMA Fastrach - for achieving and maintaining an airway in the difficult airway situation, and as a guide for intubation of the trachea.
- LMA Fastrach ETT (packaged separately)- indicated for using through the LMA
- Additional drugs and equipment will be needed as for intubation, i.e. bag-valve-mask, suction, ventilator, ETCO2 etc.

Technique

A. Insertion of the intubating LMA

1. Check sizing: Size 4 Fastrach LMA suits a 50-70kg (sometimes larger) adult and accepts 6mm,6.5mm or 7mm Fastrach disposable ETT.
2. Check the cuff of the LMA and deflate.
3. Lubricate the LMA on the posterior (palate) side only- lubricating the anterior side may lead to tube blockage or aspiration. Position the patient's head in the intubating position.
4. Sedate and apply cricoid pressure.
5. Hold the LMA Fastrach by its handle, approximately parallel to the patient's chest. Position the mask tip against the hard palate and slide the tip briefly back and forth to distribute the lubricant and prevent folding the tip before sliding the mask further backwards following the curve of the rigid airway tube. Do not use the handle as a lever to force the mouth open.
6. Advance (without rotation) the curved airway until the straight part of the airway tube contacts the chin. Rotate the mask in place using a circular movement ensuring pressure is maintained against the soft palate and posterior pharynx.
7. After insertion, check the tube emerging from the mouth is parallel to the plane of the inner surface of the upper incisors.
8. Inflate the cuff to a pressure of approx 60cm H2O (max 30ml for size 4)
9. Check you can bag the patient, connect to capnograph +/- ventilator.
10. Stabilise the LMA with tape.

B. Tracheal intubation through the intubating LMA

1. Although other ETTs can be used, it is recommended to use the LMA Fastrach ETT for this procedure. Size 6mm, 6.5mm or 7mm will fit a Size4. Check the cuff, gently fit the connector into the LMA Fastrach ETT and lubricate the distal end of the tube.
2. Ensure the patient is appropriately preoxygenated, anaesthetised, and paralysed and the LMA is properly positioned.
3. Pass the lubricated ETT into the LMA Fastrach airway tube and distribute the lubricant by moving the ETT up and down until it slides freely.

4. Position the longitudinal line of the ETT to face the LMA handle. Gently insert the ETT into the device airway tube- the ETT should not pass beyond the 15cmdepth marker. Ensure the tip of the ETT does not enter the mask aperture.
5. Slide the ETT gently to 1.5 cm past the 15cm mark. If no resistance is felt, continue to advance the ETT while holding the device steady until intubation is accomplished. You may need to pull up on the Fastrach handle to assist the ETT through the cords.
6. Inflate the cuff of the ETT.
7. Bag the patient and confirm intubation by conventional means, e.g. end-tidal CO2.

Note on removing the LMA

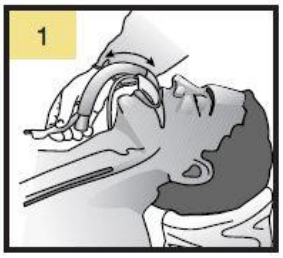
1. After intubation, the Fastrach LMA can be left in place as a bite guard while the patient is ventilated through the ETT for transport. This is probably the safest option for the occasional operator.
2. If you decide to remove the LMA, first disconnect the circuit including the connector., deflate the cuff on the LMA, apply the plastic bougie provided with the kit to the end of the ETT and hold it in position, then slide the LMA back over the ETT until you can see the distal end of the ETT in the mouth. Grab it as you continue to remove the LMA.
3. Check position of the ETT, check you can ventilate, check ETCO2 and insert a bite guard (Guedel airway or rolled gauze). The supplied ETT is soft and will easily obstruct if the patient bites on it.

1.9 LMA Fastrach Insertion Technique

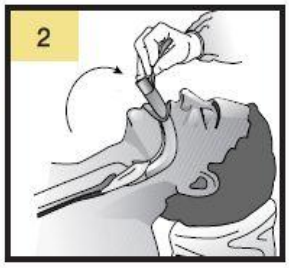
LMA Fastrach™
Insertion Technique

TO INSERT THE LMA FASTRACH™

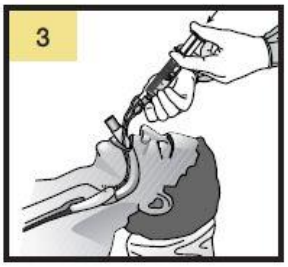
Deflate the cuff of the mask and use a water soluble lubricant on the posterior surface. Rub the lubricant over the anterior hard palate.



Swing the mask into place in a circular movement maintaining contact against the palate and posterior pharynx. Never use the handle as a lever.



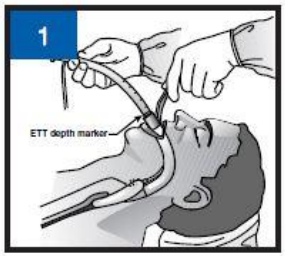
Inflate the mask, without holding the tube or handle, to a pressure of approximately 60 cm H_2O.



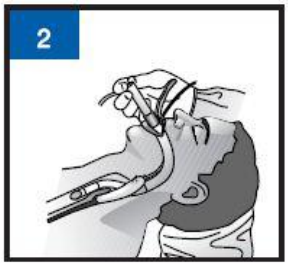
TO INSERT THE LMA™ ET TUBE AND REMOVE THE LMA FASTRACH™

Hold the LMA Fastrach™ device handle while gently inserting the lubricated ETT into the airway shaft.

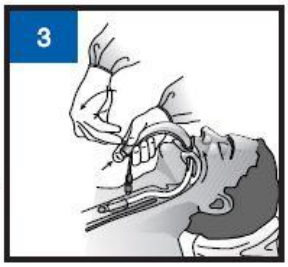
(The use of standard, curved, PVC ETT's is not recommended.)



Advance the ETT, inflate the cuff and confirm intubation.



Remove the ETT connector and ease the LMA Fastrach™ out by gently swinging the handle caudally. Use the stabilizing rod to keep the ETT in place while removing the LMA Fastrach™ until the tube can be grasped at the level of the incisors.



Remove the stabilizing rod and gently unthread the inflation line and pilot ballon of the ETT.

Replace the ETT connector.

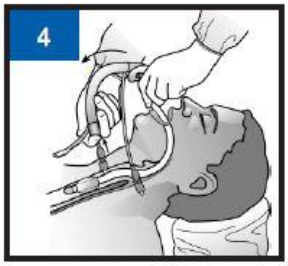


Table 1.9.1 LMA Fastrach Insertion Technique

References

Instructions For Use – LMA Fastrach™, LMA Fastrach™ Single Use, LMA Fastrach™ ETT & LMA Fastrach™ ETT Single Use, The Laryngeal Mask Company, 2011

1.10 Needle Cricothyroidotomy

Definition

Insertion of a wide bore needle through the cricothyroid membrane to provide an emergency airway and facilitate jet insufflation.

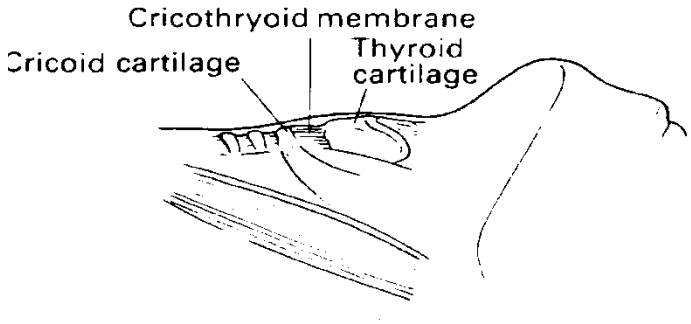


Fig 1.10.1 Needle Cricothyroidotomy

Technique

1. Assemble and prepare a length of oxygen tubing by cutting a hole toward one end.
   A. Connect one end of the oxygen tubing to an oxygen source, capable of delivering 50 psi or greater at the nipple (*or* a flow meter set at 15 l/min [paediatrics: 1 litre per year of age, increasing by increments of 1 litre until desired effect is reached]).
   B. Connect the other end to a Y connector and ensure free flow of oxygen through the tubing.
   C. Alternative means of attachments include:
      - Attaching the oxygen tubing directly to the hub of the catheter needle or
      - Attaching the tubing to a 3 way tap (hole in tubing *not* required) which is then connected to the catheter *or*
      - Attaching the catheter directly to the hub of a 3mm ETT connector and a ventilator circuit *or*
      - Indirectly to a barrel of a 2 ml syringe and then to a size 7.5 – 8 ETT connector and a ventilator circuit.
2. Place the patient in a supine position.
3. Assemble a 12 or 14G IV cannula-over-needle to a 5 or 10 mL syringe.
4. Surgically prepare the neck, using antiseptic swabs.
5. Palpate the cricothyroid membrane, anteriorly, between the thyroid cartilage and cricoid cartilage. Stabilise the trachea with the thumb and forefinger of one hand to prevent lateral movement of the trachea during the procedure.
6. Puncture the skin in the midline directly over the cricothyroid membrane (ie, mid-sagittal).
7. Direct the needle at a 45° angle caudally, while applying negative pressure to the syringe.

Needle Cricothyroidotomy (Continued)

8. Carefully insert the needle through the lower half of the cricothyroid membrane, aspirating as the needle is advanced.
9. Aspiration of air signifies entry into the tracheal lumen.
10. Remove the syringe and withdraw the stylet while gently advancing the catheter downward into position, being careful not to perforate the posterior wall of the trachea. Connect the oxygen tubing.
11. Intermittent ventilation can be achieved by occluding the open hole cut into the oxygen tubing with your thumb for 1 second and releasing it for 4 seconds. After releasing your thumb from the hole in the tubing, passive exhalation occurs (via the upper airway).
12. Note that adequate P_aO_2 can be maintained for only 30 to 45 minutes, and CO_2 accumulation may occur more rapidly.
13. Continue to observe lung inflations and auscultate the chest for adequate ventilation.

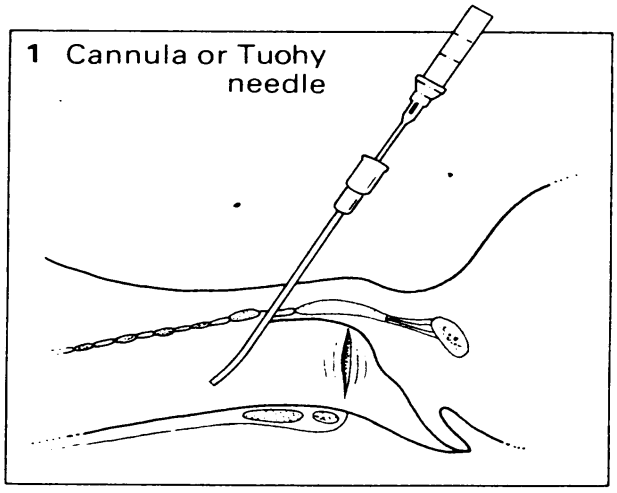


Fig 1.10.2 Needle Cricothyroidotomy

Complications

1. Inadequate ventilation leading to hypoxia and death
2. Aspiration (blood)
3. Oesophageal laceration
4. Haematoma
5. Posterior tracheal wall perforation
6. Subcutaneous and/or mediastinal emphysema
7. Thyroid perforation

References

American College of Surgeons Committee on Trauma. *Advanced Trauma Life Support for Doctors: Student Course Manual*,8th Ed, American College of Surgeons Chicago, 2008

Advanced Life Support Group. *Advanced Paediatric Life Support.* 5th Ed, BMJ Publishing Group, 2005.

1.11 Scalpel Bougie Technique

Theory

A surgical airway technique developed at Royal Perth Hospital as part of their CICV (Can't Intubate, Can't Ventilate) algorithm. Consists of a simple surgical cricothyroid puncture and insertion of a Frova bougie, which can be used to oxygenate the patient, prior to railroading an ETT into the trachea. Simple and effective.

Equipment

Scalpel, Frova bougie, bougie oxygen connector or 14G Insyte, lubricated size 6 cuffed ETT

Technique

Approach patient from the left side, with their head to the operator's right.

1. Identify the cricothyroid membrane and stabilise with non-dominant (ND) hand.
2. With scalpel in right (dominant) hand make a horizontal stab incision through cricothyroid membrane.
3. Rotate blade through 90° so that the blade points caudally.
4. Pull scalpel towards you. Maintain perpendicularity, producing a triangular hole.
5. Switch hands so that the left (non-dominant) hand now stabilises the scalpel.
6. With the bougie pointing away and parallel to the floor, insert tip into trachea using the blade as a guide.
7. Rotate and align bougie to allow insertion along the line of the trachea.
8. Connect oxygen tubing to the bougie with special connector or by inserting a 14G Insyte into the bougie and using a Luer lock connector. Reoxygenate via the bougie with jet ventilation.
9. Railroad a lubricated 6.0 ETT (remove the 15-mm connector to aid passage over the bougie). Continually rotate tube to facilitate placement.
10. Remove bougie.
11. Reattach 15-mm Portex connector to ETT and ventilate.
12. Secure tube and check bilateral ventilation.

Watch the YouTube video demonstrating this technique as referenced below. (Also available on RFDS website.)

References

Heard AM, Green RJ, Eakins P. The formulation and introduction of a 'can't intubate, can't ventilate' algorithm into clinical practice. Anaesthesia. 2009 Jun;64(6):601-8. doi: 10.1111/j.1365-2044.2009.05888.x.
http://www.youtube.com/watch?v=TveIsbjmakU Scalpel Bougie. DrAMBHeardAirway

1.12 Scalpel Finger Cannula Technique

Theory

A surgical airway technique developed at Royal Perth Hospital as part of their CICV (Can't Intubate, Can't Ventilate) algorithm.

A rapid surgical dissection of the anterior neck followed by insertion of a cannula. This can then be used to oxygenate the patient, prior to conversion to a Melker size 5.0 Seldinger airway.

A reliable technique when a systematic needle cricothyroidotomy approach has failed, scalpel bougie has failed, or palpation of the airway is not possible.

Equipment

Scalpel, long 14G Insyte cannula, 5mL syringe with saline, jet ventilation oxygen tubing connections.

Technique

Approach patient from the left side, with their head to the operator's right.

1. Stabilise the neck in the midline with the left (non-dominant) hand.
2. Make a vertical midline incision of at least 6 cm caudal to cranial through skin and subcutaneous tissue.
3. Insert fingers of both hands to separate strap muscles by blunt dissection.
4. Identify airway structures with left (non-dominant) hand and stabilise with index and middle fingers.
5. Insert 14G Insyte (connected to syringe with saline) with right (dominant) hand using a ‘aspirate as you go’ technique.
6. Secure, insert and confirm position of the cannula as per needle cricothyroidotomy technique.
7. Attach to jet ventilator (such as Enk Oxygen Flow Modulator).
8. Once stabilised can convert to Melker 5.0 cuffed tube.

Watch the YouTube video demonstrating this technique as referenced below. (Also available on RFDS website.)

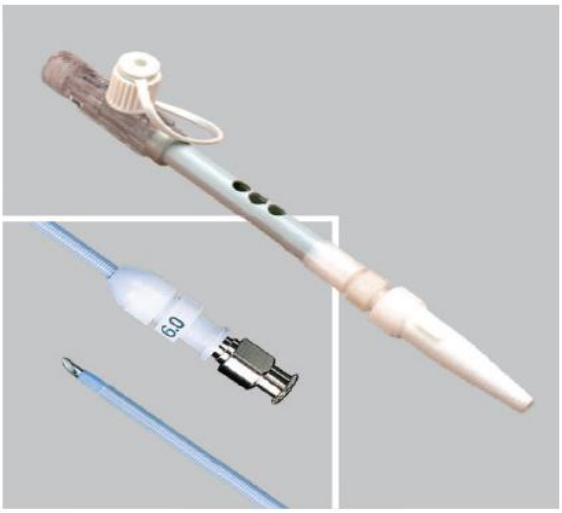


Figure 1.12.1. Enk Oxygen Flow Modulator allows manual oxygenation through the needle cricothyroidotomy. (Kit version includes a wire-reinforced catheter over needle.)

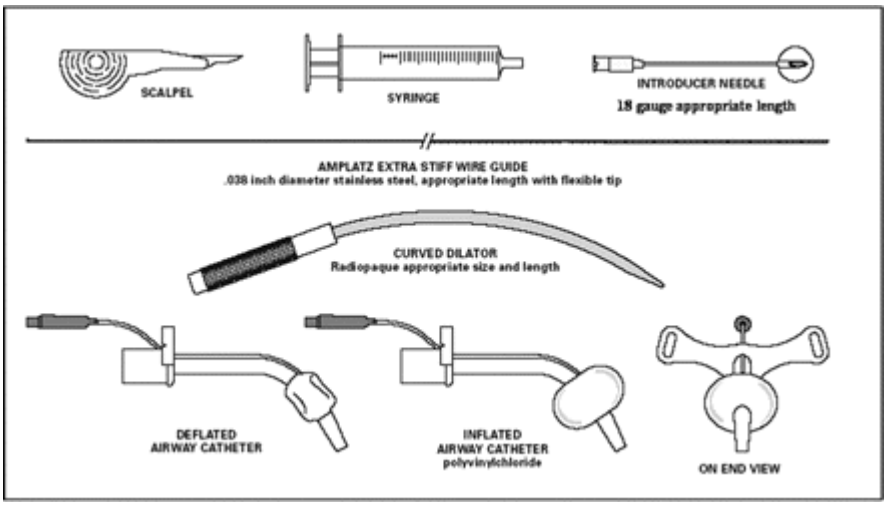


Figure 1.12.2. Melker Emergency Cricothyroidotomy Catheter set components. Includes cuffed tube, dilator and Seldinger style wire.

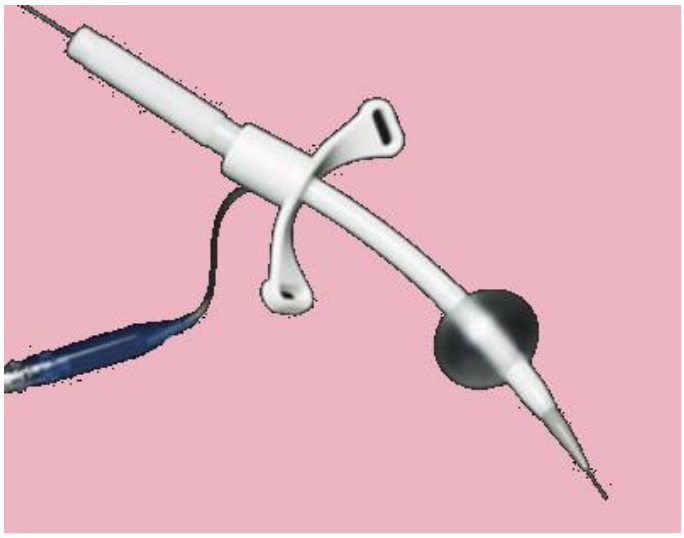


Figure 1.12.3 Melker Emergency Cricothyroidotomy Catheter assembly components with cuffed tube.

References

Heard AM, Green RJ, Eakins P. The formulation and introduction of a 'can't intubate, can't ventilate' algorithm into clinical practice. Anaesthesia. 2009 Jun;64(6):601-8. doi: 10.1111/j.1365-2044.2009.05888.x.

http://www.youtube.com/watch?v=waGiiEyzgX8 Scalpel Finger Cannula. DrAMBHeardAirway

1.13 Melker Cricothyroidotomy Conversion Technique

Theory

A surgical airway technique modified at Royal Perth Hospital as part of their CICV (Can't Intubate, Can't Ventilate) algorithm.

This technique converts a cricothyroid cannula to a Melker size 5.0 airway using a Seldinger wire technique.

The Melker is not recommended as a first line technique but is reliable once a needle cricothyroidotomy is in place.

Equipment

Melker emergency cricothyroidotomy kit including scalpel, dilator, size 5 cuffed ETT, syringe.

A long 14G Insyte cannula (already in place).

Technique

Approach patient from the left side, with their head to the operator's right.

1. Insert wire through cannula.
2. Remove the cannula.
3. Make a stab incision caudally with a scalpel.
4. Pass Melker tube & dilator assembly device over the wire.
5. Ensure the dilator is fully and completely seated inside the airway.
6. Grip the airway assembly device in the right (dominant) hand so as to prevent the dilator moving back when the assembly is advanced.
7. Advance the assembly with moderate force over wire through the skin and into the airway.
8. Remove the wire and introducer.
9. Inflate the cuff.
10. Attach a self-inflating bag or circuit and ventilate.
11. Secure in place with cloth tape.

Watch the YouTube video demonstrating this technique as referenced below. (Also available on RFDS website.)

References

Heard AM, Green RJ, Eakins P. The formulation and introduction of a 'can't intubate, can't ventilate' algorithm into clinical practice. Anaesthesia. 2009 Jun;64(6):601-8. doi: 10.1111/j.1365-2044.2009.05888.x.

http://www.youtube.com/watch?v=J1pUJYOWfog Melker. DrAMBHeardAirway

Melker Emergency Cuffed Cricothyrotomy Catheter Set - Product Information.

1.14 Surgical Cricothyroidotomy

Theory

Not recommended in children < 12 years old as this is the narrowest part of the airway and the only circumferential support of the upper airway.

Technique

1. Place the patient in a supine position with the neck in a neutral position and assemble the necessary equipment. If there is no risk of neck injury, consider extending the neck to improve access.

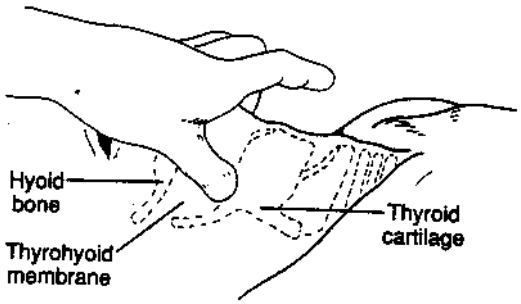


Fig 1.11.1 Surgical Cricothyroidotomy

2. Locate the cricothyroid membrane by standing on the patient's right side and with the palm of the left hand placed against the chin, use the thumb and middle finger to palpate the hyoid bone (fig 1.10.1).
3. The index finger then palpates the thyrohyoid membrane and then the larynx. The middle finger and thumb are then removed to a position on either side of the larynx to stabilise this structure while the index finger 'walks down' the thyroid notch until the an indentation is felt between the cricoid and thyroid cartilages. This indentation is the cricothyroid membrane. The thyroid rings should be able to be felt inferiorly.
    - One of the most common complications of this procedure is not identifying the cricothyroid membrane correctly and performing an incision through the thyrohyoid membrane.

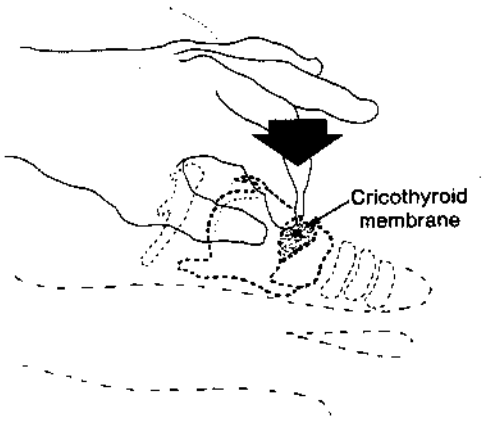


Fig 1.11.2 Cricothyroid Membrane

Surgical Cricothyroidotomy (Continued)

4. If time permits and the patient is awake, surgically prepare and anaesthetise the area with 1% Lignocaine (with Adrenaline).
5. Stabilise the thyroid cartilage with the left hand and maintain stabilisation until the trachea is intubated.
6. Make a transverse skin incision over the cricothyroid membrane, and carefully incise through the membrane transversely.
    - The scalpel must be held between the thumb and index finger in such a way that only the tip of the blade can enter the trachea during the initial stab incision to avoid perforation of the oesophagus.
7. Insert the scalpel handle into the incision and rotate it 90^{o} to open the airway. (A haemostat or tracheal spreader also may be used instead of the scalpel handle.)
8. Insert an appropriately sized, cuffed endotracheal tube or tracheostomy tube (usually a #5 or #6) into the cricothyroid membrane incision, directing the tube distally into the trachea.
9. Inflate the cuff and ventilate the patient.
10. Observe lung inflations and auscultate the chest for adequate ventilation.
11. Secure the endotracheal or tracheostomy tube to the patient to prevent dislodging.
12. **Caution:** Do not cut or remove the cricothyroid cartilage.

Complications

1. Aspiration (eg blood)
2. Creation of a false passage into the tissue
3. Subglottic stenosis/oedema
4. Laryngeal stenosis
5. Haemorrhage or haematoma formation
6. Laceration of the oesophagus
7. Laceration of the trachea
8. Mediastinal emphysema
9. Vocal cord paralysis, hoarseness

Special note

A Minitrach kit is carried in all RFDS aircraft to assist in this procedure.

References

American College of Surgeons Committee on Trauma, *Advanced Trauma Life Support for Doctors: Student Course Manual*, 8th Ed, American College of Surgeons Chicago, 1997.

Advanced Life Support Group. *Advanced Paediatric Life Support.* 5th Ed, BMJ Publishing Group, 2005.

1.15 Needle Thoracocentesis

Theory

This procedure is for the rapidly deteriorating critical patient who has a life-threatening tension pneumothorax. If this technique is used and the patient does not have a tension pneumothorax, a pneumothorax and/or damage to the lung may occur.

Technique

1. Assess the patient's chest and respiratory status.
2. Administer high-flow oxygen and ventilate as necessary.
3. Identify the second intercostal space, in the mid-clavicular line on the side of the tension pneumothorax (consider also 5th Intercostal space, anterior axillary line).
4. Surgically prepare the chest.
5. Locally anaesthetise the area if the patient is conscious or if time permits.
6. Place the patient in an upright position if a c-spine injury has been excluded.
7. Insert a 14G or 16G IV cannula (5cms long) into the skin and direct the needle just over (ie superior to) the rib into the intercostal space.
8. Puncture the parietal pleura.
9. Listen for a sudden escape of air when the needle enters the parietal pleura, indicating that the tension pneumothorax has been relieved.
10. Remove the needle. Leave the plastic catheter in place open-ended and apply a bandage or small dressing over the insertion site.
11. Prepare for a chest-tube insertion if necessary.
12. Obtain a chest x-ray when possible

Complications

1. Local haematoma.
2. Pneumothorax.
3. Lung laceration.

References

American College of Surgeons Committee on Trauma. *Advanced Trauma Life Support for Doctors: Student Course Manual*, 8th Ed, American College of Surgeons Chicago, 2008.

1.16 Chest Tube Insertion

Definition

The placement of an intercostal catheter or chest drain into the pleural cavity for treatment or prophylaxis of a pneumothorax or haemothorax.

Theory

1. Release of air through a one-way valve mechanism, aids in reinflation of the underlying collapsed lung, improving oxygenation and preventing the development of a tension pneumothorax.
2. Chest drains should be used in patients with an existing pneumothorax *or* at risk of developing a pneumothorax, prior to instituting positive pressure ventilation.
3. Appropriate drainage of a pneumothorax is mandatory for air transport to prevent complications from expansion of trapped intra-thoracic gas at altitude.
4. In a haemothorax, chest drainage allows determination of the volume of blood lost and continuous monitoring of loss.
5. In cases of massive haemothorax, a large (#38 French) tube should be inserted. Smaller tubes are appropriate for pneumothoraces.

Technique

1. Determine the insertion site - usually the nipple level (5th or 6th intercostal space) anterior to the mid-axillary line on the affected side, alternatively the 2nd intercostal space in the midclavicular line may be used. A second chest tube may be used for a haemothorax.

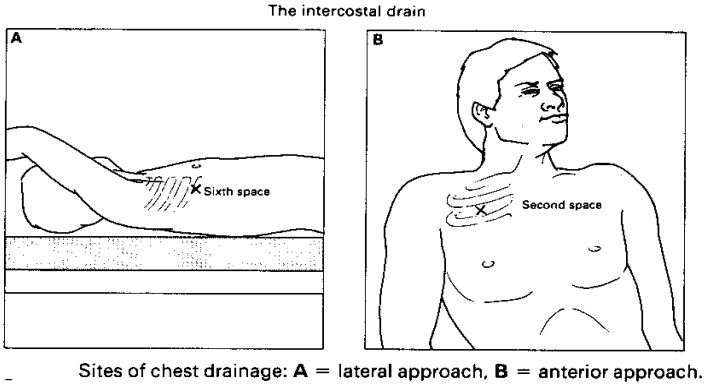


Fig 1.12.1 Sites of Chest Drainage

2. Surgically prepare and drape the chest at the predetermined site of the tube insertion.
3. Locally anaesthetise the skin and rib periosteum.
4. Make a 2- to 3-cm transverse (horizontal) incision at the predetermined site and bluntly dissect through the subcutaneous tissues, just over the top of the rib.
5. Puncture the parietal pleura with the tip of a clamp and put a gloved finger into the incision to avoid injury to other organs and to clear any adhesions, clots, etc.
6. Clamp the proximal end of the chest tube and advance the tube into the pleural space to the desired length.
7. Look for “fogging” of the chest tube with expiration or listen for air movement.

Chest Tube Insertion (Continued)

8. Connect the end of the chest tube to a Pneumostat or Heimlich valve (preferable for transport) or an underwater-seal apparatus.
9. Suture the tube in place.
10. Apply a dressing, and tape the tube to the chest.
11. Obtain a chest x-ray where possible.
12. Obtain arterial blood gas values where indicated.

Complications

1. Laceration or puncture of intrathoracic and/or abdominal organs, all of which can be prevented by using the finger technique before inserting the chest tube.
2. Introduction of pleural infection, eg, thoracic empyema.
3. Damage to the intercostal nerve, artery, or vein.
4. Converting a pneumothorax to a haemopneumothorax.
5. Resulting intercostal neuritis/neuralgia.
6. Incorrect tube position, extrathoracic or intrathoracic.
7. Chest tube kinking, clogging, or dislodging from the chest wall, or disconnection from the under water-seal apparatus.
8. Persistent pneumothorax.
9. Large primary leak.
10. Leak at the skin around the chest tube; suction on tube too strong
11. Leaky underwater-seal apparatus – water from underwater seal bottle being poured into chest via tube.
12. Subcutaneous emphysema, usually at tube site
13. Recurrence of pneumothorax upon removal of chest tube; seal of thoracostomy wound not immediate
14. Lung fails to expand due to plugged bronchus; bronchoscopy required
15. Anaphylactic or allergic reaction to surgical preparation or anaesthetic.

References

American College of Surgeons Committee on Trauma, *Advanced Trauma Life Support for Doctors: Student Course Manual*, 8th Ed, American College of Surgeons Chicago, 2008.

2 CIRCULATION

2.1 Intraosseous Puncture/ Infusion - EZ-IO

Definition

This procedure describes the insertion of an intraosseous needle using the EZ-IO drill.

Theory

The IO route can be used to administer drugs, give fluid volume and to take blood.

- Any intravenous medication can be safely given by the IO route.
- IO and IV doses are the same but follow each medication with a 3-5 ml fluid flush.
- The medullary space has a higher pressure than the venous circulation, so volume administration is enhanced with a pressure bag or volumetric pump.
- The humeral site is said to provide the most rapid flow into the right atrium.
- Blood can also be taken for pathology tests, but discard the first 2ml as waste.

The EZ-IO drill provides an easier means of establishing rapid and stable access to the bone marrow space, compared with using the Cook needle.

Indications

Patients who require urgent vascular access where venous routes are difficult or have not been successful.

Contraindications

- Fracture of the bone
- Previous I/O in the bone within 24 hours
- Previous orthopaedic surgery at site such as prosthesis
- Unable to locate landmarks
- Infection at site (acute burns overlying site are not a contraindication)

Technique

1. Consent

Explain procedure to patient and family.

2. Determine site of insertion

The EZ-IO is approved for use in the distal tibia, proximal tibia and proximal humerus.

Select the site based on absence of contraindications, ease of access and ease of securing of the needle afterwards.

In adults, the humeral head site is said to offer the best flow rates for volume resuscitation.

3. Select needle to use

Open the kit and select the needle to use.

All needles are the same gauge (15G) but vary in length (15mm, 25mm and 45mm), so selection is based on the estimated thickness of soft tissue, muscle or oedema overlying the bone.

When you insert the needle into the skin, if at least one black line is not showing, then a longer needle is required.

The 45mm is used for the proximal humerus site in patients over 40kg.

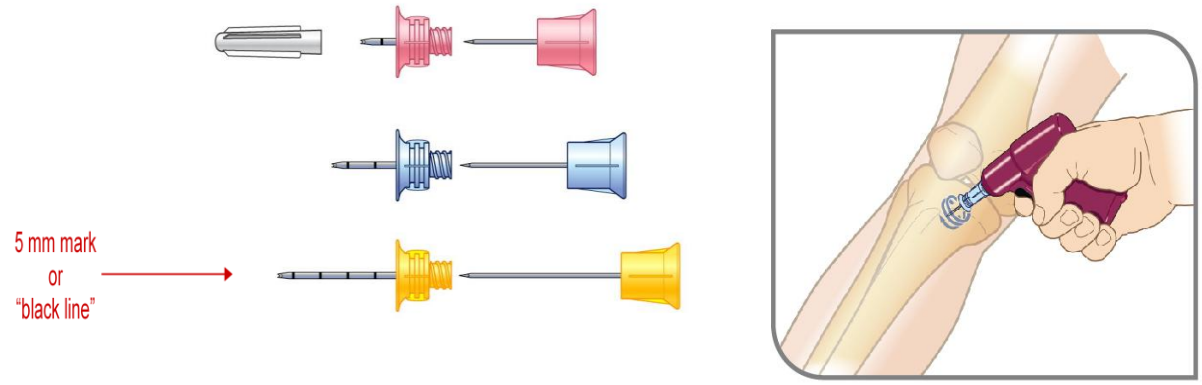


Figure 2.1.1 Needle selection

4. Prepare driver, needle, tubing and insertion site

Attach driver to needle set and leave cap on needle till ready to proceed.

Attach the EZ-Connect extension tubing to a 20mL syringe filled with saline and prime the tubing. Leave attached to the syringe.

Identify and swab insertion site.

5. Insert

Stabilize the site with one hand and insert needle through the skin at 90 degrees until it reaches bone.

Confirm at least one black line is showing. (If not, use a longer needle).

Then, with gentle pressure, depress trigger and allow needle to advance into the bone.

Release the trigger when you feel a "pop" or "give".

Stabilize needle hub and remove driver.

Stabilize needle and unscrew the stylet anti-clockwise. Needle should feel secure.

6. Flush

If a needle stabilizer (triangular pad) is available, apply first.

Connect the EZ-Connect tubing to the needle hub.

Aspirate to confirm placement.

A rapid and vigorous flush with at least 10mL of saline will clear the thick fibrin mesh in the medullary space and ensure a good flow rate is subsequently achieved. Some initial resistance will be felt.

7. Administer drugs or fluids

Connect extension tubing (not the needle directly) to a giving set or syringe and commence infusion or drug administration.

Fluid volumes are best administered with a volumetric pump or pressure bag.

8. Removal

If necessary to remove, attach a Luer lock syringe directly to the needle, rotate it clockwise whilst pulling out.

Notes

1. "EZ-does it." Use gentle pressure and allow the drill to do the work.
2. "Stop when you pop." Release trigger when you feel the needle give.
3. "No flush = no flow." Failure to appropriately flush the IO catheter may result in limited or no flow. Push through the initial resistance.
4. If insertion fails, try the alternative limb, not the same bone.
5. A small dose of plain Lignocaine can be instilled prior to flushing, to anaesthetize the medullary space, if patient is pain sensitive. In most emergency cases this will not be necessary.

References

Vidacare. EZ-IO training materials and product information. 2010

2.2 Intraosseous Puncture/ Infusion - Cook Needle

Technique

- Select site for insertion, immobilise, drape and prepare with Povidone-Iodine solution.
- Infiltrate with 1% Lignocaine down to periosteum if patient is conscious. Confirm landmarks.
- Insert needle perpendicular to the skin but angled away from the epiphysial plate ie. towards foot if using proximal tibia, or towards head if using distal tibia.
- Apply pressure in a twisting screwing motion until a pop or decreased resistance is noted. Needle should be in the medullary cavity. Penetration distance is rarely more than 1 centimetre (note depth marking on some needles).
- Whilst holding needle, gently unscrew Trocar hub assembly from needle.
- Aspirate bone marrow (blood) from needle to confirm placement (only seen in 50% cases). Flush needle with 2-5mls of Saline to clear. A slow bolus of resuscitation fluid may be given by syringe.
- Connect to intravenous line and tape dressing around needle entry site as appropriate. Anchor IV tubing to leg to prevent inadvertent tension.
- Routinely reevaluate position- observe for extravasation which suggests placement is either too shallow or too deep (penetrated other side of bone).

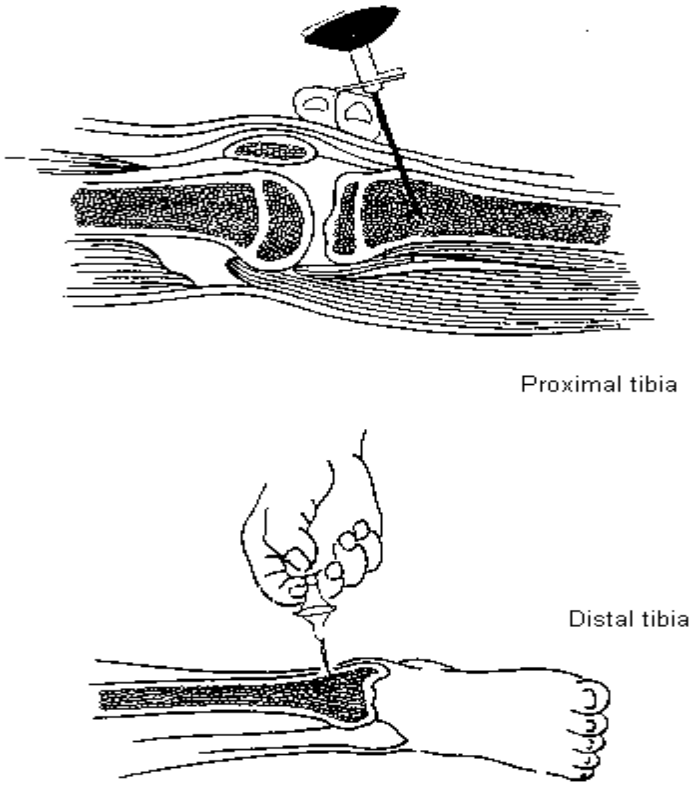


Figure 2.2.1 Intraosseus Puncture

References

Royal Children's Hospital, Melbourne. *Paediatric Handbook*. 5th Ed. Blackwell Science, 1996.

2.3 Subclavian Venipuncture – Infraclavicular Approach

Theory

Central venous access is rarely if ever required in the early management of trauma patients but may be required for drug administration and fluid status monitoring in medical patients.

Central access via the infraclavicular approach to the subclavian vein carries a risk of causing a pneumothorax, a consideration in patients who are to be transferred ventilated at altitude.

Technique

1. Place the patient in a supine position, at least 15° head-down to distend the neck veins and prevent an air embolism. Turn the patient's head away from the venipuncture site (in trauma patients exclude a cervical spine injury before moving the neck).
2. Place a folded sheet under the patient's upper back between the shoulder blades (fig 2.3.1). This will allow the shoulders to fall back and widen the space between the 1st rib and the clavicle, thus allowing easier entrance into the subclavian vein.

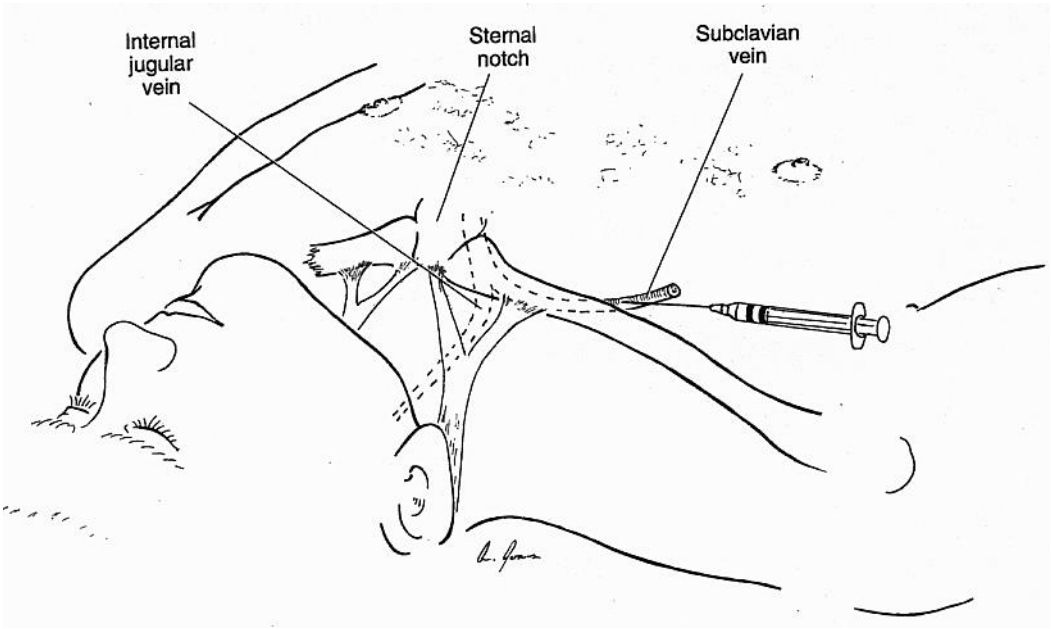


Fig 2.3.1 Subclavian vein cannulation using infraclavicular approach. Place index finger in sternal notch, thumb at point of needle insertion. Insert needle under clavicle, aim at suprasternal notch (index finger) whilst syringe and needle parallel to table.

3. Cleanse the skin well around the venipuncture site and drape the area. Sterile gloves should be worn when performing this procedure and sterile technique.
4. If the patient is awake, use a local anaesthetic at the venipuncture site.
5. Introduce a large-calibre needle, attached to a 10 mL syringe with 0.5 to 1 mL saline, 1 cm below the junction of the middle and medial thirds of the clavicle. Ultrasound can be used as an adjunct.
6. The needle and syringe are held parallel to the frontal plane.

Subclavian Venipuncture - Infraclavicular Approach (Continued)

7. Direct the needle medially, slightly cephalad, and posteriorly behind the clavicle toward the posterior, superior angle of the sternal end of the clavicle (toward finger placed in the suprasternal notch).
8. Slowly advance the needle while gently withdrawing the plunger of the syringe.
9. When a free flow of blood appears in the syringe, rotate the bevel of the needle caudally, remove the syringe, and occlude the needle with a finger to prevent an air embolism.
10. Insert the guidewire while monitoring the electrocardiogram for rhythm abnormalities. Then remove the needle while holding the guidewire in place.
11. Insert the catheter over the guidewire to a predetermined depth (tip of catheter should be above the right atrium for fluid administration).
12. Pass dilator over guidewire then remove.
13. Connect the catheter to the intravenous tubing.
14. Affix the catheter securely to the skin (eg, with suture) and dress the area.
15. Tape the intravenous tubing in place.
16. Where possible obtain a chest film to identify the position of the intravenous line and a possible pneumothorax.

Complications

1. Pneumothorax (especially with the associated use of positive pressure ventilation)
2. Haemothorax
3. Venous thrombosis
4. Arterial or neurologic injury
5. Arteriovenous fistula
6. Chylothorax
7. Infection
8. Air embolism

References

American College of Surgeons Committee on Trauma, *Advanced Trauma Life Support for Doctors: Student Course Manual*, 8th Ed, American College of Surgeons Chicago, 2008.

2.4 Internal Jugular Venipuncture – Middle Or Central Route

Theory

Central venous access is rarely if ever required in the early management of trauma patients but may be required for drug administration and fluid status monitoring in medical patients.

Central access via the internal jugular vein carries a slightly lower risk of causing a pneumothorax, a consideration in patients who are to be transferred ventilated at altitude.

Technique

Note: internal jugular catheterization is frequently difficult in the injured patient due to the precautions necessary to protect the patient's cervical spinal cord.

1. Place the patient in a supine position, at least 15° head-down to distend the neck veins and prevent an air embolism. Turn the patient's head away from the venipuncture site (in trauma patients exclude a cervical spine injury before moving the neck).
2. Cleanse the skin well around the venipuncture site and drape the area. Sterile gloves should be worn when performing the procedure.
3. If the patient is awake, use a local anaesthetic at the venipuncture site.
4. Introduce a large-calibre needle, attached to a 10 mL syringe with 0.5 to 1 mL of saline, into the centre of the triangle formed by the two lower heads of the sternomastoid and the clavicle. Ultrasound can be used as an adjunct.
5. After the skin has been punctured, with the bevel of the needle upward, expel the skin plug that may occlude the needle.
6. Direct the needle caudally, parallel to the sagittal plane, at a 30° posterior angle with the frontal plane.
7. Slowly advance the needle while gently withdrawing the plunger of the syringe.
8. When a free flow of blood appears in the syringe, remove the syringe and occlude the needle with a finger to prevent air embolism. If the vein is not entered, within 4-5cms, withdraw the needle and redirect it 5° to 10° laterally.

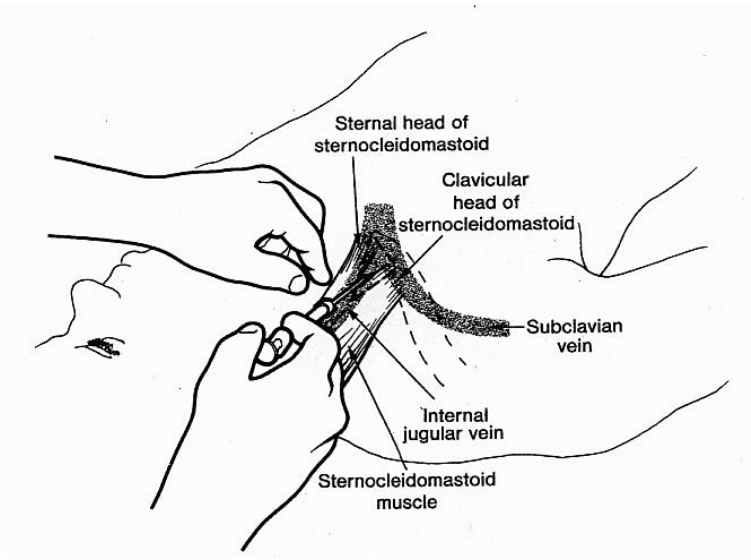


Fig 2.4.1 Anterior approach, internal jugular vein cannulation. Insertion point is at apex of triangle formed by junction of sternal and clavicular heads of sternocleidomastoid muscle and clavicle inferiorly. Insert at 30° posterior angle and direct toward ipsilateral nipple.

Internal Jugular Venipuncture – Middle Or Central Route (Continued)

9. Insert the guidewire while monitoring the electrocardiogram for rhythm abnormalities.
10. Remove the needle while securing the guidewire and advance the catheter over the wire. Connect the catheter to the intravenous tubing.
11. Affix the catheter in place to the skin (e.g. with suture) and dress the area.

    Tape the intravenous tubing in place.
12. Where possible obtain a chest film to identify the position of the intravenous line and a possible pneumothorax.

Complications

1. Pneumothorax (especially with the associated use of positive pressure ventilation).
2. Haemothorax.
3. Venous thrombosis.
4. Arterial or neurologic injury.
5. Arteriovenous fistula.
6. Chylothorax.
7. Infection.
8. Air embolism.

References

American College of Surgeons Committee on Trauma, *Advanced Trauma Life Support for Doctors: Student Course Manual*, 8th Ed, American College of Surgeons Chicago, 2008.

2.5 Venous Cutdown

Technique

The primary site for a peripheral venous cutdown is the greater saphenous vein at the ankle, which is located at a point approximately 2 cm anterior and superior to the medial malleolus. A secondary site is the antecubital medial basilic vein, located 2.5 cm lateral to the medial epicondyle of the humerus at the flexion crease of the elbow.

Fig 2.5.1 Site of long saphenous cutdown and technique

1. Prepare the skin of the ankle with antiseptic solution and drape the area.
2. Infiltrate the skin over the vein with 1% lignocaine.
3. Make a full-thickness transverse skin incision through the area of anaesthesia to a length of 2.5cm.
4. By blunt dissection, using a curved haemostat, identify the vein and dissect it free from any accompany structures.
5. Elevate and dissect the vein for a distance of approximately 2 cm, to free it from its bed.
6. Ligate the distal, mobilised vein, leaving the suture in place for traction.
7. Pass a tie around the vein, cephalad.
8. Make a small transverse venotomy and gently dilate the venotomy with the tip of a closed haemostat.
9. Introduce a plastic cannula through the venotomy and secure it in place by tying the upper ligature around the vein and cannula. The cannula should be inserted an adequate distance to prevent dislodging.
10. Attach the intravenous tubing to the cannula and close the incision with interrupted sutures. Apply a sterile dressing and topical antibiotic ointment.

Complications

1. Cellulitis
2. Haematoma
3. Phlebitis
4. Perforation of the posterior wall of the vein
5. Venous thrombosis
6. Nerve or Arterial Transection

References

American College of Surgeons Committee on Trauma, *Advanced Trauma Life Support for Doctors: Student Course Manual*, 8th Ed, American College of Surgeons Chicago, 2008.

2.6 Femoral Venous Cannulation

Theory

Central venous access is rarely if ever required in the early management of trauma patients but may be required for drug administration and fluid status monitoring in medical patients.

Central access via the femoral vein, unlike access via the subclavian or jugular veins, is not associated with a risk of causing a pneumothorax, a consideration in patients who are to be transferred ventilated at altitude.

Technique

1. Place the patient in a supine position.
2. Cleanse the skin well with Betadine around the venipuncture site and drape the area. Sterile gloves should be worn when performing this procedure.
3. Locate the femoral vein by palpating the femoral artery. The vein lies directly medial to the femoral artery (nerve, artery, vein, empty space). A finger should remain on the artery to facilitate anatomical location and to avoid insertion of the catheter into the artery. Untrasound can be used as an adjunct.
4. If the patient is awake, use a local anaesthetic at the venipuncture site.
5. Introduce a large-calibre needle attached to a 10 mL syringe with 0.5 to 1 mL of saline. The needle, directed toward the patient's head, should enter the skin directly over the femoral vein.
6. The needle and syringe are held parallel to the frontal plane.
7. Directing the needle cephalad and posteriorly, slowly advance the needle while gently withdrawing the plunger of the syringe.
8. When a free flow of blood appears in the syringe, remove the syringe and occlude the needle with a finger to prevent air embolism.
9. Insert the guidewire and remove the needle. Use an introducer if required. Then insert the catheter over the guidewire.
10. Remove the guidewire and connect the catheter to the intravenous tubing.
11. Affix the catheter in place (ie with suture), apply opsite and dress the area.
12. Tape the intravenous tubing in place.
13. Where possible obtain chest and abdominal x-rays to identify the position and placement of the intravenous catheter.
14. The catheter should be changed as soon as practical.

Complications

1. Deep vein thrombosis.
2. Arterial or neurologic injury.
3. Infection.
4. Arteriovenous fistula.

References

American College of Surgeons Committee on Trauma, *Advanced Trauma Life Support for Doctors: Student Course Manual*, 8th Ed, American College of Surgeons Chicago, 2008.

2.7 Arterial Cannulation

Definition

Insertion of an indwelling arterial cannula.

Theory

1. Arterial lines are used primarily for two purposes during transport:
   - For direct arterial pressure monitoring, (especially in critically ill patients undergoing long distance flights); and
   - For regular arterial blood sampling (blood gas estimations during transport).
2. Due to the time involved and potential complications, arterial lines are normally only inserted for critically ill patients, usually on inotropes where accurate monitoring of blood pressure is important and for long distance transport where the benefits outweigh the potential complications.
3. Some patients already have an arterial line and it is relatively easy to connect to our equipment to provide accurate and continuous blood pressure monitoring.

Technique

1. If the radial site is to be used, perform a modified Allen's Test:
   - Hold the patient's hand up and palpate radial and ulnar arteries at the wrist. Occlude both with pressure and ask the patient to clench and open the hand several times. The hand becomes blanched. Release the pressure on the ulnar artery and watch a blush appear rapidly over the hand, demonstrating patency of that artery. Repeat with the radial artery. Patency of both is required before proceeding.
2. Select a site and palpate the vessel.
3. Clean thoroughly with antiseptics.
4. Insert 20G IV cannula at 30^{o} angle to skin over radial pulse at wrist.
5. Cannulate the lumen of the artery so blood appears in the flashback chamber. Alternatively, advance cannula through the other side of the vessel, withdraw the needle partially and pull the cannula back until blood pours freely from it. Advance the cannula up the artery and remove the needle.
6. Flush the cannula with saline ensuring no air enters.
7. Secure the cannula. Attach the transducer and flush-device which has been primed with saline. (See procedure on invasive pressure monitoring.)

Complications

1. Thrombosis.
2. Haematoma formation.
3. Embolisation.
4. Infection.
5. Late complication of aneurysm formation or arteriovenous fistula formation.
6. Inadvertent injection of irritant drugs intra-arterially.
7. Disconnection and haemorrhage (especially in children).

Arterial Cannulation (Continued)

Notes

Ensure the line is marked as an arterial line.

Ensure the line is on a continual flush device.

Ensure there is no air in the system.

References

Soni, N. *Anesthesia and Intensive Care; Practical Procedures*. Heinemann Medical Books, Oxford, 1989.

To Obtain Arterial Blood for ABG's Using I-STAT

1. Turn stop-cock on arterial line OFF. Remove cap.
2. Insert small syringe, turn stop-cock so that blood can be withdrawn into syringe. Discard this blood (which will have some saline mixed with it).
3. Withdraw 1-2mls with **second** syringe and use this for ABG assessment.
4. Return stop-cock to original position and flush arterial line until clear.

2.8 Invasive Pressure Monitoring

Theory

Both arterial and central venous pressure monitoring gives very useful information about the patient's haemodynamic status. The equipment must be set up accurately and then cared for diligently.

On long flights the zeroing procedure should be repeated.

Equipment required includes:

- ICU Medical Transducer disposable monitoring kit and reusable cable.
- Propaq monitor with invasive pressure monitoring capability and pressure monitoring cable.
- Pressure infusion bag with aneroid gauge.

Connecting procedure

1. Connect transducer kit to 500 ml saline bag.
2. Partially fill (one third) the chamber and then pressurise the infusion bag to 300mmHg.
3. Flush the line completely by pulling the blue tab. Also flush the side port and replace the white (aerated) cap with the yellow cap provided. Ensure there are no bubbles in the line.
4. Connect to the patient and the monitor kit is set to run at approximately 3mls per hour.
5. Fix the transducer at the appropriate level. This will be on the forearm for radial artery line or on the anterior chest for a central line.
6. Connect the monitor to the cable and thence to the Propaq. NOT ZEROED will appear in the Propaq's display.

Zeroing Procedure

1. Open the transducer to the atmosphere by turning the stopcock off to the patient. Remove the yellow cap. Remember to keep it sterile.
2. For pressure 1 press SENSORS then INV PRS then ZERO P.
3. For pressure 2 press SENSORS then INV PRS then MORE then ZERO P2.
4. Wait for the tone and the word "ZEROED" will appear in the screen. You are now ready to monitor the pressure.

Monitoring the Pressure

1. Turn the stopcock off to the side port – the Propaq will then scale the pressure as it sees best to demonstrate the waveform.
2. You can change the scale by using the RANGE/RESCALE buttons.

Labelling

1. Always label the line clearly if it is arterial to avoid accidental administration of drugs through the line. Labels are supplied in transducer pack.
2. On the Propaq, press the LABEL button until the desired label appears (ART or CVP).

Flushing Device

1. This is the blue tab near the transducer. It is used to remove blood, air, bubbles and clot from the monitoring equipment.

Invasive Pressure Monitoring (Continued)

2. If a bubble or clot lies between the stopcock and the patient then it must be aspirated out via the stopcock and not flushed into the patient. The flush device may then be used to flush the blood out of the line.

Potential Problems

1. Clots/bubbles in the line – these will reduce the quality of the trace. The systolic pressure tends to be increased and the diastolic reduced. Mean is still accurate.
2. Clots/bubbles between the IV bag and the stopcock can be flushed out of the side port. Between the transducer and the patient they must be aspirated through the port.
3. Level of the transducer – it must lie at the level at which you wish to know the pressure otherwise it will be altered by hydrostatic pressure effects.
4. NEVER give drugs via an arterial line.

References

Prepared by Dr Peter McCallister, Royal Flying Doctor Service (WA Section), 1992, updated by Kate Zanotti, Clinical Educator, RFDSWO, 2012

2.9 Pericardiocentesis

Technique

1. Monitor the patient's vital signs and ECG before, during, and after the procedure.
2. Surgically prepare the xiphoid and subxiphoid areas, if time allows.
3. Locally anaesthetise the puncture site, if necessary.
4. Using #16- to #18 gauge, 6-inch (15-cm) or longer over-the-needle catheter, attach a 35-mL empty syringe with a three-way stopcock.
5. Assess the patient for any mediastinal shift that may have caused the heart to shift significantly.
6. Puncture the skin 1 - 2 cm inferior to the left of the xiphochondral junction, at a 45° angle to the skin.
7. Carefully advance the needle cephalad and aim toward the tip of the left scapula.
8. If the needle is advanced too far (into the ventricular muscle), an injury pattern appears on the ECG monitor eg. extreme ST-T wave changes, widened and enlarged QRS complexes, premature ventricular contractions. Withdraw needle until the previous baseline ECG tracing reappears.
9. When the needle tip enters the blood-filled pericardial sac, withdraw as much non-clotted blood as possible.
10. During the aspiration, the epicardium reapproaches the inner pericardial surface, as does the needle tip. Subsequently, an ECG current of injury pattern may reappear. Withdraw the needle slightly. Should this injury pattern persist, withdraw the needle completely.
11. After aspiration is completed, remove the syringe, and attach a three-way stopcock, leaving the stopcock closed. Secure the catheter in place.
12. Option: Applying the Seldinger technique, pass a flexible guidewire through the needle into the pericardial sac, remove the needle, and pass a 14-Gauge flexible catheter over the guidewire. Remove the guidewire and attach a three-way stopcock.
13. Should the cardiac tamponade symptoms persist, the stopcock may be opened and the pericardial sac reaspirated. The plastic pericardiocentesis catheter can be sutured or taped in place and covered with a small dressing to allow for continued decompression en route to surgery or transfer to another facility.

Complications

1. Aspiration of ventricular blood instead of pericardial blood
2. Laceration of ventricular epicardium/myocardium
3. Laceration of coronary artery or vein
4. New haemopericardium, secondary to lacerations of the coronary artery or vein, and/or ventricular epicardium/myocardium.
5. Ventricular fibrillation
6. Pneumothorax, secondary to lung puncture.
7. Puncture of great vessels with worsening of pericardial tamponade.

References

American College of Surgeons Committee on Trauma, *Advanced Trauma Life Support for Doctors: Student Course Manual*, 8th Ed, American College of Surgeons Chicago, 2008.

2.10 Umbilical Vessel Catheterization

Definition

Insertion of catheter in an umbilical vessel.

Theory

A useful procedure for obtaining vascular access in the newborn. Still possible to use up to 72 hours after birth. Cord contains two thick-walled arteries (usually constricted) and one larger thin-walled vein.

Indications

Venous access for drug and fluid administration.

Arterial access for monitoring and blood sampling.

Technique

1. Use an Argyle umbilical artery catheter 3.5Fr. for infants <1500g and 5Fr. for larger infants.
2. Requirements include: dressing pack, antiseptic solution, catheter, small dilator, small curved mosquito forceps, sterile saline and syringe, scalpel, adhesive tape, 3-0 silk suture, 3-way stopcock.
3. Keep infant warm (radiant warmer or isolette).
4. Sterile technique. Prep umbilical cord and surrounds with Betadine and drape.
5. Fill catheter with Saline or Heparinized Saline. Leave syringe attached.
6. Loosely tie suture around base of umbilical cord, ready to control brisk bleeding and eventually secure catheter in place.
7. Hold cord using gauze swab. Cut cord cleanly, 1-2cm from the level of the skin, with scalpel.
8. Identify vessel to be catheterized. In emergency resuscitation this will usually be the vein. Arteries may be dilated using dilator or tip of forceps.
9. Introduce saline filled catheter. Advance gently. Obstruction may occur at 1-2cm at level of abdominal wall. This can be overcome by gently pulling stump upwards.
10. In emergency setting, secure catheter when free blood flow obtained. (Optimal position is the shortest distance below the skin to obtain easy blood flow.) Tighten suture around stump and tie to catheter. Flush and secure further with tape bridge.

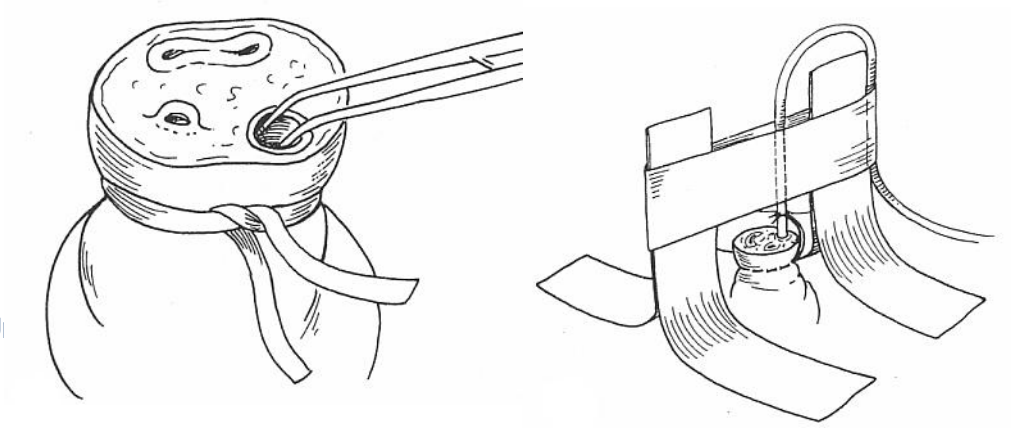


Figure 2.10.1 Umbilical Vessel Catheterization

11. If catheter is to remain in place for transport seek paediatric advice and x-ray to determine position (where available).
12. If peripheral venous cannulation is subsequently successful, consider removal of catheter.
13. Consider antibiotic prophylaxis.

Complications

Exact positioning of catheter tip is important for prolonged placement. Complications can arise from portal vein or renal artery obstruction. Insertion distance depends on length of infant (for which tables/graphs apply) and whether "high" or "low" position preferred. Seek paediatric advice.

Watch for blanching of a lower limb when arterial line used. Will require removal of catheter.

References

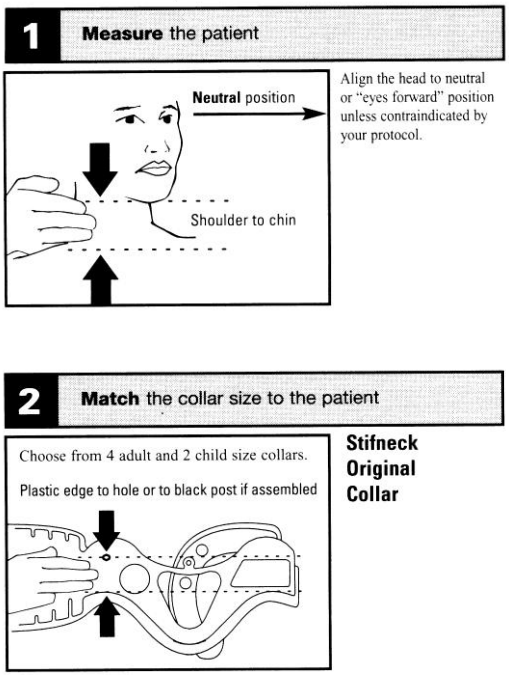
MacNab, AJ et al. Eds. *Care of the Critically Ill Child*. Churchill Livingstone, 1999.

Simon, R & Brenner B. *Emergency Procedures and Techniques. 3rd Ed*. Williams & Wilkins, 1994.

Klaus, M & Fanaroff, A. *Care of the High-Risk Neonate. 3rd Ed.* W.B. Saunders, 1986.

3 TRAUMA

3.1 Application of stifneck cervical collar



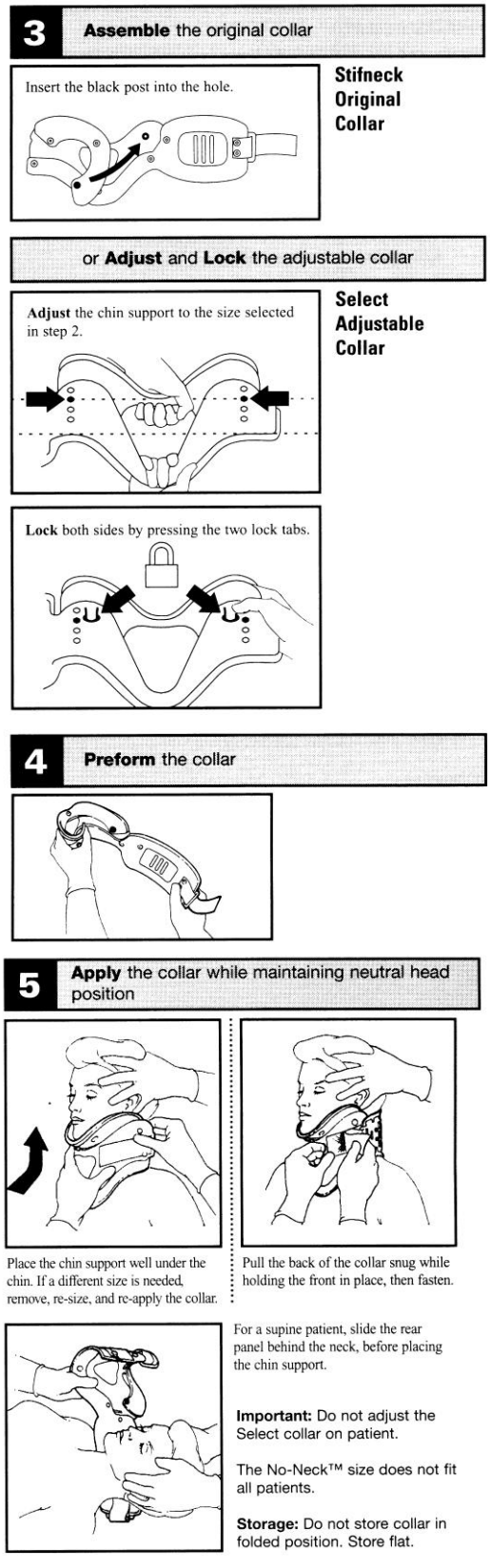


Figure 3.1.1 Application of Stifneck Collar

3.2 Helmet Removal

Patients wearing a helmet who require airway management should have the head and neck held in a neutral position while the helmet is removed using the two-person procedure.

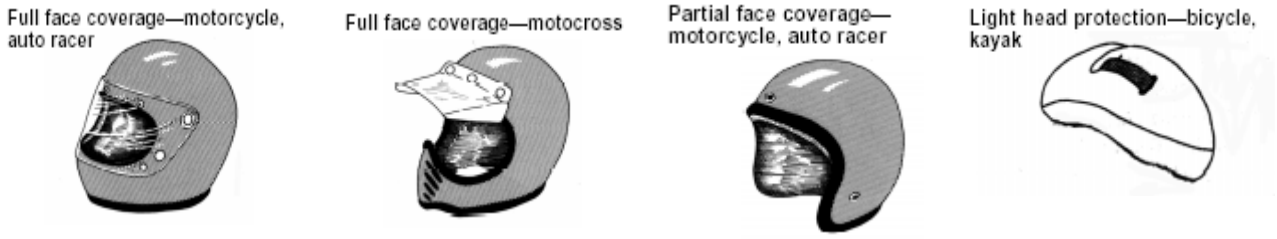
Technique

1. One person stabilises the patient's head and neck by placing one hand on either side of the helmet with the fingers on the patient's mandible. This position prevents slippage if the strap is loose.
2. The second person cuts or loosens the helmet strap at the D-rings.
3. The second person then places one hand on the mandible at the angle, with the thumb on one side and the fingers on the other. The other hand applies pressure from under the head at the occipital region. This manoeuvre transfers the responsibility of inline immobilisation to the second person.
4. The first person then expands the helmet laterally to clear the ears and carefully removes the helmet. If the helmet has a face cover, this device must be removed first. If the helmet provides full facial coverage, the patient's nose will impede helmet removal. To clear the nose, the helmet must be tilted backward and raised over the patient's nose.
5. Through this process, the second person must maintain inline immobilisation from below to prevent head tilt.
6. After the helmet is removed, inline manual immobilisation is re-established from above and the patient's head and neck are secured during airway management.
7. If attempts to remove the helmet result in pain and paraesthesia, the helmet should be removed with a cast cutter. If there is evidence of a c-spine injury on the x-rays, the helmet also should be removed utilising a cast cutter. The head and neck must be stabilised during the procedure, which is accomplished by dividing the helmet in the coronal plane through the ears. The outer rigid layer is removed easily, and the inside styrofoam layer is then incised and removed anteriorly. Maintaining neutral alignment of the head and neck, the posterior portions are removed.

References

American College of Surgeons Committee on Trauma, *Advanced Trauma Life Support for Doctors: Student Course Manual*, 8th Ed, American College of Surgeons Chicago, 2008.

Fig 3.2.1 Helmet Removal



1

One rescuer maintains inline immobilization by placing her hands on each side of the helmet with the fingers on the victim's mandible. This position prevents slippage if the strap is loose.

2

A second rescuer cuts or loosens the strap at the D-rings.

3

The second rescuer places one hand on the mandible at the angle, the thumb on one side, the long and index fingers on the other. With his other hand, he applies pressure from the occipital region. This maneuver transfers the inline immobilization responsibility to the second rescuer.

4

The rescuer at the top moves the helmet. Three factors should be kept in mind:

- The helmet is egg shaped and therefore must be expanded laterally to clear the ears.
- If the helmet provides full facial coverage, glasses must be removed first.
- If the helmet provides full facial coverage, the nose may impede removal. To clear the nose, the helmet must be tilted backward and raised over it.

5

Throughout the removal process, the second rescuer maintains inline immobilization from below to prevent unnecessary neck motion.

6

After the helmet has been removed, the rescuer at the top replaces her hands on either side of the victim's head with her palms over the ears.

7

Inline immobilization is maintained from above until a backboard is in place and a cervical immobilization device (collar) is applied.

Summary

The helmet must be maneuvered over the nose and ears while the head and neck are held rigid.

- Inline immobilization is first applied from above.
- Inline immobilization is applied from below by a second rescuer with pressure on the jaw and occiput.
- The helmet is removed.
- Inline immobilization is reestablished from above.

3.3 Application of the Hare Traction Splint

Technique

1. Application of this device requires two people – one person to handle the injured extremity, the other to apply the splint.
2. Remove all clothing, including footwear, to expose the extremity. Apply sterile dressings to open wounds, and assess the neurovascular status of the extremity.
3. Cleanse any exposed bone and muscle of dirt and debris before applying traction. Document that the exposed bone fragments were reduced into the soft tissues. If circumstances permit then a femoral nerve block may be helpful; otherwise IV analgesia (morphine) should be used.
4. Determine the length of the splint by measuring the uninjured leg. The upper cushioned ring should be placed under the buttocks and adjacent to the ischial tuberosity. The distal end of the splint should extend beyond the ankle by approximately 6 inches (15 cm). The straps on the splint should be positioned to support the thigh and calf.
5. The femur is aligned by manually applying traction through the ankle. After realignment is achieved, gently elevate the leg to allow the assistant to slide the splint under the extremity so that the padded portion of the splint rests against the ischial tuberosity. Reassess the neurovascular status of the distal injured extremity after applying traction.
6. The ankle hitch is positioned around the patient's ankle and foot while the assistant maintains manual traction on the leg. The bottom strap should be slightly shorter than, or at least the same length as, the two upper crossing straps.
7. Attach the ankle hitch to the traction hook while the assistant maintains manual traction and support. Apply traction in increments using the windlass knob until the extremity appears stable, or until pain and muscular spasm are relieved.
8. Reassess the neurovascular status of the injured extremity. If perfusion of the extremity distal to the injury appears worse after applying traction, gradually release the traction.
9. Secure the remaining straps.
10. Frequently re-evaluate the neurovascular status of the extremity. Document the neurovascular status after every manipulation of the extremity.

References

American College of Surgeons Committee on Trauma, *Advanced Trauma Life Support for Doctors: Student Course Manual*, 6th Ed, American College of Surgeons Chicago, 1997.

3.4 Principles of Spinal Immobilisation and Log-Rolling

Method of Log Roll

1. Log rolling requires **four people** - one at the head, and three along the same side of the patient.
2. The person at the head will maintain manual in-line stabilization (MILS) of the head and neck.
3. The three team members on the side of the patient will position themselves so one member is at the chest, one at the abdomen/pelvis, and one at the legs. These three team members will reach across the patient to the opposite side of the body and place their hands on the patient in preparation to log roll.
4. On direction from the person at the head, the command will be given to roll the patient on the "count of three." On the count of three, the patient will be rolled toward the three team members, resulting in a lateral position of the patient. The back will be inspected, and all clothing, straps and debris will be removed.
5. A warm blanket can be placed under the patient prior to rolling the patient onto their back. The patient may be rolled onto a spinal board or other device.
6. All movements are called by the person at the head!

Immobilization

1. For transport, patients with suspected spinal injuries should be immobilised on a vacuum mattress, carefully moulded to achieve a neutral position and prevent lateral rotation. Spinal boards are for extrication only and **NOT** for transport.
2. A Ferno Universal Head Immobilizer set of foam pads may be used to achieve immobilization of the head and neck. A small flat cushion or folded towel can also be placed under patient's head to avoid hyperextension of cervical spine. A correctly fitting rigid cervical collar should be applied. Sandbags are of limited use in the air transport environment.
3. A small pad may likewise be required under the shoulders of an infant to prevent flexion (due to larger head). Children may require shoulder or pelvic immobilisation and sedation.

4 REGIONAL ANAESTHESIA

4.1 Femoral Nerve Block

Theory

1. The femoral nerve is formed from the anterior branches of nerves L234. It innervates anterior compartment of the thigh and overlying skin, hip and knee joints.
2. The nerve lies in the femoral triangle lateral to the artery (NAVEL)
3. Indications:
   - fractured shaft of femur (especially useful for fracture reduction and application of traction)
   - fractured neck of femur
   - fractured patella (innervates medial side only)

Procedure

1. Prep the skin with antiseptic
2. Use 10 – 20 ml 0.5% Bupivacaine diluted to 40 ml with saline – it is easier if you use a small extension tubing and a 23 or 21G needle.
3. Palpate the femoral artery
4. Insert needle 1 cm lateral to the artery just below the inguinal ligament, aspirate then inject fanwise up to 3 cm lateral to artery.
5. For fractured neck of femur, get an assistant to compress femoral sheath mid-thigh with a hand to direct LA cephalad to fracture site.

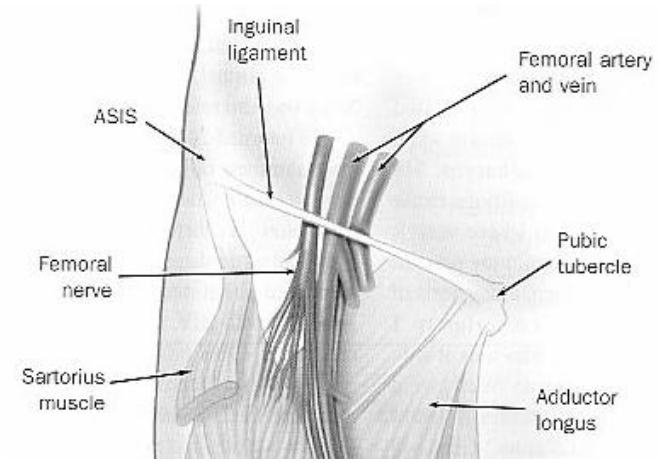


Figure 4.1.1 Femoral Nerve Block

Complications

1. Accidental arterial injection with subsequent systemic toxicity.
2. Neuropathy from intraneural injection.
3. Haematoma from puncturing artery.

References

Simpson, S. Regional Nerve Blocks (Part 6 Femoral Nerve Block), Australian Family Physician. Vol. 30(10), October 2001.

Murtagh J. Practice Tips. McGraw-Hill. 2nd Ed. 1997.

4.2 Intercostal Block

Theory

1. Most useful for patients with fractured ribs, or post-operatively in patients with upper abdominal or thoracic wounds. It provides excellent analgesia, allowing patients to breathe more deeply and cough up secretions.
2. The neurovascular bundle to each rib lies in a groove on the inferior surface of the rib. Each nerve has motor and cutaneous (sensory) branches.

Procedure

1. Position patients on their side, prone or sitting up leaning forward hugging a pillow.
2. Prep with Betadine and drape appropriately.
3. Inject 0.5 % Bupivacaine, using a 23G needle at each costal angle 4 finger breathes lateral to the spinous process (i.e. at the lateral border of the sacrospinalis muscle). It helps if the arms are drawn forward and superiorly, lifting the scapulae out of the way.
4. Insert needle and advance until it hits the rib. “Walk” the needle inferiorly until it slips below the inferior border of the rib. Advance a further 2-3 mm, aspirate and inject 3-5 ml of local anaesthetic.

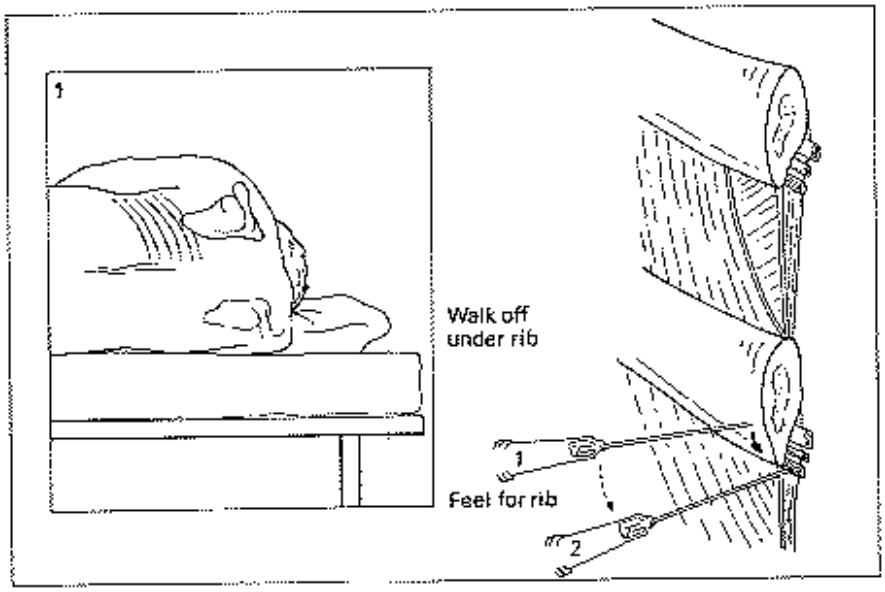


Figure 4.2.1 Intercostal Block

Complications

1. Pneumothorax is the most serious complication, particularly if the patient then requires aeromedical retrieval. The risks need to be assessed prior to carrying out the block.
2. Intravascular injection resulting in local anaesthetic toxicity.

4.3 Bier's Block

Theory

1. Intravenous regional anaesthesia can be produced in the hand and forearm, less commonly in the lower leg below the knee. The limb is isolated from the circulation by a tourniquet and filled with local anaesthetic intravenously, producing anaesthesia, muscle relaxation, and a bloodless field.
2. Indications – fracture reduction (eg. Colles fractures), foreign body removal and minor surgical procedures (eg. carpal tunnel release, repair of lacerations).
3. Operation time is usually limited by discomfort from the cuff to approx. 30 mins.
4. The cuff must not be released less than 20' after injection of the local anaesthetic, as the local anaesthetic may not be fully tissue-bound and systemic toxicity may occur.
5. 0.5% Prilocaine is the only local anaesthetic that should be used as deaths have occurred with other local anaesthetics.

Procedure

1. The procedure should be explained to the patient and written consent obtained.
2. The patient should be fasted as for a general anaesthetic, should be fully monitored and resuscitation and intubation equipment must be easily accessible.
3. Three people are required for the procedure – an operator (doctor), a 2nd person (ideally a 2nd doctor) to supervise the anaesthetic and monitor the patient, and an RN who's job is to continuously monitor the cuff pressure and assist in an emergency.
4. IV access should be obtained in the non-operable limb prior to commencing the anaesthetic.
5. Insert a small IV cannula in the limb for operation, preferably distal to the site of operation.
6. Elevate the limb for 3 minutes, use an Esmarch bandage to exsanguinate the limb.
7. Inflate a BP cuff on the limb to 100 – 150 mm Hg above the patient's systolic pressure (to max. 300 mm Hg) then lower the limb.
8. Slowly inject Prilocaine 0.5% (0.5 mg/kg to max. of 40 ml).
9. Onset of anaesthesia is rapid but it is better to wait 10–15' for it to reach its maximum efficacy.
10. The IVRA can be supplemented with IV sedation or opiates if required.
11. Discomfort from the cuff can be overcome using a double cuff with the 2nd more proximal cuff inflated once the limb is anaesthetic and the distal cuff let down.
12. After the procedure is finished the cuff may be deflated provided at least 20 minutes have passed. The cuff must NEVER be deflated sooner than this.

Complications

1. Inadequate anaesthesia – can be avoided by exsanguinating the limb as much as possible prior to injecting the local anaesthetic.
2. Systemic toxicity – agitation, perioral paraesthesia, dizziness, seizures, cardiac arrhythmias and LOC.

4.4 Dental Blocks - Maxillary Infiltration

Definition

Infiltration anaesthesia involves placement of the solution directly into the site above the roots of the Maxillary teeth.

Theory

Infiltration is possible in Maxillary teeth because of the more “porous” nature of the alveolus cancellous bone which allows solution to reach the apices of the teeth.

Technique

1. Inject 1ml – 2ml of solution after inserting needle (bevel toward bone) into the buccal mucosa aiming for the apex of the teeth (see diagram A).
2. Aspirate prior to injection to ensure the needle is not in a blood vessel.

Contradictions

Infections or acute inflammation in area of injection.

Complications

Pain on needle insertion with needle tip against periosteum. Withdraw needle slightly prior to injection.

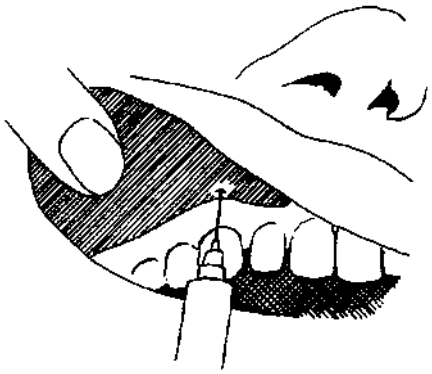


Fig 4.4.1 An apical nerve block

4.5 Dental Blocks - Mandibular Infiltration

Definition

Infiltration anaesthesia is not feasible for general use in the mandible, because dense cortical bone limits diffusion of the solution near the apices of the teeth. The aim is to block the Inferior Dental Nerve before it enters the mandibular foramen by depositing 1- 2mls of solution into the pterygomandibular space.

Technique

Open Mouth Technique

1. Line up needle with syringe over the opposite premolars, keeping syringe and needle parallel to occlusal plane of lower teeth.
2. Aim for spot in back of mouth, adjacent to buccal fat.
3. If you are in the pterygomandibular space there will not be much resistance to pushing solution in.

   TIP 1 – Aim needle at same level as bottom of ear lobe on target side. Insert needle 25mm. Aspirate if possible to ensure not in a blood vessel and deposit solution.

   TIP 2 – If you want lingual nerve anaesthesia of anterior 2/3 of tongue on that side and lingual soft tissues and periosteum, then deposit some solution ½ way in l line with block injection before block site is reached (ie: 12-15 mm in).

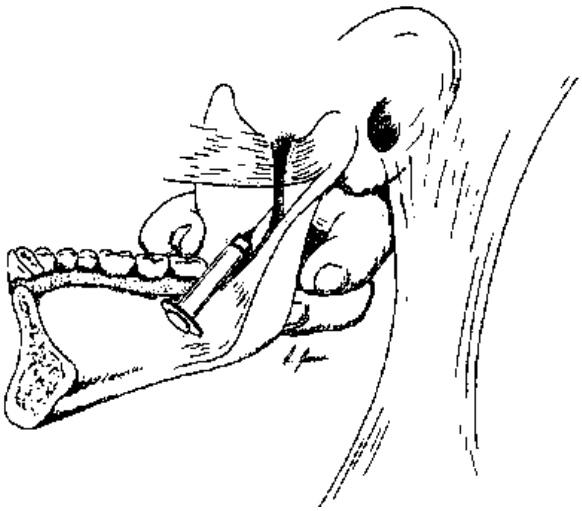


Fig 4.5.1 Open mouth technique, inferior Alveolar Nerve

Closed Mouth Technique (AKINOSI)

This technique is useful if patient can't open mouth or you can't get closed mouth block to work.

1. Line needle and syringe up with the gum margins on top of the maxillary teeth.
2. Keep needle just off the gum teeth junction and advance to back of mouth until it penetrates mucosa.
3. Advance 25mm and deposit solution after aspiration. Nerves anaesthetised: Inferior Dental, Lingual and Long Buccal.

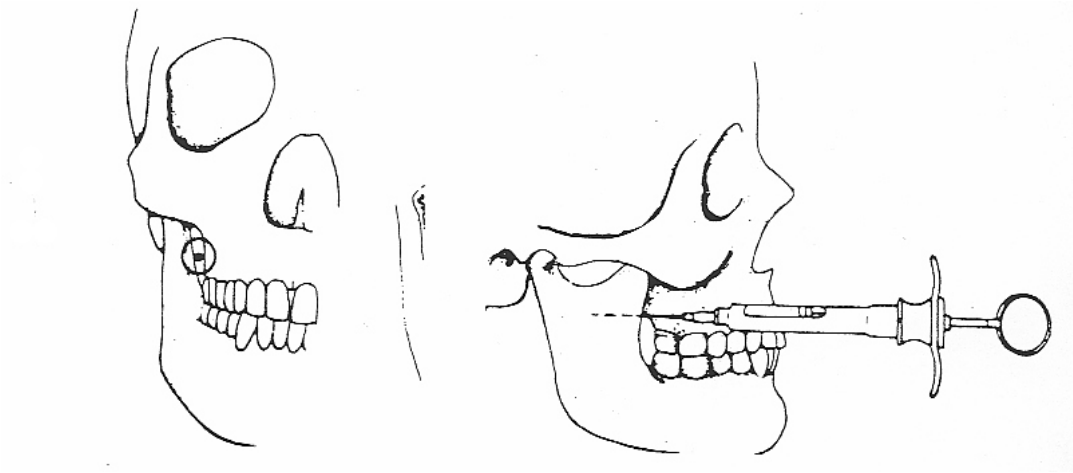


Fig 4.5.2 Closed mouth technique.

Complications

1. Haematoma < 10%
2. Trismus (rare)
3. Transient Facial Nerve VH paralysis – (Caused by over insertion of needle and injection of local anaesthetic into Parotid Gland).

Notes

1. Signs of anaesthesia – numb lip on that side and numb tongue on that side if solution deposited half way in as well or closed mouth technique used.
2. Best long term anaesthesia with Marcain 0.5% + 1.20mm Adrenaline 1:200,000 (Epinephrine).

References

Stanley F Malanea DOS, *Handbook of Local Anaesthesia*, Mosby 1997

4.6 Foot Block

Theory

1. The sole of the foot is supplied by two nerves, the tibial nerve supplies the majority of the foot and the sural nerve supplies the lateral border and the heel.
2. Blocking both nerves gives excellent anaesthesia of the sole for procedures such as laceration repair, foreign body removal or plantar wart removal. It is very useful because it is so difficult to directly infiltrate the sole.

Procedure

1. **Tibial nerve block** – palpate the tibial artery as it passes behind the medial malleolus. Inject 5-10 ml 0.5% Bupivacaine (or 1% plain lignocaine) using a 25G needle inserted either side of the artery at approximately a 45 – 60 ° angle to the skin.
2. **Sural nerve block** – use a 25G needle to infiltrate 3-5 ml of 0.5% Bupivacaine (or 1% lignocaine) subcutaneously from the superior border of the lateral malleolus to the Achilles tendon.

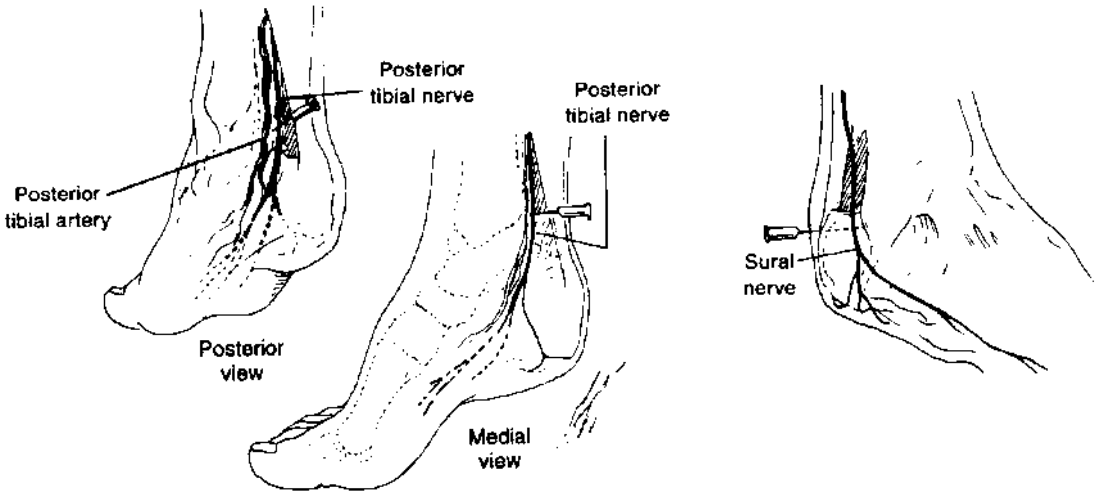


Fig 4.6.1 Posterior tibial and sural nerve blocks

Complications

1. Inadequate analgesia – it is important to wait long enough for the block to work (about 10 mins.)
2. Intravascular injection
3. Warn patient not to walk barefoot while sole is still anaesthetic.

5 OTHER

5.1 Suprapubic Catheterization - Adults

Definition

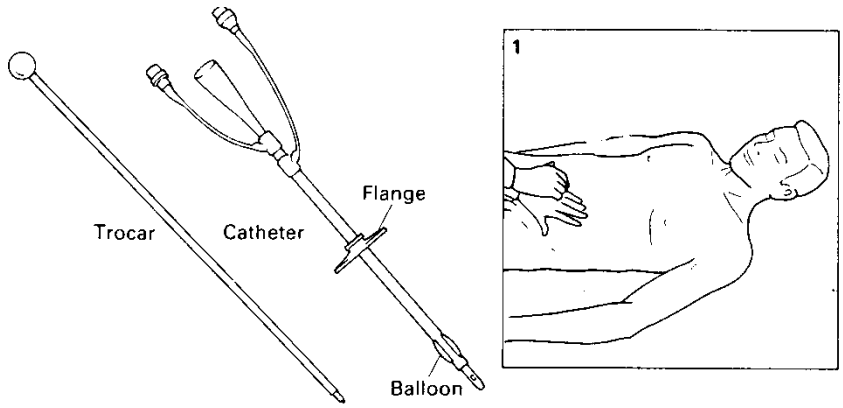
Drainage of the bladder where transurethral catheterization may be difficult or contra-indicated.

Theory

Suprapubic kits are not carried on RFDS aircraft but may be available at local hospitals.

Technique

1. Examine the abdomen and percuss the bladder.
2. Clean and drape the lower abdomen.



3. Determine a point halfway between the pubis and umbilicus. Infiltrate local anaesthetic into the skin and down into the bladder. Aspirate urine to confirm the position.
4. Use a scalpel to make a small incision in the skin down to the linea alba.
5. Check the trocar and cannula. Put the cannula over the trocar and advance the trocar at 90^{o} to the skin and push through the bladder wall. (Take great care not to push too far through the wall.)

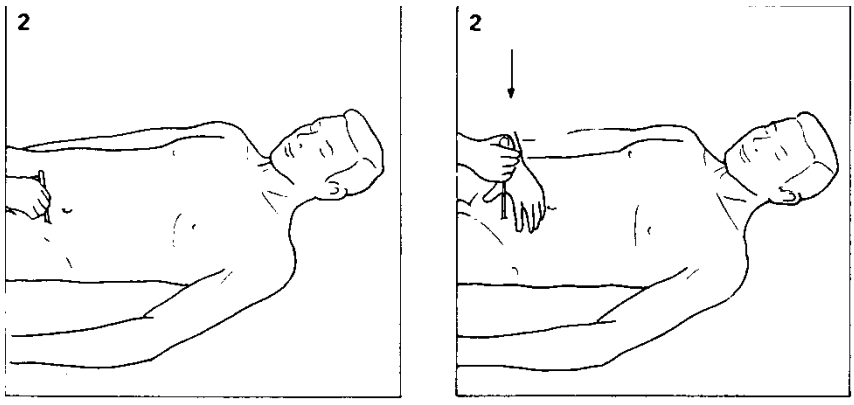
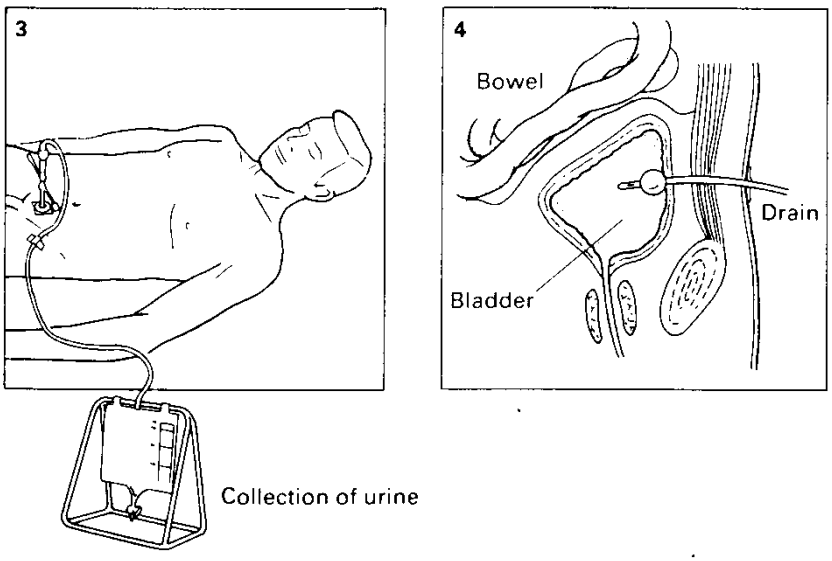


Figure 5.1.1 Suprapubic Catheterization – Adults

Suprapubic Catheterization - Adults (Continued)

6. Remove the trocar and urine should pour through the cannula. Inflate the balloon on the catheter. There should be no resistance.
7. Place a purse string suture around the cannula and secure.
8. Attach the drainage tube and catheter bag.



Special Notes

1. Useful in acute retention where urethral catheterization is unsuccessful or traumatic.
2. May be useful in trauma involving the pelvis where urethral catheterization is difficult or contra-indicated.
3. Drainage of the bladder is important for long distance transport for patient comfort and to monitor urine output.
4. Contra-indications for suprapubic catheterization include inability to percuss or palpate the bladder or presence of scars over the lower abdomen, which may be associated with tethered bowel.

Complications

1. Perforation of a viscus.
2. Misplacement of the catheter into the peritoneum.
3. Infection.

References

Soni, N. Anaesthesia and Intensive Care; Practical Procedures. Heinemann Medical Books, Oxford, 1989.