

Airway Management and Emergency Techniques in the Theater and Emergency Room

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Airway management:

Traditional endotracheal intubation uses a sterile or thoroughly disinfected endotracheal tube for each patient to prevent the spread of infectious disease. The endotracheal tube should be lubricated with a very thin layer of sterile xylocaine or K-Y jelly. The author also uses an extremely thin layer of sterile non-water-based eye lubricant to avoid the drying out of the lubricant and subsequent traumatizing removal of soft tissue during longer procedures. There is also a commercially available spray for ETT's called SILKOSPRAY by Rusch. Operators should avoid using a lubricant containing benzocaine, as this can lead to a dose-dependent methemoglobinemia (MetHb), which does not bind oxygen; most hospitals are unable to test for MetHb in clinic.

Intubation may stimulate the vagus nerve, increasing parasympathetic tone especially in dogs. This may result in bradycardia, hypotension, and cardiac dysrhythmias. If the animal has an underlying cardiovascular disease, cardiac arrest may occur. Atropine or glycopyrrolate can be given as part of the premedication. This is also a consideration when eye surgery is going to be performed or repeated movement of the head/throat region, to prevent parasympathetic stimulation.

Operators should not be forceful in the intubation technique as this can damage the larynx, pharynx, or soft palate and lead to tissue edema. Ideally, the tip of the endotracheal tube should be past the larynx and not beyond the thoracic inlet. If the tube is advanced too far, it may enter one bronchus, resulting in ventilation to only one lung. Premeasure the length of the endotracheal tube and the distance between the nose and the thoracic inlet prior to anesthesia. A general rule of thumb is once the cuff of the ETT has passed the arytenoids advance about a centimeter more, then stop. The end of the tube should be at the level of the animal's incisors to eliminate dead space and respiratory resistance.

Laryngeal Mask Airways (LMAs) for the veterinary patient were introduced by Docsinnovent with the v-gel™ for rabbits and felines (soon to have a canine and equine model), which is a modified tube that only covers the supraglottic region. Although ET intubation is the author's preferred method, v-gel™ offers a quick and easy approach when ET intubation proves too difficult. They are not ideal for animals requiring oral surgery as they take up a decent amount of space in the mouth, and there is potential for fluid leakage around the tube if undergoing a dental procedure. The other limiting factor is that they require capnography to ensure proper placement. The tubes themselves have a build in port for sidestream capnography, but also support mainstream capnography with an adaptor that will add to the total deadspace. Older sidestream machines may not be ideal for small patients as some machines require taking 50-200 ml/min of the ventilated gasses for sampling.

In the event an animal cannot be intubated, the **forced mask ventilation technique** may need to be utilized. This technique consists of fitting a patient with a mask that covers the nose and mouth with as few leaks as possible. The head should be placed so that the trachea is fully extended and as straight as possible to allow easier movement of air. There are various pre-manufactured masks, but at times it is

necessary to create a homemade mask out of syringe cases, small bottles or tubing. Taking advantage of the patient's bottom incisors case be useful for masks made form syringe cases. The technique involves using a larger suture or small sized string tied/looped around the top incisors or canines and pulled through the mask. Letting the string hang out the end and pulling taught as the non-rebreathing circuit is connected will ensure a sealed mask. Careful attention should be paid to not create ocular trauma, using careful positioning and plenty of eye lubricant. If the forced mask ventilation technique is used, it is important to remember to protect the animal's eyes. Too often a mask is left putting pressure or digging into the inferior eye socket. This technique can also lead to gas in the stomach that may need to be treated postoperatively by tubing or carefully expressing the air out.

If direct visualization of the glottis or a portion of it is not possible, Jane E. Ouandt, DVM., M.S., DACVA describes the following techniques: in the case of a pharyngeal or an oral mass, one method to use is **retrograde intubation**. A hypodermic needle is passed through the ventral aspect into the skin of the neck and into the trachea at the junction of the second and third tracheal rings. A guide wire, or canine urinary catheter that will pass easily through the needle, is maneuvered through the needle cranially into the larynx, pharynx, and oral cavity. It is then used as a guide for the passage of the endotracheal tube. After the tip of the tube is within the larynx, the needle and guide wire can be removed. The endotracheal tube is then advanced into the final position. Subcutaneous emphysema and pneumothorax are possible complications with this technique.

In an emergency situation a **tracheostomy** can be performed. Indications for a tracheostomy include to relieve an upper respiratory tract obstruction, facilitate removal of respiratory secretions, decrease dead space, provide a route for inhalant anesthesia when oral or facial surgery is complex, reduce resistance to respiration, when you are unable to orally intubate, reduce the risk of closed glottis pressure, or cough, following pulmonary or cranial surgery.

To perform a tracheostomy, make a midline skin incision on the ventral neck equidistant from the larynx and the manubrium. Part the two sternohyoid muscles on the midline and continue blunt dissection down to the tracheal rings. Make an incision transverse between the rings; keep the incision small, only big enough for the tracheostomy tube. Alternatively, make a longitudinal incision to include two or three tracheal rings. Don't place the incision too close to the first tracheal ring, or it could potentially damage the cricoid cartilage and lead to subglottic laryngeal stenosis. Place stay sutures around the tracheal ring adjacent to the incision on either side of the surgical opening. The sutures will aid in placement of the tube and are left in, labeled cranial and caudal, to help when the tube is routinely replaced or cleaned, or if it gets dislodged.

The tube ideally is two-thirds to three-fourths of the tracheal diameter. If a specifically designed tracheostomy tube is not available, an endotracheal tube can be used but may need to be cut so it is short enough that it does not go into one bronchus. Fasten the tube in place by tying it around the neck with umbilical tape or gauze. The soft tissue is loosely closed with sutures and the skin is closed with non-absorbable sutures. It is important to allow any air escaping around the tube to vent to the outside and not accumulate under the skin.

External pharyngotomy is a type of intubation that can be performed for oropharyngeal surgery or orthopedic procedures of the mandible or maxilla. This type of intubation aids in the visualization of the area and allows for normal dental occlusion so that proper reduction of jaw fractures can be achieved.

Initially place the endotracheal tube orally. Make a skin incision near the angle of the mandible. Pass hemostats bluntly through the incision into the caudal part of the pharynx. Remove the endotracheal tube adapter, grasp the tube, and pull it through from the pharynx through the subcutaneous tissue and skin incision. Replace the adapter and connect the tube to the breathing circuit. Secure with tape and suture. Extubation is done with the cuff deflated and the tube pulled through the skin incision.

Jet insufflation is a technique similar to the retrograde intubation except a small oxygen tube is connected to the need or catheter tip and the air is forcefully pushed into the lungs. It is imperative that the air can escape, otherwise lung injury can result.

Central Venous and Sampling Catheters

Objective: To describe indication, placement, and care of central venous catheters.

Introduction and Indications: Central venous catheters have many advantages over peripheral catheters, including allowing for a longer dwell time, and safer administration of more caustic solutions (diazepam CRI or Chemo) and hyperosmolar solutions such as total parental nutrition. They also allow for central venous pressure monitoring and repeated blood sample analysis. Typically, these catheters are placed in the jugular vein, but can also be placed in the caudal vena cava in the dog or medial saphenous vein in the cat.

Intracaths can also be used in larger peripheral vessels, entering into or near the vena cava.

Complications: Possible slight patient discomfort, infection, increased intracranial pressure for similar catheter to vein size ratio or during insertion. Edema of neck or sternum.

Contraindications: Jugular central lines should be avoided in patients with increased intracranial pressure; instead, use a peripheral access site. Patients with risk of thrombosis or active coagulopathy. Cervical disease or pain. Soft tissue trauma near site of catheter insertion.

Personnel: Trained RVT or assistant, DVM

Materials: We currently stock guide wire central venous catheters and through the needle kits (Intracaths). We also have the supplies for the over the needle technique using long peripheral IV catheters of larger gauge catheter sizes.

Additional supplies needed not provided in the kits:

- 11 blade surgical scalpel
- Sterile gloves
- Surgical scrub
- Monofilament non-absorbable suture
- Forceps and needle drivers
- Quarter drapes or small fenestrated drape
- Sterile gauze
- Heparinized saline
- Bandage material
- Telfa pad

Supplies for over the needle technique:

- Long peripheral IVC (18g, 14g, 16g, 20g)
- T-port or Y connector
- All supplies listed above

Guide Wire Central Venous Catheter Placement:

1. When patient is under deep sedation or general anesthesia (some debilitated patients may not need sedation or anesthesia), shave region of insertion avoiding any nick to skin.
2. Place patient in dorsal or lateral recumbency with neck extended and thoracic limbs pulled caudally.
2. Using aseptic technique, prep area for a sterile procedure.
3. Perform lidocaine bleb (recommended for patients not under sedation or anesthesia)
4. Drape area around anticipated insertion site and put on sterile gloves
5. Using the provided guide wire and catheter, pre-measure from the intended insertion site to the 3rd or 4th intercostal space. If placing in the caudal vena cava, you do not need to pre-measure unless it is a small patient.
6. Having someone hold off the vessel or using one hand, insert the provided needle into the vessel.
7. Insert provided guide wire, J shaped end, into the needle and advance forward. Stop insertion of the guide wire at the pre-measured location.
8. Before removing the access needle, make a tiny nick in the skin where the needle enters the skin to allow easier access of the dilator.
9. Remove access needle over the guide wire, using sterile gauze to apply pressure over the access site to prevent bleeding.
10. Place provided dilator over the guide wire and forcibly push/twist into soft tissue into the vessel, approximately half the length of the dilator and hold for a few seconds. Remove dilator, again holding pressure over the site with sterile gauze.
11. Feed central catheter over guide wire to desired pre-measured depth. The guide wire will exit via the shortest lumen. A piece of the guide wire should always be visible to prevent it from getting sucked into the central venous space. When the catheter is placed to the desired depth, remove the wire through the lumen access point.
12. Using a partially filled syringe with heparinized saline, aspirate all lumens until blood and any air is drawn back into syringe and then flush with the heparinized saline.
13. Add provided catheter stay device, cap all lumens after flushing, and suture the central line in place, avoiding any sharp angles.
14. Confirm placement with lateral x-ray.
15. Place a Telfa or sterile gauze over the insertion site along with a small amount of triple antibiotic ointment (TAO). Apply a light bandage.

Guide Wire Central Venous Catheter Placement:

Through the Needle Technique (Intracaths)

1. Follow steps 1-6 of the guide wire technique.
2. Using the protective sleeve, advance the catheter to desired depth.
3. When done advancing use the wing clip to secure the needle.
4. Using a partially filled syringe with heparinized saline, aspirate lumen until blood and any air is drawn back into syringe, and then flush with the heparinized saline.
5. Cap lumen after flushing and suture the central line in place, avoiding any sharp angles.
6. Place a Telfa or sterile gauze over the insertion site and apply a light bandage.

Over the Needle Technique

1. Follow steps 1-6 of the guide wire technique.
2. Place catheter into vessel like a peripheral IV catheter.
3. Add T-port or Y connector and flush.
4. Using a finger trap technique, suture catheter in place.
5. Place a Telfa or sterile gauze over the insertion site and apply a light bandage.

Catheter Care and Maintenance

1. Visually check catheter every 2 hours. Check for bandage condition (soiling, tightness or slipping).
2. Every time a lumen is used it should be cleaned first with an alcohol swab.
3. Flush every 2-4 hours with heparinized saline. All lumens should be aspirated and flushed with slightly more fluid than the priming volume. It is best to time this with sampling times.
4. Check insertion site once daily. Evaluate for any signs of infection or inflammation, as well as general cleanliness. It is advised to always wear gloves during this process. This may require carefully undoing the bandage. Apply TAO after cleaning insertion site with an alcohol pad.
5. Re-evaluate the need for the catheter daily. It should only be left in as long as the function is needed.