

Gizmos and Gadgets

Jennifer J. Devey, DVM, Diplomate ACVECC
Saanichton, British Columbia
jenniferdevey@gmail.com

Crash Cart

A crash cart can be made from a handyman's cart with multiple drawers in it (available from any hardware store) or fishing tool box. Each drawer should be labeled. Foam padding can be used to line each drawer and holes can be cut out of the foam to hold tube and bottles in place. The first drawer should contain airway materials - endotracheal tubes, a long polypropylene 3.5 or 5 Fr catheter for instilling drugs intratracheally during CPR, forceps for removal of foreign material and a scalpel or Mayo scissors for surgical airways. Mechanic's helpers available from any automotive store make very useful grabbers for oral, airway and esophageal foreign bodies. Each endotracheal tube should have a partially inflated syringe attached to the cuff and gauze attached to the tube for securing the airway once it is in place. The second drawer should contain emergency drugs and syringes (1 cc and 12 cc) preloaded with 18ga needles. The third drawer should contain hypodermic needles, peripheral catheters of various sizes, butterfly catheters, and larger 13 cm 14g and 16g catheters for pericardiocentesis and diagnostic peritoneal lavage. Syringes, tape, number 15 scalpel blades for making side holes in catheters and a 35 to 60 cc syringe with an extension set and 3-way stopcock connected should be present. All equipment should be compartmentalized in order to visualize the retrieve the appropriate equipment rapidly. Instead of compartmentalization certain supplies can be placed in labeled zip lock bags. The fourth drawer should contain fluids and administration set, extension sets, t-ports and male catheter plugs. Buretrols are useful for making up smaller volumes of fluids with additives. Blood transfusion sets and filters ideally should be available.

AMBU Bag

AMBU bags are resuscitator bags with one-way valves. A section of corrugated tubing or a rebreathing bag is attached to the end of the AMBU bag to act as a reservoir for oxygen to be stored in while the AMBU bag is squeezed, delivering positive pressure ventilation to the patient. When using an AMBU bag, conventional or high frequency ventilation can be delivered easily without concern for the pop-off valve and worrying about matching flow rates to the rates needed during resuscitation. Because the hands of the ventilator are closer to the patient he/she can "feel" the pressure developing in the lungs much better than if using a rebreathing bag on an anesthetic machine. Also pure oxygen, not oxygen that is scented or containing any anesthetic gases can be delivered via an endotracheal tube or mask if assist ventilation is being attempted. In the former case this is important because even a small amount of anesthetic can have disastrous negative consequences in an animal that is arrested. In the latter case it is important in the conscious patient that frequently objects to the anesthetic.

"Y" Connector

Oxygen is given by tubing connected to the anesthesia unit by a "Y" connection. The oxygen hosing from the source to the anesthetic machines is removed at the insertion to the anesthetic machine. A "Y" connector is inserted at the tubing. If a "Y" connector is not available then a "T" connector from the plumbing section of a hardware store is used. One end of the "Y" is connected back into the anesthetic machine via a piece of suction or oxygen hosing. The other arm of the "Y" is connected to suction or oxygen hosing and coiled up for use in emergency situations as oxygen tubing. The "Y" has 2 clamps on it- one going to the anesthetic machine and one going to the oxygen tubing. If oxygen is required the clamp is closed going to the anesthetic leading to the anesthetic circle to prevent oxygen going anywhere than to the oxygen hood, mask, nasal cannula or AMBU bag. The tubing and connectors are all available through medical supply companies but can also be purchased in home hardware stores. A commercially available mare uterine flush system can also be used in place of "Y" or "T" connectors.

Oxygen Hood (Collar)

These can be made from Elizabethan collars and plastic food wrap or it can be commercially purchased. Homemade collars should have the top ¼ of the collar open to the air. The oxygen tube is placed into the collar from the neck side and taped in place to the inside of the collar and to the outside of the collar to prevent accidental dislodgement. A roll of 1" or 2" tape taped to the outside of the underside of the collar will create a pendulum effect and help prevent the collar from rotating. Oxygen flow rates vary from 1-10l/min depending on the size of the patient. The oxygen should not be humidified to prevent moisture build-up. The patient must be monitored closely for signs of overheating – especially if the patient is panting.

Foerster Sponge Forceps

These 10" slightly curved sponge forceps should be always available for the retrieval of oral, pharyngeal and upper airway foreign bodies. A gauze sponge can be placed in the jaws and the oropharynx can be swabbed effectively to help clear an airway obstruction of mucus, blood or vomitus without having to insert fingers into the mouth of the animal. They can also be helpful when used across the hilus of the lung or spleen when these are badly traumatized and hemorrhaging badly.

Velsellum Forceps

These straight forceps have jaws with 2 sharp prongs on each side. They are very useful for grabbing smooth objects such as rubber balls that become lodged in the oropharynx.

Brake Line Suction Unit

This is a hand-held suction unit used to clear air from brake lines. It is a very effective device for suctioning airways and will generate pressures of up to 760 mm Hg. A fluid trap can be placed between the suction tubing and the suction tip to avoid having fluid accumulate in the suction unit. It can be purchased from hardware and automotive stores.

Clear Endotracheal Tube

Endotracheal Tube - The clear low pressure, high volume cuffed tube is the preferred to opaque tubes. This is because of the ability to monitor the inside of these tubes for a vapour trail or the lack of it, blood, vomitus, etc. The cuff is much safer than those in many other types since it is lower pressure than the red tubes. The cuff inflating mechanism has a one-way valve on it, making it easier to inflate. Red tubes tend to become more brittle with continued use and may create more trauma to the tracheal mucosa.

Tracheotomy Tube - The connector is removed from the end of the tube. Two incisions 180 degrees apart are made in the tube, peeling it down like a banana. Care is taken to keep the cuff inflation mechanism intact. The incisions are made so that the intact section of the endotracheal tube is the right length for the patient (i.e. from the tracheotomy incision to the thoracic inlet). The plastic connector is reattached to the tube and the split pieces are connected to gauze or sections of umbilical tape.

Chest Tube - This can be made out of a clear disposable endotracheal tube and the use of a bone rongeur to make side holes. The cuff inflation tubing needs to be tied off. The chest tubes can be sterilized by ethylene oxide or glutaraldehyde.

Mouth Gag – Sections of 3-4 mm endotracheal tube can be used to make mouth gags.

Copper Wire

Copper wire that is sanded on the tip makes a malleable stylet for endotracheal tubes. The size of the copper wire can be adjusted based on the size of the endotracheal tube.

Fluid Bags

Closed Collection Systems - Partially or completely empty fluid bags should be kept sterile and saved for use as urine collection bags for closed systems. The drip set can be left attached to the bag and tied off so it won't be used further, or the bag can be emptied, a new drip set is attached and the entire unit is sterilized as a closed collection system.

Irrigation Fluids - Intravenous fluid bags are sterile inside the outer wrap. If the outer wrap is properly opened the bag can be placed on the surgical table and used by the surgeon as sterile lavage fluids.

Dressings - Fluid bags can be emptied and opened to be used as sterile waterproof dressings for open abdominal drainage. This is ideal if there is tension due to abdominal packing, bowel edema, bowel distention, or any other situation when closure may create abdominal compartment syndrome (excessive intraabdominal pressure). The bag can be sutured in place to provide a complete seal. If only a temporary, non-waterproof closure is indicated it can be secured to the wound edges using safety pins.

Fluid bags make strong waterproof coverings to protect foot bandages from getting wet.

Autotransfusion Sets – Empty fluid bags can be sterilized with a blood administration set and kept ready for use as autotransfusion sets. The blood is collected into syringes or sterile suction bottles and then placed into the fluid bag and delivered to the patient.

Enteral Feeding Bags – Empty fluid bags can be filled with liquid enteral feeding formulas and dripped through a regular fluid administration set. The bag should be washed out with very hot water every 24 hours to prevent residue build-up and avoid bacterial contamination.

Fluid Administration Set Drip Chamber

Tracheostomy - The drip chamber is cut in half. The spiked end can be inserted in an emergency into the trachea as a transtracheal cannula. The open end will fit exactly onto an AMBU bag so that the patient can be ventilated. Since the spike is made of hard plastic that can damage the trachea, this device should not be used except in a dire emergency. As packaged these drip sets are sterile. A feeding tube can be placed into the trachea via the drip chamber and the chamber can then be removed. This provides transtracheal access for delivery of oxygen.

Tracheal Prosthesis – The drip chamber is cut into thin sections and sutured in place as a tracheal prosthesis for surgical repair of tracheal collapse.

Fluid Administration Set Line

Used fluid lines can be recycled and used as ties for endotracheal and tracheostomy tubes. The line is cut into sections of a suitable length and kept in a bag beside the anesthetic machine. The line should be stretched prior to use which will help the knot stability.

Syringe Case

Oropharyngeal Airway - A syringe case with the end cut off makes an effective oropharyngeal airway. This can be used in times of emergency when there is significant oral trauma but the larynx and trachea are functional.

Mouth Gag – The end of the syringe case is cut off and both ends are padded with gauze or tape. The case can then be inserted between the upper and lower canines as a mouth gag.

Tail Protector – Sutured tail wounds tend to rebleed when the dog knocks its tail. The plastic case is placed over the lightly padded bandage on the tip of the tail. When the tail wags the sutures are protected and repeat

hemorrhage is minimized.

Mask – The end of a large syringe case is cut off and a hole is made in the tip of the case. This can be attached to oxygen or to a gas anesthetic circuit for birds, pocket pets and other small patients.

Syringes

Mouth Gag – The ends of the syringes are cut off and both ends are padded with gauze or tape. The syringe tubing can then be inserted between the upper and lower canines as a mouth gag.

Tubing Connector – The plunger of a 1 cc syringe is withdrawn and discarded. The base of the barrel is cut off. The tip will fit all narrow gauge tubes and the barrel end will fit almost all suction hosing and oxygen hosing.

Suction Drain – The plunger of the syringe is withdrawn approximately two-thirds of the length of the barrel and an 18 ga needle is placed across the base of the barrel to stop the plunger from depressing. The tip of the needle is cut off to prevent injury. The needle is withdrawn and the plunger is depressed fully. The syringe is then attached to the suction drain and the plunger is withdrawn. The needle is reinserted creating steady negative pressure.

Slam Bags

Fluid Infusor - Fluids often need to be given rapidly to patients in hypovolemic shock. This requires that the fluids be delivered under pressure. A pressure infusor bag is an effective way of delivering pressurized fluids. The fluid bag is inserted into the pressure infusor bag and the pressure then can be inflated up to 300 mm Hg.

Pressure Cuff – The bag can be placed proximal to or over the site of a large bleeding wound (with or without padding). The bag can be inflated to a sufficient pressure to control active hemorrhage. In small animals this can be used as an abdominal counterpressure wrap (see below).

Blood Pressure Cuff

Hemorrhage Control - A Doppler blood pressure cuff can be placed proximal to a bleeding wound and inflated to 20-40 mm Hg above systolic pressure. This will control arterial hemorrhage to the region. This is especially useful for distal limb hemorrhage. Adult human thigh cuffs can be used as abdominal counterpressure wraps in small patients (see below).

Feeding Tubes

Three and a half, 5 and 8 French feeding tubes can serve multiple purposes - especially if they are made of minimally reactive material such as medical grade silicone.

Nasal Tubes – Feeding tubes can be placed with the tip in the nasopharynx or in the trachea to deliver oxygen into the respective sites. They can be placed into the esophagus or stomach and used as nasoesophageal or nasogastric tubes for decompression and feeding.

Intravenous Catheters - They make effective long central lines in dogs in which the commercial lines are too short. A 14 ga or 16 ga over the needle 2 inch catheter is inserted into the vein. A 5 Fr or 3.5 Fr feeding tube, respectively, is inserted through the catheter to the desired length. A few drops of 50% dextrose placed on the outside of the feeding tube will help the tube slide easier through the catheter. The catheter is withdrawn from the vein and the feeding tube is sutured in place and a sterile dressing is placed.

Vascular Loops - When using as a vascular loop the tube is passed around the vessel or vascular pedicle and the loop is tightened by sliding hemostats down the tubing and tightening on the vessel. This is a modified Rumel tourniquet.

Bubble Wrap

Splints - Bubble wrap makes effective lightweight splints for distal limb fractures. Radiographs can be taken through bubble wrap.

Blanket - It also can be heated in a microwave in a bowl of water to create a warm “blanket”. This can be particularly useful in the operating room.

Oxygen Tent - When placed over the front of a cage it creates an effective “oxygen tent”.

Towels

Abdominal Counterpressure - Towels can be wrapped around the pelvic limbs and abdomen of a patient and anchored with duct tape to serve as external counterpressure wraps. When doing this a towel first should be placed as padding between the pelvic limbs. A second towel is placed around the pelvic limbs wrapping from the toes to the hips in a barber pole fashion. The wrap is continued then around the abdomen to the level of the diaphragm if needed. It is anchored in place with duct tape. Care should be taken not to wrap the towels too tightly. Two fingers should easily be able to be placed under the abdominal counterpressure wrap once it is in place.

Surgical Paper Drape

Surgical drape material makes an effective water repellant outer layer for bandages. It can be sutured in place or tied in place using umbilical tape to provide a water repellant outer layer for open abdominal drainage bandages. It can be safety-pinned or taped in place to cover larger wounds.

EMMA[®]

The EMMA (Masimo, Irvine, CA) is a portable battery run capnograph. Within as short a period of time as 15 seconds the device will provide a respiratory rate and continuous capnogram and an end-tidal carbon dioxide measurement (ETCO₂). It is waterproof and has been designed to withstand being dropped. Capnography provides a continuous noninvasive assessment of ventilation and the ETCO₂ provides an estimation of the PaCO₂. The ETCO₂ provides information about pulmonary blood flow in the face of severe hypotension. During anesthesia if the ETCO₂ drops below 18 mm Hg the arrest is imminent. During CPR if the ETCO₂ rises to 15 mm Hg or higher return of spontaneous circulation is very likely.

Radical 7[®]

The Radical 7 (Masimo, Irvine, CA) is a portable pulse oximeter that continuously calculates a plethysomographic variability index or pleth variability index (PVI). The PVI is an assessment of changes in the amplitude of the pulse oximetry waveforms during different phases of respiration. Patients do need to be mechanically ventilated to maintain consistency in changes in intrathoracic pressure. In the face of hypotension the PVI will indicate whether a patient is likely to be fluid responsive or not.

Kitty Kollar[®]

The Kitty Kollar[®] (Orange, CA) is a collar designed to replace a standard bandage for an esophagostomy tube. It is made of a soft padded washable fabric. The tube exits the collar through a buttonhole and a Velcro hook and loop fastener secures the tube to the collar. The collar is secured around the patient's neck with a Velcro tab.

References available on request.