

THE FIRST 5 MINUTES

Keeping them alive!

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HOSPITAL READINESS

Along with the first responders, the veterinary team plays an integral role in initial evaluation and stabilization of the emergent and critical patient. Increased public demand for state-of-the-art emergency care obligates the veterinary team to provide quality care or make a direct referral to an emergency facility. By practicing organized team work and hospital readiness, the veterinary team can provide successful resuscitation and stabilization of the emergent patient.

Teamwork is essential in any emergent situation. By pre-assigning roles and practicing responses to various life-threatening situations, valuable time is saved, and patient morbidity is decreased. In-hospital training and practice sessions with animal models help the team respond as an effective unit.

Veterinary hospital readiness consists of providing a place for receiving, assessment of and treatment of the emergent patient. The area should be free of obstacles, and transport of the animal to the area should be uncomplicated. The area should have basic equipment and drugs required for resuscitation of the most life-threatening conditions. Hair clippers should be in the ready area for intravenous (IV) catheter placement. Isotonic crystalloid fluids with attached intravenous administration sets can be hanging ready to use in the receiving area. Synthetic colloid fluids should be kept nearby. It is ideal to have supplemental oxygen and suction units as well as small and large ambu bags and oxygen administration sets in near proximity of the resuscitation area. This is why many veterinary clinics establish a ready area near the anesthesia equipment.

For those practices that see a large volume of emergencies, setting up a large mobile cart housing the instruments and equipment is of great value.(Table 1) Otherwise, maintaining a tackle box with emergency equipment and drugs can be an inexpensive way to provide emergency care.(Table 2) Having a clipboard with a CPR record and an attached CPR dose schedule (Table 3) facilitates record keeping, billing and drug calculation and administration. Equipment and drugs should be inspected daily, and following resuscitation, to ensure that the ready area is set up for the next emergency situation. Marking a check-off list, which itemizes the contents, allows anyone to perform the inspection. The equipment and drugs should be rotated with the hospital supply monthly to avoid waste due to expiration.

These preparatory measures will make any veterinary team ready for most emergency presentations. Additional preparations can be made as incoming calls are taken and information gathered.

FIRST AID AND TRANSPORT

Owners can provide significant medical assistance at the scene of the injury. The person taking the call must try to determine from the owner what the mentation, breathing pattern and perfusion status of the pet is at the time of the telephone conversation. The first concern is for the safety of the owner. Instruct the owner to survey the scene and to move to a place of safety. The nicest animal can become vicious and aggressive when it is painful or has anxiety. Placing a light cloak or cloth over the head of the pet can remove light and sound - external stimulus that add to fear and aggression in the pet. Cats can be placed in dark boxes to minimize stress during transport. The owners should place air holes and a hole large enough for observation of the animal.

When moving the animal, try to minimize motion of the head, neck and spine. Using a flat, firm board of wood, cardboard or thick fabric that provides support is a suitable method. These materials will allow radiographs to be taken through the board without having to move the animal. Animals suffering respiratory distress should have limited activity during transport, and allowed to maintain a position of comfort. If a foreign object is causing an upper airway obstruction, the owner is instructed on how to perform a Heimlich-type maneuver.

If they are not breathing, mouth-to-nose resuscitation and chest compressions may provide enough respiratory and circulatory support to maintain life during transport. After it has been established that the



animal is unconscious and not breathing, the owner is instructed to extend the pet's head and neck, pull the tongue forward and close the pet's mouth, and to place their lips over the pet's nostrils. They should give 3-4 strong breaths initially into the nostrils. Frequently, this initial breathing action is enough to initiate spontaneous ventilation if there has been a respiratory arrest from a vasovagal reflex.

Should breathing not become spontaneous, the owner should breathe for the pet 10-12 times per minute. If they are calm enough, they can be taught to compress the esophagus behind the trachea so that the majority of the air will go down the airway instead of into the stomach. If they do not detect a heartbeat, they can perform chest compressions and assisted ventilations at a 5:1 ratio. Of course, someone else will have to drive during transport.

Owners must be asked if there is ongoing hemorrhage or if there was bleeding seen at the site of injury. Slow, dark, oozing blood is generally low pressure, venous blood. Direct digital pressure is often enough to stop the bleeding. If there is a laceration on a distal limb with venous bleeding, elevating the limb above the level of the heart is often enough to stop the bleeding. Active, red, pulsating, arterial bleeding should be controlled by direct digital pressure, and placement of a pressure bandage over the bleeding site. Any long pieces of fabric or gauze can be used. Often washcloths and hand towels are adequate when applied with mild pressure. Should the blood soak through the bandage, additional material is placed over the original bandage. Surgical wounds that have broken open should be protected with a bandage prior to transport, to prevent further dehiscence.

Penetrating foreign objects should remain in place with the owner guarding against further penetration or movement of the object. When an arrow has penetrated a body cavity, there is the potential for the blades to lacerate organs or blood vessels if the shaft of the arrow is allowed to move during transport. It is often necessary to stabilize the shaft of the arrow just outside the body. The owners can be instructed to stabilize the shaft with pliers close to the entrance site, and holding it firmly, cut off the shaft. The arrow will then be removed surgically as soon as possible. Penetrating objects are immediately removed only when they obstruct the airway.

Fractures below the elbow or hock with significant displacement should be supported. The owner can make a support splint from a rolled newspaper or magazine, which is then secured in place by long pieces of fabric or duct tape. Because cats often move aggressively to remove bandages, the cost benefit ratio must be carefully assessed before placing the bandage in each individual cat.

Animals with altered mentation after trauma should be transported with the head and neck level or slightly elevated 20 degrees. There should not be any jerking or thrashing motions and compression of the neck or jugular veins should be avoided.

Once it has been determined that a patient with a potentially life-threatening problem is due to arrive, the treatment staff should be notified verbally. A dry erase board can be placed in the general treatment area and all animals listed that are due to arrive, with their estimated time of arrival and presenting complaint noted. This allows the treatment staff to plan their time and procedures efficiently.

Common complaints that indicate life-threatening problems, and motivate the team to be as ready as possible ahead of time include:

hit by car, dog fight, falling from height, gunshot, stabbing, potential toxicity, inability to urinate, abdominal distension, labored breathing, seizures, collapse, altered consciousness, profuse bleeding, dystocia, snake bite, prolapsed organs, heat stroke, severe cold exposure, electrocution, and burns.

The nursing staff should have an idea of the usual procedures and equipment required for the critical presenting complaints. The equipment that is usually needed is laid out ahead of time, so that any patient needing life-saving intervention, time is not wasted searching for materials. There should be a list compiled by the nurses, under the supervision of the veterinarians, of the equipment, drugs and materials needed, termed "set-ups". There will be different set-ups for different problems.

Once the patient arrives at the clinic, the person taking the call will notify the nurse or clinician that a triage (with or without a gurney) is required. A quick statement identifying the presenting complaint and an indication of the urgency (whether "stat" or not) completes the immediate information.



Triage

Triage is the art of giving priority to patients and their problems upon presentation to the hospital. The primary complaint and the time of onset are obtained, and the animal is removed from the carrier or towel and quickly examined for abnormalities. Significant changes require that the patient be taken directly to the treatment area. There are several historical or observed problems that warrant immediate triage to the treatment area, to include:

trauma, profuse diarrhea, urethral obstruction, labored breathing, altered mentation, seizures, loss of consciousness, excessive bleeding, history of poisoning, prolapsed organs, potential snake bite, heat prostration, open wounds exposing extensive soft tissue or bone, signs of shock, anemia, burns, dystocia, and expired animals (for the client's benefit)

The emergent patient presents a special challenge because the underlying problem may not be evident for 24-48 hours post-presentation. The problems can arise from an acute illness, from a chronic illness that has decompensated, or from an unexpected complication of another illness. All post-operative patients are considered critical care patients until life-threatening anesthetic or surgical complications are ruled out.

The GOLDEN RULE of emergency medicine is "**treat the most life-threatening problems first**". Therefore, the animal's airway, breathing, circulation and mentation must be rapidly assessed (Table 4). Patients with catastrophic problems (airway obstruction, respiratory failure, and circulatory failure) can die within seconds if left untreated. Severe problems are life-threatening but allow more time for stabilization. The diagnostic, monitoring and therapeutic procedures must be coordinated with a coherent priority approach as the patient moves from the emergency situation, to surgery or diagnostic procedures, and then finally to the critical care area.

Variables that contribute to the overall success of patient resuscitation include the severity of the primary illness or injury, the amount of fluid or blood lost, patient age and previous health problems, the number and extent of associated medical conditions, time delay in instituting therapy, the volume and rate of fluid administration, and the choice of fluids - crystalloid, blood components, synthetic colloids. Therapy must be done at the right time, in the right amount and in the right order. **Therapeutic failures are generally not from ignorance but rather from failure to act expeditiously at a crucial moment.**

Primary Survey

Airway: The airway is cleared and the head and neck gently extended, pulling the tongue forward, and carefully clearing the mouth of any foreign objects, mucus, blood or vomitus. Tracheal intubation, either orally, or via slash tracheostomy will provide an immediate airway. In situations of airway compromise in a partially conscious animal, mild sedation utilizing benzodiazepine or opioid derivatives may be necessary to facilitate intubation, or a transtracheal oxygen catheter can be placed providing oxygen flow at 0.5ml/kg/min. If a foreign object is unable to be easily removed, a Heimlich-like maneuver can be performed. If intubation is not necessary, 100% oxygen is always supplemented by mask, bag, nasal cannula, or flow-by.

Breathing: Positive pressure ventilation by hand to an inspiratory pressure of 15-20cmH₂O for the dog and 10-15cmH₂O for the cat is required. Fluid in the airways will increase pressure requirements, and suctioning should be performed. Respiratory arrest is not always associated with cardiac arrest. When it is determined that there is no heartbeat, then CPR measures are instituted. When the heart is beating, the chest is evacuated of air or blood. If fluid or air is suspected, a chest tap should be performed before any radiographs are taken. A negative tap does not necessarily indicate a normal pleural space. If a pneumo- or hemo-thorax is suspected, pleural evacuation with thoracocentesis or chest tube placement is performed. In cases of tension pneumothorax, a small incision is made for immediate release of pleural air until a chest tube can be placed and continuous suctioning supplied. Mechanical ventilation will insure adequate tidal volume in this case.



Circulation: Hemorrhage is controlled, and vascular access rapidly obtained. Dose and type of fluid administered, and pharmacological intervention is determined by the level of shock and existing problems present.

Level of Consciousness: If there is a reduced level of consciousness, careful handling of the patient is necessary. Keep the head and neck as level as possible and limit any compression of the neck which may reduce jugular drainage. Avoid placing anything into the nostrils which may stimulate sneezing and an increase in intracranial pressure. Transport the patient on a flat surface between areas of the hospital.

Level of Pain: Pain elicits the same responses as circulatory shock. Treatment using intravenous agonist opioids can provide immediate relief. Adding benzodiazepines can reduce the overall need for opioids. Both are titratable and reversible (naloxone for opioids and flumazaniil for benzodiazepines).

Secondary Survey: History, Physical Exam and Data Base

Following the triage and resuscitation process, more information is obtained from the owner. The presenting complaint and information of when the animal was last normal should have been obtained at the time of triage. Chronology and progression of signs is also important. Organ systems not involved are reviewed, and background information (including previous medical problems, drug therapies, allergies, vaccination history, and previous transfusions) is obtained. A thorough physical exam involving the entire dog, including rectal and genital exam, and vital signs is required.

On every emergent patient, an initial database consisting of packed cell volume (PCV), total solids (TS), dextrostick, azostick, electrolyte and venous blood gas panel are performed. Depending on the situation, a blood smear, saline agglutination, prothrombin/activated partial thromboplastin time as well as urine specific gravity and dipstick pre-fluid therapy can provide baseline values and early detection of abnormal values. Lavender, red and blue top tubes are filled with pretreatment blood samples for complete blood count and serum chemistry analysis when time permits.

Important keys to successful patient management

- * Identify and treat the most life-threatening problems first.
- * Make the patient as stable as possible before undertaking stressful procedures.
- * The critical patient is rapidly changing and requires intensive monitoring and frequent re-evaluation.
- * It is important to anticipate complications and initiate monitoring procedures for early detection.
- * It is the trend of change in monitored parameters that are more significant than a single value.
- * Make sure that the treatment orders are clear and concise and that the technical staff and clinicians are making the same interpretations of monitoring values and treatment regimes.
- * Many post-trauma complications do not become evident for 24-72 hours. Do not take a patient's stable condition for granted.
- * There is less tolerance for error, indecisiveness, or delay in the critical patient.



TABLE 1 Emergency Equipment for a Crash Cart

Endotracheal tubes: #3, 5, 8, 10, 14, with cuff-inflating syringes already attached and stylets in place
Laryngoscope: large and small blades
Emergency drugs: epinephrine, lidocaine, atropine, calcium gluconate, etomidate, insulin, dextrose, sodium bicarbonate, and assorted syringes (1-, 3-, 6-, 12-cc) with needles attached
Surgical scrub and taping material: for IV catheter placement and surgical procedures
Drug administration: IV catheters: 14, 16, 18, 20, 24 gauge, intraosseous catheters, central venous catheters, polypropylene tubes (for intratracheal administration of drugs)
Chest aspiration setup: 1.5"- 18 and 22 ga. needles, 3-way stop cock, extension set, 60cc syringes; #10 scalpel blade
Stat database: capillary tubes and clay for PCV/TS, dextrose, BUN, venous blood gas and electrolytes
Foreign body retrieval forcep: Sponge or Velselum forceps
Minor surgical pack: to include instruments for emergent thoracotomy, tracheostomy, and thoracostomy tube placement
ECG, Blood pressure with multiple cuff sizes
Pulse oximetry, End tidal CO₂
Defibrillator: with internal and external paddles
Suction apparatus: with Yankauer and flexible tips
Oxygen supply dedicated to area

TABLE 2 Emergency Equipment for a Tackle Box

Endotracheal tubes: #3, 5, 8, 10, 14, with cuff-inflating syringes already attached and stylets in place
Laryngoscope: large and small blades
Emergency drugs: epinephrine, lidocaine, atropine, etomidate, and assorted syringes (1-, 3-, 6-, 12-cc) with needles attached
Surgical scrub and taping material: for IV catheter placement
Drug administration: IV catheters: 14, 16, 18, 20, 24ga, 3.5 and 8 French polypropylene tubes (for intratracheal administration of drugs)
Chest aspiration setup: 1.5"- 18 and 22ga. needles, 3-way stopcock, extension set, 60cc syringes; #10 scalpel blade
Stat database: capillary tubes and clay for PCV/TS, dextrose, and BUN

TABLE 3 DOSE SCHEDULE FOR CARDIOPULMONARY RESUSCITATION

DRUG (ml, IV)	STANDARD DOSE	2.5 kg	5 kg	7 kg	10 kg	12 kg	15 kg	17 kg	20 kg	25 kg	30 kg	35 kg	40 kg	45 kg
Epinephrine (1:1000, 1 mg/ml)	0.2 mg/kg	0.5	1. 0	1.5	2. 0	2.5	3. 0	3.5	4.0	5. 0	6. 0	7. 0	8. 0	9. 0
Atropine (0.5 mg/ml)	0.05 mg/kg	0.25	0. 5	0.7 5	1. 0	1.2 5	1. 5	1.7 5	2.0	2. 5	3. 0	3. 5	4. 0	5. 0
Lidocaine (20 mg/ml)	2.0 mg/kg	0.25	0. 5	0.7 5	1. 0	1.2 5	1. 5	1.7 5	2.0	2. 5	3. 0	3. 5	4. 0	5. 0
Sodium bicarbonate (1 mEq/ml)	1.0 mg/kg	2.5	5. 0	7.5	10	12. 5	15	17. 5	20	25	30	35	40	50
External Countershock	2-20 ws/kg	25	50	75	10 0	125	15 0	175	20 0	25 0	30 0	35 0	40 0	50 0
Internal	1-2	2.5	5	7.5	10	12.	15	17.	20	25	30	35	40	50



Countershock	ws/kg					5		5					
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TABLE 4 Physical parameters evaluated at triage

<u>Parameter</u>	<u>Abnormality</u>	<u>Interpretation</u>
Airway	no air passage loud sounds inspiratory expiratory	total obstruction or respiratory arrest partial upper airway obstruction pharyngeal/laryngeal intrathoracic trachea or bronchi
Breathing patterns	loud sounds dysynchronous synchronous expiratory push minimal effort and cynaosis not breathing	upper airway obstruction pleural space disease parenchymal small airway neuromuscular paralysis (paralyzed patient) respiratory arrest
External hemorrhage	pulsing blood slow oozing	arterial venous
Capillary refill time	< 1 second > 2 seconds	hyperdynamic state or peripheral vasodilation poor peripheral perfusion, vasoconstriction
Mucous membrane color	white blue brown petechiation brick red yellow	anemia, severe shock, poor oxygenation cyanosis methemoglobinemia thrombocytopenia hyperdynamic shock icterus
Pulse intensity	weak bounding	poor peripheral perfusion hyperdynamic perfusion
Heart rate	Dog: >200 bpm < 60 bpm Cat: >250 bpm < 150 bpm	poor coronary diastolic filling impaired cardiac output poor coronary diastolic filling impaired cardiac output
Level of consciousness	uncontrolled hyperexcitability obtunded seizures, stupor, coma	consider toxins increased intracranial pressure hypoglycemia, electrolyte abnormality hepatic failure
Wounds or fractures	open, unstable	bacterial invasion, nerve and muscle damage

