

## **A HBC Enters your Clinic. Step by Step of What to Do**

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### **INTRODUCTION**

At some point every veterinary clinic will have the surprise emergency hit-by-car (HBC) arrive. It's important to be able to deal with the client in an effective manner so that treatment to the pet can occur in a timely manner. Being able to take a step-by-step approach to the trauma patient will allow you to provide fast and effective care.

### **TRIAGE**

All HBC pets are emergencies. This includes if the pet seems completely "normal" after being hit. Adrenaline is usually released in large quantities when the pet experiences blunt trauma. Adrenaline acts as a pain reliever and helps to elevate the heart rate. Because of this, the pet may get hit and then immediately act as if nothing happened. Unfortunately this can mask underlying signs such as pulmonary contusions or internal bleeding.

One of the fastest and most effective ways to triage is by using the RAP system: Respiration, Alertness, Perfusion. Immediately upon entering the hospital a technician should listen to the heart and lungs and check the mucous membranes and pulses. Most times the pet is experiencing some type of shock and will need emergency treatment. Being able to communicate to the owner what is going to happen is important.

### **DEALING WITH THE CLIENT**

Client reaction can be completely unexpected. It's important to remember to not become emotionally involved yourself. Maintain a calm and professional attitude at all times. Clients may express sadness, anger, indifference, confusion or be in a state of shock themselves. No behavior is inappropriate except one that involves a physical threat or a danger to you or the clinic. Remember that if the client is yelling, they are likely upset about the situation, not at you directly. Reacting to a client will only fuel their emotions. Clients act out because they are unsure of the future of their pet and they are fearful.

- Owners of these pets should be informed in a clear concise manner of WHY, WHAT and HOW MUCH.
  - WHY their pet needs emergency treatment
  - WHAT is going to be done to their pet
  - HOW MUCH it is going to cost (rough estimate)
- Owners must then be given a brief timeline of what to expect

### **SHOCK**

In order to understand how to treat the HBC pet you must understand what shock is. Shock is defined as the decline in vital organ function due to maldistribution of blood causing oxygen and nutrients to be inadequately delivered. It is the body's life-saving mechanism because the body pulls blood from non-essential areas (legs, GI tract) and pushes it to essential areas (heart, brain, lungs).

There are three main phases of shock: Early, Decompensatory, Terminal. In the early phase the animal may actually appear normal. The circulatory system becomes compromised causing baroreceptors in aortic arch and carotid arteries to detect a decrease in cardiac output. The baroreceptors stimulate the sympathetic nervous system, which causes catecholamines (epinephrine) to be released. The release of the catecholamines causes:

- Heart Rate Increases (the key indicator that the pet is in the early stage of shock)
- Cardiac Contractility Increases
- Vasoconstriction Occurs
- Blood Flow Decreases To GI Track, Muscle and Skin
- Splenic Contraction (falsely elevated increase blood volume by 20% more)
- Decrease Oxygen Delivery To The Tissues

Ultimately if treatment is not initiated in the early stage, the body may be able to either pull itself out of shock or the shock may worsen. It is possible that the pet gets hit by a car and immediately goes into the decompensatory or terminal stage of shock. This decompensatory stage is marked by:

- Multiple Organ Failure
- Low Temperature
  - Due to the continued poor perfusion and hypotension
- Poor Pulses
- Pale/Muddy Mucous Membranes
- Prolonged Capillary Refill Time
- Tachycardia
- Depressed Mentation

Unfortunately, most pets are not responsive to treatment if they are in the terminal phase of shock. This phase is characterized by:

- Bradycardia
  - The heart is no longer able to keep up with the demand
- Hypotension
- Heart Failure
- Severe Mental Depression
- Abnormal Respiratory Pattern
- Cardiopulmonary Arrest

It is important to note that in dogs the shock organ is the gastrointestinal track. This means that post-shock dogs generally experience GI symptoms including ileus, diarrhea or melana. In cats the shock organ is the lung. Post-shock cats often experience respiratory problems.

### **STEP-BY-STEP: A 10 Step Approach**

*Immediately upon a HBC pet arriving a veterinarian should be notified of arrival. This does not mean that initial treatment should be put on hold while a veterinarian is notified since it may take a couple of minutes for notification. Instead benign, non-invasive treatments should begin.*

- 1) Triage using R.A.P.. Minimally obtain heart rate, pulse, mucous membrane color and note respiratory effort.
- 2) Notify the owner of WHY, WHAT, HOW MUCH
  - *Your dog is in shock. He needs treatment in order to save his life. We are going to need to place an IV catheter, start fluids and perhaps run some bloodwork. This will cost between \$300-\$600. Is this okay? The doctor will be out to speak to you once we have Fido a little more stable*
  - Get a signed form that allows you to treat
- 3) Obtain blood pressure, pulse ox and attach ECG
- 4) Administer oxygen if in shock, respiratory distress or if you are unsure of pet's condition
- 5) Obtain official set of vitals (T, P, R) if there is time and if it is appropriate  
(If pet is in the decompensatory or terminal stage of shock procedure to step 6)  
***Initiate CPR immediately at any point if pet arrests***
  - Temperature
  - Heart Rate With Pulses
  - Respiratory Rate With Effort
  - Mucous Membranes
  - Mentation
  - Capillary Refill Time
- 6) Place IV catheter(s), attach 3cc syringe and draw back to obtain ideally 3mls of blood
  - Run PCV, TS, BG
  - Run any other bloodwork prescribed by veterinarian
- 7) Start fluid therapy if appropriate and consider pain medication
- 8) Obtain approval for other treatments (radiographs, ultrasound, medications)
  - Update owner on pet's status
- 9) Veterinarian should have a basic diagnosis and prognosis and should speak to owner at this point
- 10) Continue to work on stabilizing pet
  - Prepare pet for hospitalization and further treatments

## **TREATMENT OF HBC PET**

It is important to obtain permission from the owner before treatment can begin. Having them sign a consent form to treat and explaining exactly the procedures that are going to take place will help to avoid confusion as well as help to protect the practice and staff involved.

The goal for any emergency is to return the circulatory system back to normal by working to perfuse the organs and provide adequate oxygen delivery to them.

Providing oxygen is important for any patient in any type of shock or respiratory distress. If you are unsure whether the pet needs oxygen, it is better to give it than to not. The goal is to administer oxygen the most effective and least stressful way to the patient. Flow-by Oxygen is effective, but usually only if owners are there to administer it because animals in general do not like air blowing on their noses. The efficacy of flow-by is still debated because of the extreme variables. The flow rate, the distance of the tubing from the patient's nose and the movement of the patient all contribute to how much oxygen the patient actually intakes. Administering oxygen via a face mask is more effective, but generally not tolerated if the patient is alert at all. Studies have shown it to be very effective at administering 60% FiO<sub>2</sub> very quickly. The disadvantage is, if the diaphragm is left on, the patient cannot appropriately exhale CO<sub>2</sub>.

Oxygen hoods have a particular advantage because they tend to be more tolerated in alert animals and allow for patient movement. Roughly 75% of an Elizabethan collar should be covered. The remaining 25% allows for ventilation and the escape of CO<sub>2</sub>. The oxygen line is placed through the e-collar so that it rests in front of the patient nose. FiO<sub>2</sub> levels can get up to 80% very quickly. Lastly the oxygen cage is good at providing oxygen support, but it is impossible to work with the patient while they are in the cage.

Depending on the nature of the emergency it may not be able to get a full set of vitals right away. The importance of obtaining a temperature or capillary refill time may not be as important as initiating CPR. When appropriate all vitals should be obtained at some point. In addition to performing a full physical exam all HBC patients should receive a blood pressure, an ECG and a pulse ox.

Gaining venous access is important in all HBC pets. You should place 1-2 peripheral catheters that are short and large diameter. As a general rule, healthy patients that are 2-5 pounds should receive a 22g, 1" (2.5cm) over-the-needle catheter. Healthy patients that weight 5-20 pounds should receive a 20g, 1-1.25" (3.1cm) over-the-needle catheter. Patients that weight 20-75 pounds should receive a 18g, 1.25" (3.1cm) over-the-needle catheter. Anything greater than 75 pounds should have a 16g over-the-needle catheter placed. Exotics and neonates should receive 24g over-the-needle catheters. Studies have shown that short, large diameter catheters allow for higher fluid flows and increasing the diameter of the catheter by one size can cut the time it takes to bolus a liter of fluids by half. This may mean the difference between life and death to a patient. The above recommended IV catheter sizes are merely a guideline. When a pet is hemodynamically unstable you may have to choose a smaller gauge catheter because of smaller-than-normal vein size or poor integrity of the vessels. The most common peripheral catheter locations are the cephalic, saphenous and femoral. Peripheral catheters can also be placed in the dorsal pedal vein, aural vein, umbilical vein (neonates) and jugular vein (neonates/exotic). If venous access is too difficult to obtain attempting a cut-down or placing an intra-osseous catheter should be considered.

When you place the peripheral catheter, you should attempt to draw blood from it first before you flush or start any fluids. This is the fastest way to obtain blood without performing another venipuncture stick. This method may not always be successful depending on the patient's perfusion. All emergency patients should have a PCV, TS BG and lactate run. Lactate is a measurement of anaerobic metabolism and becomes built up in the blood stream during periods of poor perfusion. In some cases lactate may be the only indicator that a perfusion problem of the microvascular system exists. Values under 2 mmol/L are considered normal. If the pet initially has a high lactate, giving fluids should help correct the hyperlactatemia. The veterinarian may prescribe other bloodwork for the pet (CBC, Chemistry, blood gas). If blood cannot be obtain through the IV catheter, IV fluids should be initiated. Once the patient is stable it may be easier to obtain blood from another peripheral vein.

Pain can increase and even cause shock, so it is important treat the pain. Opioids are great because they have limited effects on hemodynamics. Unfortunately there continue to be many false thoughts about the benefits of pain (helps to inhibit patient movement, can't fully assess the patient, etc). It is has been proven that recovery time is greatly reduced when pets experience less pain.

There are very few other treatments that need to be performed that are emergent. Permission from the owner should be obtain for any other diagnostics. While obtaining radiographs or an ultrasound may yield a better diagnostic picture, it is always important to

stabilize the patient first. A team member should alert the owner as to the pet's status, what is being done to help the pet and how long it will be until the veterinarian is able to speak with them.

#### **IV FLUIDS**

There are two types of fluids that can be given: Crystalloids (the most common) and Colloids. Interestingly enough there is no clear consensus that proves one type of fluid reduces mortality.

There are three types of crystalloids: Isotonic (LRS, Norm-R, P-Lyte, Hypertonic (7-7.5% NaCl), Hypotonic (0.45% NaCl). Isotonic crystalloids are still the most common used. They are similar to the body's extracellular fluid by containing similar electrolyte concentrations (sodium, chloride, potassium, magnesium, calcium and bicarbonate-like anions). Isotonic crystalloids will distribute rapidly. Within 30 minutes 75-98% of the fluids shift into the extravascular space. You need large volumes in order to make a difference and the infusion must be continuous.

Hypertonic fluids contain a higher osmotic pressure than isotonic. Useful when large volumes cannot be given fast enough. Hypertonic saline causes fluid to shift from the intracellular space to the extracellular space, which causes improved venous return and cardiac output. One dose equals four times the volume of isotonic saline. The use of hypertonic saline is also known as limited-volume resuscitation and is currently recommended in head trauma cases. It helps to reduce cerebral swelling without worsening edema.

Hypotonic fluids contain a lower osmotic pressure than isotonic (5% Dextrose in Water, 0.45% NaCl). Hypotonic fluids should NOT be used to treat shock because they contain too much water and will redistribute too quickly.

Colloids (hetastarch, albumin, plasma, blood) are high molecular weight fluids that do not pass readily through the capillary membranes. Colloids help to increase oncotic pressure because they keep fluids in the intravascular space. Roughly 50-80% of the infused volume stays in the intravascular space. Most veterinarians reach for colloids when crystalloids fail.

#### **WHAT TO DO IF THE PATIENT ARRESTS**

- 1) Start chest compressions **FIRST**
  - Studies have proven that starting chest compression before gaining access to an airway offers the best chance of survival
  - Perform 100-120 bpm while pet is lying on their side (stayin' alive)
  - Remember that chest compression are more important than anything else you will do for CPR
- 2) Intubate **SECOND**
  - One breath every 6 seconds
  - No studies have proven that administering 100% oxygen offers a better chance of survival.
- 3) Obtain venous access (ideally at the same time as someone is trying to gain an Airway)
- 4) Consider drugs if needed
  - CPR drugs can be given via trachea, but have slower absorption times and usually require 5 times larger dose.
  - ATROPINE: Bradycardia

- EPINEPHRINE: Asystole
- IV FLUIDS: Just enough to keep the catheter patient. Large volumes should only be given for hypovolemic shock. Recent studies have shown that large boluses for all other causes of arrest cause a decrease in coronary perfusion.

## **CONCLUSION**

Dealing with the surprise emergency starts with the owner. Administering oxygen for any shock or respiratory distress is important in helping to maintain adequate oxygenation to the organs. Stabilization occurs through improving tissue perfusion by IV fluids. Once the patient is more stable, further diagnostics can occur.

It is important to be organized and take a step-by-step approach with any hit-by-car. Failure to do so can cause added stress to the situation and may delay patient care. Having all members of the team understand what steps need to be taken can mean the difference between life and death for the patient.

*References Available Upon Request*