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Shock Talk

Shock is a common syndrome experienced by many patients in many scenarios. Can you recognize it in your patients? This talk will help you learn to recognize, treat and monitor shock.

Before we begin, it's important to understand the difference between perfusion and hydration:

- Perfusion: refers to intravascular volume and cardiac output. The volume of fluid that is circulating through the body and the strength of the cardiac contractions to move the fluid.
- Hydration: refers to interstitial volume and intravascular volume. Strictly speaking of the amount of fluid within the vessels and in body tissues.

When we talk about shock we are really talking about a deficit of supply and demand. Every cell in the body requires ATP to protect cell wall integrity and perform cellular functions. ATP has a life span of 3 seconds, so cells are constantly making ATP. The body needs oxygen to create this ATP. Without oxygen cells begin to die. In a shock situation, because the body is no longer perfusing tissues as it should, oxygen distribution is interrupted, ATP production decreases and cells die.

The body is set up to try and avoid this cell death, and baroreceptors are the back-up. They are located in the aorta and sense when blood flow gets low. They tell the heart that blood flow is low and compensation kicks in. This compensation shows up as the clinical signs of shock.

So let's get back to perfusion and hydration. When we collect vital signs and perform serial exams on our patients we are checking signs of perfusion. We can measure perfusion by looking at the patient's mucus membranes/CRT, by assessing pulse quality, and looking at heart rate. Make sure to look at all three together. A dog may have good pulse quality but if his heart rate has to be elevated to maintain that quality the dog isn't normal. If perfusion begins to decrease the body will start to preferentially take care of organs; the heart/lungs/brain being the most important. Tissues in the periphery will start to get decreased blood and oxygen supply.

To measure hydration we look at skin turgor, mucus membrane moisture, and the patient's eyeballs. Eyes that are sunken indicate severe dehydration, as does prolong skin tenting and dry tacky mucus membranes.

There are four main categories of shock:

- The first is hypovolemic shock. Hypovolemia (low volume) is caused by salt and water loss and/or blood loss. Most commonly we see this category of shock in patients with severe vomiting and diarrhea. Blood loss can occur from a bleeding tumor, GI ulcer, etc. Hypovolemic shock is the result of both poor perfusion and dehydration.
- Second is traumatic shock. If an animal sustains enough trauma and experiences high amounts of blood loss they will have an interruption of oxygen supply. Crushing injuries (like patients run over by a car or big by a larger animal) can also have traumatic shock. It is the result of both hypoperfusion and dehydration.
- Third is cardiogenic shock. This is challenging to treat, as the lack of oxygen delivery is due to the heart not being able to adequately pump. Our normal treatments for shock cannot be used on a heart that has poor cardiac output. Cardiogenic shock is the result of hypoperfusion.
- Lastly and least common is distributive shock. This is caused by vasodilation usually due to sepsis. In distributive shock the patient's volume is often sitting in expanded vessels instead of circulating through the body. Again it is challenging to treat as it is the result ofhypoperfusion and the patient is often well hydrated.

Now that you understand the causes and compensatory mechanisms next is recognizing the signs of shock. Early shock is only exhibited by our canine patients. These signs are the result of the body recognizing an impending problem with perfusion and trying to compensate. The signs are:

- Tachycardia
- Bounding Pulses
- Bright MM/Fast CRT

These patients often have normal mentation. The heart is trying to circulate a smaller volume to all of the tissues and so it works harder giving us the increased heart rate and bounding pulses.

The next stage of shock, compensatory shock, sees the patient still trying to keep up with losing perfusion. This stage mimics the pain response in animals, so pain management is important to not only keep them comfortable, but to rule out this stage of shock.The signs are:

- Tachycardia
- Weak Pulses
- Pale MM
- Decreased Mentation

These patients are still trying to keep up with the elevated heart rate but the body is beginning to pull inward and only perfuse the major organs (heart lungs and brain).The periphery is less important, and so we see weak peripheral pulses and can feel cold extremities. Cats in this stage will often spiral downward very quickly.

In late or decompensated shock the body begins to shut down and can no longer keep up with oxygen needs. The heart rate may be decreased, mm color is white or gray, and pulses may be absent.

To treat patients in shock the first treatment should be to provide oxygen. Providing flow-by or mask oxygen is a good start. Next is to provide fluid therapy. As long as you know the patient is not in cardiogenic shock

fluids need to be given quickly and often. A large bore short length IV catheter needs to be placed and IV fluids given. Lactate readings can help you determine the efficacy of your fluid therapy.

Crystalloid fluids are replacement electrolyte solutions that will increase circulating intravascular volume, but only for a short time. Crystalloids are often bolused with the technician responsible for checking vital sign improvements between boluses. Colloids are fluids made of larger molecules that will stay in the intravascular space longer than crystalloids and will even draw other fluids into the intravascular space. They can be used in conjunction with crystalloids to manage blood pressure and perfusion.

It is important to note that cats do not respond to shock the same way dogs do. Cats in shock will vasodilate (not vasoconstrict like dogs), lose body heat, and their blood pressure drops not necessarily from low volume. As cats warm up their vessels will constrict and if they have been fluid resuscitated while cold they will dump excess fluids into their lungs. It is very important to be careful with fluid administration on hypothermic cats and focus on warming them as much as 'hydrating' them.

Shock patients need careful monitoring to chart their progress. The DVM should set some heart rate and blood pressure goals for the patient and treatment administered until those goals are met. The technician should be monitoring the cardiovascular parameters (heart rate, mm color, CRT, limb temperature, urine output), respiratory parameters (rate and effort, Sp02), blood pressure, and ECG if possible. Vitals should be checked multiple times per hour on the critical patients.

Patients under anesthesia can experience shock for the same reasons awake animals experience shock. The signs and treatments are the same, so use care with anesthetized patients and don't assume tachycardia means the anesthesia level is too light. Look at blood pressure, mm color and CRT to help you determine the best course of treatment.