FLUID THERAPY FOR HYPOVOLEMIC SHOCK

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Loss of fluid volume from the vasculature (hypovolemia) is most often associated with blood loss and severe dehydration. Hypovolemia prevents the body from adequately providing oxygen and other nutrients to the tissues. This condition is referred to as 'hypovolemic shock'. Left untreated, hypovolemic shock can result in hypoxic tissue damage, organ failure, and, ultimately, death. The key to successful treatment of this condition is to recognize the clinical signs of hypovolemia, provide *immediate* and appropriate intravenous fluid therapy, and monitor the patient carefully throughout this process. Here is a quick refresher!

The body's response to hypovolemia is mediated by the sympathetic nervous system (SNS). In an effort to maximize blood flow to the most important organs in the body (the heart, lungs, and brain) blood vessels in the periphery constrict and the heart rate increases. 'Perfusion parameters' are the physical exam findings associated with this physiologic response. They include:

- mucus membrane colour (pale with vasoconstriction)
- capillary refill time (prolonged with vasoconstriction)
- heart rate (elevated with SNS stimulation)
- peripheral pulse strength and quality (weak and thready with vasoconstriction)
- rectal temperature (decreased with vasoconstriction)
- extremity temperature (cool ears and feet with vasoconstriction)
- mentation (dull)
- urine production (decreased to prevent further volume loss)

A patient with these physical exam findings should be quickly evaluated for other possible causes of SNS stimulation (eg. severe pain, cardiac disease). If the patient's history is consistent with hypovolemia, intravenous fluid therapy treatment should be instituted immediately.

The IV catheter should be as large as possible (18g in dogs, 20g in small dogs and cats). Its diameter may limit the rate at which fluids can be administered. Crystalloid fluid therapy should be initiated using a balanced electrolyte solution (Plasmalyte A or Lactated Ringer's Solution). To dogs, administer 20 mL/kg over 15 minutes. To cats, administer 10 mL/kg over 15 minutes. Animals with suspected pulmonary compromise (eg. pulmonary contusions following vehicular trauma) should receive more conservative boluses (eg. Dog: 10 mL/kg over 15 minutes) and should be carefully observed for evidence of respiratory compromise. Following each bolus, reassess the perfusion parameters. If they are still abnormal, repeat the bolus. If, after 3 or 4 boluses, the perfusion parameters are still abnormal, consider other possible reasons that the animals may not be responding as expected. These include, but are not limited to, unmanaged/inadequately managed pain, anemia, hypoproteinemia (preventing fluids from remaining in the intravascular space), and ongoing hemorrhage.

If an animal is extremely painful, consider administering 0.05 – 0.1mg/kg of hydromorphone (NSAIDs are contraindicated and butorphanol is insufficient for severe pain). If the animal is anemic, crystalloid therapy will help to restore its intravascular volume but it may require a blood transfusion to restore the oxygen-carrying capacity of the blood. Hypoproteinemia will cause crystalloid fluids to leak from the vasculature into the interstitium resulting in edema and ongoing hypovolemia. If hypoproteinemia is present and the patient is not responding to crystalloid therapy or only has a transient response, administer an artificial colloid such as pentastarch. Bolus 5 mL/kg over 15 minutes in dogs, and 2.5 mL/kg over 15 minutes in cats. Do not give more than 20 mL/kg/day to dogs, or more than 10 mL/kg/day to cats. Animals with internal bleeding should receive conservative fluid resuscitation as sudden increases in intravascular volume may cause fragile blood clots at the hemorrhage site to be dislodged.

Once the patient's perfusion parameters have been restored to normal, the underlying cause of hypovolemia must be identified and treated.