

Guidelines for re-hydrating severely dehydrated refugee animals

Most animals rescued from a disaster situation will be dehydrated to some degree. Dehydration is defined as a decreased salt and water content in the interstitial space (the fluid-filled space that bathes the body's cells). Patients who are dehydrated are also, by definition, hypovolemic to an extent – that is, they also have decreased blood volume, which will cause shock when severe. It is important to differentiate patients that have 1) simple (even if severe) dehydration from those with 2) dehydration AND hypovolemic shock, since treatments differ.

Since hypovolemic shock is more immediately life-threatening than “simple” dehydration, it is important to evaluate all patients for shock **FIRST**, and then assess hydration after any existing blood volume deficits are addressed.

Recognizing hypovolemic shock in veterinary patients

The **cardiovascular system** is the most important system to assess in veterinary patients that have decreased food or water access for an extended period of time. Hypovolemic shock manifests in the following six clinical signs:

- 1) Decreased mentation -- anywhere from quiet / depressed to comatose.
- 2) Pale or pale pink mucous membrane color. Remember that normal cats are a paler shade of pink than normal dogs in the first place
- 3) Capillary refill time > 2 seconds. When you press the gum above the teeth or on the inner lip, the tissue should blanch initially, then return to pink in fewer than 2 seconds. If it takes > 2 seconds for color to return to baseline, this is a sign of shock.
- 4) Altered heart rate. Dog heart rate > 120 may be a sign of shock. Feline heart rate > 220 **or** < 140 may be a sign of shock.
- 5) Poor pulse quality. The femoral pulse is the easiest to find. Place the flat of at least 2 fingers along the upper inner thigh between or superficial to the large muscle bellies – there should be a palpable, full pulse in all normal animals

(unless exceptionally obese). Absent or weak femoral pulse quality is a sign of shock. You can also feel for pulses along the medial aspect of the front of the rear foot (just past the hock). These metatarsal arterial pulses should be palpable in any dog > 5 kg; cats may be variable.

- 6) Cool extremities. If the feet feel subjectively cool to the touch, this is consistent with hypovolemic shock.

Remember that *many animals in hypovolemic shock do not meet all 6 of these criteria* – if the patient fits even 2-3 criteria, shock is likely and should be appropriately addressed.

Treating hypovolemic shock in veterinary patients

In the field, the most reliable, least expensive way to treat hypovolemic shock is with a bolus of ISOTONIC crystalloid fluids (i.e., LRS, Norm R, Plasmalyte 148, or 0.9% NaCl) delivered intravenously. Patients should **NEVER** be resuscitated with hypotonic fluids such as 0.45% NaCl or D5W, and you *cannot* adequately resuscitate a hypovolemic patient with subcutaneous, peritoneal, or oral fluids.

Dogs: 80-90 ml/kg (35-40 ml/lb) isotonic crystalloid IV; this dose should be given in ~30 ml/kg increments AS FAST AS POSSIBLE (each increment in 10-20 minutes at the slowest), reassessing after each 30 ml/kg. Keep giving 30 ml/kg increments, up to or even exceeding the 90 ml/kg mark, until the patient's 6 cardiovascular parameters become more normal. Normalization may occur with as little as the first increment bolus.

Cats: 40-50 ml/kg (18-22 ml/lb) isotonic crystalloid IV. This dose should be given in ~20 ml/kg increments over 15-20 minutes each, reassessing after each 20 ml/kg. Keep giving 20 ml/kg increments, up to the 50 ml/kg mark, until the patient's 6 cardiovascular parameters become more normal. Normalization may occur with as little as the first increment bolus.

After treating hypovolemic shock, interstitial hydration status should be addressed.

Recognizing dehydration in refugee animals

As noted above, dehydration is defined as decreased salt and water content in the interstitial space (the fluid-filled space that bathes the body's cells). Dehydration will not be found on physical examination of the dog or cat until the animal has lost at least 5% of its body weight in fluid; therefore, animals may be "subclinically" dehydrated and still have normal hydration assessment on physical exam.

Dehydration is best assessed in dogs and cats by tenting the skin above the shoulder blades and looking for the normal recoil of the skin back to the resting position. If the skin returns to normal position, but more slowly than usual, the animal is about 5% dehydrated. If the skin returns to normal position but after a significantly long period (more than about 2 seconds), the animal is 7-8% dehydrated. If the skin remains in a tented fold above the shoulder blades after release, the animal is 10-12% dehydrated – these are the animals most likely to have concurrent hypovolemic shock in a refugee scenario. Patients > 12% dehydrated are unlikely to be found alive.

Hydration status can also be evaluated with moistness of the oral or genital mucous membranes, the presence of adequate tear film in the lower conjunctival sac of the eye, and the position of the eye in the bony orbit. Dry membranes, dry conjunctiva, or sunken eyes can be signs of dehydration.

Also important to note is that rapid and/or severe weight loss can lead to delayed skin tent or sunken eyes on its own. Moistness of eyes and mucous membranes must be evaluated in patients with weight loss to confirm dehydration.

Treating dehydration in refugee animals

It should be assumed that ANY animal found in a refugee situation is dehydrated to some extent, even if it doesn't show clinical signs of dehydration. Animals with no outward

signs of dehydration (normal skin tent test) are likely < 5% dehydrated, and may be re-hydrated by offering oral water and commercial pet food meals.

Dehydration should be assessed for severity using the skin tent test (see above), and the percent dehydration estimated. Re-hydration of a chronically dehydrated animal without signs of hypovolemic shock can be performed safely over a 12-24 hour period, as long as severe fluid losses (i.e., vomiting, diarrhea, excessive urination) do not occur. If abnormal fluid losses are continuing, re-hydration should be more aggressive (over 4-12 hours at the longest), and frequent re-evaluation of hydration status will be of vital importance.

Treating dehydration with fluids

Ideally, patients who are 5-12% dehydrated should be re-hydrated with intravenous, isotonic crystalloid fluids such as LRS, Norm R, Plasmalyte 148, or 0.9% NaCl. Patients can be re-hydrated by the subcutaneous route, though fluid volumes required often exceed what can comfortably fit under the skin. Oral food and water, while suboptimal as the sole route of re-hydration in clinically dehydrated patients, can be used when it is the only method available in the conscious, non-vomiting patient.

Oral rehydration

When oral rehydration is the only option available for severely dehydrated animals, orally administered electrolyte solutions, such as Pedialyte® should be used if the animal will tolerate them. Plasmalyte 56, although normally given IV, may also be tried as an oral rehydration solution. Some other fluids normally for IV use are too concentrated, but 0.9% NaCl can be diluted by 50% to give an 0.45% NaCl solution, which is acceptable. Oral water alone (without food) is inadequate for an extended time period, as it contains no salt to help hold the water in the interstitial space.

The percent dehydration should be estimated and multiplied by the approximate body weight in kilograms to determine the amount of fluid to administer (in liters). For example, a dog of approximately 20 kg (approximately 45 lb) that is 5% dehydrated

would require: $20 \times 0.05 = 1.0$ L or 1000 mL for adequate re-hydration. A cat of 5 kg that is 10% dehydrated would require: $5 \times 0.10 = 500$ mL for adequate re-hydration.

Monitoring during rehydration

Watch for signs (detailed below) of fluid or sodium imbalance during the first stages of rehydration. If these signs are seen, consult with a veterinarian immediately:

Signs of overhydration

- Swelling of conjunctiva, feet, trunk, neck or chin
- Generalized subcutaneous swelling (jelly-like feel to skin)
- Increased respiratory rate (possible sign of fluid in lungs)

Signs of sodium imbalance

- Twitching
- Abnormal mental state (e.g. depression, coma)
- Head pressing
- Seizures

Risks during re-hydration

Inadequate re-hydration.

Remember that in addition to re-hydration of existing deficits, animals may have continued vomiting, diarrhea, or excessive urination once rescued. Hydration status should be re-evaluated frequently (at least every 8-12 hours) during initial management to ensure the pet gets adequate supplementation.

Overhydration.

When initial dehydration is overestimated, patients may develop overhydration, which manifests as subcutaneous edema of dependent body parts (often feet, trunk, neck/chin)

and chemosis (swollen ocular conjunctiva). These problems are self-limiting and DO NOT pose a significant health risk. Just discontinue IV or subcutaneous fluid therapy, and they should resolve on their own.

Overhydration very rarely results in pulmonary edema (excessive fluid in the lungs), which causes increased respiratory rate and effort due to low blood oxygen.

Development of pulmonary edema is *very unlikely*, even in the aggressively re-hydrated patient, unless the patient has pre-existing heart or kidney disease. If a patient has a heart murmur, exercise caution during re-hydration – re-evaluate hydration more frequently (at least every 4 hours) to see if you can stop treatment and move to oral water, and plan to re-hydrate over a full 24 hours. But remember that many heart murmurs are “innocent,” particularly in dogs, and a heart murmur in a patient is NOT a license to under-treat severe dehydration.

Sodium problems.

Most patients with chronic dehydration, as with refugee animals, will have serum sodium concentrations within the reference interval, or at least in a “safe” range. Most dogs and cats with serum sodium concentrations between 130 – 170 mEq/L can be re-hydrated with any isotonic crystalloid fluid without complications. However, if the serum sodium concentration is lower than 130 mEq/L (hyponatremia) or exceeds 170-180 mEq/L (hypernatremia), problems can occur during re-hydration with isotonic crystalloids.

In a field situation, it is impossible to know (or even guess) a patient’s serum sodium concentration – these patients should be re-hydrated as instructed above, and monitored closely. Some general guidelines: Patients who have been trapped without access to ANY food or water are most likely to have either normal or elevated serum sodium concentrations, whereas animals trapped with access to water are more likely to have normal to decreased serum sodium concentrations.

Problems with correcting hypernatremia too rapidly: If the patient starts with a serum sodium concentration of 170 mEq/L or greater, re-hydration may result in neurologic signs such as twitching, abnormal mentation, head pressing, or seizures due to swelling of

neurons. If these signs occur, fluids should be stopped and the animal transported *immediately* to a facility with the capability to measure serum sodium concentration. (Seizures should be treated with diazepam 0.5 mg/kg IV as soon as it is available.) The patient should be treated as soon as possible with **intravenous mannitol** (0.5 – 1.0 g/kg) **or 7.2% hypertonic saline** (3-5 ml/kg) and fluid therapy continued using a fluid with a sodium concentration no more than 10 mEq/L less than the patient (i.e., if the patient has Na 190, the fluid should be no more dilute than Na 180). Serum sodium concentration should be monitored no less than every 4 hours, and the patient's serum sodium concentration should not drop more than **1 mEq per hour** until serum sodium is < 160 mEq/L. Patients treated in this manner have a fair to good likelihood of survival, barring other serious problems, especially if neurologic signs respond well to mannitol and/or hypertonic saline therapy.

Problems with correcting hyponatremia too rapidly: If the patient starts with a serum sodium concentration of 130 mEq/L or less, re-hydration may result in neurologic signs; however, these signs are usually **delayed** (by up to 2 *weeks*), and are unlikely to be recognized during re-hydration. The classic neurologic lesion associated with overly rapid correction of hyponatremia is “central pontine myelinolysis,” and it is usually fatal in veterinary patients. Though classic neurologic signs of rapidly corrected hyponatremia are delayed, if a patient that develops neurologic signs during re-hydration is noted to have hyponatremia, efforts should be made to slow sodium correction. Without the ability to measure serum sodium concentration during the re-hydration period, one would unlikely know that hyponatremia was being corrected too rapidly, since signs of this problem are almost always delayed. Luckily, severe hyponatremia is uncommon, even in severely dehydrated patients.

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