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TOP 5 INDICATIONS FOR FLUID THERAPY

Fluid therapy, a mainstay treatment, is indicated in a variety of disease states that may result in mild dehydration to severe hypovolemic shock. Depending on the disease and its severity, fluids administered either subcutaneously or intravenously may be warranted. Fluids include crystalloids, synthetic colloids, and biological fluids (eg, red blood cells, plasma, concentrated albumin transfusions). This article focuses on crystalloid fluid therapy.

1 Dehydration

Dehydration, or the loss of fluid from the *interstitial* space, is most commonly caused by decreased intake and/or increased fluid loss from vomiting, diarrhea, or polyuria. The level of dehydration is often measured as a percentage of body weight via history and examination findings. Signs include decreased skin tenting, sunken eyes, depressed mentation, and tacky/dry mucous membranes. An estimate of dehydration is often not possible (or advisable) with just one variable; for example, false negatives may occur in very young patients, which have a higher percentage of total body water and tissue that is more elastic, and in obese patients. Signs often do not appear until dehydration is at least 5% of body weight; if a patient has a history of fluid loss and decreased intake but does not seem dehydrated, a 5% dehydration status should be applied.

To calculate daily maintenance fluid rates, the following equations can be used[1]:

Cats: 80 x body weight [kg]$^{0.75}$ or 2–3 mL/kg/hr
Dogs: 132 x body weight [kg]$^{0.75}$ or 2–6 mL/kg/hr

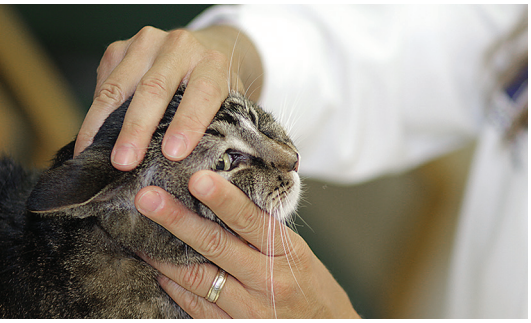
The deficit should be replaced over 8 to 24 hours, indicated by the patient's clinical status, comorbidities (eg, heart murmur), and inpatient or outpatient status. For an inpatient, the deficit amount should be added to a base maintenance rate of isotonic crystalloid fluids and the patient monitored for ongoing losses that may require fluid rate adjustment. For an outpatient, the deficit may be administered subcutaneously and reassessed in 24 hours or as needed.

2 Hypovolemia

Hypovolemia, or fluid loss from the *intravascular* space, may be caused by hemorrhage or extreme fluid loss from vomiting, diarrhea, polyuria, or prolonged decreased water intake. Signs include changes in perfusion indices: pale pink mucous membranes, prolonged capillary refill time (>3 seconds), tachycardia, decreased femoral pulse quality, depressed mentation. Patients are often hypotensive (ie, systolic blood pressure <90 mm Hg) and may have a metabolic acidosis and hyperlactatemia from poor perfusion resulting in lactic acidosis.

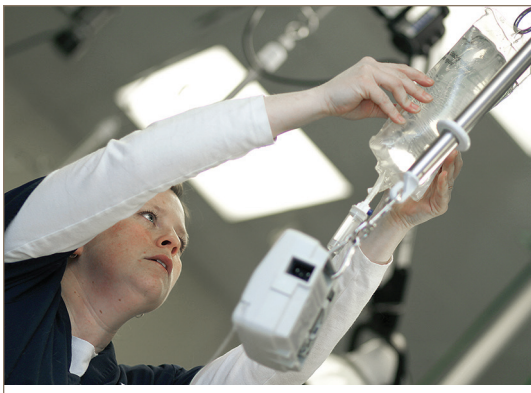
When an intravascular fluid deficit occurs, tissue perfusion decreases, resulting in tissue hypoxia and a change from aerobic to anaerobic metabolism. Lactate, a product of anaerobic metabolism, can be measured, which helps the veterinarian understand if the patient is responding to fluid resuscitation. Patients presenting in hypovolemic shock should be treated with IV isotonic crystalloid fluids via a bolus dose calculated on the patient's shock volume (ie, 90 mL/kg [dogs]; 50–60 mL/kg [cats]). The general shock volume is often given as a fraction (ie, one-fourth to one-third of the total shock volume, or 30 mL/kg [dogs] and 10–20 mL/kg [cats]) over 15 to 30 minutes. After the bolus, the patient should be reassessed for therapy response, including heart rate, pulse quality, mentation, and lactate.

If perfusion abnormalities persist, an additional bolus may be used. Continued fluid therapy is usually warranted, depending on the underlying cause. Blood product transfusions may be indicated (10–20 mL/kg of packed RBCs, fresh frozen plasma, or whole blood, over 2–4 hours), depending on cardiovascular stability.



3 Distributive Shock

Distributive shock is caused by extreme vasodilation, including sepsis, systemic inflammatory response syndrome (SIRS), anaphylaxis, Addisonian crisis, and severe transfusion reactions and results in decreased tissue perfusion and tissue hypoxia. Treatment typically includes shock doses of IV fluid therapy. Inflammatory mediators released into circulation may cause significant vasodilation, and isotonic crystalloid fluid therapy alone is often ineffective. Combinations of isotonic crystalloids, synthetic colloids, hypertonic solutions, and blood products may also be needed, as well as vasopressors if hypotension or signs of shock persist. Empiric antibiotic therapy pending culture results is indicated if sepsis is suspected.



Top 5 Indications for Fluid Therapy

- Dehydration
- Hypovolemia
- Distributive Shock
- Kidney Failure
- Certain Toxicities

Calculating Crystalloid Fluid Rate in a Dehydrated Dog*

The following example shows how to calculate the maintenance rate and dehydration deficit of a 10-kg dog presenting with vomiting and diarrhea and with normal heart, lung, and kidney function:

Dehydration deficit
8% dehydration
body weight (10 kg) × % dehydration (0.08) x 1000 = 800 mL

Maintenance rate
$132 \times 10\ kg^{0.75}$ = 742 mL/24 hours = 31 mL/hr

Replace dehydration deficit over 12 hours = 800/12 = 67 mL. Add this to the maintenance rate of 31 mL/hr = 67 + 31 = 98 mL/hr for the first 12 hours, then decrease to maintenance rate = 31 mL/hr.

*Refer to *Fluid Therapy for the Emergent Small Animal Patient: Crystalloids, Colloids, and Albumin Products* for available crystalloid fluid formations.[2]

Patients in polyuric kidney failure often require more fluids than the daily maintenance rate.

4 Kidney Failure

Administration of isotonic crystalloid fluids is common for patients with kidney disease. Newly diagnosed patients should receive IV fluid therapy to correct dehydration, improve perfusion, and promote diuresis while being monitored for body weight changes and urine output. Patients in polyuric kidney failure often require more fluids than the daily maintenance rate.

If the patient becomes oliguric (ie, urinates less than 1–2 mL/kg per hour after adequate rehydration) or does not urinate, fluid therapy may be contraindicated if the patient is overhydrated/edematous; depending on the underlying cause, diuretic therapy is usually indicated. Signs of overhydration include pleural effusion, pulmonary edema, abdominal effusion, increased body weight from decreased urine output, and excessive skin elasticity (ie, jelly- like movement when skin is tented). Intermittent subcutaneous fluid therapy is often prescribed for patients with chronic kidney disease and can be administered as an outpatient or at home, depending on the severity and stability of the disease.

5 Certain Toxicities

Many toxins are excreted, either fully or partially, via the kidneys, so fluid therapy with other treatment modalities is used to hasten toxin elimination. In some cases, such as NSAID toxicity (dogs and cats) and lily ingestion (cats), IV fluid therapy is recommended for 48 to 72 hours to help perfuse the kidneys and prevent acute kidney injury. The rate of administration should be 2 to 2.5 times higher than a typical maintenance rate to assure sufficient diuresis, as long as the patient's clinical status does not contraindicate a high fluid rate.[3]

Conclusion

In most small animal presentations, IV administration is ideal. Clinical status, including improvement of hydration status, normalization of hypotension, and improved perfusion parameters should be monitored frequently in patients receiving fluid therapy because administration rates may need to be adjusted.

See Aids & Resources, back page, for references & suggested reading.

Advantage Multi® for Dogs and for Cats

(imidacloprid + moxidectin)

BRIEF SUMMARY: Before using *Advantage Multi® for Dogs* (imidacloprid+moxidectin) or *Advantage Multi® for Cats* (imidacloprid +moxidectin), please consult the product insert, a summary of which follows:

CAUTION: Federal (U.S.A.) Law restricts this drug to use by or on the order of a licensed veterinarian.

Advantage Multi for Dogs:

WARNING

- **DO NOT ADMINISTER THIS PRODUCT ORALLY.**
- **For the first 30 minutes after application ensure that dogs cannot lick the product from application sites on themselves or other treated animals.**
- **Children should not come in contact with the application sites for two (2) hours after application.**

(See Contraindications, Warnings, Human Warnings, and Adverse Reactions for more information.)

INDICATIONS:

Advantage Multi for Dogs is indicated for the prevention of heartworm disease caused by *Dirofilaria immitis* and the treatment of *Dirofilaria immitis* circulating microfilariae in heartworm-positive dogs. *Advantage Multi for Dogs* kills adult fleas and is indicated for the treatment of flea infestations *(Ctenocephalides felis). Advantage Multi for Dogs* is indicated for the treatment and control *of sarcoptic mange* caused by *Sarcoptes scabiei var.canis. Advantage Multi for Dogs* is also indicated for the treatment and control of the following intestinal parasites species: Hookworms *(Ancylostoma caninum) (Uncinaria stenocephala),* Roundworms *(Toxocara canis) (Toxascaris leonina) and* Whipworms *(Trichuris vulpis).*

Advantage Multi for Cats is indicated for the prevention of heartworm disease caused by *Dirofilaria immitis. Advantage Multi for Cats* kills adult fleas *(Ctenocephalides felis)* and is indicated for the treatment of flea infestations. *Advantage Multi for Cats* is also indicated for the treatment and control of ear mite *(Otodectes cynotis)* infestations and the intestinal parasites species Hookworm *(Ancylostoma tubaeforme)* and Roundworm *(Toxocara cati).***Ferrets:** *Advantage Multi for Cats* is indicated for the prevention of heartworm disease in ferrets caused by *Dirofilaria immitis.Advantage Multi for Cats* kills adult fleas (Ctenocephalides felis) and is indicated for the treatment of flea infestations in ferrets.

CONTRAINDICATIONS: Do not administer this product orally. (See WARNINGS). Do not use the Dog product (containing 2.5% moxidectin) on Cats.

WARNINGS:

Advantage Multi for Dogs: **For the first 30 minutes after application: Ensure that dogs cannot lick the product from application sites on themselves or other treated dogs, and separate treated dogs from one another and from other pets to reduce the risk of accidental ingestion. Ingestion of this product by dogs may cause serious adverse reactions including depression, salivation, dilated pupils, incoordination, panting, and generalized muscle tremors. In avermectin sensitive dogs[a], the signs may be more severe and may include coma and death[b].**

[a] Some dogs are more sensitive to avermectins due to a mutation in the MDR1 gene. Dogs with this mutation may develop signs of severe avermectin toxicity if they ingest this product. The most common breeds associated with this mutation include Collies and Collie crosses.

[b] Although there is no specific antagonist for avermectin toxicity, even severely affected dogs have completely recovered from avermectin toxicity with intensive veterinary supportive care.

Advantage Multi for Cats: **Do not use on sick, debilitated, or underweight cats. Do not use on cats less than 9 weeks of age or less than 2 lbs. body weight. Do not use on sick or debilitated ferrets.**

HUMAN WARNINGS: Not for human use. Keep out of the reach of children. Dogs: Children should not come in contact with the application sites for two (2) hours after application. Cats: Children should not come in contact with the application site for 30 minutes after application.

Causes eye irritation. Harmful if swallowed. Do not get in eyes or on clothing. Avoid contact with skin. **Wash hands thoroughly with soap and warm water after handling.** If contact with eyes occurs, hold eyelids open and flush with copious amounts of water for 15 minutes. If eye irritation develops or persists, contact a physician. If swallowed, call poison control center or physician immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by the poison control center or physician. People with known hypersensitivity to benzyl alcohol, imidacloprid or moxidectin should administer product with caution. In case of an allergic reaction, contact a physician. If contact with skin or clothing occurs, take off contaminated clothing. Wash skin immediately with plenty of soap and water. Call a poison control center or physician for treatment advice. The Material Safety Data Sheet (MSDS) provides additional occupational safety information. For a copy of the Material Safety Data Sheet (MSDS) or to report adverse reactions call Bayer Veterinary Services at 1-800-422-9874. For consumer questions call 1-800-255-6826.

PRECAUTIONS: Do not dispense dose applicator tubes without complete safety and administration information. Use with caution in sick, debilitated or underweight animals. The safety of *Advantage Multi for Dogs* has not been established in breeding, pregnant, or lactating dogs. The safe use of *Advantage Multi for Dogs* has not been established in puppies and dogs less than 7 weeks of age or less than 3 lbs. body weight. *Advantage Multi for Dogs* has not been evaluated in heartworm-positive dogs with Class 4 heartworm disease.

Cats may experience hypersalivation, tremors, vomiting and decreased appetite if *Advantage Multi for Cats* is inadvertently administered orally or through grooming/licking of the application site. The safety of *Advantage Multi for Cats* has not been established in breeding, pregnant, or lactating cats. Use of this product in geriatric cats with subclinical conditions has not been adequately studied. Ferrets: The safety of *Advantage Multi for Cats* has not been established in breeding, pregnant, and lactating ferrets. Treatment of ferrets weighing less than 2.0 lbs. (0.9kg) should be based on a risk-benefit assessment. The effectiveness of *Advantage Multi for Cats* in ferrets weighing over 4.4 lbs. (2.0 kg) has not been established.

ADVERSE REACTIONS: Heartworm Negative Dogs: the most common adverse reactions observed during field studies were pruritus, residue, medicinal odor, lethargy, inappetence and hyperactivity. **Heartworm Positive Dogs:** the most common adverse reactions observed during field studies were cough, lethargy, vomiting, diarrhea, (including hemorrhagic), and inappetence. **Cats:** The most common adverse reactions observed during field studies were lethargy, behavioral changes, discomfort, hypersalivation, polydipsia and coughing and gagging. **Ferrets:** The most common adverse reactions observed during field studies were pruritus/scratching, scabbing, redness, wounds and inflammation at the treatment site, lethargy and chemical odor.

For a copy of the Material Safety Data Sheet (MSDS) or to report adverse reactions call Bayer Veterinary Services at 1-800-422-9874. For consumer questions call 1-800-255-6286.

Advantage Multi is protected by one or more of the following U.S. patents: 6,232,328 and 6,001,858.

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