Fluid Therapy

Fluid therapy is used in the clinical setting for many reasons, including replacement of hydration deficits, to maintain normal hydration, replace lost blood volume, correction of electrolyte imbalances, treating shock, and in order to infuse intravenous medications.

It is important for the veterinary technician to have knowledge of the types of fluids available, appropriate routes and rates of administration, and how to assess the patient’s hydration status. The main focus of this article will be on the most common fluids, routes, and rates used. Remember, many veterinary practices will use different formulas and rates for patients, but this will provide some basic guidelines.

Crystalloids

Crystalloids are solutions that are isotonic with plasma and contain sodium as the major osmotically active particle.

Lactated Ringer’s Solution, 0.9% Sodium Chloride (Normal Saline), and Normosol-R are isotonic crystalloid solutions. The most common uses of these solutions are for maintenance of normal hydration, replacement of hydration deficits (including use during anesthesia,) and with shock therapy. Crystalloids are also useful for the infusion of medications such as potassium chloride (KCl). It is important to remember that when crystalloids contain additives, they should never be used for fluid boluses. KCl in particular can result in arrhythmias and even death when administered rapidly. This is due to the fact that rapid infusion of potassium can induce cardiac arrest. The most common routes of crystalloids are subcutaneous (SQ), intravenous (IV), and intraosseous (IO).

Maintenance Rates:

There are several formulas for calculating maintenance fluid rates in dogs and cats.

The best or most accurate calculation for determining the crystalloid maintenance rate for dogs is the following body surface formula:

\[(\text{kg} \times \text{kg} \times \text{kg}) \times 132 \div 24 = \text{ml/hr}\]

Example: A 40-kg dog is presented to your hospital for treatment of dehydration caused by vomiting; the maintenance rate is calculated as:

\[(40 \times 40 \times 40) \times 132 \div 24 = 87 \text{ ml/hr}\]

The calculation for crystalloid maintenance rate for cats is the following formula:

\[(\text{kg} \times \text{kg} \times \text{kg}) \times 70 \div 24 = \text{ml/hr}\]

Another standard formula often used is 60mL/kg/day for maintenance fluids.

For the 40-kg dog: 60 mL X 40 kg = 2400 / 24 hours = 100 mL/hr

While there are variations in fluid rate calculations, the fluid rate should always be determined based on the hydration status and medical condition of the patient (i.e. ongoing losses, deficits, and maintenance requirements).

Anesthetic Rates:

Historically, the crystalloid anesthetic rate for dogs was 10 ml/kg/hr, and in cats the anesthetic rate was 5 ml/kg/hr. However, updated guidelines from AAHA 2013 recommend reduced anesthetic fluid rates of 5ml/kg/hr for dogs and 3ml/kg/hr for cats, as a starting point. As the patient is evaluated during anesthesia, this rate can be adjusted upwards as needed. The anesthetic rate of fluids can vary for each patient, depending on factors such as hypotension, underlying heart disease, etc.
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Example: A 20 kg dog is presented to your hospital for a routine OVH.
20 kg x 5 ml/hr = 100 ml/hr

**Shock Doses:**
During treatment for shock, LRS and Normosol-R are the preferred isotonic crystalloids, administered at a rate of 90 ml/kg in dogs and 45 ml/kg in cats. Often the shock dose is given in ¼ boluses (a quarter shock dose initially) and the patient is then reassessed. Once the patient has stabilized, a new rate is calculated in order to continue to correct for fluid deficits. Typically, the goal is to stabilize and rehydrate the patient over a 24-hour period.

**Dextrose Solutions**
Dextrose solutions are formed when dextrose is added to a crystalloid. Dextrose can be used to provide free water to replace insensible losses or for correction of hypernatremia resulting from a water deficit. When added to a crystalloid, dextrose can be used to provide an intracellular carbohydrate source in septic patients and aids in correction of hypoglycemia. These solutions should not be used as maintenance fluids because their administration will lead to the dilution of electrolytes.
Administration routes should be exclusive to IV and IO. Administering dextrose solutions into subcutaneous tissues causes electrolytes to move into these tissues, leading to a decrease in circulating blood volume and resulting in tissue necrosis. It is also important to remember that these solutions are ideal for bacterial growth; therefore, aseptic technique must be used.
Rates of administration will vary depending on the concentration and purpose.

**Synthetic Colloids**
Synthetic colloids act primarily to expand plasma volume. They are useful as either resuscitative or replacement fluids and can be given as a bolus if the patient has poor perfusion due to hypovolemia. Hetastarch, Dextran 40, and Dextran 70 are the most commonly used synthetic colloids.
Routes of administration are limited to IV and IO. The synthetic colloid maintenance rate for Hetastarch is 20 ml/kg/day. For the treatment of hypotension, 5-10 ml/kg is given as a bolus. Dextran 40 and Dextran 70 are given at a rate of 2 ml/kg/hr.

**Colloids**
Colloids are used for the relative expansion of the interstitial space in the event of a plasma volume deficiency resulting from traumatic or septic shock and for replacement of lost blood volume. Colloid solutions include human and canine albumin, fresh frozen plasma, and whole blood. Colloids are most commonly given IV but can be administered IO if venous access cannot be achieved. The rate of administration depends on the clinical status of the patient and the reason for the transfusion.

**Signs of Dehydration**
- 5% - 6% dry or “sticky” oral mucous membranes
- 6% - 8% mild to moderate decrease in skin turgor, dry or “sticky” oral mucous membranes, sunken eyes
- 10% - 12% marked decrease in skin turgor, dry mucous membranes, sunken eyes, weak and rapid pulses, slow capillary refill time, moderate to marked mental depression.
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Signs of Overhydration

- Serous nasal discharge
- Subcutaneous edema
- Increased urine output
- Ascites
- Coughing / pulmonary edema
- Increased respiratory rate

References

