Fluid Therapy

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TABLE

1 Clinical Assessment of Dehydration

Clinical Sign(s)	Dehydration Estimate (% of body weight)
Normal/not detectable	<5%
Tacky mucous membranes	<5%
Dry mucous membranes Decreased skin turgor	6%–8%
Retracted globes within orbits	8%–10%
Persistent skin tent Dull corneas Evidence of hypovolemia	10%–12%

*Modified from: Rudloff E. Assessment of hydration. In: Silverstein DC, Hopper K, eds. *Small Animal Critical Care Medicine*. 2nd ed. St. Louis, MO: Elsevier; 2015:307-310.

Which Fluid to use ?

- Types of IV Fluids

- 1. Crystalloids
- 2. Colloids

Crystalloids

Crystalloid solutions are used to increase the vascular volume when it is reduced. The reduction of intravascular volume is caused by hemorrhage, dehydration, or loss of fluid during surgery.

The most common crystalloids are

- Lactated Ringers Solution
- Normal Saline. (0.9%)

Colloids

- Colloids are gelatinous solutions that maintain a high osmotic pressure in the blood. Particles in the colloids are too large to pass through the capillary membranes so colloids stay in the intravascular spaces longer than crystalloids.
- Colloids exert a high oncotic pressure and expand the volume by holding water in the vascular space.

Crystaloids

- Most commonly used : LRS and Saline
- Less expensive than Colloids

NaCl 0.9%

- It contains sodium concentration similar to that of plasma (154 mEq/L), but abnormally high concentrations of chloride ions (154 mEq/L).
- useful replacement fluid in the treatment of hyperkalemia and hyponatremia, as seen in Addison's disease (Hypoadrenocorticism)

Lactated Ringers Soln

- Lactated Ringer's solution (LRS) is a commonly used isotonic crystalloid
- LRS to animals with liver failure or cats with hepatic lipidosis is not recommended because the liver cannot clear the lactate.
- Animals with lymphosarcoma are also lactate intolerant and should not be given LRS.

Plasma-Lyte 148, Normosol R

- Since muscles and peripheral tissues metabolize the acetate and gluconate buffers it contains,
- this solution can be used in patients with severe liver disease.

Half Strength Saline

- These fluids are an excellent choice for animals predisposed to sodium retention such as those with heart disease, hypertension, or liver failure
- Since these fluids have little effect on maintenance of intravascular volume, they should not be used for emergency (shock) fluid resuscitation.

Hypertonic Saline 7%

- Hypertonic saline (NaCl 7%) is often used in the treatment of shock and trauma
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- Dosage of hypertonic saline is 4–6 mL/kg (dogs) and 2–4 mL/kg (cats) given as a bolus over 5–10 minutes.

Colloids

- Used for severe dehydration, shock and sepsis
- Colloids are expensive and not used routinely

Hydroxyethyl Starch (HES) Solutions (Colloid)

- They are administered for volume resuscitation in patients with systemic inflammatory response syndrome (SIRS), sepsis, hypoalbuminemia, shock, trauma, hypotension, and peripheral edema

Potassium Supplementation :Normal Level 3.5 -5.5 meq/L

TABLE 1-5. Parenteral Potassium Supplementation[a]

Severity of Potassium Depletion	*Serum Potassium (mEq/L)*	*Potassium Dosage (mEq/kg/day)*	*KCl (mEq) Added to 250 ml Fluid*
Mild	3.0–3.7	1–3	7
Moderate	2.5–3.0	4–6	10
Severe	<2.5	7–9	15–20

[a]Be certain urine output is adequate prior to potassium administration. If the intravenous route is used, do not exceed 0.5 mEq KCl/kg/hr. It is preferable to administer potassium-containing fluids orally unless vomiting is present. The subcutaneous route can also be used, and concentrations of potassium of up to 40 mEq/L can be so administered.

Estimation of Fluid Volume Requirments

- Existing deficit (cc) = body weight (kg) x % dehydration x 1000
- Maintenance Requirements = BW (kg) x 40-60cc/kg/day
- Continuing losses = estimation of fluid volume loss (cc/day)

Example of a 10 kg Dog

- A 10 kg dog is dehydrated to be estimated at 5%
- Decreased skin elasticity, dry mucous membranes and prolonged capillary refill time

What volume of fluids is Required?

- Existing Deficit -10 kg x 0.05 x 1000 = 500 cc
- Maintenance - 10 kg x 60 ml/kg/day = 600 cc
- Continuing losses – estimated at 200 cc

- Total 1300 cc

Administration

- Give ½ of 1300 cc in the first 6 hours
- 650 cc /6 hrs = 108.33 cc/hour

- Give the second ½ over 18 hours
- 650 cc /18 = 36.11 cc/hr

Quick Calculation

- Give between 5.0 and 7.4 cc/hr
- 5.0 = approximately 5 % dehydration
- 7.4 = approximately 8 % dehydration
- Existing Deficit (5.0-7.4 cc/hr)x BW (kg)
- 5.0 x10 kg = 50 cc/hr or x 24 hr = 1200 cc

Quite close to the long calculation of 1300 cc

Maintence Fluid Required

- Maintenance fluid – 2.4 mls x BW (kg)
- 2.4 cc/hr x BW (10 kg) = 24 cc/hr

IV Drip Chamber: 15 or 60 drops per minute

How many drops/minute

- Example
- 1500 cc IV LRS over 12 hours
- Or 1500/12 = 125 cc /hr
- Or 15 drops /cc chamber 15 x125 =1875 drops in 1 hour
- Or 1875/60 = 31.25 drops per minute

How many drops per minute

- # drops/minute = #cc/hr x drip factor 15 or 60
- 1500/12 = 125 cc/hr = 125/60 =2.08 cc minute
- Or 2.08 cc minute x 15 = 31.25 drops /min

DROP FACTOR ↓	20	25	30	50	60	70	75	80	100	110	120	125	130	150	175	200
	↓ DROPS PER MINUTE ↓															
10 Drops / mL	3	4	5	8	10	11	12	13	16	18	20	21	22	25	30	34
15 Drops / mL	5	6	7	12	15	17	18	20	25	27	30	31	32	38	44	50
20 Drops / mL	6	8	10	16	20	22	24	26	32	36	40	42	44	50	60	68
60 Drops / mL	20	25	30	50	60	70	75	80	100	110	120	125	130	150	175	200

To Calculate IV Flow Rate:

- Volume of fluid to be infused
- Total infusion time
- Drop Factor: the # of drops per mL that the

$$\frac{\text{Volume (mL)}}{\text{Time (hours)}} = \text{Hourly IV Flow Rate}$$

Shock Dose Therapy

- Most animals with moderate to severe shock will receive a bolus of a crystalloid 20-40 cc/kg over 15- 30 minutes.
- Evaluate and repeat if necessary
- With severe shock animals may receive the full shock dose 60-90 cc/kg in dogs and 40-60 cc in cats although this is rare

Concentration Solutions

- 0.5% = 5 mg/cc
- 1.0% =10 mg/cc
- 2.0% = 20 mg/cc
- 5.0% = 50 mg/cc
- to make a 5 % solution
- Each ml of a 50 % dextrose solu is 0.5gm
- 50 cc 50 % dextrose to 450 LRS
- 100 cc 50% dextrose to 900 mls LRS