How To Give Fluids
FLUID THERAPY, (part 3)

Now that you diagnosed dehydration and what fluids you want to give

3. Select a route of administration

- **Enteral** – VERY useful, always use if available
  - Voluntary intake, force feeding
  - Feeding tubes - nasogastric, percutaneous via esophagus, stomach, small intestine

- **Subcutaneous**
  - Small animals, any species with loose skin
  - Patients with mild deficits, without signs of shock
  - Supplementation if not drinking well yet, w chronic disease, eg., chronic renal failure cat

- **Intravenous**
  - Any species with accessible veins
  - Jugular, cephalic, saphenous veins most common
  - Auricular vein in big dogs, cows, pigs
  - Brachial vein in birds
  - Vital for resuscitation of severe deficits
  - Multiple catheters, central and peripheral sites

- **Intraosseous**
  - Small animals, birds, reptiles, foals, neonates, etc
  - Very dehydrated patients, or difficult to catheterize
  - Volume and speed similar to IV

- **Intraperitoneal**
  - Primarily in small laboratory animals
  - Enterocentesis a concern

ORAL rehydration via nasogastric intubation is still the mainstay of treatment for medical colic

PEG tube in dog with esophageal stricture; (percutaneous endoscopic gastrostomy)
4. Select supplies needed for fluid therapy

- Indwelling Catheters
  - Method of introduction – single lumen
    - Over the needle or through the needle
    - Multi-lumen – usu. placed “over a wire” via an introducer
  - Catheter composition
    - Polyurethane and Teflon most common
    - Silastic – best for long term central lines
    - Polypropylene – very short term only
    - Thrombogenicity
      - Silastic << Polyurethane <<< Teflon <<< Polypropylene
    - Various coatings – anti-bacterial, etc
  - Catheter size – judge patient size and speed of infusion
    - Larger bore = faster flow
    - You want as large as possible if severely hypovolemic, or use multiple catheters
    - Catheter must be smaller than vein to decrease phlebitis;
    - Longer catheters stay in better
- Infusion/injection caps, T-ports, multi-ports
- Extension sets to add length, mobility
- Intravenous lines – many types available
  - +/- drip chamber, piggy back capability
  - Spike end for bags/bottles vs. funnel end for bottles
  - 10, 15, 20, 60 drops/ml
  - Hi-flow for large animals – larger diameter tubing
  - Specific types for some infusion pumps
- Catheter flush solution – heparinized saline
  - 4 IU/ml heparin sodium
  - Take care with very small patients – can become heparinized

Catheter sizes, by species and size

<table>
<thead>
<tr>
<th></th>
<th>Adults:</th>
<th>Small cat/kitten: 24g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dogs</td>
<td>Big dog: 18g x 1-2”</td>
<td>Med. Dog: 20g X 1-1.25”</td>
</tr>
<tr>
<td></td>
<td>Small dog/puppy: 22g x 1”</td>
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<tr>
<td>Horses</td>
<td>Adults: 14 or 12g X 5”</td>
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<td></td>
<td>Foals: 16g or 14g; 3.5 to 5”</td>
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<tr>
<td>Ruminants Camelids</td>
<td>Adult cows: 14 or 12g X 5”</td>
<td>Adult camelids: 16 or 14g, 3.5 - 5”</td>
</tr>
<tr>
<td></td>
<td>Small ruminants, calves 16 or 14g, 3.5 - 5”</td>
<td></td>
</tr>
</tbody>
</table>

Need “pilot holes” in ruminants/camelids – use a #15 scalpel (it’s leather!)
5. **Select administration technique** for IV therapy

- Intermittent bolus
- Intermittent infusions
- Constant rate infusion machines (CRI, see below) – count drops per second, or use pump

**Maintenance fluids post-op**
- Cephalic catheter, IV set on pump

**Intermittent bolus post-obstruction**
- Cephalic catheter

**Bolus therapy for acute colic**
- Jugular catheter; spike IV set

**Intermittent bolus**
- Jugular catheter; extension set, coil IV set

- **Rate of fluid administration** – depends on condition
  - Acute illness/loss – correct may proceed faster
  - Severe hypovolemia – shock doses of crystalloids given over 30-60 min, reassess
    - Colloids and/or hypertonic saline improve intravascular volume faster
  - Less severe deficits – give a portion of deficit over 30-60 min, then rest over 12-24 hrs
  - Chronic losses – give over 24 hrs
  - Uncontrolled hemorrhage – be careful with fluid rates
- **Monitor therapy** via improvement in attitude, clinical signs, vital signs, lab data
- **Reassess** often at first, less as condition improves

**Shock dose** ≈ blood volume
- ~ 80 ml/kg dog
- ~ 50 ml/kg cat
- ~8 % BW horse/cow

*Saphenous vein catheter with extension set in small cat for anesthesia/surgery*
In summary, fluid therapy protocol:

- Identify deficit via clinical signs +/- laboratory data
- Determine volume of loss, maintenance requirements
  - Identify particular electrolyte, protein, red blood cell deficits via blood work
- Determine type of fluid loss and select replacement fluids, supplements needed
- Decide what route of administration is necessary
- Gather supplies, prepare patient, place catheter if needed, and GO

Intravenous catheterization: step by step

First – does patient need sedation to allow catheterization? Adequate restraint (human and sometimes chemical) is necessary to perform this task quickly, correctly, and with minimal stress to patient and people involved.

1. Thorough skin preparation – clip hair, antiseptic scrub, usually iodine or chlorhexidine-based; contact time important, ~5 min for adequate bacterial killing. Remove scrub with alcohol or sterile saline; Raise vein with a tourniquet or via assistant’s thumb;
2. Insert catheter into center of vein and at least 2-3 mm past the distal edge of the catheter; carefully slide catheter off the needle into vein,
3. Attach cap, t-port or other extension set;
4. Dry area and secure with tape; cover with bandage if desired.

Use aseptic technique with sterile gloves, sterile bandage materials, etc, for placement of longer term catheters, central line catheters, etc.
Zuku Review FlashNotes

How To Give Fluids

FLUID THERAPY, (part 3)

References and suggested reading:
Cardiovascular Physiology Concepts RE Klabunde, PhD


Subcutaneous fluid therapy for cats, Washington St Univ: Oral Fluid Therapy for Dairy Cows; Many Sick Cows Need Fluid Therapy, Dr. Geof Smith, and Fluid Therapy in The Merck Manual, 10th Ed.

All photos courtesy of Dr. JG Adams, unless otherwise indicated.

<p>| Constituents of commonly used fluid products in veterinary medicine; comparison to plasma |
|---------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|</p>
<table>
<thead>
<tr>
<th></th>
<th>pH</th>
<th>Osmolarity mOsmo/L</th>
<th>Tonicity</th>
<th>Na+ mEq/L</th>
<th>K+ mEq/L</th>
<th>Ca²⁺ mEq/L</th>
<th>Mg²⁺ mEq/L</th>
<th>HCO₃⁻ / buffer mEq/L</th>
<th>Dextrose g/L</th>
<th>Use</th>
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<tr>
<td><strong>Plasma</strong></td>
<td>7.4</td>
<td>300</td>
<td>-</td>
<td>145</td>
<td>105</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>24</td>
<td>~1 (glucose)</td>
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<tr>
<td><strong>ECF</strong></td>
<td>7.4</td>
<td>145</td>
<td>110</td>
<td>4</td>
<td>2.5</td>
<td>1</td>
<td>24</td>
<td>-</td>
<td>-</td>
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<tr>
<td><strong>ICF</strong></td>
<td>7.4</td>
<td>12</td>
<td>4</td>
<td>140</td>
<td>4</td>
<td>34</td>
<td>12</td>
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**Crystalloids**

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<tr>
<th></th>
<th>pH</th>
<th>Osmolarity mOsmo/L</th>
<th>Tonicity</th>
<th>Na+ mEq/L</th>
<th>K+ mEq/L</th>
<th>Ca²⁺ mEq/L</th>
<th>Mg²⁺ mEq/L</th>
<th>HCO₃⁻ / buffer mEq/L</th>
<th>Dextrose g/L</th>
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<tbody>
<tr>
<td><strong>0.9% Saline</strong></td>
<td>5.0</td>
<td>310</td>
<td>Iso</td>
<td>154</td>
<td>154</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Rpl</td>
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<tr>
<td><strong>Ringers</strong></td>
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<td>310</td>
<td>Iso</td>
<td>148</td>
<td>156</td>
<td>4</td>
<td>4.5</td>
<td>-</td>
<td>-</td>
<td>Rpl</td>
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<tr>
<td><strong>Lactated Ringers</strong></td>
<td>6.5</td>
<td>272</td>
<td>Iso</td>
<td>130</td>
<td>109</td>
<td>4</td>
<td>3</td>
<td>28(L)</td>
<td>-</td>
<td>Rpl</td>
</tr>
<tr>
<td><strong>Normosol</strong></td>
<td>6.4 R</td>
<td>296</td>
<td>Hyper</td>
<td>140</td>
<td>98</td>
<td>5</td>
<td>-</td>
<td>3</td>
<td>27(A)</td>
<td>-</td>
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<tr>
<td><strong>Plasmalyte</strong></td>
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<td>294</td>
<td>Hyper</td>
<td>140</td>
<td>98</td>
<td>5</td>
<td>-</td>
<td>3</td>
<td>27(A)</td>
<td>-</td>
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<tr>
<td><strong>5% Dextrose</strong></td>
<td>7.4 A</td>
<td>294</td>
<td>Hypo</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td><strong>2.5% Dex/0.45% NaCl</strong></td>
<td>4.5</td>
<td>280</td>
<td>Iso</td>
<td>77</td>
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<td>-</td>
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<tr>
<td><strong>2.5% Dex/½ str LRS</strong></td>
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<td>4</td>
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<tr>
<td><strong>7% NaCl</strong></td>
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<td>2567</td>
<td>Hyper</td>
<td>1283</td>
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<td>-</td>
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<td>-</td>
<td>-</td>
<td>Rs</td>
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</table>

**Buffers**: A = Acetate, G = Gluconate = Lactate; Rpl = replacement, M = maintenance, Rs = resuscitation

Adapted from manufacturers' online sources and DiBartola’s “Fluid Therapy in Small Animal Practice”, 2nd ed.