



Zuku Review FlashNotes

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)

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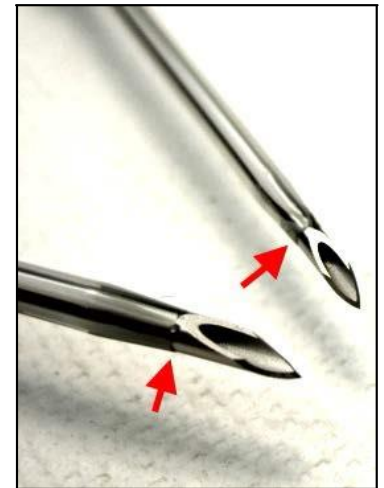
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4. Select supplies needed for fluid therapy

- 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



Catheters, from small to large gauge
24 gauge, 22g, 20g, 18g, 16g, 14g;
Image courtesy [Intropin](#)



TIP: Note edge of catheter is **beyond** the hole; if not placed into vein past this point, will see blood in hub but catheter is not yet in vein; tip may be damaged catheter tube will not slide into vein.

Image courtesy [Intropin](#)

Catheter sizes, by species and size

Cats	Adults: 22g x1"		Small cat/kitten: 24g
Dogs	Big dog: 18g x 1-2"	Med. Dog: 20g X 1-1.25"	Small dog/puppy: 22g x 1"
Horses	Adults: 14 or 12g X 5"		Foals: 16g or 14g; 3.5 to 5"
Ruminants Camelids	Adult cows: 14 or 12 g X 5"	Adult camelids: 16 or 14g, 3.5 - 5"	Small ruminants, calves 16 or 14g, 3.5 - 5"

Need “pilot holes” in ruminants/camelids – use a #15 scalpel (it’s leather!)



Injection ports and caps

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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



Saphenous vein catheter with extension set in small cat for anesthesia/surgery



*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 \approx blood volume
 ~ 80 ml/kg dog
 ~ 50 ml/kg cat
 ~8 % BW horse/cow



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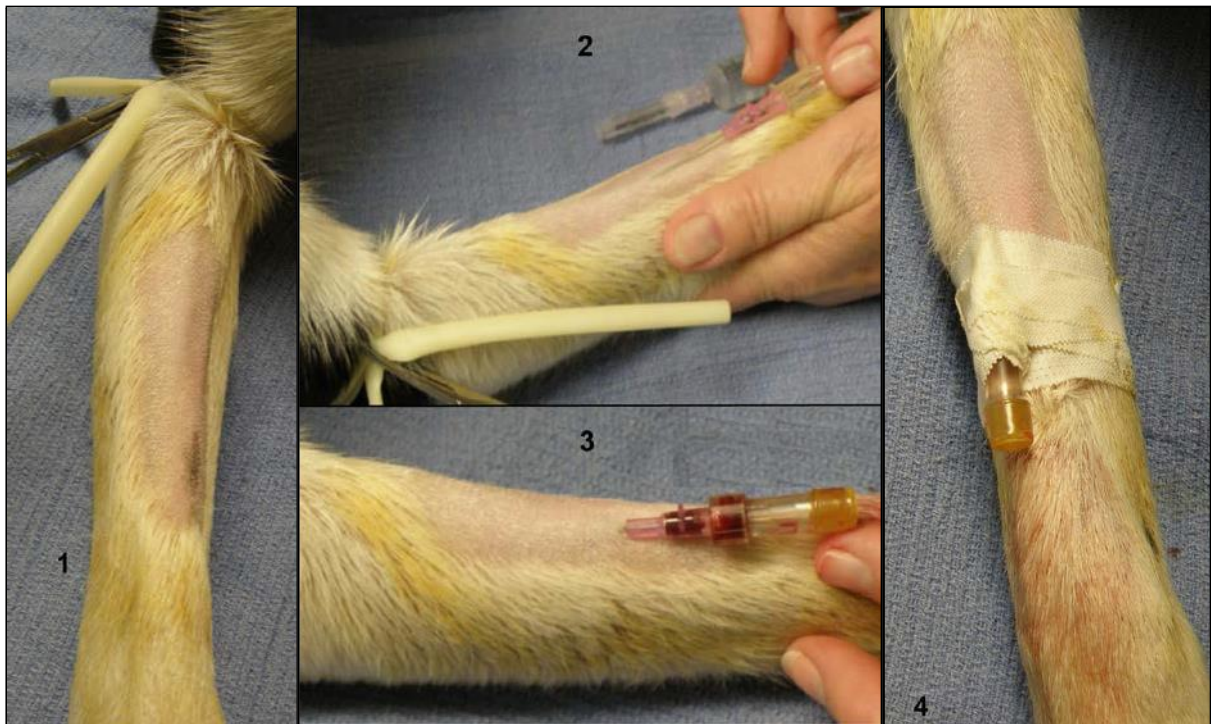
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In summary, fluid therapy protocol:

- 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.



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References and suggested reading:

[Cardiovascular Physiology Concepts RE Klabunde, PhD](#)

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Kirby R. 2009. The Physiology Of Fluid Therapy Proceedings, the 15th IVECCS Symposium. Chicago, Ill.

DiBartola S, ed. Fluid Therapy in Small Animal Practice, 2nd ed. 2000; newer editions available – all DiBartola books are excellent.

Part VI. Fluid Therapy In, Small Animal Critical Care Medicine, DC Silverstein & K Hopper, eds. 2009. Elsevier. pp. 260-86.

Schott HC. 2006. Fluid Therapy: A Primer for Students, Technicians, and Veterinarians, in Equine Practice. Vet Clinics NA, Equine Practice. Elsevier, 22(1) 1-14.

Lopes MA, Hepburn RJ, McKenzie HC, Sykes BW. 2003. Enteral Fluid Therapy for Horses. Compendium Equine. Vol 25(5): 390-7.

Hallowell GD and Potter TJ. 2009. Intravenous fluid therapy in cattle. UK Vet: Livestock. 14(1) 30-34.

[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.

Constituents of commonly used fluid products in veterinary medicine; comparison to plasma

	pH	Osmolarity mOsmo/L	Tonicity	Na ⁺ mEq/L	Cl ⁻ mEq/L	K ⁺ mEq/L	Ca ²⁺ mEq/L	Mg ²⁺ mEq/L	HCO ₃ ⁻ / buffer mEq/L	Dextrose g/L	Use
Plasma	7.4	300	-	145	105	5	5	3	24	~1 (glucose)	
ECF	7.4			145	110	4	2.5	1	24	-	
ICF	7.4			12	4	140	4	34	12	-	
Crystalloids											
0.9% Saline	5.0	310	Iso	154	154	-	-	-	-	-	Rpl
Ringers	5.5	310	Iso	148	156	4	4.5	-	-	-	Rpl
Lactated Ringers	6.5	272	Iso	130	109	4	3	-	28(L)	-	Rpl
Normosol	R 6.4	296	Iso	140	98	5	-	3	27(A) 23(G)	-	Rpl
	M 5.5	364	Hyper	40	40	13	-	3	16 (A)	50	M
Plasmalyte	A 7.4	294	Iso	140	98	5	-	3	27(A) 23(G)	-	Rpl
	148 5.5	312	Iso	140	98	5	-	3	27(A) 23(G)	-	Rpl
	M 5.0	377	Hyper	40	40	16	5	3	12(A) 12(L)	50	M
5% Dextrose	4.0	252	Hypo	-	-	-	-	-	-	50	
2.5% Dex/0.45% NaCl	4.5	280	Iso	77	77	-	-	-	-	25	
2.5% Dex/½ str LRS	5.0	263	Hypo	65.5	55	4	3	-	28(L)	25	
7% NaCl	5.0	2567	Hyper	1283	1283	-	-	-	-	-	Rs
Colloids											
6% Hetastarch / NaCl	5.5	309	Iso	154	154	-	-	-	-	-	Rs
In Lactated Ringers	5.9	307	Iso	143	124	3	5	-	28(L)	-	Rs
6% Dextran 70 / NaCl				154	154					-	Rs
In 5% Dextrose				-	-					50	Rs

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.