Fluid Therapy For Wildlife

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Outline

- The Importance of Fluids
- What is Dehydration?
  - Assessing Dehydration
  - Clinical Signs of Dehydration
- Fluid Therapy
  - Calculating Fluid Requirements
  - Fluid Types
  - Routes of Administration
- Summary

The Importance of Fluids

"We never know the worth of water till the well is dry."

– Thomas Fuller

Why is water important?

- **Living things are made of water.**
  - 60% of an adult's body weight is water.
  - 80-90 % in young animals.
- Water in the form of blood is the transport mechanism for the bodies required nutrients and also for the removal of waste.
- Without adequate water hormones, medications, and chemical messages can not reach their destinations.

Water Movement in the Body

Definitions

- **Solute:** is a substance dissolved in another substance
- **Solvent:** is a substance that dissolves a solute (a chemically different liquid, solid or gas), resulting in a solution
- **Osmosis:** the net movement of solvent molecules through a partially permeable membrane into a region of higher solute concentration, in order to equalize the solute concentrations on the two sides

Hydration: A balance of gains and losses

To maintain adequate hydration the body is constantly moving water into or out of one of the three major reservoirs.

- Intravascular fluid: in the vessels (5-7%)
- Interstitial fluid: baths non-blood cells (25%)
- Intracellular fluid: inside the cell (60%)

What's the normal rate of fluid loss?

Occurs roughly at a daily rate of 60ml/kg of body weight or 6% of the animal's weight each day.

Sources of Water	Losses of Water
Ingestion of water	Elimination (urine/feces)
Water in food	Respiration
Water produced in metabolism	Evaporation

What is Dehydration?

Dehydration is the loss of water and salts essential for normal body function.

Dehydration: The Common Causes

Decreased Intake
- Systemic illness
- Starvation
- Injury

Increased Loss
- Bleeding (trauma)
- Polyuria (urine)
- Diarrhea
- Vomiting
- Panting
- Burns

Dehydration: The Results

What happens to you when you are dehydrated?
- Thirst/dry mouth
- Loss of appetite
- Dry skin
- Constipation
- Decreased urination
- Weakness
- Headache
- Muscle cramps
- Dizziness
- Decreased blood pressure

Assessing Dehydration

How to tell when your patient is more than thirsty.

Assessing Dehydration: Skin Tenting

- **Definition: The time it takes for skin pulled away from the body to fall back into a normal resting position.**
- Where to Pinch
  - **Mammals**: skin between shoulder blades.
  - **Birds**: skin over the toes or eyelids.
  - **Reptiles**: skin tenting is not a reliable test.
- Dehydration is present when it takes longer than **one second** for the skin to return to a normal resting position.

Assessing dehydration by the skin tent method on a Virginia Opossum

Dehydrated American Robin hatchling. Note the wrinkled abdominal skin.

Assessing Dehydration: Capillary Refill Time

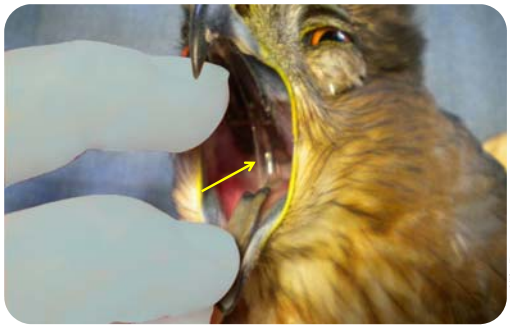
- **Definition: The time it takes for the capillaries to refill after applying enough pressure to blanch the surrounding area.**
- Where to Apply Blanching Pressure
  - **Mammals**: perform on the gums (can be difficult with aggressive patients)
  - **Birds**: use the basilic/ulnar vein (inside of elbow)
  - **Reptiles**: difficult
- A Capillary Refill Time (CRT) of greater than **2 seconds** is indicative of dehydration greater than 7%.

Assessing dehydration by the CRT method on a Virginia Opossum.

Ulnar vein on a Great Horned Owl. CRT assessment site.

Assessing Dehydration: Mucous Membranes

- **Definition: Visually examining the color and texture of the mucous membranes.**
- Where to look
  - Can evaluate oral membranes, eye conjunctiva, vulva or cloaca.
- What is normal
  - Pale pink to pink membrane color, but know your species not all animals have pink membranes.
  - Glistening and moist.
  - If membranes are pale and tacky or the animal has thick mucous strands in mouth they are dehydrated.



Coopers Hawk with pale mucous membranes and thick mucous strands.

Clinical Signs of Dehydration

In most cases with wild animals, particularly if there is trauma or disease, it is safe to assume there is at least 5% dehydration.

Clinical Signs of Dehydration: Birds

Clinical Signs	Percent Dehydration
No obvious signs, but assume all injured or orphaned birds have a fluid deficit.	< 5%
Skin may appear tight, especially over the keel. It may also appear dry and wrinkly. The skin forms a temporary tent if pulled up. Eyes look dull and eyelids tent. Inside of mouth is tacky, mucous strands.	5-10%
Inside of mouth is dry. Extremities are cold. Skin remains tented when pulled up. Heartbeat is rapid. Bird looks ill, listless and depressed.	10-15%

Clinical Signs of Dehydration: Mammals

Clinical Signs	Percent Dehydration
No obvious signs, but assume all injured or orphaned mammals have a fluid deficit.	< 5%
Skin appears tight; forms temporary tent if pulled up. Inside of mouth is dry. Decreased capillary refill time. Eyes starting to appear dry and sunken. Urine is concentrated and decreased volume.	5-7%
Pulse is weak and rapid. Eyes are sunken. Extremities are cold. Skin remains tented when pulled up. Mucous membranes are pale. Life threatening.	7-10%

Clinical Signs of Dehydration: Reptiles

Clinical Signs	Percent Dehydration
Increased thirst, slight lethargy, decreased urates.	3%
Increased thirst, anorexia and dullness. Dry loose wrinkled skin; slowly returns to normal when tented. Dull eyes. Dry, often sticky mucous oral membranes. Will start to see dysecdysis (abnormal shedding.)	7%
Dull to comatose. Skin remains tented after pinching. Animal feels light. Dry mucous membranes. Sunken eyeballs. No urates.	10%

Laboratory Evaluation

- Hematocrit (PCV)
- Total plasma protein concentration
- Urine specific gravity (mammals)
- All 3 can be elevated with dehydration.

Test	Birds	Mammals	Reptiles
PCV	35-55%	35-55%	20-40%
Total Protein	3.5-5.5 g/dl	5.5-7.5 g/dl	3.0-8.0 g/dl

Fluid Therapy

The regulation of water balance in a patient by careful measurement of fluid intake against daily losses.

Cautionary Note

- Fluid Therapy is an inexact science.
- The fluid in the body is in a continuous state of flux through normal physiologic processes.
- There are many diverging opinions regarding the type of fluid, volumes and rates of fluid administration and when and how to determine when enough fluid has been administered.
- **The point is that fluid therapy must be reassessed at frequent intervals and adjusted to obtain the maximum benefit and results.**

Goals of Fluid Therapy

- **Maintenance Fluids**
  - Provide daily needs
- **Fluid Deficite**
  - Correct existing deficits
- **Ongoing Losses**
  - To replace ongoing losses from bleeding, diarrhea, kidney problems, etc.

Additional Benefits of Fluid Therapy

- Strengthens patient
- Faster recovery
- Warms patient
- Increases circulation
- Detoxifies –increases blood passing through the liver and kidneys
- Stimulates the gastrointestinal tract

Getting Started

- Once the degree of dehydration is determined the next step is to develop a plan that includes:
  - **Total fluid requirement**
  - **Fluid type**
  - **Administration route**

Calculating Fluid Requirement

Math can be your friend.
It is time to learn how.

Calculating Fluid Requirements

- Daily Maintenance Fluids
- Fluid Deficit
- Ongoing Losses
- Patients Weight (kg or g)

Pieces of the Fluid Calculation Puzzle

Common Conversions

- 1 kg = 1000 g
- 1 lb = 454 g
- 1 ml = 1 cc

- **Maintenance Fluids**
  - 6% of body weight
- **Fluid Deficit**
  - % dehydration
- **Ongoing Losses**
  - Estimate of ongoing losses from bleeding, diarrhea, kidney problems, etc.

Total Fluid Requirement: Step One

Patient is a 1.2 kg Red-tailed Hawk that is 8% dehydrated and is losing 7 ml of blood per day as a result of an actively bleeding wound

Step one: Convert the weight to g

1 kg = 1000 g

1.2 kg x 1000 g = 1200 g

Total Fluid Requirement: Step 2

Step Two: Multiply the body weight in g by the percentage of required daily maintenance fluids plus the fluid deficit

BW (g) x (Maintenance Fluids + Fluid Deficit) =

BW (g) x (Maintenance (6%) + Fluid Deficit (8%)) =

1200 g x (6% + 8%) =

14% = 0.14

1200 g x (0.14) = 168 ml

Total Fluid Requirement: Step 3

Step Three: Add the ongoing losses to the answer from step two

7 ml of daily blood loss

Answer from step two + ongoing losses =

168 ml + 7 ml = 175 ml

175 ml or cc of fluids per 24 hours

Total Fluid Requirement: Step 4

Step Four: Calculate how much fluid to administer.

- Normal Crop or Stomach Capacity

Body Weight (g) x 5% = Maximum crop/stomach capacity

- Debilitated Crop or Stomach Capacity

Body Weight (g) x 2.5% = Debilitated capacity

- Total Subcutaneous (SC) Capacity

Body Weight (g) x 3% = Maximum SC capacity

Total Fluid Requirement: Step 4

Calculate Normal Crop/Stomach Capacity

Body Weight (g) x 5% = Debilitated crop/stomach capacity

1200g x 0.05 (5%) = 60 cc or ml

Gavage 60 ml per feeding

Total Fluid Requirement: Step 5

Step 5: Determine fluid frequency.

Divide total fluid requirement (175 ml)
by
the crop capacity (60 ml)

175 ml / 60 ml = 2.9

Gavage 60 ml 3 times daily

Creating a Multiday Plan

- Day One
  - Maintenance Fluids
  - Fluid Deficit
  - Ongoing Losses
- Day Two & Beyond
  - Maintenance Fluids
  - Ongoing Losses

Remember that this calculation does not replace ongoing patient assessments and monitoring. Stress of frequent handling and the animal's overall condition must always guide our care.

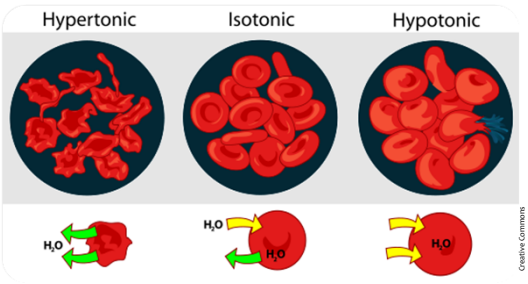
Therapeutic Fluid Types

Do you want that shaken or stirred?

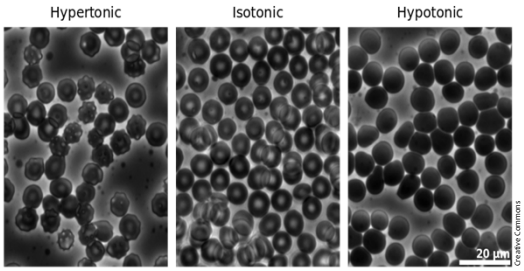
Fluid Types

Definitions

- **Osmotic pressure:** the minimum pressure needed to nullify osmosis.
- **Tonicity:** measure of osmotic pressure, comparison of solutes in two solutions
- **Isotonic:** concentrations of solutes that are comparable to normal body fluids
- **Hypertonic:** higher concentrations of solutes than in normal body fluids
- **Hypotonic:** less concentration of solutes than in normal body fluids



Osmotic pressure on mammalian red blood cells diagram.



Osmotic pressure on human red blood cells.

Therapeutic Fluid Types

Oral Rehydration Solutions

- Commercial products for human pediatric or calf diarrheal treatments
- Can be given PO only.

Crystalloids

- Can enter cells and all body fluid compartments.
- Used for replacement or maintenance of blood volume.
- Can be given PO, SQ, IV.

Colloids

- Large molecular weight substances that are restricted to bloodstream.
- More of this fluid remains in the bloodstream.
- Ideal for animals in shock.
- Must be given IV or IO.
  - Hetastarch
  - Oxyglobin
  - Whole blood or plasma

Fluid Type: Hypertonic

Oral rehydration solutions should be hypertonic and should contain glucose and sodium.

- Pedialyte
- Equalyte
- Dioralyte ORS

Caution
For oral use only!

Fluid Type: Isotonic

Administer SC or IV. If given PO should be diluted and with glucose added.

- Lactated Ringers Solution
- 0.9% Sodium Chloride
- Normosol–R
- 2.5% Dextrose
- Plasma-LTE

Caution
5% Dextrose is Hypertonic
Do not use SC!

Fluid Management

- Store fluids in cool, dark place.
- Place date opened on bag/bottle.
- Always check to make sure there is no discoloration or particulate matter floating in fluids prior to use.

Routes of Administration

The route of administration should be determined by the animal's condition, the volume of fluid needed to be given and the expertise of the administrator.

Choosing the Right Route

Route	Advantages	Disadvantages
Oral (PO)	Cheap, very effective, most natural. Helps flush the GI system.	Must be conscious, holding head up and swallowing. Risk of aspiration.
Subcutaneous (SC)	Simple, cheap, effective, can give large bolus to minimize handling.	Minimal absorption if animal is in shock. Must be administered using sterile techniques.
Intravenous (IV) Intraosseous (IO)	Delivers fluid directly into blood volume.	Risk of infection. Stress from catheter placement; can fall out. Risk of fluid overload.
Peritoneal (IP)	Can give large bolus, absorbed slowly over time.	Risk of infection, puncturing an internal organ. Must use correct fluid temperature.

Which Route of Administration is Best?

- In patients with a functional gastrointestinal tract (normal bowel movements), PO fluids are best.
- SQ fluids can be used for dehydrated patients that have diminished GIT function (diarrhea, vomiting) or in patients unable to maintain a normal upright posture.
- When replacing large fluid deficits (critical patients), IV or IO routes are best.
- Fluids should never be administered into body cavities of birds (can enter air sacs and drown the patient).

Oral Fluids: Gavage

If the gut works, use it.

Gavage: Step by Step Instructions

Getting Ready: Gavage

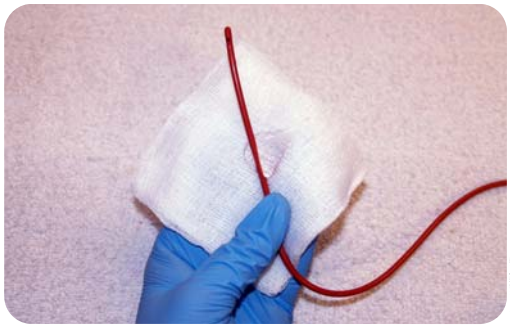
- Calculate the gavage volume.
- Measure out the solution in an appropriately sized syringe.
- Select the appropriately sized gavage tube.
  - Should be a larger diameter than the glottis or trachea.

Glottis on a Great Horned Owl.

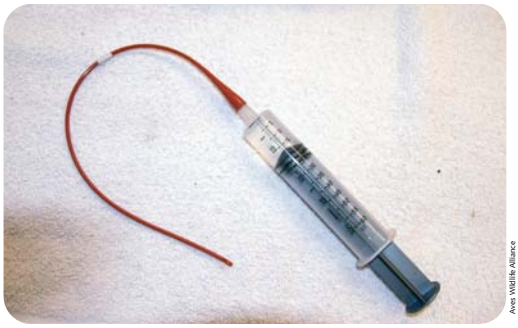
Warm the gavage solution to the approximate temperature of the animal.

Externally measure the length of tube needed to reach the stomach or crop.

Mark the tube length with a small piece of tape.



Lubricate the end of the tube with a water based lubricant.

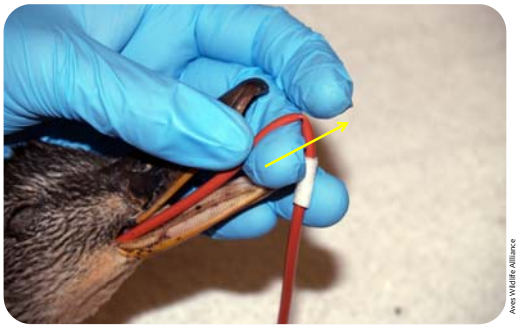


Charge the tube with the gavage solution to prevent injecting air.

Extend the animals head upward and in a bird identify the glottis.

Insert tube past the glottis to the premeasured tape mark.

Slowly dispense the gavage solution. Watch the back of the mouth for any fluid.



Pinch the tube & withdraw. Slowly let the head come back to a normal position.

Subcutaneous Fluids

This simple procedure, if done right, is one of the most critical in a wildlife rehabilitators life saving tool box.

Sites for Subcutaneous Fluids

Birds

- **Inguinal skin fold** (the juncture of the leg and body).
- **Interscapular region** (featherless tract on either side of the spine over the shoulder area).
- Never inject into the patagiumor in the armpit.
- Avoid if patient has subcutaneous emphysema –air bubbles under the skin.

Mammals

- Loose skin along the back of the neck between the shoulder blades.
- Almost any area of loose skin along the back and flanks.

Reptiles

- Inguinal or axillary area (turtles).
- On either side of the spine in the mid-third of the body (snakes).

SC Fluids: Step by Step Instructions

Getting Ready: SC Fluids

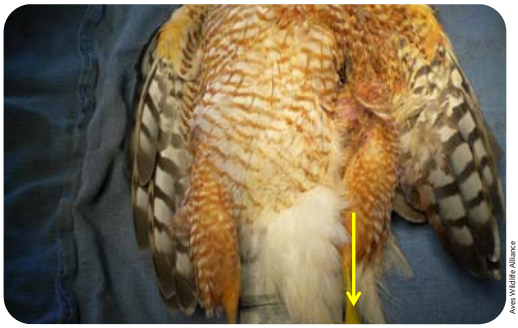
- Calculate the fluid volume.
- Using sterile technique, draw out the fluids into an appropriately sized sterile syringe.
- Select the appropriately sized sterile needle.

Fluid Management

- Fluids should be warmed to roughly body temperature prior to administration.

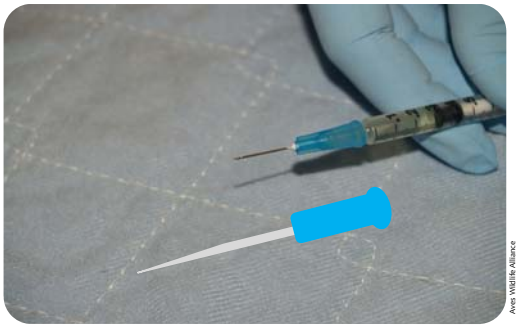
Species	Fluid Temperature
Birds	100 –104° F
Mammals	96–100° F
Marsupials	94 –98° F
Reptiles	86 –89.5° F

Locate injection site. Vest on a mammal.



Locate injection site. Inguinal area on a bird.

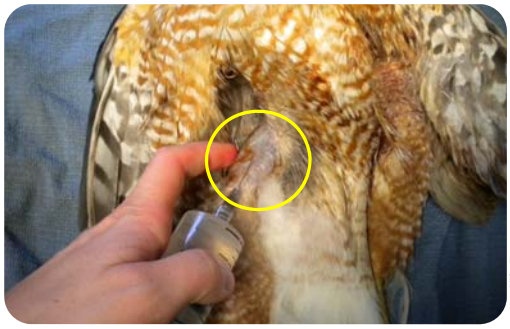
Wet the fur or feathers with alcohol to visualize the injection site.



Make sure the needle is bevel side up.

Angle the syringe so that it is parallel to the skin.

Insert needle under the skin, pull back on the plunger to check for a blood flash.



A fluid blister will form as the fluids are slowly expelled.

If the skin becomes very taut, move to a new site to administer remaining fluid.

Signs of Rehydration

- Increased weight
- Increased urination
- Eyes brighter
- Gums less tacky
- Improved attitude
- Increased appetite
- Improved skin elasticity
- Stronger pulse
  - Increase blood pressure
  - Normal CRT
- Decreased PCV/TP

When to Stop

- Once an animal is eating and drinking readily on its own.
- Hydration has been restored and the patient is able to maintain hydration without support.
- May want to taper fluid therapy by decreasing the amount administered by 25% per day.

Summary

- Maintaining an adequate fluid balance in the body is critical for normal body function.
- As rehabilitators we are responsible for helping maintain that balance for our wildlife patients.
- You can save lives by understanding how to calculate fluid volumes, choose the correct fluid type and administer fluids.

Credits

Rebekah Weiss, CET, CWR graduated from the University of Wisconsin Sevens Point with a B.S. in Wildlife Ecology, Animal Physiology, and Captive Wildlife Management. She is a Wisconsin State and USFWS Licensed Wildlife Rehabilitator and Educator.

Founded in 2009 Aves Wildlife Alliance is a 501c3 non-profit organization committed to conserving and restoring native wildlife though innovation and excellence in community outreach and wildlife rehabilitation.

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