Fluid therapy in Wildlife

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Introduction

The successful treatment of shock involves the administration of suitable warmth and fluids. However, deciding on when fluids are indicated, which ones and how much has meant that wildlife rehabilitators are sometimes unsure how to use fluids most effectively in their patients. These notes aim to provide rehabilitators with the understanding on how to use fluid therapy safely and effectively on the injured wildlife in their care.

Physiology of shock

The body has an intricate system designed to manage shock. The body has the objective of maintaining blood pressure, providing blood to important organs (brain and heart) and ensuring the heart works efficiently to achieve these goals.

The response of the body is to cause the small arteries in the skin and gut to constrict and to then push this blood into the bloodstream to maintain the blood volume. This means that there is less blood in the skin to heal and in the gut for the absorption of food until shock is treated – what you see is cool extremities. The heart beats faster and contracts more strongly – so you see an animal with a faster heart rate. A drop in blood pressure reduces the blood flow to the kidney and this works to reduce urine production and releases hormones that promote resorption of more water from the blood taking waste through the kidney. What you see is an animal that does not urinate for hours until it is warmed and fluids given.

However, other types of shock may release other chemicals which can have their own discrete effects on the body. An animal with sepsis, or bacteria in the bloodstream, may have the bacteria or its toxins working to stimulate cells that mediate other responses to prevent the toxins from having a negative effect on the heart (Tobias & Schertel).
Without the treatment of shock, the body may be unable to reverse these protective mechanisms and death may result.

What situations require fluids?

Some situations will need veterinary involvement to make a diagnosis.
However, fluids can be assumed to be required for the following situations:

- Shock from trauma or predation
- Vomiting or diarrhoea
- Hypovolemia – loss of blood in the body from burns, bleeding, dehydration

Timing of fluid administration

It is important that shock is addressed by warming the animal prior to the administration of fluids. Place the animal in an incubator or in a pouch with heat for 30 – 60 minutes before administering fluids. The temperature should be monitored with a thermometer near the animal. If the animal still feels cold at the end of this time, increase the heat by increments until it feels warm, while continuing to monitor the behaviour of the animal. Hot animals will pant, lick themselves, move away from the heat and sit with wings away from the body. The animal's temperature could also be taken to monitor the response to warming.

It is also important to remember that the fluids that are going to be administered are warmed.
Fluids are given warmed to the body temperature of the animal:

- Birds: 39 – 40ºC
- Reptiles: 30 – 32ºC
- Marsupials: 36 – 38ºC

Fluids may be warmed by placing the fluid bag in a microwave until it is warmed to a suitable temperature, warming the fluids in a warm water bath, or running the giving set line through a water bath.

Assessment of dehydration

Dehydration can be assessed using several methods. We combine these tools to gain an estimate of the percentage of dehydration, as summarized in Table 1.

Table 1: Clinical signs associated with varying levels of dehydration

% Dehydration	Clinical signs
<5	Normal on examination
5	Dry mucus membranes
6 - 8	Dry mucus membranes, skin tenting for 1s
10 - 12	Dry mucus membranes, skin tenting >2s, slow refill time, depressed, fast & weak pulse

- **Skin tenting**. The time taken for the skin to fall indicates the severity of dehydration. It is normal for the skin to take one second to fall. Dehydration is present when the skin takes longer than one second to fall. In mammals, the skin in between the shoulder blades is pinched and lifted. However, this site cannot be used in all species. Wombats and koalas have skin that is difficult to tent in that location and so skin may be tented in the groin of wombats and on the head of koalas.
  Birds have less collagen in their skin, so skin tenting can be difficult to use. However, the skin over the toes of birds can be pinched. Or the skin over the keel is pushed to the side – if it tents and looks crepy, this indicates dehydration.

- **Capillary refill time**. The time that it takes for the capillaries (very small blood vessels in tissues) to refill can also indicate dehydration. This is often performed using the gums in the mouth. Raise a lip and press an index finger firmly onto the gum for one second and lift your finger. The gum should return to its original colour by one second. Shock is present if takes longer than one second to return to the original colour.
  For birds, it can be more useful to occlude the basilic vein on the inside of the elbow of the wing. If it takes longer than one second to fill, the bird is greater than 7% dehydrated (Steinorht).

- **Mucus membrane colour.** This can be checked inside the mouth by looking at the colour of the gums. However, the conjunctiva of the eye or the inside of the cloaca may also be used. Most species will have a pale pink to pink colour. But there are some variations – such as yellow inside the mouth of tawny frogmouths or black pigment inside parrot mouths. If you touch the mucus membrane, it should feel slippery to touch (try the inside of your mouth). If the gums feel tacky, like partly-dried glue, then dehydration is present.

- **Other signs** that suggest dehydration include:
  - Lethargy;
  - Cold extremities - ears, feet;
  - Weakness;
  - Eyes may be glazed (mild); or sunken (severe) (Redig).

How much fluids are required?

Animals require fluids for:

- Maintenance;
- Rehydration;
- Replacement of ongoing losses.

The maintenance requirement of most species has been estimated to be 50-60 ml/kg/day, or 5% of body weight. Smaller species, such as passerines, may require up to 8% of body weight daily for maintenance.

It is a reasonable assumption that most animals present with 10% dehydration. The total volume of fluid given must address both the ongoing maintenance requirements and the replacement required from dehydration.

In this scenario, 50% of this deficit is replaced in the first twenty-four hours and the remainder over the following two days.

Day 1: maintenance (5%) + rehydration (5%) = 10% of body weight
Day 2: maintenance (5%) + rehydration (2.5%) = 7.5% of body weight
Day 3: maintenance (5%) + rehydration (2.5%) = 7.5% of body weight

The total requirement for 24 hours should not be given all at once. The amount is divided and given at regular intervals – for example, every 4 – 6 hours.

If too much fluid was given, and this may be possible with intravenous fluids, the animal may have signs of nasal discharge, coughing, panting, ascites or diarrhoea.

What fluids are suitable?

Fluids may be described as **balanced** – having a composition similar to blood; or **unbalanced** if it does not.

Fluids are also broken down into **crystalloid** fluids (e.g.: Hartmann's, (Baxter)) which contain electrolytes able to enter into cells; and **colloids** which have large molecules that can only stay in the blood stream.

Crystalloids stay in the bloodstream for a shorter period of time than colloids. Crystalloid fluids are also described as being used for replacement or maintenance of blood volume. They can be given intravenously or subcutaneously.

It is not necessary to stock a large range of fluids as most animals can be treated with a few crystalloid solutions as shown in Table 2. Balanced replacement solutions, such as Hartmann's (Baxter) and 0.9% saline (Baxter) are suitable for most situations. 5% dextrose (Baxter) can be used as a replacement fluid. It does not provide sufficient energy for maintenance. The glucose is converted to carbon dioxide and water (DiBartola).

Some fluids such as Hartmann's contain ingredients such as lactate which is used by the body to counter metabolic acidosis. Metabolic acidosis is seen in many situations that cause shock.

Table 2: Products and routes used in dehydration

Route	Level of dehydration	Indication	Suitable products
Oral	Mild	Maintenance	Oral rehydration products, e.g.: Lectade, Vytrate
Subcutaneous	Mild to moderate	Maintenance & replacement	Hartman's, saline
Intravenous	Severe	Resuscitation	Hartman's, saline
Intraosseus	Severe	Resuscitation	Hartman's, saline

Suitable oral rehydration products are many and varied – they will usually have a combination of electrolytes and energy sources such as glucose. Examples include Lectade (Jurox®), Vytrate (Jurox®) and Spark (Vetafarm®). A home-made rehydration solution can be made by adding 1 teaspoon of table salt and 1 teaspoon of sugar to 1 metric cup (250ml) of boiled water. Stir and allow the solution to cool to the correct temperature before administration.

Products such as Polyaid Plus (Vetafarm®), Wombaroo First Aid (Wombaroo®), fruit juices, hand-rearing mixes, milks and baby foods are not oral rehydration products in the true sense as they contain food ingredients. They do not play a role in replacement of fluids from shock, but contribute towards the daily maintenance requirement of fluid. The suitable time for their use is once the animal is rehydrated.

How can fluids be given?

There are several different routes by which fluid can be given. It is important to choose a route that you feel comfortable with. It is recommended that you gain experience under supervision of a veterinarian or experienced rehabilitator before performing these techniques yourself. It is important to remember that the easy and simple ways work just as well, if not better, than more complicated routes. The advantages and disadvantages of each route are summarized in Table 3 below.

- **By mouth**. This works well as the animal can determine how much it wants, and the gut system is ideally designed to absorb fluids.
  However, the animal must be conscious and swallowing for oral fluids to be given without causing aspiration pneumonia. Oral fluids are not recommended for vomiting or recumbent patients
- **Subcutaneous.** Fluids can be injected into the space under the skin above the muscles. Sites that are suitable for subcutaneous fluids include the area in between the shoulders for marsupials, birds and reptiles. This is well-suited for animals that are 5 – 10% dehydrated. Aim to give ¼ of the fluid requirements initially and follow up with the remainder evenly spaced over 24 hours. Due to thick skin over the shoulders, the groin area of wombats is more suitable for the administration of subcutaneous fluids.
- **Intravenous.** A catheter is placed aseptically into a vein. This procedure is best performed by a veterinarian as the ideal vein varies with species. The stress of having a catheter placed and maintained must be weighed up against the benefits of obtaining fluid in by this route. Intravenous catherization is associated with sepsis from unhygienic catheter placement, fluid overload or fluids being given into the area under the skin. An intravenous bolus of fluids stays in the blood for only seven minutes, and represents little real value to the animal. Continuous rate infusion requires control over the rate of delivery by using a burette, a syringe pump or fluid pump, to avoid delivering more fluids that what is required. Fluids must be kept warm during delivery using this system. Continuous intravenous fluids are suitable for severe shock of 10% and greater.
- **Peritoneal.** Injections of fluids can be given into the abdominal cavity. The peritoneum is the lining of the inside of the cavity, thus it is into this potential space that the fluids are administered. It is suitable for giving a bolus of fluids, which will be slowly absorbed. However, it is not suitable in birds due to the presence of air sacs. It can be done with caution in reptiles, considering that in some species – such as blue tongue lizards and dragons, the extent of the lungs reaches the pelvic canal, and thus inadvertent administration into the lungs is possible. The species in Australia where this is used most commonly is the flying fox. Caution needs to be excised if the animal is pregnant. The disadvantages to this route include peritonitis – or infection of the abdominal cavity when good sterility is not performed; and puncture of an organ, with gut contents entering the abdominal cavity and development of peritonitis. The temperature of the fluids must be very accurately measured – they can scald the outside of the organs, or when cool, contribute to further hypothermic shock. This technique is not recommended, and needs to be performed with caution and adequate training.

Table 3: Advantages and disadvantages of the routes of fluid administration.

Route	Advantages	Disadvantages
Mouth	Simple, cheap, very effective	Conscious, swallowing, patient required Risk of aspiration
Subcutaneous	Simple, cheap, effective, bolus can be given which reduces handling	Minimal absorption if animal is still in shock
Intravenous	Deliver fluids directly into blood volume	Risk of infection, stress from placement, catheter can come out, fluid overload,
Peritoneal	Absorbed slowly over time, bolus amount can be given	Risk of infection, risk of puncturing an internal organ, risk of inducing shock from cool fluids

Monitoring response to fluids

This can be achieved by several methods:

1. **Re-evaluation of the wildlife patient**. As animals respond to fluids, they become more alert, their eyes become brighter. The severity of skin tenting is reduced. The gums become less tacky. Animals become more interested in food.
2. **Urine production**. Urine should be produced, and ideally a greater amount of urine than normal is expected once rehydration is successful.
3. **Weight gain** is a tangible, easily-performed parameter to perform. With adequate hydration, animals should initially gain or maintain their weight.

Conclusion

Administration of appropriate fluid therapy to injured wildlife will lead to improved treatment of shock, and thus better outcomes for our wildlife patients.

References

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