

Fluid therapy

In the nineteenth century. Only severely ill patients received intravenous fluids and proctoclysis (rectal administration of fluid), while less critical patients were given subcutaneous and intraperitoneal fluid therapy

In both veterinary and human intravenous fluid therapy are remarkable.

Perioperative patients often are not drinking or eating. The animal continues to make urine, saliva, and gastrointestinal secretions, and to lose fluid via respiratory evaporation.

During times of illness or following surgery, both increased fluid losses and decreased intake may lead to dehydration.

Dehydration, also known as hypohydration, is defined as loss of bodily fluids and can cause changes in all fluid departments, depending on the type of fluid lost.

Abnormal fluid losses commonly occur via urinary (e.g., polyuria) and gastrointestinal (e.g., diarrhea and vomiting) losses, although skin (e.g., burns), respiratory tract, salivary gland, hemorrhage, and third space (e.g., abdominal fluid, hematomas, pleural effusion, tissue trauma) losses can also result in decreased effective circulating volume.

Isotonic replacement fluids should be administered according to a. the patient's estimated dehydration(replacement need), b. maintenance needs, and c. anticipated ongoing losses.

Physical examination findings in animals with evidence of dehydration can be found in Table

Physical Examination Findings in Dehydrated Patients

PERCENT DEHYDRATION	CLINICAL SIGNS
<5	No detectable abnormalities
5-8	Decreased skin turgor, dry mucous membranes
8-10	Decreased skin turgor, dry mucous membranes, eyes may be sunken in orbits, slight prolongation of capillary refill time
10-12	Severe skin tenting, prolonged capillary refill time, dry mucous membranes, eyes sunken in orbits, possibly signs of shock
>12	All of the above, plus signs of shock, often life threatening

General guidelines for rehydrating patients with evidence of interstitial dehydration (loss of water and solutes from the interstitial space most commonly seen in animals with 5% to 8% dehydration) use the following formula:

$$\begin{aligned} &\text{Body weight in kg} \times \text{Percent dehydration} = \text{Deficit (in liters)} \\ &\text{PLUS} \\ &\text{Estimated ongoing losses} \\ &\text{PLUS} \\ &\text{Maintenance} = \\ &\text{Fluid amount to be given over next 6 to 24 hours} \end{aligned}$$

Ongoing losses include those caused by vomiting, diarrhea, polyuria, open wounds or burns, fever, third-spacing, or blood loss.

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Maintenance fluid rates are estimated at 2 to 4 mL/kg/hr, with larger or overweight animals using the lower end of the range and smaller or thin patients the upper end. More exact requirements can be found in Tables

FOR DOGS: BW(KG) ^{0.75} × 132 = ML/DAY					
BODY WEIGHT (KG)	WATER (ML/DAY)	WATER (ML/HR)	BODY WEIGHT (KG)	WATER (ML/DAY)	WATER (ML/HR)
1.0	132	6.0	21.0	1295	54.0
2.0	222	10.0	22.0	1341	56.0
3.0	301	13.0	23.0	1386	58.0
4.0	373	16.0	24.0	1431	60.0
5.0	441	19.0	25.0	1476	62.0
6.0	506	21.0	26.0	1520	64.0
7.0	568	24.0	27.0	1564	65.0
8.0	628	26.0	28.0	1607	67.0
9.0	686	29.0	29.0	1650	69.0
10.0	742	31.0	30.0	1692	71.0
11.0	797	33.0	35.0	1899	79.0
12.0	851	36.0	40.0	2100	88.0
13.0	904	38.0	45.0	2293	96.0
14.0	955	40.0	50.0	2482	104.0
15.0	1006	42.0	55.0	2666	111.0
16.0	1056	44.0	60.0	2846	119.0
17.0	1105	46.0	70.0	3195	133.0
18.0	1154	48.0	80.0	3531	147.0
19.0	1201	50.0	90.0	3857	161.0
20.0	1248		174.0		

Daily Water Requirements

FOR CATS: BW(KG) ^{0.75} × 80 = ML/DAY		
BODY WEIGHT (KG)	WATER (ML/DAY)	WATER (ML/HR)
1.0	80.0	3.0
1.5	108.4	5.0
2.0	134.5	6.0
2.5	159.1	7.0
3.0	182.4	8.0
3.5	204.7	9.0
4.0	226.3	9.0
4.5	247.2	10.0
5.0	267.5	11.0

During anesthesia, most animals are given 5 to 10 mL/kg/ hr of isotonic crystalloids intravenously to maintain intravascular volume and pressures.

Animals that have considerable ongoing losses and those that will not be able to drink within a short time require additional fluid therapy.

*Continued intravenous fluid therapy is especially important in **geriatric animals**, **those that have considerable postoperative fluid losses** and **patients that are not cardiovascularly stable**.*

FLUID TYPES AND USES

- Fluid types available for use in the surgical patient include isotonic crystalloids, hypotonic crystalloids, hypertonic crystalloids, synthetic colloids, and blood products.

Crystalloid solutions contain electrolytes and other solutes

تحتوي المحاليل البلورية على إلكتروليتات ومواد مذابة أخرى

*Isotonic crystalloids, also known as **replacement fluids**, are electrolyte-containing fluids with a composition similar to that of extracellular fluid.*

1. Isotonic Crystalloids

Isotonic crystalloids are the type of fluid most commonly used for perioperative treatment.

In animals with cardiopulmonary or intracranial pathology, careful monitoring is essential to avoid pulmonary or cerebral edema, respectively

البلورات متساوية التوتر هي نوع السائل الأكثر شيوعاً في العلاج قبل الجراحة

*Infusion of isotonic crystalloid fluids **does not significantly change the osmolarity** of the vascular or extravascular (both interstitial and intracellular) space.*

These fluids are typically used to expand the intravascular and interstitial spaces and to maintain hydration.

Isotonic crystalloids most commonly used contain mixtures of electrolytes, water, \pm acid-base components, \pm dextrose.

Most available isotonic crystalloids, other than 0.9% NaCl, contain a bicarbonate precursor such as lactate, acetate, or gluconate.

Animals with hypochloremia, hyponatremia, or a metabolic alkalosis will often benefit from the administration of 0.9% NaCl.

These fluids are "extracellular-expanding fluids," and 75% of the volume infused redistributes to the interstitial space, while only 25% remains in the vascular space .

هذه السوائل عبارة عن "سوائل تنتشر خارج الخلية" ، ويتم إعادة توزيع 75٪ من الحجم الذي يتم ضخه في الفراغ الخلالي ، بينما يبقى 25٪ فقط في حيز الأوعية الدموية.

A typical shock dose is ≈ 1 blood volume (i.e., 90 mL/kg in the dog and 50 mL/kg in the cat). Although replacement fluids are commonly used for maintenance of hydration, .

جرعة الصدمة النموذجية هي 1 حجم دم (أي 90 مل / كجم في الكلب و 50 مل / كجم في القط). على الرغم من استخدام سوائل الاستبدال بشكل شائع للحفاظ على التروية

The typical dose of replacement fluids that is used to maintain hydration is 2 to 4 mL/kg/hr. Large and giant breed dogs, as well as overweight animals, require less fluid to maintain hydration compared with smaller or leaner animals.

الجرعة النموذجية من السوائل البديلة المستخدمة للحفاظ على التروية هي 2 إلى 4 مل / كجم / ساعة. تتطلب كلاب السلالات الكبيرة والعلاقة ، وكذلك الحيوانات ذات الوزن الزائد ، كمية أقل من السوائل للحفاظ على الترطيب مقارنة بالحيوانات الأصغر أو الأصغر حجماً الهزيلة.

Excessive fluid administration should be avoided and can be harmful to the small animal surgical patient. Interstitial fluid gain can lead to interstitial edema, pulmonary edema, and cerebral edema.

Animals with recently lacerated or ruptured blood vessels are susceptible to rebleeding following aggressive fluid therapy. In those animals suffering blood loss, hypotension may contribute to cessation of bleeding.

الحيوانات التي لديها أوعية دموية تمزق أو تمزق مؤخرًا هي عرضة للنزيف من جديد بعد العلاج بالسوائل العدوانية. في الحيوانات التي تعاني من فقدان الدم ، قد يساهم انخفاض ضغط الدم في وقف النزيف

Surgical patients with a hypochloremic metabolic alkalosis will benefit from 0.9% NaCl because this is the highest chloride-containing fluid. It will help to normalize blood pH by dilution and by increased chloride, with a subsequent decrease in bicarbonate concentration.

سيساعد على تطبيع درجة الحموضة في الدم عن طريق التخفيف وزيادة الكلوريد ، مع انخفاض لاحق في تركيز البيكربونات.

Surgical animals that are severely acidotic may benefit from a crystalloid that contains a buffer agent such as acetate, gluconate, or lactate (i.e., NOT 0.9% NaCl because this fluid tends to be acidifying).

قد تستفيد الحيوانات الجراحية شديدة الحموضة من مادة بلورية تحتوي على عامل منظم مثل الأسيتات أو الغلوكونات أو اللاكتات (أي ليس 0.9% كلوريد الصوديوم لأن هذا السائل يميل إلى التحميض).

Large quantities of acetate can cause vasodilation and a decrease in blood pressure in animals with preexisting hypovolemia.

يمكن أن تسبب الكميات الكبيرة من الأسيتات توسع الأوعية وانخفاض ضغط الدم في الحيوانات التي تعاني من نقص حجم الدم الموجود مسبقًا.

2. Hypotonic Solutions

Maintenance fluids are hypotonic and refer to the volume of fluid and quantity of electrolytes that must be consumed on a daily basis to keep the volume of total body water and electrolyte content within the normal range.

سوائل الصيانة ناقصة التوتر وتشير إلى حجم السوائل وكمية الإلكتروليتات التي يجب استهلاكها بشكل يومي للحفاظ على الحجم الكلي لمياه الجسم ومحتوى الإلكتروليت ضمن النطاق الطبيعي.

They are especially useful in perioperative patients that are not eating or drinking but are otherwise stable and do not have ongoing fluid losses beyond those of a normal animal.

Maintenance solutions include 0.45% sodium chloride, 2.5% dextrose with 0.45% saline, 2.5% dextrose with half-strength lactated Ringer's solution

تشمل حلول الصيانة 0.45% كلوريد الصوديوم ، و 2.5% سكر العنب مع 0.45% محلول ملحي ، و 2.5% سكر العنب مع محلول رينجر اللاكتيكي نصف القوة

Large volumes of hypotonic maintenance fluid administration can lead to a rapid decrease in osmolarity and subsequent cerebral edema.

3. Hypertonic Solutions

Hypertonic (7.0% to 7.5%) sodium chloride administration causes a transient osmotic shift of water from the extravascular to the intravascular compartment. Small volumes of ≈ 4 to 6 mL/kg can be administered over 10 to 20 minutes.

يؤدي تناول كلوريد الصوديوم مفرط التوتر (7.0% إلى 7.5%) إلى تحول تناضحي عابر للماء من خارج الأوعية الدموية إلى الحيز داخل الأوعية. يمكن إعطاء كميات صغيرة من 4 إلى 6 مل / كجم خلال 10 إلى 20 دقيقة.

It help to reduce endothelial swelling, increase cardiac contractility, cause mild peripheral vasodilation, modulate inflammation, and decrease intracranial pressure.

Hypertonic saline is especially useful for the treatment of head trauma or cardiovascular shock in animals >30 kg that require large amounts of fluid for resuscitation e.g., patients with gastric dilatation-volvulus.

Because of the osmotic diuresis and rapid redistribution of sodium cations that ensue following administration of hypertonic saline, the intravascular volume expansion is transient (<30 minutes) therefore additional fluid therapy must be used to maintain intravascular volume and prevent dehydration. For example, combinations of hypertonic saline and synthetic colloid solutions have shown beneficial effects

بسبب إدرار البول التناضحي وإعادة التوزيع السريع لكاتيونات الصوديوم التي تنتج بعد إعطاء المحلول الملحي مفرط التوتر ، يكون توسع الحجم داخل الأوعية عابراً (أقل من 30 دقيقة) ، ويجب استخدام علاج سوائل إضافي للحفاظ على الحجم داخل الأوعية ومنع الجفاف. على سبيل المثال ، أظهرت مجموعات من المحاليل الملحية مفرطة التوتر والمحاليل الغروانية الاصطناعية تأثيرات مفيدة

Although 25% mannitol could also be used as a hypertonic fluid.