승 영 신

동물보건 응급간호학

3. Fluid

1. Introduce many types of intravenous catheters.
2. Discuss different placement techniques used in veterinary medicine.
3. Understand the limitations and all access points for venous access.
4. Prevent infection of intravenous catheters

Introduction

- The healthy body :: 60~70% water
- Fluid :: balanced state for metabolic processes can function
- Fluid :: fluid chemical materials essential for body metabolism
- Problems :: Dehydrated or go into shock and DIE
- Purpose :: replace any deficit

  -> circulation fluid volume restored and renal function improved
- Replace must be as close as possible.

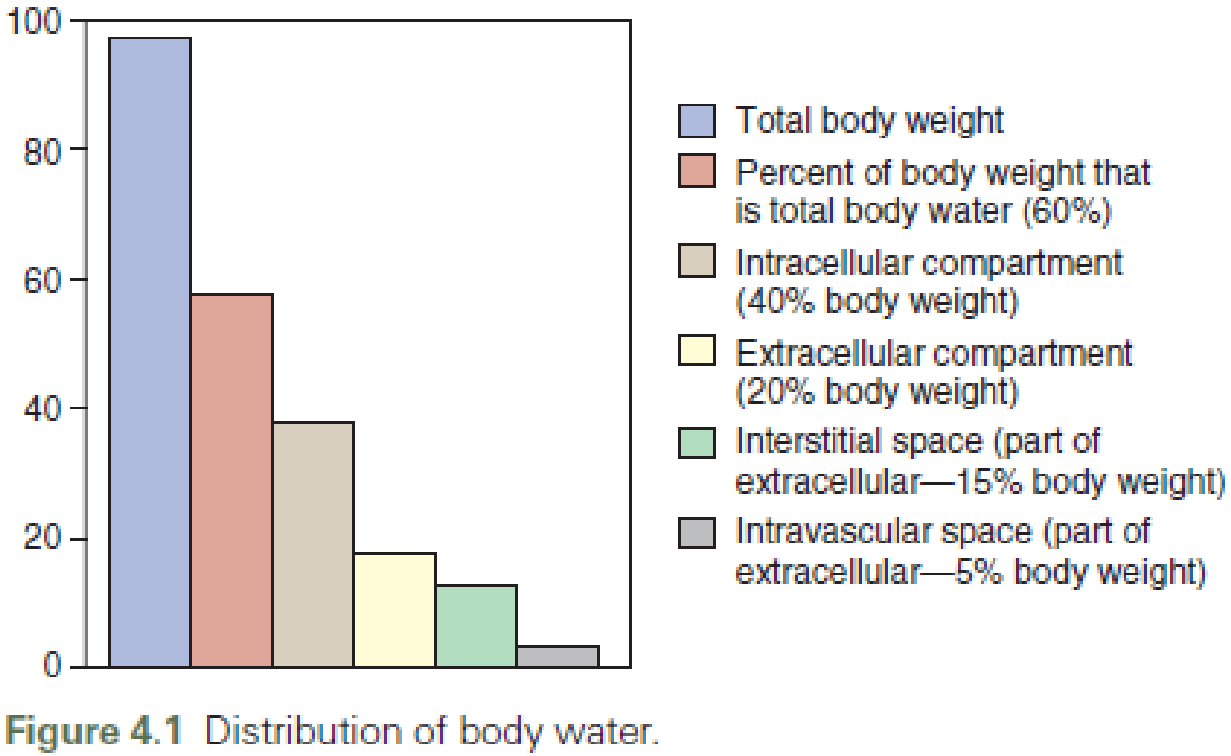
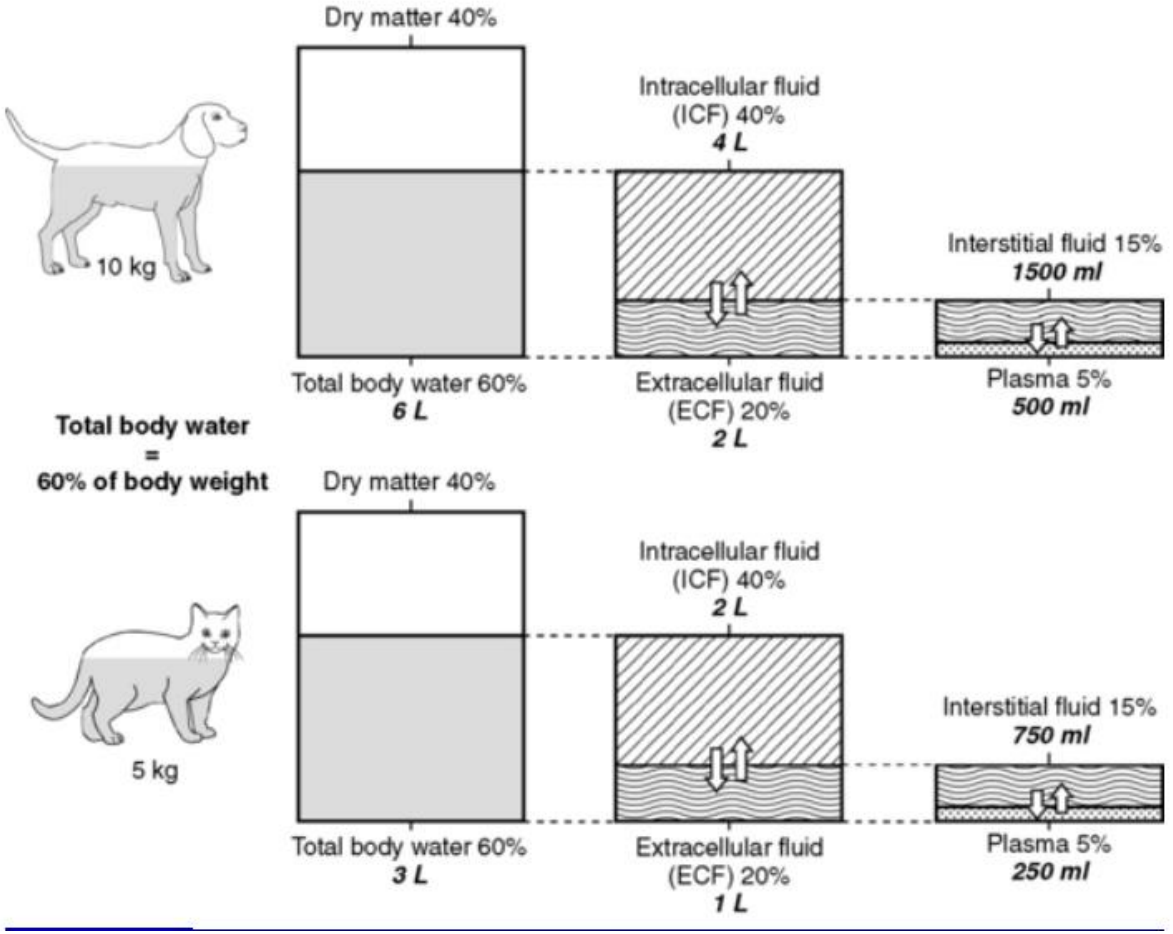


Figure 4.1 Distribution of body water.



물과 음식섭취를 통해 체수분 유지
호흡 배뇨 배설을 통해 체수분 손실 : 50ml/kg/day

Procedure: Appreciation of water balance in the body

- Intake

1. Ingestion
2. Metabolism

- Loss

1. Sensible water loss :: 25ml/kg/24h via urine
2. Insensible water loss :: 25ml/kg/24h via respiratory, cutaneous, faeces

- Water replacement :: 50ml/kg/24h – to balance water loss

TABLE 4.1 Routes of Administration

Route	Indications	Contraindications	Equipment Required	Technician Notes
Oral	Mild dehydration Short-term illness Small patients Animals with feeding tubes	Hypovolemia Shock Vomiting or nauseous animals Mentally inappropriate patients Decreased to absent gag/swallow reflex	Nasal/esophageal/percutaneous gastrostomy tube Syringes Baby bottles (neonates)	Confirm tube placement in appropriate location before administration of fluids Aspirate tubes before fluid administration/check residual volume
Subcutaneous	Mild dehydration Nonhospitalized animals	Hypovolemia Shock Hypothermia Dermal infection Skin wounds	Bag of sterile IV fluid for injection Administration set Needle (18–20 gauge) Isotonic crystalloid solution	Administer up to 10 ml/kg at each site Do not administer fluids under pressure because it can damage tissues and cause pain New sterile needle for each patient
Intravenous (IV)	Dehydration Hypovolemia Anorexia/vomiting/diarrhea of several days' duration Surgical procedures IV drug administration	Patients medically managed at home are not ideal candidates for IV fluid therapy	Sterile fluids for injection Administration set IV catheter and supplies Dial volume set/burette or fluid infusion pump Technical staff	Consider the patient's clinical signs when choosing site for IV catheter When possible avoid areas likely to be contaminated
Intraosseous (IO)	Cardiovascular collapse Lack of IV access Neonatal patients Avian patients Short-term use until IV access is obtained	Skin lesions at site of insertion Fractures Osteomyelitis	Hypodermic needle (neonates) Spinal needle IO catheter (various types) Administration set Technical staff	Familiarity with landmarks is essential Fluids safe for IV administration are safe for IO administration

수액처치시 고려사항

- Shock 인가?
- 탈수는 어느정도인가?
- 수액처치가 필요한가?
- 어떤 종류의 수액을 줄 것인가?
- 어떤 경로로 수액을 줄 것인가?
- 어떤 속도로 수액을 투여할 것인가?
- 얼마나 수액을 투여할 것인가?
- 언제 수액처치를 중지해야 하나?

Shock 상태의 환자

- 신체검사의 특징
  - Mental : 의식변화 Alert lethargy stupor coma
  - HR : 빈맥 / 중증의 서맥
  - BP : 저혈압
  - 점막색깔 : 창백 (빈혈과 구분 필요)
  - CRT : 측정불가 또는 지연
  - 맥박 : 감소 또는 소실
  - 사지온도 : 냉감
- Hypovolemia 저혈류량 vs Dehydration 탈수
  - Hypovolemia : intravascular
  - Dehydration : intravascular, extra(interstitial, intracellular)



Skin tugor / eye position / 점막 촉촉함





Figure 4.2 Evaluating the animal's eye position can provide clues to hydration status.

- 수액공급량(부족한)
- 탈수율 *체중 *1000
- 유지 수분량 : 50ml/kg

Ex) 25kg 7% 탈수시

1.부족한수액량 공급량
2.기본 평상시 손실량
3.시간당 몇ml 의 수액을 줘야?

25*0.07*1000+25*50= 3000ml/day=125ml/hr

TABLE 4.2 Estimating Percentage of Dehydration

< 5%	Subclinical—unable to appreciate hydration-related changes on physical exam History of illness involving fluid loss, not prolonged Normal mucous membranes, vital signs not appreciably changed
5%	Mucous membranes tacky or dry History of fluid loss
7%	Dry mucous membranes Prolonged skin tent Increased heart rate Pulse pressure/quality and blood pressure normal History of illness involving fluid loss, somewhat prolonged
10%	History of illness involving fluid loss, somewhat prolonged Dry mucous membranes Prolonged skin tent Increased heart rate Weak to thready pulse pressure Hypotension
12%	History of marked fluid loss Dry mucous membranes Prolonged skin tent Increased or decreased (decompensatory shock) heart rate Hypotension Pulses weak to absent Decreased body temperature ± cool extremities Diminished/abnormal mentation Sunken eye position

- PCV / TS

• Dehydration can cause an increase in both PCV and TS

measurements.

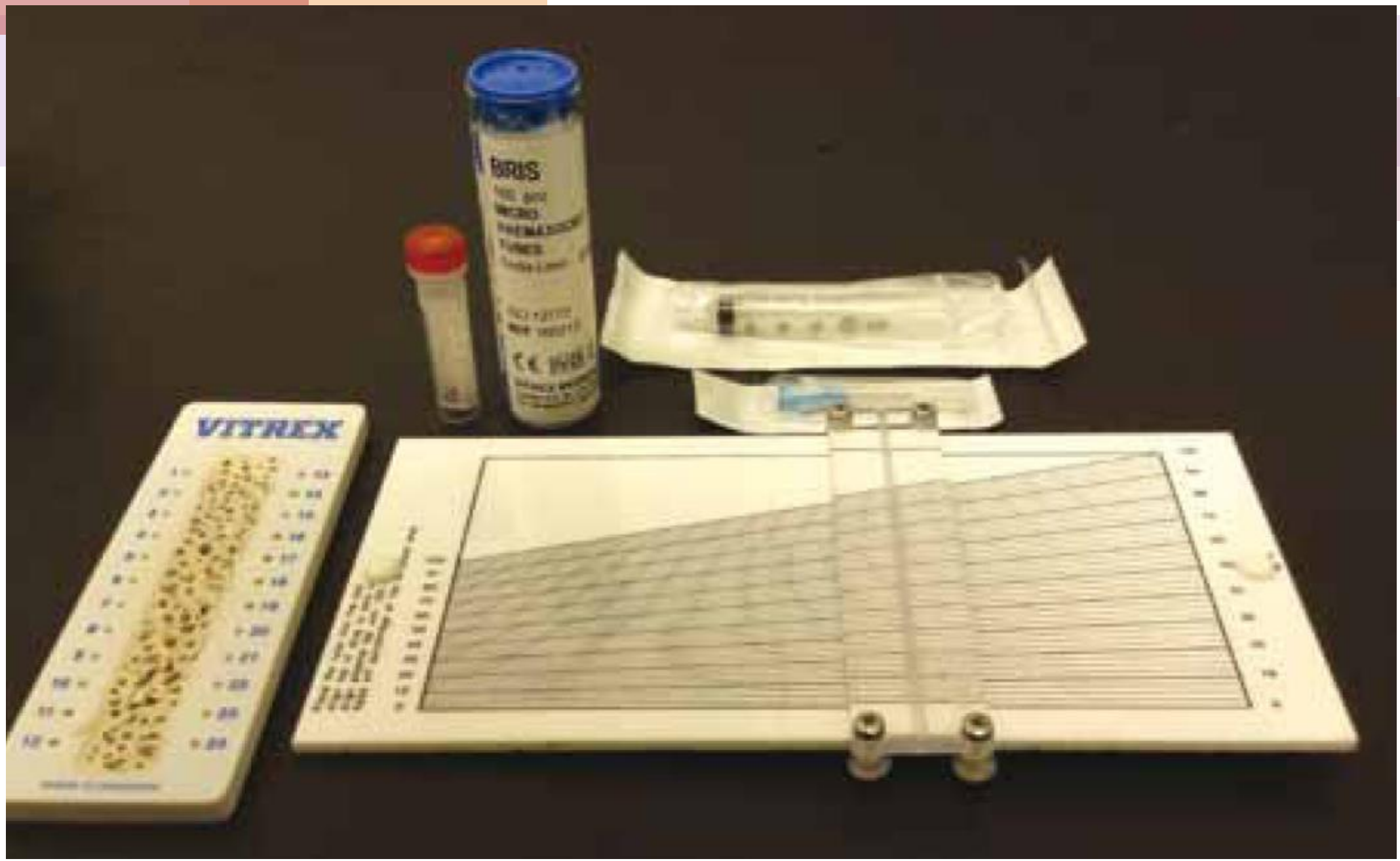
• Volume lost from hemorrhage may be accompanied by decreased PCV/TS values.

• Dehydration may cause the PCV value to appear falsely elevated in the anemic patient.

• Decreases in PCV/TS values attributable t hemorrhage may not be immediately apparent.



Figure 4.3 Packed cell volume (PCV)/total solids (TSs), blood urea nitrogen (BUN) stick, and urine specific gravity (USG) measurements should be obtained at time of admission and will help assess the animal's hydration and volume status.


VITREX

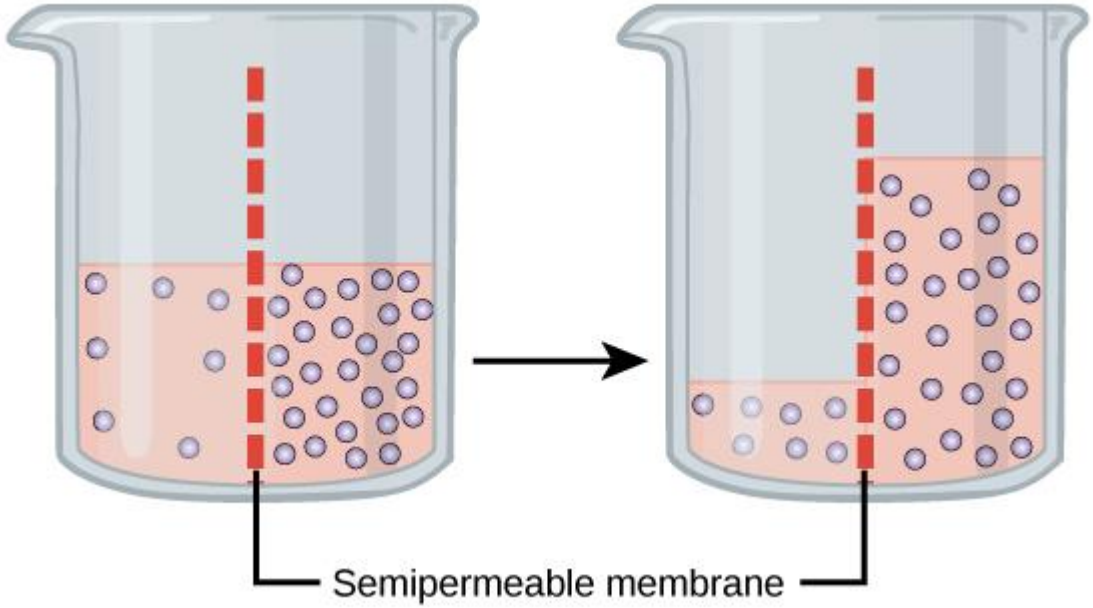
수액의 종류

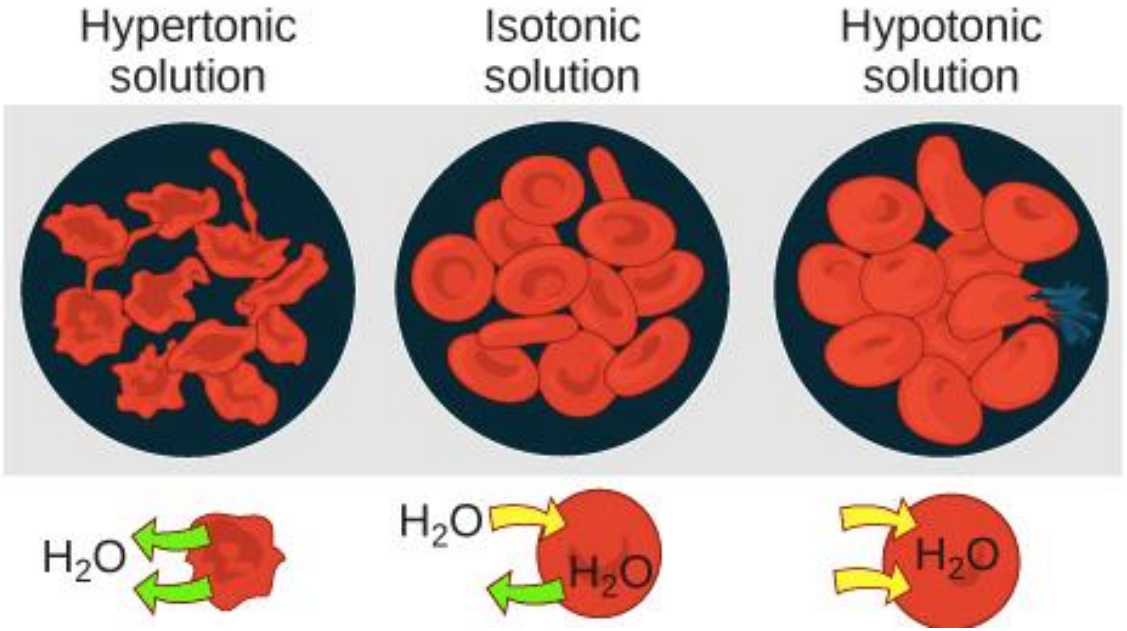
- Crystalloids :: 전해질만으로 이루어짐 투여량 ¼ 혈관내잔존
  - 보충 / 유지 / 고장
- Colloids :: 분자량이 큰 알부민등 포함
  - 합성 hetastarch / plasma / human albumine
- Blood
  - 전혈 / pRBCs / plasma
- Parenteral Nutrition
  - PPN / TPN



Figure 4.7 Synthetic colloids are effective volume expanders and are used in conjunction with crystalloids in resuscitation of hypovolemic patients.

- 수분의 이동 !!
- Isotonic에 저장성의 수액을 준다면?? Swells
- Isotonic에 고장성의 수액을 준다면?? Shrinks





등장성 : 혈액내 삼투압 290-310mOsm/L

TABLE 4.3 Isotonic Replacement Fluids

Solution	Osmolality (mOsm/L)	Sodium (mEq/L)	Potassium (mEq/L)	Chloride (mEq/L)	Calcium (mEq/L)	Buffer	Tonicity	Indications
Lactated Ringer's	273	130	4	109	3	Lactate	Isotonic	Dehydration Hypovolemic shock Vomiting Diarrhea Acute kidney injury Metabolic acidosis
Plasma-Lyte A	294	140	5	98	0	Acetate gluconate	Isotonic	Dehydration Hypovolemic shock Vomiting Diarrhea Acute kidney injury Metabolic acidosis
0.9% NaCl	310	154		154			Isotonic	Dehydration Hypovolemic shock Vomiting Diarrhea Hyperkalemia Metabolic alkalosis
Normosol-R	296	140	5	98			Isotonic	Dehydration Hypovolemic shock Vomiting Diarrhea Hyperkalemia Metabolic alkalosis

2(Na+K) + BUN/2.8 + Glu/18

1. 산증인가?
2. Na 수치는 어떠한가?

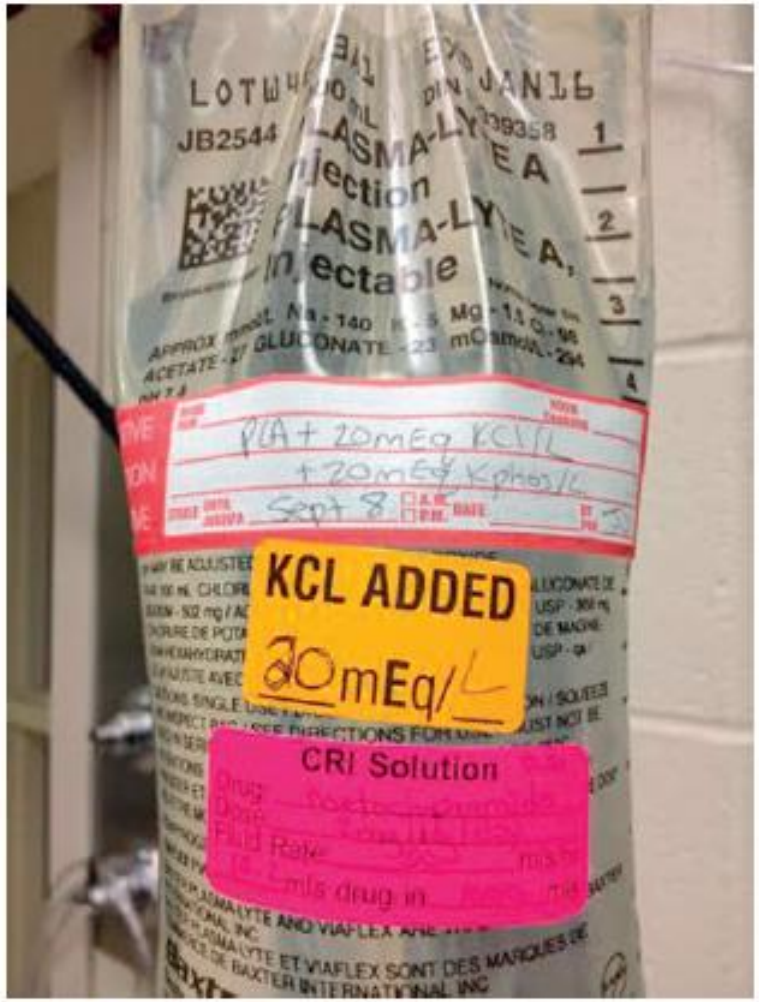


Figure 4.6 A bag of crystalloids may contain numerous medications for continuous infusion. Bags should be well labeled at all times.

TABLE 4.4 Hypotonic Crystalloid Solutions

Solution	Osmolality (mOsm/L)	Sodium (mEq/L)	Potassium (mEq/L)	Chloride (mEq/L)	Calcium (mEq/L)	Buffer	Tonicity	Indications
Plasma-Lyte M	363	40	13	40			Hypotonic	Replacement/maintenance of extravascular volume
0.45% NaCl	155	77		77			Hypotonic	Maintenance of extravascular volume
5% dextrose in H_2O (D_5W)	253						Hypotonic	Extravascular volume replacement Congestive heart failure Hypernatremia

- 저장성: 초기 체액소생 적합하지 않다. 저혈량증치료엔 부적합
- 고장성: 빠르게 혈관으로 확장. 체액이 혈관내공간으로 이동
  - 탈수환자에겐 사용하지 않고 (두부외상환자에 적합)

TABLE 4.5 Hypertonic Crystalloid Solutions

Solution	Osmolality (mOsm/L)	Sodium (mEq/L)	Potassium (mEq/L)	Chloride (mEq/L)	Calcium (mEq/L)	Buffer	Tonicity	Indications
3% NaCl	1026	513		513			Hypertonic	Hypovolemic shock Intravascular volume expansion
7.5% NaCl	2464	1232		1232			Hypertonic	Hypovolemic shock Intravascular volume expansion
Normosol-M + 5% dextrose	363					Acetate	Hypertonic	Intravascular volume expansion

Colloids

- 응급 및 중증치료시설에서 흔히 사용하는 수액
- 고분자량 입자가 들어있어 모세혈관 막을 통과하기 어려워 혈관에 주ㅇㅂ시 혈관내 구역에 남아있어 교질삼투압을 증가시켜 혈관내 공간으로 체액을 증가시켜 혈압과 관류를 개선시킨다. 즉, 소량의 Colloids로도 다량의 crystalloids를 투여했을때의 효과를 나타낼수 있으므로 다량의 수액을 감당하지 못하는 환자에게 사용.
- Ex) 저혈량증을 보이는 대형견 : 교질+결정질 동시 투여
- But : 과민반응 가능성 (아나필라시스), 응고시간 증가 가능성

TABLE 4.6 Summary of Dosage Guidelines for Intravenous Fluid Administration*

Solution	Indications	Contraindications	Rate (Guideline only)
Isotonic crystalloids	Hypovolemic shock	Volume overload Congestive heart failure	10–20 ml/kg bolus over 15–20 min; reassess and repeat if necessary
Hypertonic crystalloids	Hypovolemic shock Head trauma	Hypernatremia Severe dehydration	4 ml/kg
Synthetic colloids	Hypovolemic shock Trauma	Coagulopathy Renal disease	10–20 ml/kg/day (canine) 10–15 ml/kg/day (feline)
Isotonic crystalloids	Ongoing illness Maintenance	Congestive heart failure Volume overload	50–60 ml/kg/day

*It is important to recall that each patient must be evaluated as an individual. The following fluid rates are guidelines only and may not be appropriate for some patients.

TABLE 4.7 Selection of Fluids for Certain Diseases

Condition	SERUM					Fluid of choice
	Na^+	Cl^-	K^+	HCO_3^-	Volume	
Diarrhea	D	D	D	D	D	Plasma-Lyte A + KCl Lactated Ringer's + KCl Normosol-R
Pyloric obstruction	D	D	D	I	D	0.9% NaCl
Dehydration	I	I	N	N/D	D	Plasma-Lyte A + KCl Lactated Ringer's 0.9% NaCl Normosol-R
Congestive heart failure	N/D	N/D	N	N	I	0.45% NaCl + 2.5% dextrose 5% dextrose
End-stage liver disease	N/I	N/I	D	D	I	Plasma-Lyte A + KCl 0.45% NaCl + 2.5% dextrose + KCl
Acute renal failure						Plasma-Lyte A Normosol R Lactated Ringer's 0.9% NaCl
Oliguria	I	I	I	D	I	0.9% NaCl
Polyuria	D	D	N/D	D	D	Plasma-Lyte A Lactated Ringer's + KCl Normosol-R
Chronic renal failure	N/D	N/D	N	D	N/D	Lactated Ringer's solution Plasma-Lyte A 0.9% NaCl
Adrenocortical insufficiency	D	D	I	N/D	D	0.9% NaCl
Diabetic ketoacidosis	D	D	N/D	D	D	0.9% NaCl (± KCl)

D, Decreased; *I*, increased; *N*, normal.

수액 속도 계산하기

- 60Drop set 가정 (60drop=1ml)
  - 유지속도 2.5ml/kg/hr = 150drop/kg/60m = 2.5drop/kg/m
- 20Drop set 가정 (20drop=1ml)
  - 유지속도 2.5ml/kg/hr = 50drop/kg/60m = 0.8drop/kg/m

- 20drop 계산시 원하는 시간당 ml를 분당 드롭 수로 계산한 다음 3배느리게 주면 된다.

Procedure: Oral fluid therapy

- Indication

  - Can drink / not vomiting / absence of intestinal obstruction

- Hypotonic electrolyte solution or water

Procedure: Subcutaneous fluid therapy



FIG. 4.2 Equipment used to provide intravenous fluid therapy

Procedure: Subcutaneous fluid therapy

- Indication
- Mild dehydration
- Fluid :: crystalloid isotonic solution :: 0.9% / H/s
- Maximum 10-20ml/kg/site

Procedure: Intraperitoneal fluid therapy

- Indication
  - Mild dehydration / cannot be administered orally
  - Larger volumes need to be infused rapidly (Neonates / Exotics)
- Fluid choice

  - crystalloid fluid (0.9N/S / H.S)
- Restraint

  - dorsal recumbency
  - clipper / sterile syringe / skin scrub sol / swab / globe /
  - surrounding umbilicus
  - prewarmed fluid

Procedure: Preparation of equipme
fluid administration



FIG. 4.3 Intravenous therapy set-up using a type of infusion pump

fluid deficit and remen

BW	Healthy Dogs 132mL x BW$^{0.75}$ ml/day	Healthy Dogs 132mL x BW$^{0.75}$ ml/hr	Sick Dogs 97ml x BW$^{0.655}$ ml/day	Sick Dogs 97ml x BW$^{0.655}$ ml/hr	BW	Healthy Dogs 132mL x BW$^{0.75}$ ml/day	Healthy Dogs 132mL x BW$^{0.75}$ ml/hr	Sick Dogs 97ml x BW$^{0.655}$ ml/day	Sick Dogs 97ml x BW$^{0.655}$ ml/hr
1	132	5.5	97	4.0	26	1,520	63.3	820	34.1
2	222	9.2	153	6.4	27	1,563	65.1	840	35.0
3	301	12.5	199	8.3	28	1,607	66.9	860	35.8
4	37								
5	44								
6	50								
7	56								
8	62								
9	68								
10	742	30.9	438	18.3	35	1,899	79.1	996	41.5
11	797	33.2	467	19.4	36	1,940	80.8	1,014	42.3
12	851	35.5	494	20.6	37	1,980	82.5	1,033	43.0
13	904	37.7	520	21.7	38	2,020	84.2	1,051	43.8
14	955	39.8	546	22.8	39	2,060	85.8	1,069	44.5
15	1,006	41.9	572	23.8	40	2,100	87.5	1,087	45.3
16	1,056	44.0	596	24.8	41	2,139	89.1	1,104	46.0
17	1,105	46.0	620	25.9	42	2,178	90.7	1,122	46.8
18	1,154	48.1	644	26.8	43	2,217	92.4	1,139	47.5
19	1,201	50.1	667	27.8	44	2,255	94.0	1,157	48.2
20	1,248	52.0	690	28.8	45	2,293	95.6	1,174	48.9
21	1,295	54.0	713	29.7	46	2,332	97.1	1,191	49.6
22	1,341	55.9	735	30.6	47	2,369	98.7	1,208	50.3
23	1,386	57.8	756	31.5	48	2,407	100.3	1,225	51.0
24	1,431	59.6	778	32.4	49	2,445	101.9	1,241	51.7
25	1,476	61.5	799	33.3	50	2,482	103.4	1,258	52.4

Daily Energy Requirement = 132 ml X BW(kg) $^{0.75}$

Lewis LD (Nutrients, Small animal clinical nutrition, 3rd edition. 1987) 등이 작성한 책자 참조.

Body Weight (kg)	Total Daily Fluids (ml/day)	Total Daily Fluid per Body Weight (ml/kg/day)	Hourly Rate of Total Daily Fluid (ml/hr)
1	132	132	6
2	214	107	9
3	285	95	12
4	348	87	15
5	407	81	17
6	463	77	19
7	515	74	21
8	566	71	24
9	615	68	26
10	662	66	28
11	707	64	29
12	752	63	31
13	795	61	33
14	837	60	35
15	879	59	37
16	919	57	38
17	959	56	40
18	998	55	42
19	1037	55	43
20	1075	54	45
25	1256	50	52
30	1427	48	59
35	1590	45	66
40	1746	44	73
45	1896	42	79
50	2041	41	85
55	2182	40	91
60	2319	39	97
65	2453	38	102
70	2583	37	108
75	2710	36	113
80	2836	35	118
85	2960	35	123
90	3080	34	128
95	3200	34	133
100	3316	33	138

*Based on 104–132 × BW (kg)$^{0.75}$.

Procedure: Calculation of drip rate

- Check 60drop? 20drop? /ml
- IF 60 drop/ml ml/hr = drop/min
- 1ml/hr = 60drop/hr = 1drop/min drop/S = 몇초에 한방울?
- 공식처럼 외우기. :: 수액속도는 보통 시간당 몇미리를 넣는지 확인하기 때문에 60drop 짜리를 쓴다면 1분당 몇drop이 되는지.

Ex) 25kg에게 수액을 유지(이번의 경우 50ml/kg을 하루유지에 필요한 양으로 가정시)로 줄때 몇초에 1drop 이 되게 해야 하는가?

25*50 = 1250ml/day = 52ml/hr => 52drop/min 0.86drop/1S
= 1.2초에 1drop 대략.

Procedure: Maintenance of intravenous fluid therapy – general maintenance

- Infusion site kept clean . Avoid touching site / catheter
- Use bandage
- Check catheter placement :: redness heat swelling
- BT check 3~4times a day (increasing BT indicate infection)
- Flush catheter at least twice daily
- Check the urine

Procedure: Maintenance of fluid therapy – replacement or changing of intravenous fluid bags

- Remove the new fluid bag wrapping
- Identify the correct fluid (check date)
- Hang the bag drip stand
- Switch off
- Holding empty fluid bag at the base, remove the infusion set
- Insert spike into new fluid bag
- Switch on flow control

Procedure: Maintenance of fluid therapy – removal of intravenous fluid therapy equipment from patient

- 3M tape / swap / scissors
- Restrain
- Terminate flow (infusion pump) switching off
- Remove catheter
- Applies pressure over the vein
- Maintain pressure on the site of catheter removal placing swab

- When using scissors!!

Procedure: Monitoring of fluid therapy – general guidelines

- Baseline parameters
- BP HR CRT MM color
- Monitoring

Procedure: Monitoring of fluid therapy – essential parameters

- All receiving fluids
- Pulse rate , rhythm and quality, including core and peripheral pulses
- Mucous membrane color and feel
- CRT
- Ausculation / Respiratory rate and depth
- Peripheral edema
- BT
- Urine output :: 1ml/kg/h
- Skin turgor
- BW
- General demeanour / clinical observation



Figure 4.9 Syringe drivers are used for administration of small volumes of fluid, medications, or blood products.



Figure 4.11 Burette is helpful in avoiding accidental administration of large fluid volumes to small patients. Additive labels are important criteria of fluid therapy. All fluids must be labeled at all times to ensure patient safety.



Figure 4.10 Many types of refurbished fluid pumps are used in the veterinary setting.



Figure 4.12 It is important to ensure the proper equipment is being used with specific pumps. Many have dedicated types of IV lines with which they must be used.

체액 부족 vs 과다

TABLE 4.8 Clinical Signs of Extracellular Fluid Volume Depletion and Overload

Depletion	Overload
Pale, dry mucous membranes	Serous nasal discharge
Poor skin elasticity	Subcutaneous edema
Reduced urine output	Increased urine output with normal kidney function
Microcardia on thoracic radiographs	Ascites
Sunken orbits	Chemosis
Cool distal extremities	Exophthalmos
Slow capillary refill time	Restlessness, coughing
Weak rapid pulse	Increased respiration rate
Increased temperature	Vomiting

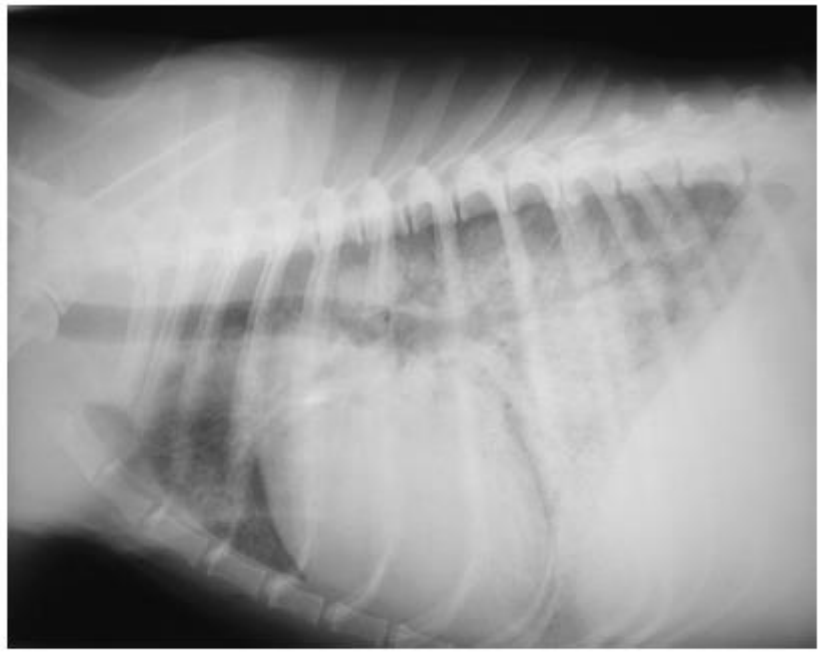


Figure 4.13 Pulmonary edema secondary to fluid overload in a cat.

SHOCK

shock: 쇼크, 충격

1. 정신적 평형의 돌연한 장애. 2. 어떠한 원인으로 진행성인 말초순환부족의 결과로 조직의 산소부족증을 일으켜 탄산가스나 유산등의 대사산물의 축적을 일으킨 상태를 말한다. 쇼크의 임상증상은 ① 피부의 창백, ② 손발톱모세혈관의 재충만 지연, ③ 의식장애, ④ 혈압하강, 맥박긴장저하, ⑤ 요량감소 등이다. 쇼크의 분류에는 1차성쇼크, 2차성쇼크가 있으며 순환동태에 의한 분류로서 저혈류량성쇼크, 말초혈관확장성쇼크, 심장성쇼크가 있다. 병인적인 분류로서 신경탓쇼크, 아나피락시스쇼크, 국소마취약 중독의 결과로 일어나는 쇼크 등이 있다.

- 관류(perfusion)가 되지 않아 조직 등에 산소전달이 되지 않는 상태. 즉, 부적절한 세포에너지생성

Shock

- Hypovolemic shock : 혈관내 부피감소. 심박출 감소
  - 탈수를 일으키는 질환 (혈량의 15~25% 이상 손실시)
- Distributive shock : 혈관확장으로 인해 발생
  - 혈관운동 긴장도 교감조절기능 감소, 혈관확장 매개체에 의해)
  - septic, anaphylactic, neurogenic (파보장염, 복막염, 급성 췌장염, 장폐색증,감염)
- Cardiogenic shock
  - 원발성 심질환, 심장사상충, 혈전색전증
- Obstructive shock
  - Tension pneumothorax, cardiac tamponade, pulmonary embolism

쇼크의 분류

Classification	Subclassification	Description	Causes
Circulatory	Hypovolemic	Decreased blood volume	Trauma, hemorrhage, dehydration
	Cardiogenic	Cardiac origin, decreased forward flow	Congestive heart failure, cardiac tamponade, arrhythmias
	Distributive	Vascular origin, dysfunction that alters delivery	Vasodilatation, caval syndrome
Metabolic		Intracellular energy production malfunction	Hypoglycemia, cyanide toxicity
Hypoxic		Decreased oxygen content of arterial blood	Anemia, methemoglobinemia, carbon monoxide toxicity

Shock의 구분

Parameter	hypovolemic: 출혈	Septic : 감염의 증거	Cardiogenic
심박수	증가	증가	증가
맥박	약함	세다가 약해짐	약함
점막색	창백	Brick red	증가
CRT	증가	감소(1초미만)	증가
호흡수	증가	증가	증가
중심체온	감소	증가	감소
말초체온	감소	감소	감소
배뇨량	감소	감소	감소
혈압	감소	감소	감소

Volume expansion
- Crystalloid
- Colloid

Volume expansion
- Crystalloid
- Colloid

Dobu/vaso/Norepi
Hydrocortisone

Dobu/Vaso/Norepi

Perfusion parameters

TABLE 14.1 Perfusion Parameters

Parameter
Mentation
Mucous membrane color
Capillary refill time
Heart rate
Pulse quality
Extremity temperature

TABLE 14.2 Changes in Clinical Signs Due to Changes in Vasomotor Tone

Clinical Signs	Vasoconstriction	Vasodilation
Mentation	Altered	Altered
Mucous membrane color	Pale to white	Injected (brick red)
Capillary refill time	Slow to absent	Fast
Heart rate	Increased	Increased
Pulse quality	Poor	Bounding
Extremity temp	Cool	Warm

Additional Assessment parameters

- Jugular vein distention
- USG caudal vena cava assessment
- Shock Index (HR/SBP)
- Lactate concentration
- Base Deficit / Base Excess

Shock treatment

- Oxygen
- Venous Access
- Fluid resuscitation
- Sympathomimetics

BOX 14.1 Summary of Therapy to Improve Oxygen Delivery (DO_2)

Correct Primary Problem
- Control fluid loss
- Treat infection

Oxygenation
- Provide supplemental oxygen (mask, nasal, or cage)

Fluid Resuscitation
- Crystalloids
  Dogs: 80–90 ml/kg (dosed to effect)
  Cats: 50–55 ml/kg (dosed to effect)
- 7.5% hypertonic saline
  Dogs: 4–6 ml/kg
  Cats: 3–4 ml/kg
- Synthetic colloids (consider)
  Dogs: 10–20 ml/kg
  Cats: 5 ml/kg increments over 15–20 minutes
- 7.5% hypertonic saline and synthetic colloid
  Dogs: 1.5–3 and 3–6 ml/kg
  Cats: 1.5 and 3 ml/kg
- Plasma: 10–30 ml/kg
- Whole blood: 10–30 ml/kg
- Red blood cells: 5–10 ml/kg

NOTE: All fluids given to effect. Consider sympathomimetics—dopamine 5–10 mcg/kg/min, norepinephrine 0.1–2 mcg/kg/min, and/or dobutamine 2–15 mcg/kg/min.

- SpO2
- Arterial Blood pressure/CVP
- Electrocardiogram
- Urinary Output

TABLE 14.4 Normal Lab Values: UCD Emergency and Critical Care Service and the Text Small Animal Critical Care Medicine 2nd ed Silverstein and Hopper*

Electrolyte	Canine (mmol/L)	Feline (mmol/L)
Sodium	145–153	149–155
Potassium	3.5–4.8	3.6–4.1
Chloride	110–121	118–124
Ionized calcium	1.30–1.46	1.10–1.30
Ionized magnesium*	0.43–0.60	0.43–0.70

* In D.C Silverstein and K. Hopper (Eds.), Small animal critical care medicine (ed 2 Inside front cover) Elsevier: St. Louis, MO

- HCT / TS
- Electrolyte
- Blood gases and pH
- Osmotic pressure

TABLE 14.5 Resuscitation Endpoints

Resuscitation Parameter	Endpoints
Perfusion parameters	Most if not all values within normal limits
Urine production	≥ 0.5 ml/kg/hr
Mean arterial pressure or systolic blood pressure	> 65 mm Hg or > 90 mm Hg
Shock index	≤ 1
PaO_2/SpO_2	≥ 80 mm Hg/≥ 95%
Hemoglobin	≥ 9 g/dl
Lactate	≤ 2 mmol/L
$ScvO_2$	≥ 70%
Jugular venous PO_2	≥ 42 and 45 mm Hg dog and cat, respectively
pH	7.35–7.45
Base deficit	0 ± 4

다음 강의

Chapter 5.







추석 잘 보내세요 ☺



