Fluid and Electrolyte Therapy

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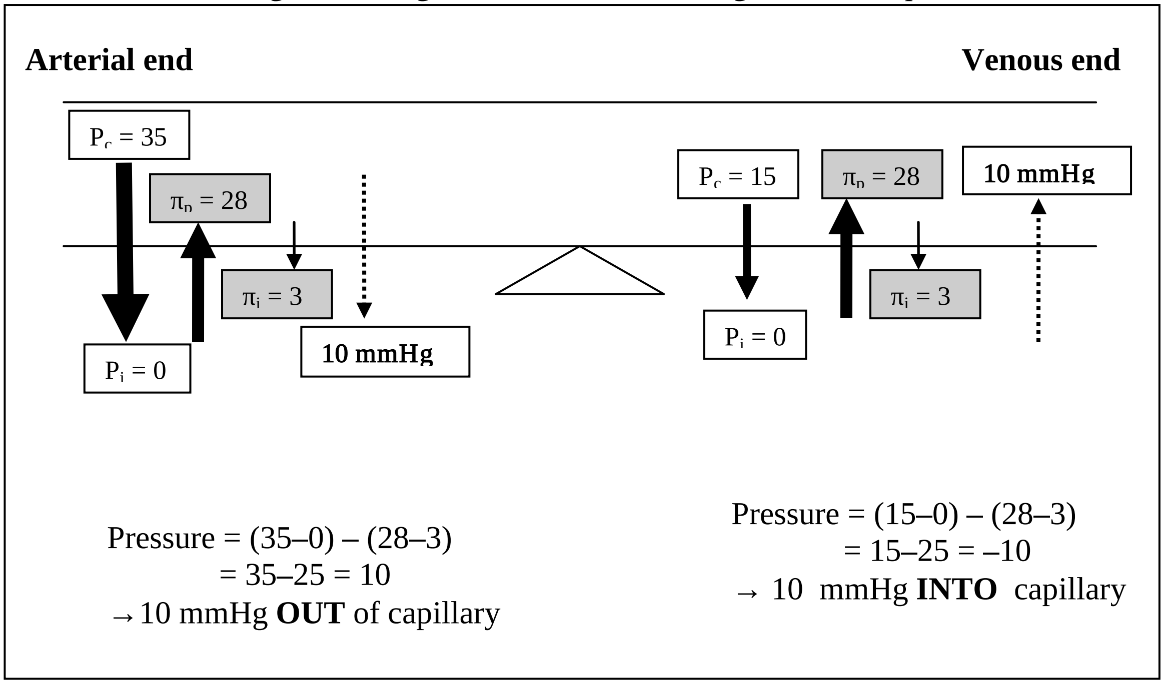
Figure 2. Diagram to show the Starling forces in capillaries



- What happens if animal loses 500 ml of blood?
  - The capillary hydrostatic pressure (Pc) drops especially at the venous end. The net pressure into capillary increases and the balance is no longer maintained so fluid is retrieved into the circulation from the interstitium until Pc is restored.
  - However, this assumes there are enough interstitial (or intracellular) fluids available to shift into the circulatory space without compromising the patient, but when the cell is dehydrated already, only exogenous fluid administration can provide effective circulatory volume replacement in response to the blood volume loss.

Review of normal electrolyte distribution

Sodium

- The major component of ECF
- Osmotic concentration is regulated by maintaining sodium balance and provides osmotic forces to maintain water balance in interstitial fluid compartment
- Generally, water and sodium disturbances occur simultaneously
- Sodium levels indicate overall fluid balance
- Sodium levels are regulated by the kidney, through aldosterone and other related factors

Potassium

- The major component of ICF
- 98% of total body potassium is located intracellularly
- Provides osmotic forces to maintain water balance in intracellular fluid compartment

- Plasma potassium levels may not reflect total body potassium levels! Because it is indirect measure of intracellular K^+
- Potassium imbalances result in altered function of excitable membranes (e.g., heart, CNS)
- Normal renal function is required to prevent hyperkalemia
- Hypokalemia should be treated slowly: *do not exceed 0.5- 1 mEq K^+ /kg/hr, also maximum concentration 40 mEq/L.*

Calcium:

- Vital ion in normal neuromuscular activity, cardiac rhythm and contractility, cell membrane function, and coagulation
- Highly protein bound: total plasma calcium levels vary with plasma albumin levels, however ionized calcium levels may remain constant

Chloride

- Many anesthetic agents produce *vasodilation and hypotension relative hypovolemia!*
- Results in alterations in sympathetic nervous system activity and the endocrine system
- Redistribution of blood flow with changes in vascular resistance
- Reduction in urinary flow rate, renal blood flow, and glomerular filtration rate seen with withholding water (fasting), anesthetic drug effects, and increased ADH levels
- *These effects can be eliminated or reduced by "filling the tank" with crystalloids*

Table 1. Physiologic parameters useful for fluid therapy planning

Parameters	***Less fluid required***	***Ideal***	***More fluid required***
Central venous pressure	> 8 to 12 cm H_2O	3 to 8 cm H_2O	Negative to 5 cm H_2O
Pulmonary capillary wedge pressure	> 18 mmHg	5 – 18 mmHg	< 5 to 8 mmHg
Heart rate		< 120 / min	> 140 / min
Cardiac gallop	Gallop present		
Urine output	> 2 ml/kg/hr	1 – 2 ml/kg/hr	< 0.5 ml/kg/hr
BUN / Creatinine		Normal	Rising/ above normal
Urine SG			> 1.020 –

- Commonly administered during general anesthesia to diminish the cardiovascular effects of anesthetic drugs and replace ongoing fluid losses
- Usually administered at 10-20 ml/kg/hr in small animal
- Usually administered at 5-

on of Several Colloidal Fluids Plasma

K	Ca	Colliod	COP (mmHg)	pH	Osm

Principles of blood and plasma transfusions

- Consider transfusion if PCV < 20% and/or TPP < 4 gm/dl
- Transfuse appropriate blood components
- Administration rate: < 10 ml/kg/hr (unless in crisis)

Complications of blood and plasma transfusions:

- Immune response to red cell antigens
- Immune response to white cell antigens
- In vitro (storage) changes
- Coagulation defects
- Citrate intoxication
- Hyperkalemia
- Hypothermia
- Sepsis

Blood substitutes - Oxyglobin®

- Purified bovine hemoglobin in lactated ringer's solution
- Doesn't contain red blood cells - instead contains crosslinked hemoglobin molecules
- Plasma half life is 30-40 hours
- Approved for use in dogs, but may also be used in other species
- Pro

- Hemoglobin molecules disperse throughout the plasma and provide oxygen to the tissues, and oxyglobin molecules disperse throughout the small vessels more readily due to