Fluid Therapy for the Emergent Small Animal Patient

Crystalloids, Colloids, and Albumin Products

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KEYWORDS

• Intravenous fluids • Crystalloids • Colloids • Albumin • Volume resuscitation
• Dehydration

KEY POINTS

- Fluid therapy is essential in the treatment of emergent veterinary patients and includes crystalloid solutions, blood component therapy, concentrated albumin solutions, and synthetic colloids.
- Bolus intravenous (IV) fluid therapy can restore perfusion and stabilize critically ill and injured patients for further diagnostics and treatment.
- Synthetic colloids help maintain colloid osmotic pressure (COP) and improve blood pressure but should be used with caution in coagulopathic patients or those with cardiac disease.
- Concentrated albumin solutions may have a role in the treatment of critically ill veterinary patients with severe hypoalbuminemia (eg, septic peritonitis); further prospective, comparative studies are needed to fully elucidate the role of albumin solutions in dogs and cats.
- The pros and cons of the use of human serum albumin (HSA) and canine serum albumin (CSA) will be reviewed.

Water is essential for life. Without adequate fluid intake, normal body functioning becomes impaired and ultimately can lead to death. A fluid therapy plan should be considered for any small animal patient that has either inadequate fluid intake, excessive fluid loss, or both. A simplified approach to fluid therapy begins with an understanding of the composition of fluid and its distribution within the body. Next, consideration of electrolyte loss, acid-base disturbances, perfusion impairment, and loss of protein also becomes important when replenishing deficits by using various fluids that are commercially available to small animal practitioners.

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TOTAL BODY WATER AND FLUID COMPARTMENTS WITHIN THE BODY

A discussion of IV fluid administration is incomplete without an understanding of total body water (TBW) and fluid balance between the various compartments within the body. Approximately 60% of a healthy animal's total body weight is water. This value can change slightly depending on age, lean body mass, degree of leanness or obesity, and gender. Total body water has been estimated as approximately 534 mL/kg to 660 mL/kg in healthy dogs and cats.[1]

Conceptually, the body can be divided into the intracellular and extracellular compartments. Fluid located within cells is known as intracellular fluid (ICF) and contributes approximately two-thirds (66%) to TBW. Extracellular fluid (ECF) is that located outside of cells and contributes approximately one-third (33%) to TBW; the ECF can be further subdivided into the intravascular and interstitial compartments. Fluid contained within blood vessels is intravascular fluid. The intravascular fluid contains plasma water, cellular components, proteins, and electrolytes. The interstitial extravascular compartment is the space located outside of the blood vessels. Intravascular fluid contributes only 8% to 10% of TBW, and interstitial fluid contributes 24% of TBW. A small amount of fluid is known as transcellular fluid and is located within the gastrointestinal tract, joints, cartilage, and cerebrospinal space.[1] Total intravascular fluid volume has been estimated as 80 mL/kg to 90 mL/kg in dogs and cats. Of that, the fluid component, or intravascular plasma water volume, has been estimated as approximately 45 mL/kg to 50 mL/kg.[1]

GOALS OF FLUID THERAPY

Administration of IV fluids requires an understanding of the type of fluid lost, the presence of underlying disease processes, an animal's hydration and intravascular volume status, acid-base and electrolyte derangements, an animal's ability to retain fluid within the intravascular space, and determinants of resuscitation endpoints when treating dehydration or various forms of hypovolemia. An understanding of electrolyte and protein composition within the body is also essential to help maintain homeostasis and to use the variety of crystalloid fluids that are available to treat specific abnormalities. Thus, the goals of fluid therapy are to replenish interstitial, intracellular, and intravascular fluid deficits; to correct and maintain electrolyte and acid-base derangements; and to maintain normal TBW in the face of excessive loss or lack of adequate intake.

CRYSTALLOID FLUIDS

A crystalloid fluid contains water and various forms of electrolytes (including salt) or sugar crystals (**Table 1**).[1,2] Some crystalloid fluids also contain buffers (eg, acetate, gluconate, and lactate) that are metabolized to bicarbonate to increase serum pH. Crystalloid fluids are categorized according to their osmolality relative to that of plasma. An isotonic crystalloid fluid has an osmolality similar to or equal to that of plasma and the extracellular compartment (eg, approximately 300 mOsm/L). Fluids with tonicity lower than that of the extracellular space are called hypotonic fluids (eg, 0.45% dextrose and 5% dextrose in water [D5W]) and can cause fluid influx into red blood cells (RBCs) and hemolysis.[1,2] Fluids with tonicity greater than that of the ECF compartment (eg, >300 mOsm/L) are called hypertonic solutions (eg, 7.2% and 23.4% hypertonic saline) and can be used to expand intravascular fluid volume in a hypovolemic animal by pulling water from the interstitial into the intravascular space. It has been estimated that approximately 80% of an isotonic crystalloid fluid