***Types of Fluids***

***1) Crystalloids****-* are able to enter all body compartments. They are easily mixed and dissolve in a solution. The solutes may be electrolytes or nonelectrolytes (dextrose) which are small molecules that flow across the semipermeable membrane, allowing transfer from bloodstream into cells and body tissues. This may increase the fluid volume in both interstitial and intravascular spaces. There are 3 types of crystalloids: Isotonic, Hypotonic, and

Hypertonic.

**2)** ***Colloids***- are restricted to the plasma compartment. Contain large molecules that do not pass through semipermeable membranes so that when infused, they remain in the vascular system to expand the intravascular volume (draws fluid from extravascular spaces by oncotic pressure) - "Volume Expanders". Work like hypertonic crystalloids but don't require as much volume; last longer than crystalloids. Used for hypoproteinemia, malnourished

states, pts who need plasma volume expansion but can't tolerate the large infusions of crystalloids

*If there is an electrolyte imbalance present then it may be necessary to add the appropriate electrolyte solution.*

***When to administer crytalloids***

* Standard crystalloid hypovolemic shock doses are essentially one complete blood volume.
* Shock rates are 80–90 mL/kg IV in dogs and 50–55 mL/kg IV in cats.
* Begin by rapidly administering 25% of the calculated shock dose. Reassess the patient for the need to continue at each 25% dose increment.
* Monitor signs as described in the patient assessment portion of this document. In general, if 50% of the calculated shock volume of isotonic crystalloid has not caused sufficient improvement, consider either switching to or adding a colloid.
* Once shock is stabilized, replace initial calculated volume deficits over 6–8 hr depending on comorbidities such as renal function and cardiac disease.

***When to administer colloids***

* When it is difficult to administer sufficient volumes of fluids rapidly enough to resuscitate a patient and/or when achieving the greatest cardiovascular benefit with the least volume of infused fluids is desirable (e.g., large patient, emergency surgery, large fluid loss).
* In patients with large volume losses where crystalloids are not effectively improving or maintaining blood volume restoration.
* When increased tissue perfusion and O2 delivery is needed.
* If edema develops prior to adequate blood volume restoration.
* When decreased oncotic pressure is suspected or when the total protein is ,< 35 g/L (or albumin is ,< 15 g/L).
* When there is a need for longer duration of effect. Preparations vary, and some colloids are longer lasting than crystalloids (up to 24 hr).28 Use of colloids can prolong the effects of hypertonic saline administration. The typical hydroxyethyl starch dose for the dog is up to 20 mL/kg/24 hr (divide into 5 mL/kg boluses and reassess). For the cat, the dose range is 10–20 mL/kg/24 hr (typically, 10 mL/kg in 2.5–3 mL/kg boluses).29–31 Titrate the amount of colloid infused to effect.

***Simultaneously administering crystalloids and colloids***

* Use this technique when it is necessary to both increase intravascular volume (via colloids) and replenish interstitial deficits (via crystalloids).
* Administer colloids at 5–10 mL/kg in the dog and 1–5 mL/kg in the cat. Administer the crystalloids at 40–45 mL/kg in the dog and 25–27 mL/kg in the cat, which is equivalent to approximately half the shock dose. Titrate to effect and continually reassess clinical parameters to adjust rate and type of fluid administered (crystalloid and/or colloid).

***Using hypertonic saline***

* To achieve the greatest cardiovascular benefit with the least volume of infused fluids (typically reserved for large patients or very large volume losses).
* To achieve translocation of fluids from the interstium to the intravascular space (e.g., for initial management of hemorrhage).
* In animals with hemorrhagic hypovolemic shock as a fastacting, low-volume resuscitation. Shock doses of hypertonic saline are 4–5 mL/kg for the dog and 2–4 mL/kg for the cat. Direct effects of hypertonic saline last 30–60 min in the vascular space before osmotic forces equilibrate between the intraand extravascular space. Once the patient is stabilized, continue with crystalloid therapy to replenish the interstitial fluid loss.
* In conjunction with synthetic colloids to potentiate the effects of the hypertonic saline.
* Do not use hypertonic saline in cases of either hypernatremia or severe dehydration.

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| **Crystalloid solutions in common use** | | | | | | |
| Name | Na \ensuremath{^+} | K \ensuremath{^+} | Cl \ensuremath{^-} | HCO \ensuremath {_3^-} | Ca \ensuremath{^{2+}} | Glucose |
| Normal Saline N/S 0.9% | 150 | 0 | 150 | 0 | 0 | 0 |
| Hartman's | 131 | 5 | 111 | 29 | 2 | 0 |
| Dextrose Saline D/S / solution 18 | 30 | 0 | 30 | 0 | 0 | 43 g/L |
| Dextrose 5% | 0 | 0 | 0 | 0 | 0 | 50 g/L |

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| **Colloids in common use** | | |
| *Name* | **Pros** | **Cons** |
| *Gelofusin* | Made from degraded gelatin (formerly extracted from horses hooves), cheap, no chance of viral transmission, is cleared from the circulation in about 8 hours. No cross match required, on the shelf | Allergic reactions, good for volume but not oxygen carriage |
| *Whole blood* | Great for active blood loss, | Hard to come by as the blood bank likes to use this blood to get clotting factors and other goodies. Cross match required, emergency cross match takes 20-40 minutes. |
| *Packed cells* | Good to replace haemoglobin, | No clotting factors. Citrate is used as an anticoagulant and binds calcium so the recipient may get citrate toxicity / hypo calcaemia. Risk of viral transmission. Cross match required. |
| *FFP* | Replace clotting factors | Expensive, risk of viral transmission. Must be matched to blood type. Once unfrozen has to be given quickly or will go off. |