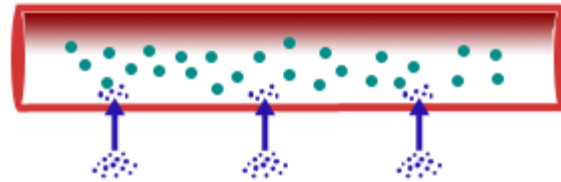


For most patients undergoing surgery, the administration of crystalloid solutions is an adequate method to restore fluid volume, but in situations of significant tissue injury or major surgery, the effects of inflammation lead to increased capillary permeability. The net result is the extravasation of intravascular fluid into the extravascular space. In this situation, as much as 80% of crystalloid solution administered will collect in the extravascular space.

The two principal colloids naturally present in the bloodstream are albumin and globulin. They exert two effects that help keep fluid within the vascular compartment: osmotic pressure and the Gibbs-Donnan effect. The Gibbs-Donnan effect is an electrochemical force whereby the negatively-charged plasma proteins attracts positively charged cations which combine to draw water from the interstitium into the vascular space.



*The picture above depicts the effect of colloid molecules (teal) pulling extravascular water molecules back into the intravascular compartment.*

Colloid solutions available for use in patients include albumin, dextrans, and hydroxyethyl starches. Albumin is derived from human blood or plasma and is pasteurized and contains no significant antibodies and can be administered regardless of the donor and recipient's ABO blood group or Rh factor. It is available in a 5% solution (50 mg of albumin per milliliter) which is iso-oncotic with human plasma, meaning that it exerts the same oncotic force as normal human plasma and as a 25% solution (250 mg of albumin per milliliter).

The dextrans are d-glucose polymers that are biosynthesized commercially. The different forms of dextran are designated by their average molecular weight. For example, the average dextran molecule in Dextran 40 is 40,000 Daltons whereas for Dextran 70, the average molecule in the solution is about 70,000 Daltons. In general, the amount of fluid mobilized by dextrans into the vascular compartment is equivalent to the amount of Dextran given. The higher the weight of the Dextran, however, the longer the fluid will remain in the compartment. Unlike albumin, Dextran can have a significant effect on coagulation and if more than 1.5 grams/kg are administered, bleeding times should be ordered. Dextran can also interfere with blood typing, making it preferable to perform blood-typing before Dextran is given. The typical limit for Dextran 40 is 20 mL/kg in a 24 hour period.

The hydroxyethyl starches are generally known as hetastarch and are polysaccharides derived from amylopectin. Hetastarches can be eliminated in the urinary tract and degraded enzymatically in the bloodstream. The most well-known form of hetastarch used is Hespan which is usually formulated in normal saline and can pull about 20 mL of water into the vascular compartment for each gram administered. Although allergic reaction to hetastarch is uncommon, it will result in an elevated amylase level as the hetastarch molecule binds with amylase and prevents its normal excretion. The total dose of hetastarch should be limited to 20 ml/kg as it can have an adverse effect on coagulation by impairing von Willebrand factor and factor VIIIC.

The current practice is to replace blood loss with colloids in a 1:1 ratio. The colloid osmotic pressure (ability to draw fluid into the vascular space) from greatest to least in commonly available solutions is 10% Dextran 40 > 25% albumin > 6% Dextran 70 > 6% Hetastarch > Fresh frozen plasma = 5% albumin.

*Longnecker DE. Anesthesiology. New York: McGraw-Hill; 2008: 674-676.*

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