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Hypoalbuminemia as a Modifier of Volume Resuscitation and Plasma Augmentation with Intravenous Plasma Protein Solution

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Short Communication

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INTRODUCTION

In critically ill patients, hypovolemia is the leading cause of hemodynamic instability and micro vascular perfusion defects, and it is frequently the reason for intensive care monitoring and treatment. The most common intervention used to correct hypovolemia is intravenous (IV) administration of infusion solutions, particularly in intensive care units. The physiological properties of the available IV solutions differ, which are related to clinical efficacy, frequency, and type of adverse reactions. Crystalloids (e.g., 0.9% saline or lactated Ringer's solution) or colloids (e.g., hydroxyethyl starch (HES), gelatin, or albumin) are the most common IV solutions. Fluid administration in hypovolemia is influenced not only by the type of IV solution used, but also by the amount administered. In hypovolemia, IV infusion is insufficient to compensate for the lack of effective intravascular volume, and perfusion deficits in various organ systems proliferate and worsen.

DESCRIPTION

An excess of delivered volume, on the other hand, worsens clinical outcomes due to edoema formation and the consequences of hypervolemia. Critical illness, particularly sepsis and severe trauma, increases vascular wall permeability, and trans-endothelial escape of serum albumin, the major oncotic plasma constituent, contributes to the development of hypo albuminemia and edema. Increasing plasma volume with IV infusion aims to improve tissue perfusion over time; however, significant fluid shifts between physiological compartments are possible, especially with repeated fluid administration [1-3]. Crystalloid infusion therapy was invented in the nineteenth century. Colloidal solutions were then added, beginning with concentrated albumin from human plasma and progressing to semi-synthetic artificial colloids. IV infusions for fluid replacement and fluid balance maintenance are limited to crystalloid solutions.

Boluses of both crystalloid and colloid solutions, however, are frequently used in combination for resuscitation and hemodynamic instability correction. The duration of the achieved plasma volume expansion by IV solutions is critical for the long-term improvement of tissue perfusion with reduced risks of edoema formation and cumulative positive fluid balance. The duration of the volume-expanding effect of IV solutions is determined by hydrostatic pressure, oncotic pressure, and the semi-permeability of the vessel wall, all of which are regulated by the endothelial glycocalyx. Fluid management aims to improve the pumping capacity of the heart, which is dependent on preload and contractility, in addition to maximising the intravascular effect of administered infusion volumes. Bolus administrations of so-called balanced crystalloids (with a chloride content less than 0.9% saline) are preferred for resuscitation in hemodynamic instability, unless there is traumatic brain injury or a reason for decreased serum sodium and chloride levels to be treated with 0.9% or even hypertonic saline solution [4,5].

Large volumes of lactated Ringer's solution administered to healthy humans produced small transient changes in serum osmolality, according to studies in healthy volunteers. Large amounts of sodium chloride had no effect on osmolality but did lower the pH. A comparison of calculated and measured in-vitro osmolality indicates that 4% human albumin solutions, Hartmann's solution, and, to a lesser extent, gelatine preparations are hypo osmolar and may thus increase brain volume and intracranial pressure. Colloidal solutions, on average, have longer intravascular retention times than crystalloid solutions. Because both too little and too much fluid administration can be harmful, all IV solutions are classified as drugs. Low-volume resuscitation strategies based on the physiological properties of colloid solutions have recently been developed for patients at risk of hypervolemia.

CONCLUSION

Pharmaco-epidemiological studies on colloid solutions (HES, gelatin, dextran, and albumin) have revealed that, until recently, the semi-synthetic artificial colloids HES and gelatin were many times more common than the natural colloid albumin, and colloid was administered to more patients and during more episodes than crystalloid. However, patterns of IV fluid resuscitation, which differed significantly across countries, changed due to longstanding controversial safety concerns that are well established and obvious, but practice still varied significantly across geographical regions.

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CONFLICT OF INTEREST

Authors declare no conflict of interest.

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