Effects of Hetastarch on Colloid Osmotic Pressure

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In the literature

Borrelli A, Maurella C, Lippi I, et al. Evaluation of the effects of hydroxyethyl starch (130/0.4) administration as a constant rate infusion on plasma colloid osmotic pressure in hypoalbuminemic dogs. *J Vet Emerg Crit Care*. 2020;30(5):550-557.

FROM THE PAGE ...

This study sought to investigate the effects of 2 CRIs of hydroxyethyl starch (HES) on plasma colloid osmotic pressure (COP) in dogs with hypoalbuminemia. A total of 24 dogs were included in the study. Dogs were randomly placed into 2 groups and given a synthetic colloid (HES 130/0.4, 1 mL/kg/hour CRI or 2 mL/kg/hour CRI for 24 hours). Causes of hypoalbuminemia varied and included diarrhea, chylothorax, protein-losing nephropathy, septic peritonitis, and hypoadrenocorticism. No difference was found in measured COP over time between the groups, and there was no discussion on the clinical effect of these infusions.

Intravascular hydrostatic pressure promotes fluid extravasation, and intravascular osmotic pressure opposes extravasation. COP (ie, oncotic pressure) is the portion of osmotic pressure attributed to plasma proteins (albumin accounts for ≈80% of COP)[1] and is dictated by the concentration of molecules in the solution, not the size of molecules. However, because colloids do not readily cross the vascular endothelium, due in part to size, these molecules increase COP by remaining in the intravascular space. Synthetic colloids are intravenous fluids manufactured with high molecular weight particles (eg, hetastarch, tetrastarch) that have the potential to increase COP and remain within the vascular space.

The modified Starling equation expresses the balance between osmotic and hydrostatic pressures governing fluid flux across the endothelium but does not represent all contributing factors to fluid movement. The endothelial glycocalyx (a meshwork of membrane-bound proteoglycans and glycoproteins lining the luminal surface of the endothelium[2]) is crucial to vascular integrity in health and disease. Soluble plasma molecules, including plasma proteins, dynamically integrate into and shed from the endothelial surface layer. Trauma, sepsis, and low protein environments, along with other pathologies, can rapidly lead to glycocalyx shedding.[3] Loss of the glycocalyx typically results in abnormal vascular permeability and fluid extravasation.[2,3] Synthetic colloids administered in the presence of a degraded glycocalyx can extravasate and accumulate in the interstitium; they do so more readily than natural colloids, eliminating the intended positive effect on COP.[3] Natural colloids (eg, albumin solutions, plasma transfusion) are more effective at restoring the glycocalyx.[3]

It is difficult to draw clinical conclusions from these study findings. Patients received variable volumes of concurrent crystalloid fluids that could have a dilutional effect on COP. Given their underlying diseases, these patients may have had an abnormal glycocalyx, leading to the loss of HES 130/0.4 molecules into the interstitium, with no net overall effect on COP. Because of the crucial role of the glycocalyx, measured COP is unlikely to predict the volume-expanding effects of a colloid. Although synthetic colloids are readily available, affordable, and can be stored safely, their use includes the risk for acute kidney injury, coagulopathy, and unfulfilled expectations of vascular expansion.[4-6]

… TO YOUR PATIENTS

Key pearls to put into practice:

1. Natural colloids (eg, canine albumin solution, plasma transfusion) can be considered in patients with hypoproteinemia that need fluid therapy and COP support.[7] Natural colloids are more effective at restoring the glycocalyx and vascular integrity.
2. Synthetic colloids should be used at the lowest effective dose for the shortest period of time possible. Prolonged use of synthetic colloids increases the risk for acute kidney injury in dogs.[4]
3. Synthetic colloids should not be used in patients with suspected or documented sepsis due to the risk for acute kidney injury; however, this originates from human guidelines and has not been proven in veterinary patients.

References

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Research Note:
Homocysteine in Feline Chronic Kidney Disease

Although chronic kidney disease (CKD) is one of the most common diseases that affects elderly cats, few tests are currently recommended for diagnosing early-stage CKD and forecasting disease progression. In humans and dogs, homocysteine (Hcy) has been associated with certain aspects of renal dysfunction, including a positive correlation to systolic blood pressure in humans. Because it can be difficult to obtain blood pressure readings and to predict and track early renal disease in hospitalized cats, the authors investigated the potential applications of Hcy in feline CKD diagnostics. In this study, Hcy increases could be correlated to International Renal Interest Society (IRIS) stage; however, significant differences between IRIS groups were not always present. A significant difference was not found between concentration of Hcy and degree of proteinuria, and no correlation was found between high Hcy levels and hypertension. Thus, the authors concluded that serum creatinine provides more reliable information than Hcy concentration for purposes of early identification and staging of CKD in cats.

Source

Giraldi M, Paltrinieri S, Curcio C, Scarpa P. Serum concentration of homocysteine in spontaneous feline chronic kidney disease. *Vet J*. 2019;254:105358.