

The Ongoing Debate Between Crystalloid and Colloid

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Albumin Replacement in Patients With Severe Sepsis or Septic Shock

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Crystalloid vs Colloid: What's the 'Solution'?

The first choice made when selecting a resuscitation fluid is whether to use a crystalloid or colloid solution. While there are really only 2 types of isotonic crystalloids used for resuscitation -- normal saline and lactated Ringer's -- there are several colloids available, including blood products, starches, and albumin at different concentrations.

Colloid is intuitively attractive because it tends to remain within the vasculature and causes less third spacing, due partly to its higher oncotic pressure. Blood pressure improves more rapidly than with crystalloid, an effect that makes us feel good but seems to have no impact on clinical outcomes. Colloid is generally more expensive, has immunomodulatory side effects, and seems to be harmful in certain populations.^[1]

What is interesting about the crystalloid-vs-colloid debate is that the "signals" initially found from observational studies and subgroup analyses following randomized controlled trials (RCTs) have held up. For example, the nearly decade-old American Thoracic Society (ATS) consensus statement on using crystalloids vs colloids,^[1] which drew heavily from the Saline versus Albumin Fluid Evaluation (SAFE) study,^[2] reported complications from different colloid types in specific patient populations. We were told that using starches to resuscitate patients with sepsis caused renal failure, and albumin was harmful for patients with traumatic brain injury (TBI). Both the ATS consensus statement and the SAFE trial also told us that outside of these 2 populations, it really doesn't matter whether you resuscitate your patient with saline or albumin.

Analyzing New and Old Data

Several years later, investigators went back and reanalyzed data from the SAFE trial, confirming that albumin is harmful when used for resuscitation in the presence of TBI.^[3] While this wasn't an RCT, it provides reasonably good data in a population that's seldom randomized. A meta-analysis,^[4] 2 well-conducted RCTs,^[5,6] and several review articles have shown that hydroxyethyl starch increases mortality when used as a resuscitation fluid for any critically ill patient, not just those with sepsis.

This most recent RCT, published online at the end of March by the *New England Journal of Medicine*, shows that albumin has no benefit over crystalloid for patients with sepsis. To be clear, there are several important differences between this trial and the SAFE study. Of most importance, while the patients they enrolled had early sepsis or septic shock, they weren't all enrolled during the first 6 hours of early goal-directed therapy. Second, they used 20% albumin instead of the 4% used in the SAFE trial because they weren't using albumin as a resuscitation fluid. Rather, they were providing daily albumin to the

intervention arm in an attempt to maintain serum albumin concentration higher than 3 g/dL because an earlier study showed a benefit to this approach.^[7]

There was no significant difference in the primary (28-day mortality) or principal secondary (90-day mortality) outcome. The albumin group consistently achieved a serum albumin level greater than 3 g/dL, had a lower net fluid balance, and had a more rapid increase in blood pressure and decrease in heart rate (a phenomenon we have seen before). Of note, though, in a subgroup analysis, patients with severe sepsis had a significant decrease in mortality at 90 days. Unfortunately, this post-hoc analysis was not prespecified, so the finding must be interpreted with caution.

Ending the Debate?

So where does this leave us in the crystalloid-vs-colloid debate? Although the physiologic rationale is appealing, the data for albumin just aren't strong enough to justify the excess cost associated with routine use. No doubt albumin lovers will cling to the subgroup findings. I wouldn't fault anyone for using it while resuscitating a patient with septic shock, but I can't see continuing administration for the duration of the patient's ICU stay (or for a full 28 days).

Otherwise, I suggest continued adherence to the guidance of using no albumin for TBI, no crystalloid for hemorrhagic shock, and no starches for anyone. I think that covers it.

Abstract

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