The role of albumin in the fluid resuscitation of major burn injuries

Burns and burn resuscitation remain a significant challenge to anesthesiologists and intensivists worldwide. As is well known, major burn injuries produce profound and prolonged increases in capillary permeability within the burn wound microcirculation, starting immediately, peaking around 8 hours post-burn and persisting for at least 48 hours [1-3]. Albumin (ALB), being the most abundant of all plasma proteins in the body (50% of all plasma protein, with the majority being extra vascular), is particularly affected in burns and other syndromes involving capillary leakage.

Fluid resuscitation practices vary substantially worldwide and the decision to employ crystalloid vs. colloid early in the resuscitation process has been controversial. In the USA, the most recent practice guidelines of the American Burn Association on burn shock resuscitation state that one option is to administer colloid-containing fluids (type unspecified) between 12 and 24 hours post-injury to decrease overall fluid requirements during acute burn resuscitation [4, 5]. Practices in Europe are more variable. A 2008 survey of 80 European burn units found that although 86% of practitioners “always or often” use crystalloids for acute resuscitation, 44% initiate colloids before 24 hours post-burn, and ALB is the colloid of choice in 51% of cases (starches, dextran, and plasma comprising the other half) [6]. What is generally well established with ALB usage is that it has a volume-sparing effect and promotes adequate volume resuscitation with less overall fluid requirement and less edema formation than with crystalloids alone. Worldwide, the actual timing of ALB administration varies and three general patterns seem to exist: immediate use (within 8 hours of injury); intermediate use (sometime between 8 and 12 hours post injury); and later use (sometime between 18 and 24 hours post-injury). There does not appear to be any consensus on either timing or approach.

In this issue of the journal, Cucureanu-Badica et al. investigate the correlation between burn size and serum albumin in the immediate 48 hours following major burn injury [7]. In their paper, the authors proposed to develop a method of calculating the expected serum albumin related to the extent of burn areas. Specifically, their aim was to find whether there was a correlation between the percentage of the burned body surface area and the lowest serum albumin during the first 48 hours after severe burn injury. Forty-seven patients admitted to the intensive care unit of a single hospital were studied, with burns ranging from 25-90%, over a six and a half year period. Patients with burns less than 25%, as well as those with significant cardiovascular, hepatic and renal disease were excluded. Fluid resuscitation was similar in all patients, and used the Parkland protocol (crystalloid in the first 24 hours). All patients obtained enteral as well as parenteral nutrition. Serum albumin levels were determined twice daily, and the nadir of serum albumin during the first 48 hours was recorded. The authors found a negative linear correlation between the burned surface area and serum albumin level during the first 48 hours; they later sought to establish a mathematical correlation, where:

\[
\text{albumin} = \text{burned surface area} \times (p1 + p2)
\]

where:

\[
p1 = -0.01925 \text{ (range, -0.02398 to -0.01452)}
\]

\[
p2 = 2.573 \text{ (range, 2.323 to 2.823)}
\]

The authors state that the p1 and p2 coefficients are purely numerical values, with no clinical or physiologic correlation. The p1 variable is always
negative, with values in parentheses that represent minimal and maximal values that can be used to calculate minimal and maximal albumin levels for a particular burn area. The authors concluded that their formula could be used to predict albumin levels in a burn range of 25-90% of body surface area.

Based on their findings, the authors propose that since the magnitude of the initial hypoalbuminemia is related to the severity of burn injury, albumin should be started early on in the initial phase of the resuscitation.

This small but potentially important study raises some interesting questions. Are current fluid protocols physiologically correct? Should we routinely administer albumin to all patients with major burn injuries? There are definite limitations in this study: a very small patient population, predictive values only within 25-90% burn areas, differences in fluid resuscitative volumes that could have led to errors related to hemodilution, and the fact that differences in fluid resuscitation for second and third degree burns could have resulted in similar albumin level variability. The authors do accept, however, that their mathematical model is just a prototype and agree that the rationale for this study is to establish a maximum acceptable burn body surface area beyond which one should prophylactically administer intravenous albumin during the initial resuscitation phase. In their clinic, this threshold value is 60% of total body surface area. Larger studies with more diverse patient populations will be required to obtain a more universally applicable formula of the correlation between the percentage of burned body surface area and plasma albumin level. Until additional confirmatory data are obtained, it is reasonable to suggest that standard fluid resuscitation protocols be used with albumin/colloid administration dictated by patient status, hemodynamic stability and laboratory testing. Nevertheless, this study addresses a very important issue, and like most studies that challenge the “clinical status quo”, its value is more in asking the questions, not necessarily in answering them. We look forward to future studies that will address these questions.

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References