Is there a relationship between SOFA scores and albumin leak rates as a marker of endothelial dysfunction?

Damian De Francesch, David Inouye, Brian Nishiguchi, Sho Furuta, Michael Hayashi, Kevin Pei, Fedor Lurie, Danny Takanishi Jr., Mihae Yu

University of Hawaii, Department of Surgery and Critical Care and The Queen’s Medical Center

Introduction

Increased capillary permeability is a hallmark of the systemic inflammatory response syndrome (SIRS) and sepsis. An assessment of organ dysfunction may be obtained using the Sequential Organ Failure Assessment (SOFA) score (Fig 1). (2) Initial studies showed SOFA scores of greater than 5 on presentation had at least 20% mortality while scores > 11 had a mortality of 95%. (6)

When analyzing trends in the daily SOFA score during the first 96 hours, regardless of the initial score, the mortality rate was at least 50% when the score increased, 27% to 35% when it remained unchanged, and less than 27% when it decreased. (3)

The normal physiologic response to localized infection includes the activation of host defense mechanisms that result in the influx of activated neutrophils and monocytes, the release of inflammatory mediators, local vasoconstriction, increased endothelial permeability (capillary leak), and activation of coagulation pathways. This increased shift of fluid and protein from the intravascular to the interstitial space results in intravascular hypovolemia despite total body fluid overload (4).

Methods

Critically ill surgical patients requiring resuscitation of severe sepsis, septic shock, cardiovascular collapse, and/or ARDS had blood volume analysis (BVA) performed 12-24 hours after resuscitation and days 2, 3, 5. Plasma volume was measured with the BVA-100 (Daxor, NY, NY) using I-131 labeled albumin (1ml) injected into the patient with 5 sequential blood draws at timed intervals to compensate for albumin leak.

As part of the blood volume report, the albumin leak rate is presented as a % per minute, with normal values being 0-0.4% per minute. Albumin leak rate at Day 1, 2, 3, 5-7 after resuscitation was compared with the SOFA scores obtained on the same day. An example of a blood volume analysis is presented in Figure 2.

The albumin leak rate can be measured using I-131 tagged albumin (1ml) injected into the patient and measuring initial disappearance of the isotope. The albumin leak rate at day 5 has an 8 fold increase in mortality. (1)

Hypothesis

There may be a relationship between albumin leak rate and SOFA scoring.

Results

Of the 46 patients studied, demographics were: age 61 ± 16 years, 15 females: 31 males, 38 septic shock/severe sepsis, 8 cardiovascular collapse, 10 ARDS patients. APACHE II score 24 ± 7. The relationship between albumin leak and SOFA scores are presented in table 1.

Pearson correlations are represented in Figure 3. There was no statistically significant correlation between SOFA score and albumin leak on any of the days studied. There was a relationship between SOFA scores and mortality (Fig 4). Data analysis shows that there is a statistically significant survival benefit if the patient’s SOFA score continued to decrease during the first 3 days.

Conclusions

The SOFA score measures the degree of organ failure and has been related to mortality. Our previous observation reported a high albumin leak on Days 5-7 to increased mortality. This study, however, did not demonstrate a relationship between the SOFA score and albumin leak at days 5-7. Our patient population is a highly selective and small group and may explain the lack of relationship between SOFA score and albumin leak. The other possibility is that the albumin leak may be effected by albumin levels and other treatment modality which may also impact survival.

Statistical Analysis

A Pearson correlation was obtained to determine any relationship between SOFA scores and albumin leak at 1, 2, 3, 5-7 days after resuscitation.

References


Acknowledgements

Financial support provided by the Queen Emma Research Fund Bowlus HS, the American Foundation for Safe Blood & Healthcare, and the Dower Co (NY, NY).