

Hypoalbuminemia as a predictor of mortality in abdominal sepsis

Hipoalbuminemia como predictor de mortalidad en sepsis de origen abdominal

Eric M. Saucedo-Moreno*, Enrique Fernández-Rivera, and José A. Ricárdez-García,

Department of General Surgery, Hospital Ángeles MOCEL, Mexico City, Mexico

Abstract

Background: A level < 35 g/L of albumin (hypoalbuminemia) has been determined as a parameter to predict mortality and morbidity. **Methods:** This was a prospective observational study, in a period of 12 months, to patients diagnosed with sepsis of abdominal origin, they are divided into two groups based on albumin levels (cut: 3.5 g/dL) to assess mortality between both groups. **Results:** We studied 23 patients admitted to the intensive care unit (ICU). The mean albumin was 2.77 g/dL (± 0.71). When calculating the odds ratio (OR) that was a 23-fold greater risk of dying when hypoalbuminemia presented compared to the normal albumin group (OR = 23.3; 95% confidence interval [CI]: 1.948-279.42). The mean albumin for patients who died was 2.04 g/dL (± 0.31) versus 3.03 g/dL (± 0.35) ($p = 0.02$; 95% CI: -1.551--0.416). We do not assess morbidity, however, we identify a certain tendency to a longer stay in the ICU which is accompanied by a higher risk of complications and in the end a higher risk of mortality. **Conclusions:** We conclude that hypoalbuminemia represents a predictor of mortality in patients with abdominal sepsis.

Keywords: Hypoalbuminemia. Sepsis. Abdominal sepsis.

Resumen

Antecedentes: Un valor de albúmina < 35 g/l (hipoalbuminemia) ha demostrado ser un parámetro para predecir mortalidad y morbilidad. **Métodos:** Estudio observacional, prospectivo, en un periodo de 12 meses, en pacientes con diagnóstico de sepsis de origen abdominal a quienes se dividió en dos grupos según las cifras de albúmina (corte: 3.5 g/dl) para valorar la mortalidad en ambos grupos. **Resultados:** Estudiamos 23 pacientes ingresados a la unidad de terapia intensiva. La media de albúmina fue de 2.77 g/dl (± 0.71). Al calcular la odds ratio (OR) identificamos un riesgo 23 veces mayor de fallecer al presentar hipoalbuminemia en comparación con el grupo con albúmina normal (OR = 23.3; intervalo de confianza del 95% [IC 95%]: 1.948 a 279.42). La media de los valores de albúmina para los pacientes que fallecieron fue de 2.04 g/dl (± 0.31) vs. a 3.03 g/dl (± 0.35) para el otro grupo (IC 95%: -1.551 a -0.416; $p = 0.02$). Aunque no valoramos la morbilidad, identificamos cierta tendencia a un mayor tiempo de estancia en la unidad de terapia intensiva, lo que se acompaña de mayor riesgo de complicaciones y de un mayor riesgo de muerte. **Conclusión:** La hipoalbuminemia representa un predictor de mortalidad en los pacientes con sepsis abdominal.

Palabras clave: Hipoalbuminemia. Sepsis. Sepsis abdominal.

Correspondence:

*Eric M. Saucedo-Moreno

Gobernador Gregorio Villa Gelati, 29

Col. San Miguel Chapultepec 1 Sección, Del. Miguel Hidalgo

C.P. 11850, Ciudad de México, México

E-mail: cirugia.saucedo@gmail.com

Date of reception: 24-11-2019

Date of acceptance: 15-01-2020

DOI: 10.24875/CIRUE.M20000158

Cir Cir (Eng). 2020;88(4):470-473

Contents available at PubMed

www.cirugiaycirujanos.com

2444-0507/© 2020 Academia Mexicana de Cirugía. Published by Permanyer. This is an open access article under the terms of the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Introduction

Albumin normal serum concentration in healthy people is approximately 35-50 g/L. An albumin value < 35 g/L (hypoalbuminemia) is common in severely ill patients and has been shown to be a parameter for predicting mortality and morbidity^{1,2}.

The purpose of the present study was to know the application of albumin as a predictor of mortality in patients with sepsis of abdominal origin.

Methods

We conducted a prospective study in a private hospital of Mexico City over a 12-month period comprised between June 2018 and June 2019. We included all patients aged 18-95 years with a diagnosis of sepsis of abdominal origin who were admitted to the intensive care unit (ICU). We established the diagnosis of abdominal sepsis according to the Society of Critical Care Medicine and the European Society of Intensive Care Medicine 2016 guidelines: patients with suspected abdominal infection who presented with organ dysfunction characterized by 2 or more points on the Sequential Organ Failure Assessment (SOFA) scale³.

We excluded patients transferred from another institution, those who received intravenous albumin transfusion before serum concentrations measurement, and those who previously had chronic kidney disease or liver disease. We measured albumin with blood extracted by puncture or central venous catheter in all patients, in tubes with citrate. We divided the sample in two groups: Group 1 with albumin > 3.5 g/dL and Group 2 with albumin < 3.4 g/dL. Follow-up was carried out until the patient was discharged from the ICU and compared mortality between both groups.

For quantitative variables with parametric distribution, we used Student's t-test, and data were expressed as the mean $\pm$ standard deviation. We used Fisher's Chi-square or exact test for categorical data. We considered a value < 0.05 for a significant p and its 95% confidence interval (CI). Data were analyzed using the SPSS software (version 20.0 for Windows)⁴.

Results

We studied a total of 23 patients admitted to the ICU, out of whom 52.2% (12) were female; mean age

Table 1. General variables of the study sample

	Patients (n = 23)
Age, years	60.87 ($\pm$ 18.51)
Gender, F/M	12/11 (52.2%)
Albumin, g/dL	2.77 ($\pm$ 0.71)
Body mass index	26.88 ($\pm$ 5.28)
SOFA	6.13 ($\pm$ 4.003)
APACHE	19.52 ($\pm$ 8.6)
Procalcitonin	19.37 ($\pm$ 28.13)
Intensive care unit length of stay, days (standard deviation)	6.83 (4.85)

was 60.87 years ($\pm$ 3.4). Mean albumin values were 2.77 g/dL ($\pm$ 0.71) (Table 1).

We divided the sample in two groups: Group 1 (n = 8) of patients with hypoalbuminemia and Group 2 (n = 15) of patients with normal albumin. When the study variables were compared, we observed that there is homogeneity between both groups with no significant differences, except for the proportion of patients who died. When the odds ratio (OR) was calculated, we identified a 23-fold higher risk of dying when having hypoalbuminemia in comparison with the group with normal albumin (OR = 23.3; 95% CI: 1.948-279.42) (Table 2). Mean albumin values for patients who died were 2.04 g/dL ($\pm$ 0.31) versus 3.03 g/dL ($\pm$ 0.35) in those who did not (p = 0.02; 95% CI: 1.551--0.416) (Table 3 and Fig. 1).

Discussion

It is well known that patients diagnosed with abdominal sepsis, especially those who are admitted to the ICU, can be malnourished or worsen by at least three distinct mechanisms: (1) redistribution to the interstitial space, (2) albumin loss during the surgical procedure, and (3) increased catabolism. Numerous studies have shown that low albumin values are associated with higher morbidity⁵.

Various studies have also identified that elevated scores on scales such as Acute Physiology and Chronic Health Evaluation and SOFA represent a reliable parameter for predicting mortality, as well as low albumin concentrations within the first 48 h of ICU admission⁶. A meta-analysis that included 291,433 patients in critical condition found that hypoalbuminemia

Table 2. Comparison between groups

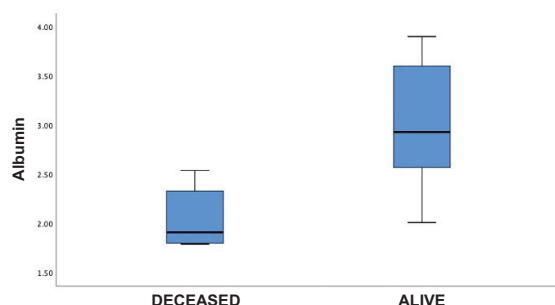
	Group 1, normal albumin (n = 8)	Group 2, hypoalbuminemia (n = 15)	p	95% CI
Age, years	64.88 (21.781)	58.73 (16.94)	0.461	−10.88 a 23.165
Gender, F/M	7/1	5/10	0.27	
Body mass index	25.61(3.94)	27.55 (5.89)	0.415	−1.48 a −0.83
SOFA	7.75 (4.97)	5.27 (3.2)	0.161	−1.073 a 6.04
APACHE	25.25 (10.99)	16.46 (5.3)	0.17	1.77 a 15.74
Procalcitonin	15.2 (22.70)	21.71 (31.38)	0.61	−32.9 a 20.05
Intensive care unit length of stay (standard deviation)	7.25 (4.83)	6.60 (1.29)	0.768	−3.86 a 5.168
Alive/deceased	3 (37%) / 5 (63.5%)	1 (26.1%) / 4 (93.3%)	0.009	OR = 23.3 1.948 a 279.42

CI: confidence interval; OR: odds ratio.

Table 3. Mean albumin values comparison in deceased and alive patients

	Deceased (n = 6)	Alive (n = 17)	p	95% CI
Albumin value, g/dL	2.04 (0.312)	3.03 (0.635)	0.002	−1.551 a −0.416

CI: confidence interval

**Figure 1. Relationship between albumin values and mortality. As it can be observed, the lower the level of albumin, the higher the mortality ($p = 0.002$).**

was a strong independent predictor of mortality: for each 1 g/dL of albumin that decreases, morbidity and mortality risks increase by 89% and 137%, respectively, and mortality is associated with nearly 100% in patients with albumin values < 2 g/dL². We did not assess morbidity, but we identified a certain tendency towards longer stay in the ICU, and it would be hazardous to conclude that patients experienced higher morbidity considering it to be directly proportional to hospital stay. Similarly, we identified a 23-fold higher

risk of mortality with albumin values < 2.4 g/dL on admission to the intensive care department.

In patients with abdominal sepsis, increased permeability to proteins and other macromolecules in the capillaries is characteristic. Some studies that directly measured albumin permeability showed that the escape velocity increases to up to 300%⁷. Neutrophil activation and cytokine release increase this capillary permeability, thus decreasing endothelial negative charges and interendothelial junctions integrity. In turn, bacterial toxins reduce oncotic power and favor osmotic forces toward the interstitium. The literature describes that patients who recover their normal albumin values improve their prognosis⁸. A study conducted by Woods and Kelley⁹ demonstrated that the distribution of albumin after exogenous injection produced a similar elevation in plasma concentration, but the decrease at 30 min was higher in patients with sepsis. These findings would support that albumin exogenous replacement has not demonstrated clinically significant benefit^{9,10}. In 2013, the EARSS multicenter trial showed no significant differences in mortality when exogenously using 20% albumin in patients with sepsis¹¹. Unfortunately, in our study, it was not possible to compare the benefit of using albumin, secondary to the fact that the cost hinders its usefulness.

One of the limitations of this study, given its observational nature, is that the potential for error is high; however, sufficient statistical power was achieved with clinically significant results. Another limitation is that it was carried out in a single private surgical center and the sample size is rather small. The methodology is quite simple, but the result has a high clinical impact

and, in addition, is applicable to all types of surgery. Further studies with different models are needed to determine the association of hypoalbuminemia with morbidity and mortality in post-operated patients.

Conclusions

In our study, we obtained a 23-fold higher risk of mortality in patients with hypoalbuminemia in comparison with those with values > 2.5 g/dL. Therefore, we conclude that albumin represents a fairly efficient predictor of mortality and that it is very easily accessible to all hospitals.

Acknowledgments

We would like to thank Hospital Ángeles MOCEL Teaching Department and general surgery residents.

Conflicts of interests

The authors declare that there are no conflicts of interest.

Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments have been performed on humans or animals for this research.

Confidentiality of data. The authors declare that they have followed the protocols of their work center on the publication of patient data.

Right to privacy and informed consent. The authors have obtained informed consent from the patients and/or subjects referred to in the article. This document is in the possession of the corresponding author.

References

1. Jain RK, Chakravorty N, Chakravorty D, Bhattacharya PK, Yadava A, Agarwal RC. Albumin: An overview of its place in current clinical practice. *Indian J Anaesth.* 2004;48:433-8.
2. Vincent J, Dubois M, Navickis R, Wilkes MM. Hypoalbuminemia in acute illness: is there a rationale for intervention? A meta-analysis of cohort studies and controlled trials. *Ann Surg.* 2003;237:319-34.
3. Singer M, Deutschman CS, Seymour CW, Shankar-Hari M, Annane D, Bauer M, et al. The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3). *JAMA.* 2016;315:801-10.
4. Saucedo EM, Fenig J. Estadística en cirugía. Cómo entender y aplicar conceptos básicos. *Cir Cir.* 2019;87:692-7.
5. Horsey P. The Cochrane 1998 albumin review – not all it was cracked up to be. *Euro J Anesth.* 2002;19:170-4.
6. Blunt M, Nicholson J, Park C. Serum albumin and colloid osmotic pressure in survivors and nonsurvivor of prolonged critical illness. *Anesth.* 1998;53:755-61.
7. Dubois M, Orellana-Jiménez C, Melot C, De Backer D, Berre J, Leeman M, et al. Albumin administration improves organ function in critically ill hypoalbuminemic patients: a prospective, randomized controlled, pilot study. *Crit Care Med.* 2006;34:2536-40.
8. Finfer S, Norton R, Bellomo R, Boyce N, French J, Myburgh J. The SAFE study: saline vs albumin for fluid resuscitation in the critically ill. *Vox Sanguinis.* 2004;350:2247-56.
9. Woods M, Kelley H. Oncotic pressure, albumin and ileus: the effect of albumin replacement on postoperative ileus. *Am Surg.* 1993;59:758-63.
10. Charpentier J, Mira JP. EARSS Study Group: Efficacy and tolerance of hyperoncotic albumin administration in septic shock patients: The EARSS study. *Intensive Care Med.* 2011;37(Suppl 1):S115-S0438.
11. Margason M, Soni N. Changes in the serum albumin concentration and volume expanding effects following of bolus of albumin 20% in septic patients. *Br J Anesth.* 2004;92:821-6.