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Research paper

Serum albumin and total cholesterol as prognostic factors of mortality in very old patients hospitalized by acute illness



A. Socorro García*, I. de la Fuente Hermosín, J.J. Baztán

Department of Geriatrics, Hospital Central de la Cruz Roja, San José y Santa Adela, C/Reina Victoria n 26, Madrid 28003, Spain

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ABSTRACT

Backgrounds and aims: To analyze whether serum cholesterol and albumin may be factors associated with early and late mortality, independent from other variables such as comorbidity, functional and mental status, in very old patients admitted with acute illness.

Methods: Prospective study of all patients admitted for medical causes in the year 2009. The primary outcome was the mortality at 6 and 36 months in relation to serum levels of albumin (categorized as > 3.5 g/dL; 3–3.5 and < 3 g/dL) and total cholesterol (grouped as quartiles). Multivariate Cox regression analysis adjusted for age, sex, diagnosis at admission, premorbid functional and mental status, functional decline at admission and comorbidity was performed to determine whether these serum parameters were associated with mortality at 6 and 36 months.

Results: One thousand two hundred and eighty-eight patients were studied, mean age 86.7 years (SD 6.69), 66.1% female. During follow-up, 848 patients died. In Cox regression multivariate analysis, decreased albumin was significantly associated with increased mortality at 6 months [HR: 1.55 (CI95% = 1.03–2.34) for 3–3.5 g/dL albumin, and HR: 1.82 (CI95% = 1.15–2.86) for albumin < 3 g/dL] and after 3 years [HR 1.39 (CI95% = 1.07–1.80) for 3–3.5 albumin; and HR 1.66 (CI95% = 1.22–2.66) for albumin < 3 g/dL]. Decreased cholesterol was associated with increased mortality, losing significance when this was adjusted for variables that influence prognosis in the elderly.

Conclusions: In very old patients admitted for acute medical conditions decreased levels of albumin may be associated with increased mortality.

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1. Introduction

More than 60% of older patients have or develop malnutrition during hospitalization. Malnutrition is associated with poor outcomes such as increased mortality and hospital readmission, increased stay, functional decline, institutionalization, and secondarily increased costs [1].

Biochemical parameters such as serum total cholesterol and serum albumin are used as markers of malnutrition. Decreased levels of albumin have been associated with the acute phase of illness, both as a result of hypercatabolism and reduced synthesis in the liver, as well as the malnutrition condition, which itself leads to increased morbidity and a susceptibility to illness. It has also been observed that hypoalbuminemia may be related to cancer, cardiac failure, diabetes, liver failure, and malabsorption, conditions that increase death risk [2]. Also, in older patients, inflammation appears to be a more powerful determinant of

albumin and its change during the hospitalization than is nutrient intake [3].

Above 70 years, the relationship between cholesterol and mortality in the elderly may be different from the one observed in the younger population, where elevated cholesterol as a risk factor for cardiovascular mortality is clearly defined [4,5]. Paradoxically, studies have appeared in recent years, in which high cholesterol levels may be associated with longer survival in older people living in the community and hospitalized for acute illness [6,7]. Malnutrition and frailty (entities associated with cholesterol lowering), most frequently in elderly, have been advanced as possible explanations for this “paradox” [8].

In older patients hospitalized for acute illness, the impact of the disease on the patient’s functional status, and the presence of functional impairment, is the major predictor of morbidity and mortality during hospitalization and after discharge in the early period [9]. The association between the ability to perform basic activities of daily living and albumin has been studied recently, noting a direct correlation between poor functional status and lower levels of albumin [10].

* Corresponding author. Tel.: +0034617150400.
 E-mail address: asocorro@yahoo.es (A. Socorro García).

The aim of this study is to analyze the relationship between serum albumin and total cholesterol at admission, and mortality at 6 months and 3 years, in a cohort of very old patients hospitalized for acute medical illness, and assess whether cholesterol and albumin may be factors associated with mortality independently of other main prognostic factors such as the functional and mental status of these patients.

2. Patients and methods

2.1. Study population

Prospective study of all patients consecutively admitted with acute medical conditions or exacerbation of chronic disease in Acute Geriatric Unit of the Central Red Cross Hospital of Madrid, between January 1, 2009 and December 31, 2009. Patients discharged in less than 48 hours were excluded, to remove the prognosis bias from failed hospital admissions, and also patients admissions for performing diagnostic test. Eighty-nine percent of patients came from the emergency department and the rest from domiciliary care or outpatients geriatric clinic.

2.2. Data collection

Sociodemographic (age, sex, prior institutionalization), clinical (diagnostic related groups [DRG] cause of admission, Charlson Comorbidity Index [11]) at admission, and functional variables (Barthel Index [BI]) 2 weeks before admission, at admission and discharge [12] were collected. Mental status was evaluated using the Red Cross Hospital Mental Scale (this scale is extensively used in Spain, and its validity and reliability have been determined previously. It assesses the cognitive status from 0-normal mental situation to 5-vegetative life; and usually points ≥ 2 are related to dementia) [13,14]. Analytical parameters (total cholesterol, albumin, hemoglobin, creatinine) were determined in the first 48 hours of admission. Creatinine clearance was categorized according to the MDRD formula [15] into three groups (< 30 mL/min, 30.1–60 mL/min and > 60 mL/min) [16].

Functional decline at admission was measured as percentage of prior function

$(((\text{previous BI} - \text{BI at admission}) / \text{previous BI}) \times 100)$ [17].

Mortality was the main dependent variable analyzed and it was recorded at discharge and after discharge (at 6 and 36 months) from the Spanish National Death Index. This index is an official

Table 1
Basal characteristics sample by mortality at 6 months.

Variable	Total	Survival	Deaths	P
<i>n</i>	1288	861	427	
Age	86.69 \pm 6.65	86.12 \pm 6.53	88.42 \pm 6.64	0.000
Gender (%)				
Male	33.9	34.5	32.8	
Female	66.1	65.5	67.2	0.29
Main diagnostic at admission (DRG) ^a (%)				
Heart failure	22.1	23.8	18.8	
Pneumoniae	16.1	14.4	19.5	
Respiratory infection	6.7	3.6	13.1	
COPD	5.4	6.6	3.1	
Stroke (not AIT)	8.9	8.7	9.1	
Tract urinary infection	10.6	11.0	9.7	
Other	30.2	32.0	26.4	0.000
Charlson Comorbidity Index	2.78 \pm 1.73	2.58 \pm 1.59	3.19 \pm 1.91	0.000
Barthel previous acute illness	57.48 \pm 36.7	66.24 \pm 33.93	33.92 \pm 34.35	0.000
Cognitive impairment previous acute illness (MRC ≥ 2) (%)	46.5	45.9	54.1	0.000
Percentage of functional decline at admission	54.4	47.77	71.12	0.000
Serum albumin (g/dL)	3.27 \pm 0.52	3.37 \pm 0.50	3.08 \pm 0.52	0.000
Total cholesterol (mg/dL)	152.58 \pm 53	156.40 \pm 47.72	144.58 \pm 61.99	0.008
Hemoglobin (g/dL)	11.77 \pm 3.31	11.72 \pm 1.96	11.89 \pm 6.99	0.50
Creatinine (mg/dL)	1.17 \pm 2.93	1.08 \pm 1.25	1.35 \pm 4.67	0.26
MDRD (%)				
< 30 mL/min	9.6	7.6	10.5	
30.1–60 mL/min	33.3	31	34.5	
> 60 mL/min	57.1	61.3	55	0.06
Serum albumin (%)				
≥ 3.5 g/dL	37.6	44.9	22.4	
3–3.5 g/dL	36.3	35.3	38.4	
< 3 g/dL	36.1	19.7	39.4	0.000
Total cholesterol (quartiles) (%)				
< 125 mg/dL	25.3	20.7	35.1	
125.1–152 mg/dL	24.9	26.4	21.6	
152.1–182 mg/dL	24.9	26.8	20.8	
> 182 mg/dL	24.9	26.0	22.4	0.001

MRC: Mental Red Cross score; COPD: Chronic obstructive pulmonary disease; AIT: Transitory ischemic accident; MDRD: Modified diet renal disease.

^a Diagnostic related groups (DRG): heart failure-DRG 87,127,544; pneumoniae-DRG 89,90,541; respiratory infection-DRG 79,540; COPD-DRG 79,88,96-102,540,588; stroke (not AIT)-DRG 14-17, 533; tract urinary infection-DRG 320,321,569.

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