ORIGINAL ARTICLE

Impact of geriatric assessment variables on 30-day mortality among older patients with acute heart failure

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Objective. To study the impact of geriatric assessment variables on 30-day mortality among older patients with acute heart failure (AHF).

Methods. Retrospective analysis of cases in the OAK Registry (Older Acute Heart Failure Key Data), a prospectively compiled database of consecutive patients aged 65 years or older treated for AHF in 3 Spanish emergency departments over a 4-month period (November-December 2011 and January-February 2014). The patients underwent a geriatric assessment adapted for emergency department use on weekdays between 8 AM and 10 PM. Demographic, clinical, laboratory, and geriatric assessment variables were recorded. The geriatric variables were concurrent diseases; polypharmacy; frailty; functional, social, and cognitive status at baseline; results of screening for confusional state, cognitive impairment, and depression; and nutritional status. The primary outcome was all-cause mortality at 30 days.

Results. We included 565 patients with a mean (SD) age of 83 (7.1) years; 346 (61.6%) were women. Sixty-five (11.5%) died within 30 days. Independent factors associated with 30-day mortality were acute confusional state (adjusted odds ratio [aOR], 2.2; 95% CI, 1.0–4.8; *P*=.04), acute illness (aOR, 1.8; 95% CI, 0.9–3.4; *P*=.05), loss of appetite in the past 3 months (aOR, 1.8; 95% CI, 1.0–3.4; *P*=.04), frailty (aOR, 2.0, 95% CI, 1.0–4.1; *P*=.05), and severe disability (aOR, 4.4; 95% CI, 1.9–11.4; *P*=.01).

Conclusions. Certain geriatric variables should be considered when assessing short-term risk in older patients with AHF.

Keywords: Frailty. Disability. Confusional state. Acute heart failure.

Impacto de las variables geriátricas en la mortalidad a 30 días de los ancianos atendidos por insuficiencia cardiaca aguda

Objetivos. Estudiar el impacto de las variables geriátricas en la mortalidad a 30 días entre los ancianos con insuficiencia cardiaca aguda (ICA).

Método. Análisis retrospectivo del registro Older Acute heart failure Key data (OAK) que incluye prospectivamente a pacientes consecutivos ≥ 65 años con ICA en 3 servicios de urgencias españoles durante 4 meses (noviembre-diciembre 2011 y enero-febrero 2014). Se realizó una valoración geriátrica adaptada a urgencias durante los días laborales de 8 am a 10 pm. Se recogieron variables demográficas, clínicas, analíticas y geriátricas (comorbilidad, polifarmacia, fragilidad, situación basal funcional, cognitiva y social, despistaje de síndrome confusional, deterioro cognitivo y depresión, y situación nutricional). La variable de resultado fue la mortalidad por cualquier causa a los 30 días.

Resultados. Se incluyeron 565 pacientes con edad media 83 años (DE 7,1), 346 mujeres (61,6%). Sesenta y cinco sujetos (11,5%) fallecieron a los 30 días. La presencia de síndrome confusional agudo (OR ajustada = 2,2; IC95% 1,0-4,8; p = 0,04), de enfermedad aguda (OR ajustada = 1,8; IC95% 0,9-3,4; p = 0,05) o pérdida de apetito (OR ajustada = 1,8; IC95% 1-3,4; p = 0,04) en los últimos 3 meses, y de fragilidad (OR ajustada = 2,0; IC95% 1,0-4,1; p = 0,05) o dependencia funcional grave (OR ajustada = 4,4; IC95% 1,9-11,4; p = 0,01) fueron factores independientes asociados con mortalidad a los 30 días.

Conclusiones. Existen ciertas variables geriátricas que debieran contemplarse en la estratificación de riesgo a corto plazo de los pacientes ancianos con ICA.

Palabras clave: Fragilidad. Discapacidad. Síndrome confusional. Insuficiencia cardiaca aguda.

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Introduction

Acute heart failure (AHF) is one of the main causes of care in emergency medical systems and in hospital emergency services (HES) in the elderly population and is associated with poor short-term outcomes[1-3]. The role of the emergency physician is to carry out the initial management of the process, the decision of admission and the design of a care[4-6]. Risk models have been derived in order to help in this decision-making process, which include various scales for risk stratification in AHF that allow predicting the short-term prognosis of patients[7-10]. A recent study concluded that risk models have shown a very limited predictive capacity in the elderly population[11].

It has been described that comorbidity, polypharmacy, cognitive, functional, social and nutritional status and the presence of frailty and geriatric syndromes are independent factors of poor prognosis among elderly patients hospitalized by AHF[12-18]. At present, there is no known work developed to analyze the effect on short-term prognosis of different variables, such as comorbidity, polypharmacy, frailty, cognitive, functional, social and nutritional, and the presence of geriatric syndromes, specifically in the elderly population with AHF treated in the HES. Therefore, the main objective of the study was to know the impact of the different geriatric variables on prognosis at 30 days among elderly patients treated for AHF in HES.

Method

This is a retrospective analysis of the Older Acute Heart Failure Key Data (OAK) Registry, an observational multicentre and multi-centre cohort study[19]. The study was approved by the Research Ethics Committees (REC) of the participating centres.

The OAK registry prospectively included all patients ≥ 65 years attended by AHF in 3 Spanish HES (Hospital Clínico San Carlos -HCSC-, Madrid, Hospital Reina Sofía -HRS, Murcia, and Hospital Santa Creu i Sant Pau -HSCSP-, Barcelona), during 4 months, in periods of 2 months (November-December 2011 and January February 2014), who gave their consent to participate in the study. All patients diagnosed with AHF were initially selected by the physician responsible for emergencies based on clinical, electrocardiographic and radiological findings, and if available, with data on plasma concentrations of B-type natriuretic peptides and ultrasound. The chief investigator of each centre reviewed all the cases and finally included only those who met the diagnostic criteria of the heart failure guidelines of the European Society of Cardiology in force at the time of the study[20]. We excluded patients with acute myocardial infarction with segment elevation to ST as precipitating factor of AHF.

For the present study, patients from the OAK registry were selected in which a geriatric assessment adapted to the emergency department was performed at the time of first care and in which follow-up data were available 30 days after the index visit.

The physicians responsible for emergency care collected the demographic data (age and gender), personal history (hypertension, diabetes mellitus -DM-, ischemic heart disease, valvular heart disease, atrial fibrillation, cerebrovascular disease, chronic renal failure, peripheral arterial disease, disease chronic obstructive pulmonary disease -COPD-, cirrhosis, cancer, previous episode of heart failure and left ventricle function), baseline cardiorespiratory status (according to the New York Heart Association class -NYHA-), clinical and analytical data of the acute episode (systolic blood pressure (SBP), heart and respiratory rate, baseline oxygen saturation by pulse oximetry, hemoglobin, natremia, renal clearance calculated by MDRD-4 and natriuretic peptide type B -NT-proBNP-) and the treatment directed during their stay in the emergency department (oxygen, non-invasive mechanical ventilation, intravenous diuretics, intravenous nitroglycerin, angiotensin-converting enzyme inhibitors -IACE inhibitors-, aldosterone receptor antagonists -RA-, beta-blockers and digoxin).

A medical researcher from each center performed a geriatric assessment adapted to the emergency department during the working days from 8 am to 10 pm. The adapted geriatric assessment included the personal history of diagnosis of dementia or depression, the degree of comorbidity (severe if ≥ 3 points according to the Charlson index), the number of drugs taken chronically (polypharmacy if ≥ 5 medications), the situation functional basal (Barthel index), the fragility screening (fragility if ≥ 3 Fried modified fragility criteria: 1) fatigue: do you often feel that everything you do is an effort?; 2) muscle strength: do you have difficulty getting up from a chair? 3) slowness of walking: do you have significant difficulty walking outside your home?; 4) physical activity: do you practice physical activity on a regular basis? and 5) weight loss: have you lost weight unintentionally in the last year?) in those without serious functional dependence (Barthel index ≥ 40 points), the short confusional syndrome (confusional picture if presented a positive Confussion Assessment Method -CAM-), the screening for dementia (probable dementia if ≥ 3 points of the Six-Item Screener -SIS-) and depression (probable depression if ≥ 2 points Geriatric Depression Scale of 5 questions -GDS-5-) in those without the presence of confusional symptoms, the answer to two questions collected in the Mini MNA related to the self-perception of the health and nutritional status (have you lost appetite or have eaten less due to lack of appetite, digestive problems, masticatory difficulties or swallowing? the last 3 months? and have you had an illness acute or psychological stress situation in the last 3 months?), the self-reported presence of deficit of visual or auditory acuity and living alone.

The main outcome variable was mortality by any cause 30 days after the index event by reviewing the clinical history or telephone call to each patient or companion between 31 and 60 days after the HES care.

For statistical analysis, quantitative variables were expressed as means and standard deviation (SD) and qualitative variables as absolute numbers and percentages. For the univariable analysis of the quantitative variables, the Student test was used, after checking with the Kolmogorov-Smirnov test that they fit a normal distribution, and for the qualitative test the chi-square test or Fisher's exact test correspond A logistic regression analysis was carried out that included all the cardiological variables with a value of $p < 0.10$ in the univariate analysis or with clinical relevance described in the literature11 and, subsequently, the geriatric variables previously identified as independently associated with the mortality at 30 days. The effects of the geriatric variables on 30-day mortality were determined, expressed as crude odds ratio (OR) (with its corresponding 95% confidence interval, -IC 95%-), and subsequently adjusted, first by the non-cardiological variables and, subsequently, both by the cardiological and non-cardiological variables. The differences were considered as statistically significant if the p value was < 0.05, the 95% CI of the OR excluded the value 1. The statistical analysis was performed with the SPSS version 18.0 for Windows (SPSS Inc., Chicago, EE .UU).

Results

We selected 565 patients from the 952 cases of the OAK registry for the present study. We excluded 349 patients in whom the geriatric assessment had not been performed and 38 patients due to lack of data on follow-up at 30 days. The comparison between included and non-included patients found no statistically significant differences except for age, history of DM and COPD, baseline cardiorespiratory status and the presence of respiratory failure on arrival at the emergency room (Table 1).

The patients included in the study had a mean age 83 (SD 7.1) years, 346 (61.6%) were women and 357 (63.2%) had had a previous episode of AHF. Sixty-five (11.5%) subjects died within 30 days of emergency care. Table 2 shows the characteristics of patients globally and grouped according to 30-day mortality.

Table 3 reflects the frequency of appearance of the geriatric variables in the elderly population with AHF. The history of dementia ($p < 0.01$) or depression ($p = 0.02$), the presence of acute confusional syndrome in the emergency department ($p < 0.01$), the existence of frailty or severe disability ($p < 0.01$)), having suffered a disease recent acute ($p < 0.01$) or loss of appetite in the last 3 months ($p < 0.01$) and the visual acuity deficit ($p = 0.03$) were associa≥ted in a statistically significant way with the poor prognosis at 30 days.

Table 1. Characteristics of patients included and not included in the study

	Included patients (N = 565) n (%)	Non- included patients (N = 387) n (%)	p
Demographic data			
Age (years) [mean (SD)]	83.4 (7.1)	82.6 (7.0)	0.01
Sex female	346 (61.6)	235 (60.6)	0.77
Personal history			
Arterial hypertension	497 (88.0)	332 (85.6)	0.28
Diabetes mellitus	201 (35.6)	169 (43.6)	0.01
Ischemic heart disease	167 (29.6)	98 (25.3)	0.13
Chronic renal failure	171 (30.3)	101 (26.0)	0.15
Cerebrovascular disease	94 (16.6)	63 (16.2)	0.80
Atrial fibrillation	263 (47.1)	159 (41.5)	0.09
Peripheral vascular disease	85 (15.0)	47 (12.1)	0.20
Valvulopathy	172 (30.4)	109 (28.1)	0.45
Chronic obstructive pulmonary disease	126 (22.3)	109 (28.1)	0.03
Previous episode of heart failure	357 (63.2)	238 (64.2)	0.82
Cirrhosis	17 (3.0)	10 (2.6)	0.84
Cancer	93 (16.5)	59 (15.2)	0.65
Basal situation			
Cardiorespiratory status (NYHA III-IV)	137 (24.6)	68 (18.2)	0.02
LVEF ≤ 45%	101 (57.7)	65 (59.1)	0.78
Acute episode data			
Hypotension (SBP < 100 mmHg)	28 (5.0)	15 (3.9)	0.46
Tachycardia (HR ≥ 100 bpm)	137 (24.6)	104 (27.1)	0.39
Tachypnea (RR > 20 rpm)	222 (39.3)	137 (47.1)	0.25
Respiratory insufficiency (Basal O_2 Sat < 90%)	146 (27.4)	80 (21.4)	0.04
Hyponatremia (Na < 135 mEq/L)	89 (16.0)	70 (18.3)	0.37
Renal insufficiency (Cl < 60 ml/min/m^2)	323 (59.0)	244 (63.9)	0.07
Anemia (Hb < 12 g/L woman and <13 g/l male)	305 (54.9)	200 (52.2)	0.44
NT-proBNP > 5,180 pg/ml	339 (60.0)	218 (56.3)	0.28
Follow up			
30 day mortality	65 (11.5)	35 (10.0)	0.23

SD: Standard deviation; n: number of cases, NYHA New York Heart Association; SBP: Systolic blood pressure; HR: Heart rate; RR: Respiratory rate; bpm: Beats per minute; rpm: Respirations per minute; O_2Sat: oxygen saturation; Na: Natremia; Cl: Estimated Renal clearance; LVEF: ejection fraction of the left ventricle; Hb: hemoglobin.

Figure 1 shows the raw and adjusted effects of each of these variables. After the multivariate analysis, the presence of acute confusional syndrome (adjusted OR = 2.2, 95% CI 1.0-4.8, p = 0.04), of acute disease (adjusted OR = 1.8, 95% CI 0 , 9-3.4, p = 0.05) or loss of appetite (adjusted OR = 1.8, 95% CI 1-3.4, p = 0.04) in the last 3 months, and frailty (OR adjusted = 2.0, 95% CI 1.0-4.1, p = 0.05) or severe functional dependence (adjusted OR = 4.4, 95% CI 1.9-11.4, p = 0.01) independent factors associated with 30-day mortality were possible.

Discussion

The present study shows that the geriatric variables are frequent in the elderly with AHF seen in the

Table 2. Characteristics of patients included according to 30-day mortality

	Total (N = 565) n (%)	Dead 30 days after (N = 65) n (%)	Alive 30 days after (N = 500) n (%)	P
Demographic data				
Age (years) [mean (SD)]	83.4 (7.1)	86.4 (6.7)	83.0 (7.0)	< 0.01
Sex female	346 (61.6)	38 (58.5)	308 (62.0)	0.58
Personal history				
Arterial hypertension	497 (88.0)	57 (87.7)	440 (88.0)	0.94
Diabetes mellitus	201 (35.6)	18 (27.7)	183 (36.6)	0.15
Ischemic heart disease	167 (29.6)	19 (29.2)	148 (29.6)	0.95
Chronic renal failure	171 (30.3)	23 (35.4)	148 (29.6)	0.34
Cerebrovascular disease	94 (16.6)	14 (21.5)	80 (16.0)	0.25
Atrial fibrillation	263 (47.1)	26 (40.6)	237 (48.0)	0.26
Peripheral vascular disease	85 (15.0)	8 (12.3)	77 (15.4)	0.51
Valvulopathy	172 (30.4)	17 (26.2)	155 (31.0)	0.42
Chronic obstructive pulmonary disease	126 (22.3)	15 (23.1)	111 (22.1)	0.87
Previous episode of heart failure	357 (63.2)	41 (63.1)	316 (63.2)	0.98
Cirrhosis	17 (3.0)	4 (6.2)	13 (2.6)	0.11
Cancer	93 (16.5)	15 (23.1)	78 (15.6)	0.12
Basal situation				
Cardiorespiratory status (NYHA III-IV)	137 (24.6)	22 (34.9)	115 (23.2)	0.04
LVEFI ≤ 45% (n= 175)	101 (57.7)	3 (21.4)	71 (44.1)	0.10
Acute episode data				
Hypotension (SBP < 100 mmHg)	28 (5.0)	7 (10.9)	21 (4.3)	0.02
Tachycardia (HR ≥ 100 bpm)	137 (24.6)	12 (18.5)	125 (25.4)	0.22
Tachypnea (RR > 20 rpm)	222 (39.3)	35 (53.8)	187 (37.4)	0.01
Respiratory insufficiency (Basal O_2Sat < 90%)	146 (27.4)	29 (45.3)	117 (24.9)	0.01
Hyponatremia (Na < 135 mEq/L)	89 (16.0)	18 (29.5)	71 (14.4)	0.01
Renal insufficiency (< 60 ml/min/m^2)	323 (59.0)	34 (56.7)	289 (59.3)	0.69
Anemia (Hb < 12 g/L woman andCl < 13 g/l male)	305 (54.9)	45 (71.4)	260 (52.7)	0.01
NT-proBNP > 5,180 pg/ml	339 (60.0)	52 (80.0)	287 (57.4)	< 0.01
Treatment of the acute episode				
Oxygen	398 (70.6)	52 (80.0)	346 (69.3)	0.07
Non-invasive ventilation	24 (4.3)	4 (6.2)	20 (4.0)	0.42
Intravenous diuretics	508 (90.1)	62 (95.4)	446 (89.4)	0.12
Intravenous nitroglycerin	29 (5.1)	4 (6.2)	25 (5.0)	0.69
ACEI or ARA	176 (31.2)	7 (10.8)	169 (33.9)	< 0.01
Beta blockers	101 (17.9)	1 (1.5)	100 (20.0)	< 0.01
Digoxin	95 (16.8)	9 (13.8)	86 (17.2)	0.49

SD: standard deviation; n: number of cases; NYHA: New York Heart Association; SBP: systolic blood pressure; HR: heart rate; RR: respiratory rate; bpm: beats per minute; rpm: breaths per minute; $SatO_2$: oxygen saturation; Na: natremia; Cl: estimated renal clearance; LVEF: ejection fraction of the left ventricle; Hb: hemoglobin; ACE inhibitors: angiotensin converting enzyme inhibitors; ARA: angiotensin receptor antagonist.

HES and that the presence of acute confusional syndrome, of frailty or severe functional dependence, and of the subjective state of health and nutrition in the last 3 months, are factors that could be associated independently with the 30-day global mortality. These findings indicate that the described geriatric variables should be considered in the future in the design of risk prediction models in patients aged 65 or older treated for AHF.

Our results are in line with previous studies on the high frequency of comorbidity, polypharmacy and geriatric syndromes in the elderly with AHF and its progressive increase as age advances[21,22]. More than half of the elderly with AHF presented altered activities of daily living and one in ten suffered severe disability. Fragility was present in one in four elderly people without serious dependence. Acute confusional syndrome occurred in one in ten cases. These data are in the range of previous studies and the possible differences found can be explained by the different measurement tools and fields of study[13,17,19,23-25]. The relevant aspect of this study is that it was carried out in a cohort of patients aged 65 years and older treated by AHF in Spanish HES, and that it did not exclude, in comparison with other registries, the elderly discharged directly from the HES[1].

The data shown provide evidence of the 30-day prognostic value of cognitive, physical and nutritional fragility in elderly patients treated with AHF in HES. Previous studies have shown that frailty and severe disability are predictors of short-term mortality[8,26], and long-term[17], and that acute confusional syndrome is associated with poor intrahospital prognosis[13,25] and short-term after discharge[13,24,25] and that malnutrition has a long-term prognostic effect[27]. An important aspect to consider is that these geriatric variables can be potentially reversible if an adequate pharmacological and non-pharmacological treatment is established[28-30]. In this sense, we would like to emphasize the importance of identifying these geriatric variables in the systematic assessment of el-

Table 3. Univariate analysis of the geriatric variables associated with mortality 30 days

Variable	Frequency n (%)	Mortality 30 days (%)	p
Acute illness in the last 3 months			< 0.01
Yes	120/565 (21.2)	25 (20.8)	
No		40 (9.0)	
Severe Comorbidity (Charlson Index ≥ 3)			0.1
Yes	329/565 (58.2)	44 (13.4)	
No		21 (8.9)	
Polymedicated (number of drugs ≥ 5)			0.62
Yes	512/565 (90.6)	60 (11.7)	
No		5 (9.4)	
Acute confusional syndrome (positive CAM)			< 0.01
Yes	55/565 (9.7)	19 (34.5)	
No		46 (9.0)	
History of dementia			< 0.01
Yes	102/565 (18.1)	26 (25.5)	
No		39 (8.4)	
Positive dementia screening (SIS ≥ 3)			0.45
Yes	153/510 (30.0)	16 (10.5)	
No		30 (8.4)	
History of depression			0.02
Yes	152/565 (26.9)	25 (16.4)	
No		40 (9.7)	
Positive Depression Screening (GDS-5 ≥ 2)			0.98
Yes	156/510 (30.6)	14 (9.0)	
No		32 (9.0)	
Visual acuity deficit			0.03
Yes	272/565 (48.2)	39 (14.3)	
No		25 (8.6)	
Hearing acuity deficit			0.12
Yes	225/565 (40.3)	31 (13.8)	
No		32 (9.6)	
Loss of appetite in the last 3 months			< 0.01
Yes	154/565 (27.3)	32 (20.8)	
No		33 (8.0)	
Fragility-disability			< 0.01
Non-frail or severe functional dependence	304/565 (53.8)	15 (4.9)	
Fragile without serious functional dependence (≥ 3 weakened criteria BI ≥ 40)	201/565 (35.6)	28 (13.9)	
Serious functional dependence (IB < 40)	60/565 (10.6)	22 (36.7)	
Lives alone			0.24
Yes	47/565 (8.4)	3 (6.4)	
No		62 (12.1)	

CAM: Confussion Assessment Method; SIS: Six-Item Screener; GDS: Geriatric Depression Scale; BI: Barthel Index.

derly patients with AHF during their urgent attention in order to improve risk stratification and establish a specific care plan in order to reverse these situations.

The present study has several limitations. It is an exploratory study from a multipurpose registry, and therefore the statistical power of the analysis may have been limited. Although no clinically relevant differences were found between the group of patients included and not included, it cannot be ruled out that this fact could have influenced the mortality rates or a selection bias, since a systematic sampling was carried out where the adapted geriatric assessment the emergency department was performed from 8 am to 10 pm on working days. Information on echocardiographic data, such as left ventricle function, and prognostic biomarkers, such as troponin, were not available in some patients, since they are not performed routinely in all patients treated for AHF in Spanish HES. The treatments prescribed during the acute phase and after discharge from the patient were at the discretion of the physicians responsible for care, and therefore this could have had an influence on the results. However, this allows the results to be more real and finally can be more easily applied to clinical practice.

It is concluded that the inclusion of activities of daily living (Barthel index) and the physical fragility (fragility phenotype questionnaire) and nutritional fragility (two subjective questions about health or nutrition in the last 3 months) are key variables when stratifying the risk at 30 days among the elderly served by AHF in the HES.

Conflicting interests

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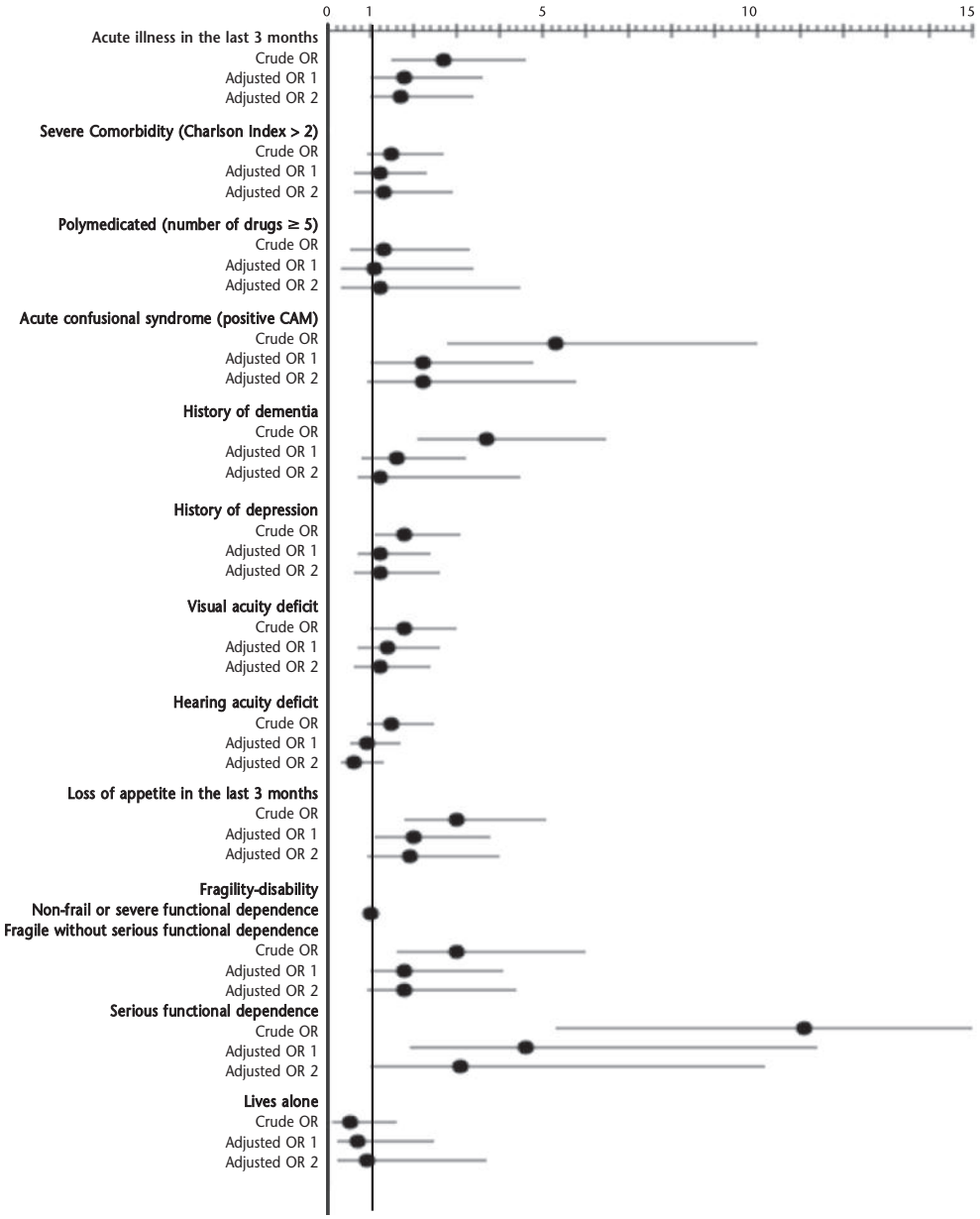

Figure 1. Crude and adjusted effects of the non-geriatric variables with respect to 30-day mortality in the elderly with acute heart failure. Adjusted 1: acute illness in the last 3 months, severe comorbidity, polymedicated, acute confusional syndrome, history of dementia and depression, deficit of visual and auditory acuity, weight loss in the last 3 months, fragility and grouped disability, and living alone. Adjusted 2: adjusted for acute illness in the last 3 months, severe comorbidity, polymedicated, acute confusional syndrome, history of dementia and depression, deficit of visual and auditory acuity, weight loss in the last 3 months, fragility and grouped disability, live alone, age ≥ 75 years old, female sex, history of diabetes mellitus, cerebrovascular disease, cancer, episode of previous heart failure, baseline cardiorespiratory NYHA III-IV, systolic blood pressure < 100 mmHg, baseline oxygen saturation < 90%, respiratory rate > 20 rpm, renal clearance < 60 ml/min, hemoglobin < 12 g/L women and < 13 g/l men, natremia < 135 mEq/l, and NT-proBNP > 5,180 pg/ml.

Ethical Responsibilities

The Clinical Research Ethics Committees of the hospitals participating in the study (Hospital Clínico San Carlos in Madrid, Hospital Reina Sofía in Murcia and Hospital de la Santa Creu i Sant Pau in Barcelona) approved the realization of the same. All patients gave their informed consent to participate in the study. All authors have confirmed the maintenance of confidentiality and respect for the rights of patients in the author's responsibility document, publication agreement and assignment of rights to EMERGENCIAS.

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Addendum

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