ORIGINAL ARTICLE

Clinical profile of patients with acute heart failure in the emergency department: preliminary data from the EAHFE (Epidemiology Acute Heart Failure Emergency) study

Pere LLORENS[1], Francisco Javier MARTÍN-SÁNCHEZ[2], Juan Jorge GONZÁLEZ-ARMENGOL[2], Pablo HERRERO[3], Javier JACOB[4], Ana Bella ÁLVAREZ[5], José PAVÓN[5], Manuel GARRIDO[6], María José PÉREZ-DURÁ[7], César GONZÁLEZ[8], Víctor GIL[9], Héctor ALONSO[10] y Colaboradores del estudio EAHFE[11]

[1]University General Hospital Alicante, Spain. [2]Clinical Hospital San Carlos, Madrid, Spain. [3]Central University Hospital Asturias, Oviedo, Spain. [4]Hospital de Bellvitge, Barcelona, Spain. [5]Hospital Dr. Negrín, Las Palmas, Gran Canaria, Spain. [6]Hospital Virgen de la Macarena, Seville, Spain. [7]Univesity Hospital La Fe, Valencia, Spain. [8]University Hospital Salamanca, Spain. [9]Hospital Clinic, Barcelona, Spain. [10]Hospital Marqués de Valdecilla, Santander, Spain.
[1-10]Members of the Spanish Society of Emergency Medicine Heart Failure Working Group (ICA-SEMES Group).
[11]Those who worked on the EAFHE study: Annex I.

Correspondence:
Pere Llorens Soriano
Servicio de Urgencias
Hospital General Universitario de Alicante
Calle Pintor Baeza, nº 12.
03010 Alicante, Spain
E-mail: llorens_ped@gva.es.

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Objective: To assess the clinical profile and treatment of patients with acute heart failure (AHF) admitted to Hospital Emergency Departments (HED).
Methods: All patents with a diagnosis of AF admitted to 10 Spanish HEDs in April 15th to May 15th 2007 were included in this descriptive crossover multicent study.
Results: 1017 patients were included in the study the mean age was 77 years; 52.1% were women. 60.6% patients showed symptoms of systemic and pulmonary congestion at admission. Before presenting to HED 88.2% patients were receiving diuretics, 55.9% ACE inhibitors and/or angotensin-II receptor antagonists (ARA) and 24.7% beta-blockers. At the HED, 84.2% received intravenous (IV) diuretics (17.2% in continuous perfusion), 25.9% IV nitroglycerine, 3.8% inotropic treatment, and 4.6% non-invasive ventilation support; 70% were hospitalized. Among the patients evaluated 44.2% remained in the Observation (OU) or Short Stay Units (SSU).
Conclusions: AHF is a frequent pathology at HED commonly associated with elderly people with important concomitant diseases; mild to moderate congestive symptoms are predominant. Most patients are usually managed at HED related units (OU or SSU). Clinical guidelines and specific HED protocols on AHF and patient registers as described above are mandatory to improve the knowledge about the current situation and management of AHF patients in the HED. [Emergencias 2008;20:154-163]

Key words: Disease management. Cardiac failure. Emergency Service, hospital.

Introduction

Acute heart failure (AHF) is one of the main causes of hospitalisation in developed societies[1] and is the reason behind most hospital visits and admission to HED for patients over the age of 65[2]. The prevalence of AHF is estimated at between 0.4% and 2% in Europe[3].

Different publications have described the clinical characteristics of patients with heart failure who are generally admitted to the cardiology department, intensive care unit and internal medicine both in Europe and in the United States[4-8]. In general, these publications do not include information about admissions, evaluation and initial

treatment received by the patient during their stay in the HED. Furthermore these publications do not include information on a large proportion of patients who can be found in other areas of the hospital like the nephrology department, pneumology department, geriatric department, short stay units, emergency observation, medium and long stay hospitals or primary care, following their treatment in the HED. Finally, in recent years, there have been changes in the way heart failure is treated during the acute phase and the use of non invasive ventilation or new inotropic drugs for example that can change the course of this condition are essentially handled by HED[9].

The primary objective of the EAHFE project was to record the clinical characteristics of all patients with AHF in the HED in order to gain a better understanding of the nature of the medical demand that this condition generates so that HED in Spain can develop more consistent and efficient operational protocols. The analysed results of the information gathered on patients with AHF (demographic data, causes, and levels of functional dependency, comorbidity, clinical symptoms, additional tests carried out, treatments and patient destination once admitted) in different HED in Spain can be found in this publication. The preliminary results obtained in this study have been compared with the profiles of patients in other countries (ADHERE[4], OPTIMIZE-HF[5], EHFS[6], Italian Acute Heart Failure Survey[7] and the EFICA study[8]).

Method

The EAHFE project is a descriptive, cross sectional, multi-centred study which includes all patients treated for AHF from 15th April 2007 to 15th May 2007 in HED in 10 tertiary care hospitals around Spain that receive a high number of patient visits (Table 1), and that belong to the Spanish Society of Emergency Medicine Heart Failure working group (ICA-SEMES group).

All the hospitals that participated had observation units (OU) linked to the HED where patients could stay for up to 23 hours. When the study was carried out, 4 hospitals had short stay units (SSU) which were also linked to the HED.

Information about all the patients that were seen in these HED and who were diagnosed with AHF was recorded according to Framingham criteria[10] which is based on the existence of various symptoms (dyspnoea, ortopnoea, paroxysmal nocturnal dyspnoea), signs (third heart sound, pulmonary crepitations, jugular venous pressure > 4 cm, sinus tachycardia at rest, oedemas, hepatomegaly, hepatojugular reflux) and lung congestion x-ray results.

Table 1. The distribution of patients per hospital (n =1,017)

Hospital	n (%)
Hospital Marqués de Valdecilla, Santander	43 (4.2)
Central University Hospital Asturias, Oviedo	45 (4.4)
Hospital Clinic, Barcelona	64 (6.3)
University Hospital Salamanca	69 (6.8)
University Hospital La Fe, Valencia	108 (10.6)
Hospital Virgen de la Macarena, Seville	110 (10.8)
Hospital Dr. Negrín, Las Palmas, Gran Canaria	122 (12)
University General Hospital, Alicante	140 (13.8)
Clincal Hospital San Carlos, Madrid	157 (15.4)
University Hospital Bellvitge	158 (15.5)

The patients were classified according to the European Society of Cardiology acute heart failure guidelines[9] which distinguish between patients with severe decompensated heart failure who had been previously diagnosed with heart failure or who had chronic symptoms which could be attributed to heart failure, and patients diagnosed with heart failure for the first time or those who did not have a previous history of heart disease and recent symptoms.

The following variables were recorded for each patient.

a. Demographic information: age, sex, level of functional dependency according to the Barthel index[11], comorbidity data (history of high blood pressure, diabetes mellitus, dyslipemia, nicotine poisoning) and the Charlson comorbidity index[12].

b. Signs and symptoms found during the examination: level of dyspnoea, ortopnoea, paroxysmal nocturnal dyspnoea, third heart sounds, pulmonary crepitations, jugular venous pressure, sinus tachycardia at rest, oedemas, hepatomegaly, hepatojugular reflux.

c. Extent to which the heart is affected: type of heart failure; either acute de novo or chronic decompensated, functional classification according to the New York Heart Association (NYHA)[13], level of seriousness according to Killip classification[14], level of ventricular function; either depressed or normal depending on whether the ejection fraction of the left ventricle (LVEF) is less than or equal to 45% or over 45%, respectively.

d. Additional tests carried out: full blood test, biochemistry, cardiac enzymes, measurement of cardiac enzymes after 6 hours, electrocardiogram, brain natriuretic peptide (BNP), NT-proBNP, coagulation, D-dimer, arterial gasometry, chest x-ray.

e. Treatment before admission because of heart failure.

f. Treatment given in the emergency department.

g. Final destination of patient.

Statistical analysis

In order to describe the qualitative values, the absolute and relative frequency of each of the variables was used. For the quantitative variables the standard deviation was used. The software program SPSS 12.0 was used to gather the data and carry out the statistical analysis.

Results

During the period of this study information about 1,017 patients with AHF in HED was gathered. The patient distribution can be found in Table 1.

The socio-demographic characteristics of the patients and ther level of comorbidtity are shown in Table 2. The mean age of the sample was 77.2 (± 10.28), women represented 52.1% of the cases and showed significant comorbidity: 79.4% had high blood pressure, 43.8% diabetes mellitus, 42.2% auricular fibrillation, 35.7% a previous history of ischemic heart disease, 32.4% dyslipemia, 21.5% heart valve disease, 19.7% were obese and 11.3% had nicotine poisoning.

73.5% of cases involved patients with known heart disease who had developed intercurrent decompensation, and in 26.5% heart disease was acute de novo.

In 52.7% of patients the type of left ventricular dysfunction was not known while 33.6% had systolic dysfunction and 13.7% had diastolic dysfunction.

The main clinical manifestations in patients on arrival at the HED are described in Table 2. The functional classification for most of patients was class II (50%) and class III (22.2%) according to the NYHA and according to the Killip classification the level of severity of their condition was increased. On the whole, signs and symptoms related to high left and right ventricular filling pressure were predominant (60.6%) compared to isolated left ventricular dysfunction (32.8%) and isolation right ventricular dysfunction (6.6%).

The treatment of heart failure using drugs prior to patient admission to the HED and the treatment given in the HED are summarised in Table 3: 569 patients were treated with ACE-inhibitors or ARA-II (55.9%), 647 were taking high ceiling loop diuretics (63.6%), 251 patients were on beta blockers (24.7%), 211 were taking digoxin (20.7%), 188 were taking aldosterone inhibitors (18.4%) and 386 were receiving antiagreggant treatment (38%).

Table 2. Socio-demographic and clinical characteristics and the level of comorbidity of patients with acute heart failure (n = 1,017)

	n (%)	Average (±SD)
Age		77.2 (10.3)
Sex (female)	530 (52.1)	
Comorbidity		
High blood pressure	807 (79.4)	
Diabetes mellitus	445 (43.8)	
Auricular fibrillation	429 (42.2)	
Ischemic heart disease	363 (35.7)	
Dyslipemia	329 (32.4)	
Heart valve disease	219 (21.5)	
Obesity	200 (19.7)	
Nicotine poisoning	115 (11.3)	
Charlson comorbidity index		2.94 (2.29)
Barthel index		83.5 (22.7)
Clinical characteristics		
Dyspnoea at rest	597 (8.7)	
Lung crepitations	885 (87)	
Oedemas	768 (75.5)	
Ortopnoea	660 (64.9)	
Paroxysmal nocturnal dyspnoea	392 (28.5)	
Jugular venous pressure	302 (29.7)	
Tachycardia at rest	140 (13.8)	
Hepatojugular reflex	127 (12.5)	
Hepatomegaly	78 (7.7)	
Third heart sounds	67 (6.6)	
Level of heart failure according to the NYHA		
I	265 (26.3)	
II	503 (50)	
III	224 (22.2)	
IV	15 (1.5)	
Level of severity according to the Killip classification		
I	56 (5.6)	
II	828 (82.4)	
III	113 (11.2)	
IV	8 (0.8)	
Clinical syndrome		
Mixed AHF	616 (60.6)	
Left ventricular AHF	334 (32.8)	
Right ventricular AHF	67 (5.5)	
Left ventricle dysfunction		
Systolic	342 (33.6)	
Diastolic	139 (13.7)	
Unknown	536 (52.7)	

AHF: acute heart failure; NYHA: New York Heart Association.

Most patients received conventional oxygen therapy (86.6%) and diuretics(84.2%), although oxygen therapy was administered using non invasive ventilation (NIV) and continuous infusion diuretics were not common (4.6% and 17.2%, respectively). Thirty-eight patients received inotropic drugs; 20 of them (2%) were given levosimendan and 18 were treated with dopamine and/or dobutamine.

A large percentage of patients were taken to acute care patient rooms and not consultation rooms (73.4% versus 26.6%) with a significant number of additional tests being performed (Table 4). It is clear from the results that BNP or

Table 3. The treatment given in hospital emergency departments and the treatment received by patients with acute heart failure prior to be being admitted (n = 1,017)

Treatment	n (%)
Prior treatment	
Antiaggregants	386 (38)
Digoxin	211 (20.7)
Aldosterone inhibitors	188 (18.4)
Beta blockers	251 (24.7)
High ceiling loop/thiazide diuretics	647/65 (63.6/6.4)
ACE-inhibitors/ARA-II	346/223 (34/22)
Treatment given in the HED	
Conventional oxygen therapy	834 (82)
Non invasive ventilation	47 (4.6)
Bolus intravenous furosemide	856 (84.2)
Continuous furosemide infusion	175 (17.2)
Intravenous nitroglycerin	263 (25.9)
Levosimendan	20 (2)
Dopamine/Dobutamine	18 (1.8)

HED: hospital emergency departments; ACE-inhibitors: angiotensin converter enzyme inhibitors; ARA-II: angiotensin II receptor antagonists.

NT-proBNP and echocardiograms (10.8% and 2.3%, respectively) were seldom carried out. A cardiologist was requested in 117 cases (11.5%) to review the patient.

Finally, of the 1,017 patients attended, 640 were admitted to hospital (70%) with the most common patient destinations being: short stay units (37%) and internal medicine (32%). Only 17% were admitted to the cardiology department and 5% in intensive care units. Of all the patients with AHF in the HED, 13% were discharged from the emergency department and 17% from the observation unit (Figure 1).

Discussion

This study reports the preliminary results of the EAHFE project which is an epidemiological study of patients with acute heart failure in the emergency departments of different hospitals around Spain. It should be highlighted that to our knowledge, this is the first national and international study carried out in patients with AHF in HED. Until now, most epidemiological data on patients with AHF have been from series involving large numbers of patients admitted to cardiology departments or intensive care units[4-8]. Our study shows that these patients only represent 13% of all patients with attended in HED and therefore, they provide a very limited perspective on the situation regarding patients with AHF.

In our study, most patients with AHF are taken to observation areas or SSU that are linked to the HED. These alternatives to conventional hospital admission represent an important additional care option in our working environment[15,16] when faced with series of factors such as the high demand for medical care (patients with multiple illnesses, old people who are fragile and/or terminally ill), rising costs and the need to group patients together in diagnostic categories and guarantee continuous care[17,18]. In this way, these units cover the needs of patients with chronic illnesses, such as those in this study with AHF (elderly, high comorbidity and functional dependency) and they also make the best use of the limited resources and optimise hospitalisation[19,20]. In comparison with other studies, in the United States patients with AHF are admitted to units with telemetry and in Europe there are units with telemetry and other conventional rooms[4-8].

Table 4. Additional tests carried out in the hospital emergency departments

Additional tests	Number (%)
Full blood test	996 (97.9)
Biochemistry	987 (97.1)
Coagulation	877 (86.2)
D-dimer	62 (6.1)
Cardiac enzymes	555 (54.6)
Arterial gasometry	577 (56.7)
BNP or NT-proBNP	110 (10.8)
Electrocardiogram	974 (95.8)
Chest x-ray	979 (96.3)
Echocardiogram	23 (2.3)

The patients in our study are distributed very differently compared to those in other published series[4-8,21,22] because of their age, functional dependency and general comorbidity which means that they have to be handled by other medical care services which are different to those published (Figure 2). It should be emphasised that this high comorbidity (Charlson index 2.9) is linked to high mortality, risk of complications, readmissions and dependency[23-25].

The symptoms and clinical manifestations of our patients were not different from those found in other series and the vast majority were hypervolemic with symptoms of lung and/or systemic congestion (dyspnoea on exertion, lung crepitations and oedemas were predominant)[4-8,25] (Figure 3). It was necessary to identify and treat these symptoms in HED because of the evidence to suggesting that high congestion increases the risk of death and hospitalisation caused by heart failure[27].

The type of pre-existing heart dysfunction affecting over half of the patients with AHF arriving at the participating hospitals was unknown, despite most cases being patients with known chronic heart failure with intercurrent decompen-

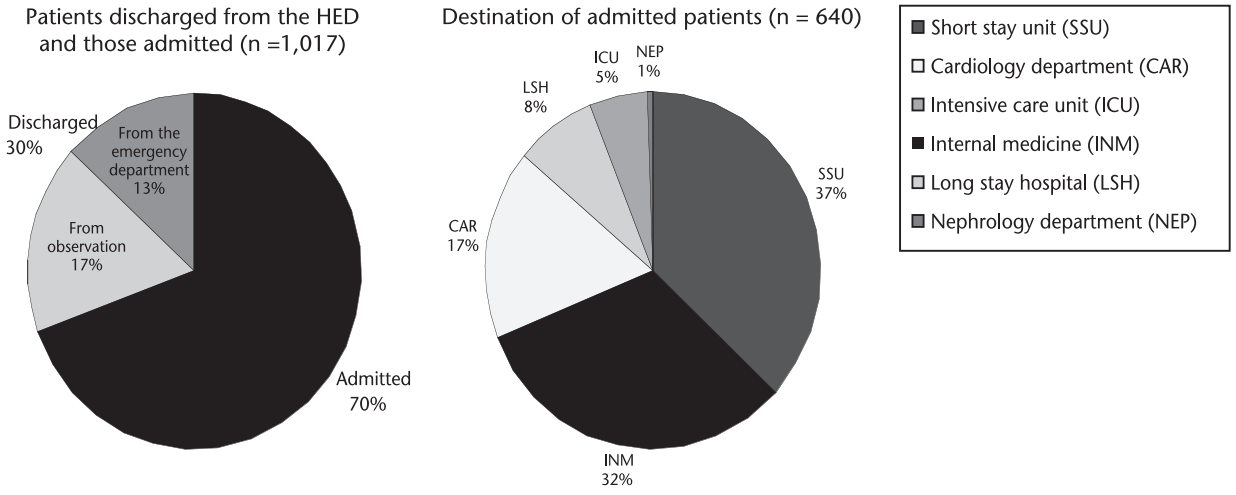

Figure 1. The destination of patients with acute heart failure (AHF) after discharge from hospital emergency departments (HED).

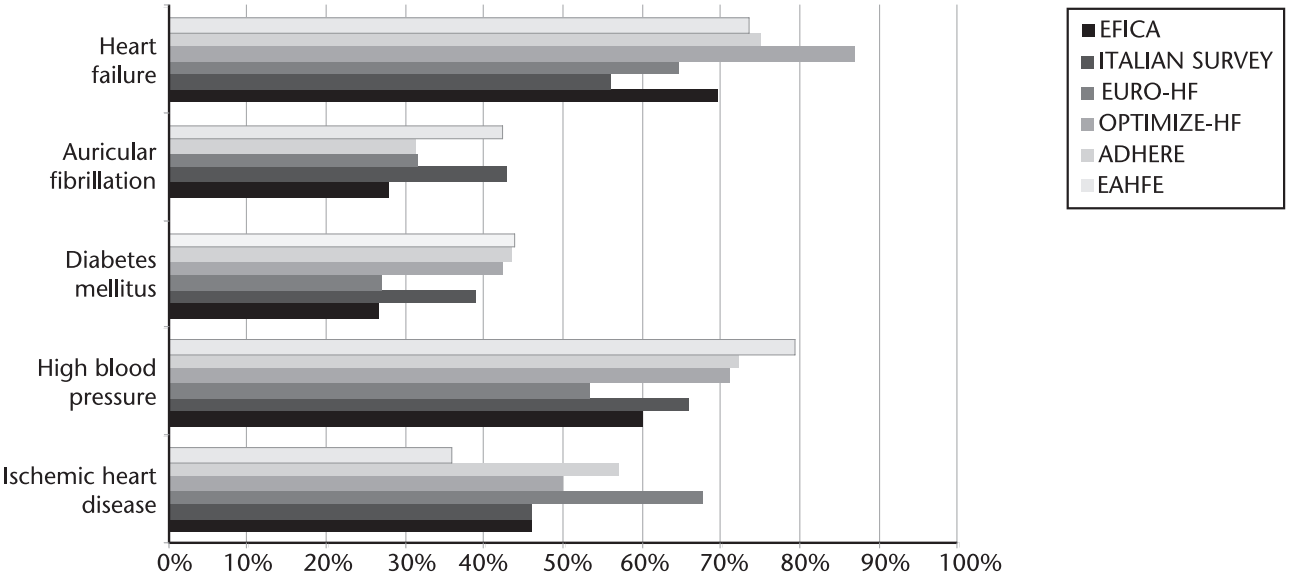

Figure 2. Comorbidity in patients with acute heart failure (AHF) according to different series.

sation. Therefore, not only is it necessary to diagnose the heart failure but also to identify the type of pre-existing heart disease and the level of systolic function given that this will have an impact on our choice of treatment in the emergency department.

There are no significant differences with regard to patients' previous treatment in our study compared to heart failure treatment in European and American series. The use of diuretics was 88.2% in our study compared with 87% and 70% in European and American series respectively; ACE-inhibitors or ARA-II were used in 55.9% of cases in our study compared with 67% and 52% and digoxin was used in 20.7% compared with 36% and 28%[4-8,22]. The main difference was found in the use of beta blockers which was slightly lower in our study compared to other investigations (24.7% compared with 37% in Europe and 48% in the United States) and is far from the standards set, reflecting the need to implement prescription strategies given that they can help to reduce the morbimortality of these patients[28-30] (Figure 4).

With regard to the treatment in the HED, most patients were given oxygen therapy and intravenous diuretics; however, there are two important aspects that could be improved: the infrequent use of NIV and continuous infusion diuretics. Despite the use of

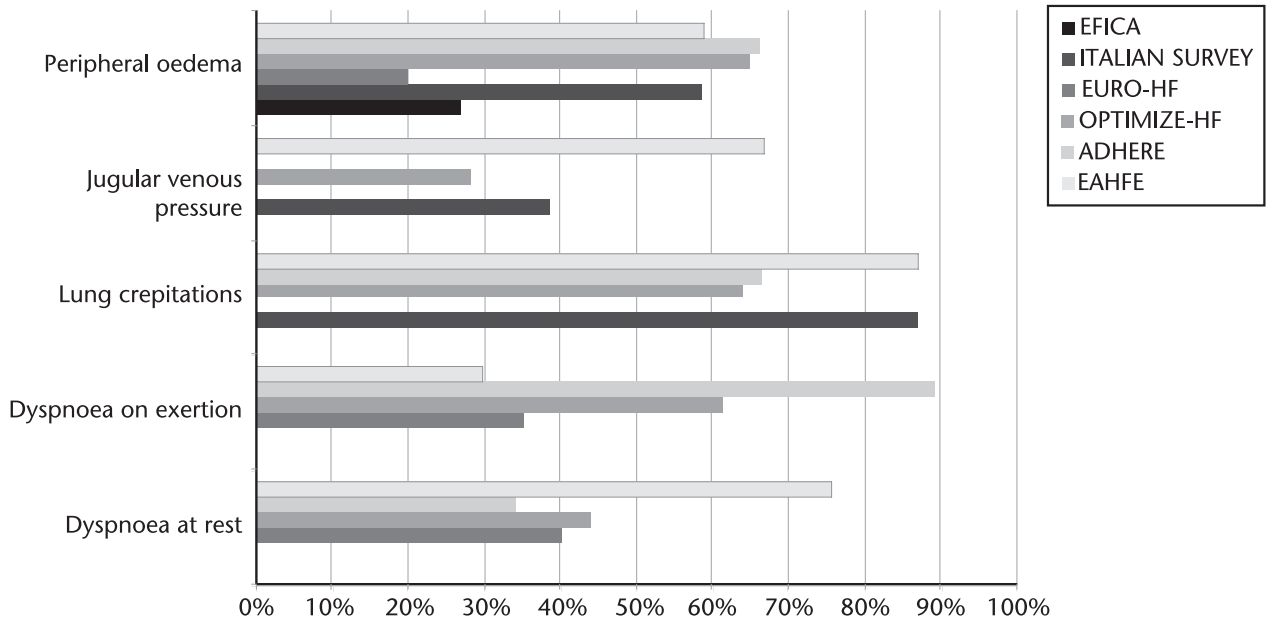

Figure 3. The clinical manifestations of acute heart failure (AHF) according to different series.

NIV being similar to that found in other series (4.6% in EAHFE compared to 5.1% in the Euroheart Failure Survey-II31) the percentages are far from what we would expect, bearing in mind that AHF in HED manifests itself in acute lung oedemas and/or hypertensive heart dysfunction in 20% to 30% of cases[26]. We should also consider that in certain situations, NIV can reduce the need for orotracheal intubation and invasive ventilation, decrease the number of admissions to intensive care units and reduce the length of hospital stays, morbidity and mortality[32-35]. Therefore, it is necessary to familiarise ourselves with the technique and use it early on in the HED.

We should treat patients who have moderate or severe congestion with continuous intravenous infusion of diuretics because it is safer and more effective compared to intermittent bolus administration[9,36].

The infrequent use of inotropic drugs was of note (levosimendan 2% and dobutamin and/or dopamine 1.8%) in our study compared to that of the European series (levosimendan 3.9% and dobutamin and/or dopamine 21.5%)[31]. Considering that 40%-50% of patients with AHF who come to the HED have systolic dysfunction and/or many show resistance to treatment with diuretics and/or vasodilators, and/or have signs or peripheral hypoperfusion (fatigability, low blood pressure, reduced kidney function) we expect drugs such as levosimendan to be used more often[37] in the HED for treating patients, given the clinical and haemodynamic benefits associated with these drugs[38,39] (Figure 5).

Most our patients were taken to acute care patient rooms with motorised beds rather than to consultation rooms. This is due to the fact that most of the patients that arrive at the HED are in a chronic state and this is reinforced by the high percentage with severe AHF according to the NYHA and Killip classification systems. As a result, these patients require more medical attention from doctors and nurses and additional tests (full blood test, biochemistry, coagulation, gasometry, chest x-ray, electrocardiogram, cardiac enzymes). However, infrequent testing for biochemical markers such as BNP or NT-proBNP in order to identify heart failure was of note given that they have been proven to be very effective markers for diagnosing AHF and furthermore, can provide information related to the prognosis. There by aicling decisiion making regarding patient admission and treatment[40-43]. It is likely that this situation will change in the near future and that this technique will go from being used exclusively in clinical studies or a few hospitals to becoming part of the daily clinical practice in HED. Another interesting point is the low number of echocardiograms carried out in the emergency departments (scarcely reaching 2%), not only because this is the procedure of choice used to diagnose heart failure but also because it provides important information about pre-existing heart disease which can influence the type of treatment administered, the prognosis and patient destination. If treating a patient with a neurological deficit in the emergency

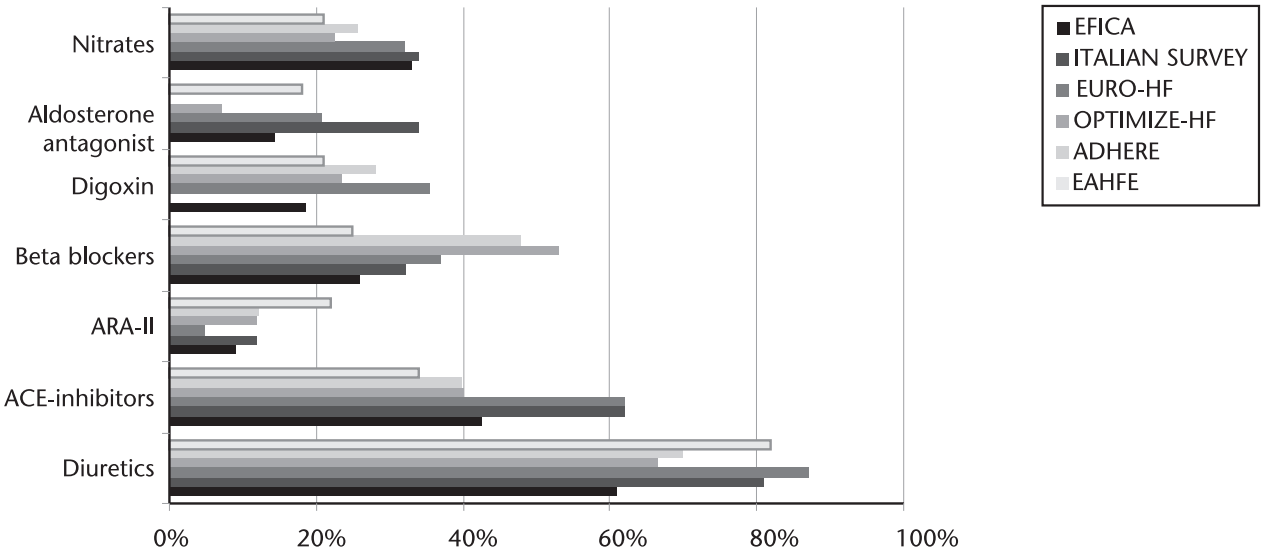

Figure 4. Chronic treatment prior to acute heart failure (AHF) according to different series. ARA-II: angiotensin II receptor antagonists. ACE-inhibitors: angiotensin converter enzyme inhibitors.

department without carrying out a head CT is unthinkable, as is treating a patient with a complicated urinary tract infection without carrying out a ultrasound of the kidneys or treating thromboembolic disease without carrying out an echocardiogram, then why do we not try to increase the number of echocardiograms carried out in the HED for patients with AHF who demonstrate higher mortality and complications with regard to treatment?

We should also question another finding of this study based on a large number of patients who were exclusively treated in HED and associated units: 30% of patients with AHF who were examined were discharged from the emergency department, either from the HED or from the OU, and 37% of hospital admissions were to the SSU. This highlights the fact that we should be thinking about the importance and the impact that this condition has on our hospitals, on the need for training in different treatment techniques like NIV and the implementation of treatment protocols which would contribute to improving morbimortality. One of our priorities should be to promote research into the different aspects associated with AHF, as well as establishing guidelines and a consensus with all those who are involved in dealing with these kinds of patients. This would result in more tangible benefits for the increasing number of people affected by the condition.

To summarise, we believe that the EAHFE project has demonstrated the importance of carrying out thorough investigations on patients with AHF in the HED. Thanks to this project we have been able to establish the significant impact that the condition has on HED in Spain, not only because of its increased prevalence but also because of the increased work load it generates and the associated morbimortality and complications in terms of treatments. An important point that needs to be emphasised is that the majority of our patients are different to those described in previously published series and so therefore, the EAHFE study provides us with a broader perspective on patients in Spain with AHF that is more accurate compared with that of previous research work submitted by other departments.

Patients with AHF in the emergency department are usually elderly with a significant level of comorbidity, in these cases lung and systemic congestion are predominant and patients require treatment in the HED beginning with oxygen therapy and diuretics, which needs to be re-examined in the light of recent findings. The use of NIV and continuous intravenous infusion of diuretics should be encouraged and new drugs like levosimendan should be given to patients with systolic dysfunction and/or those who have a resistance to diuretics and/or vasodilators, as recommended in the most recently published guidelines.

Finally, we believe in the importance of creating interdisciplinary working groups made up of emergency physicians, cardiologists, internal medicine doctors, geriatric doctors and general practitioners, that will develop the way these patients are managed so that their quality of life is improved.

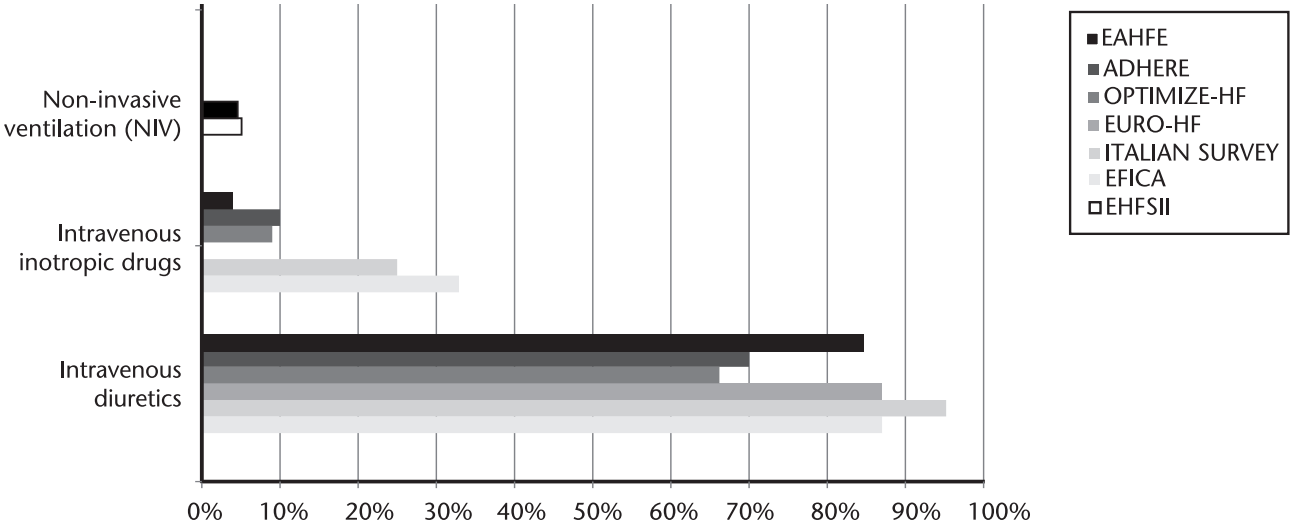

Figure 5. The use of non-invasive ventilation (NIV), intravenous diuretics and inotropic drugs for treating acute heart failure (AHF) according to different series.

In conclusion, AHF is a condition that is commonly found in the emergency department and is associated with elderly patients and significant comorbidity. It frequently manifests as in moderate-severe lung congestion and generally speaking most patients have severe decompensated heart failure. In order to adapt to the most recently published guidelines, our HED should increase the use of non-invasive ventilation, continuous infusion diuretics and inodilators such as levosimendan for patients with systolic dysfunction and/or those with a resistance to diuretics and/or vasodilators.

We should also consider implementing techniques like testing BNP or NT-proBNP in HED and carrying out echocardiograms as this would allow us to evaluate patients more accurately. Research work, like the EAHFE study is necessary in order to gain a better understanding of the situation that patients with AHF and other conditions in HED find themselves in.

Annex I

Those who collaborated in the EAFHE study:

– Juan González del Castillo, Pedro Villaroel. Clinical Hospital San Carlos. Madrid.

– Ferrán Llopis, Ana Álvarez, Laura Iglesias, Xavier Palom. Hospital de Bellvitge. Hospitalet de Llobregat. Barcelona.

– Fadoua Laghzoui, Santiago Diéguez, José Fermín Carbajosa, José Murcia. University General Hospital Alicante. Alicante.

– Nayra Sánchez, Luz María Casal, José Tomás Lubillo, José Medina. Hospital Dr. Negrín. Las Palmas, Gran Canaria.

– Guillermo Moreno, Juan Luis Pérez, José Luis Gálvez. Hospital Virgen de la Macarena. Seville.

– Ana Pozo, Elena Álvaro, José Manuel Valles, Álvaro García. University Hospital La Fe. Valencia.

– José Manuel Martín, Francisco Diego, María Jesús Alario, Susana Grande. University Hospital Salamanca. Salamanca.

– Oscar Miró, Rafael Perelló, Gloria García. Hospital Clinic, Barcelona.

– Joaquín Vázquez, María Fernández. Central University Hospital Asturias. Oviedo.

– Luis Iglesias, Gonzalo Pérez, Felipe Gómez-Ullate, José Manuel Díaz. Hospital Marqués de Valdecilla. Santander.

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Perfil clínico del paciente con insuficiencia cardiaca aguda atendido en los servicios de urgencias: Datos preliminares del Estudio EAHFE *(Epidemiology Acute Heart Failure Emergency)*

Llorens P, Martín-Sánchez FJ, González-Armengol JJ, Herrero P, Jacob J, Álvarez AB, Pavón J, Garrido M, Pérez-Durá MJ, González C, Gil V, Alonso H y colaboradores del estudio EAHFE

Objetivo: Conocer el perfil clínico y tratamiento de los pacientes con insuficiencia cardiaca aguda (ICA) atendidos en los servicios de urgencias hospitalarios (SUH).
Método: Estudio descriptivo, transversal y multicéntrico, que incluye todos los pacientes atendidos por ICA en los SUH de 10 hospitales españoles en el periodo comprendido entre el 15 de abril al 15 de mayo del 2007.
Resultados: Un total de 1.017 pacientes fueron incluidos en el estudio. La media de edad fue de 77 años. El 52,1% de los pacientes eran mujeres. El 60,6% mostraba síntomas de congestión pulmonar y sistémica. En los enfermos, a su llegada a urgencias, se documentaba que un 88,2% eran tratados habitualmente con diuréticos, 55,9% con inhibidores del enzima convertidor de la angiotensina (IECA) y/o con bloqueadores del receptor de la angiotensina-II (ARA-II) y el 24,7% con beta-bloqueantes. En los SUH, el 84,2% recibieron diuréticos intravenosos (17,2% en perfusión continua), el 25,9% nitroglicerina intravenosa, el 3,8% tratamiento inotrópico, y en el 4,6% se utilizó soporte con ventilación no invasiva (VNI). El 70% de los pacientes fueron hospitalizados. Del total de enfermos valorados en el SUH, el 44,2% permanecieron en unidades de observación (UO) y unidades de corta estancia (UCE).
Conclusiones: La ICA es una patología frecuente en los SUH, y se asocia a una edad avanzada y comorbilidad importante, y predominan los síntomas congestivos de grado leve-moderado. La gran mayoría suelen manejarse en unidades adscritas a los servicios de urgencias (UO y UCE). Es necesaria la implementación de guías clínicas y protocolos propios de los SUH, así como llevar a cabo registros de este tipo que nos permitan conocer la realidad de los pacientes con ICA en los SUH. [Emergencias 2008;20:154-163]

Palabras clave: Perfil clínico. Insuficiencia cardiaca aguda. Servicios de urgencias.