

XVIII CONAREC Registry on Decompensated Heart Failure in Argentina

Insuficiencia Cardíaca Descompensada en la Argentina. Registro Conarec Xviii

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ABSTRACT

Background: Decompensated heart failure (DHF) is currently a major public health problem and a clinical condition that frequently appears in patients with chronic heart failure. In our country, several registries provide information on the characteristics and treatment of patients hospitalized for DHF in the last decades, including the 1998 and 2004 CONAREC registries.

Despite the availability of drugs with proven efficacy for the treatment of chronic heart failure, DHF is an area where little progress has been made. There is need of definitions and characteristics of the population admitted to hospital to improve the prevention of these cases.

Objective: The aim of this study was to describe the clinical characteristics of patients admitted for DHF in centers with Residence in Cardiology belonging to the Argentine Council of Cardiology Residents (CONAREC).

Methods: A multicenter, prospective, observational, cross-sectional study was designed to include patients admitted with DHF as main diagnosis in the intensive care unit of 64 centers with cardiology residency associated to CONAREC in Argentina, during July and August 2011.

A cross audit was performed in 20% of participating centers to verify loading of consecutive patients.

Descriptive data were presented as frequency distributions for all the included study variables, and statistical significance was established using the chi-square test provided by SPSS 15.0 for Windows software package.

Results: A total of 1,277 patients were included in the study. Mean age was 73 years (62-82) and 40.6% were women. The most prevailing conditions were hypertension in 80% of patients, diabetes in 31.4%, prior myocardial infarction in 24%, and chronic atrial fibrillation in 32.5%. The etiology was ischemic-necrotic in 34%, hypertensive in 18% and chagasic in 4%. History of heart failure included 52% of patients with previous DHF, 28% hospitalized for DHF during the last year, and prior ventricular function evaluation in 64%, 22% of whom had preserved left ventricular systolic function (ejection fraction > 55%). Systolic blood pressure at admission was 133±32.2 mm Hg. The most prevalent causes of decompensation were: progression of heart failure, infections, insufficient medication, and food transgressions. A cause for decompensation was identified in 75% of cases, with the following forms of presentation: congestion in 76% of patients, pulmonary edema in 20% and shock in 4%. Treatment at discharge included beta-blockers in 81% of cases, furosemide in 85%, ACEI/ARB II in 77%, antialdosterone agents in 51%, and digoxin in 16%. Median hospital stay was 6 days (4-10), and in-hospital mortality was 11%. Multivariate analysis showed the following independent predictors of mortality: use of inotropic drugs [OR 4.83 (95% CI 3.13-7.45)], normal functional class ≥ II [OR 2.16 (95% CI 1.10-4.23)], shock as presentation event [OR 2.08 (95% CI 1.01-4.29)] and history of renal failure [OR 1.80 (95% CI 1.21-2.7)]. Participating centers corresponded to the following regions: Center (27.5%), Argentine Great North (13.3%), New Cuyo (2.5%), Patagonia (2%), and Buenos Aires and CABA (54.4%).

Conclusions: Decompensated heart failure is a disease with growing prevalence correlating with increased life expectancy, and consequently associated to an affected population of increasing average age. Despite improved treatment, decreased mortality has not been achieved. Hypertension represented a dominant condition, suggesting that a more intense patient education on this and other preventable factors is necessary. Use of drugs with proven beneficial effects at discharge was adequate though lower than in other registries, also indicating the need to support continuing medical education.

Keywords: Heart Failure - Hospitalization - Prognosis.

RESUMEN

Introducción: La insuficiencia cardíaca descompensada (ICD) constituye actualmente un problema de salud pública importante y es una situación clínica que se presenta con frecuencia en pacientes con insuficiencia cardíaca crónica. En nuestro país existen varios registros con información sobre las características y el tratamiento de los pacientes hospitalizados por ICD en las últimas décadas, entre los que se incluyen los registros CONAREC de 1998 y 2004.

A pesar de la disponibilidad de drogas con evidencia demostrada para el tratamiento de la insuficiencia cardíaca crónica, la ICD es un área en la cual hubo muy pocos avances. Son necesarias definiciones y características de la población ingresada a

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los fines de mejorar la prevención de los eventos.

Objetivo: Describir las características clínicas de los pacientes internados por ICD en centros con residencia médica de cardiología pertenecientes al Consejo Argentino de Residentes de Cardiología (CONAREC).

Material y métodos: Estudio de diseño prospectivo intrahospitalario, observacional, transversal y multicéntrico. Se incluyeron pacientes admitidos durante los meses de julio y agosto de 2011 en unidades de cuidados intensivos por ICD como diagnóstico principal en 64 centros que cuentan con residencia de cardiología asociada al CONAREC en la Argentina.

Se realizó auditoría cruzada en el 20% de los centros participantes para verificar la carga consecutiva de los pacientes. Los datos se presentaron de modo descriptivo por medio de distribuciones simples de frecuencias para todas las variables incluidas en el estudio, utilizando pruebas de chi cuadrado para determinar significación estadística a través del programa estadístico SPSS 15.0 para Windows®.

Resultados: Se incluyeron 1.277 sujetos, mediana de edad 73 años (62-82) y 40,6% mujeres. Los antecedentes más frecuentes fueron hipertensión arterial en el 80%, diabetes en el 31,4%, infarto previo en el 24% y fibrilación auricular crónica en el 32,5%. La etiología fue isquémico-necrótica en el 34%, hipertensión arterial en el 18% y chagásica en el 4%. La historia de insuficiencia cardíaca incluyó 52% de pacientes con diagnóstico de ICD previa, el 28% con internación en el último año por ICD, y evaluación previa de la función ventricular en el 64%, de los cuales el 22% presentaban función sistólica del ventrículo izquierdo conservada (fracción de eyección >55%). La presión arterial sistólica de ingreso fue de $133 \pm 32,2$ mm Hg. Las causas de descompensación más frecuentes fueron progresión de la insuficiencia cardíaca, infecciones, medicación insuficiente y transgresión alimentaria. En el 75% de los casos se identificó una causa de la descompensación, con las siguientes formas de presentación: congestión 76%, edema pulmonar 20% y shock 4%. El tratamiento al alta incluyó betabloqueantes en el 81%, furosemida en el 85%, IECA/ARAII en el 77%, antialdosterónicos en el 51%, digoxina en el 16%. La mediana de permanencia fue de 6 días (4-10), con una mortalidad hospitalaria del 11%. El análisis multivariado mostró predictores independientes de mortalidad: la utilización de inotrópicos con un OR de 4,83 (IC95% 3,13-7,45), la clase funcional habitual II con un OR de 2,16 (IC95% 1,10-4,23), el shock como forma de presentación con un OR de 2,08 (IC 95% 1,01-4,29) y el antecedente de falla renal con un OR de 1,80 (IC 95% 1,21-2,7). Los centros participantes correspondieron a las siguientes regiones: Centro (27,5%), Norte Grande Argentino (13,3%), Nuevo Cuyo (2,5%), Patagonia (2%), Buenos Aires y CABA (54,4%).

Conclusiones: La ICD en nuestro país es una patología de prevalencia creciente en correlación con el incremento en la expectativa de vida, de lo que se deriva una población afectada con un promedio etario cada vez más alto. A pesar de la mejora en el tratamiento no hemos logrado el descenso de la mortalidad. La hipertensión arterial representó un antecedente dominante, lo que sugiere la necesidad de una educación más intensa del paciente sobre este y otros factores prevenibles. El uso de drogas con evidencia demostrada al alta es adecuado, aunque más bajo que en otros registros, lo cual refleja también la necesidad de reforzar la educación médica continua.

Palabras clave: Insuficiencia cardíaca - Internación - Pronóstico

Abbreviations

ACEI	Angiotensin converting enzyme inhibitors	DHF	Decompensated heart failure
AI	Aldosterone inhibitors	EF	Ejection fraction
ARB II	Angiotensin II receptor blockers	FC	Functional class
BB	Beta blockers		

INTRODUCTION

Decompensated heart failure (DHF) is currently a major public health problem (1, 2) and a clinical condition that frequently occurs in patients with chronic heart failure, although it can also develop in subjects without prior history of the disease in whom there is a gradual or sudden change of symptoms. (3)

Population studies report an incidence ranging from 1-5 cases per 1000 person-years and in subjects over 75 years of age an increase of 40 cases per 100 person-years. (4) Probably, longer life expectancy, cardiovascular disease improved treatments, and increased survival from other diseases have contributed to this phenomenon. The situation described is associated with high mortality, need for hospitalization, quality of life impairment and healthcare resource consumption. (1, 5-7)

Decompensated heart failure is now considered a prototype of chronic disease affecting elderly patients, usually demanding multidisciplinary care from different health professionals. These patients are frequently readmitted to hospital (8) and the economic

cost is high. (9). Decompensated heart failure is one of the main causes for hospitalization in developed countries: it represents about 5% of medical admissions in Europe and the United States, and is the most common diagnosis among hospitalized patients over 65 years of age. (5, 10)

Clinical practice in DHF differs strikingly among countries, among geographical areas within a country and among different subgroups of patients. (1, 2, 7, 11, 12) These differences in diagnostic procedures and therapeutic measures often depend on the idiosyncrasies of each healthcare organization. (13, 14)

In our country there are several registries with information about the characteristics and treatment of patients hospitalized for DHF in the last decade, including the 1998 and 2004 CONAREC registries. (15, 16) In order to update these data, CONAREC decided to make a new registry, which, among other objectives, aims to analyze the clinical characteristics, treatment and hospital outcome of patients with DHF diagnosis admitted to Argentine hospitals with cardiology residency.

METHODS

Study population

The study included patients with DHF admitted to intensive care units of 64 centers having residency programs associated to the Argentine Council of Residents in Cardiology (CONAREC) during July and August 2011.

Study design

This was a multicenter, in-hospital, prospective, observational, cross-sectional study.

Inclusion and exclusion criteria

All adult patients admitted with new onset DHF or chronic decompensated heart failure in different centers of Argentina with cardiology residency associated to CONAREC were considered for the study.

Inclusion criteria

Patients ≥ 18 years at hospital admission, with diagnosis of DHF as leading cause of hospitalization according to the healthcare team.

Exclusion criteria

Presence of heart failure as a comorbidity, but which is not the main diagnostic or treatment focus during hospitalization (e.g. Killip and Kimball acute myocardial infarction \geq B).

Variables and data collection processes

The collection process consisted in loading through the website (www.conarec.org) all patients admitted with heart failure as leading diagnosis. Data were collected in an instrument including the 113 study variables. Then, the data were digitized in the EXCEL 2010 program and SPSS 15.0 for Windows (Statistical Package for Social Sciences) software package was used for statistical analyses.

Data analysis

Data processing and information analysis

Simple frequency distributions for all the variables included in the study were obtained from the database generated from the collected information, and were reported as median and interquartile range, as appropriate. Qualitative variables were expressed as percentages and the chi-square test was used to establish statistical significance. The odds ratio (OR) with its corresponding 95% confidence interval (95% CI) was used to express risk ratio. A two-tailed $p < 0.05$ was considered as statistically significant. A multivariate analysis was performed to establish independent predictors of mortality with all the variables that presented $p < 0.10$ in the univariate analysis.

Participating centers

Participating centers and their principal investigators are listed in Appendix 1.

Participating centers corresponded to the following regions: Center (28%), Argentine Great North (13%), New Cuyo (3%), Patagonia (2%), and Buenos Aires and CABA (54%).

Definitions

Study definitions are specified in Appendix 2.

RESULTS

Baseline population characteristics

A baseline population characteristics are detailed in Table 1. A total of 1,277 patients were included dur-

ing the study period. Mean age was 73 years (62-82) and 59% were men.

Eighty percent of patients had history of hypertension, 33% of chronic atrial fibrillation, 24% of previous myocardial infarction and only 4% of Chagas disease. During the previous year, 32% of patients had been admitted due to heart failure. Almost 64% had prior ventricular function assessment; of these, 48% (396 patients) had ejection fraction (EF) $> 45\%$ and 51% (419 patients) had EF $< 45\%$.

Regarding the different etiologies of heart failure, the origin was ischemic-necrotic in 34% of patients, hypertensive in 18%, valvular in 18%, idiopathic in 6% and chagasic in 4%.

Seventy-nine percent of patients were in functional class (FC) II-III and 20% in FC I.

Admission

The most frequent causes of admission were heart failure progression (25%), infections (22%), medication discontinuation (13%) and food transgressions (10%).

Forms of presentation were venous congestion in 76% of cases, acute pulmonary edema in 20% and cardiogenic shock in 3%.

Mean systolic blood pressure was 133 ± 32.2 mm Hg, and mean heart rate was 90 ± 24.2 bpm. Table 2 shows clinical, biochemical and electrocardiographic findings.

Thirty-nine percent of patients received nitroglycerin, 5% sodium nitroprusside, and 17% inotropic drugs (62% dopamine, 56% dobutamine, 28% noradrenaline, 12% milrinone and 11% levosimendan).

Echocardiographic assessment of ventricular function was performed in 965 patients (76%). Forty-four percent of these patients had EF $> 45\%$ and the remaining 56% had EF $< 45\%$, most of which (68%) presented EF $< 35\%$. Prior EF was unknown by 9% of patients and neither had been studied during hospitalization.

In-hospital outcome

Median hospital stay was 6 days (4-10).

During hospitalization, 14% of patients received non-invasive ventilation, 12% mechanical respiratory assistance, 10% underwent coronary angiography, a Swan-Ganz catheter was placed in 7% and 5% were submitted to hemodialysis. Overall mortality was 11% (141 patients): 42% corresponded to patients admitted with cardiogenic shock, 13% to pulmonary edema and 9% to venous congestion.

Mortality-related variables in the univariate analysis were diabetes, chronic renal failure, prior hospitalization for heart failure, FC \geq II, use of inotropic drugs, cardiogenic shock as presentation condition and systolic blood pressure at admission. The multivariate analysis identified use of inotropic agents during hospitalization [OR 4.83 (3.13-7.45)], FC \geq II [OR 2.16 (1.10-4.23)], cardiogenic shock as presenta-

Table 1. Baseline characteristics (n = 1,277)

Age, years	73 (62-82)	
	n	%
Female gender	518	41
Functional class (NYHA)		
I	253	20
II	750	59
III	262	20
IV	12	1
Hypertension	1,020	80
Dyslipidemia	538	42
Smoking	174	14
Diabetes	401	31
Sedentarism	823	64
CRF	292	23
COPD	161	13
Dysthyroidism	130	10
Chronic AF	415	33
AMI	306	24
Previous hospitalizations	664	52
Heart transplantation	4	0,3
Previous treatment		
ACEI/ARB II	791	62
Beta-blockers	742	58
Furosemide	742	58
Statins	418	33
Antialdosterone drugs	380	30
Aspirin	629	49
Digoxin	170	13
Amiodarone	183	14
Hydrochlorothiazide	62	5
Anticoagulation	259	23
Ivabradine	5	0.4

NYHA: New York Heart Association. CRF: Chronic renal failure. COPD: Chronic obstructive pulmonary disease. AF: Atrial fibrillation. AMI: Acute myocardial infarction. ACEI: Angiotensin converting enzyme inhibitors. ARB II: Angiotensin II receptor blockers.

tion condition at admission [OR 2.08 (1.01-4.29)] and chronic renal failure [OR 1.80 (1.21-2.7)] as independent predictors of mortality.

Discharge medication

Eighty-five percent of patients were prescribed furosemide, 51% antialdosterone drugs, 81% beta-blockers, and 77% ACEI/ARB II at discharge. Table 3 indicates medications at discharge and the percentages prescribed.

Physician adherence to treatment recommended by heart failure guidelines in patients with ventricu-

Table 2. Findings at admission

Physical examination		
SBP (mmHg)	133 ± 32	
DBP (mmHg)	77.1 ± 17.2	
HR (bpm)	89.9 ± 24.2	
Laboratory		
Hematocrit, %	38 ± 6.7	
White blood cells/mm ³	8,917 ± 3,692	
Serum sodium, mEq/L	136.5 ± 5.8	
Blood creatinine, mg/dL	1.77 ± 1.6	
Potasseemia, mEq/L	4.1 ± 0.68	
Electrocardiogram (n = 1,277)		
	n	%
Sinus rhythm	717	717
Atrial fibrillation	426	426
Atrial flutter	22	22
Pacemaker	112	112
CLBBB	240	240
CRBBB	168	168

SBP: Systolic blood pressure. DBP: Diastolic blood pressure. HR: Heart rate. CLBBB: Complete left bundle branch block. CRBBB: Complete right bundle branch block.

lar function impairment (EF < 45%) was evaluated. According to current guidelines use of beta-blockers [BB] + ACEI/ARB II at discharge was considered as optimal treatment. (17, 18) In addition, adherence to optimal treatment was evaluated in patients with EF < 35% (BB + ACEI/ARB II + aldosterone inhibitors [AI]).

Fifty-one percent of patients, with mean age of 68 ± 15 years, presented EF < 45%. At discharge, 84% were treated with beta-blockers, 79% with ACEI/ARB II, 89% with furosemide, and 65% with AI. Sixty-nine percent of patients were discharged with optimal treatment.

In the subgroup of patients with EF < 35%, 69% was discharged with BB + ACEI/ARB II and optimal treatment was indicated in 51%.

The comparison of treatment indication prior to admission and at discharge showed a significant increase in the prescription of drugs with proven efficacy (p < 0.001).

DISCUSSION

Heart failure is a disease whose importance has grown exponentially in recent decades, needing the identification of the different characteristics and modifiable factors that accompany its appearance in order to achieve a better understanding and a more efficient management of its problems.

As observed in our study and in agreement with previous national registries, hospitalization for heart

Table 3. Medications at discharge

Medication (n = 1,277)	n	%
Furosemide	1.091	85
Thiazides	39	3
Antialdosterone agents	651	51
Digoxin	206	16
Amiodarone	162	13
Beta-blockers	1.034	81
Ivabradine	13	1
Statins	666	52
ACEI/ARB II	988	77
Anticoagulants	390	31
Aspirin	483	38
Calcium blockers	57	5

ACEI: Angiotensin converting enzyme inhibitors. ARB II: Angiotensin II receptor blockers.

failure occurs in a heterogeneous elderly population with a high prevalence of female gender and comorbidities such as dyslipidemia, sedentary lifestyle, diabetes, atrial fibrillation and hypertension as its most prevalent risk factor. The detection and treatment of the latter risk factor is essential for the early control of heart failure (stage A, ACC-AHA) as prevention of more serious forms. A history of previous hospitalization for heart failure occurs in more than 50% of patients, including 21% in higher functional class (III-IV), a percentage slightly lower than the one published in national registries. (19) Preserved systolic function assessed by echocardiography on admission, had a higher prevalence (44%) than the one observed in previous national registries, but was similar to that published in the ADHERE registry. (20) Does the better control and treatment of ischemic heart disease and cardiovascular disease lead to a new paradigm of heart failure, where the majority of patients no longer have systolic dysfunction but preserved ejection fraction?

The etiological analysis continues to show a high prevalence of ischemic heart disease and higher dispersion compared with data from previous national registries, thus making the gap with hypertension, still occupying the second place, more significant. Interestingly, the percentage of chagasic cardiomyopathy continues to be low. Although centers from endemic areas were included, the load of patients was not significant compared with that of CABA, Santa Fe and Córdoba, the latter province being the one with the highest presentation rate of this etiology (10%). This could be attributed to a lack of serology demand for Chagas during hospitalization, (21) to a low patient load in centers from endemic areas seen on this registry, as well as to the high prevalence of participants from private centers and from CABA and the Greater Buenos Aires.

Regarding factors triggering decompensation, 32% of patients had modifiable and/or avoidable factors, such as food transgression and discontinuation or insufficient medication, which are important when assessing both the therapeutic and patient educational approach by the professional team. The infectious etiology had a significant prevalence as triggering factor (22%), similar to previous national registries, which shows the importance of prophylaxis, mainly influenza and pneumococcal vaccine, an aspect not evaluated in this registry.

The most common form of presentation was venous congestion in 76% of cases, which taking into account that this registry included patients admitted to intensive care units, indicates the prompt admission for treatment, preventing its evolution to more severe stages.

Regarding treatment we can divide it into three groups: firstly, the analysis of patient treatment prior to admission, secondly, the treatment established on admission and finally the treatment prescribed at discharge.

In the group of patients with left ventricular ejection fraction < 35% we observed a greater utilization of Class I level of evidence A indication drugs, such as beta-blockers, ACEI/ARB II or antialdosterone agents, than in previous national registries. (17, 18) (Table 4)

When analyzing the treatment established at admission, we observed that the use of loop diuretics accompanying the presentation form remains high (93%) and compared with the results of other national and international registries, the trend remains the same regarding their high intravenous use both as bolus and continuous infusion, (22, 23) due to their known efficacy on symptoms, although no reduction in mortality has been established in evidence-based randomized studies. (24) (Table 4)

The use of inotropic agents (29%) was similar to previous registries. Dopamine is still the most used inotropic agent, followed by dobutamine, norepinephrine, milrinone and levosimendan, a tendency observed in other registries. (25). Nitroglycerin and sodium nitroprusside vasodilators were indicated in 39% and 5% of cases, respectively, and their use was correlated with the presence of venous congestion and pulmonary edema, where the prescription was higher. These results remain similar to those observed in previous registries.

Very encouraging results are observed in the treatment based on Class I level of evidence A drugs (17, 18) prescribed at discharge, even more when compared with previous national registries. Treatment with ACEI/ARB II in 77% of cases and with beta-blockers in 81% is higher than that reported in the last registries. (12, 15, 19, 26-28) The indication of antialdosterone drugs at discharge was 68.6% for patients with severely impaired EF, showing that its prescription is nearer to that indicated by the evidence. (29-31) These three groups of drugs were used in greater proportion

Table 4. Prevalence of hypertension evolution in the different registries. Comparison of Class I Level of evidence A drug use prior to admission in national registries.

	1993 ENUC %	1999 VI CONAREC %	2002 IC SAC %	2004 IC SAC %	2004 XII CONAREC %	2007 HOSPITAL %	2007 IC SAC %	2009 REPLICAR %	2011 XVIII CONAREC %
ACEI/ARB III	29.9	57.7	51.3	45.8	53.4	72.2	47.0	68.1	61.9
Beta-blockers	4.2	1,5	9.3	26.0	33.2	48.1	49.0	34.7	58.1
Antialdosterone agents	-	-	17.0	18.5	26.1	28.2	23.0	32.6	29.8

ACEI: Angiotensin converting enzyme inhibitors. ARB II: Angiotensin II receptor blockers.

in the treatment established at discharge than in the preceding period. The use of digoxin (16%) is associated with high prevalence of chronic atrial fibrillation (33%), and when analyzed in this subgroup of patients it can be seen that the use at discharge was 32%.

Compared to admission, there was an improvement in the prescription of ACEI, beta-blockers and antialdosterone drugs at discharge.

In-hospital mortality in intensive care units was 11%, in agreement with that published in international (20) and national registries. (26, 32)

The main causes of death were DHF refractory to the established treatment (67%) and infections (23%).

In the multivariate analysis, use of inotropic drugs, cardiogenic shock and renal failure were independent predictors of mortality. This reflects patients with severe forms of presentation in intensive care units, and probably cannot be extrapolated to other forms of presentation.

Limitations

Surveys based on patient voluntary participation and recruitment have limitations that should be acknowledged.

Firstly, data loaded in the survey may be biased towards larger hospitals with more patients.

Secondly, patient loading was concentrated mainly in CABA, Buenos Aires, Santa Fe and Córdoba, which accounted for 82% of the sample and may underestimate certain diseases such as heart failure etiology.

CONCLUSIONS

Decompensated heart failure is a disease of growing prevalence in our country, correlating with increased life expectancy and hence with a higher average age population affected. Despite improvements in treatment a decline in mortality has not been achieved. Hypertension represented a key precursor of the disease, suggesting the need for more intensive patient education on this and other preventable factors. The use of drugs with proven efficacy at discharge was adequate, although lower than in other registries, which also reflects the need to strengthen continuing medical education.

Conflicts of interest

None declared.

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APPENDIX 1**Participating centers and responsible participants**

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RICARDO GERONAZZO	INCOR (New Cuyo)	La Rioja

APPENDIX 2

Definitions

Cardiovascular risk factors

Hypertension: Self-referential, blood pressure > 140/90 mm Hg (130/80 mm Hg in diabetic and chronic renal failure patients) in baseline conditions or patients on antihypertensive therapy.

Diabetes: According to diagnostic criteria of the American Diabetes Association. Fasting blood glucose > 126 mg/dL, OGTT > 200 mg/dL at 2 hours, or random blood glucose > 200 mg/dL prior to event. Patients treated with glucose lowering drugs or insulin. Self-referential. (Guidelines 2010). (33)

Dyslipidemia: Total cholesterol > 200 mg/dL, triglycerides > 150 mg/dL. (34).

Smoking: regular or occasional tobacco consumption within the year prior to the event. (35)

Alcoholism: Men having 15 or more drinks a week. Women having 12 or more drinks a week. Anyone having 5 or more drinks per occasion, at least once a week. (A drink is defined as a 340 ml bottle of beer, a 141 ml wine glass, or a 42 ml shot of liquor). (36)

Sedentary lifestyle: Lack of regular physical activity, self-referential.

Comorbidities

Chronic renal failure: creatinine clearance < 60 ml/min/1.73 m² (MDRD <http://mdrd.com/>) for a > 3 month period. (37)

Chronic obstructive pulmonary disease: Diagnosed by spirometry.

Peripheral vascular disease: Diagnosed by Doppler or angiography.

Heart Failure

Chronic decompensated heart failure: When there are symptoms lasting more than 3 months and aggravation in the past two weeks.

Acute heart failure: When symptoms appear in the last three months and the clinical condition and echocardiography suggest an acute etiology.

Refractory heart failure: When there are severe persistent symptoms despite use of an optimized medical therapy.

Functional class (NYHA) (38)

Class I: No limitation of physical activity. Ordinary

activity does not cause undue fatigue, palpitations, dyspnea or anginal pain.

Class II: Slight limitation of physical activity. Comfortable at rest. Ordinary activity causes fatigue, palpitations, dyspnea or anginal pain.

Class III: Marked limitation of physical activity. Comfortable at rest. Less than ordinary physical activity causes fatigue, palpitations, dyspnea or anginal pain.

Class IV: Inability to perform any physical activity without discomfort. Symptoms of heart failure or anginal syndrome may be present even at rest. If any physical activity is undertaken, discomfort increases.

Ventricular function (assessed by ejection fraction) (Simpson) (39)

Preserved: > 55%.

Mild: 54-45%.

Moderate: 44-36%.

Severe: < 35%.

Presentation form:

Cardiogenic shock: Systolic blood pressure < 90 mm Hg for more than 30 minutes, cardiac index < 2.2 L/min/m², oliguria, altered sensorium, signs of poor peripheral perfusion.

Acute pulmonary edema: Diagnosed by clinical examination, blood gases and chest X-rays
Venous congestion: jugular engorgement, hepatojugular reflux, bilateral edema, hepatomegaly.

Decompensation causes

Heart Failure progression: When the patient presents with progressive symptoms of heart failure over time that are not attributable to infections, treatment discontinuation, acute ischemia or arrhythmia.

Infection: Documented by radiology, laboratory and clinic as the responsible factor of decompensation.

Treatment discontinuation: Discontinuation of chronic heart failure treatment (one or more drugs) in the past 48 hours or more.

Atrial fibrillation: High acute ventricular response or exacerbation as the primary cause of decompensation.

Ischemia: Documented in the electrocardiogram.