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Original article

Economic Impact of Heart Failure According to the Effects of Kidney Failure

Antoni Sicras Mainar,[a,*] Ruth Navarro Artieda,[b] and Jordi Ibáñez Nolla[c]

[a] Departamento de Planificación, Badalona Serveis Assistencials S.A., Badalona, Barcelona, Spain
[b] Departamento de Documentación Médica, Hospital Germans Trias i Pujol, Badalona, Barcelona, Spain
[c] Departamento Médico, Badalona Serveis Assistencials S.A., Badalona, Barcelona, Spain

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ABSTRACT

Introduction and objectives: To evaluate the use of health care resources and their cost according to the effects of kidney failure in heart failure patients during 2-year follow-up in a population setting.
Methods: Observational retrospective study based on a review of medical records. The study included patients ≥ 45 years treated for heart failure from 2008 to 2010. The patients were divided into 2 groups according to the presence/absence of KF. Main outcome variables were comorbidity, clinical status (functional class, etiology), metabolic syndrome, costs, and new cases of cardiovascular events and kidney failure. The cost model included direct and indirect health care costs. Statistical analysis included multiple regression models.
Results: The study recruited 1600 patients (prevalence, 4.0%; mean age 72.4 years; women, 59.7%). Of these patients, 70.1% had hypertension, 47.1% had dyslipidemia, and 36.2% had diabetes mellitus. We analyzed 433 patients (27.1%) with kidney failure and 1167 (72.9%) without kidney failure. Patients with kidney failure were associated with functional class III-IV (54.1% vs 40.8%) and metabolic syndrome (65.3% vs 51.9%, $P < .01$). The average unit cost was €10 711.40. The corrected cost in the presence of kidney failure was €14 868.20 vs €9364.50 ($P = .001$). During follow-up, 11.7% patients developed ischemic heart disease, 18.8% developed kidney failure, and 36.1% developed heart failure exacerbation.
Conclusions: Comorbidity associated with heart failure is high. The presence of kidney failure increases the use of health resources and leads to higher costs within the National Health System.

Impacto económico de la insuficiencia cardiaca según la influencia de la insuficiencia renal

Palabras clave:
Insuficiencia cardiaca
Insuficiencia renal
Uso de recursos
Costes directos
Costes indirectos

RESUMEN

Introducción y objetivos: Evaluar el uso de los recursos sanitarios y sus costes según la influencia de la insuficiencia renal en sujetos con insuficiencia cardiaca durante un periodo de seguimiento de 2 años en un ámbito poblacional.
Métodos: Se efectuó un diseño observacional-retrospectivo realizado a partir de la revisión de registros médicos. Se incluyó a sujetos ≥ 45 años que demandaron atención durante 2008-2010. Se constituyeron dos grupos según los pacientes tuvieran insuficiencia renal o no. Principales mediciones: comorbilidad, clínicas (clase funcional, etiología), síndrome metabólico, costes y nuevos casos de eventos cardiovasculares e insuficiencia renal. El modelo de costes incluyó los costes sanitarios directos e indirectos. El análisis estadístico incluyó modelos de regresión múltiple.
Resultados: Se reclutó a 1.600 sujetos (prevalencia, 4,0%; media de edad, 72,4 años; mujeres, 59,7%). El 70,1% tenía hipertensión; el 47,1%, dislipemia y el 36,2%, diabetes mellitus. Se analizó a 433 pacientes (27,1%) con insuficiencia renal y a 1.167 (72,9%) sin ella. Los pacientes con insuficiencia renal se asociaron a la clase funcional III-IV (el 54,1 frente al 40,8%) y síndrome metabólico (el 65,3 frente al 51,9%; $p < 0,01$). El promedio unitario del coste fue 10.711,4 euros. El coste corregido en presencia de insuficiencia renal fue 14.868,2 frente a 9.364,5 euros ($p = 0,001$). Durante el seguimiento, el 11,7% sufrió cardiopatía isquémica; el 18,8%, insuficiencia renal y el 36,1%, reagudización de la insuficiencia cardiaca.
Conclusiones: La comorbilidad asociada a la insuficiencia cardiaca es elevada. La presencia de insuficiencia renal ocasiona más utilización de recursos sanitarios y mayores costes para el Sistema Nacional de Salud.

* Corresponding author: Dirección de Planificación y Desarrollo Organizativo, Gaietà Soler 6–8 entlo., 08911 Badalona, Barcelona, Spain.
E-mail address: asicras@bsa.cat (A. Sicras Mainar).

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Abbreviations

HF: heart failure
KF: kidney failure
PC: primary care

INTRODUCTION

Cardiovascular disease is the leading cause of mortality in developed countries.[1] The detection and control of cardiovascular risk factors remains the key strategy in its prevention.[2] Heart failure (HF) is a major public health problem and is characterized by significant mortality, frequent hospitalization, and poor quality of life. The overall prevalence of HF is increasing. In Europe, the prevalence of HF is 2% to 3% and affects 10% to 20% of patients > 65 years.[3] In-hospital mortality is high and readmissions are frequent.[4,5]

Ischemic heart disease is the most common cause of HF, occurring in 60% to 70% of HF patients, and is particularly prevalent in elderly patients.[2] Renal dysfunction is common in HF patients and its prevalence increases according to the severity of HF, age, and a history of hypertension or diabetes mellitus.[1] Kidney failure (KF) is an accepted risk factor for poor prognosis in HF patients and can affect 30% to 50% of patients.[6]

Heart failure is among the diseases with the greatest impact on health and society, not only because of its high prevalence, but also because of its associated acute and chronic complications. Heart failure increases the use of health resources.[2,5,7] In general, the management of HF consumes 1% to 2% of health budgets in European countries, of which around 75% are hospital costs.[2,8]

Few studies have been conducted in Spain on the use of health care resources and costs in HF patients and the relationship between HF and KF (a risk factor for poor prognosis in HF patients) in the general population. This study contributes information relevant to this issue.

The main aim of the study was to assess the use of health care resources and costs in HF patients according to the effects of KF during 2-year follow-up in a population setting. Secondary aims were to determine the comorbidity and mortality associated with HF patients.

METHODS

Study Design and Setting

This was an observational, longitudinal, retrospective, multicenter study based on medical records extracted from electronic health records of hospital outpatients (OMIAPWIN, Stacks CIS) and inpatients (GesDohc, Cibal Systems). The study population consisted of patients from 6 primary care (PC) centers and 2 acute care hospitals. The majority of patients registered in the hospitals lived in cities, were of low-middle socioeconomic status, and worked in factories.

Inclusion and Exclusion Criteria

All patients admitted for an HF episode (prevalent or incident) from 2008 to 2010 (inclusion date) who fulfilled the following characteristics were included in the study: *a)* age ≥ 40 years; *b)* undergoing regular follow-up (> 1 visit per year) according to the protocol/guidelines for cardiovascular risk established by each hospital, and *c)* patient follow-up could be guaranteed. Patients were excluded if they had been transferred or moved to other geographic areas. The patients were divided into 2 groups according to the presence/absence of KF.

Diagnosis of Heart Failure and Kidney Failure

A diagnosis of HF was made according to the ICPC-2 (International Classification of Primary Care, second edition)[9] (code: K77) and/or the ICD-9-CM (International Classification of Diseases, Ninth Revision, Clinical Modification) (code: 428). A diagnosis of acute HF (exacerbation in hospital) was made according to a diagnostic coding derived from the Framingham diagnostic criteria[10] and the European Society of Cardiology guidelines.[2] Kidney failure (estimated glomerular filtration rate) was defined as a deterioration of renal function (serum creatinine: men, > 133 mmol/L; women, > 124 mmol/L; or estimated glomerular filtration rate < 60 mL/min) based on the first measurements following inclusion.

Sociodemographic and Comorbidity Variables

Main study variables were age, sex, and duration of HF (from diagnosis); personal history according to the ICPC-2[9] (hypertension, diabetes mellitus, dyslipidemia, obesity, smoking, alcoholism, liver failure, ischemic heart disease, stroke, chronic obstructive pulmonary disease, bronchial asthma, dementia or memory disorders); neurological diseases (Parkinson disease, epilepsy, multiple sclerosis, and other neurological diseases); depressive syndrome, malignant neoplasm, valvular heart disease, atrial fibrillation, anemia, and thyroid abnormalities. The following indicators were used to obtain a summary comorbidity variable for each patient: *a)* the Charlson comorbidity index[11] to estimate patient severity; *b)* the number of diagnoses, and *c)* an individual case-mix index obtained using the Adjusted Clinical Groups patient classification system that assigns each patient to a single group with similar resource consumption.[12] The Adjusted Clinical Groups system provides resource utilization bands whereby each patient is grouped into 1 of 5 mutually exclusive categories based on their overall morbidity.

Biochemical and Anthropometric Parameters and the Definition of the Metabolic Syndrome

Biochemical and anthropometric parameters: systolic blood pressure, diastolic blood pressure, body mass index, baseline glycemia, glycohemoglobin, serum triglycerides, total cholesterol, high-density lipoprotein cholesterol, low-density lipoprotein cholesterol, and serum creatinine. The metabolic syndrome was defined by the presence of 3 of the 5 National Cholesterol Education Program-Adult Treatment Panel III modified diagnostic criteria.[13] In this study, a body mass index value ≥ 28.8 was used in place of waist circumference. This approach has been applied by other authors.[14] The first measurements obtained after patient inclusion were used.

Other Clinical Variables

Data on the following clinical variables were obtained from electronic medical records: *a)* preserved left ventricular ejection fraction ≥ 45% or depressed left ventricular ejection fraction < 45% (of any etiology); *b)* NYHA (New York Heart Association) class I-II and III-IV; *c)* de novo HF or a first diagnosis of chronic decompensated HF, and *d)* cause of HF (ischemia, hypertension, valvular heart disease, idiopathic dilated cardiomyopathy, or other). The first measurements obtained after patient inclusion were used.