

Scientific letters

Predictors of Prolonged Hospitalization in Cardiology

Predictores de hospitalización prolongada en cardiología

To the Editor,

Cardiovascular disease is still one of the main causes of morbidity and mortality in industrialized countries. Coronary disease causes 5 million hospital admissions for acute myocardial infarction,¹ and heart failure (with a prevalence of 6.8% in the population older than 45 years) is the first cause of hospitalization in patients older than 65 years in Spain.² Therefore, both diseases involve high health care resource utilization and many cardiology hospital admissions, with wide variation in length of hospital stay. Determining which factors prolong hospitalization is important when planning occupation needs and strategies to avoid admissions.

The objective of this study was to determine the factors that could predict prolonged hospitalization (PH) in the cardiology ward of our hospital. To do this, we conducted a prospective, observational study that analyzed 1650 patients who were consecutively admitted to the cardiology ward of another hospital between August 2011 and January 2012, referred by the emergency department, the coronary unit, or another department. We excluded patients with scheduled admissions for diagnostic and/or therapeutic procedures. We collected demographic and clinical variables and the diagnostic tests performed while the patients were in hospital. The mean hospital stay was defined as the interval (days) between hospital admission and the discharge date. To avoid extreme values, patients who were below the 5th percentile or above the 95th percentile were excluded from the mean hospital stay (n=83). PH was defined as a hospital stay longer

than 4 days. The categorical variables were expressed as percentages and the quantitative variables as mean (standard deviation); comparisons were made with the χ^2 test, Fisher's exact test or Student's *t* test, respectively. The predictors of PH were determined with a univariable analysis, and statistically significant variables were included in the multivariable binary logistic regression analysis expressed as the odds ratio. The statistical analysis was performed with the IBM SPSS Statistics 2.0 program (Chicago, Illinois, United States). *P* values of <.05 were considered statistically significant.

The total number of patients included was 1567 and 61.3% (n=961) were male, with a mean age of 73 (12.8) years. The mean duration of admission was 5.3 (3.4) days and the median [interquartile range] was 5 [3-8] days; 713 patients (45.5%) were admitted for ischemic heart disease; 380 (24.3%) for heart failure; 182 (11.6%) for bradycardia or tachycardia; 96 (6.1%) for chest pain; 65 (4.1%) for syncope; and the remaining 131 (8.36%) for other causes such as endocarditis, myocarditis, or pericardial disease. More than half of the patients (53.1%) were in hospital for >4 days (PH). The baseline characteristics and differences according to whether hospitalization was prolonged or not are summarized in Table 1. In the multivariable analysis, age, admission for congestive heart failure, creatinine and hemoglobin levels at admission, the performance of 3 or more diagnostic tests, and admission on a Friday rather than on other days of the week were independent PH predictors, whereas the performance of coronary angioplasty was a protective factor (Table 2).

The mean hospital stay in our ward was within the range published by other articles.³ Our results, like those reported for similar environments,⁴ show that hospital stay is longer in older patients with more comorbidity than in younger patients with fewer concomitant diseases. Importantly, the performance of

Table 1
Characteristics of the Sample at Baseline and According to the Period in Hospital

	Total patients (N=1567)	Stay >4 days (N=832)	Stay ≤4 days (N=735)	<i>P</i>
Males, %	61.3	58.9	64.8	.016
Age, years	70.46	71.88	68.84	< .001
HT, %	68	77.8	71.2	.004
DM, %	37.1	43.7	37.7	.022
Dyslipidemia, %	54	58.2	60.4	NS
AF, %	22.2	28.4	15.2	<.001
Creatinine, mg/dL	1.12	1.18	1.06	.001
Hemoglobin, g/dL	13.1	12.79	13.43	<.001
RDW, %	15.11	15.40	14.78	<.001
HDL, mg/dL	39.39	39.17	39.69	NS
LVEF, %	53.6	55.2	52.2	.001
≥ 3 DT, %	11.4	15.5	6.8	<.001
Friday admissions, %	15.4	15.4	7.5	<.001
Admissions for HF, %	45.5	33.3	14.0	<.001
Admissions for IHD, %	24.3	37.7	54.3	<.001
Admissions for arrhythmia, %	11.6	10.2	13.2	NS
Use of LMWH and/or OAC	22.8	33.3	17.9	<.001

AF, atrial fibrillation; DM, diabetes mellitus; DT, diagnostic tests; HDL, high-density lipoprotein; HF, heart failure; HT, hypertension; IHD, ischemic heart disease; LVEF, left ventricular ejection fraction; LMWH, low molecular weight heparin; NS, non significant; OAC, oral anticoagulants; RDW, red blood cell distribution width.

Table 2
Independent Predictors of Prolonged Hospitalization (>4 Days) (Multivariable Analysis, Logistic Regression)

Variable	OR (95%CI)	P
Age	1.012 (1.002-1.022)	.017
Friday admission	2.021 (1.349-3.028)	.001
Admission for heart failure	2.398 (1.761-3.265)	<.001
Hemoglobin at admission	0.888 (0.831-0.948)	<.001
Creatinine at admission	1.264 (1.025-1.559)	.029
Three or more diagnostic tests	2.545 (1.712-3.783)	<.001
Stent implantation	0.635 (0.483-0.836)	.001

95%CI, 95% confidence interval; OR, odds ratio.

coronary angioplasty was a protective factor, due to a tendency to perform percutaneous revascularization earlier and more conservatively, which can reduce hospital stay and its associated complications.

Some of the factors related to PH in cardiology, such as age, creatinine, and hemoglobin at admission, are inherent to the population admitted to hospital and cannot be modified, but others, such as Friday admissions, admissions for heart failure, early revascularization strategies, and the performance of multiple tests can be taken into account when planning policies to reduce length of hospital stay. A change in working hours could be proposed (eg, making Saturdays an ordinary working day) as well as encouraging the creation and promotion of heart failure units with resources, or accelerating the performance of diagnostic

techniques (or performing them on an outpatient basis), which could reduce the PH rate. One of the limitations of our study is its observational design and therefore data could only be recorded while the patients were in hospital, without correlating PH and the complications of follow-up.

Pilar García-González, Lorenzo Fácila Rubio,* Vicente Montagud, Natalia Chacón-Hernández, Óscar Fabregat-Andrés, and Salvador Morell

Servicio de Cardiología, Consorcio Hospitalario General Universitario de Valencia, Valencia, Spain

* Corresponding author:

E-mail address: lfacila@gmail.com (L. Fácila Rubio).

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Initial Results From a National Follow-up Program to Monitor Radiation Doses for Patients in Interventional Cardiology

Resultados iniciales de un programa nacional para el seguimiento de dosis de radiación en pacientes de cardiología intervencionista

To the Editor,

Catheterization techniques are essential in the diagnosis and treatment of certain cardiac diseases, but the ionizing radiation used in some of these procedures is associated with health risks for patients and health care staff alike. The radiation doses should be minimized as far as possible. The impact of interventional techniques on the radiation dose received is not negligible. According to the 2011 activity registry of the Spanish Society of Cardiology Working Group on Cardiac Catheterization,¹ 2998 diagnostic studies and 1368 percutaneous coronary interventions were performed per million population. The Spanish legislation requires individual registration of the radiation dose received in interventional procedures.² The International Commission on Radiological Protection recommends that levels of reference doses be established for different fluoroscopy-guided procedures to optimize the doses administered to patients.³ Reference values should not be applied in an individual manner because due to complexity reasons or the patient's size these could be exceeded. However, if the reference values were exceeded in a large number of patients, corrective actions would need to be taken.

With the aim of investigating and proposing updated reference dosage values for patients undergoing catheterization procedures, the DOCCACI (*DOsimetría y Criterios de Calidad en Cardiología Intervencionista* in Spanish, or *Dosimetry and Quality Criteria* in

Interventionist Cardiology in English) group was formed in 2010, under the auspices of the Spanish Society of Cardiology Working Group on Cardiac Catheterization. The list of professionals who constitute the DOCCACI group can be found in the [supplementary material](#) that accompanies this article.

Seven public hospitals in 6 different Spanish autonomous communities joined the project. In each center, a catheterization cardiologist and a radiophysicist took on responsibility for providing data on the radiation dose administered to the patients.

The working group was limited initially to the most common procedures, coronary angiography (CA) and percutaneous transluminal coronary angioplasty (PTCA). The PTCA procedures included both those deferred after a prior CA and a CA with PTCA in the same procedure.

The dose indicator most used for patients in interventional techniques is the dose-area product, which is defined as the integral of kerma in air over the radiation field and expressed in units of dose per area, generally in Gy·cm². Since 2010, as part of the DOCCACI program, anonymous data have been collected that include the type of procedure, dose-area product, fluoroscopy time, number of sequences, and the total number of cine images acquired. Some of the centers with automatic data collection systems via DICOM connections with the devices have acquired a large amount of data without noting the complexity of the cases. The centers that have manually compiled the data and provided the smallest samples selected the cases with normal complexity.

The reference values were calculated for dose-area product, fluoroscopy time, number of sequences, and the total number of cine images acquired as the third quartile of the medians of the distributions in each center. Using this methodology, all centers had the same statistical weight in the calculation of the reference values.