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Original article

Changes in Acute Coronary Syndrome Treatment and Prognosis After Implementation of the Infarction Code in a Hospital With a Cardiac Catheterization Unit

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ABSTRACT

Introduction and objectives: Emergency care systems have been created to improve treatment and revascularization in myocardial infarction but they may also improve the management of all patients with acute coronary syndrome.
Methods: A comparative study of all patients admitted with acute coronary syndrome before and after implementation of an infarction protocol.
Results: The study included 1210 patients. While the mean age was the same in both periods, the patient group admitted after implementation of the protocol had a lower prevalence of diabetes mellitus and hypertension but more active smokers and higher GRACE scores. The percentage of ST-segment elevation acute coronary syndrome (29.8%-39.5%) and coronary revascularizations (82.1%-90.1%) significantly increased among patients admitted with acute coronary syndrome, and primary angioplasty became routine (51.9%-94.9%); there was also a reduction in time to catheterization and an increase in early revascularization. The mean hospital stay was significantly shorter after implementation of the infarction protocol. In-hospital mortality was unchanged, except in high-risk patients (38.8%-22.4%). After discharge, no differences were observed between the 2 periods in cardiovascular mortality, all-cause mortality, reinfarction, or major cardiovascular complications.
Conclusions: After implementation of the infarction protocol, the percentage of patients admitted with ST-segment elevation acute coronary syndrome and the mean GRACE score increased among patients admitted with acute coronary syndrome. Hospital stay was reduced, and primary angioplasty use increased. In-hospital mortality was reduced in high-risk patients, and prognosis after discharge was the same in both periods.

Cambios en el tratamiento y el pronóstico del síndrome coronario agudo con la implantación del código infarto en un hospital con unidad de hemodinámica

Palabras clave:
Síndrome coronario agudo
Código infarto
Revascularización
Mortalidad

RESUMEN

Introducción y objetivos: Los sistemas de atención urgente del infarto se han creado para mejorar su tratamiento y la revascularización, pero pueden mejorar el manejo de todos los pacientes con síndrome coronario agudo.
Métodos: Estudio comparativo de todos los pacientes ingresados por síndrome coronario agudo antes y tras la implantación de un código infarto.
Resultados: Se incluyó a 1.210 pacientes, y aunque la media de edad fue igual en ambos periodos, los pacientes ingresados tras la implantación del código infarto presentaron menor prevalencia de diabetes mellitus e hipertensión pero más tabaquismo activo y mayor GRACE. Se observó un incremento significativo en el porcentaje de pacientes ingresados por síndrome coronario agudo con elevación del segmento ST (29,8-39,5%) y de revascularizaciones coronarias (82,1-90,1%), así como la generalización de la angioplastia primaria (51,9-94,9%), además de una reducción en el tiempo hasta el cateterismo e incremento de la revascularización precoz. La estancia hospitalaria media fue significativamente más corta tras la implantación del código infarto. No se observaron diferencias en la mortalidad hospitalaria, salvo entre los pacientes de alto riesgo (38,8-22,4%). Tras el alta no se observan diferencias entre ambos periodos en mortalidad cardiovascular, mortalidad por cualquier causa, reinfarto o complicaciones cardiovasculares mayores.

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Conclusiones: La implantación del código infarto conllevó un incremento de pacientes ingresados por síndrome coronario agudo con elevación del segmento ST y mayor puntuación en la escala *Global Registry of Acute Coronary Events*. Se redujo la estancia hospitalaria, se generalizó la angioplastia primaria y se redujo la mortalidad hospitalaria de los pacientes de alto riesgo. El pronóstico tras el alta fue igual en ambos periodos.

Abbreviations

ACS: acute coronary syndrome
GRACE: Global Registry of Acute Coronary Events
NSTEACS: non—ST-segment elevation acute coronary syndrome
STEACS: ST-segment elevation acute coronary syndrome

INTRODUCTION

Percutaneous coronary revascularization is the mainstay of treatment for acute coronary syndrome (ACS),[1] particularly for ST-segment ACS (STEACS).[2] The widespread use of coronary revascularization has led to the creation of more catheterization units and local and regional STEACS emergency care systems.[3] These initiatives have been demonstrated to improve reperfusion rates and times.[4–11] Most of the publications analyzing outcomes of an infarction protocol have focused purely on patients with STEACS[4–7,9,11]; however, this represents less than 35% of all patients with ACS.[12,13]

Over the past decade, the incidence of STEACS has decreased, while the incidence of non—ST-segment elevation ACS (NSTEACS) has remained steady or even increased.[12,14,15] In NSTEACS, although invasive treatment has been demonstrated to be superior to conservative treatment,[16,17] the revascularization rate is usually lower than in STEACS, and the patients usually have somewhat different clinical and hemodynamic profiles.[12] The creation and implementation of an infarction protocol regulates emergency care only, almost always in relation to STEACS only. Nonetheless, it is easy to glean that the use of a common protocol that is standardized between different departments and hospitals could lead to an overall improvement in the treatment of patients with STEACS as well as those with NSTEACS.[13,18,19] However, this has not been analyzed until now, and all the available evidence relates only to STEACS. The aim of our study was to describe the differences in clinical profile, treatment, and prognosis of patients with any type of ACS admitted to a secondary hospital with a cardiac catheterization laboratory after the implementation of a regional infarction protocol.

METHODS

This was an observational study of all patients admitted with ACS in the *Hospital Universitario de San Juan* in Alicante, in 2 defined periods: the 2 years prior to and the first year after implementation of the infarction protocol. The registry of patients with ACS and the informed consent form were approved by the hospital ethics committee. Acute coronary syndrome was defined as elevated enzyme markers of myocardial damage to above the normal limit of our hospital laboratory (troponin I $\geq$ 0.04 ng/dL or highly sensitive troponin $>$ 0.056 ng/dL) and/or electrocardiographic changes indicative of myocardial ischemia or damage, with associated chest pain consistent with ACS.[1] Patients were categorized according to GRACE score (Global Registry of Acute Coronary Events) into low-risk ($<$ 108), intermediate-risk (109-140) and high-risk ($>$ 140).[20]

During each admission, a record was made of the diagnosis, medical history, cardiovascular risk factors, treatments, investigations, and in-hospital complications of each patient. Glomerular filtration rate was estimated from serum creatinine levels using the Modification of Diet in Renal Disease Study equation.[21] Statin therapy was considered intensive at a dose of 40 mg to 80 mg/day of atorvastatin and 20 mg to 40 mg/day of rosuvastatin, in line with the classification of the 2013 American guidelines on dyslipidemia.[22] Combined analysis of comorbidities was performed using a modified Charlson index for patients with ischemic heart disease.[23]

Patients were followed up over the first year postdischarge by review of clinical notes and computerized medical records (from both primary care and the emergency department) and by telephone. The primary prognostic endpoint during follow-up was cardiovascular mortality, and the secondary endpoints were all-cause mortality, reinfarction, and the incidence of major cardiovascular complications (reinfarction, unplanned urgent revascularization, and readmission due to heart failure or stroke).

Statistical Analysis

Analysis was carried out using the IBM program SPSS 22.0 for Mac. Qualitative variables were assessed using the chi-square test and Fisher's exact test when necessary; quantitative variables were compared using Student's *t* test and ANOVA. Factors associated with in-hospital mortality were identified using logistic regression, and the model included risk factors, history of cardiovascular disease, treatment received during hospital stay, and revascularization. Calibration of the logistic regression model was analyzed with the Hosmer-Lemeshow test, and diagnostic capacity was analyzed using the area below the ROC curve of probability estimated by the model. Survival analysis was performed using Cox proportional hazards regression, with forward stepwise selection, which included age, sex, all risk factors, any existing cardiovascular disease, treatment at discharge, and coronary revascularization. *P*-values $<$ .05 were considered statistically significant.

RESULTS

During the study period, we included 1210 patients with a diagnosis of ACS. As shown in Table 1, the patients' medical histories differed in the 2 periods: although the mean age was the same in both periods, patients admitted after implementation of the infarction protocol had a lower prevalence of diabetes mellitus and hypertension but a higher rate of active smoking. In addition, they generally had fewer comorbidities, as reflected by the lower Charlson index. After implementation of the infarction protocol, the percentage of patients admitted with STEACS and the mean