

Original

Impact of myocardial perfusion gated-SPECT on the decision to perform coronary angiography in patients with left ventricular dysfunction of ischemic origin[☆]

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ABSTRACT

Objectives: The aim of this study was to analyze how the myocardial perfusion gated-SPECT (Single Photon Emission Computed Tomography) influences the practice of a coronary angiography in patients with ischemic cardiomyopathy (IM).

Patients and methods: A total of 120 consecutive patients (mean age: 64.9±11.5 years, 25 female) with IM (left ventricular ejection fraction ≤40%) and without previous coronary angiography were evaluated by myocardial perfusion gated-SPECT (96 stress-rest and 24 only at rest). The ventricular ejection fraction (EF) was obtained at rest by gated-SPECT in all patients. The ischemic origin of the systolic dysfunction was established by means of coronary angiography in 64 patients and by previous myocardial infarction in the rest. Gated-SPECT results of these 64 patients were compared with those of 56 patients in whom coronary angiography had not been indicated.

Result: Scintigraphic myocardial ischemia (HR: 5.2; CI 95%: 2.68 to 10.35) in patients who were able to perform the stress-rest test and who had severely impaired EF (<30%) (HR: 0.9; CI 95%: 0.89 to 0.99) were the best independent predictors of coronary angiography. On the contrary, scintigraphic criteria of viability were not a determinant, from the statistical point of view, of coronary angiography in this series.

Conclusions: In patients with IM, demonstration of ischemia and severe reduction of the EF, but not detection of viable myocardium, prompted the performance of coronary angiography

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Impacto de la gated-SPECT de perfusión miocárdica en la indicación de una coronariografía en pacientes con disfunción ventricular izquierda de origen isquémico

RESUMEN

Objetivo: El objetivo de este estudio fue analizar cómo la gated-SPECT (Single Photon Emission Computed Tomography) de perfusión miocárdica influye en la práctica de una coronariografía en los pacientes con miocardiopatía isquémica (MI).

Material y métodos: Se evaluaron consecutivamente 120 pacientes (edad media: 64,9 ± 11,5 años, 25 mujeres) con MI (fracción de eyección ventricular izquierda ≤ 40%) mediante gated-SPECT de perfusión miocárdica (96 estrés-reposo y 24 sólo reposo) y sin coronariografía previa. La fracción de eyección (FE) fue obtenida en reposo mediante gated-SPECT. El origen isquémico de la disfunción sistólica se estableció mediante coronariografía en los 64 pacientes en que fue practicada después de la gammagrafía y por el antecedente de infarto de miocardio en el resto. Los resultados de la gated-SPECT se compararon con los de los 56 pacientes en los que no se indicó la coronariografía.

Resultados: La isquemia miocárdica gammagráfica (HR: 5,2; IC 95%: 2,68 a 10,35) en los pacientes que habían podido realizar una prueba de estrés y la disminución severa de la fracción de eyección (FE < 30%) (HR: 0,9; IC 95%: 0,89 a 0,99) fueron predictores independientes de la práctica de una coronariografía mientras que los criterios gammagráficos de viabilidad miocárdica no fueron determinantes, desde un punto de vista estadístico, para la práctica del cateterismo.

Conclusiones: En los pacientes con MI, la demostración de isquemia y la reducción severa de la FE en la gated-SPECT de perfusión miocárdica influyeron en la indicación de una coronariografía, sin que los criterios gammagráficos de viabilidad tuvieran un impacto significativo en esta decisión.

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Palabras clave:

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Introduction

Ischemic cardiomyopathy (IC) is a disease with elevated morbidity and mortality.¹⁻⁷ The principal motives to evaluate these patients with Gated myocardial perfusion SPECT (Single Photon Emission Computed Tomography) are the detection of myocardial viability, myocardial ischemia and quantification of left ventricular function.

In spite of all the existing literature, the impact of these findings on the management of patients with IC in the clinical practice has been analyzed in depth. Thus, the purpose of this study has been to evaluate in a single center the influence of the gated myocardial perfusion SPECT on decision-making to perform a coronary angiography (CA) in patients with coronary arterial disease and moderately to severely reduced left ventricular systolic function.

Methods

Patient screening

One hundred twenty patients (mean age: 64.9±11.5 years, 25 women), with IC (left ventricular ejection fraction ≤ 40%), and without previous CA were studied with gated myocardial perfusion SPECT. The ejection fraction (EF) was always calculated at rest using the gated-SPECT. The ischemic origin was established by CA in the 64 patients in whom it was performed and by the background of myocardial infarction in the remaining 54 (anterior: 37, inferior: 17). Mean interval between the myocardial infarction and the gated-SPECT was 3.3 years.

Beginning with the 363 patients with EF ≤ 40% evaluated by gated myocardial perfusion SPECT, 243 were excluded due to heart valve diseases or idiopathic dilated cardiomyopathy (n: 61), cardiac pacemakers (n: 10), previous myocardial revascularization (n: 86) and previous CA (n: 86).

The images of the gated myocardial perfusion SPECT, the clinical data and performance of a CA during a 12-month follow-up of each patient were analyzed. The clinical variables and gated-SPECT variables were included prospectively and stored in a data bank of the Nuclear Cardiology Unit.

Gated myocardial perfusion SPECT

Of the 120 patients studied, 96 (80%) were evaluated with a short protocol (one day) of stress rest SPECT and 24 (20%) only rest gated-SPECT. In 56% of the patients, ^{99m}Tc-MIBI was used and in the remaining 44% ^{99m}Tc-Tetrofosmin was used.

In 86 patients, a stress test was performed with a cycloergometry test and in 10, dipyridamole was administered during the stress as they did not reach 80% of the tachycardization percentage calculated for their age without symptoms or electrocardiographic abnormalities.⁸

The first radiopharmaceutical dose, injected between 30 and 60 seconds prior to the completion of the maximum effort, was 8 mCi and the second dose (at rest) was 24 mCi, with an interval of not less than 45 minutes between the injection of both doses.

Acquisition was obtained with an adjacent Siemens ECAM dual head gammacamera (at 90°) with a low energy high resolution collimator and performing a simicircular orbit initiated in the right anterior oblique view at 45° with detections every 3° until completing a 180° circle in left posterior oblique position. A 64 × 64 matrix and acquisition zoom factor of 1.45 were used. The number of images per cardiac cycle for the at rest gated-SPECT-1 and the at rest gated-SPECT-2 was 8. For the reconstruction, a filtered back projection was used with an order 5 Butterworth filter and 0.35 frequency for the stress test and an order 10 Butterworth filter and frequency of 0.45 for both at rest studies. Tomography slices were obtained on the short axis, horizontal long axis and vertical long axis slices. No attenuation and scatter correction was performed.

The left ventricle was divided into 17 segments⁹ and each one of them were allotted a score for uptake level of the myocardial perfusion of 0 to 4 (0=normal activity, 1=slightly decreased, 2=moderately decreased, 3=severely decreased, and 4=absence of activity), and for thickening (0=normal, 1=slightly decreased, 2=moderately decreased, 3=severely decreased and 4=absence of thickening). The perfusion summed rest score (SRS), perfusion summed stress score (SSS), perfusion summed difference score (SDS) and the summed thickening score at rest (STS) were analyzed.^{5,6}

At 10 minutes of administering 10 mg of sublingual nitroglycerin, the myocardial viability was measured in gated-SPECT rest images in regions with severe hypokinesia and akinesia. It was considered that a patient had myocardial viability criteria when there was ≥ 3 myocardial segments (17% of all the left ventricle) with severe hypokinesia, akinesia or dyskinesia with a perfusion score of 0-2 plus systolic thickening.^{5,6,10}

The percentage of myocardial viability was calculated using the following equation: ([number of viable segments]/[total segments]) × 100.

It was considered that there was myocardial ischemia when the summed perfusion difference score (SPD) between stress and rest was ≥ 2.^{5,6,10} The SDS was grouped into three categories: low SDS=0 to 2, intermediate SDS=3 to 7, and elevated SDS > 7.^{11,5}

The percentage of ischemia was calculated with the following equation ([number of ischemic segments]/[total segments]) × 100.^{5,6} It was considered as distant ischemia when there was the presence of ischemia in the regions contralateral to the myocardial viability study.

Calculation of the EC and ventricular volumes was done using the automatic delimitation of endocardial and epicardial borders with the QGS® quantitative program (Cedars-Sinai Medical Center, Los Angeles, CA) in the rest gated SPECT.¹²

Statistical analysis

All the continuous variables were expressed with the mean and standard deviation (SD) and all the categorical variables were expressed in percentages.

The comparison of quantitative variables was performed with the Student's T test for independent samples. To compare two independent categorical variables, the χ^2 test, and Fisher's exact test was used.

To evaluate the decision to perform a CA, we studied the presence of myocardial viability in the rest gated-SPECT of 120 patients and the presence of myocardial ischemia in rest-stress SPECT of 96 patients.

For the identification of the independent predictor variable of a CA, the Cox regression multivariate analysis was used (FSTEP [LR], the threshold for the entry of the variables was p<0.05, and for the exit was p<0.10). The likelihood of a CA during the post-gated-SPECT follow-up was calculated with the Kaplan-Meier method and for comparison of the different groups, the log-rank test was used.

All the variables analyzed were introduced into a data base made in SPSS (Version 13.0, SPSS Inc., Chicago; and MedCalc® Version 9.5.2.0.). A statistical difference was considered as significant when p was <0.05.

Results

A CA was performed on 64 patients (53%) during the post gated-SPECT follow-up. The mean interval between the gated-SPECT and CA was 3 months (SD=2 months). In 43 out of the 64 patients, the CA was performed within the first 60 days post gated-SPECT.

Tables 1, 2 and 3 show the clinical characteristics and those of the gated-SPECT of the patients with and without CA. A total of 96

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