ORIGINAL ARTICLE

Normal Myocardial Perfusion SPECT Database for the Spanish Population

Gemma Cuberas-Borrós,[a] Santiago Aguadé-Bruix,[b] María Boronat-de Ferrater,[b] María África Muxí-Pradas,[c] Guillermo Romero-Farina,[a] Joan Castell-Conesa,[b] Verónica Aliaga,[a] David García-Dorado,[a] and Jaume Candell-Riera,[a] for the Nuclear Cardiology Working Group*

[a]Servicio de Cardiología, Hospital Universitario Vall d'Hebron, Universidad Autónoma de Barcelona, Barcelona, Spain
[b]Servicio de Medicina Nuclear, Hospital Universitario Vall d'Hebron, Universidad Autónoma de Barcelona, Barcelona, Spain
[c]Servicio de Medicina Nuclear, Hospital Clínico Universitario de Barcelona, Universidad de Barcelona, Barcelona, Spain

Introduction and objectives. The aims of this study were to create a Spanish database of normal myocardial perfusion SPECT (single-photon emission computed tomography) data, termed the normal Spanish database, and to compare it with a database of normal data from the North American population.

Methods. We selected 104 healthy volunteers (45 female, mean age 42±14 years) who underwent SPECT during stress and at rest. The findings were analyzed using the 4DM-SPECT commercial software package. The resulting normal Spanish database for males and females was compared with the North American population database (from 70 men and 60 women) provided with the 4DM-SPECT software.

Results. In the Spanish database, the highest percentage uptake during both stress and rest was observed in the medial–lateral region and the lowest, in the basal–septal region. The percentage uptake in the anterior–medial region was significantly lower in women than men, while uptake in the inferior, medial–septal and apical regions was lower in men than women. Data values in the Spanish database were significantly lower for the majority of heart regions than those in the database with the 4DM-SPECT software.

Conclusions. A Spanish database of normal myocardial perfusion SPECT data was created and included separate data for men and women. Significant differences were observed between this database and a commercial North American database that is commonly used in semiquantitative studies.

Key words: *Nuclear medicine. Isotopes. Scintigraphy. Perfusion.*

Base de datos de normalidad de la SPECT de perfusión miocárdica en la población española

Introducción y objetivos. El objetivo de este estudio ha sido crear una base de datos española (BDE) de normalidad de la SPECT *(single photon emission computed tomography)* de perfusión miocárdica y compararla con una base de datos de normalidad de población norteamericana.

Métodos. Se seleccionó a 104 voluntarios sanos (45 mujeres, media de edad, 42 ± 14 años) a los que se practicó una SPECT de estrés y reposo, procesándose los estudios en el programa comercial 4DM-SPECT. La BDE de normalidad generada para varones y mujeres se comparó con la base de datos de la población norteamericana (70 varones y 60 mujeres) que proporciona el programa 4DM-SPECT.

Resultados. En la BDE el mayor porcentaje de captación correspondió a la región lateral-medial, y el menor, a la región septal-basal, tanto en estrés como en reposo. En las mujeres el porcentaje de captación de la región anterior-medial fue significativamente más bajo que en los varones, mientras que en éstos se observó una menor captación en las regiones inferiores, septal medial y apical con respecto a las mujeres. Los valores de la BDE fueron significativamente más bajos que los de la 4DM-SPECT en la mayoría de las regiones.

Conclusiones. Se ha creado una base de datos de normalidad española para mujeres y varones por separado de la SPECT de perfusión miocárdica, y se ha observado que hay diferencias significativas con una base de datos comercial de origen norteamericano que suele utilizarse en estudios semicuantitativos.

Palabras clave: *Medicina nuclear. Isótopos. Gammagrafía. Perfusión.*

*A list of the members of the Nuclear Cardiology Working Group is provided at the end of the article.

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Correspondence: Dr. J. Candell-Riera.
Servei de Cardiología. Hospital Universitari Vall d'Hebron. Universitat Autònoma de Barcelona.
Pg. Vall d'Hebron, 119-129. 08035. Barcelona. España.
E-mail: jcandell@vhebron.net

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ABBREVIATIONS

SDB: Spanish database
SPECT: single photon emission computed tomography

INTRODUCTION

The software programs applied in the quantitative and semiquantitative analysis of myocardial perfusion use databases of normal values obtained from volunteers with a low probability of having coronary disease.[1-4] In daily clinical practice, single photon emission computed tomography (SPECT) myocardial perfusion images are not usually interpreted by comparing the data to those recorded in a database of reference values obtained from healthy subjects.[5-7] In multicenter studies, however, and particularly when the images are interpreted by an imaging unit, the database should be constructed from a population similar in biotype to the patients under assessment.

Most commercially available programs for processing SPECT images provide a database of normal values obtained from populations in the United States. These include the means and standard deviations of maximal uptake in each of the left ventricular regions, which serve as reference values. Nonetheless, the normal values in these databases can differ from those of study populations from other countries. This inherent limitation can be resolved with a database generated from the results of healthy individuals who are representative of the geographic area where the tests are being performed. In nuclear cardiology, the most commonly used programs that provide a database of normal reference values are Quantitative Gated SPECT and Perfusion SPECT (QGS/QPS, Cedars-Sinai Medical Center, Los Angeles, California, USA),[8,9] the Emory Cardiac Toolbox (ECTb; Emory University, Atlanta, Georgia, USA),[10] and 4DM-SPECT (University of Michigan Medical Center, Ann Arbor, Michigan, USA).[4] 4DM-SPECT is the only one of these in which data from healthy individuals obtained by the user can be introduced to create a database of normal values representative of the geographic area of interest.

The aim of the present study was to construct a reference database of normal myocardial perfusion values for our country (the normal Spanish database) by performing SPECT in volunteers with a <5% prevalence of coronary disease. The results were then compared to the values provided in the 4DM-SPECT commercial software program to determine whether there were differences.

METHODS

Study Population

We selected healthy volunteers who had a <5% probability of presenting coronary disease based on Bayesian criteria according to age, sex, medical history, clinical examination, baseline ECG, and maximal stress ECG.[11] The following were exclusion criteria: hypertension (according to World Health Organization values), lung disease, valvular disease or any other type of heart disease, abnormal ECG findings, any pharmacologic treatment, diabetes or other endocrine disorders, abnormal blood tests, positive pregnancy test in premenopausal women, abnormal echocardiogram, and positive stress test on clinical or electrocardiographic criteria.

Of 169 examinations from the initial multicenter study,[12,13] 15 were rejected because pixel size was greater than 8 mm, and 49 were excluded because the polar map lacked homogeneity, having been carried out in centers with different gamma cameras. The final number of subjects included was 104 (45 women and 59 men). Of the total, 8.87% (15) of the women and 9.46% (16) of the men were overweight (body mass index, 25-30). Obese individuals (BMI>30) were excluded.

The clinical and ergometric characteristics of the volunteers selected to generate a database of normal reference values are shown in Table 1. All subjects gave informed consent to participate, and all underwent echocardiography and a symptom-limited stress testing on an ergometric bicycle, with normal results in all cases.

The reference population included in the 4DM-SPECT program is comprised of 70 men and 60 women from the United States.

Image Acquisition and Quantification

All SPECT studies were performed using a short protocol with ^{99m}Tc-tetrofosmin injection (250-300 MBq during stress, and 2-3 h later, 750-900 MBq while at rest). The interval between ^{99m}Tc-tetrofosmin administration and image acquisition was 15 to 90 minutes, and the total duration of the examination was 5 hours. The acquisition parameters required for inclusion were a circular orbit of 180°, stop-and-shoot mode, 64×64 matrix, and 30 or 32 views (10-25 s/view). Neither gated acquisition nor attenuation correction was carried out. All studies were performed with gamma cameras that had previously passed several quality control tests.[12]