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# The importance of the prone position in myocardial scintigraphy acquired in CZT

**Keywords:** cardiovascular disease, coronary artery disease, scintigraphy, semiconductor crystals

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## Introduction

Cardiovascular disease is the leading cause of death in the world, in which coronary artery disease (CAD), whose early identification allows for initial treatment and modification of the prognosis. In general, one in three men and one in four women will have, at some point in life, some demonstration of CAD. Among these, half will have as the first demonstration of CAD an acute coronary diagnostic.

Consequently, tracing, detecting and treating these patients appropriately are fundamental measures and should be considered an absolute priority in terms of public health. The advent of new imaging techniques and new biomarkers has made it possible to know better, in vivo, the development and prognosis of the CAD. Also, it is important to note that even with the discovery of so entitled "new risk markers for CAD" the so-called traditional risk factors (i.e.: age, male, diabetes mellitus, arterial hypertension, increased LDL fraction and decreased HDL fraction of Cholesterol, smoking and family history of premature CAD) remain extremely important in the evaluation and treatment of the disease. In addition, these diagnosed patients can still be evaluated using imaging methods; The discovery of subclinical atherosclerotic disease has allowed the early detection of a group of patients who can benefit from more aggressive treatment of their risk factors.

The investigation of coronary artery disease can be carried out in a non-invasive way by the scan of myocardial perfusion, which stands out by detecting changes in myocardial perfusion and left ventricular function in the face of physical stress or pharmacologically stimulation. Mainly because is not to assess the magnitude of coronary obstruction, but it is impact on the perfusion of the myocardial-irrigated territory, so the information obtained is not anatomical, but physiological or functional, aiding the diagnosis of DAC - being of great value in the process of clinical decision. However, the principles of the techniques of Nuclear medicine, MS (myocardial scintigraphy) is based on the physiology and pathophysiology of the various organs and systems, and distinguishes itself from the other modalities of diagnosis by image that usually find morphological changes. Hence, the examinations with more dynamic and deductive interpretations than simply static observation by evaluating the intensity and extent of the perfusion changes present in the ischemic or myocardial infarction, MS provides information, which becomes a solid basis in decision making determining whether or not the need for cardiac catheterization or myocardial revascularization.[1]

In nuclear medicine MS is a specialty of uses radioactive substances, administered in the patient, usually intravenously for the realization of images. The main radioactive substance used in MS is the 2-methoxy-2-isobutyl-Isonitrila (Sestamibi) drug marked with technetium (99MTC), after becomes known as: technetium-99m-Sestamibi (MIBI). The Sestamibi is a member of the chemical family referred to as isonitrilas. The 99mTc-Sestamibi is a monovalent cation, in which the 99mTc is surrounded by six isonitrilas ligands. The technetium-99m (99mTc) is the radionuclide that presents physical characteristics ideal for use in nuclear medicine. It is a low-energy gamma emitter (140 KeV) and has relatively short half-life time (6, 02h). Also, it is obtained by means of the radioactive decay of molybdenum-99 (99Mo), for that reason, it is an element of easy acquisition, economically viable and chemically presents several states of oxidation, providing its connection with countless biologically substances Active, concentrating on the fabric or organ of interest.

The images of the MS can be performed in conventional range-chamber SPECT (sodium telluride crystals doped with thallium), or in range chambers with solid state stationary electronic detectors (cadmium and zinc telluride crystals–CZT). Semiconductor crystals present with a density of approx. 5.8 g/cm$^2$, a range of advantages when compared to traditional scintillators, starting with the possibility of direct conversion of gamma rays into electric pulses, thus dispensing the use of photomultipliers. This density and its high effective atomic number (Zeff~50) confer a high breaking power for the typical energies used in Nuclear medicine; Also giving it a linear attenuation coefficient greater than that of sodium iodide crystals. In a direct conversion detector, such as CZT, the radiation deposits its energy at some point in the crystalline matrix which results in the generation of pairs of chargers. Applying an electric field these loads are removed to the cathode and anode of the device, where they end up inducing the formation of a pulse that can be detected. Discovery NM 530C employs a detection system based on an arrangement of multiple CZT detectors arranged in modules called triplets. All in all are nine fixed triplets and each of them covers a certain angle in a spatial region.[2,3]

The study, the standard one-day protocol was used and an average dose of 7mCi (259 MBQ) for rest phase and 21mCi (777 MBQ), for the stress phase. The rest images were acquired about 30 minutes after the administration of the MIBI, already the stress images from 15-30 minutes after the physical stress and 45-60 after the pharmacological stimulus. The equipment used for the evaluation was the gamma-chamber Discovery NM530c (CZT) and the drug administered was MIBI. The duration of the images was 5 minutes for the rest and 3 minutes for the stress. The rest and stress images were acquired in the supine position and synchronized with electrocardiogram, the parameters used for the acquisition of the images were: Matrix 32x32, Zoom 1.0 and 50 multiframes or projections. The images were

processed on the workstation–Xeleris, and rebuilt using Alcyone technology, iterative algorithm (OSEM/MLEM); Postfilter: 3d Bw 0.37/7; Trx Slice THK: 4.00mm; Trx Pixel Size: 4.00mm.

## Conclusion

In cases where there was attenuation of the lower wall, the stress images were acquired in prone position, in order to observe improvement in the inferior wall of the heart muscle. The interpretation of the images was performed by one or more members of our medical team. The diagnostic criteria were based on the presence of reversible perfusion defects (considered ischemia), fixed perfusion defects (considered as infarction) or partially reversible defects (considered as infarction and ischemia). No quantitative analysis was used, only visual analysis of experienced observers. Analyzing the data, we observed that of a total of 196 acquisitions, 126 cases presented diminished uptake in the inferior wall. We performed new acquisition in prone position. In the 126 cases with images in both positions (supine and prone), we observed that 23 patients (18.3%) in which image presented scintigraphic alteration, that is, it maintained the pattern of diminished uptake and in 103 patients (81.7%) the image was normalized. The results obtained in this study suggest that additional image acquired in ventral decubitus was of great benefit because it avoided falsely altered result in large numbers of patients. Attenuation correction leads to a better evaluation for the diagnosis of the patient and consequently, a greater diagnostic accuracy of myocardial scintigraphy (Table 1).[4,5]

**Table 1** Number of acquisitions with prone and without prone

| **Total complete acquisitions: 196** | **With prone** | **No prone** |
|---|---|---|
| | 126 | 70 |
| Altered reports | 23 | 5 |
| Normal reports | 103 | 65 |

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None.

## Conflicts of interest

Author declares that there is no conflict of interest.

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