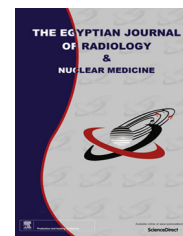




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ORIGINAL ARTICLE

# Comparison of non-attenuation corrected and attenuation corrected myocardial perfusion SPECT



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## KEYWORDS

Coronary artery disease;  
Myocardial perfusion imaging;  
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**Abstract** *Purpose:* To assess the significance of attenuation correction on sensitivity, specificity and diagnostic accuracy of myocardial perfusion SPECT.

*Methods:* 102 patients referred for myocardial perfusion imaging (MPI) were divided into two groups: 42 patients (mean age:  $54.6 \pm 12.6$ ) were enrolled in the group A, who had undergone coronary artery angiography, within six months of the scan. 60 patients (mean age:  $49.79 \pm 11.3$ ) were placed in the group B who had a  $<15\%$  pretest likelihood of CAD. Both non-corrected (NC) and attenuation corrected (AC) images were visually analyzed according to 17-segment model of the left ventricular cavity. Visual assessment derived sensitivity, specificity, diagnostic accuracy and normalcy rate of NC and AC sets of images were compared using McNemar test.

*Results:* Sensitivity, specificity and diagnostic accuracy for detection of coronary artery disease were found to be 100%, 11% and 79% respectively for NC images and 66%, 78% and 68% for AC images. The  $p$  value was found to be significant in only the RCA territory. Normalcy rates in the group B population were 19% for NC image set and 74% for the AC image set. No significant difference on basis of BMI was observed in attenuation corrected scans. The technique appears to be more valuable in men.

*Conclusion:* This study demonstrates that CT based attenuation corrected Tc-99m sestamibi SPECT myocardial perfusion imaging significantly improved the specificity of the RCA territory compared with non-attenuation corrected Tc-99m sestamibi SPECT myocardial perfusion imaging in both genders irrespective of BMI.

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## 1. Introduction

The worth of myocardial perfusion imaging (MPI) is undisputable. It is not only useful in the diagnosis of coronary artery disease (CAD) but also helps in risk stratification and management of patients with known or suspected CAD (1–3). Despite the progress in the field of medical technology, soft tissue attenuation is still a hindrance in the path of the diagnostic accuracy of myocardial perfusion imaging. Soft tissue photon attenuation produces inhomogeneous defects that decrease the specificity of the test, thereby making it difficult to distinguish between coronary artery disease and the attenuation artifact. This may lead to predominant increase in false positive studies (4). Diaphragmatic attenuation and breast attenuation are the most commonly documented artifacts. In obese persons lateral wall artifacts may also be noted (5). Any or all of these may adversely affect any patient's study. Thus it is evident that attenuation artifact is a significant and notorious pitfall of SPECT MPI. Several methods have been approved for determining attenuation artifacts such as prone imaging, electrocardiography (ECG) gated SPECT imaging and attenuation correction (6). For this, the ideal way is to create attenuation maps from transmission tomographic image generation through an external source of photons (7). The external source of photons could be some radionuclide source or X-ray tube. Computed tomography attenuation correction (CT-AC) has advantages of higher photon flux and shorter scan times (8).

In the current study by using hybrid SPECT/CT (Infinia Hawkeye), we tried to evaluate does attenuation correction reduces attenuation artifacts? If yes who are the candidates in which it could be most usefully employed.

## 2. Materials and methods

### 2.1. Study population

A total of 102 patients were prospectively analyzed who were referred to our department, for either diagnostic or prognostic purposes as part of their clinical management. They were categorized into two groups. The group A comprised of 42 patients who got coronary angiography done within a period of six months of cardiac scintigraphy. Their ages ranging from 30 to 74 years (mean age =  $54.6 \pm 12.6$ ) with male/female ratio of 36/6. The other group i.e. B composed of 60 patients who had low likelihood of CAD (<15% pretest probability) fulfilling Morise criteria (9) and they hadn't undergone coronary angiography. Their ages range from 30 to 75 (mean age =  $49.79 \pm 11.3$ ) with male/female ratio of 30/30.

The patients selected in the group A did not have MI, LBBB, history of revascularization or cardiomyopathies. These patients underwent coronary angiography 6 months pre or post MPI SPECT. Coronary angiography was set as a gold standard. Stenosis of  $\geq 70\%$  was regarded as significant.

All patients gave informed consent as part of the protocol approved by the ethical committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments.

### 2.2. Stress/rest protocol

Patients were asked to come for cardiac perfusion study after a 4 h fasting period and they were advised to refrain from tea, coffee, and chocolate cola drinks at least 12 h before stress. Beta-blockers were discontinued for 72 h, calcium channel blockers for 48–72 h and long acting nitrates for 12 h before the study. Physical examination and baseline ECG were done and IV line was maintained.

Patients who were unable to exercise in order to achieve target heart rate were infused intravenously with Dipyridamole at a dose of 0.56 mg/kg intravenously over 4-min period. The patients who were able to exercise underwent symptom limited exercise tolerance test following Bruce or Modified Bruce protocol to achieve at least 85% of age-adjusted maximal predicted heart rate and five metabolic equivalents.

All the patients were injected with Tc-99m sestamibi following One day protocol (10 and 30 mCi for stress and rest imaging respectively).

### 2.3. Acquisition parameters

Each patient underwent stress/rest Tc-99m MIBI SPECT with CT-based attenuation correction. Patients were placed in the supine position with arms over their heads. The SPECT scans were immediately followed by CT. SPECT images were acquired using Infinia Hawkeye equipped with two detectors positioned at 90 degree (L mode).

### 2.4. Data analysis

All the studies were assessed for any mal-registration and patient movement. If there was slight misregistration between emission and transmission data, the images were reprocessed but discarded if there was evidence of significant patient motion or misregistration during acquisition.

For visual interpretation of Non-corrected (NC) and CT-AC views, reconstructed short- and long-axis (horizontal long and vertical long axes) images and polar maps were created by Myovation Perfusion SPECT. The myocardium was divided into 17 segments as recommended by the quality assurance committee of ASNC (10).

All coronary segments were assessed by 2 experienced nuclear physicians. Stress and rest tomograms were presented in a random sequence for interpretation to the experienced observers. For visual interpretation, no clinical information was given to experts, such as patient history and coronary angiography (CAG) findings. Computer generated myocardial perfusion scores were also masked from the experts. The observers interpreted the both the image sets i.e. NC and AC by rating each segment as normal or abnormal with a special emphasis on whether the abnormal segment had reversible or a fixed perfusion defect on short axis and long axis slices as well as the polar map. A third expert was called in when there was disagreement between the two experienced nuclear physicians.

On stress images, a defect in perfusion that was partially or absolutely resolved in the rest images in two or more contiguous segments or slices was marked as a reversible perfusion defect. On the other hand, a defect in perfusion on stress images in two or more contiguous segments or slices that per-

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