Original Article

Usefulness of Dipyridamole Myocardial Perfusion SPECT in Patients with Left Bundle Branch Block

Shahram Dabiri, MD[1*], Naser Aslanabadi, MD[2]

[1]Emam Hospital, Nuclear Medicine Department, Tabriz University of Medical Sciences, Tabriz, Iran.
[2]Madani Heart Hospital, Tabriz University of Medical Sciences, Tabriz, Iran.

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Abstract

Background: *Diagnosis of coronary artery disease (CAD) in patients with left bundle branch block (LBBB) is considered as a challenge in cardiology due to the low accuracy of noninvasive methods such as basal and stress electrocardiography (ECG). This diagnostic challenge can be reduced but not eliminated using dipyridamole as a stress method instead of exercise. The aim of this study was to assess the diagnostic value of dipyridamole stress Tc-99m Sestamibi single photon emission computed tomography (SPECT) myocardial perfusion imaging in patients with complete LBBB.*

Methods: *We studied 40 patients with permanent and complete LBBB using Tc-99m Sestamibi SPECT and dipyridamole stress to evaluate CAD. Perfusion defect was considered fixed when there was no difference between rest and stress score, while reversible defect was defined as a segment with higher score on stress images. All patients underwent coronary angiography.*

Results: *Eleven patients (27.5%) had normal myocardial perfusion SPECT and 29 patients (72.5%) had reversible perfusion defects. Angiography was positive in 30 patients, while 10 cases showed normal angiography. The sensitivity, specificity, positive predict value and negative predict value of our study for detecting >50% coronary stenosis was 86.6%, 70%, 89% and 64% respectively.*

Conclusion: *We found 33 (82.5%) patients with concordant angiography and myocardial perfusion SPECT results (p=0.002). Angiography was positive in 90% of patients with reversible perfusion defects on myocardial perfusion SPECT. In summary, Tc-99m Sestamibi SPECT in patients with LBBB showed high accuracy (82.5%) in detecting >50% coronary stenosis.*

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Introduction

Noninvasive diagnosis of coronary artery disease (CAD) in patients with left bundle branch block (LBBB) continues to be a challenge in nuclear cardiology. Basal and stress ECG has persistently shown low sensitivity and specificity in

[*]**Corresponding Author:** ***Shahram Dabiri****, Emam Nuclear Medicine Department, Tabriz University of Medical Sciences, Daneshgah Ave, Tabriz, Iran. Tel:+98 411 3347503. Fax: +98 411 5555671. E-mail: sh_dabiri@yahoo.com.*

diagnosing of CAD in this group of patients. Since the 1990s, several studies acknowledged the diagnostic value of Thallium-201 (Tl-201) myocardial perfusion imaging in patients with complete LBBB.[1-4] Stress scintigraphy is not specific for the frequent occurrence of septal, anterior and apical defects in the absence of CAD. This diagnostic challenge can be reduced but not eliminated using dipyridamole as a stress method instead of exercise.[5] Good results have been reported using exercise (+dipyridamole) SPECT with technetium compounds both in Non-LBBB patients and LBBB patients with no previous acute myocardial infarction.[6]

Confirming CAD has obvious implications for management. Several studies have shown greater cardiac mortality in the presence of LBBB. Generally, a good prognosis has been found in patients with LBBB and normal or near-normal myocardial perfusion scintigraphy.[7] Noninvasive diagnosis of CAD in patients with LBBB will help in stratifying this group according to cardiovascular morbidity and mortality risks, thus allowing clinicians to provide early treatment especially to patients in the high risk category. The purpose of this study was to assess the diagnostic value of Tc-99m Sestamibi SPECT myocardial perfusion imaging and dipyridamole in patients with complete LBBB.

Methods

We studied 40 patients with permanent and complete LBBB (QRS with ≥ 0.12 sec) on surface electrocardiograms. Patients were referred to dipyridamole stress perfusion SPECT imaging with Tc-99m Sestamibi for evaluation of CAD from March 2004 to December 2005. Indication for performing myocardial SPECT imaging was chest pain syndrome. Patients with significant valvular disease, previous myocardial infarction, pulmonary edema, active asthma and history of revascularization were excluded from the study. All patients gave their informed consent and signature and the study was approved by the Institutional Ethics committee.

0.56 mg/kg dipyridamole was infused over a period of 4 minutes. No patient had obstructive lung disease, took Theophylline, or drank coffee within the previous 12-24 hours. Tc-99m Sestamibi was injected intravenous (IV) 3 minutes after the end of dipyridamole IV infusion. A 12-lead ECG was recorded prior to and every minute during infusion. Heart rate and blood pressure were recorded at 1-minute intervals during infusion. All patients underwent same-day rest/stress Tc-99m Sestamibi SPECT perfusion imaging protocol. A rest dose of 296 MBq (8 mCi) was used. A high-fat snack (milk) was provided to facilitate hepatobiliary tracer elimination of Tc-99m Sestamibi. Rest imaging was carried out 1 hour after injection. Stress dose of 814 MBq (22 mCi) was used. Stress imaging was done 1 hour after stress dose. SPECT scintigraphy images were obtained on an ADAC dual head gamma camera equipped with high resolution collimators. An energy window was set at symmetric 20% over 140 kev photopeak; 32 images at 30 sec/stop were obtained and stored in 64×64 matrix over 180 from RAO (right anterior oblique) 45º. Zoom factor was 1.3, while slice thickness was 5mm/pixel. Images were processed to obtain short and long axis sections perpendicular to cardiac axes. Tomograms were divided into 25 segments for qualitative and quantitative interpretation. Myocardial perfusion status was scored as follows: 0=normal radiotracer uptake; 1=mildly reduced uptake; 2=moderately reduced tracer uptake; 3=severely reduced tracer uptake; and 4=absent radiotracer uptake. Perfusion defect was considered fixed when there were no differences between rest and stress score, while reversible defect was defined as a segment with higher score on stress images. Ischemia was defined as a change of one or more grades between rest and stress images. Interpretation of tomographic images was done by consensus of two experienced observers unaware of other patient data.

All patients underwent coronary angiography within 3 months after myocardial perfusion imaging. Patients were considered having significant coronary stenosis if > 50% reduction of luminal diameter was present. All angiograms were reviewed by attending physicians in the cardiac catheterization

laboratory without knowledge of myocardial imaging results. Data were expressed as mean values ± standard deviation (SD). Chi-square with Yates correction was used to compare differences among patient groups. For statistical analysis, we used SPSS version 10 (SPCC, Inc., Chicago, IL, USA); P value< 0.05 was considered statistically significant.

Results

Forty patients were studied; their mean age was 62±10 years (39-76 years), 17 (42.5%) were men and 23 (57.5%) women. Eleven patients (27.5%) had a normal myocardial perfusion SPECT. Fixed defect of septum without extension to the other walls was considered as normal scan. Twenty nine patients (72.5%) had reversible perfusion defects. Multiple perfusion defects were observed in two or more than two walls in 20 cases, while single perfusion defect was noted in 9 cases (2 in lateral wall and 7 in anteroseptal and anterior walls). Thirty patients had positive angiography (12 cases with 3VD, 8 cases with 2VD and 10 cases with 1VD). Among the patients with one vessel disease, 6 had LAD lesions lesion and LCX stenosis was observed in 4 other cases.

Four patients showed normal myocardial perfusion scan with positive angiography where all vessels had less than 70% stenosis (3 LCX lesions and 1 LAD lesion). Three patients had reversible defects on myocardial perfusion SPECT, while their angiography was normal. Normal angiography and myocardial perfusion scan was observed in 7 cases (figure 1).

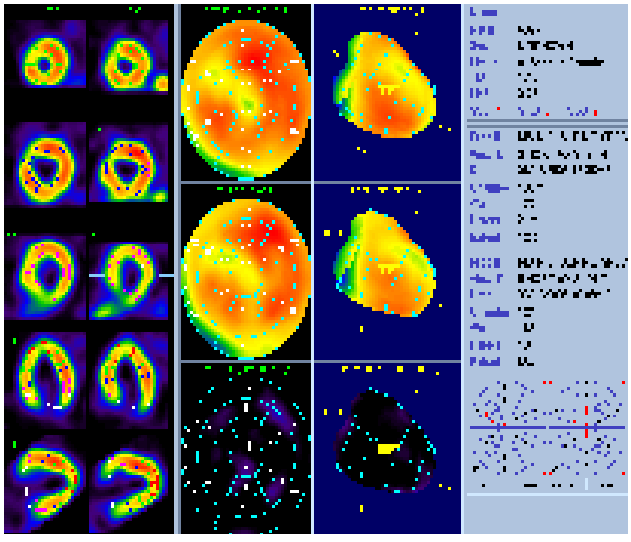

Figure 1. Fixed defect of septum in patient with normal angiography and perfusion scan

The results of both studies were positive in 26 patients (figure 2).

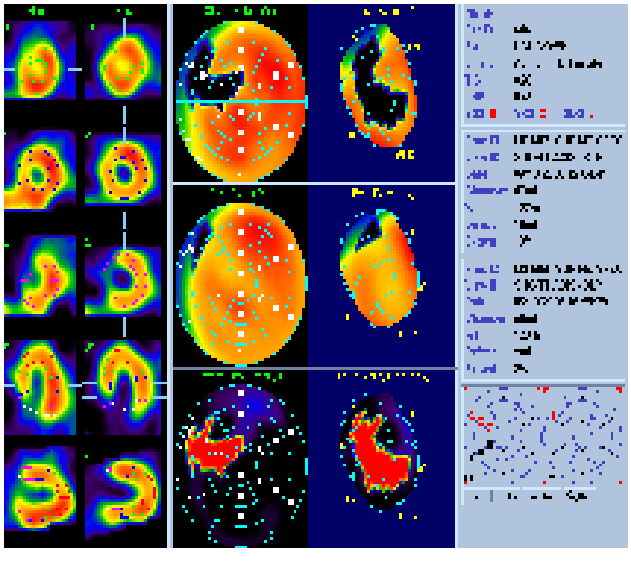

Figure 2. Reversible defect in anteroseptal and apical walls on myocardial perfusion SPECT

Overall, we found 33 patients (82.5%) with concordant angiography and MPS results (P=0.002). The sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of our study for detecting>50% coronary stenosis was 86.6%, 70%, 89%, 64%, and 82.5% respectively (table 1).

Table 1. Angiography and MPI findings in patients with LBBB

Angio \ MPI	Positive	Negative	Total
Positive	26	4	30
Negative	3	7	10
Total	29	11	40

Angio, Angiography; MPI, Myocardial Perfusion Imaging; LBBB, Left Bundle Branch Block

Discussion

Patients with LBBB often have high prevalence of perfusion abnormalities, especially in the anteroseptal region even in the absence of CAD or LAD disease.8-11 Thus, noninvasive assessment of LAD disease in patients with LBBB remains a challenge in nuclear cardiology, even in the era of advanced technology. Various reports2,3 have confirmed the prevalence of LAD disease by coronary angiography within the range of 45-48% among patients with LBBB referred for dipyridamole or exercise Thallium-201 scintigraphy.

Our results using Tc-99m Sestamibi and SPECT showed higher prevalence of anteroseptal perfusion abnormalities (62.5%). Its reason is that we studied LBBB patients with chest pain syndrome. The probability of CAD in this group of patients is usually high.12

Reversible perfusion defects were present in 72.5% of our patients. Angiography was positive in 90% of these patients, confirming the results of MPI. Our results agreed with those of Knapp et al.13 who reported that 14 of 15 patients with significant LAD stenosis showed reversible changes in septum using Tc-99m Sestamibi.

Exercise-induced septal perfusion defects in the presence of LBBB did not necessarily indicate CAD, however it may have reflected functional ischemia due to asynchronous septal contraction14, metabolic abnormalities in myocardium15, or reduced coronary flow reserve.16 However, reversible changes in LAD distribution remain suggestive of significant LAD stenosis even in the presence of LBBB.

Several recently reported series of exercise stress planar or SPECT imaging in patients with LBBB showed sensitivity from 27 to 100% and specificity from 14 to 79% using different indices.2,3,17 O'Keefe et al.18 reported that adenosine Tl-201 SPECT achieved significantly higher overall accuracy (93%) than exercise Tl-201 imaging (68%) in detection of LAD disease. False-positive rate was 5% in adenosine group vs. 35% in exercise group. The authors proposed using pharmacologic stress perfusion imaging as the preferred method for CAD evaluation in patients with LBBB. Our study was not designed to test the differences between exercise and dipyridamole stress scintigraphy, but

the false-positive rate in our study was 10% which is similar to the above mentioned adenosine group.

Conclusion

Our data showed that reversible perfusion defects in MPI have high sensitivity (86.6%), specificity (70%), and accuracy (82.5%) in detecting >50% coronary stenosis. One can appreciate the fact that myocardial perfusion scan and coronary angiography should be considered complementary tools in evaluation of patients with LBBB and coronary artery disease.

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