Myocardial perfusion SPECT imaging in patients with myocardial bridging

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Background. **Although myocardial perfusion single photon emission computed tomography (SPECT) imaging is widely used to assess myocardial ischemia in patients with known or suspected coronary artery disease, only a few patients with myocardial bridging have been evaluated with nuclear techniques. Furthermore, it has been suggested that dipyridamole stress images might underestimate perfusion defects compared with exercise stress images. This study was done to determine the concordance of exercise stress SPECT images with that obtained by dipyridamole stress SPECT images as a means of detecting ischemia in patients with myocardial bridging.**

Methods and Results. **Sixteen consecutive patients with angina and normal arteries but myocardial bridging of the left anterior descending artery underwent rest–exercise stress SPECT imaging. Within 2 weeks after angiograms were obtained, only dipyridamole stress images were repeated. The mean angiographic systolic occlusion within the myocardial bridges was 73% ± 10%. Overall, the prevalence of an abnormal scan was no different in patients who underwent exercise stress myocardial perfusion imaging (MPI) as compared with patients who underwent dipyridamole stress MPI (14/16 [88%] vs 13/16 [81%], respectively; P = .953). Exercise stress MPI showed a higher stress score than dipyridamole stress MPI, but the difference did not reach statistical significance (7.5 ± 3.3 vs 6 ± 2.7, P = .147). The strength of agreement among exercise stress MPI and dipyridamole stress MPI studies was good (κ = 0.765; 95% CI, 0.318 to 1.211; $P < .05$).**

Conclusions. **Cardiac SPECT studies can be used effectively for assessing ischemia in patients with angina and myocardial bridging. The evaluation of myocardial perfusion with dipyridamole stress SPECT imaging showed a good agreement with exercise stress SPECT imaging for the detection of ischemia in this group of patients. (J Nucl Cardiol 2005;12:318-23.)**

Key Words: Myocardial bridging • myocardial perfusion imaging • cardiac single photon emission computed tomography

Myocardial bridging is defined as a band of cardiac muscle that overlies an intramural segment of a coronary artery.[1] Myocardial bridges are the most common inborn coronary anomalies, and the incidence varies substantially between 0.5% and 16% as assessed by angiography versus up to 80% as assessed at autopsy.[2] Reports have suggested that myocardial bridging may be associated with myocardial ischemia,[3] myocardial infarction,[4] and arrhythmias and sudden death.[5]

Although myocardial perfusion single photon emission computed tomography (SPECT) imaging is widely used to assess myocardial ischemia and prognosis in patients with known or suspected coronary artery disease, only a few patients with myocardial bridging have been evaluated with nuclear techniques.[6-10] Stress-induced perfusion defects were documented in only 33% to 63% of patients in whom the SPECT study was performed.[11] Furthermore, it has been suggested that dipyridamole stress images might underestimate perfusion defects compared with exercise stress images.[9,10] Therefore whether nuclear techniques can be used to assess myocardial ischemia remains to be shown in patients with myocardial bridging.

This study was conducted to determine the concordance of exercise stress SPECT images with that obtained by dipyridamole stress SPECT images as a means of detecting ischemia in a group of patients with angina and myocardial bridging.

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METHODS

Study Population

We included 16 consecutive patients from 2000 to 2003 with typical symptoms of angina and normal arteries as documented by coronary angiography but myocardial bridging of the midportion of the left anterior descending artery (LAD) with more than 50% narrowing during systole. All patients had had at least one previous hospital admission because of exertional chest pain with significant ST-segment depression of greater than 0.1 mV or T-wave inversion in the anterior leads. No patients had evidence of previous myocardial infarction. Referral for coronary angiography and stress testing and treatment of patients were done according to physician discretion and not per study protocol. All subjects gave informed consent to participate in the study protocol.

Study Protocol

Patients were initially evaluated with a rest–exercise stress SPECT imaging protocol with technetium 99m sestamibi. Within 2 weeks after angiograms that documented myocardial bridging were obtained, only dipyridamole stress images were repeated. All cardiac medications were withdrawn at least 48 hours before the beginning of each testing. No patients were taking theophylline-containing medications, and caffeinated beverages were stopped the night before the dipyridamole stress studies.

SPECT myocardial perfusion imaging. Rest–exercise stress SPECT studies were performed by use of a same-day imaging protocol. The first dose was injected at rest (low-dose injection, 444-555 MBq [12-15 mCi]), and the second dose was injected during peak treadmill exercise (high-dose injection, 925-1110 MBq [25-30 mCi]). Within 2 weeks, the same high-dose injection was repeated for each patient during peak pharmacologic vasodilation with dipyridamole (0.56 mg/kg over a 4-minute period). SPECT imaging was started approximately 30 minutes after injection during exercise or 45 minutes after pharmacologic vasodilation. Rest SPECT imaging was started approximately 60 minutes after injection.

SPECT acquisition. Myocardial perfusion SPECT imaging was performed with the use of a single-headed SPECT camera (Orbiter; Siemens Hoffman Estates, Ill) following standardized imaging protocols.[12] No attenuation or scatter correction was applied.

SPECT image interpretation. Summed electrocardiography-gated images were visually analyzed with the use of a 17-segment model.[13] The images were analyzed by 2 independent observers (E.V. and M.M.) blinded to the patient's clinical diagnosis and stress modality by mixing in SPECT images from other patients who did not have myocardial bridging. Each segment was graded according to perfusion by use of a semiquantitative score based on a 5-point scoring system (0, normal uptake; 1, mild decreased uptake; 2, moderate decreased uptake; 3, severely decreased uptake; and 4, absence of uptake).[14] The perfusion score was derived by the summation of the score of the 17 myocardial segments. The values of the summed stress scores were divided into 4 categories: normal (0-3), mildly abnormal (4-8), moderately abnormal (9-13), and severely abnormal (>13).

Table 1. Population characteristics

Age (y)	55 ± 5 (range, 50 to 66)
Gender	
Male	10 (62%)
Female	6 (37%)
Hypertension	11 (69%)
Diabetes mellitus	5 (31%)
Hypercholesterolemia	4 (25%)
Smoking	5 (31%)

Angiographic measurement. Left heart catheterization was performed with the use of a standard Judkins technique, and images were obtained in multiple views. All images were analyzed by an experienced interventional cardiologist (I.S.) who was unaware of the patient's nuclear imaging results. Angiograms of the myocardial bridge segment and the normal segment proximal to the myocardial bridging in the single right anterior oblique 30° view were projected and magnified with an angiogram projection system (Tage Arno, Copenhagen, Denmark). Measurements were done manually with the guiding catheter as a reference. The vessel stenosis at the most severe site of the myocardial bridging was quantified as the percentage of the reference diameter, which was the normal diameter of the LAD just proximal to the myocardial bridge. Myocardial bridging was considered to be present if coronary artery narrowing of greater than 50% was observed during systole.

Statistical Analysis

Continuous data were expressed as mean ± SD and categoric data as proportions. Paired and unpaired Student *t* tests were used as a means of comparing values within and between groups. The degree of agreement between exercise and dipyridamole summed stress scores was calculated by use of the Cohen κ index.[15] All statistical analyses were performed with a commercially available software package (SPSS, version 10.0; SPSS