
False-Positive Reversible Perfusion Defect During Dobutamine-Thallium Imaging in Left Bundle Branch Block

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In the presence of pre-existing left bundle branch block (LBBB) exercise stress thallium scans have been associated with false-positive septal and apical perfusion abnormalities. Recent reports have documented a lower incidence of false-positive septal perfusion defects when pharmacologic agents such as dipyridamole or adenosine are utilized in patients with LBBB. Dobutamine, a synthetic catecholamine, is being used with increasing frequency in combination with perfusion agents for the diagnosis of coronary artery disease in patients unable to achieve an adequate exercise workload. Because the positive inotropic and chronotropic actions of dobutamine are similar to the physiologic effects of treadmill exercise, it is conceivable that false-positive perfusion abnormalities will be observed in patients with pre-existing LBBB undergoing dobutamine perfusion imaging. We describe a patient with underlying LBBB who underwent dobutamine thallium imaging which revealed septal and periapical defects. Subsequent coronary angiography showed these abnormalities to be false-positive. It is concluded that septal and periapical perfusion abnormalities during dobutamine thallium imaging may be false-positive and should be interpreted cautiously.

Key Words: thallium perfusion imaging; dobutamine; left bundle branch block

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Exercise stress thallium scans have been associated with false-positive septal perfusion abnormalities in patients with pre-existing left bundle branch block (LBBB) (1-4). Modified interpretation criteria regarding anterior, septal and apical defects in patients with LBBB have not proven to enhance the detection of coronary artery disease (CAD) involving the left anterior descending artery (4). Recent reports have documented a lower incidence of false-positive septal perfusion defects in pharmacologic

stress tests using dipyridamole or adenosine in patients with underlying LBBB (5-7). Because dobutamine is an agent that increases heart rate, blood pressure, and contractility, it is being used with increasing frequency in pharmacologic stress testing (8-10). To date, it is not known whether the presence of LBBB frequently induces septal and apical perfusion abnormalities during dobutamine-thallium imaging. We report the case of a patient with underlying LBBB who underwent dobutamine-thallium imaging which revealed reperfusing septal and periapical defects and subsequent coronary angiography that showed these defects to be false-positive.

A 63-yr-old male presented with a 1-mo history of atypical left-sided chest pain that was not related to exertion. His past medical history was significant for asthma, hypertension, renal artery stenosis treated with percutaneous angioplasty and bilateral carotid artery disease. Cardiac catheterization performed 3 yr earlier to evaluate chest pain revealed normal coronary arteries. Medications at the time of examination included verapamil, enalapril, indapamide and aspirin. His physical examination was remarkable only for an S₄ and bilateral carotid and femoral artery bruits. His resting electrocardiogram (ECG) showed sinus rhythm with LBBB.

To evaluate his chest pain, the patient underwent an exercise stress test with thallium imaging. He exercised to Stage 2 of the Bruce protocol (7 METS) achieving a maximum heart rate of 148 beats/min with a normal blood pressure response. The ECG portion of the test revealed an additional 2 mm of ST-segment depression in leads II and V₅. At peak exercise, 3 mCi of ²⁰¹Tl was administered with imaging in the anterior, 40° left anterior oblique (LAO) and 60° LAO projections beginning within 10 min postexercise and 4 hr later. The perfusion images revealed a mild to moderate decrease (25%-50% reduction from peak maximal activity) in septal and inferoapical activity with partial redistribution.

The patient was referred for adenosine thallium imaging because of the possibility that the noted defects were an artifact secondary to LBBB, but this test was contraindicated because of his history of asthma. A pharmacologic

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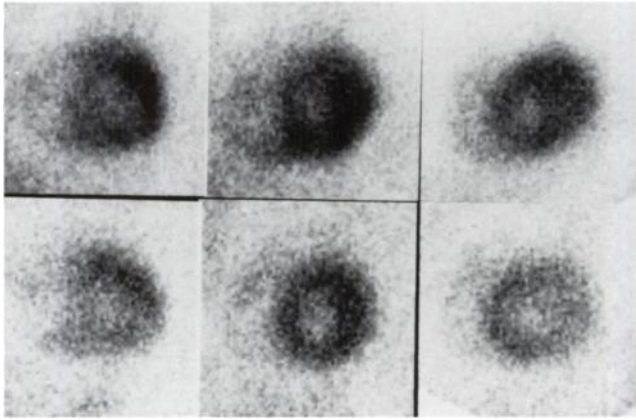


FIGURE 1. Dobutamine ^{201}Tl perfusion images with anterior projections on the left, 40° left anterior oblique (LAO) projections in the middle and 60° LAO projections on the right. Images obtained immediately after infusion (top row) show mild to moderate perfusion defects in the septum and apex. Delayed images (bottom row) show redistribution in these areas.

stress test with dobutamine and ^{201}Tl imaging was substituted. Dobutamine was infused at a rate of 5, 10, 20, 30 and 40 mcg/kg/min for 3 min each. Thallium-201 was administered at the peak infusion rate and imaging was performed as outlined above. The patient achieved a maximal heart rate of 130 beats/min with a normal blood pressure response. The ECG portion of the test revealed an additional 2 mm of ST-segment depression in lead V_5 . The perfusion scans demonstrated a mild to moderate decrease in septal and periapical activity with redistribution (Fig. 1). Subsequent cardiac catheterization revealed normal coronary arteries (Fig. 2).

In the presence of LBBB, exercise stress testing is not considered useful because of the high incidence of ST-segment displacement due to the associated repolarization abnormalities (11). Combining a radionuclide perfusion agent with the exercise protocol may improve the sensitivity and specificity of the test, but frequently a false-positive reperfusing defect in the ventricular septum and apex is noted despite an angiographically normal left anterior descending coronary artery (1-4). The exact nature of this septal perfusion defect is unknown, but postulated mechanisms include septal myocardial fibrosis, prolonged compression of the septal perforators, small vessel CAD, reduced diastolic blood flow and ventricular asynchronous

contraction with unequal septal perfusion governed by autoregulation (6). Recent case series of patients with underlying LBBB, have combined perfusion imaging with pharmacologic stress testing utilizing dipyridamole and adenosine. These have documented an improved accuracy in the diagnosis of CAD compared to exercise perfusion imaging (7-9). By virtue of their mechanism as coronary vasodilators, dipyridamole and adenosine may lessen the effects of coronary autoregulation on flow to the ventricular septum decreasing the incidence of reperfusing septal defects (7). Vasodilator stress tests are not associated with the large increase in heart rate and levels of blood pressure and catecholamines that accompany exercise stress tests. As a consequence they do not cause the high peak heart rates, increase in contractility, and decrease in diastolic filling time which may contribute to the reduced incidence of septal defects observed with vasodilator infusion (3).

Dobutamine, a synthetic catecholamine, is being utilized with increasing frequency in combination with perfusion agents for the diagnosis of CAD in patients unable to achieve an adequate exercise workload and in those with a contraindication to dipyridamole or adenosine (8-10). The mechanism of action of dobutamine includes both positive inotropic and chronotropic effects which increase myocardial oxygen demand in a fashion similar to treadmill exercise (10). Because of the similar physiologic effects of increased contractility and increased peak heart rate, it is probable that septal perfusion abnormalities will be observed in patients with pre-existing LBBB undergoing dobutamine infusion.

Pennell and coworkers have recently described two asthmatic patients with LBBB who underwent dobutamine ^{201}Tl imaging revealing a false-positive septal perfusion defect which in at least one of the patients extended into the anterior and inferior walls (12). The current report constitutes the third described case of a patient with underlying LBBB and a false-positive reversible septal perfusion abnormality on dobutamine-thallium imaging as indicated by angiographically normal coronary arteries. Though planar imaging, as was used in this case, revealed a rather obvious perfusion defect, a more extensive and marked defect may have been present had SPECT imaging been performed. Septal and apical perfusion abnormalities associated with dobutamine-thallium imaging may be false-positive in patients with pre-existing LBBB and should

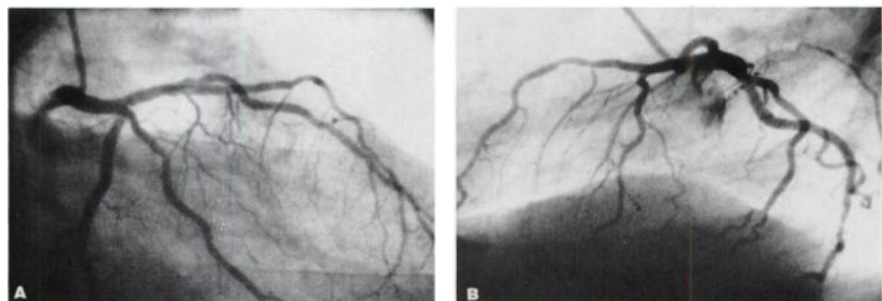


FIGURE 2. Coronary arteriograms in the right anterior oblique (A) and left anterior oblique (B) projections showing a normal left coronary system. The right coronary artery (not shown) was also normal.

therefore be interpreted with caution. Further studies are needed to define the specificity and positive predictive accuracy of these defects. Until such studies are carried out, these three reported cases indicate that perfusion imaging during pharmacologic stress testing should utilize agents such as dipyridamole or adenosine rather than dobutamine to diagnose CAD in patients with underlying LBBB.

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