Case Report

Comprehensive assessment of a post-coronary bypass graft patient with cardiovascular magnetic resonance imaging and multi-detector computed tomography

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Coronary bypass graft surgery (CABG) is a revascularization procedure which reduces myocardial ischemia and cardiovascular morbidity and mortality in selected patients; however, up to 40% of saphenous vein grafts may degenerate over 10 years. Although coronary angiography is the gold standard to detect graft patency and native vessel disease, sometimes it is difficult to locate the grafts resulting in increased exposure to radiation and contrast administration. This case highlights the utility of cardiac computed tomography and magnetic resonance imaging to provide comprehensive noninvasive assessment in a patient post CABG. (J Geriatr Cardiol 2007;4:244-247.)

Key Words bypass graft; coronary artery disease; computerized tomography; magnetic resonance imaging; myocardial ischemia

Coronary bypass graft surgery (CABG) is a revascularization procedure which reduces myocardial ischemia and cardiovascular morbidity and mortality in selected patients. Cardiothoracic surgeons elect to insert venous or arterial grafts, depending on availability and suitability according to the individual patient's situation. It has been known that up to 40% of saphenous vein grafts may degenerate over 10 years 1 and often patients present to physicians for assessment of the extent of myocardial ischemia either from native or graft diseases. Although coronary angiography is the gold standard to detect graft patency and native vessel disease, sometimes it is difficult to locate the grafts. In addition, coronary angiography cannot provide information on degree of ischemia and viability, which is important for clinical decision making and especially for recommending a revascularization procedure for the culprit lesions.

We highlight the utility of emerging noninvasive cardiac imaging techniques to provide comprehensive information in a patient post-CABG.

Case illustration

Sixty-three year old male patient who had histories of diabetes mellitus, hypertension, hypercholesterolemia, and peripheral vascular disease underwent CABG procedure 5 years ago. Over the past few months, he developed dyspnea on exertion and atypical chest pain. His medical regimen was aspirin, digoxin, beta-blocker, nitrate, angiotensin converting enzyme inhibitor, diuretics, and sulfonylurea. Physical examination revealed no jugular venous distension, no lung...
crackles, and no peripheral edema. His cardiac examinations revealed no heave or thrill, normal S1 and S2, but noted S3 gallop. ECG had evidence of old antero septal myocardial infarction. Chest-X-ray revealed mild cardiomegaly without congestion. Lab: Hb 15.4 g/dl, WBC 6 200 cells/ml, platelet 297 000 cells/ml, fasting plasma glucose 249 mg/dl, creatinine 1.0 mg/dl, total cholesterol 172 mg/dl, HDL-C 34 mg/dl, LDL-C 125 mg/dl, triglyceride 261 mg/dl, and NT-proBNP 439 pg/ml.

Patient underwent cardiac computed tomography angiography (CTA, 64-slice multi-detector CT scanner, Philips Medical System, USA) to assess the patency of the bypass grafts, and cardiovascular magnetic resonance imaging (CMR, 3.0 Tesla MRI scanner, Philips Medical System, Best, Netherlands) to assess the extent of myocardial ischemia and viability, and to see whether any revascularization procedure would be necessary.

Cardiac CTA revealed severe stenosis of native coronary arteries as shown in Figure 1. Saphenous vein and left internal mammary artery grafts were patent (Figure 2).

Persantine stress CMR was performed as standard protocol and revealed severe left ventricular systolic dysfunction, with calculated LVEF to be 25% (Figure 3). There was no evidence of myocardial ischemia, while subendocardial to transmural scar was detected in the territory of LAD and RCA (Figure 4).
As all bypass grafts were patent and there was no significant extent of myocardial ischemia, medical therapy was recommended. Six months after adjustment of medication and aggressive control of risk factors, the patient has not had any cardiovascular events.

Discussion

This case highlights the utility of comprehensive information on function, perfusion, viability, and graft visualization from cardiac CTA and CMR for management of a post-CABG patient. Currently, it has been shown that routine stress testing such as exercise electrocardiography, stress echocardiography, and stress nuclear scintigraphy have good accuracy for determining myocardial ischemia of post-CABG patients; however, the limitations from these examinations are noted. First, if the test is abnormal, sometimes it cannot define whether ischemia has resulted from graft or native coronary artery diseases. Second, patients with severely impaired LV systolic function with regional wall motion abnormality consistent with previous infarction sometimes make it difficult to appreciate ischemia in those regions on echocardiography or nuclear images. Therefore, some of those patients are referred for diagnostic coronary angiography to assess the graft patency and the extent of coronary artery disease, and a number of patients do not need a revascularization procedure. Due to advancements in cardiac imaging techniques, clinicians may be able to select CABG patients who should have coronary angiography for possible revascularization procedures.

To date, cardiac CTA is the best available imaging technique to identify the bypass graft and the patency of the graft with excellent accuracy (greater than 95%). However, limitations for clinical decision making are that distal runoff may not be easily determined, and artifacts from surgical clips and severe coronary arterial calcification limit luminal assessment in those segments. Therefore, information on the extent of myocardial ischemia is still needed in order to decide whether any invasive procedure is necessary.

Persantine stress CMR has been shown to provide accurate assessment of myocardial perfusion with both sensitivity and specificity in the range of 80-90% for detecting coronary arterial stenosis. The procedure can be performed within 20-30 minutes and the result can be interpreted in real-time. In addition, delayed images after gadolinium administration will provide information on myocardial viability. Delayed hyperenhancement is an accurate technique for determination of myocardial scar and is comparable to histologic information.

Limitations

Only selected patients are suitable for cardiovascular CT or CMR examination. Cardiac CT and CMR examination requires good cardiac gating during image acquisition; therefore, patients with irregular heart rhythms will not be good candidates. Heart rate should be in the range of 50-70
beats per minute during the cardiac CT angiographic study; therefore, beta-blockers are often used to control heart rate and physicians should be aware whether patients have a contraindication to this medication. Iodinated-contrast is used for cardiac CT exam; therefore, kidney function should be in normal range to minimize the risk of contrast-induced nephropathy. Contraindication to radiation exposure, such as pregnancy, needs to be screened. For CMR in patients with an implanted device such as an implantable cardioverter defibrillator or pacemaker, specific intracranial brain clips are contraindicated for the CMR study. The details of these problems are discussed extensively elsewhere.15,16

Conclusion

This case illustrates that combined information on graft patency from cardiac CT, and the extent of myocardial ischemia and viability from CMR can provide helpful information for managing a CABG patient. These powerful technologies may offer an alternative method to current noninvasive assessment for post-CABG patients.

References