Failure of multiple coronary angiographies to identify left main coronary artery disease in a patient diagnosed by transesophageal echocardiography

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Abstract
This case report describes the role of transesophageal echocardiography to diagnose proximal left main coronary artery disease.
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We report a patient with classical angina pectoris with significant proximal left main coronary artery (LMCA) disease, suggested by coronary angiogram and confirmed by transesophageal echocardiography (TEE). The report discusses the role of TEE in the diagnosis of LMCA disease.

Case report
A 67-year-old male presented with two weeks history of progressive anginal pain. On presentation he had class III angina. He is not known to have diabetes mellitus, hypertension or hyperlipidemia. Cardiac catheterization done in 1998, and 2001 only revealed mild (30%) right coronary artery (RCA) disease. During the course of his disease, a stress test was not performed. Physical examination including cardiovascular examination was normal. Twelve-lead electrocardiograms (ECG) revealed dynamic ST segment elevation of 1–2 mm in lead V2—lead V6. Multiple sets of cardiac enzymes, 8 h apart, were normal and troponin test was negative. The echocardiogram showed normal left ventricle systolic function with no regional wall motion abnormality and normal valves. During coronary angiogram and upon engagement of the LMCA there was damping of blood pressure from 140 to 60 mmHg. A significant LMCA disease was suspected but could not be confirmed by coronary sinus injection (Fig. 1). The rest of the coronary arteries were normal except for a 60% stenosis in the mid right coronary artery (RCA).
Due to the damping of pressure, intravascular coronary ultrasound (IVUS) was not safe to further evaluate the LMCA disease and transesophageal echocardiogram (TEE) was performed. The mid esophageal transverse view, at the base of the heart and at the level of the left sinus of Valsalva, visualized the entire length of the LMCA. A proximal concentric atheroma with 60% luminal diameter stenosis was found. Color Doppler imaging showed flow turbulence at the site of stenosis (Fig. 2) and the pulsed Doppler revealed a diastolic flow velocity of 88 cm/s (Fig. 3A). Further distal imaging showed the LM bifurcation, proximal left anterior descending (LAD) and left circumflex (LCx) coronary arteries to be free of the disease. The diastolic coronary velocity in the LAD was 44 cm/s (Fig. 3B). Accordingly the patient had coronary artery bypass surgery with left anterior mammary to the LAD and two saphenous vein grafts to RCA and LCx coronary arteries. The patient became asymptomatic in the immediate postoperative course as well as at 6 months later in the clinic follow-up.

**Discussion**

Visualization of the coronary arteries has been one of the challenging tasks for echocardiography. Weyman was the first to describe the feasibility of visualizing the LMCA with transthoracic echocardiography.\(^1\) Other studies demonstrated the ability of detecting the distal left anterior descending coronary artery using high frequency transducer (7.5 MHz) in 85% of patients.\(^2\) TEE has been used successfully in assessing the proximal coronary arteries, identifying anomalous coronary arteries, and coronary fistulae.\(^3\) In a study of 160 patients who underwent both TEE and coronary angiography, the entire proximal left coronary artery was identified in 70% of patients. The sensitivity and specificity of TEE in identifying

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**Figure 1** Left sinus of Valsalva angiograms, in the left anterior oblique (A) and right anterior oblique (B), both with cranial angulations, failed to demonstrate the presence of significant left main coronary artery disease.

**Figure 2** Transesophageal echo view at the level of the sinus of Valsalva with color Doppler imaging of the left main coronary artery (LMCA), demonstrating a significant concentric atheroma and color flow turbulence in the proximal LMCA (arrow head). LA: left atrium, LAA: left atrial appendage.
stenosis of the LMCA, proximal LAD, and proximal LCx arteries were 100% and 98%, 79% and 89%, 54% and 84%, respectively. Recording the flow with pulsed-wave Doppler was feasible in 88% of studies for the LMCA, 85% for the LAD, 58% for the left circumflex, and 65% for the RCA. In a comparative study of 94 patients, a high correlation was found between the results of TEE and quantitative coronary angiography for the LMCA, LAD, LCx and RCA. Also, a good linear correlation was found between TEE derived luminal percent area stenosis, using a modified continuity equation, and quantitative angiography. In addition, three dimensional transesophageal echocardiography was found to be successful in delineating normal and stenotic proximal coronary arteries. The LMCA, LAD, LCx and RCA were visualized in 100%, 100%, 98%, and 72% of the patients, respectively, with a sensitivity and specificity in detecting significant stenosis of 84% and 97%.

Our patient presented with typical anginal chest pain with minimal exertion suggesting significant coronary artery disease. The only clue to the presence of proximal LMCA disease was the pressure damping with LMCA engagement. Multiple angiographic views did not delineate the presence of significant LM coronary artery disease. The TEE was considered safer than IVUS, because of the pressure damping during cardiac catheterization. In this case, the entire length of the LM, and the proximal luminal stenosis was demonstrated clearly by TEE. The bifurcation and proximal LAD, and LCx arteries were also visualized and were free of disease. The color Doppler imaging further localized the site and extent of stenosis which was depicted as aliasing and turbulence of color flow. The pulse Doppler showed the increase in peak diastolic velocity in LM compared to diastolic velocity in the LAD, indicating the presence of significant flow limiting lesion. The normal coronary flow in the left system consists of small systolic and large diastolic components as shown in Fig. 3. This flow pattern is due to the presence of a gradient between the aorta and the coronary vessels in diastole as compared to systole. This case demonstrates clearly the usefulness of TEE in estimating the severity of LMCA disease especially when IVUS cannot be performed.

**References**