Noninvasive Assessment of Coronary Endothelium-Dependent Vasomotion

Kuvin and Karas provide an interesting review of diagnostic techniques to assess endothelial dysfunction. However, the authors have focused on the peripheral brachial artery as a surrogate of the coronary artery. Brachial artery examination has important limitations. Brachial and myocardial circulations differ in terms of the microvascular architecture, the pattern of blood flow and vascular resistance (eg, shunt vessels occur in the hand but not in the myocardium), their metabolic regulation, types of receptors that contribute to humoral regulation, and the pathways that are activated to induce hyperemia. When comparing vasomotor reactivity of conduit artery in the coronary versus peripheral vessels, the correlation of endothelial function/dysfunction in both vascular systems was modest ($r=0.36$), with largely scattered values. Therefore, it is necessary to give up the surrogate target artery and focus on coronary circulation, which is now accessible by transthoracic Doppler echocardiography. This method is noninvasive, reproducible, and relatively inexpensive. However, it has several limitations; coronary flow velocity can be reliably measured mainly in the left anterior descending coronary artery, and recording of the systolic component of the coronary flow and measurement of volumetric (absolute) coronary flow are difficult.

The endothelium-dependent vasodilatation has been invasively tested mainly by intracoronary infusion of acetylcholine. However, other stimuli combined with noninvasive assessment measurements can be used. In our studies, cold pressor test, hand grip, and pacing stress using the previously implanted pacemaker have been applied. The most attractive stimulus seems to be a cold pressor test that can be easily performed with negligible extra costs.

Noninvasive echocardiography can be used to examine asymptomatic patients or those with exertional dyspnea and easy fatigability but without anginal pain (ineligible for invasive coronary angiography), and healthy volunteers who can serve as control groups. Measurements can be done several times, which allows comparison of different pharmacological and nonpharmacological treatments that alter coronary microvascular blood flow in a given patient. Therapy may normalize coronary vasodilator response. However, there are few studies showing therapy-induced improvement in the endothelium-dependent coronary vasodilatation, perhaps as a result of limited availability of positron emission tomography—another noninvasive technique for assessing coronary flow. A wider use of echocardiography to evaluate endothelium-dependent vasodilatation may improve our abilities to monitor the effects of therapy in the same way that classical coronary flow reserve (endothelium-independent vasodilatation) has been successfully applied in various clinical settings.

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Response

We appreciate Dr Dimitrow’s remarks regarding our article on the current status of the clinical utility of endothelial function testing, and as discussed in our article, we agree that there are limitations to the present methodologies used to evaluate endothelium-dependent vasomotion. In addition, we agree that testing the coronary circulation, rather than peripheral arteries, has significant clinical relevance. At this point, however, despite their various limitations, invasive coronary artery testing, brachial artery ultrasound, and venous plethysmography are the most thoroughly studied techniques, and each has been shown to be a useful tool in the evaluation of endothelial function. In addition, evaluation of endothelial function by these methods has prognostic importance. New techniques, such as coronary artery flow reserve measurement with Doppler echocardiography, laser Doppler flowmetry of the skin microcirculation, and peripheral arterial tonometry on the finger, are exciting and deserve the same rigorous evaluation that the more established methods have undergone.

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