



# Coronary microvascular disease

**Mario Marzilli**

**Cardiothoracic Department, University of Pisa, Pisa, Italy**

Correspondence: Professor Mario Marzilli, Dipartimento Cardiotoracico, University of Pisa, Via Paradisa 2, 56100 Pisa, Italy.

Tel: +39 050 996751; e-mail: marzilli@med.unipi.it

Over the past three to four decades, the view has evolved that myocardial ischemia in patients with coronary artery disease is caused by atherosclerotic plaques that obstruct flow and may undergo rupture, with subsequent thrombus formation.

However, a large body of evidence challenges this view that attributes myocardial ischemia entirely and exclusively to atherosclerotic obstruction of large epicardial coronary vessels. Altered control of distal coronary tone may aggravate the effects of epicardial obstructions or hinder myocardial perfusion, or both, even in the absence of a proximal obstruction. Abnormalities in coronary vasomotion can contribute to the precipitation and maintenance of ischemia in man. Endothelial dysfunction may impair microvascular adaptation to ischemia, and constrictor responses to reduced intraluminal pressure have been described in isolated microvessels.

A number of experimental and clinical observations support the hypothesis of a more complex pathogenesis of myocardial ischemia. Several investigators, using different techniques, have reported that myocardial perfusion and coronary blood flow reserve remain impaired after "successful" coronary recanalization.

The limited impact of revascularization procedures on prognosis and the persistence of angina in a large number of patients after removal of coronary obstructions indirectly support the concept of additional factors contributing to the pathogenesis of coronary syndromes. In the Randomised Intervention Treatment of Angina (RITA)-2 trial, after a median 7 years

of follow-up, death or myocardial infarction occurred in 14.5% of patients who had undergone revascularization by percutaneous transluminal coronary angioplasty (PTCA) and in 12.3% of medically treated patients. Furthermore, the prevalence of angina remained increased in both groups, with 70% and 83%, respectively, of patients treated medically or with PTCA receiving at least one antianginal drug at 5 years. In the recent Clinical Outcomes Utilizing Revascularization and Aggressive Drug Evaluation (COURAGE) trial, one-third of patients still complained of angina at 1 year of follow-up, in both the medically and the PTCA-treated groups.

Among the additional factors in coronary pathogenesis, microcirculatory dysfunction is emerging as a key mechanism for myocardial ischemia. It manifests as a paradoxical increase in resistance to flow in response to reduced perfusion pressure, and contributes to the precipitation of ischemic attacks both in stable angina and in acute coronary syndromes.

In this issue of *Heart and Metabolism*, the role of the coronary microcirculation in normal and pathologic conditions is described, and strategies to prevent microvascular damage are discussed in detail.

The purpose of this entire issue of *Heart and Metabolism* is to increase awareness that coronary microvascular dysfunction may be a major player in the pathogenesis of ischemic heart disease, and that inclusion of microvascular dysfunction in the clinical assessment of coronary patients may direct treatment and improve the prognosis.