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Know the strengths and weaknesses of ischemia tests to guide the therapeutic strategy of a patient with multi-vessel disease

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To the Editor:

1. Introduction

Ischemia is a strong predictor of adverse cardiac events and detection of ischemia is an important part of the diagnostic and therapeutic strategies in current guidelines [1]. Several modalities such as stress echocardiography, single-photon emission tomography (SPECT), positron emission tomography (PET), cardiac magnetic resonance (CMR), and fractional flow reserve (FFR) are available in clinical practice for evaluation of patients with coronary artery disease (CAD). However, each modality has strengths and weaknesses and clinical practitioner must be aware of these aspects to offer the best therapeutic strategy to his patients. We report here the case of a patient with CAD, which illustrates strengths, and weaknesses of SPECT, CMR and FFR.

A 60-years-old man with known CAD underwent SPECT for atypical chest pain in September 2014. Separate acquisition rest-thallium-201/exercise-technetium-99m sestamibi dual-isotope myocardial perfusion SPECT was performed and evidenced an anterior wall ischemia of 15% (Fig. 1) and a left ventricular ejection fraction at 0.73 by-gated SPECT. Coronary angiography performed subsequently showed an intermediate stenosis on the left anterior descending artery (LAD), a chronic total occlusion of the first diagonal branch deserving a small myocardial territory, an optimal result of previous drug eluting stent (DES) implantation on the right coronary artery (RCA), and a DES intermediate restenosis on the left circumflex (LCx). Based on viewing the angiogram data, it is difficult to explain an anterior wall ischemia of more than 15% due to small chronic total occlusion of the first diagonal branch. So, FFR was performed on the LAD with normal values of 0.93. Because DES intermediate restenosis on the LCx was questionable, FFR was performed on the LCx and was normal (0.92) (Fig. 2). Faced with conflicting results of SPECT and FFR, we decided to carry out an additional CMR: Stress perfusion CMR imaging revealed normal perfusion, but delayed-enhancement (DE) CMR imaging showed focal non-transmural hyperenhancement involving the medial anterior walls (Fig. 3). Results of multimodal modalities were analyzed by integrating strengths and weaknesses as each modality. We concluded to peri-infarct ischemia due to CTO of the first diagonal coronary artery. Optimal medical treatment was provided with uncomplicated subsequent evolution.

2. Discussion

Last ESC and ACC/AHA guidelines give the same level of evidence and strength for all myocardial imaging modalities in symptomatic patient with intermediate pre-test probability of CAD [2]. However, stress echocardiography, nuclear imaging, perfusion CMR and, PET perfusion have their own strengths and weaknesses as well as FFR which is now the new gold standard to diagnose functional stenosis CAD. FFR is an invasive technique, which requires the catheterization of the coronary arteries with a pressure guidewire introduced through the stenosis. In our case the presence of a CTO on the first diagonal coronary artery results in the impossibility of assessing ischemia in this territory using FFR. Myocardial ischemic burden assessed by myocardial perfusion scintigraphy is commonly used to risk-stratify patients with CAD. The presence

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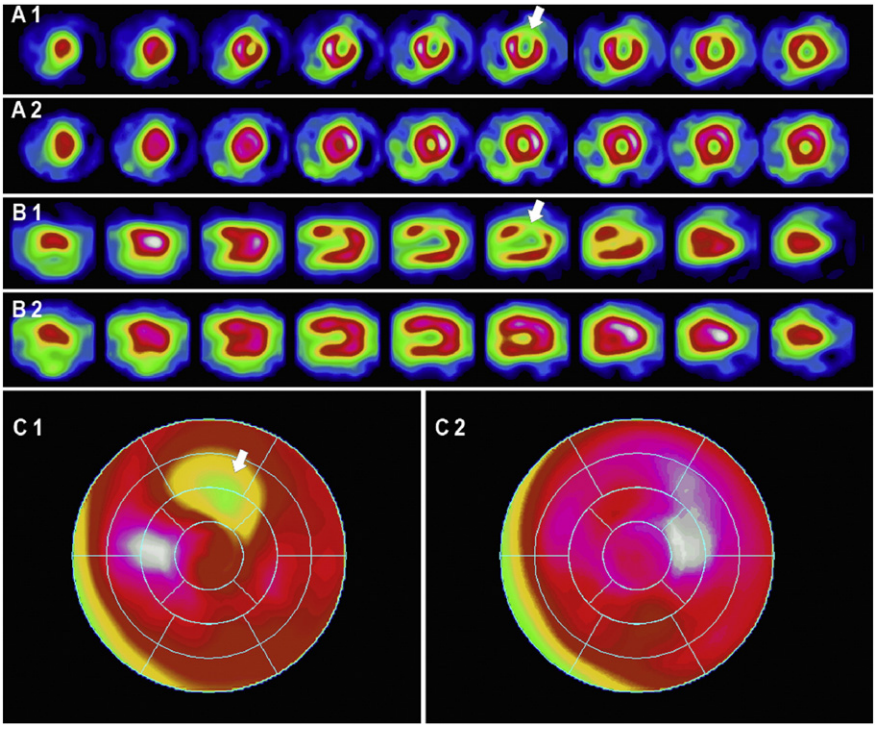

Fig. 1. Short axis (A), vertical axis (B) and bull's eye projection (C) of myocardial stress Tc-99m sestamibi [1] and rest thallium-201 [2] perfusion images, showing stress perfusion defects of the medial anterior walls (arrow).

of an ischemic burden >10% of total myocardium is a threshold above which revascularization leads to better outcomes than optimal medical therapy alone [3]. Indeed, the evidence shows that nuclear medicine is highly effective for prognostication of patients with CAD [4]. However, study results suggest that SPECT underdiagnoses small infarcts, mainly because of its fairly poor spatial resolution. On the other hand, LGE

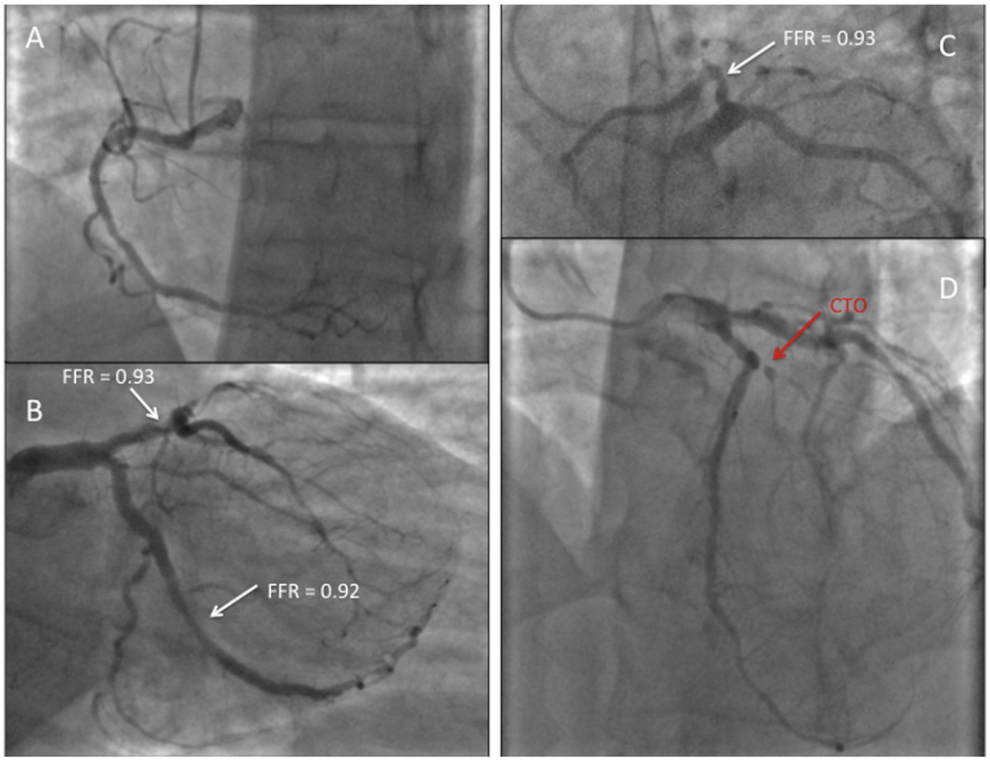

Fig. 2. Invasive Coronary Angiography (ICA) showed an optimal result of previous drug eluting stent (DES) implantation on the right coronary artery (RCA) (A), a DES intermediate restenosis on the left circumflex (LCx) with fractional flow reserve (FFR) at 0.92 (B), an intermediate stenosis on the left anterior descending artery (LAD) with FFR value of 0.93 (B,C) and, a chronic total occlusion (CTO) of the first diagonal coronary with small perfusion territories (D).