^{82}Rb PET•CT Myocardial Perfusion and Blood Flow Evaluation in a Patient with Multivessel Disease and Impaired Ventricular Function

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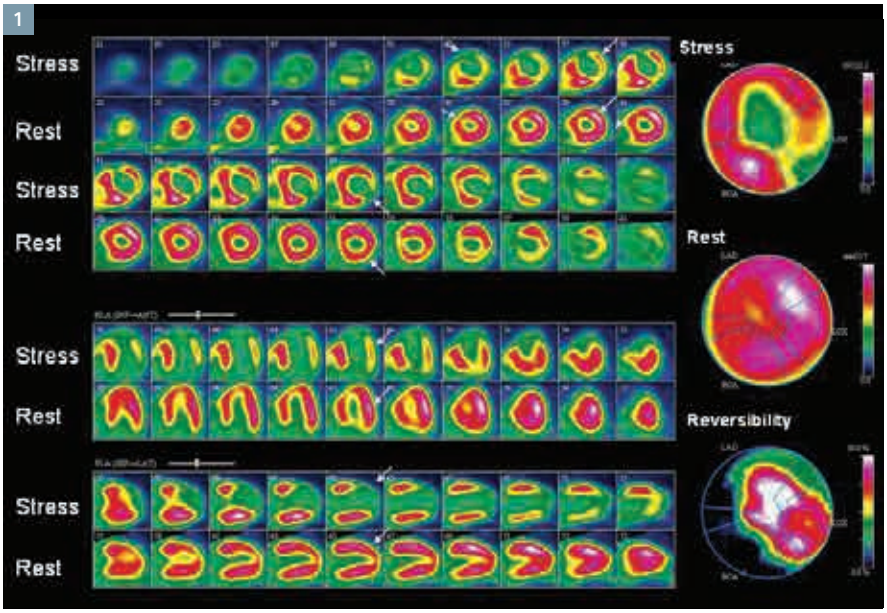
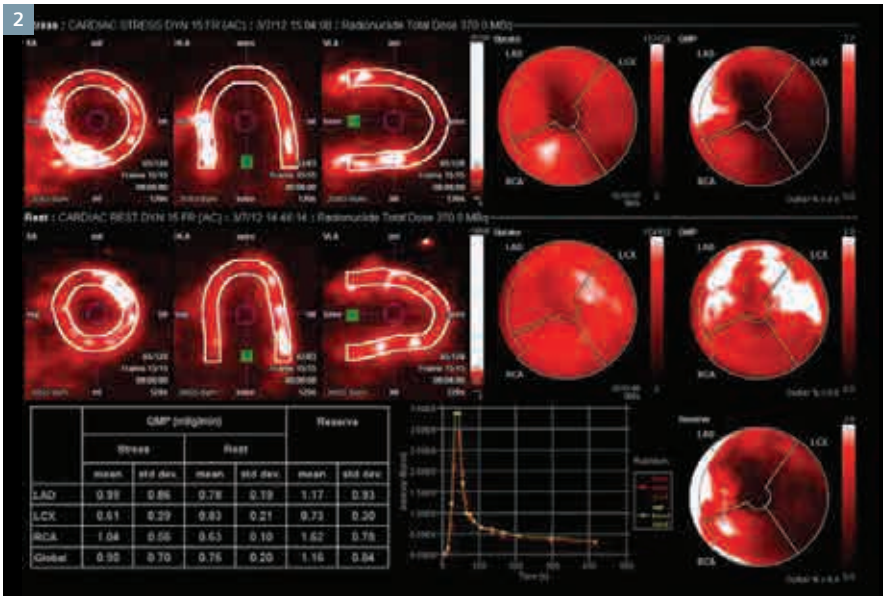
Data courtesy of Parkway Hospitals, Singapore

History

A 61-year-old man with a history of diabetes, hyperlipidemia and hypertension presented with occasional chest discomfort. The patient had a history of myocardial infarction in 1993, which was treated with angioplasty to left anterior descending (LAD) and left circumflex (LCX) arteries. An echocardiography showed left ventricular hypertrophy with normal ejection fraction and anteroseptal wall-motion abnormalities at rest. The patient underwent an ^{82}Rb myocardial perfusion PET•CT study at rest, followed by dipyridamole stress. The study was performed on a Biograph™ mCT PET•CT scanner. A myocardial blood flow (MBF) evaluation was also performed using the *syngo*®.PET Myocardial Blood Flow package.



1 Static ^{82}Rb PET myocardial perfusion images show global ischemia with complete reversibility.



2 MBF evaluation shows severe global decrease in blood flow at peak stress, particularly in the anterior wall, apex and inferolateral wall, along with decreased coronary flow reserve.

Diagnosis

The PET myocardial perfusion study demonstrates severe perfusion defects in the anterior wall, apex and infero-lateral wall. Posterobasal, lateral and inferior walls also show moderate perfusion defects. A rest study shows complete reversibility of all ischemic segments. A small fixed defect in the antero-apical-segment reflects previous myocardial infarction. There is significant post-stress left ventricular (LV) dilatation that normalizes at rest, which is an indicator of multi-vessel disease and stress-induced LV dysfunction.

Coronary flow reserve was severely compromised: Global 1.16, LAD 1.17, LCX 0.73 and right coronary artery (RCA) 1.62. The most severe compromise was in the LCX territory. Stress MBF in the LCX territory was 0.61 ml/gm/min, while the lower limit for normal is accepted to be around 2.0 ml/gm/min.

The patient also had a very high coronary calcium score total: 1704 LM 5, LAD 807, LCX 612 and RCA 280.

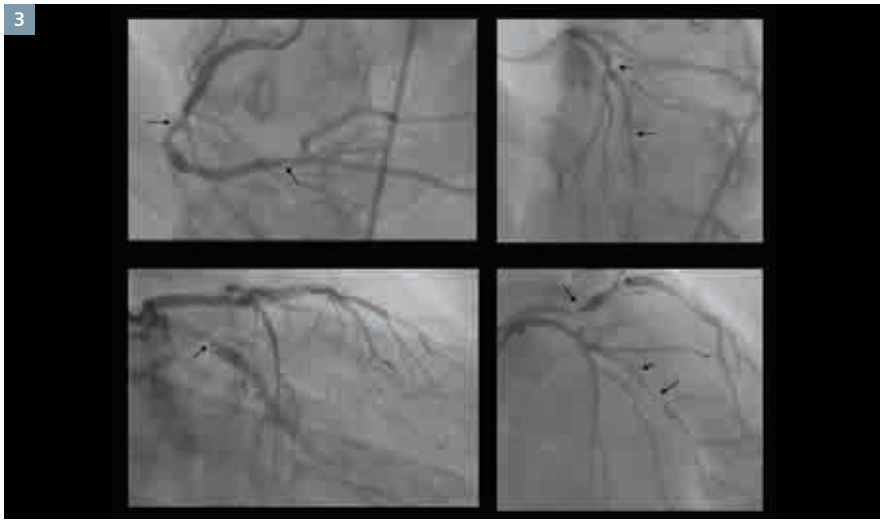
Patient was referred for coronary angiography.

A coronary angiography performed in March 2012 demonstrated severe triple vessel disease with serial 95% stenoses in the proximal and mid LAD, as well as 99% stenosis in distal LAD. Proximal and distal LCX arteries showed 95% stenoses. Dominant RCA showed 90% mid-level stenosis and 90% distal stenosis.

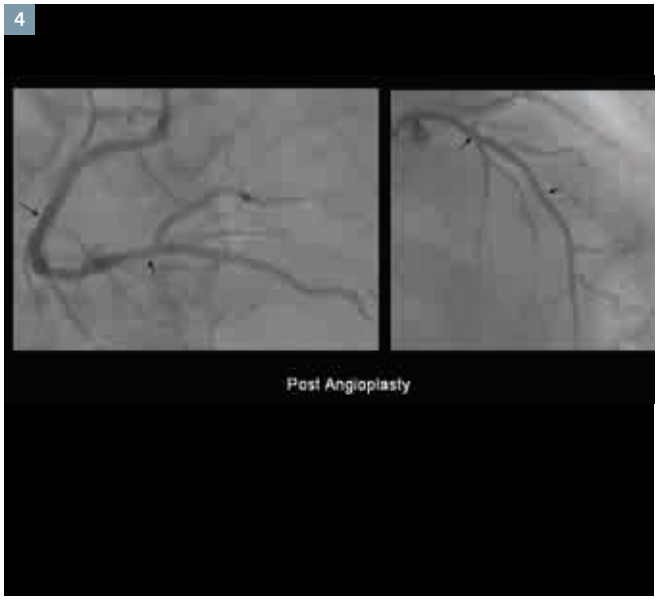
The patient underwent successful percutaneous transluminal coronary angioplasty (PTCA) of the diffuse proximal and distal LAD stenosis with 4 overlapping drug eluting stents. Proximal and mid-distal LCX stenoses were also stented. The RCA stenoses were not treated, since intervention was planned for a later date.

The patient underwent a relook coronary angiography after 1 week, which showed patent stents in the proximal-mid LAD, as well as patent stents in the proximal and distal LCX. The calcified diffuse, 90% mid RCA and 90% distal RCA lesions, were successfully stented using drug eluting stents.

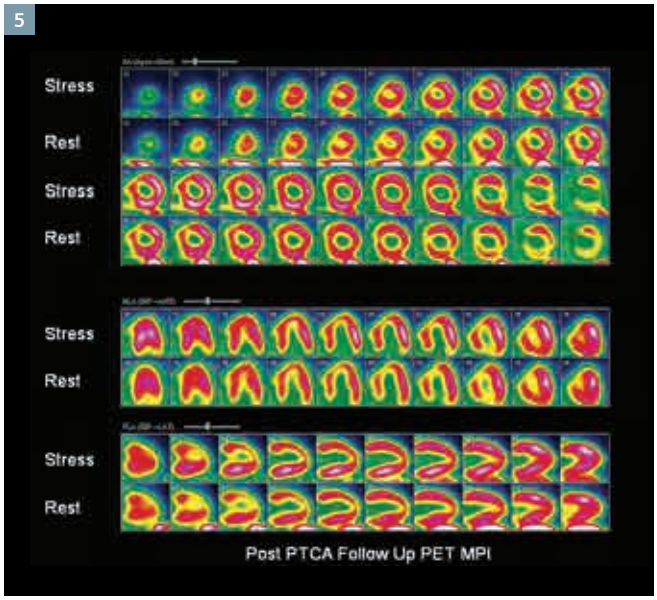
Figure 4 shows coronary angiographic images of RCA and LAD, which demonstrate normalization of flow through patent stents in mid and distal RCA as well as in proximal, mid and distal LAD.



3 Coronary angiography shows multiple stenosis in LAD, RCA and LCX.



4 Post-stent placement relook coronary angiography showing patent LAD and RCA stents.

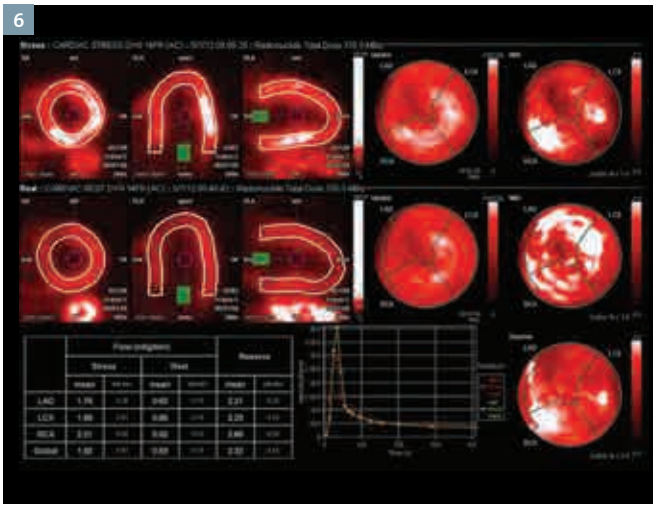


5 Follow-up ^{82}Rb PET myocardial perfusion study shows near normalization of perfusion in most arterial territories.

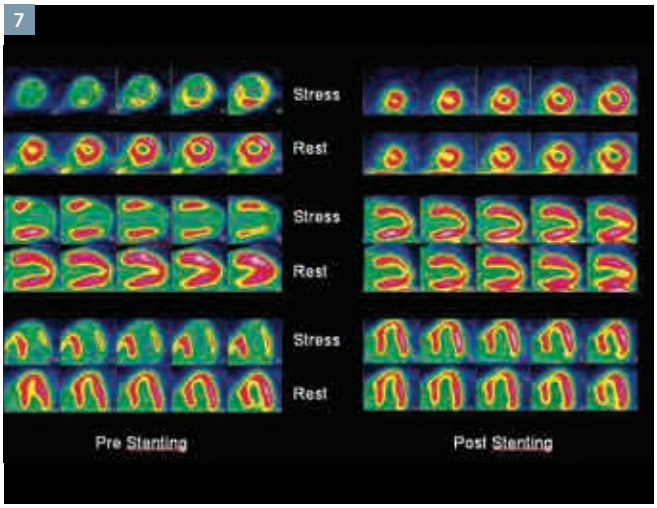
Subsequently, the patient underwent ^{82}Rb myocardial perfusion PET•CT after 2 months (May 2012) for a post-revascularization follow-up.

The follow-up ^{82}Rb PET stress/rest myocardial perfusion study showed significant improvement of perfusion for all arterial territories with resolution of high-risk features like post-stress LV dilatation. A mild fixed-perfusion defect in the antero-apical segment reflects previous infarction. A small area of residual ischemia was visualized in the inferolateral wall. Left ventricular ejection fraction (LVEF) was calculated to be 49%. Overall, the clinical impression was of significant improvement in global LV perfusion and resolution of high-risk features with minor persistent inferolateral inducible ischemia and moderate LV dysfunction. The patient was put on aggressive medical therapy and close clinical follow-up.

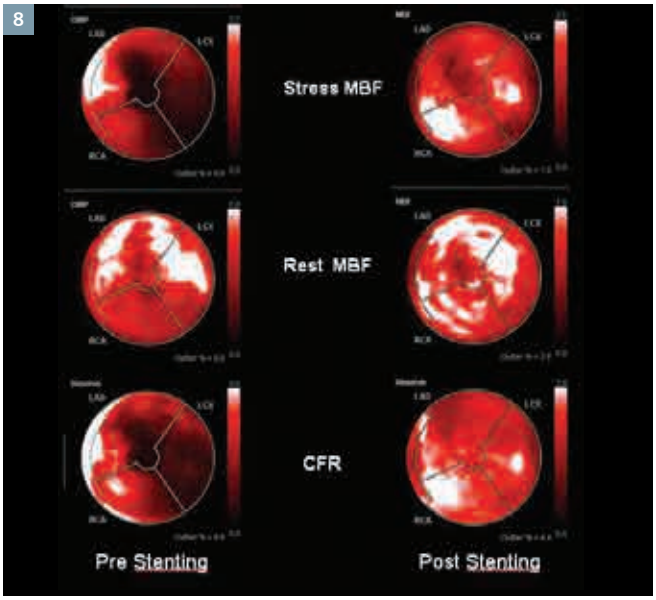
Stress MBF in the LCX territory was 1.89 ml/gm/min, a significant improvement when compared to the pre-PTCA study. The coronary flow reserve was also normal and significantly higher than the previous study: Global 2.32, LAD 2.21, LCX 2.20 and RCA 2.66.



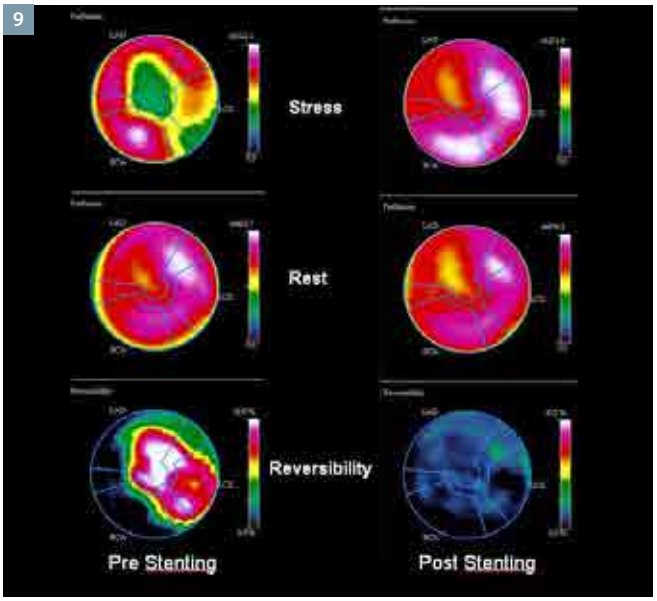
6 Post-PTCA follow-up MBF evaluation shows near normal stress blood flow in all arterial territories.



7 Static images of PET myocardial perfusion studies before and after stenting showing significant improvement in perfusion in all arterial territories.



8 Comparison of polar plots in perfusion studies, before and after stenting, demonstrate the extent and severity of ischemia and the near complete resolution of perfusion defect following stenting.



9 Comparison of polar plots of MBF and CFR, before and after stenting, shows the significant improvement in absolute blood flow and flow reserve following stenting.

Comments

This case illustrates the sensitivity of ^{82}Rb PET myocardial perfusion when detecting the extent and severity of ischemia and the extent of reversibility, as well as the accuracy of myocardial blood flow and coronary flow reserve measurements for the evaluation of ischemia severity and as an objective indicator of the success of interventions like stenting. *syngo*.PET MBF software's easy-to-use tool for measuring MBF and CFR is key in the adoption of absolute flow measurements, as a routine, in PET myocardial perfusion, and such an adoption can provide key criteria and benchmarks when measuring therapy response, as in this clinical example.

Value of Technology

Myocardial blood flow measurements using ^{82}Rb dynamic PET perfusion studies are helpful for quantitative assessments of coronary interventions, especially stents. MBF measurements with *syngo*.PET MBF software enable routine usage of such quantitative measurements due to the automated nature of the software and the ease of use.

Examination Protocol

Scanner	Biograph mCT 64
Scan Dose	^{82}Rb 40 mCi injection
Protocols	Acquisition Dynamic List mode (7 min) CT Low dose for CTAC

The statements by Siemens customers described herein are based on results that were achieved in the customer's unique setting. Since there is no "typical" hospital and many variable exist (e.g., hospital size, case mix, level of IT adoption) there can be no guarantee that other customers will achieve the same results.