

Case 6

A Comprehensive Cardiac CT Examination – CT Angiography, CT Stress Perfusion and CT Delayed Enhancement

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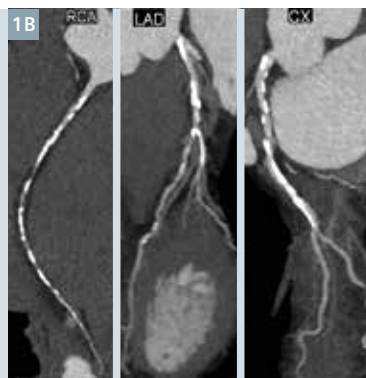
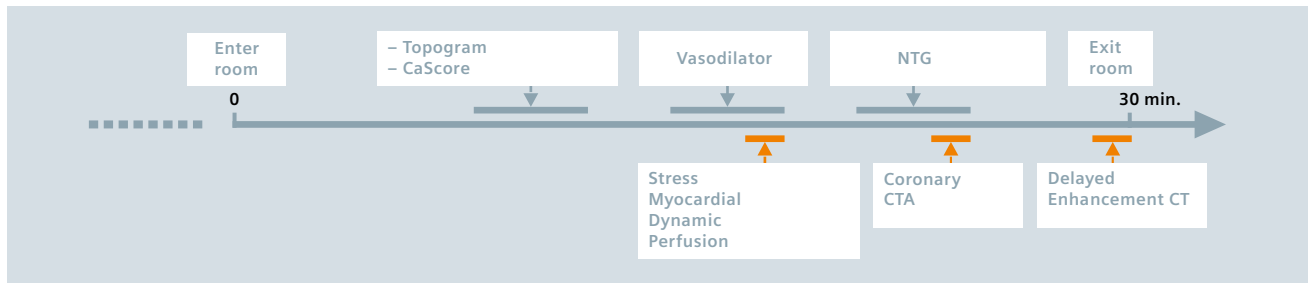
History

A 79-year-old male patient was referred to our hospital for a follow-up of his coronary heart disease. He was on medication for hypertension and was asymptomatic. The referring physician reported that the patient was diagnosed with multiple significant stenoses (#1 90%, #2 99%, #5

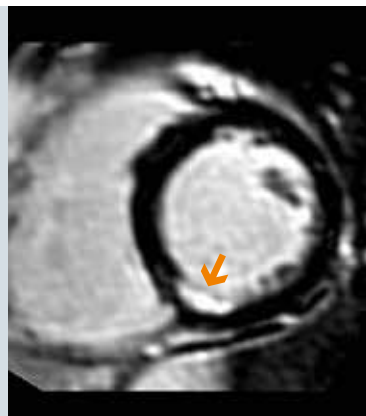
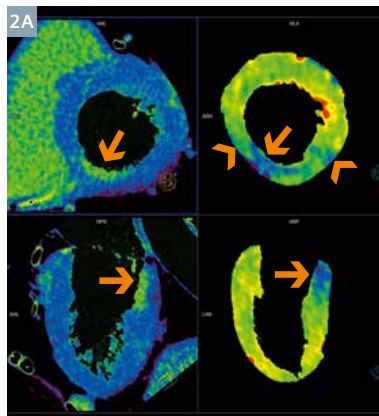
50%, #7 50% and #13 75%) by invasive coronary angiography in 2001, but had refused to undergo invasive revascularization. In 2010, the referring physician convinced the patient to undergo cardiac MR for follow-up. A sub-endocardial myocardial infarction with ischemia in the inferior wall

was revealed. The patient again preferred not to be treated by invasive angiography. Although multiple coronary stenoses were known, the main concern was whether the myocardial infarction or ischemia had worsened. This time, cardiac CT was indicated and an integrated cardiac CT examination

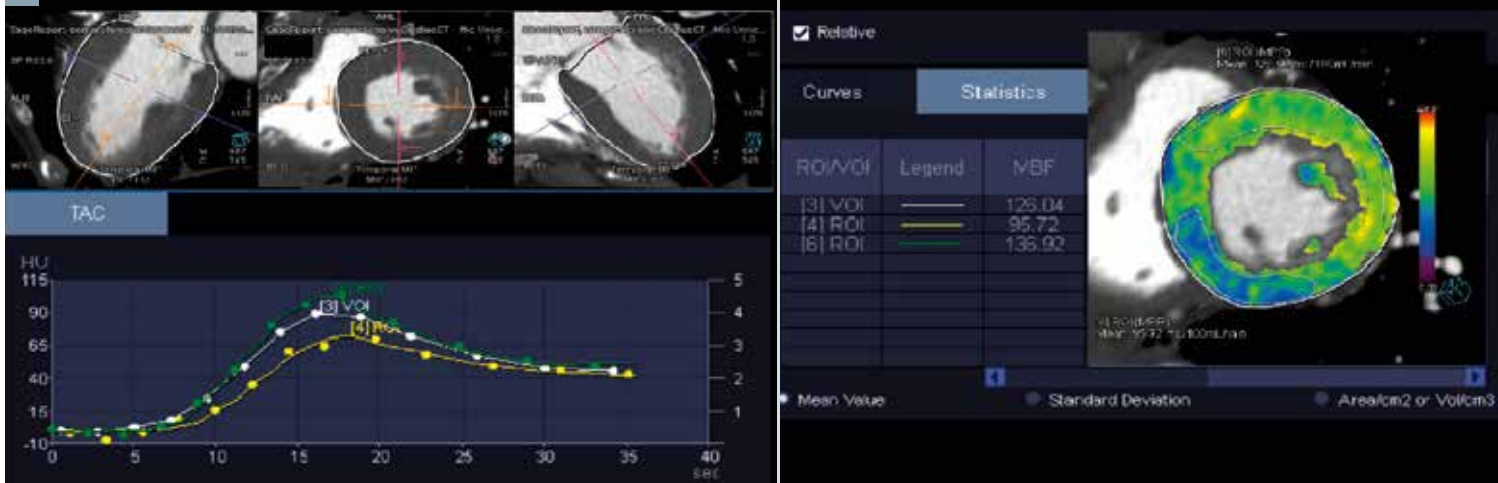
Table 1: Scheme of a comprehensive cardiac CT study



1
VRT (Fig. 1A) and curved MPR (Fig. 1B) images show coronary arteries with extensive calcifications.



2
A small area of severe perfusion deficit (arrows) within a larger one of moderate ischemia (arrowheads) in the inferior wall is shown in the MBF map (Fig. 2A, right, see also Fig. 3). This corresponds to a small subendocardial lesion (arrows) in the CT delayed enhancement scan (Fig. 2A, left). The left ventricle blood pool is suppressed by fusion with an end-systolic cCTA reconstruction. There is no significant change in comparison to the MR image acquired in 2010 (Fig. 2B).



3 MBF evaluation reveals a moderate ischemic area (ROI#4, in yellow, 96 mL/100 mL/min) in comparison to the normal myocardium in the same slice (ROI#6, in green, 137 mL/100 mL/min) and the whole myocardium (VOI#3, in white, 126 mL/100 mL/min).

was performed to assess the coronary arteries as well as the condition of the myocardium.

Diagnosis

Coronary CT angiography (cCTA) revealed extensive calcifications in the coronary arteries (Fig. 1); the right coronary artery (RCA) appeared to be affected most severely. Moderate ischemia was seen in the inferior wall in the myocardial blood flow (MBF) maps of the CT stress perfusion examination (Fig. 3). This RCA territorial ischemia included a severe perfusion deficit in the MBF maps at the same location of a small endocardial lesion in CT delayed enhancement scan, corresponding to a small infarction area (Fig. 2A). The sub-endocardial lesion was unchanged compared to the finding on cardiac MR 5 years earlier (Fig. 2B). As the patient was asymptomatic and did not wish invasive treatment, he was discharged to continue optimal medical therapy at home.

Comments

In cases of severely calcified coronary arteries, a direct evaluation of stenoses is difficult. However myocardial infarction and ischemia can be evaluated regardless of the condition of the arteries, as in this case. The 79-year-old patient was reluctant to undergo an invasive examination, a comprehensive CT evaluation including cCTA, myocardial stress perfusion and late enhancement, enabled by Dual Source CT, was helpful to analyze his situation. ■

Examination Protocol

Scanner	SOMATOM Force		
Scan area	Heart		
Scan mode	Stress myocardial perfusion	cCTA (Seq.)	Delayed enhancement
Scan length	101 mm	134 mm	103 mm
Scan direction	shuttle	Cranio-caudal	shuttle
Scan time	34 s (13 phases)	4.75 s	7 s (3 phases)
Tube voltage	80 kV	80 kV	80 kV
Tube current	88 mAs/rot.	130 mAs/rot.	190 mAs/rot.
CTDI _{vol}	22.6 mGy	6.7 mGy	11.2 mGy
DLP	239 mGy cm	239 mGy cm	118.6 mGy
Effective dose	3.3 mSv	1.27 mSv	1.66 mSv
Rotation time	0.25 s	0.25 s	0.25 s
Slice collimation	48 × 1.2 mm	168 × 0.6 mm	192 × 0.6 mm
Slice width	3 mm	0.6 mm	1 mm
Reconstruction increment	1 mm	0.3 mm	1 mm
Reconstruction kernel	Qr36	Bv40 ADMIRE 3	Qr36
Heart rate	53–115 bpm	48–51 bpm	48–51 bpm
Contrast		370 mg/mL	
Volume	40 mL	43 mL	–
Flow rate	5 mL/s	3.5 mL/s	–
Start delay	4 s	17 s	7 minutes after cCTA
Scan timing	ATP infusion start ↓ 3 min scan	ATP infusion release ↓ 3 min Nitro ↓ 7 min scan	coronary CTA ↓ 5 min scan

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