Case 2

Revealing a Myocardial Perfusion Defect, unseen on MRI, using Adenosine-stress Dual Energy CT

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History

A 68-year-old male patient, with a known history of coronary artery disease, was referred to our hospital due to unclear chest pain. Previously the patient had undergone percutaneous coronary angioplasty with stent placement. An adenosine-stress myocardial perfusion MRI was performed revealing no perfusion defect. Thereafter, the patient was referred for a coronary CT angiography with adenosine-stress myocardial perfusion using Dual Energy CT (DECT) mode.

Diagnosis

CT was carried out directly under stress conditions after an i.v. infusion of adenosine (140 µg per kg body weight per minute) and no rest phase.

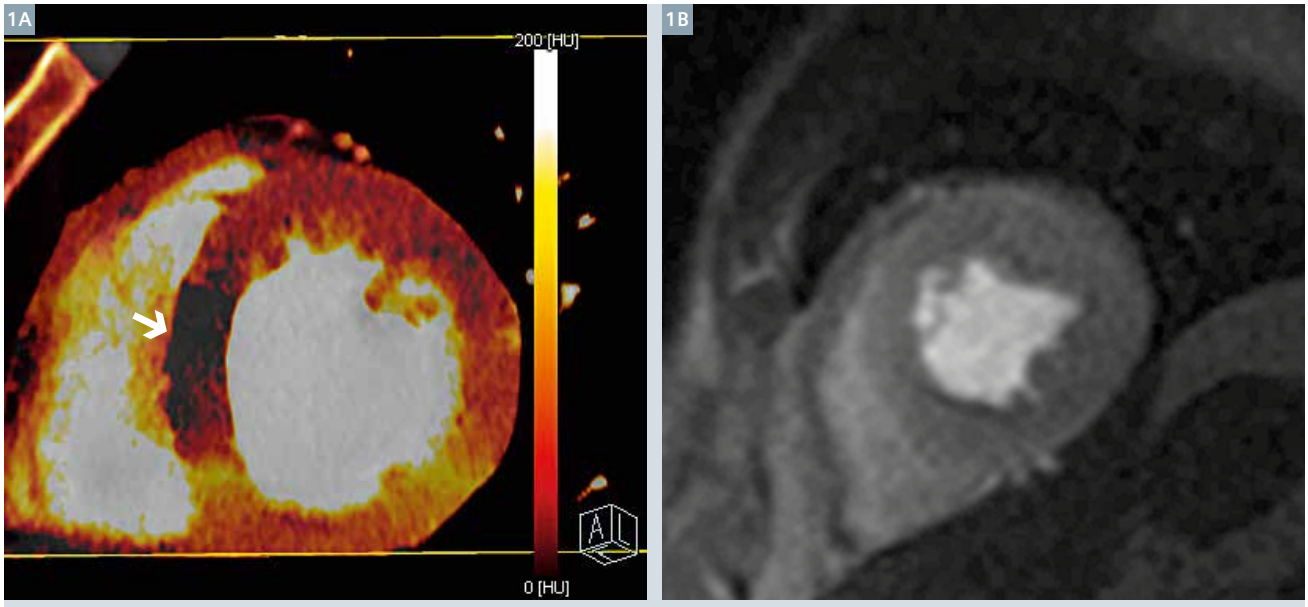
CT angiography with systolic reconstruction revealed a moderate stenosis in the mid-left anterior descending coronary artery (LAD) caused by a non-calcified plaque. Myocardial iodine distribution maps, as a surrogate for myocardial perfusion generated using *syngo*.CT DE Heart PBV, showed a large perfusion defect in the mid-septum with normal wall motion and no late enhancement (not shown). Invasive coronary angiography confirmed the LAD stenosis with a pathological fractional flow reserve (FFR) of 0.68 and was therefore stented. An additional high-grade septal branch stenosis was seen but not treated due to its small vessel caliber.

Comments

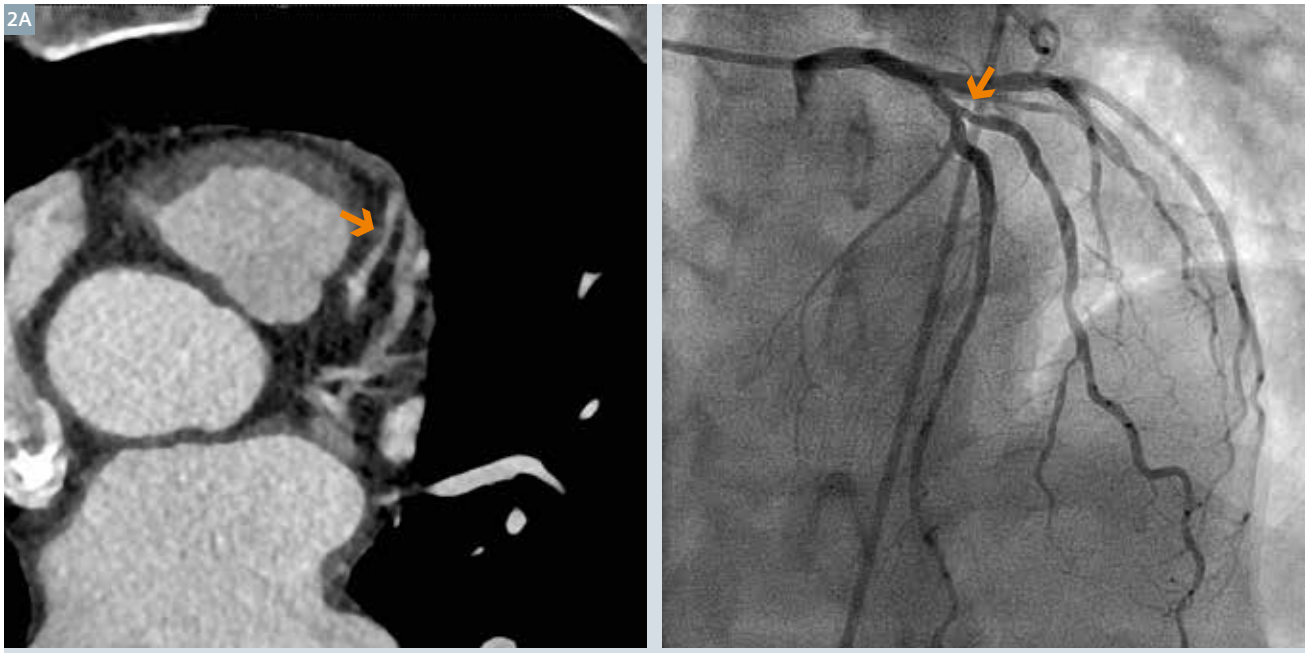
The contradicting results of two "gold standard" tests, i.e. adenosine-stress MRI and invasive FFR, makes this case interesting. While MRI, as the preferred non-invasive imaging test in this clinical scenario, is negative whereas a still novel and non established method, i.e. adenosine-stress DECT, delivers both information on a moderate LAD stenosis and its impact on myocardial perfusion with an obvious perfusion defect of the septum in agreement with invasive coronary angiography and FFR measurement. This case highlights the necessity of deepening research and widening clinical implication of myocardial perfusion imaging with DECT as it can provide both morphological and functional information from one scan. Compared to time-resolved myo-

Examination Protocol

Scanner	SOMATOM Force		
Scan area	Heart	Pitch	0.28
Scan length	97 mm	Slice collimation	128 × 0.6 mm
Scan direction	Cranio-caudal	Slice width	1.5 mm
Scan time	2.3 s	Reconstruction increment	1 mm
Tube voltage	90 / Sn150 kV	Reconstruction kernel	Qr40 ADMIRE 2
Tube current	130 / 102 mAs	Heart rate	68 – 83 bpm
Dose modulation	CARE Dose4D	**Contrast**	400 mg/mL
$CTDI_{vol}$	20.75 mGy	Volume	50 mL
DLP	266.3 mGy cm	Flow rate	5 mL/s
Effective dose	3.7 mSv	Start delay	Test bolus
Rotation time	0.25 s		



1 Mid-ventricular short axis view of iodine distribution maps of stress DECT (Fig. 1A, arrow) reveals a large septal perfusion defect which is not seen in the stress myocardial perfusion MRI (Fig. 1B).



2 CT angiography with systolic reconstruction shows a moderate stenosis of the LAD (Fig. 2A, arrow). An invasive coronary angiography (Fig. 2B, arrow) confirms CTA results with pathological FFR of the LAD stenosis of 0.68 indicating an ischemia.

cardial imaging approaches, such as dynamic perfusion CT or MRI, DECT images are acquired in just one single breath-hold within typically 8–10 seconds shortly after peak aortic enhancement. In our opinion, this makes the dual energy approach to myocardial perfusion imaging an attractive method with enormous potential for clinical use. ■

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