Case 2

Low Dose Coronary CT Angiography using ECG-Gated Retrospective Spiral CT

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History

A 75-year-old male patient, with high blood pressure and elevated cholesterol levels, was admitted due to a recent onset of atypical chest discomfort. The physical examination was unremarkable. Biometric parameters, such as weight (58 kg), height (169 cm), heart rate (53 bpm), blood pressure (130/80 mmHg), as well as ECG and echocardiogram were normal at admission. A maximal treadmill stress test (Bruce Protocol) disclosed moderate exercise tolerance (7'30") with no angina but minor ST-T changes on the left precordial leads. A coronary CT angiography (cCTA) was requested for further evaluation.

Diagnosis

cCTA images depicted a 14 mm-long mixed plaque in the mid-left anterior descending artery (LAD) causing a 70–90% stenosis in the distal section. No significant plaques were seen in the left-main (LM), the circumflex (Cx) or the right coronary artery (RCA). The left ventricular ejection fraction was 65% with no wall motion abnormalities.

Calcium scoring (with a total score of 59.5) revealed a mild calcification status with calcified plaques mainly distributed in the LAD and the Cx.

A cardiac catheterization was performed, confirming the LAD stenosis. A zotarolimus-eluting stent (2.75 × 14 mm) was successfully deployed after a pre-dilatation using a plain balloon. An excellent angiographic result was achieved and the patient was then asymptomatic.

Comments

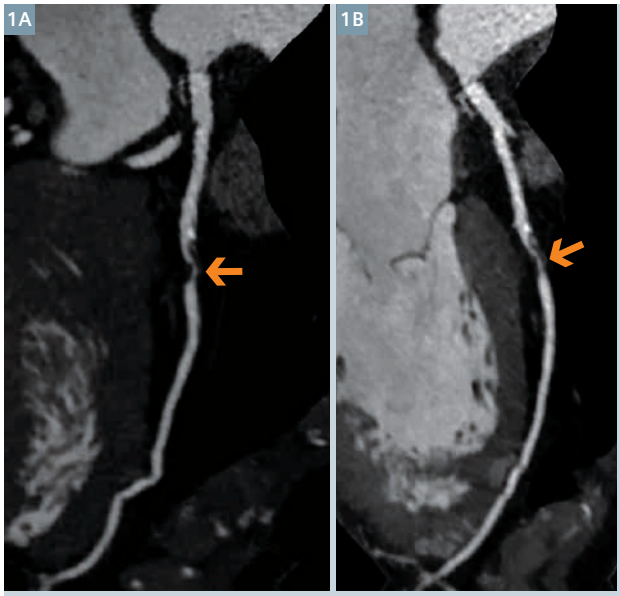
cCTA resulted in a decisive diagnosis for this patient considering the original symptoms of atypical chest pain and an equivocal stress test. The disclosed nature of the plaques and severity of the stenosis further helped in planning a percutaneous interventional procedure.

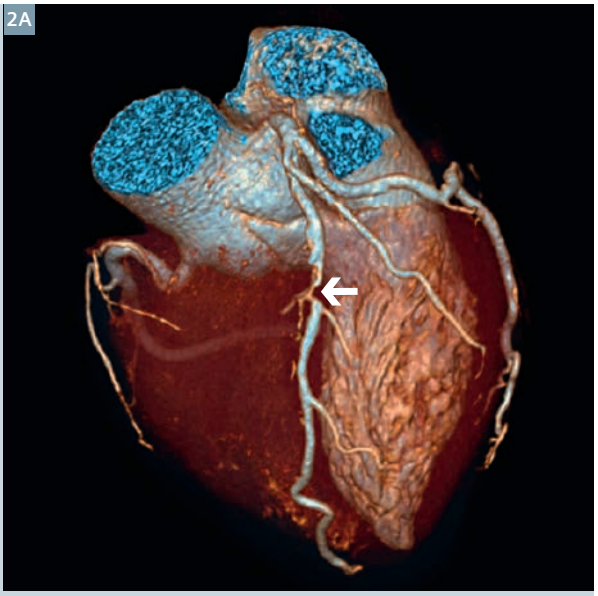
The application of all supplied advanced techniques, such as ECG pulsing, iterative reconstruction (SAFIRE[1]), iTrim and lower kV setting (110 kV), resulted in excellent image quality and a very low effective dose of only 1.44 mSv. ■

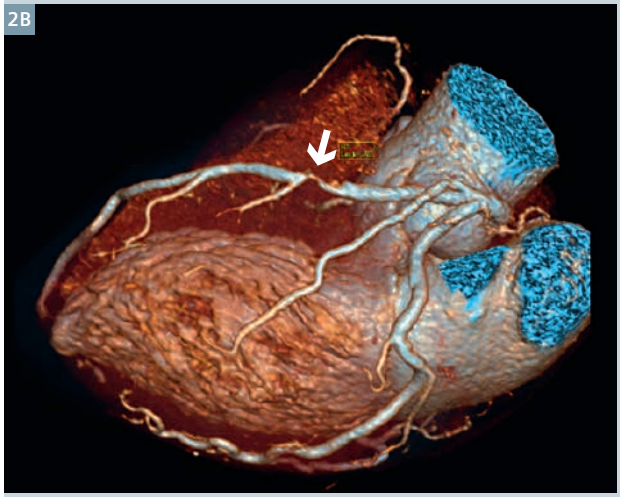
Examination Protocol

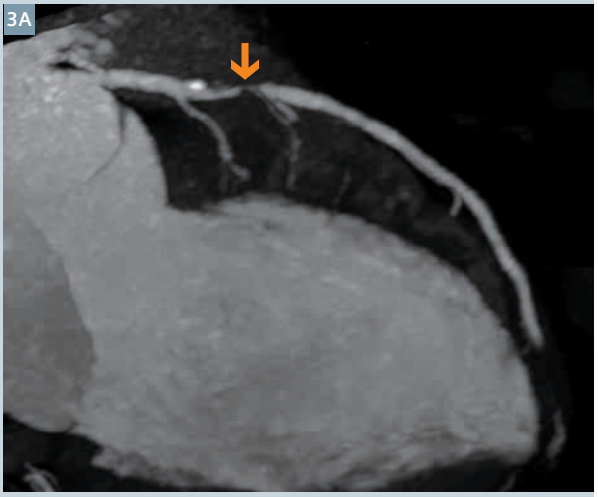
Scanner	SOMATOM Perspective		
Scan area	Heart	Rotation time	0.48 s
Scan mode	ECG-gated retrospective spiral scan	Pitch	0.27
Scan length	99.5 mm	Slice collimation	64 x 0.6 mm
Scan direction	Cranio-caudal, feet first	Slice width	0.75 mm
Scan time	4.6 s	Reconstruction increment	0.5 mm
Tube voltage	110 kV	Reconstruction kernel	I30s
Tube current	87 mAs	Heart rate	51–53 bpm
Temporal resolution	195 ms with iTrim	**Contrast**	370 mg / mL
$CTDI_{vol}$	6.47 mGy	Volume	75 mL + 60 mL saline
DLP	103 mGy cm	Flow rate	6 mL / s
Effective dose	1.44 mSv	Start delay	Test bolus

[1] In clinical practice, the use of SAFIRE may reduce CT patient dose depending on the clinical task, patient size, anatomical location, and clinical practice. A consultation with a radiologist and a physicist should be made to determine the appropriate dose to obtain diagnostic image quality for the particular clinical task. The following test method was used to determine a 54 to 60% dose reduction when using the SAFIRE reconstruction software. Noise, CT numbers, homogeneity, low-contrast resolution and high contrast resolution were assessed in a Gammex 438 phantom. Low dose data reconstructed with SAFIRE showed the same image quality compared to full dose data based on this test. Data on file.









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Angio TAC coronárias
Patient Protocol
28-10-2013 12:20:20

Total mAs 1195 Total DLP 181 mGycm

	Scan	kV	mAs / ref.	CTDIvol mGy	DLP mGycm	TI s	cSL mm
Patient Position F-SP							
Topograma	1	130		0.10(a)	4.87	4.5	0.6
CaScoreSeq	2	130	16 / 30	1.96(a)	20.31	0.41	0.6
TestBolus	5	110	40	53.08(a)	53.08	0.6	5.0
CorCTA	24	110	87 / 250	6.47(a)	103.01	0.48	0.6

Z: 1
C: 200
W: 50

Page: 1 of 1 Phantom Type (a) 32cm (b) 16cm

1–3 Curved MPR (Fig. 1), VRT (Fig. 2) and MIP (Fig. 3) images show a severe LAD stenosis (arrows) caused by mixed plaques.

4 Patient protocol records the dose resulting from each scan series.