Intern Emerg Med (2010) 5:67–69
DOI 10.1007/s11739-009-0279-7

CE - MEDICAL ILLUSTRATION

Anomalous origin of circumflex arteries evaluated with MDCT

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Received: 8 May 2009 / Accepted: 10 June 2009 / Published online: 8 July 2009

Introduction

To date, coronary angiography (CA) is the gold standard technique for the evaluation of coronary vessels (CVs). However, CA provides only a two-dimensional view of the CVs and sometimes fails to clearly visualise the relationship between CVs and surrounding structures. This issue becomes critical when anomalous CVs must be visualised. Moreover, it is not always easy to selectively engage the anomalous CV which may lead to the erroneous assumption that the CV is occluded.

Congenital coronary artery anomalies are rare and occur in 0.17% of the autopsy cases. The incidence of anomalous origin of the CVs is higher in the population of patients referred for CA (0.6–1.3%) [1].

Although anomalous CVs lack clinical significance, in the majority of the patients, there are some "malignant" anomalies that may cause non-fatal or fatal acute myocardial infarction or sudden death especially in young athletes without atherosclerotic coronary artery disease (CAD). In older patients, both CAD and CV anomalies may be present and in these cases it is difficult to clarify the exact mechanism of myocardial ischaemia.

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In the last few years, several studies showed the usefulness of non-invasive modalities for the detection of CV anomalies such as magnetic resonance imaging, electron beam computed tomography (EBCT) and especially multidetector computed tomography (MDCT).

Although the clinical role of MDCT is under discussion, several studies have been published where MDCT with retrospective ECG-gating was used as a non-invasive tool to visualise coronary anatomy. In clinical practice, MDCT is being used for the detection of CV lesions in symptomatic patients with low–intermediate pre-test probability to have CAD, to follow-up CAD patients treated with bypass surgery or percutaneous angioplasty [2]. This is possible because MDCT has an excellent spatial resolution which allows a good assessment of the atherosclerotic plaque. In the recent scientific statement of the American Heart Association, MDCT was pointed as a class IIa technique (level of evidence C) for the visualisation of CV anomalies [3].

In the literature, there are several interesting papers where MDCT was successfully used to visualise anomalous CVs [4, 5].

In this paper, we describe the anomalous origin and course of two circumflex arteries.

Case 1

A 63-year-old male was referred to us because during a routine EBCT, calcium scoring test was found to have a moderate Agatston score. The patient is a mild smoker, but asymptomatic. Basal physical examination, blood pressure (135/80 mmHg) and blood tests were within normal limits. No abnormalities were found in the electrocardiogram; his heart rate was 56 beats per minute.

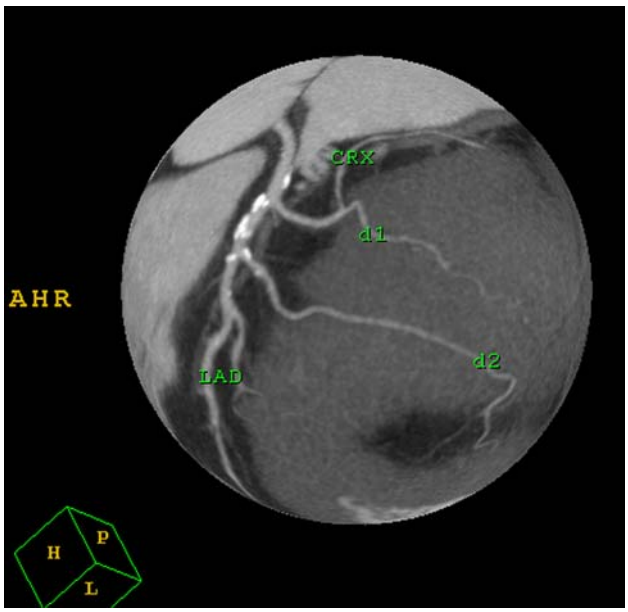

Fig. 1 Globe image of the left coronary artery; the circumflex artery (*CRX*) originates from the first diagonal branch (*D1*). The left anterior descending coronary artery (*LAD*) has calcified plaques in the mid-portion which caused a mild stenosis (<50%)

MDCT was performed successfully (Philips Brilliance 64) using 80 ml contrast medium (Iomeron 400, Bracco) and all coronary segments were visualised.

The right coronary artery (RCA) was the dominant vessel and had no significant lesions; also, the posterior descending coronary artery (PD) and a postero-lateral vessel (PL) were free and form significant atherosclerotic lesions. Left main (LM) was normal. The left anterior descending (LAD) coronary artery showed calcified plaques in the mid-portion, which caused a mild stenosis (<50%). No lesions were seen in the proximal and distal portions of the LAD. There were three big diagonal vessels without lesions. Interestingly, the circumflex artery (CX) arose from the first diagonal vessel and had no significant lesions (Fig. 1).

Because the patient was asymptomatic and there was no evidence of significant CAD, he underwent only a maximal treadmill test which was negative. At a follow up, 1 year later, he was still asymptomatic and doing fine.

Case 2

A 61-year-old male patient was referred to us after having performed a traditional CA for suspected CAD.

CA showed that RCA was the dominant vessel and along with the left coronary artery (LCA) originated from the right sinus of Valsalva (Fig. 2). Although several projections were performed, it was not possible to visualise the CX artery.

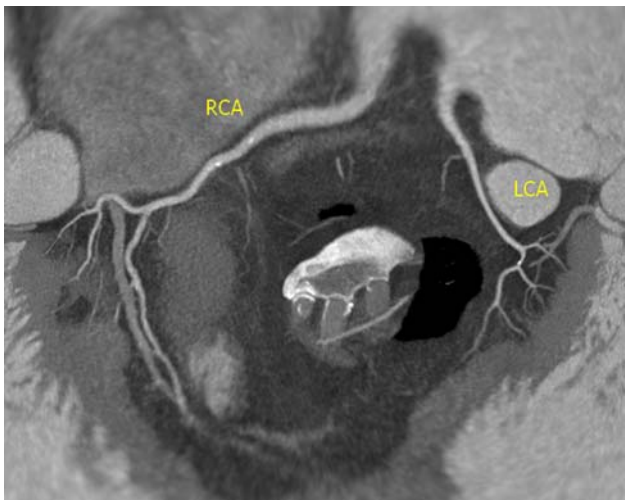

Fig. 2 Two-dimensional map (2D map) of the coronary tree. The left coronary artery (*LCA*) originates close to the right coronary artery and gives only a left anterior descending artery (LAD); the circumflex artery is absent. The right coronary artery (*RCA*) is dominant and has a soft plaque at the crux (50%)

MDCT was performed successfully (Philips Brilliance 64) using 100 ml contrast medium (Iomeron 400, Bracco) and all coronary segments were visualised. Prior to MDCT, the patient was treated with beta-blockers per os (metoprolol 50 + 50) because his heart rate was high.

The RCA was the dominant vessel; at the crux, there was a soft plaque which caused a 50% reduction of the lumen (Fig. 2). There were a big PD and PL arteries that were free from significant atherosclerotic lesions.

The LCA arose from the right sinus of Valsalva and gave origin only to an LAD in the absence of CX artery. From the LAD originated three diagonal branches without lesions (Fig. 3).

Discussion

Coronary angiography is still the gold standard technique to evaluate CVs. However, this technique is a luminography and is unable to visualise the vessel's wall and the presence of soft or calcified plaques.

EBCT gives us information regarding the presence of calcium in the CVs wall which is important to stratify the prognostic value of CAD. However, with EBCT, the data related to the lumen of the vessel as well as the presence of non-calcified plaques are missed.

All these information can be obtained with MDCT.

However, MDCT should be used carefully as there is some concern regarding its high radiation dosage, especially when patients, besides MDCT, must perform CA and/or myocardial perfusion scintigraphy. Fortunately, recent improvements in MDCT technology with the

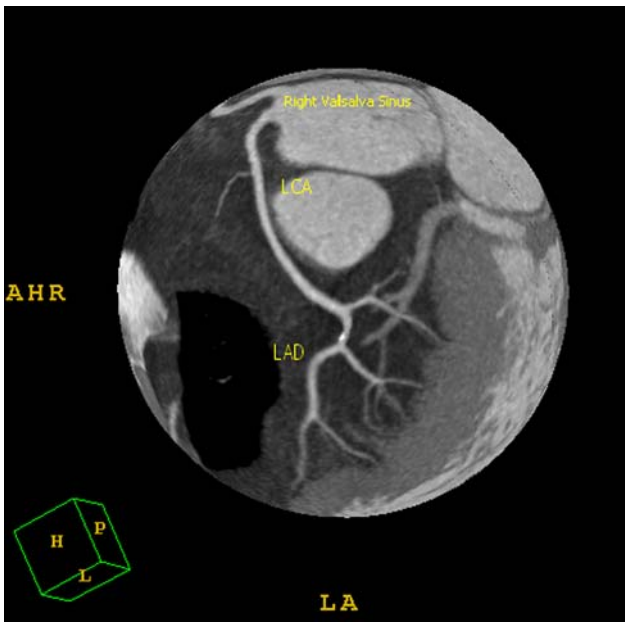

Fig. 3 Globe image of the left coronary artery (*LCA*). The LCA arises from the right sinus of Valsalva and gives origin only to a left anterior descending artery (*LAD*); there is not a circumflex artery

introduction of the "step and shoot" protocols reduced the radiation dosage significantly from about 18 to 4 mSv which is almost equal to that of traditional CA.

In the first case, MDCT showed us that regardless of the Agatston score the calcified plaques in the LAD were not significant.

In the second case, CA was not able to visualise the soft lesion of the RCA at the level of the crux which in fact could be responsible for the symptoms of the patient.

Moreover, MDCT in both cases was able to give us information related to the anomalous origin of both CX arteries and visualise the course of the CVs within the heart.

In both cases, MDCT was useful to decide on how to treat the patient.

Conclusion

In this paper, we describe the usefulness of MDCT in the evaluation of patients suspected to have CAD. In particular, MDCT was able to detect a rare anomalous origin of a CX artery which arose from the first diagonal branch and a case of a LCA which arose from the right sinus of Valsalva and gave origin only to the LAD in the absence of CX artery.

Conflict of interest statement The authors declare that they have no conflict of interest related to the publication of this manuscript.

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