VIA MEDICA

CASE REPORT

Vol. 64, No. 4, pp. 334–337

ISSN 0015–5659
www.fm.viamedica.pl

An unusual crossed course of separately originating left circumflex and left anterior descending arteries with concomitant anomalies found in multi-slice computed tomography

Elżbieta Czekajska-Chehab[1], Grzegorz J. Staśkiewicz[3], Elżbieta Mazur-Stążka[2], Andrzej Drop[2], Ryszard Maciejewski[3]

[1]*First Department of Radiology, Medical University of Lublin, Poland*
[2]*Department of Cardiology, Medical University of Lublin, Poland*
[3]*Department of Human Anatomy, Medical University of Lublin, Poland*

[Received 29 June 2005; Accepted 25 July 2005]

Coronary artery anomalies occur in approximately in 1–2% of the population. The split origin of branches of the left coronary artery is a relatively common anomaly, usually with no significant observable impairment of cardiac function. The application of multi-slice computed tomography (MSCT) for cardiac imaging is increasing and becoming, along with other techniques, a recognised method of examination of the coronary arteries.
In the case presented we observed in an ECG-gated MSCT the anomalous origin and proximal course of the arteries of the left sinus of Valsalva. The ostiae of both coronary arteries were located unusually: the ostium of the LAD was found posterior to the ostium of the LCx. Because of this, the proximal part of the LAD crossed the proximal part of the LCx superiorly. Furthermore, muscular bridges were found in the middle part and in the first diameter branch of the LAD. To our knowledge, this is the first case of a crossed course of the LCx and the LAD to be presented in the literature.
Applications of MSCT in coronary imaging are presented in comparison with other diagnostic imaging methods. The advantages and limitations of MSCT as a diagnostic tool for anomalies of the coronary arteries are discussed.

Key words: coronary arteries, coronary vessel anomalies, computed tomography

INTRODUCTION

Coronary artery anomalies (CAA) occur in approximately 1–2% of the population [5]. CAA are observed in up to 5.64% of patients undergoing coronary angiography [3], albeit in only 0.3% of cases in autopsies [2]. Abnormalities may affect the following features of the coronary arteries: number, location, size and angle of origination of the ostium, size, proximal course, mid-course, arteriolar ramifications and termination [3]. CAA present with varying severity and a wide range of clinical symptoms, from benign or even asymptomatic, to severe or critical.

The split origin of branches of the left coronary artery (LCA) is a relatively common CAA. The left main trunk (LMT) is absent and there are separate but adjacent ostia of the left anterior descending artery (LAD)

Address for correspondence: Elżbieta Czekajska-Chehab, MD, PhD, First Department of Radiology, ul. Jaczewskiego 8, 20–954 Lublin, Poland, tel: +48 81 742 52 10, e-mail: czekajska@gazeta.pl

and left circumflex artery (LCx) from the left sinus of Valsalva (LSV). The distribution pattern of the vessels is otherwise normal. This anomaly is found more often in patients with dominance of the left coronary artery and aortic valve disease [6]. Rigatelli and Rigatelli [9] found this anomaly in 0.31% of examinations and included it in the group of benign coronary artery anomalies, as no haemodynamic impairment is observed in patients [4]. In our material of over 600 cardio-CT examinations we found a separate origin of branches of the LCA in 6 patients. In one case we observed unusual courses of the LCx and LAD. To our knowledge, this is the first case of a crossed course of the LCx and LAD to be presented in the literature.

Figure 1. Maximum intensity projection (MIP) of the left sinus of Valsalva. Crossed origins of the LAD (arrowhead) and LCx (blank arrowhead) are visible.

Figure 2. A volume rendering (VR) view of the heart and great vessels shows the crossed course of the LAD (arrowhead) and LCx (blank arrowhead).

CASE REPORT

S.P., a 57-year-old male, was referred to the Department of Radiology for a MSCT examination of the heart to be performed because of an atypical cardiac pain during the preceding month. Pre-contrast and contrast-enhanced MSCT of the heart was performed in an attempt to visualise coronary anatomy in the patient. MSCT was performed using an 8-row LightSpeed Ultra scanner (GE Medical Systems). Scanning, with a 0.5 s. rotation time, 8 × 1.25 mm collimation and 2.75 mm/s table feed, was performed pre-contrast and after an iv 130 ml bolus of non-ionic contrast with 0.5 s. rotation time, 8 × 1.25 mm collimation and 2.75 mm/s table feed. The delay time was determined with a test bolus option with measurements of attenuation in the left atrium. Retrospective ECG-gated reconstruction was performed at a 1.25 mm interval with predefined temporal offset at a 70% R-R wave interval (at diastole). Secondary reconstructions of a series of axial scans were performed at 5–95% R-R with a 10% increment. Post-processing of the axial scan series was performed with multi-planar reformations (MPR) in sagittal, frontal, curved and oblique planes, and 3D reconstructions in volume rendering mode.

The examination showed minimal enlargement of the left ventricle: EDV — 182 ml, ESV — 79 ml, SV — 103 ml, EF — 56%. The Agatston calcium score was 57. In the left sinus of Valsalva separate ostiae of the LCx and LAD were observed (Fig. 1). The ostiae of both coronary arteries were located unusually: the ostium of the LAD was found to be posterior to the ostium of the LCx. Because of this, the proximal part of the LAD crossed the proximal part of the LCx superiorly (Figs. 2, 3). Both branches were slightly smaller proximally, although in the distal parts of both arteries the diameters were normal. In the proximal parts of both branches of the LCA insignificant atherosclerotic plaques were found. Muscular bridges were found in two arteries: in the middle part of the LAD, a superficial intramuscular course of about 12 mm and a longer one of about 20 mm in the course of first diagonal artery (Dx1) (Figs. 4, 5). A short, soft atherosclerotic plaque was found in the middle part of the RCA, which was narrowing the

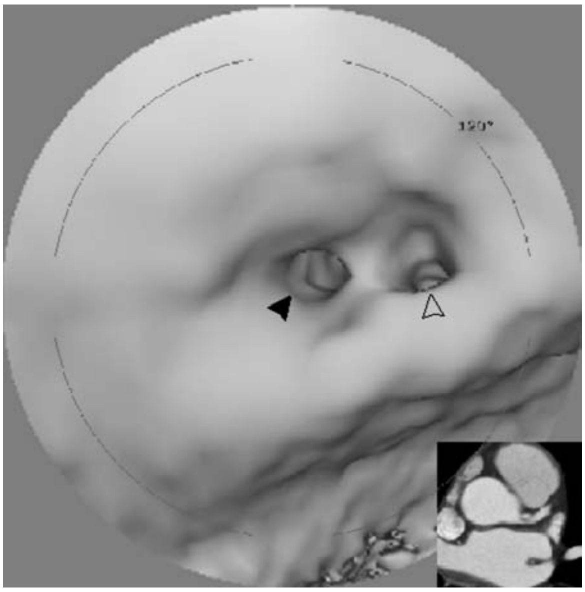

Figure 3. Virtual angioscopy of the left sinus of Valsalva with an endoluminal view of the separate origins of the LAD (arrowhead) and LCx (blank arrowhead).

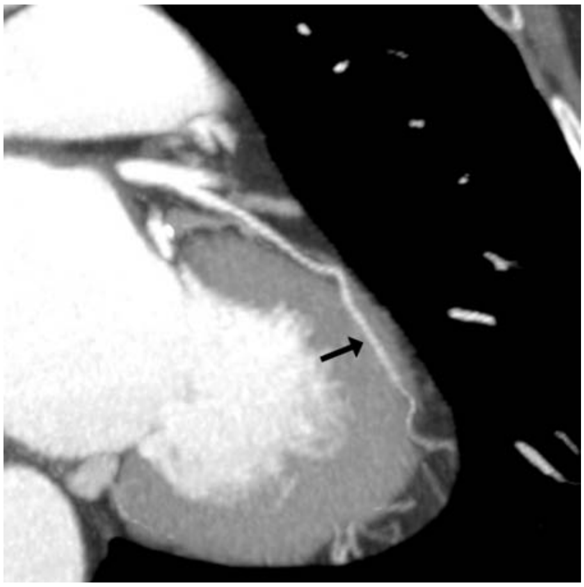

Figure 5. Muscular bridge in the course of the Dx1 (arrow); curved plane reconstruction.

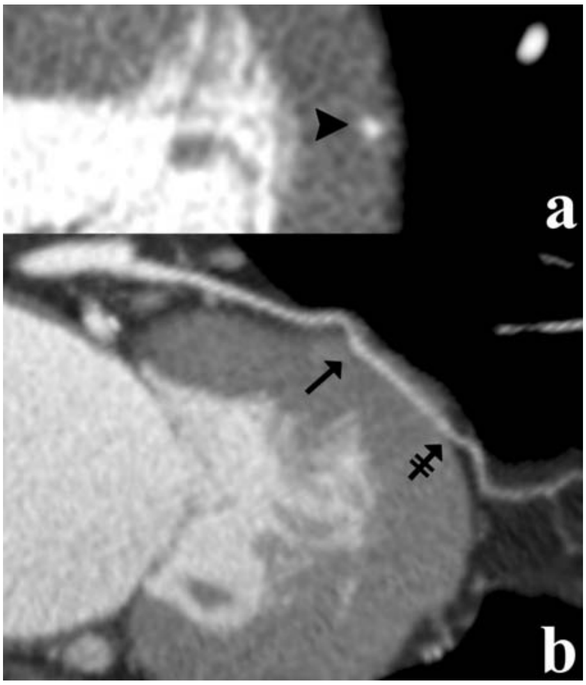

Figure 4. Muscular bridge in the course of the LAD. The part of the figure indicated by the arrowhead (**a**) shows the intramural course of the LAD; the part indicated by the arrow and crossed arrow (**b**) — a curved plane reconstruction — shows the proximal and distal end of the bridge respectively. Narrowing of the lumen in the intramural part of the vessel is visible.

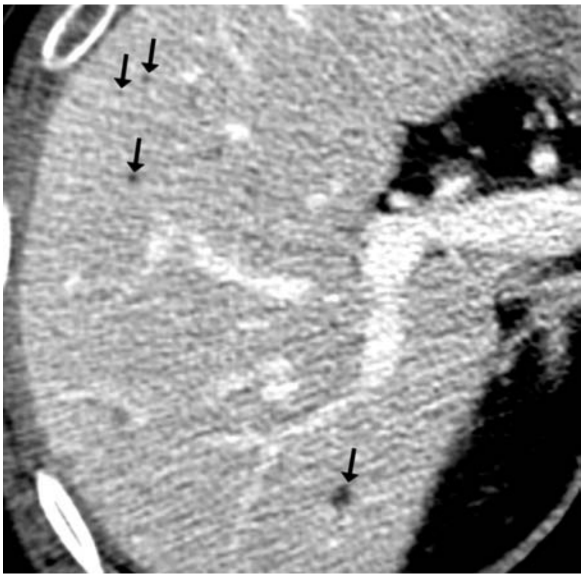

Figure 6. Multiple hypodense lesions (arrows) of the liver diagnosed as multiple lipomas.

lumen by about 50% when compared to the slightly dilated prestenotic part, and by about 22% when compared to the lumen of the whole artery. The courses of distal parts of the coronary arteries were normal. The part of the liver included in the examination showed multiple small hypodense lesions, which were found to be hyperechogenic in ultrasound examination and diagnosed as multiple lipomas of the liver (Fig. 6).

On the basis of the changes found, oral statins were administered to the patient and he was referred for control CT study for follow-up in six months.

DISCUSSION

MSCT is an emerging method for examination of the coronary arteries. Its major advance is its excellent spatial and temporal resolution, its qualitative and quantitative cardiac analysis and the application of post-processing methods. Although temporal resolution of MSCT is lower in comparison with conventional coronary angiography, MSCT is not limited by such features of angiography as its invasive character, with its 1.5% morbidity rate [1], or its planar view, with the restricted angle of angiographic projections. Although MRI allows multiplanar reformations, it is limited by its temporal resolution [8], which may result in poor image quality, especially in patients with tachycardia or arrhythmia, and by the yet unresolved question of safety in patients with pacemaker implants [4].

In patients with a separate origin of the LAD and LCx it may be angiographically difficult to visualise the difference between a short and an absent LMT. According to Yamanaka and Hobbs [12], in some cases it may not be recognised if the catheter is positioned anteriorly or posteriorly in the LSV and misinterpreted as an obstruction or absence of the LCx or LAD, respectively. Furthermore, it is difficult to assess the relationship of the anomalous artery to other structures such as the pulmonary arteries in angiography as the catheter limits the location of a contrast injection [7]. In our opinion, the variant we presented here might have been unrecognised in previously presented cases of coronary artery anomalies because of the mentioned limitations of angiographic procedures.

The value of cardiac MSCT examination is still increasing. Although 4-slice CT has been considered to be an appropriate mode of examination of only proximal segments of coronary arteries [11], the modern CT scanners allow both spatial and temporal resolution of sufficient quality to assess the middle and even distal parts of the coronary arteries, as in the case presented. We found all post-processing of the algorithms used in the study — multiplanar reformations (MPR), virtual angioscopy, volume rendering and curved plane reformations — useful in assessment of the relations and morphology of the anomalous coronary artery. MPR and virtual angioscopy are considered to be useful, especially for delineation of the shape of the anomalous orifice of the coronary arteries, which is essential if vascular intervention is planned in the patient [10]. Volume rendering allows three-dimensional relations of adjacent structures to be presented, which may be important for clinicians and surgeons in further therapy planning.

In the case presented MSCT enabled the anomalous course of proximal parts of the LAD and LCx to be visualised with additional examination of their distal parts, diagnosis of muscular bridges and atherosclerotic plaques, estimation of cardiac function and visualisation of concomitant lesions of the liver.

REFERENCES

1. Achenbach S, Ulzheimer S, Baum U, Kachelriess M, Ropers D, Giesler T, Bautz W, Daniel WG, Kalender WA, Moshage W (2000) Non-invasive coronary angiography by retrospectively ECG-gated multislice spiral CT. Circulation, 102: 2823–2828.
2. Alexander RW, Griffith GC (1956) Anomalies of the coronary arteries and their clinical significance. Circulation, 14: 800–805.
3. Angelini P (2002) Coronary artery anomalies — current clinical issues. Tex Heart Inst J, 29: 271–278
4. Gimbel JR, Kanal E (2004) Can patients with implantable pacemakers safely undergo magnetic resonance imaging? J Am Coll Cardiol, 43: 1325–1327.
5. Gowda RM, Khian IA, Undavia M, Vasadava BC, Sacchi TJ (2004) Origin of all major coronary arteries from left sinus of Valsalva as a common coronary trunk: single coronary artery. A case report. Angiol, 55: 103–105.
6. Hobbs RE, Millit HD, Raghavan PV, Moodie DS, Sheldon W (1982) Congenital coronary anomalies: clinical and therapeutic implications. In: Vidt D (ed.). Cardiovascular Therapy. Philadelphia, PA: FA Davis, pp. 43–58.
7. van Ooijen PMA, Dorgelo J, Zijlstra F, Oudkerk M (2004) Detection, visualization and evaluation of anomalous coronary anatomy on 16-slice multidetector-row CT. Eur Radiol, 14: 2163–2171.
8. Pannu HK, Flohr TG, Corl FM, Fisman EK (2003) Current concepts in multi-detector row CT evaluation of the coronary arteries: principles, techniques, and anatomy. Radiographics, 23: S111–S125.
9. Rigatelli G, Rigatelli G (2003) Coronary artery anomalies: what we know and what we have to learn. A proposal for a new clinical classification. Ital Heart J, 4: 305–310.
10. Shi H, Aschoff AJ, Brambs HJ, Hoffman MHK (2004) Multislice CT imaging of anomalous coronary arteries. Eur Radiol, 14: 2172–2181.
11. Wintersperger BJ, Nikolaou K, Jakobs TF, Reiser MF, Becker CR (2003) Cardiac multidetector-row computed tomography: initial experience using 16 detector-row. Crit Rev Comp Tom, 44: 27–45.
12. Yamanaka O, Hobbs RE (1990) Coronary artery anomalies in 126.595 patients undergoing coronary arteriography. Cathet Cardiovasc Diagn, 21: 28–40.