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*The concomitant intramyocardial bridging in the left coronary artery  
and anomalous origin of the right coronary artery – evaluation  
in ECG-gated multi-slice computed tomography (MSCT)*

In contrast to common anatomical variations in the course and number of coronary artery branches, anatomical abnormalities of the coronary arteries, which may result in serious consequences, are rare.

The bridging of myocardial vessels was first described by Block in 1796. Intramyocardial bridging means that the coronary artery deviates from its typical course within the fatty tissue of the epicardium and runs for some distance surrounded by muscular fibres and is therefore subjected to the stresses of the ventricular wall. The clinical importance of intramyocardial bridging has not been fully defined; it is believed that in some cases it may result in ischaemic episodes. In vast angiographic studies, the percentage of anomalous origin of the coronary arteries is found to be 0.83–1.2%, including the anomalous origin of the right coronary artery from the left sinus of Valsalva, which is observed in 0.07–0.6% of cases (1). Due to this location of the ostium the artery originates at an acute angle and running between the aorta and right ventricular infundibulum may be compressed by both big vessels (3, 5, 6). The aim of the paper is to present the diagnostic possibilities of CT to detect the anomalous origin of the coronary artery, the presence of intramyocardial bridging and its hemodynamic sequels.

CASE REPORT – CLINICAL DATA

A 63-year-old patient with history of angina pectoris (CCS II) was referred to the CT laboratory for the heart CT examination. The clinical data available were very scant and the patient had no medical records of his previous examinations. Two years earlier the patient was subjected to angioplasty with stent implantation because of an acute coronary episode. According to the patient, since then the pains were still felt on exertion; moreover, the exercise test performed several weeks earlier was positive and echocardiographic results abnormal. Prior to CT, the TSH and plasma creatinine levels were determined and were found to be within normal limits.

CT TECHNIQUE

The ECG-gated CT examination of the heart was conducted with an 8-row Light Speed Ultra (GE) scanner using the axial method to define the calcium score and after the intravenous contrast medium bolus using the spiral technique with collimation 1.2 mm and pitch 0.275 at BPM 49–52. Before the examination beta blockers were not used. A non-ionic contrast medium, 140 ml, was administered with a power injector at the speed of 4 ml/s. The scanning delay was determined by the bolus test technique.

The examination covered the area of FOV 26.3 cm from the level of the aortopulmonary window to the infracardiac region. The native scans reconstructed primarily in the phase 70% R-R and the series additionally reconstructed every 10% in the phases 15–85% R-R were evaluated and subjected to secondary reformations on the diagnostic workstation Advantage Window 4.0 (GE). The two-plane multiplanar reconstructions were used in the axial, sagittal, frontal, curved, and oblique projections (including the projection along the short and long cardiac axis and 3D volume rendering reconstructions). Additionally, in the analysis of vascular structures the maximum intensity option (MIP) was used.

#### MSCT AND CORONARY ANGIOGRAPHY

On CT examination the heart size was found normal although slight features of muscular hypertrophy of the left ventricular wall were observed. The foci of calcifications were visualized in the ring and cusps of the aortal valve with slight stenosis and three small foci in the proximal left anterior descendens (LAD) and left circumflex artery (LCA) – the volumetric index- 45 mm<sup>3</sup>, Agatston index – 54. The right coronary artery (RCA) originated from the left sinus of Valsalva at a very acute angle and for short distance ran between the aorta and pulmonary artery conus (Fig. 1a, b). The artery width did not exceed 1.5 mm; its course and branches indicated their recessive character; the features of lumen stenosis were not detected. The left main coronary artery was normal. In the proximal LAD, a patent stent was visible and the lumen was constricted by about 30% at the distance of about 15 mm directly behind the stent and in front of the origin of the first diagonal branch, which was caused by the mixed atheromatous plaque – in the initial part its density was about 60 UH-unstable change and it was partially calcified (Fig. 2). In the further part of LAD, intramuscular location of the artery was visible at the distance of 20 mm, which formed the picture of intramyocardial bridging (Fig. 3a, b, c). The further epicardial segment up to the heart apex was normal. The vessel's diameter within the myocardial bridging was decreased by about 60% in the systolic phase and by 20% in the diastolic phase. The MSCT scans were compared with the records of coronarography performed 2 years earlier (Fig. 4) and those of the new coronarographic examination. It was found that the interpretation of MSCT lesions was in accordance with the coronarographic findings.

#### DISCUSSION

Despite the lack of previous angiographic records, CT allowed us to diagnose easily both the anomalous origin of RCA and the presence of intramyocardial bridging in the anterior intraventricular branch. Moreover, it visualized the features of massive calcifications and stenosis of the aortal valve and muscular hypertrophy of the left ventricle with the accuracy comparable to that of echocardiography. The concomitant intramyocardial bridging and anomalous origin of RCA is rare but very unfavourable for patients (5). The recessive right artery may be compressed by adjacent big arteries and in future the condition is likely to be aggravated by the widening of the ascending aorta due to stenotic changes in the aortal valve. The literature reports describe the cases of angina pectoris, myocardial infarction and even sudden deaths due to this vascular anomaly (3, 5, 6). The bridging in LAD increases the risk of atheromatous changes proximally to it, which confirms the necessity of stent implantation in the patient. When the vascular occlusion extends into diastole, the ischaemic symptoms and anginal pain on exertion are likely to develop, which may lead to infarction and cardiac sudden death.

The presented case indicates the usefulness of MSCT in the diagnosis of anomalies of the origin and course of coronary arteries, whose detection may be clinically extremely important (3, 4). The precise diagnosis of such lesions and other accompanying abnormalities within the cardiac cavities, valval apparatus or coronary arteries is possible even in patients whose detailed clinical data are not available or those in whom CT is performed instead of planned coronarography (2, 4).



Fig. 1. MSCT – the anomalous origin of RCA from the left sinus of Valsalva; a) oblique MPR view, b) 3D volume rendering view

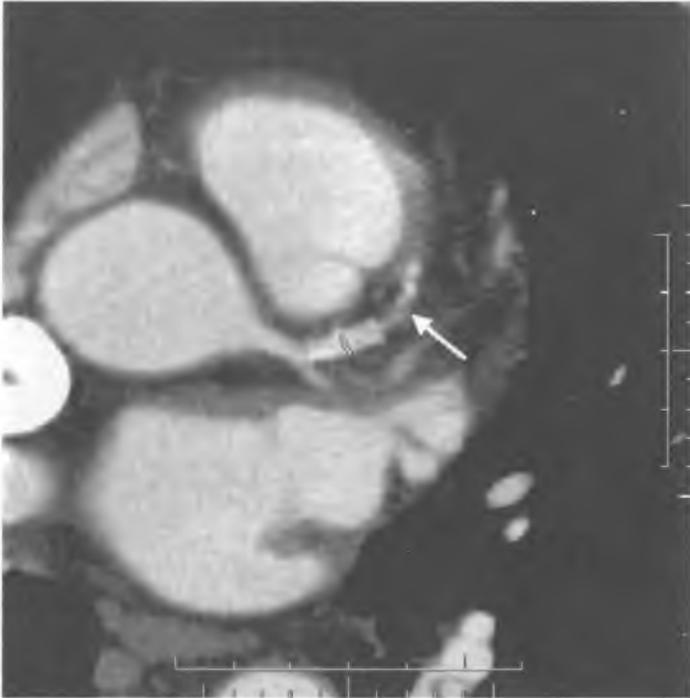


Fig. 2. Nonhomogeneous atheromatous plaque situated behind the stent in LAD and constricting the lumen by about 30%



Fig. 3 a



Fig. 3 b

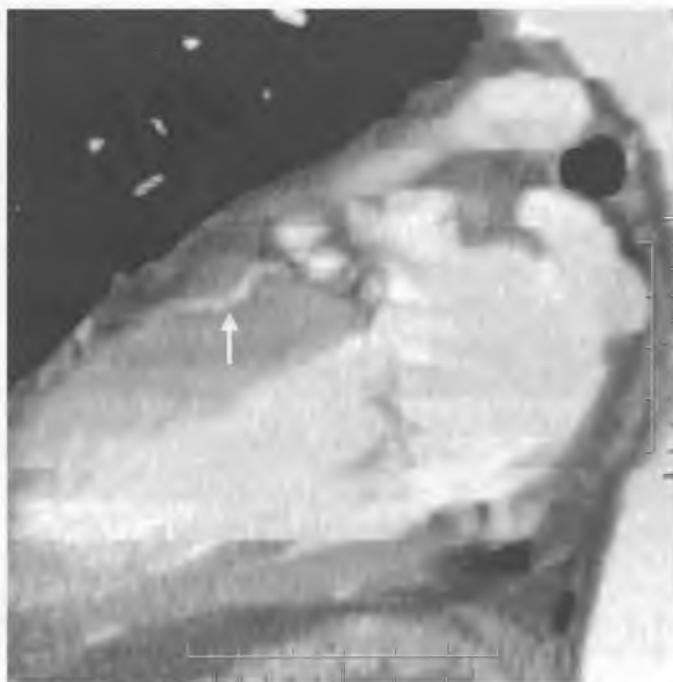


Fig. 3 c

Fig. 3. Intramyocardial bridging in LAD; a) 3D volume rendering view in the diastolic phase, b) in the systolic phase, c) oblique MPR view

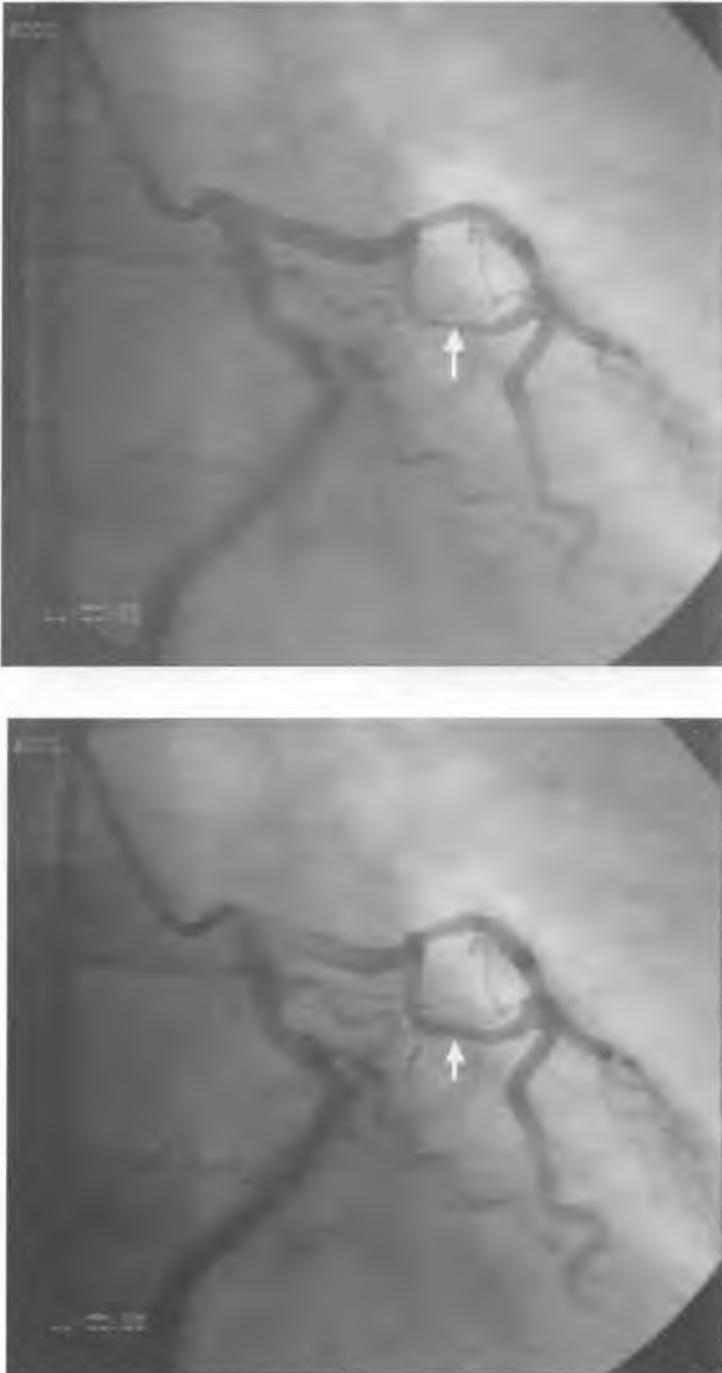


Fig. 4. Coronary angiography – intramyocardial bridging view in the systolic (a) and diastolic (b) phases

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## SUMMARY

The anomalous origin and course of coronary vessels are rare and in some cases may lead to the symptoms of heart ischaemia. The paper presents the case of a 63-year-old patient with angina pectoris evaluated in ECG-gated multi-slice CT and coronarography in whom the concomitant ectopic origin of the recessive right coronary artery from the left sinus of Valsalva and intramyocardial bridging in the left anterior descendens artery were observed.

Współistnienie mostka mięśniowego w obrębie lewej tętnicy wieńcowej i anomalii odejścia prawej tętnicy wieńcowej z lewej zatoki Valsalwy – ocena w wielorzędowej tomografii komputerowej

Anomalie odejścia i przebiegu naczyń wieńcowych są rzadkie i w niektórych przypadkach mogą być powodem wystąpienia objawów niedokrwienia serca. W pracy przedstawiono przypadek 63-letniego chorego z objawami dusznicy bolesnej, ocenianego w wielorzędowej tomografii komputerowej z brakiem EKG i koronarografii, u którego stwierdzono współistnienie ektopowego odejścia recesywnej prawej tętnicy wieńcowej z lewej zatoki Valsalwy z mostkiem mięśniowym w gałęzi międzykomorowej przedniej lewej tętnicy wieńcowej.