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# Single coronary artery originating from the right sinus Valsalva

## Abstract

Anomalous origin of coronary arteries represents a rare anomaly affecting around 1% of the population out of which the aberrant origin of the left main stem is its rarest form. Clinically it may cause recurrent ischaemia, heart failure or sudden death. There are four anatomical variants of this malformation classified according to the course of the main stem. Coronary angiography is the golden standard to visualise both, the course and the lumen of the vessel. In certain cases its proximal course can be also visualised by other complementary methods like multislice beam computed tomography or magnetic resonance.

In this case presenting with signs of heart failure and chest pain, we were able to show the presence of a single coronary artery originating from the right sinus of Valsalva with a main stem course anterior to the right ventricular outflow tract, using both visualisation methods, coronary angiography and 16-detector row gated CT angiography. CT allowed a clear visualisation of the angulated take-off of the single vessel trunk, probably involved in pathogenesis of the clinical picture.

*Key words: single coronary artery; coronary angiography; multislice computed tomography*

## Introduction

An anomalous origin of the coronary arteries is a rare anomaly described in 0.6 to 1.3% of the population. An aberrant origin of the left main stem (MS) from the right sinus Valsalva represents one of the rarest forms of all coronary anomalies and can be the cause of sudden cardiac death, myocardial ischaemia and congestive heart failure. It presents in four anatomical variants out of which the one with an interarterial course has been described to have the worst prognosis. Coronary angiography is still the golden standard for making

the diagnosis of these anomalies but there are also new complementary methods like electron beam (EBCT) or multislice (MSCT) computed tomography which can precisely define the proximal course of anomalous coronary arteries [1]. Treatment is still controversial and clear guidelines have not yet been defined. Presented is a case with congestive heart failure and a single coronary artery (SCA) originating from the right coronary sinus with anterior course of the main stem as confirmed by MSCT.

## Case report

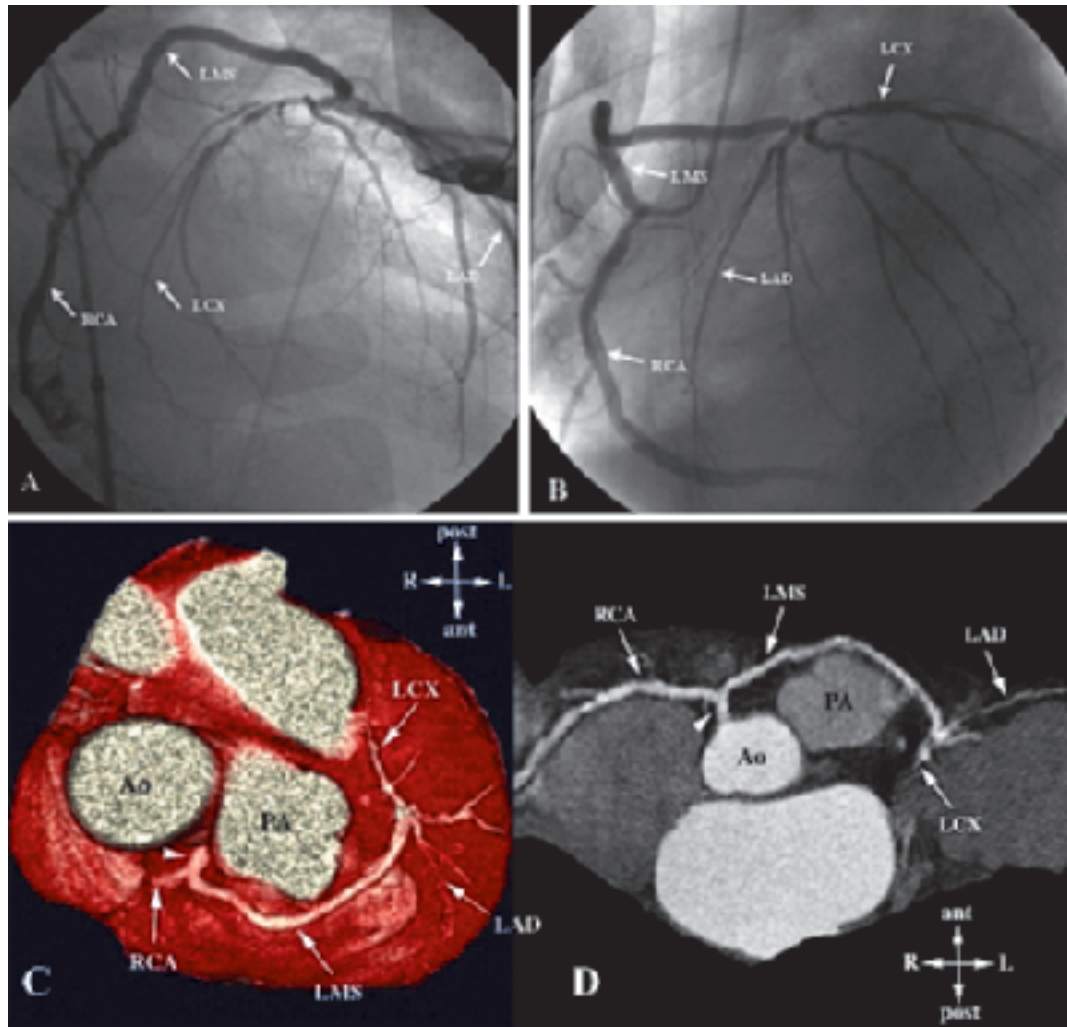
A 76-year-old patient, with treated hypertension, presented with chest pain lasting for about 30 minutes. ECG on admission showed a regular sinus rhythm with a heart rate of 90 beats/min, and a complete left bundle branch block. The patient had tachypnoea at rest with oxygen saturation of 90% under a FiO<sub>2</sub> of 65%. Blood pressure was 95/60 mm Hg, cardiac auscultation was normal but at pulmonary level bilateral basal crackles were present. Cardiac enzymes were slightly elevated (TnI: 3 µg/l [norm: <0.09] and CK: 360 U/l [norm: 47–222]).

Coronary angiography revealed a single coronary vessel arising from the right sinus of Valsalva. The right coronary artery (RCA) showed a normal course and the MS appeared to be anterior to the aorta (fig. 1A, 1B). Left ventriculogram showed a severely impaired systolic function (EF of 25%) with diffuse hypokinesia and an elevated end-diastolic pressure (24 mm Hg). In order to better define the course of the MS, we performed a MSCT which confirmed the anterior course (fig. 1C, 1D).

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**Figure 1**

Coronary angiography in RAO 30° (A) and LAO 60° (B) projections showing a single coronary artery (SCA) arising from the right sinus Valsalva and dividing in RCA and MS. The course of the main stem is anterior and turns around the right ventricular outflow tract. Volume rendering (view from above) (C) and Curved Multiplanar Reconstruction (MPR) (D) from 16-detector row gated coronary MSCT angiography following the course of right and left coronary arteries show the SCA (arrowhead) arising from the right sinus of Valsalva. The MS crosses the heart anterior to the pulmonary artery (PA) and divides into left anterior descending (LAD) and left circumflex LCX) arteries. Ao = aortic root.



## Discussion

The overall incidence of coronary anomalies in humans is 0.6 to 1.3% out of which the single coronary artery with anomalous MS originating from the right coronary sinus accounts for 1.3% of all coronary anomalies [2, 3]. It appears that it affects more men than women (5:1) and it has been observed more often in younger subjects (<50 years) [4].

Concerning the course of a single coronary vessel arising from the right coronary sinus, four anatomical variants have been described according to the crossing of the MS to the left side of the heart: (1.) anterior: MS turns anteriorly in front of the right ventricular outflow tract; (2.) inter-arterial: MS lies between the great vessels, aorta and pulmonary artery; (3.) septal: MS has an intramyocardial septal course; (4.) posterior: MS turns posteriorly behind the aorta in infero-posterior direction [5–7].

The interarterial course has been known to have the worst prognosis with the highest

rate of sudden cardiac death (>50%) [8]. Other types can present with myocardial ischaemia, congestive heart failure and sudden cardiac death.

Myocardial ischaemia is thought to occur due to the impaired coronary flow reserve and also secondary to the anatomic and functional anomaly of the ostium (acute aortocoronary angulation, slit-like ostium, ostial tissue flaps and initial course of the coronary artery within the aortic wall) [5]. In the inter-arterial variant, ischaemia or sudden death are assumed to be caused by vascular compression or kinking [5, 9].

The golden standard diagnostic method is coronary angiography. Nevertheless, it is very important to define the course of the MS and in that regard some misinterpretations of the coronary angiography are possible. Therefore, additional noninvasive imaging methods have been suggested like magnetic resonance imaging (MRI) or multislice computer tomography (MSCT) [1, 10, 11]. The complementarity of MSCT is shown in figure 1 demonstrating the

kinked take-off of the single vessel as well as the anterior course of the MS suspected on the coronary angiography but definitely confirmed by the MSCT.

Since the overall number of patients is small, the treatment strategy varies and is not clearly defined. The possible treatment of choice to prevent sudden cardiac death, in particular for the interarterial course, is CABG using the internal mammary artery as conduit [9, 12, 13]. Due to the anterior course of the MS, this case was treated by medical treatment solely.

This case demonstrates elegantly the complementarity of both imaging techniques in establishing a final diagnosis. Anterior course of the MS was suspected on angiography but was definitely confirmed by MSCT.

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