

# Single coronary artery from right aortic sinus in a very elderly patient



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In the absence of other associated cardiac anomalies, single coronary artery (SCA) *per se* is a rare anomaly detected during coronary angiography or autopsy. Various types of SCA detected during coronary angiography have already been described. We herein report a type of SCA originating from the right sinus of Valsalva, with the right circumflex, left circumflex, and left anterior descending coronary arteries arising from the proximal part of the SCA in a 76-year-old female patient. She developed ventricular fibrillation during coronary angiography, which calls for caution while performing a coronary angiogram in such patients.

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**Keywords:** Coronary artery anomalies, Single coronary artery

## Introduction

Various types of single coronary artery (SCA) have been detected during coronary angiography. We herein report a type of SCA originating from the right sinus of Valsalva, with the right circumflex, left circumflex (LCX), and left anterior descending (LAD) coronary arteries arising from the proximal trunk of the SCA in a 76-year-old female patient.

## Case report

A 76-year-old hypertensive Arabian female patient presented with exertional angina Class II,

which she had been experiencing for the past 6 months. Results of her cardiac examination, electrocardiogram, and echocardiogram were normal except for mild left ventricular hypertrophy. Her coronary angiogram revealed the absence of the left main coronary artery with no artery arising from the left sinus. Cannulation of the right coronary artery (RCA) using a JR4 (Cordis Corporation, Bridgewater, NJ, USA) 6-Fr catheter revealed an SCA originating from a single right coronary ostium situated in the right sinus of Valsalva (Figs. 1A and 1B). The SCA arising from the normal position of the ostium of the RCA continued as a large RCA in the right atrioventricular groove and gave rise to the posterior descending artery and a posterolateral branch at the crux (Fig. 1B). The

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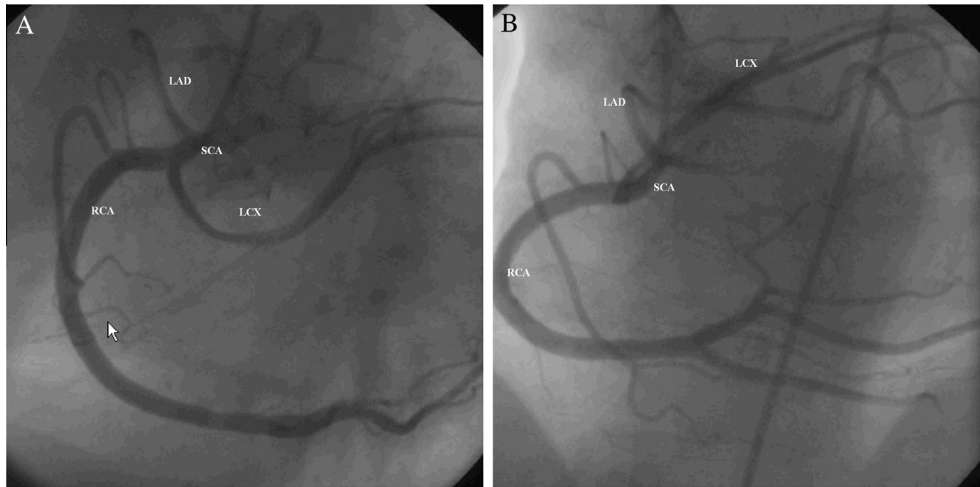


Figure 1. Coronary angiogram showing the single coronary artery (SCA) arising from the right sinus of Valsalva and giving rise to the left anterior descending (LAD) artery, the left circumflex (LCX) artery, and continuing as the right coronary artery (RCA) in a 76-year-old female patient (A). The LAD artery takes a prepulmonic course and the LCX artery takes a retroaortic course to reach their respective destination (B).

LAD artery arose from the proximal trunk of the SCA as the first branch, and took a prepulmonic course (on the anterior side; Figs. 1A and 1B). The LCX artery arose as the second branch of the SCA and took a retroaortic course (Fig. 1A). There was no flow-limiting stenosis. During the last injection, the patient sustained ventricular fibrillation with loss of consciousness, which necessitated applying a 200-J direct current shock two times. The patient then had complete recovery. Computed tomography coronary angiogram confirmed the SCA arising out of the single ostium from the right sinus of Valsalva and then dividing into the RCA, the

LAD artery, and the LCX artery (Figs. 2 and 3). There was no interarterial course of neither the SCA nor its branches. Because the course of the anomalous arteries was not malignant and the patient was a case of Class II angina, optimal antianginal treatment was recommended. At 4 years' follow-up she was doing well.

### Discussion

Congenital coronary artery anomalies not associated with structural heart disease are seen in 1.3% of coronary angiography studies and their



Figure 2. Volume-rendered three-dimensional coronary computed tomography angiogram showing (A) the single coronary artery (SCA) arising from the single ostium from the right sinus of Valsalva and then dividing into the right coronary artery (RCA), the left anterior descending (LAD) artery, and the left circumflex (LCX) artery. (B) The retroaortic course of the LCX artery close to the aorta and the anterior course of the LAD artery are seen clearly.

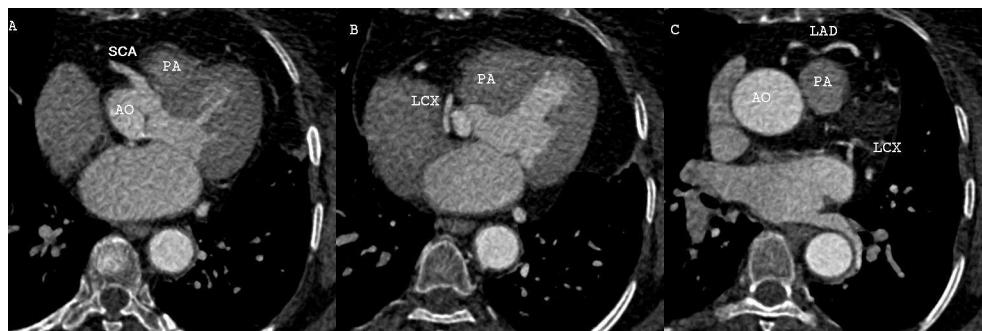


Figure 3. Contrast-enhanced axial computed tomography images showing the origin of the single coronary artery (SCA), which continues as (A) the right coronary artery (RCA), (B) the left circumflex (LCX) artery with a retroaortic course, and (C) the left anterior descending (LAD) artery with a prepulmonic anterior course. Note that no artery goes between the aorta (AO) and the pulmonary artery (PA).

prevalence ranges from 0.21% to 5.79% [1,2]. Various types of congenital coronary artery anomalies are described in the literature [1,3]. In most cases, these patients are asymptomatic. However, they can develop myocardial ischemia, infarction, syncope, and/or sudden death. The anomalous coronary arteries from the right sinus after origin can take any of the following four courses: interseptal, anterior free wall, retroaortic, or interarterial [3].

The SCA refers to the origination of both the left coronary artery and the RCA from a single coronary ostium [4,5]. The SCA in structurally normal hearts has a prevalence of 0.024–0.066% in the general population [3,5]. It accounts for <3% of all major coronary anomalies [1]. Lipton et al [4] classified SCA into three types (Types I–III). In Type I (rare), the SCA follows the course of RCA and then continues into the LCX artery, which then continues as the LAD artery or a single left main artery that branches into the LAD and LCX arteries, the latter of which extends across the crux to form the RCA [6]. In Type II (commonest), the main trunk of SCA, after its origin, divides into the right and left main arteries, which then divide into the LAD and LCX arteries, respectively. In Type III, the main trunk of SCA separately gives rise to the RCA, the LAD artery, and the LCX artery, which was the case in our patient. In patients with coronary anomalies, including the SCA, the causes of ischemia are multifactorial including atherosclerosis, slit-like ostium, ostial ridge, acute-angle takeoff, coronary spasm, an interarterial course with associated hypoplasia, and an intramural course (at the aortic wall) with lateral compression or exercise-related narrowing [7].

This patient had SCA with the LAD artery arising 3 mm from the SCA ostium and taking a

prepulmonic anterior course and the LCX artery taking the retroaortic course, which is usually benign. However, there was no interarterial course, which could be malignant as it can lead to sudden cardiac death. In an autopsy study among 126 military recruits, an anomalous coronary artery was responsible for one third (21 of 64) of the cardiac deaths. In each case, the left coronary artery arose from the right sinus of Valsalva, coursing between the aorta and the pulmonary artery leading to sudden cardiac death [8]. However, our patient did not have such a course, but had symptomatic angina without coronary stenosis, which was most probably due to abnormal tortuous anatomy of the LAD artery. Shirani and Roberts [9] reported that 15% of SCA cases develop ischemia and angina caused directly by the abnormal anatomy of the arteries and not by the coronary artery disease. Coceani et al [10] have reported an abnormal course of the left main artery arising from the proximal trunk of SCA without stenosis, which needed surgical coronary reimplantation to relieve angina. However, their patient responded to medical therapy. Symptomatic patients with SCA are advised percutaneous coronary intervention or coronary artery bypass surgery in the presence of coronary stenosis. Patients with anomalies with interarterial course presenting with unexplained syncope or malignant arrhythmia or aborted sudden death are usually recommended to undergo surgical correction by coronary reimplantation or unroofing of intramural coronary segment [11]. In asymptomatic patients, however, interarterial course surgery is advised if functional testing is positive; it is also advised for patients under 30–35 years of age even if functional testing is negative [11]. In the case of older patients, the risk of sudden death decreases with age and is extremely low [11].

There are two interesting features in this patient. Ventricular fibrillation during coronary angiography may be related to ischemia (deep intubation or spasm) or it may have been due to contrast-induced regional repolarization changes. In our patient, ventricular fibrillation may be due to deep intubation of the catheter in the SCA, which occluded its first branch, that is, the ostium of the LAD artery caused slow flow in the LAD artery as noted in the angiogram, which indicates that even diagnostic coronary angiogram in SCA cases can be fatal. In another study, the incidence of ventricular arrhythmias during coronary angiogram was 0.131% [11]. As a general rule, the authors recommend avoiding deep intubation during RCA injection, to avoid both rapid (when the position of the catheter tip is not clear) and slow contrast injection, and prevent catheter occlusion during coronary angiography [12]. They also opine that the incidence of ventricular arrhythmias reduces with use of 5-Fr catheters. These recommendations are more appropriate for SCA patients. Whenever there is suspicion of SCA, it is better to use a small-size catheter and to avoid deep intubation, which can lead to occlusion of other major arteries arising from the SCA as it happened in our case. The second interesting feature is the age of the patient with SCA. In a recent study from Turkey, SCA was detected in 0.031% of patients with mean age of  $48 \pm 11$  years (range 29–75 years) [13]. Our patient at 76 years is one of most elderly patients living with a coronary anomaly from the Gulf region.

In conclusion, we have reported a type of SCA originating from the right sinus of Valsalva, with the right circumflex, LCX, and LAD coronary arteries arising from the proximal trunk of the SCA in a very elderly female patient, thus confirming the benign nature of these anomalies in the absence of coronary stenosis. In addition, cardiologists need to be cautious in treating such patients during percutaneous coronary intervention as relative obstruction of SCA can lead to global ischemia and ventricular arrhythmias.

## References

- [1] Yamanaka O, Hobbs RE. Coronary artery anomalies in 126,595 patients undergoing coronary arteriography. *Cathet Cardiovasc Diagn* 1990;21:28–40.
- [2] Pérez-Pomares JM, de la Pompa JL, Franco D, Henderson D, Ho SY, Houyel L, et al. Congenital coronary artery anomalies: a bridge from embryology to anatomy and pathophysiology—a position statement of the development, anatomy, and pathology ESC Working Group. *Cardiovasc Res* 2016;109:204–16.
- [3] Roberts WC, Shirani J. The four subtypes of anomalous origin of the left main coronary artery from the right aortic sinus (or from the right coronary artery). *Am J Cardiol* 1992;70:119–21.
- [4] Lipton MJ, Barry WH, Obrez I, Silverman JF, Wexler L. Isolated single coronary artery: diagnosis, angiographic classification and clinical significance. *Radiology* 1979;130:39–47.
- [5] Desmet W, Vanhaecke J, Vrolix M, Van de Werf F, Piessens J, Willems J, et al. Isolated single coronary artery: a review of 50,000 consecutive coronary angiographies. *Eur Heart J* 1992;13:1637–40.
- [6] Prashanth P, Mukhaini M. Single right coronary artery continuing as left circumflex artery and hypoplastic left anterior descending artery: a rare coronary anomaly. *J Invasive Cardiol* 2008;20:E192–4.
- [7] Angelini P, Walmsley RP, Liberos A, Ott DA. Symptomatic anomalous origination of the left coronary artery from the opposite sinus of Valsalva. Clinical presentations, diagnosis, and surgical repair. *Tex Heart Inst J* 2006;33:171–9.
- [8] Eckart RE, Scoville SL, Campbell CL, Shry EA, Stajduhar KC, Potter RN, et al. Sudden death in young adults: a 25-year review of autopsies in military recruits. *Ann Intern Med* 2004;141:829–34.
- [9] Shirani J, Roberts WC. Solitary coronary ostium in the aorta in the absence of other major congenital cardiovascular anomalies. *J Am Coll Cardiol* 1993;21:137–43.
- [10] Coceani M, Ciardetti M, Pasanisi E, Schlueter M, Palmieri C, Neglia D, et al. Surgical correction of left coronary artery origin from the right coronary artery. *Ann Thorac Surg* 2013;95:e1–2.
- [11] Cheitlin MD. Finding asymptomatic people with a coronary artery arising from the wrong sinus of Valsalva: consequences arising from knowing the anomaly to be familial. *J Am Coll Cardiol* 2008;51:2065–7.
- [12] Chen J, Gao L, Yao M, Chen J. Ventricular arrhythmia onset during diagnostic coronary angiography with a 5F or 4F universal catheter. *Rev Esp Cardiol* 2008;61:1092–5.
- [13] Turkmen S, Yolcu M, Sertcelik A, Ipek E, Dokumaci B, Batyraliev T. Single coronary artery incidence in 215,140 patients undergoing coronary angiography. *Folia Morphol (Warsz)* 2014;73:469–74.