Int Cardiovasc Res J.2020;**14**(2):65-67.icrj.102070

International Cardiovascular Research Journal
www.ircrj.com

Sudden Cardiac Arrest in A Young Adult Caused by Anomalous Origin of the Left Anterior Descending Artery from the Right Sinus of Valsalva: A Case Report

Abdullah Alhouri [1, *], Hasan Al Houri [2], Omar S. Obedat [1], Bayan A. Banissa [1], Malik E. Juweid [3]

[1] Department of Internal Medicine, Division of Cardiology, University of Jordan, Amman, Jordan
[2] Internal Medicine Department, Al Assad University Hospital and AL Mouwasat University Hospital, Damascus, Syria
[3] Department of Radiology and Nuclear Medicine, University of Jordan, Amman, Jordan

ARTICLE INFO

Article Type:
Case Report

Article History:
Received: 21 Feb 2020
Revised: 9 May 2020
Accepted: 27 May 2020

Keywords:
Heart Ventricles
Sudden Cardiac Arrest

ABSTRACT

Introduction: Coronary Artery Anomalies (CAAs) are rare, with their prevalence ranging from 0.6% to 1.3%.

Case Presentation: A 33-year-old man with no previous medical history was referred to the emergency department with Sudden Cardiac Arrest (SCA) while playing soccer. Systematic assessment revealed that the SCA was caused by a scarce CAA; the Left Anterior Descending (LAD) artery arising from the Right Sinus of Valsalva (RSV). There was also Left Ventricular (LV) systolic dysfunction with an LV ejection fraction of 35%. The patient subsequently underwent single vessel coronary artery bypass grafting of the Left Internal Mammary Artery (LIMA) to LAD as well as cardioverter-defibrillator placement and had no further incidence of SCA.

Conclusions: Comprehensive knowledge of CAAs and the related symptoms shortens the time to correct diagnosis and initiation of proper management and is likely to reduce the frequency of complications.

1. Introducation

Coronary Artery Anomalies (CAAs) are rare, with the prevalence ranging from 0.6% to 1.3% (1). Clinically, CAAs are divided into benign and potentially serious categories (1). Benign cases represent about 80% of the total anomalies, while the potentially serious anomalies represent 20% of the cases among which the Left Anterior Descending (LAD) artery originating from the Right Sinus of Valsalva (RSV) is found in only about 2.3% (1). CAAs are usually discovered as incidental findings during coronary angiography or autopsy (2). Herein, a very rare CAA involving the LAD originating from the RSV along with Left Ventricular (LV) systolic dysfunction was presented as a case of Sudden Cardiac Arrest (SCA).

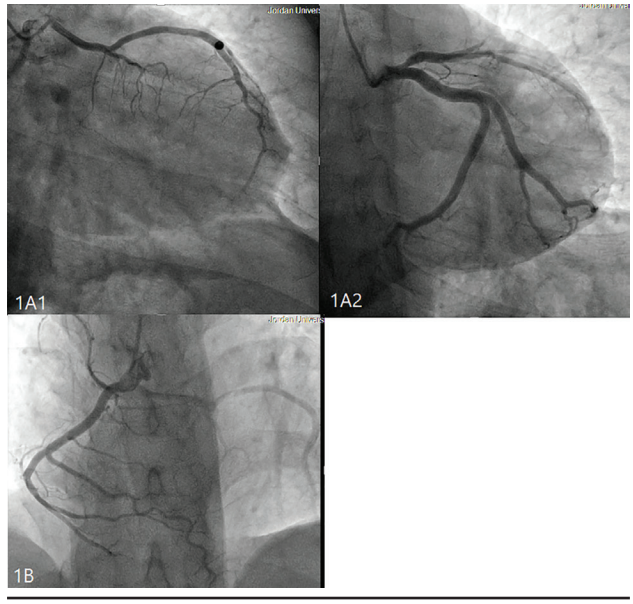
2. Case Presentation

A 33-year-old man with no previous medical history was referred to the emergency department after experiencing SCA while playing soccer with his friends. Standard cardiopulmonary resuscitation was started by his friends and by the time the ambulance arrived, he was fully awake and alert with no arrhythmias on the monitor. The patient denied being exposed to any head trauma during the match or feeling chest pain prior to the SCA. He did report one previous episode of loss of consciousness a year ago while exercising lasting only for a few seconds and spontaneously resolving, for which he had not sought for medical help. His current examination revealed stable vital signs and his physical examination showed no significant abnormalities with a normal body mass index of 24 kg/m2. He was admitted to the hospital for further evaluations. Resting Electrocardiogram (ECG) showed regular sinus rhythm with normal axis and intervals and no ST-segment or T-wave abnormalities. Laboratory tests were also within the normal ranges, except for mild elevation of the serial cardiac troponin enzyme of 240 and 270 ng/l (normal < 28 ng/L), indicating a cardiac event. Two-dimensional (2D) echocardiogram showed a reduced LV ejection fraction of 35% with no significant valvular heart disease. Brain Magnetic Resonance Imaging (MRI) and Electroencephalogram (EEG) were normal, as well. Cardiac catheterization surprisingly revealed that the LAD artery originated from

*Corresponding author: Abdullah Alhouri, Department of Internal Medicine, Division of Cardiology, University of Jordan, Amman, Jordan.
Cellphone: +962-780787332,
E-mail: abdallahouri1995@hotmail.com.

the RSV coursing between the aorta and the pulmonary trunk (Figure 1), which was confirmed by coronary Computed Tomography Angiogram (CTA) (Figure 2). CT reconstruction also showed that LAD originated from the RSV (Figure 3). The patient subsequently underwent single vessel Coronary Artery Bypass Graft (CABG) of the Left Internal Mammary Artery (LIMA) to LAD artery and was later discharged in stable conditions. His LV dysfunction was initially thought to be due to ischemia from the CAA and he was scheduled to have a follow-up echocardiogram in three months. On follow-up, the patient was doing well until three months after CABG when he presented to the clinic with a history of palpitation. Holter monitor revealed 74 episodes of non-sustained ventricular tachycardia. His 2D echocardiogram did not show any improvements in his LV function and cardiac catheterization showed patent LIMA to LAD artery. The patient subsequently underwent a single-chamber Implantable Cardioverter Defibrillator (ICD) placement. After one year of follow-up, he continued to have impaired LV function with a stable ejection fraction of 35%, but no further incidence of SCA.

Figure 1. Left Heart Catheterization



A) Anomalous left anterior descending coronary artery from the right sinus of Valsalva (A1) and the right anterior oblique caudal projection showing the large left circumflex coronary artery with absent left anterior descending artery (A2). B) Anterior posterior projection showing the right coronary artery with faint shadow of the left anterior descending coronary artery originating from the right sinus of Valsalva.

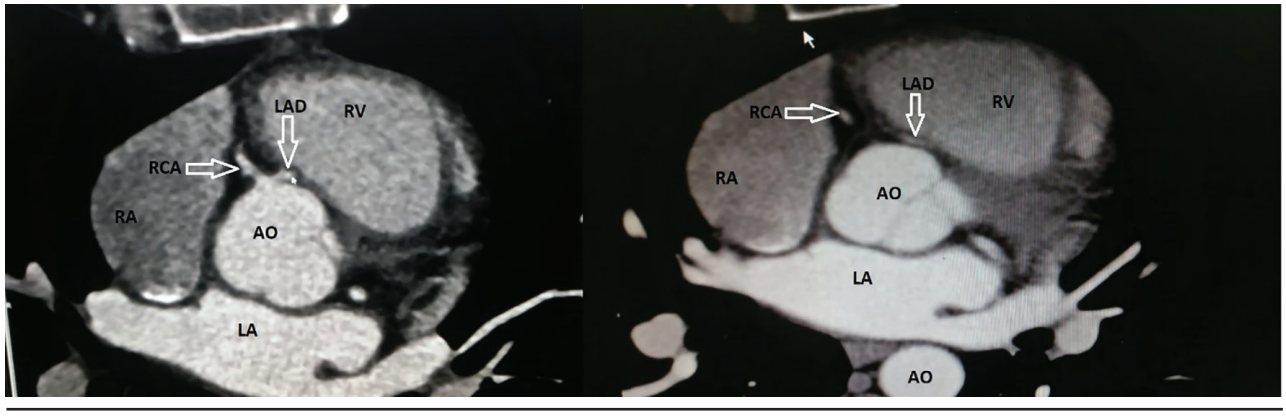
3. Discussion

Diagnosis of CAAs is a great challenge for physicians because most patients with this condition remain asymptomatic for a long time or present with non-specific symptoms, such as fatigue, syncope, headache, palpitation, anxiety, and dizziness (3). However, CAA is obviously catastrophic when the first presentation is a sudden cardiac death (3). CAA is in fact the second cardiac cause of sudden death in young patients after Hypertrophic Obstructive Cardiomyopathy (HCM) (4).

The heart has two main coronary artery systems, the left and right coronary arteries. The Left Coronary Artery (LCA) arises from the left sinus of Valsalva and starts with the left main coronary artery, which is divided into the LAD artery and the Left Circumflex Artery (LCX). The Right Coronary Artery (RCA) arises from the RSV giving the right posterior descending artery in 90% of the cases. CAA can be either in the origin or in the course of the coronary artery and can even occur as hypoplastic or absent single or multiple coronary arteries (5). CT angiography is a non-invasive diagnostic tool, which visualizes the coronary arteries in three dimensions, giving the exact anatomical origin, course, and distribution of the anomalous artery in relation to the aorta and the pulmonary artery (6).

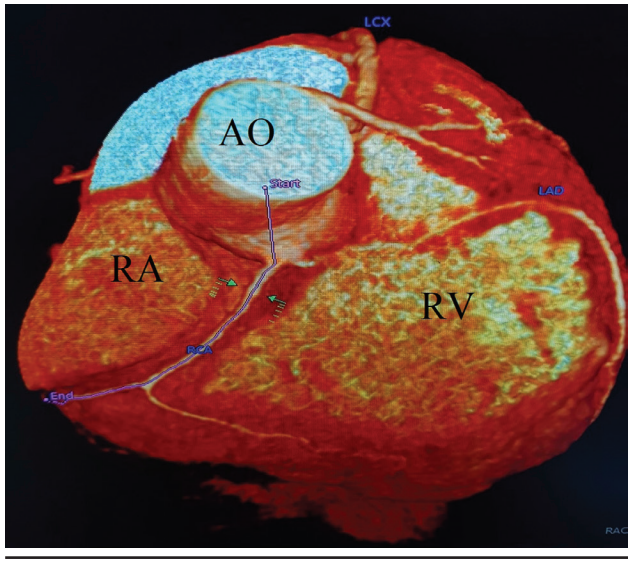
In the case reported here, the patient with SCA was found to have his LAD artery originating from the RSV, coursing between the aorta and the pulmonary trunk in addition to having impaired LV function. The SCA in this anomaly has been suggested to be due to coronary artery compression between the aorta and the pulmonary trunk, especially with exertion vs. slit opening of the ostium of the anomalous vessel, which worsens with exertion (7). The present case underwent CABG; LIMA to LAD artery with no further incidence of SCA. However, he continued to have LV dysfunction, which is an unusual finding in patients with CAA. Lack of improvement in LV function

Figure 2. Coronary CT Angiogram Showing Lad Artery Arising from the Right Coronary Cusp Next to the Ostium of The RCA. The Lad Artery Is Coursing Between the Aorta and the Pulmonary Arteries.



RV, right ventricle; RA, right atrium; LA, left atrium; LAD, left anterior descending; RCA, right coronary artery; AO, aorta.

Figure 3. The CT Reconstruction Showing LAD Artery Arising from the Right Coronary Cusp Next to the Ostium of the RCA. The LAD is Coursing between the Aorta and the Pulmonary Arteries.



RV, right ventricle; RA, right atrium; LAD, left anterior descending; RCA, right coronary artery; AO, aorta.

with CABG might indicate an underlying cardiomyopathy rather than ischemia as the cause of the LV dysfunction. Although the SCA could be due to the rare malignant CAA, underlying cardiomyopathy and later finding of non-sustained ventricular tachycardia on Holter monitor could indicate an arrhythmic reason for the SCA.

Several publications have reported similar CAAs. However, to the best of our knowledge, the present case was one of the very few ones reporting SCA as the first presentation of the LAD artery originating from the RSV in combination with systolic LV dysfunction (6, 8, 9).

In conclusion, CAA is a rare cause of SCA and can be missed easily without a proper systematic approach. CAA should always be considered in any young patient with unexplained SCA with or without cardiac symptoms (10). Having a high index of suspicion for CAA, especially in young patients presenting with SCA, will shorten the time to diagnosis and initiation of proper management and will help prevent fatal complications (11).

3.1. Informed Consent

The informed consent form has been submitted.

Acknowledgements

There is no acknowledgement.

Authors' Contribution

O. O. diagnosed this case and supervised the management of the patient. O. O., B. B., and A. A. documented the case. H. A., A. A., and M. J. equally participated in writing the paper. O. O. and M. J. participated in editing the manuscript. O. O., H. A., and A. A. participated in searching the medical literature. O. O. and B. B. followed the patient up. All authors reviewed the last edition of the paper.

Funding/Support

There was no funding support.

Financial Disclosure

The authors have no financial interests related to the material in the manuscript.

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