Isolated Single Left Coronary Artery Anomalies as An Incidental Finding in ST-Elevation Myocardial Infarction: A Rare Case

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ARTICLE INFO

Article history:
Submitted: 10. 8. 2021
Accepted: 6. 10. 2021
Available online: 17. 8. 2022

Klíčová slova:
Infarkt myokardu s elevací úseku ST
Solitární koronární tepna
Tomografická koronární angiografie

SOUHRN

Úvod: Solitární koronární tepna (single coronary artery, SCA) bez přidruženého vrozeného srdečního onemocnění představuje vzácnou vrozenou anomálii. Ve většině případů, asymptomatických a zjištěných zcela náhodně, může být SCA příčinou ischemie, městnavého srdečního selhání a náhlé srdeční smrti.
Kazuistika: Čtyřiačtyřicetiletá žena byla přivezena na naše oddělení akutních příjmů s typickou bolestí na hrudi. Po vyšetření byla u ní stanovena diagnóza infarktu myokardu zadní stěny s elevací úseku ST. Pacientka následně podstoupila perkutánní koronární intervenci. Selektivní kanylaci pravé koronární tepny (right coronary artery, RCA) nebylo možno provést. Angiografické vyšetření levé koronární tepny prokázalo kritickou stenózu (99%) středního segmentu levé přední sestupné větve (RIA). Byla provedena perkutánní transluminální koronární angioplastika se zavedením stentu do středního segmentu RIA. Dva týdny po intervenci byla provedena tomografická koronární angiografie (coronary computed tomography angiography, CCTA), která potvrdila absenci pravé koronární tepny i stenózu RIA.
Závěr: Jednou z nejvzácnějších anomálií je solitární levá koronární tepna při vrozené absenci RCA. U některých pacientů je tato anomálie spojena s rozvojem ischemie; přitom může být život ohrožující. Pro stanovení diagnózy a stratifikaci rizika se přednostně používá metoda CCTA. Přestože si jsme vědomi mezer v našich znalostech o těchto anomáliích, mohou si některé případy vyžádat intervenci, aby se předešlo náhlé srdeční smrti a zvýšila se kvalita života.

Keywords:
Coronary computed tomography angiography
Single coronary artery
ST-elevation myocardial infarction

ABSTRACT

Introduction: Single coronary artery (SCA) with no associated congenital heart disease is a rare congenital anomaly. SCA may cause ischemia, congestive heart failure, and accidental cardiac death in most cases, which are asymptomatic and unintentional.
Case report: A 44-year-old woman came to our emergency room with a typical chest pain. After work up in ER, the patient was diagnosed with inferior ST-elevation myocardial infarction. Then the patient underwent percutaneous coronary intervention. Selective cannulation of the right coronary artery (RCA) was not possible. We found critical stenosis 99% at the mid-left anterior descending artery (LAD) from left coronary artery angiography. Percutaneous transluminal coronary angioplasty with stent was done in mid LAD. Coronary computed tomography angiography (CCTA) was done two weeks after the PCI procedure. From CCTA, it was confirmed the absence of RCA and no coronary stenosis.
Conclusion: One of the rarest coronary artery anomalies is left SCA with congenital absence of the RCA. It is associated with ischemia in some patients and may be life-threatening. For diagnosis and risk stratification, CCTA is the preferred method. Despite our current understanding of such anomalies' shortcomings, action may be warranted in some cases to prevent sudden death and increase the quality of life.

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DOI: 10.33678/cor.2021.120

Please cite this article as: Purnama Dewi I, Setia Putra KN, Kusuma Wardhani LF, et al. Isolated Single Left Coronary Artery Anomalies as An Incidental Finding in ST-Elevation Myocardial Infarction: A Rare Case. Cor Vasa 2022;64:463–467.

Introduction

Single coronary artery anomaly (SCA) is a coronary artery disorder in which only one coronary artery arises from one coronary ostium to supply the entire heart muscle.[1] SCA is usually associated with other heart disorders. It is uncommon for SCA to be an "isolated" disorder. SCA has a diverse clinical presentation, ranging from mild nonspecific symptoms to sudden cardiac death (SCD).[1]

SCA is usually incidentally diagnosed during a coronary artery angiography or post mortem examination. The prevalence of SCA in the general population is approximately 0.024–0.044%.[2] The multiple SCA variations are difficult to comprehend. Lipton et al. listed the various forms of SCA in a systematic way. The majority of SCA cases are asymptomatic. The malignant type of SCA is when the coronary arteries run between the large blood vessels (aorta and pulmonary artery).

Case report

A woman, 51 years old, came to the emergency room with a typical chest pain complaint 17 hours ago. It is accompanied by nausea, vomiting, and cold sweat. The patient has a history of uncontrolled diabetes mellitus (DM) type 2 and hypertension from past medical history. The general condition was fair. The vital signs obtained blood pressure (BP) 131/76 mmHg, regular pulse 72 beats/minute (bpm), breath frequency (RR) 18 breaths/minute, and O_2 saturation (SaO_2) 98% with O_2 nasal 3 liters/minute. A physical examination heart and lungs are within normal limit. Examination of the head/neck, abdomen, and extremities were within normal limits. From electrocardiography (ECG), it was obtained sinus rhythm 72 bpm, normal frontal axis, the horizontal axis of CWR, ST elevation in the lead III, aVF, QS pattern in the lead III, aVF, V_1–V_3, T inversion in lead V_2–V_6, I, aVL with conclusion anterior inferior STEMI (Fig. 1A). The chest X-ray examination found an impression of cardiomegaly, and the pulmo was within normal limits (Fig. 1B).

Our patient did a lab examination and obtained Hb 13.5, leukocyte 8940, platelet 416000, SGOT 115, SGPT 36, BUN 9, SK 0.8, albumin 3.5, Na 140, K 4.0, Cl 105, blood glucose 311, APTT 31.4, PPT 12.7, troponin I 1998, CKMB 54.8. Blood gas analysis results were normal; pH 7.44, pCO_2 35, pO_2 113, HCO_3 23.8, BE –0.4, SaO_2 99%, P/F ratio 538. From COVID-19 screening, negative antigen swabs, rapid IgG and IgM COVID-19 negative. The patient then performed echocardiography with results; trivial mitral regurgitation, LV dilatation (LVIDd 5.3 cm), decreased LV systolic function: decreased (EF by Teich 39%, by Biplane 42%), hypokinetic at inferoseptal (B-M), anteroseptal (B-M), inferior (B-M-A), and septal (A) from LV segmental analysis, and eccentric LVH (LVdMI 96.80 g/m^2; RWT 0.380) with normal hemodynamic parameters.

The patient was then diagnosed with STEMI inferior Killip I late-onset and hyperglycemic DM type II. For initial management, we provide therapy; aspilet 300 mg then 1× 100 mg, clopidogrel 300mg then 1× 75 mg, atorvastatin 0-0-40 mg, lisinopril 1× 5 mg, bisoprolol 1× 2.5 mg, Novorapid insulin 3× 6 IU s.c, and Levemir insulin 0-0-10 IU s.c.

We observe the patient at the cardiovascular care unit. On day 4 of hospitalization, the patient was then performed PCI, resulting in a single coronary artery disease with critical stenosis 99% at mid-left anterior descending artery (LAD). Therefore, percutaneous transluminal angioplasty (PTCA) with stent was done in mid LAD with TIMI flow III (Fig. 2A). During the procedure, it was difficult to engage on right coronary artery (RCA) ostium. Therefore, the operator performed aortography to ensure the position of the RCA ostium. As a result, there is no RCA seen from the aortography (Fig. 2B). Then the patient is advised to undergo a CCTA for coronary arteries evaluation.

The patient was finally discharged from the hospital on day 7th of hospitalization. CCTA was performed two

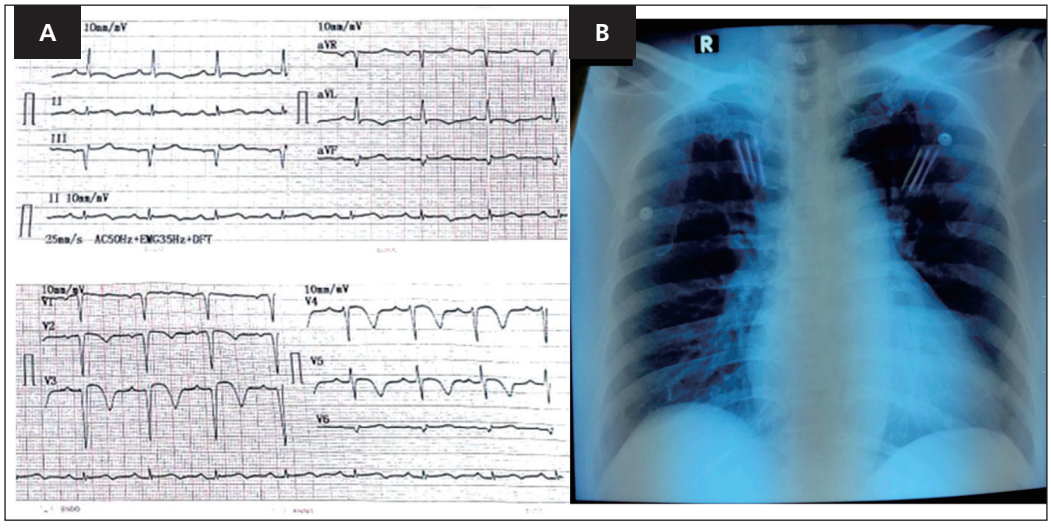

Fig. 1 – (A) EKG examination showed an anterior inferior STEMI. (B) From the CXR examination, cardiomegaly and normal lungs were found.

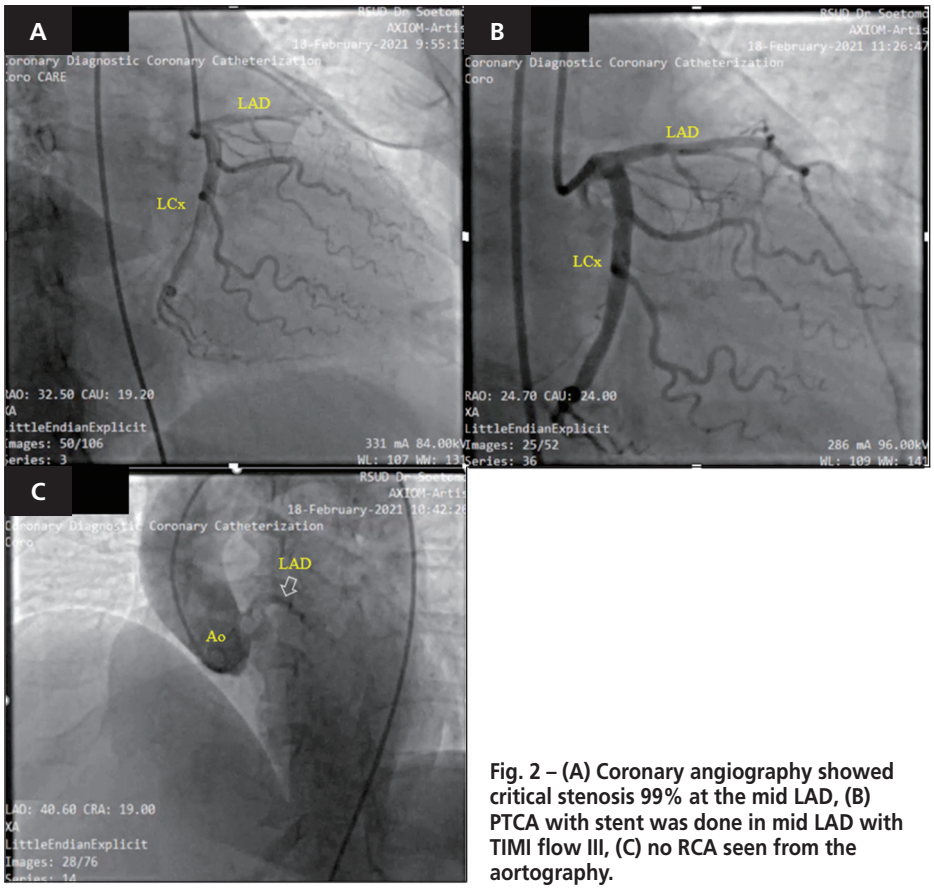

Fig. 2 – (A) Coronary angiography showed critical stenosis 99% at the mid LAD, (B) PTCA with stent was done in mid LAD with TIMI flow III, (C) no RCA seen from the aortography.

weeks later with results of SCA with the left circumflex artery (LCx) running posterior, RCA atresia, and good stenting without any coronary thrombus (Fig. 3). Then we educate the patient regarding the condition, and the patient asked to continue her optimal medical therapy.

Discussion

SCA is a condition where only one coronary artery originates from the aortic sinus (right or left), which supplies the entire coronary circulation. SCA may not be associated with congenital heart disease (isolated). Isolated SCA is associated with normal heart structures.[3] SCA was found in 0.019% of 126,595 patients in a serial case study. However, congenital heart conditions such as tetralogy of Fallot, truncus arteriosus, and transposition of the great arteries account for 40% of these conditions.[3]

SCA has many different classification systems based on necropsy and conventional coronary angiography findings in some literature. Lipton et al. (1979) classified SCA into two main types: left (L) and right (R) type, which indicate SCA origin in the left or right coronary sinus. Furthermore, based on the anatomy of the SCA is divided into three subtypes:

- Type I: SCA is originating from the left or right coronary sinus. LM can continue into LCx and LAD,

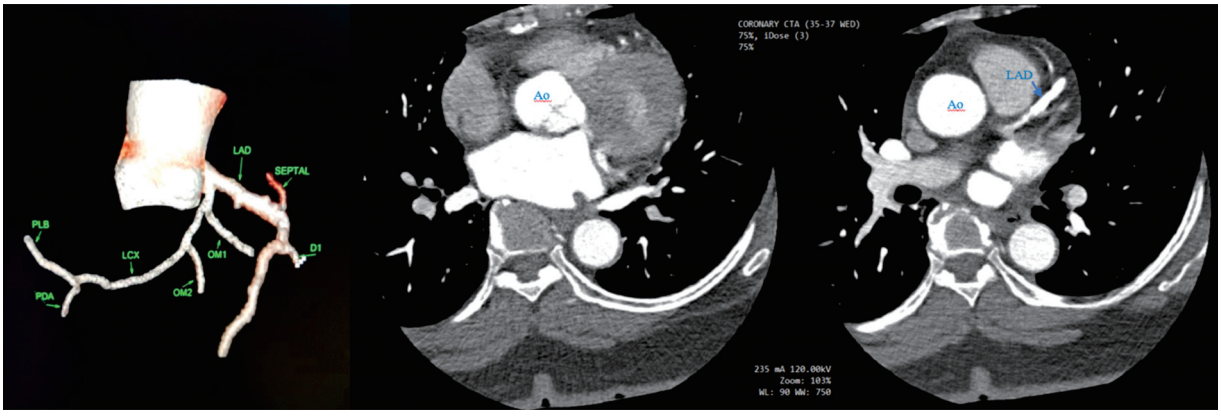

Fig. 3 – The CCTA results in the SCA of LAD. LCx was running posterior interventricular sulcus to the apex.

whereas LCx can end up as RCA. RCA can progress down the left atrioventricular pathway to become LCx and end up as LAD.
- Type II: SCA originates from the left or right coronary sinus. In the SCA's proximal segment, an arterial anomaly can cross the heart base before adhering to another normal coronary anatomy.
- Type III: LCx, and LAD arise separately from the proximal portion of the normal RCA.[4]

Based on the relationship between SCA, the aorta, and pulmonary arteries, Lipton et al. categorized SCA into three categories:
- Category A, artery anomaly passes anterior to the main pulmonary artery.
- Category B, artery anomaly passes anteriorly between the ascending aorta and the main pulmonary artery.
- Category P, artery anomaly passing posterior to the ascending aorta.[4]

Moreover, in 1990, Yamanaka and Hobbs entered two new categories:
- Category S indicates the presence of transeptal and transeptal anomalous arteries.
- Category C indicates an arterial anomaly that passes through more than 1 section.[2]

In 2005, Rigatelli et al. classified coronary artery anomalies based on the level of the clinical condition related to the location of large blood vessels and atherosclerosis in coronary heart disease (CHD). SCA is not included in the benign category (class 1). The presence of SCA with persistent myocardial ischemia is included in the class II category. Subtypes L or R, I-II-III, A-P can be categorized as class III, related to an increased risk of sudden cardiac death (SCD). Subtypes L or R, I-II-III B can be categorized in class IV, where SCD can be caused by CHD.[5]

Most patients with an SCA are asymptomatic or with nonspecific symptoms, but several variants have typical chest pain, syncope, ventricular tachycardia, and sudden cardiac arrest.[6] In addition, an SCA can contribute to typical angina pectoris if there is a narrowing of the proximal arteries, which can cause a decrease blood flow to the heart.

An SCA can be diagnosed with various modalities, including conventional coronary angiography, CCTA, and cardiac MRI. Conventional coronary angiography has become one of the modalities evaluating coronary arteries, although it is invasive. In contrast, the CCTA procedure is a non-invasive diagnostic tool with a high spatial and temporal resolution to detect and characterize coronary artery abnormalities. CCTA can accurately describe arterial abnormalities, provide a 3-dimensional view of arterial deformities and other cardiovascular structures [7]. Meanwhile, MRI is a non-ionizing diagnostic tool used to detect an SCA. It can describe the coronary artery and assess the myocardium's viability. However, MRI has a lower spatial and temporal resolution compared to CCTA. Moreover, MRI is difficult to provide in general health facilities and is contraindicated in patients with a permanent pacemaker.[8]

The prognosis in patients with an SCA can vary. The presence of an SCA event without other congenital abnormalities does not usually result in abnormal heart function. However, a change in ostium anatomy usually results in the progression of atherosclerosis.[6] SCD can happen due to the narrowing of coronary arteries between the two large blood vessels, the aorta, and the pulmonary artery. This compression usually occurs during moderate-to-heavy activities such as sports. Kinking can also be the most likely cause of SCD.[9] Awareness of coronary artery abnormalities and their characteristics is critical to avoid potential complications such as PCI or CABG during coronary intervention. A multidisciplinary approach involving cardiac interventionists and cardiothoracic surgeons is required to decide the best treatment options. In most asymptomatic patients with the absence of atherosclerosis, no invasive intervention is recommended.[9,10]

Conclusions

The incidence rate of a single left coronary artery without an RCA is one of the rarest coronary artery anomalies. An SCA can be classified into several different subtypes. CCTA is a non-invasive diagnostic tool that has an essential role in determining several variants of an SCA. The presence of significant symptomatic symptoms can be treated with the following options: 1. drug therapy/observation, 2. coronary angioplasty, 3. surgery, where intervention is preferred to prevent SCD and can improve quality of life.

Authors' contributions
IPD and KNSP have given substantial contributions to the conception of the design of the manuscript and were major contributors in writing the manuscript. IPD and KPD were editing the manuscript for publications. RAF was the physician who was attending the coronary angiography. IPD and LFKW were the physicians who were done the CCTA. All authors have participated in drafting the manuscript, A revised it critically. All authors read and approved the final version of the manuscript.

Competing interests
The authors declare that there is no conflict of interest.

Ethics approval and consent to participate
This paper already get ethical approval, and the patient/the family sign the informed consent for publication.

Funding
The authors report no involvement in the research by the sponsor that could have influenced the outcome of this work.

Consent for publication
Written informed consent was taken from the patient to use medical data for academic and research purposes, including publication.

Availability of data and material
The datasets used are available from the corresponding author on reasonable request.

Acknowledgements
Not applicable.

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