

Recurrent Multivessel Coronary Artery Spasm Presented as Myocardial Infarction

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Coronary artery spasm is typically a transient and marked narrowing of a single coronary artery lumen that induces myocardial ischemia. In general, patients with coronary spastic angina have a good prognosis. Herein, we described a case of recurrent diffuse multivessel coronary artery spasm presented as myocardial infarction, which was a very rare form of coronary heart disease. Although several similar ones have been reported worldwide, this is the first case rechecked by coronary angiography (CAG) in the follow-up period.

A 64-year-old man was brought to the emergency department at a local hospital after acute severe onset chest pain in his sleep at night. He was a heavy smoker and suffered a similar but milder chest pain 1 month earlier. A 12-lead electrocardiogram (ECG) showed ST-segment elevation in leads I, avL, V1–V4 [Figure 1a]. Emergent CAG was performed which revealed severe stenoses of the left anterior descending (LAD) artery, left circumflex (LCX) artery, as well as right coronary artery (RCA) [Figure 2a–2c and Movie 1]. The LAD and LCX had thrombolysis in myocardial infarction (TIMI) 3 flow, while the posterior descending branch and posterior lateral branch of the RCA had TIMI 1 flow.

During the procedure, his ECG showed junctional rhythm and systolic blood pressure dropped to 60 mmHg [Figure 1b], which failed to improve despite aggressive fluid loading. Intra-aortic balloon pump (IABP) was inserted with 1:1 frequency. He was started on inotropic support with atropine and dopamine to maintain a mean arterial pressure of about 70 mmHg. No drug was given intracoronary at that time. Due to the complexity of lesions, no further intervention

was performed, and a plan for coronary artery bypass grafting (CABG) was drawn up.

Intravenous nitrates, oral aspirin, clopidogrel, and statin were given, then the chest pain resolved gradually and ECG showed remarkable resolution of ST-segment elevation in those leads [Figure 1c]. IABP was removed after the patient became hemodynamically stable. The value of troponin I reached a peak value to 16 ng/ml 4 h after admission and decreased rapidly to 2 ng/ml 4 days later. Echocardiography revealed normal cardiac structure and function.

After 15 days, the patient was transferred to our hospital. ECG showed no obvious ST-segment elevation in all leads [Figure 1d]. Repeated CAG surprisingly revealed complete recovery of all stenoses [Figure 2d–2f and Movie 2]. The patient was strongly advised to quit smoking and was discharged on a regimen of isosorbide 5-mononitrate, nifedipine, and diltiazem.

During the following 6 months, the patient did not suffer any chest pain. Repeated ECG showed no obvious ST-segment elevation in all leads as before. However, follow-up CAG revealed severe stenoses of coronary arteries exactly as they were at the first time, probably due to the irritation of

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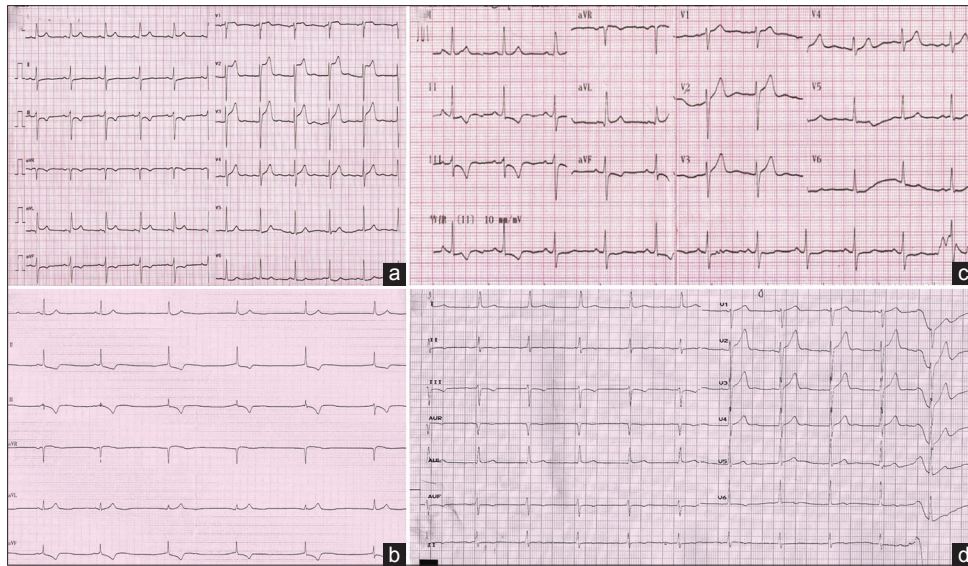


Figure 1: Electrocardiograms when admitted to the Emergency Department (a), during (b) and after (c) the coronary angiography, 15 days later (d). Admission electrocardiogram showed ST-segment elevation in leads I, aVL, V1–V4 (a). During the procedure, the electrocardiogram showed junctional rhythm (b). After the coronary angiography, repeated electrocardiogram showed remarkable resolution of ST-segment elevation (c). No obvious ST-segment elevation in all leads 15 days later (d).



Figure 2: Coronary angiography when admitted to the Emergency Department (a-c), 15 days later (d-f) and 6 months later (g-i). Admission coronary angiography showed multivessel stenoses of coronary arteries (a-c). 15 days later, repeat coronary angiography revealed complete recovery (d-f). 6 months later, follow-up coronary angiography showed re-stenoses (g) and complete recovery after intracoronary nitroglycerin injection (h and i).

guide catheter or contrast medium [Figure 2g and Movie 3]. Nitroglycerin was injected intracoronary and all the stenoses were resolved immediately [Figure 2h, 2i and Movie 4]. Because of the rapid recovery of the coronary arteries, the patient did not feel any uncomfortable during the process. No change was found in the ECG, and the value of troponin I elevated only mildly. The patient was discharged with continuous use of antispastic medicine.

Based on the symptom of severer chest pain, elevated value of troponin I, and completely reversible stenoses of coronary arteries during CAG, the diagnosis of multivessel coronary artery spasm presented as myocardial infarction was established.

There are three core elements establishing the diagnosis of vasospastic angina, including nitrate-responsive angina, transient ischemic ECG changes, and angiographic evidence of coronary artery spasm. In patients with a documented spontaneous episode, the diagnosis can be made on the basis of nitrate-responsive angina with associated transient ECG changes. Occasionally, a spontaneous episode may occur during diagnostic CAG so that all the three elements may be documented. However, typical spontaneous episodes are not documented. As such, provocative testing is undertaken to make the diagnosis. During provocation testing, the diagnosis of vasospastic angina is confirmed if the provocative stimulus induced chest pain, transient ECG changes, and a >90% constrictor response. In this case, typical spontaneous episode was indeed documented, soprovocation test was not needed. Takotsubo cardiomyopathy was not considered because of significantly elevated value of cardiac enzyme, severer spasm of coronary arteries, and absence of stressful trigger. However, left ventricular angiography is very important to rule out Takotsubo cardiomyopathy. Thus, it might be better to perform it during the first angiography.

This case highlights the importance of identifying possible vasospasm for severe multivessel stenoses to avoid unnecessary intervention. At the first time, the patient was originally diagnosed and treated for acute ST-segment elevation myocardial infarction related to atherosclerotic plaque based on clinical presentations and angiographic findings. The diagnosis of coronary artery spasm was not considered as it typically involves a temporary tightening of only one of the coronary arteries. Hence, intracoronary nitroglycerin was not used at that time, leading to misdiagnosis.

Multivessel coronary artery spasm is a very rare form of coronary heart disease. From a review of literature of cases with similar presentation, most of the patients suffered multivessel coronary artery spasm for the first time when they admitted to hospital, meaning they did not have past medical history of coronary heart disease^[1-5] [Table 1]. Vineeta Ahooja reported a similar case with unnecessary CABG.^[5] Therefore, excluding the possibility of vasospasm is sometimes mandatory even for diffuse multivessel coronary artery stenoses, especially for patients with no confirmed history of coronary heart disease.

The patient in this case developed severer hypotension, so IABP was used to provide hemodynamic support. Multivessel coronary artery spasm often causes serious consequence compared to classic ones, such as cardiogenic shock,^[1,2,4] malignant arrhythmia,^[1,4] and even death.^[4]

Besides the common risk factors for vasospasm such as smoking,^[6] previous studies have showed that coronary artery spasm was associated with allergic reactions sometimes, such as asthma^[1] or hypersusceptibility to specific drugs.^[3] Allergen screening could be helpful for these patients to avoid unnecessary provocations. Our patient had no history of asthma or illegal drug abuse. Allergen screening was performed and showed negative result.

This is the first reported case of multivessel coronary artery spasm rechecked by CAG in the follow-up period. The complete free of symptom during this period could probably be the effect of antispastic medicine. However, as being provoked by tiny stimulation, the coronary artery still became spasm even after the patient was completely asymptomatic for 6 months, indicating that the coronary artery itself could possibly has some unique characteristics to be irritated easily. Intravascular ultrasound or optical coherence tomography might be helpful to discover the underlying reason.

Multivessel coronary artery spasm is a very rare form of coronary artery disease with severer complication. Excluding the possibility of vasospasm is sometimes essential for diffuse multivessel coronary artery stenoses to avoid unnecessary percutaneous coronary intervention or CABG, especially for patients with no confirmed past medical history of coronary heart disease. Close follow-up is essential even the patient is asymptomatic. Allergen screening is recommended for these patients to avoid unnecessary provocation.

Table 1: Cases of multivessel coronary artery spasm

References	Race	Age (years)	Sex	PMH of CHD	Risk factor	Arrhythmia	Cardiogenic shock	Outcome
Asano <i>et al.</i> ^[1]	Asian	40	Male	None	Asthma	VT	Yes	Recovery
Hao <i>et al.</i> ^[2]	Asian	43	Female	None	*	None	Yes	Recovery
Krim <i>et al.</i> ^[3]	Caucasian	60	Female	None	Sumatriptan	None	No	Recovery
Haghi <i>et al.</i> ^[4]	Caucasian	60	Female	None	*	VF, cardiac arrest	Yes	Death
Ahooja and Thatai ^[5]	African-American	50	Male	None	*	None	No	CABG

*Undetermined. PMH: Past medical history; CHD: Coronary heart disease; VF: Ventricular fibrillation; AVB: Atrial ventricular block; VT: Ventricular tachycardia; AF: Atrial fibrillation; CABG: Coronary artery bypass grafting.

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Conflicts of interest

There are no conflicts of interest.

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