Spontaneous diffuse vasospasm simultaneously found at left main trunk, left anterior descending, left circumflex and right coronary arteries

Yue–Hai WANG*, Guang–Yong HUANG, Xiao–Hua WANG
Cardiovascular Department, Liaocheng People’s Hospital of Taishan Medical University, Liaocheng, Shandong, China

J Geriatr Cardiol 2017; 14: 772–775. doi:10.11909/j.issn.1671-5411.2017.12.008

Keywords: Coronary artery spasm; Diagnosis; Therapy

Coronary artery spasm (CAS) is found not only in Asian but also in white patients.[1,2] CAS can lead to angina pectoris, myocardial infarction, ventricular arrhythmias and sudden cardiac death. But CAS diagnosis is not necessarily easy, and it also remains highly challenging to therapy and prevention. We present a spontaneous extensive-CAS case with typical clinical features of acute myocardial infarction, despite the regular vasodilator treatment.

A 51-year-old Chinese woman was admitted to hospital with a fifteen-hour history of persistent chest pain accompanied by cold sweat, without apparent cause. The patient blood pressure was 115/65 mmHg, heart rate was 77 beats per minute, respiratory rate was 20 breaths per minute, and her temperature was 36.1 °C. Other positive findings included acute ST-segment elevations [leads III, left foot augmented unipolar (aVF) and right arm augmented unipolar (aVR)] and depression [leads I, left arm augmented unipolar (avL), V2 to V4] and abnormal Q waves [leads III and aVF] on electrocardiogram (ECG) (Figure 1 D), higher titers of serum troponin I [Troponin I (TnI), 0.39 ng/L] and MB isoenzyme of creatine kinase [CKMB] (110.1 U/L).

The patient suffered acute inferior wall myocardial infarction five months ago, but subsequent transthoracic echocardiogram (TTE) showed normal left ventricles (LV), with ejection fraction (EF) of 60%, and the regular medication included aspirin (100 mg per day), clopidogrel (75 mg per day), warfarin (2.5 mg per day), atorvastatin (20 mg per day), isosorbide 5-mononitrate (40 mg per day) and felodipine (5 mg per day). The patient’s history also included eight years of hypertension that was in remission, seven years of hysterectomy for fibroid, and nine months of meniscus arthroplasty accompanied by thrombosis of calf intermuscular vein.

The initial diagnosis of the patient is inferior wall acute ST segment elevation myocardial infarction, coronary artery possibly suffered inferior-wall blood supply vessel occlusion with three or left main artery stenosis. We performed coronary angiography and found that all the epicardial coronary arteries (left main trunk, left anterior descending, left circumflex and right coronary arteries) simultaneously showed diffuse severe stenosis (Figure 2 A and B). It was not appropriate to implement coronary stenting or bypass grafting. We had to adopt medication including aspirin, clopidogrel, enoxaparin, metoprolol, atorvastatin and isosorbide dinitrate. But the patient successively suffered congestive heart failure with left ventricular ejection fraction (LVEF) of 20% and increased titer of serum B-type natriuretic peptides (2263 pg/mL), ventricular tachycardia (Figure 1 G and H) and fibrillation in the following ten days. After timely treatment of noninvasive ventilator, torasemide, spironolactone, amiodarone and defibrillation, the patient received coronary angiography again. To our surprise, all coronary lesions disappeared (Figure 2 C and D) completely and the diagnosis of CAS was confirmed. Then we withdrew the treatment of metoprolol and began to administer diltiazem to prevent CAS. But we had to individually withdraw the treatment of diltiazem and isosorbide dinitrate because of symptoms of heart failure and severe hypotension (80/50 mmHg) in following two weeks. Furthermore, the patient refused implantable cardioverter defibrillator (ICD) treatment.

After 1-month of hospitalization, the patient was discharged and scheduled to receive regular follow-up examination. The regular medication included aspirin (100 mg per day), clopidogrel (75 mg per day), torasemide (10 mg per day), spironolactone (40 mg per day) and amiodarone (200 mg per day). The patient did not complain of chest pain and dyspnea during the following nine months, and TTE showed improvement in cardiac function (LVEF 40%), but
WANG YH, et al. Spontaneous diffuse coronary spasm

Figure 1. Changes on electrocardiogram. There was not abnormal Q wave on ECG seven years ago, (A); or seven months ago, (B): five months ago; the patient suffered first acute myocardial infarction (AMI) and ECG showed abnormal QS wave on lead III, abnormal Q wave on lead avf; (C): the patient suffered second AMI and ECG showed abnormal QS waves on leads III, avF and avR, and depressed ST-segments on leads I, avL, V2 to V4 on first day; (D): abnormal QS waves on leads II, III and avF, and flat T waves on leads V2 to V6 on fifth day; (E): abnormal QS waves on leads III, avF, and V1. voltage-decreased R waves on leads II, V2 and V3 on seventeenth day; (F): and ventricular tachycardia on third, or seventh days (G and H). AMI: acute myocardial infarction; avF: left foot augmented unipolar; avR: right arm augmented unipolar; avL: left arm augmented unipolar.

global wall hypokinesis was found in left ventricular inferior wall, posterior wall, high lateral wall and interventricular septum.

During hospitalization, we analyzed the evolutions of ST-T and Q waves in ECG (Figure1 A to H), which revealed the attacks of acute myocardial ischemia, myocardial necrosis and malignant arrhythmia in the patient.

Previous studies have shown that the risk factors for CAS include age, cigarette smoking, high sensitivity C-reactive protein, remnant lipoproteins, drinking alcohol, strenuous exercise, emotional stress, hyperthyreosis, anaphylaxis, post-menopause, drugs and genetic factors. In our report, the patient received hysterectomy which can affect ovari blood supply, accelerate ovarian failure and reduce estrogen secretion. 34% of women suffered ovarian failure and menopausal symptoms within two years after hysterectomy. Perhaps, hysterectomy played an important role in CAS attack of our patient.

Different studies showed CAS may be diffuse or focal, occurs at single or multi vessels or simultaneously in the same patients, with or without coronary lesion. However, these studies have been based almost entirely on Holter monitoring or acetylcholine provocation tests. Fifteen-hour of progressive chest pain and ST-segment elevation (leads III, avF and avR) revealed that the patient suffered long-time and extensive acute myocardial ischemia, which was consistent with the findings of first coronary angiography and elevated titer of serum TnI and CKMB. Severe, extensive and prolonged myocardial ischemia led to extensive myocardial injury and cardiac dysfunction and malignant arrhythmia. To our surprise, all coronary lesions disappeared completely in second angiography, and the diagnosis of CAS was confirmed. For such a wide range of coronary artery lesions, we did not expect the diagnosis of
Figure 2. Diffuse spontaneous coronary artery spasm simultaneously found at left main trunk, left anterior descending, left circumflex and right coronary arteries in angiogram. A 51-year old woman showed diffuse spontaneous coronary artery spasm (CAS) simultaneously found at left main trunk, left anterior descending, left circumflex coronary arteries (A) and right coronary artery (B). Second-time coronary angiography showed coronary artery stenosis all disappeared at left (C) and right (D) coronary arteries.

CAS, and not use intracoronary vasodilator administration in the first coronary angiography. The diagnosis of extensive coronary spasm can be quite challenging and it could be easily mistaken, especially with acute myocardial infarction with typical clinical features.

The main drugs for the treatment of CAS include nitrate and calcium channel blocker. In addition, Nicorandil, magnesium, statins, antioxidants such as vitamin C and E, angiotensin-converting enzyme (ACE)-inhibitors, angiotensin II receptor antagonist (ARBs), anti-inflammatory agents as aspirin, or estrogen in postmenopausal women, may also have beneficial effects on CAS.[1] Despite the regular treatment with nitrate, calcium channel blocker (CCB), statin, and anti-inflammatory agents, our patient suffered a severe, extensive CAS, resulting in a recurrent myocardial infarction. Previous studies show that some CAS cannot be completely controlled even by all above medications.[1] Thus, it is necessary to develop new drugs to be used in CAS treatment. The next treatment was rather difficult when our patient was complicated with severe heart failure, hypotension, and malignant arrhythmias, and the patient refused the ICD treatment. The next nine months, we took the medication including amiodarone, aspirin, clopidogrel, torasemide and spironolactone. It was exhilarating that the patient had no episodes of chest pain, palpitations, and dyspnea within the nine months. Furthermore, follow-up TTE showed the improvement of cardiac function. Nowadays amiodarone is exclusively used as an antiarrhythmic agent. However, it was primarily used as a vasodilator to treat angina pectoris.[4] The mechanisms involved in relaxation of coronary arteries need to be further clarified. The animal experiment showed that amiodarone caused endothelium-dependent vasodilation in canine coronary arteries by stimulating the release of nitric oxide and cyclooxygenase-de-pendent endothelial relaxing factors.[5] In addition, amiodarone possesses calcium channel blocker properties.[6] Thus, amiodarone possi-
bly played dual favorable roles in the prevention of CAS and antiarrhythmic treatment for our patient. Accordingly, the case provides a new approach for the exploration of new drugs for CAS treatment. However, there is a reported case of anaphylactic shock resulting in vasospasm of the distal branches of coronary vessels after amiodarone infusion.[7] Another case report showed that a 55-year-old male on long-term amiodarone therapy suffered thyroiditis-associated CAS.[8] Therefore, the role of amiodarone in the prevention of CAS needs further define in future study.

To our knowledge, our patient is the first arteriographic case with a well-documented spontaneous diffuse CAS that simultaneously occurred in all the epicardial coronary arteries: left main trunk, left anterior descending, left circumflex and right coronary arteries, despite the regular anti-vasospasm-drug treatment. The diagnosis of extensive coronary spasm can be quite challenging, especially with acute myocardial infarction accompanied by typical clinical features. More research is needed to explore drug therapies, including amiodarone.

Disclosures

This work was supported by the National Natural Science Foundation of China (No. 81573095).

References

1 Yasue H, Nakagawa H, Itoh T, et al. Coronary artery spasm: clinical features, diagnosis, pathogenesis, and treatment. J Cardiol 2008; 51: 2–17.
2 Ong P, Athanasiadis A, Borgulya G, et al. Clinical usefulness, angiographic characteristics, and safety evaluation of intracoronary acetylcholine provocation testing among 921 consecutive white patients with unobstructed coronary arteries. Circulation 2014; 129: 1723–1730.
3 Siddle N, Sarrel P, Whitehead M, et al. The effect of hysterectomy on the age at ovarian failure: identification of a subgroup of women with premature loss of ovarian function and literature review. Fertil Steril 1987; 47: 94–100.
4 Singh BN. Amiodarone: historical development and pharmacologic profile. Am Heart J 1983; 106: 788–797.
5 Rodrigues AJ, Evora PR, Maruo A, et al. Amiodarone causes endothelium-dependent vasodilation in canine coronary arteries. Arq Bras Cardiol 2005; 84: 251–255.
6 Lubic SP, Nguyen KP, Dave B, et al. Antiarrhythmic agent amiodarone possesses calcium channel blocker properties. J Cardiovasc Pharmacol 1994; 24: 707–714.
7 Cheung M, Seres T, Cleveland J, et al. Kounis syndrome, a coronary hypersensitivity disorder: A rare case of amiodarone-induced coronary vasospasm and simultaneous peripheral vasodilation intraoperatively. Int J Cardiol 2016; 218: 267–268.
8 Brooks MJ, Pattison DA, Teo EP, et al. Amiodarone-induced destructive thyroidicatized with coronary artery vasospasms and recurrent ventricular fibrillation. Eur Thyroid J 2013; 2: 65–67.