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ABOUT COVER

Editorial board member of *World Journal of Clinical Cases*, Dr. Kvolik is a Professor in the School of Medicine, Osijek University, Croatia. She obtained her MD degree, with specialization in the field of anesthesiology, resuscitation and intensive care from the Zagreb Medical School, Croatia. Afterwards, she undertook postgraduate training in Clinical Pharmacology at the same institution, defending both a Master's thesis and PhD thesis. In 2006, she joined the Osijek University Medical Faculty as a lecturer and was promoted to Professor in 2009. In 2012, she was elected Head of the Department of Anesthesiology, Resuscitation, Intensive Care and Pain Therapy, a position she occupies to this day. She is also the current Head of the Intensive Care Unit at the Osijek University Hospital, Croatia. (L-Editor: Filipodia)

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Spontaneous multivessel coronary artery spasm diagnosed with intravascular ultrasound imaging: A case report

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Abstract

BACKGROUND

Coronary artery spasm is a major cause of myocardial ischemia. Although coronary artery spasm has been known for a long time, its mechanism has not yet been identified. Many clinicians, especially young clinicians pay less attention to coronary artery spasm, which may lead to some patients not being appropriately diagnosed and treated in time. We report a patient with spontaneous multivessel coronary artery spasm for more than 30 years diagnosed with intravascular ultrasound (IVUS) imaging.

CASE SUMMARY

A 66-year-old Chinese male patient had chest squeezing at rest for more than 30 years. He had a history of cigarette smoking for more than 40 years and hypertension for 10 years. Before presenting at our institution, the patient had undergone coronary angiography 4 times and percutaneous transluminal coronary angioplasty procedures twice at other hospitals without a diagnosis of coronary artery spasm. However, his chest symptoms worsened. Spontaneous multivessel coronary artery spasm occurred during IVUS without provocation testing, and the IVUS image was recorded. Thus, the diagnosis of multifocal spontaneous coronary artery spasm was confirmed. The patient was placed on oral diltiazem, isosorbide mononitrate, and nicorandil to suppress coronary artery spasms. All medications were given at the maximum dosages tolerated by the patient. He was discharged after 5 d without complications. During the six-month follow-up period, the patient was symptom-free.

CONCLUSION

Coronary artery spasm is still prevalent in Eastern countries. It is essential for clinicians to be aware of coronary artery spasm, which may be hard to detect and can be lethal, in order to diagnose and treat patients appropriately.

Key words: Coronary artery spasm; Multivessel coronary; Spontaneous; Intravascular

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Core tip: Coronary artery spasm is an important cause of myocardial ischemia. Although coronary artery spasm has been known for a long time, its mechanisms have not yet been identified. Coronary artery spasm is prevalent in Asian countries, but many clinicians, especially young clinicians, pay less attention to coronary artery spasm, which may result in misdiagnosis and mistreatment. It is essential for clinicians to be aware of coronary artery spasm, which may be hard to detect but can be lethal, in order to diagnose and treat patients appropriately.

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INTRODUCTION

Coronary artery spasm is an important cause of myocardial ischemia. It may be associated with the pathogenesis of several cardiac diseases including sudden cardiac death, angina pectoris, acute myocardial infarction, fatal arrhythmias, and other diseases^[1]. Coronary artery spasm is thought to result from endothelin dysfunction, which impairs vasodilatation. However, under rare conditions, it may relate to multiple coronary vessels, and medical treatments may be ineffective. Variant angina is a discrete form of angina pectoris, which typically occurs during normal activity or at rest, without evident classical triggers such as exercise. In this syndrome, episodes usually occur at night or in the early hours of the morning^[2]. The diagnosis of variant angina can be challenging and it can easily be mistaken for diffuse coronary artery disease.

Previous intravascular ultrasound (IVUS) and optical coherence tomography (OCT) studies have reported the morphological features of vasospastic lesions^[3,4]. However, most of the data were obtained in a spastic lesion that was artificially induced by the administration of acetylcholine or ergonovine. In this report, we present the case of a 66-year-old male who had chest symptoms at rest for more than 30 years. Before presenting at our institution, the patient had undergone coronary angiography 4 times and percutaneous transluminal coronary angioplasty procedures twice at other hospitals without a diagnosis of coronary artery spasm. However, his chest symptoms worsened. Spontaneous multivessel coronary artery spasm occurred during IVUS without provocation testing, and the IVUS image was recorded.

CASE PRESENTATION

Chief complaints

A 66-year-old male had chest squeezing at rest for more than 30 years.

History of present illness

Thirty years ago, the patient had chest squeezing at rest which occurred most often from midnight to early morning lasting from 5 to 15 min, and was not usually induced by exercise in the daytime. Over the preceding 13 years, he had undergone coronary angiography 4 times and percutaneous transluminal coronary angioplasty procedures twice at other hospitals without a diagnosis of coronary artery spasm. In July 2006, 70% stenosis was found in the ostial left anterior descending artery and 90% stenosis was found in the mid left circumflex. The left circumflex was dilated by balloon without a stent as the left circumflex was small according to the previous angiography report. The patient was given various medications, such as beta blocker, aspirin, angiotensin-converting-enzyme inhibitor, clopidogrel, and statin, but his chest

symptoms were not relieved. Due to repeated similar complaints, angiography was performed again without percutaneous transluminal coronary angioplasty in November 2014 and August 2015. In August 2017, an electrocardiography was performed during a chest squeezing episode in the early morning at 6:08 in a hospital and ST-segment elevations in II, III, aVF and V2-V5 leads were observed. Subsequently, ST-segment depression in II, III and aVF, and ST-segment elevation in V2-V5 leads became apparent. The symptoms and ST-segment elevation or depression disappeared 3 min and 25 s after sublingual administration of nitroglycerin (Figure 1). However, the doctors did not realize that the symptoms were caused by coronary artery spasm. Coronary angiography was performed and showed severe stenosis in the proximal left circumflex which was dilated by balloon again without a stent. However, his chest symptoms occurred approximately 5 times/mo. The patient presented to the emergency room of our hospital with frequent chest squeezing episodes in March 2019.

History of past illness

The patient had a history of hypertension for 10 years.

Personal history

The patient had a history of cigarette smoking for more than 40 years.

Family history

No family history of inherited diseases, autoimmune diseases or coronary heart disease was recorded.

Physical examination

Vital signs were stable and physical examination was unremarkable.

Laboratory examinations

No elevation in high sensitivity troponin T was detected and the rest of his laboratory examinations were also completely normal.

Imaging examinations

Electrocardiography was performed during a chest pain episode and ST-segment elevations in I, aVL and V2-V3 leads were recorded which spontaneously resolved, accompanied by pain relief (Figure 2). Neither chest X-ray nor echocardiography showed any specific changes.

In order to evaluate the condition of the coronary artery, coronary angiography and IVUS were performed. An injection of acetylcholine into the coronary artery was administered to induce spasm. Coronary angiography was performed *via* right radial access. Intravenous injection of diltiazem and intracoronary injection of nitroglycerin were administered to prevent coronary artery spasm induced by the catheter or guidewire.

An initial coronary angiography showed mild atherosclerotic changes from the proximal to the mid segment in the right coronary artery. There were no obvious atherosclerotic changes in the left main trunk, left anterior descending coronary artery and left circumflex (Figure 3).

After intracoronary injection of 200 µg of nitroglycerin, each segment was examined using a mechanical IVUS system. During IVUS checking of the right coronary artery and left anterior descending coronary artery, the patient felt chest squeezing without the use of acetylcholine or ergonovine. Coronary angiography showed that a local coronary spasm occurred at the distal segment of the right coronary artery and a diffuse coronary spasm occurred at the proximal-distal segment of the left anterior descending coronary artery (Figure 4). Following an intracoronary injection of nitroglycerin (right coronary artery with 400 µg nitroglycerin and left coronary artery with 1000 µg nitroglycerin), the patient's chest symptoms and coronary spasm were relieved (Figure 5).

IVUS images showed that the right coronary artery and left anterior descending coronary artery demonstrated increased media thickness (Figure 6).

FINAL DIAGNOSIS

The diagnosis of multifocal spontaneous coronary artery spasm was confirmed.

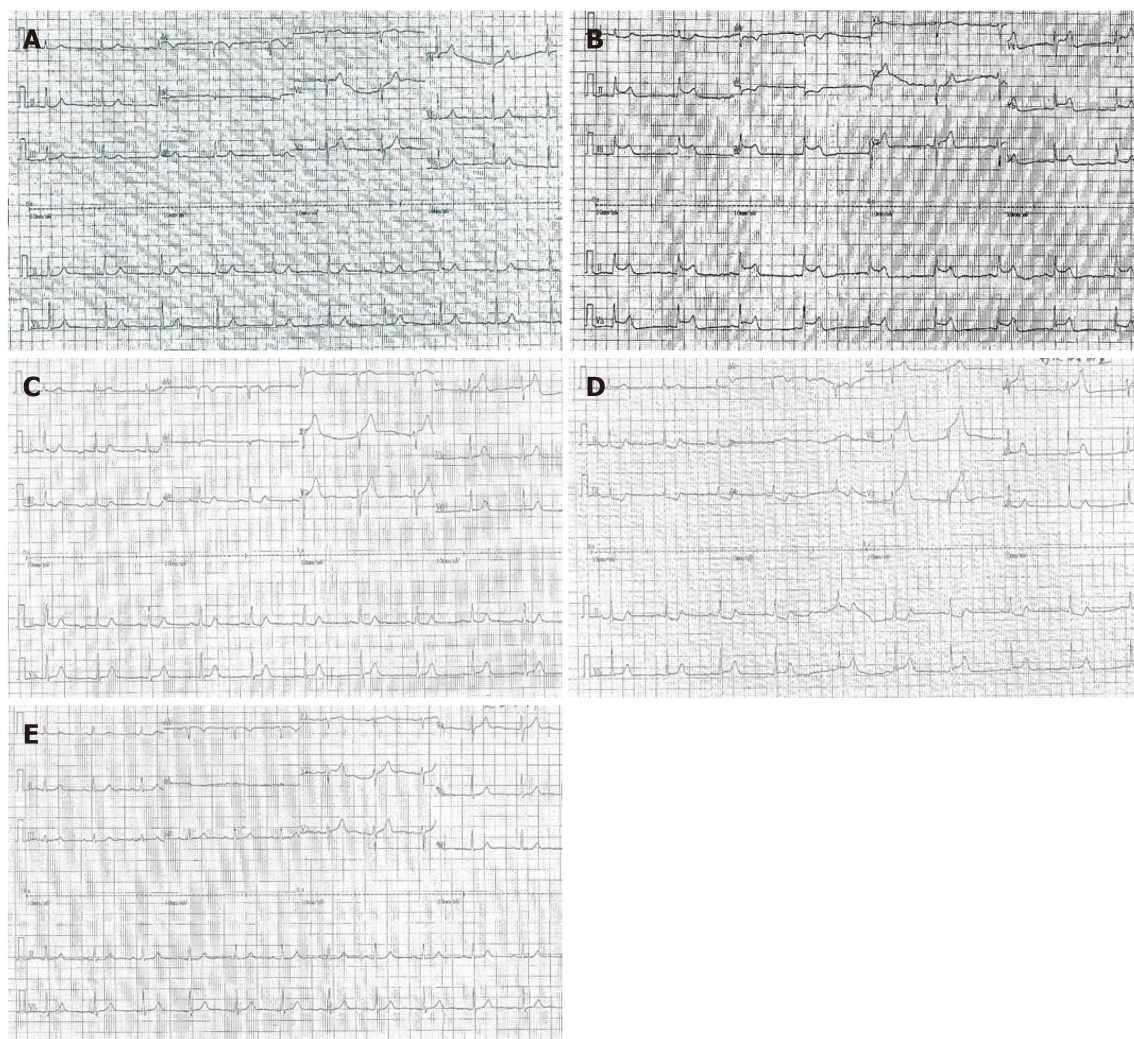


Figure 1 Electrocardiographic findings in August 2017. A: Admission electrocardiography without symptoms; B: ST-segment elevation in II, III, aVF and V2-V5 leads during a chest squeezing episode in the early morning at 6:08; C: ST-segment depression in II, III and aVF, and ST-segment elevation in V2-V5 leads 83 s after the chest squeezing episode; D: ST segment depression in II, III and aVF, and ST-segment elevation in V2-V5 leads 3 min after the chest squeezing episode; and E: ST-segment elevation or depression disappeared 3 min and 25 s after sublingual administration of nitroglycerin.

TREATMENT

Beta blocker was discontinued. The patient was placed on oral diltiazem, isosorbide mononitrate, and nicorandil to suppress coronary artery spasms. All medications were given at the maximum dosages tolerated by the patient.

OUTCOME AND FOLLOW-UP

The patient was discharged after 5 d without complications. During the six-month follow-up period, the patient was symptom-free.

DISCUSSION

We present the case of a patient with angina pectoris at rest for more than 30 years. According to electrocardiography at onset of chest symptoms, ST elevations were observed in the precordial (V2-V5), inferior (II, III, aVF) and lateral (I, aVL) leads. Before being diagnosed with variant angina at our hospital, the patient had undergone coronary angiography 4 times and percutaneous transluminal coronary angioplasty procedures twice at other hospitals without IVUS, OCT or fractional flow reserve. Spontaneous multivessel coronary artery spasm occurred during IVUS without

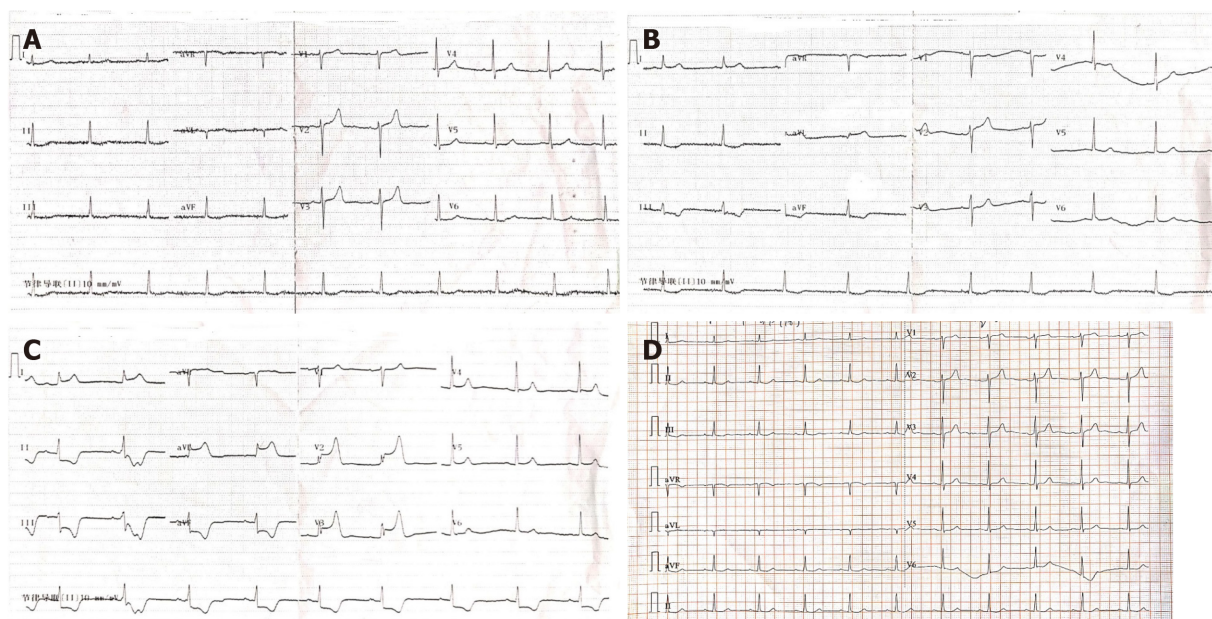


Figure 2 Electrocardiographic findings in March 2019. A: Admission electrocardiography without symptoms; B: ST-segment elevation in I and aVL leads during a chest squeezing episode; C: ST segment elevation in I, aVL and V2-V3 leads during a chest squeezing episode; and D: ST segment elevation or depression disappeared accompanied by pain relief.



Figure 3 Initial coronary angiography before intravascular ultrasound. Mild atherosclerotic changes from the proximal to the mid segment in the right coronary artery. No obvious atherosclerotic changes in the left main trunk, left anterior descending and left circumflex coronary artery.

provocation testing, and the IVUS image was recorded at our hospital. The patient was placed on oral diltiazem, isosorbide mononitrate, and nicorandil to suppress coronary artery spasms. The patient was free of symptoms during the six-month follow-up period. Thus, the diagnosis of multifocal spontaneous coronary artery spasm was confirmed.

IVUS and OCT studies have reported the morphological features of vasospastic lesions. However, most of the data were obtained in a spastic lesion that was artificially induced by the administration of acetylcholine or ergonovine. In the present study, spontaneous multivessel coronary artery spasm occurred during IVUS without provocation testing, and the IVUS image was recorded. Tanaka A used provocation testing to assess coronary artery spasm with OCT. The results showed that the spasm lesion demonstrated an increased maximum media thickness^[3]. Our patient also showed increased media thickness in the spastic coronary artery.

Coronary artery spasm is mainly a disease of middle-aged and elderly men. Smoking is a significant risk factor for coronary artery spasm. Our patient with multifocal spontaneous coronary artery spasm had a history of cigarette smoking for more than 40 years. A significantly higher proportion of patients with coronary artery spasm angina are smokers than those with stable effort angina, suggesting that the pathogenesis of coronary artery spasm may be different to the pathogenesis of coronary atherosclerosis. As cigarette smoking is an important risk factor for coronary

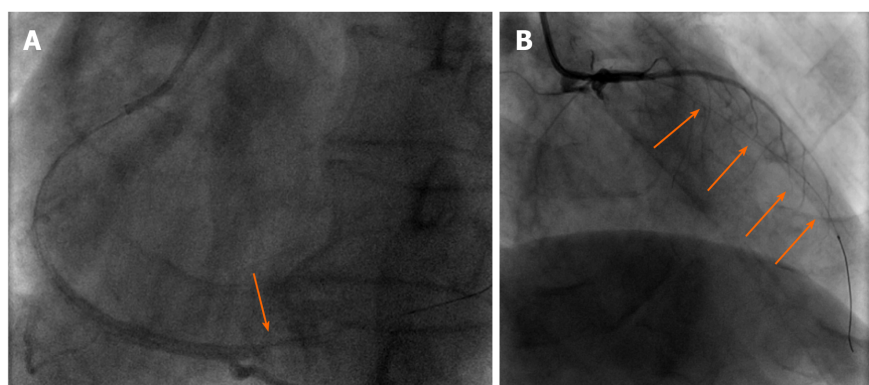


Figure 4 Coronary angiography during intravascular ultrasound. A: In the right coronary artery, a local coronary spasm occurred at the distal segment; and B: In the left coronary artery, a diffuse coronary spasm occurred at the proximal-distal segment of the left anterior descending coronary artery. The coronary spasm segments are indicated by arrows.

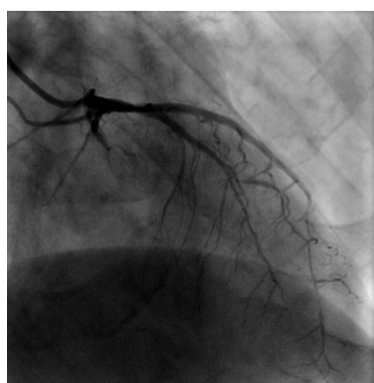


Figure 5 Coronary angiography after the intracoronary injection of nitroglycerin. The left anterior descending coronary artery spasm was relieved.

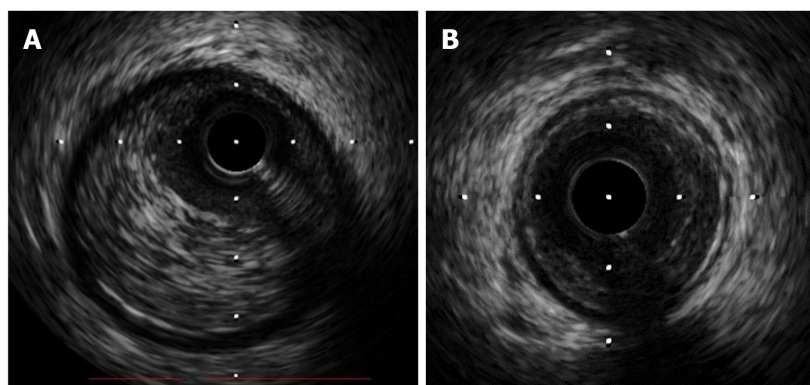


Figure 6 Intravascular ultrasound. Intravascular ultrasound images of the right coronary artery (A) and left anterior descending coronary artery (B) with increased media thickness.

artery spasm, a high smoking rate may be one of the factors associated with the high incidence of coronary artery spasm in Asian countries (*e.g.*, Japan)^[5].

CONCLUSION

Although obstructive coronary artery disease is frequently considered to be the cause of symptoms, vasospasm should be considered in some clinical settings^[6]. Many conventional drugs are ineffective in patients with coronary artery spasm and this may result in fatal arrhythmia or sudden death. It is essential for clinicians to be aware of

coronary artery spasm, which may be hard to detect but can be fatal. Further studies are required to determine the pathogenesis of coronary artery spasm and develop more effective and long-lasting treatments for this disease.

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