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Case Report

Intraoperative Coronary Artery Vasospasm Mimicking Acute Coronary Stent Thrombosis: A Case Report

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Abstract

Coronary artery vasospasm during non-coronary artery surgeries is an extremely rare but potentially life-threatening event. Diagnosing coronary artery vasospasm during surgery is particularly challenging, and identifying the underlying etiology is even more challenging. Herein, we present a case of coronary artery vasospasm that occurred during cardiac tumor resection in a patient who had recently undergone percutaneous coronary intervention for acute ST-elevation myocardial infarction.

Keywords

coronary artery; vasospasm; stent

Introduction

Coronary artery vasospasm, also known as variant angina or Prinzmetal's angina, is characterized by the reversible constriction of the epicardial coronary arteries. This condition is reported in approximately 50% of patients with angina symptoms and is broadly categorized into epicardial spasm and microvascular spasm. Epicardial spasm is diagnosed when there are typical electrocardiogram (ECG) changes and angina symptoms with >90% epicardial vasoconstriction. On the other hand, microvascular spasm occurs when there are ECG changes and angina symptoms but no epicardial vasoconstriction. These conditions can manifest with a range of clinical presentations, from asymptomatic ischemic ST-segment changes to circulatory collapse [1–3]. Currently, no non-invasive diagnostic method exists, and intracoronary spasm provocation testing is considered the gold standard for diagnosing coronary artery vasospasm. General treatment strategies include lifestyle modifications such as smoking cessation and stress avoidance. Pharmacologically, calcium channel blockers and nitrates are recommended as first-line long-term treatment agents [1].

Herein, we present a case of coronary epicardial spasm that occurred during cardiac tumor removal following percutaneous coronary intervention (PCI) for acute ST-elevation myocardial infarction (STEMI).

Case Report

A 48-year-old man was transferred to our hospital due to an intracardiac tumor. Approximately 4 weeks prior to presentation, the patient experienced chest pain and was diagnosed with acute STEMI. He underwent PCI of the mid-right coronary artery (RCA) using a platinum-chromium everolimus-eluting stent (Megatron® stent, Boston Scientific, MA, USA). At that time, echocardiography revealed a large oscillating echogenic mass measuring approximately 5 × 4 cm in the left atrium (LA), raising the suspicion of LA myxoma (Fig. 1).

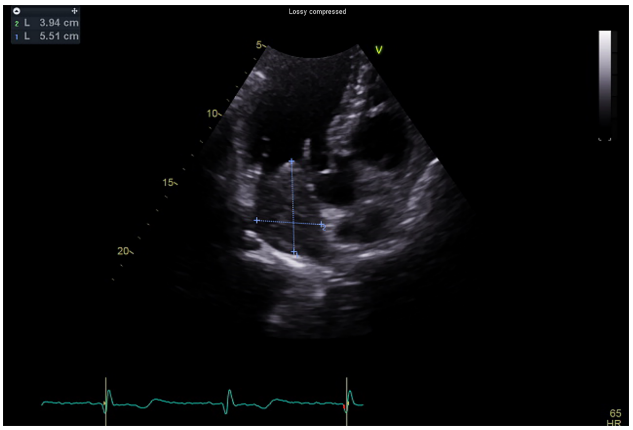

Fig. 1. Transthoracic echocardiography revealed a hyperechoic mass measuring approximately 5 × 4 cm in the left atrium.

The patient had no other significant medical history and had a medication regimen including aspirin, ticagrelor, perindopril arginine, nicorandil, atorvastatin, and carvedilol.

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Surgery to excise the tumor was scheduled for 1 month after the placement. The surgery could not be postponed because the LA tumor was large and oscillating. Hence, to minimize the risk of bleeding and prevent stent thrombosis, aspirin administration was continued while ticagrelor was temporarily discontinued. Perindopril arginine was discontinued 2 days prior to the surgery, while atorvastatin and aspirin were continued until the day before the procedure. Nicorandil and carvedilol were consistently administered up to the day of the surgery. Furthermore, considering the risk of bleeding, a sternotomy was performed instead of a thoracotomy. Bicaval cannulation was employed and the del Nido cardioplegia solution was utilized. The LA tumor was successfully removed following routine left atrial exploration.

Throughout the surgery, the patient's body temperature was maintained at 34 °C, as measured at the nasopharynx, and was gradually raised to normal levels prior to weaning the patient from cardiopulmonary bypass (CPB). The arterial blood gas analysis before CPB weaning showed normal magnesium and potassium levels.

A reduction in the right ventricle (RV) movement and a drop in blood pressure were observed upon pulling the right atrium (RA) to remove the inferior vena cava cannula after CPB weaning. This was initially attributed to excessive traction of the RA. However, subsequent observation of ST-segment elevation in lead II on ECG monitoring and decreased RV wall motion on intraoperative transesophageal echocardiography warranted the recommencement of CPB. CPB weaning was continuously attempted while administering nitroglycerin and inotropic infusions. Despite several instances of failed CPB weaning attempts and considering the use of veno-arterial extracorporeal membrane oxygenation (ECMO), successful CPB weaning was eventually achieved without the need for ECMO. Acute stent thrombosis was suspected due to the discontinuation of ticagrelor, and coronary angiography (CAG) was performed immediately after the patient was transferred to the intensive care unit (ICU). CAG revealed no evidence of stent restenosis; however, severe coronary spasm distal to the mid-RCA stent insertion site was observed (Fig. 2). The patient recovered after intracoronary nitroglycerin administration, and no further spasm recurrences were observed while the patient was administered vasodilators (diltiazem and nicorandil) instead of carvedilol, as there was concern about potential coronary vasospasm (Fig. 3) [1]. The patient was discharged without any notable findings and was followed up as an outpatient without any recurrence for a year.

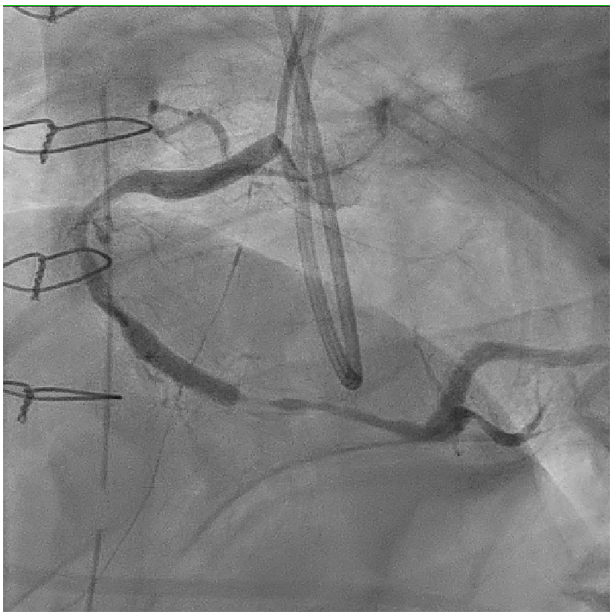

Fig. 2. Coronary angiography showed severe vasospasm of the right coronary artery distal to the stent insertion site.

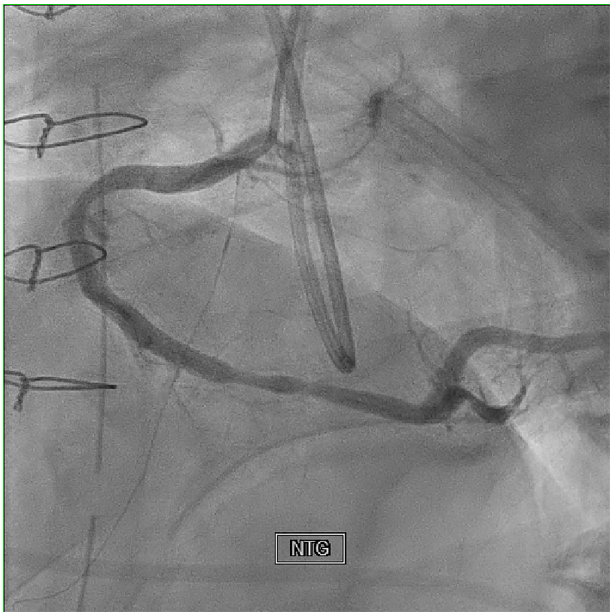

Fig. 3. Coronary angiography after intracoronary administration of nitroglycerin showed relief of vasospasm. NTG, nitroglycerin.

Discussion

Coronary vasospasm is generally attributed to abnormalities in the autonomic nervous system, endothelial dysfunction, chronic inflammation, oxidative stress, smooth muscle hypercontractility, atherosclerosis, and thrombosis. Perioperative coronary spasm; is known to occur because of factors such as hypomagnesemia, alkalotic blood pH, alpha-adrenergic stimulation, hypothermia, the release of vasospastic amines from damaged platelets, and direct trauma to the coronary artery. However, the exact etiology of perioperative coronary spasms has not yet been identified [2–5].

The patient, in the present case, underwent PCI for STEMI 1 month prior and had been taking both aspirin and ticagrelor for approximately 1 month. Although guidelines recommend administering dual antiplatelet agents for up to 6 months in cases of STEMI, waiting for up to 6 months was not possible in this case due to the large and fragile LA mass [6]. Consequently, ticagrelor was discontinued, and only aspirin was continued. This raised concerns about acute stent thrombosis. However, complete occlusion of the stent was unlikely owing to the fluctuating pattern of stable and unstable vital signs. Diagnosing vasospasm postoperatively in the ICU can be challenging. In such cases, if vital signs worsen, considering post-cardiotomy ECMO and diagnostic procedures like echocardiography or CAG to rule out other causes may be advisable.

Perioperative coronary spasm is primarily associated with coronary artery bypass grafting (CABG), and refractory vascular spasm has been reported in approximately 0.8–1.3% of all patients undergoing CABG [4,7]. In contrast, vascular spasms are reported to occur in approximately 1.5% of all patients undergoing PCI, with notably higher incidence rates when using first-generation drug-eluting stents (DES) compared to second-generation DES [8]. Although recent second-generation DES have been associated with low incidence rates of vascular spasms, they can still induce vasoconstriction owing to factors such as smooth muscle hypercontractility, inflammation, and allergic reactions in the coronary artery [9].

The first instance of suspected spasm occurred during the removal of the inferior vena cava cannula. Traction was applied to the RA wall towards the side of the second assistant in order to expose the inferior vena cava, and at that time, the mid-RCA stent area was deemed to have been subjected to irritation. This incident provides evidence that coronary artery spasms can be induced by surgical manipulation [4]. Ultimately, the patient was considered to have experienced coronary artery vasospasm due to surgical manipulation in addition to undergoing recent PCI with a second-generation DES.

Although coronary artery vasospasm is extremely rare in patients without a history of CABG, prompt diagnosis is essential to prevent hemodynamic collapse. While newer coronary stents are associated with a lower incidence of spasms, their safety is not guaranteed. In particular, older patients an increasing number of individuals with a history of PCI are undergoing cardiac surgeries other than CABG. In such cases, the risk of coronary artery vasospasms should be considered. If hemodynamics become unstable, timely initiation of veno-arterial ECMO followed by CAG may be beneficial.

The typical prognosis of coronary vasospasm indicates an annual mortality rate of $<1\%$ with proper medication therapy [1]. However, vigilance is essential due to the possibility of instances where recurrence can lead to sudden deterioration and pose a risk of fatality [5]. The CARE checklist was used when writing this case report (**Supplementary Table 1**).

Abbreviations

ECG, electrocardiogram; PCI, percutaneous coronary intervention; STEMI, ST-elevation myocardial infarction; RCA, right coronary artery; LA, left atrium; CPB, cardiopulmonary bypass; RV, right ventricle; RA, right atrium; ECMO, extracorporeal membrane oxygenation; CAG, coronary angiography; ICU, intensive care unit; CABG, coronary artery bypass grafting; DES, drug-eluting stents.

Availability of Data and Materials

Data available within the article or its supplementary materials.

Author Contributions

HK performed gather information on the case. HK, KSL and SGO contributed to the study conception and design. Material preparation, data collection and analysis were performed by YJ, ISJ, SYS and KJN. The first draft of the manuscript was written by HK. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript. All authors have participated sufficiently in the work to take public responsibility for appropriate portions of the content and agreed to be accountable for all aspects of the work in ensuring that questions related to its accuracy or integrity.

Ethics Approval and Consent to Participate

This case report was approved by the Institutional Review Board of Chonnam National University Hospital. IRB Number: CNUH-EXP-2023-369. Informed consent was obtained from the patient for scientific activity, including publication of this case report.

Acknowledgment

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Conflict of Interest

The authors declare no conflict of interest.

Supplementary Material

Supplementary material associated with this article can be found, in the online version, at https://doi.org/10.59958/hsf.6873.

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