



Distal Coronary Artery Dissection after PCI, Complicated with Coronary Artery Spasm: A Case Report

Che-Ming Chang^{1,2,3}, Ren-Jen Lee¹, Kou-Gi Shyu¹

¹*Division of Cardiology, Department of Internal Medicine, Shin-Kong Wu Ho-Su Memorial Hospital*

²*School of Medicine, Taipei Medical University*

³*School of Medicine, Fu-Jen Catholic University*

Abstract

Coronary artery dissection and spasm are horrible complications after percutaneous coronary intervention (PCI). In this article, we report the case of a 68-year-old male, who presented with acute onset of chest pain and dyspnea on exertion and was found to have a mildly elevated troponin-I level and corresponding electrocardiogram (EKG) findings, subsequently diagnosed with a non-ST elevation myocardial infarction (NSTEMI). Coronary angiography was performed 1 day later and revealed 75% stenosis of the right coronary artery (RCA), middle lesion. The patient then underwent PCI followed by a DES stenting of the middle RCA and admitted to MICU with optimal medical therapy. However, he again suffered persistent attacks of chest pain and became hemodynamically unstable for 30 minutes in the ICU, whereupon a 2nd cardiac catheterization was performed. Further angiographic examination showed type E coronary artery dissection distal to the prior RCA PCI intervention. A 2nd PCI was performed with DES stenting to the dissection area, which showed just DES distal end spasm. DES-related spasm was impressed and a BMS was deployed immediately. After the above management, the patient's general condition was stable and he was discharged 3 days later.

Keywords: coronary artery dissection, DES related coronary artery spasm, percutaneous coronary intervention

Introduction

Complications seen after percutaneous coronary intervention (PCI) include those related to cardiac catheterization and diagnostic coronary angiography, and those that occur as a consequence of the specific equipment (eg, wires, stents, etc.) required for the intervention or the

intervention itself (eg, distal embolization leading to myocardial ischemia, coronary artery dissection, or coronary artery spasm, etc.). Incidence of catheter-induced coronary artery spasm is 0.2%-3% during coronary intervention.¹⁻³ Optimization of medical therapy, especially the use of vasodilators, has been widely accepted as the initial approach to management. Coronary artery

Address for correspondence: Dr. Kou-Gi Shyu, MD

Division of Cardiology, Shin-Kong Wu Ho-Su Memorial Hospital; No. 95, Wen-Chang Rd., Shih-Lin, Taipei, Taiwan
Tel: +886-2-2833-2211; Fax: +886-2-28123397; E-mail: cmchang1@yahoo.com



spasm closely resembles a fixed atherosclerotic lesion and is usually resolved within minutes after intracoronary injection of isosorbide dinitrate.

Case presentation

A 68-year-old man presented to the emergency department with acute onset severe retrosternal chest pain and dyspnea. He had type II diabetes mellitus, hypertension, dyslipidemia, had been a heavy smoker for more than 50 years and had undergone RCA PCI about 20 years prior. The electrocardiogram revealed nonspecific findings but the cardiac enzyme was mildly elevated after a series of check-ups. Non-STEMI was impressed at that time. The patient was referred for elective PCI a day later, after his condition had stabilized. Coronary angiography performed via right radial artery access revealed 75% stenosis in the middle RCA. We engaged the RCA using a Judkin right guide initially and later changed to Amplatz-Left 1 guide for RCA intervention (Figures A, B, C, D). After RCA intervention to the RCA middle area, including DES implantation, his general condition was good and he was sent back to the ICU ward. However, chest pain developed and gradually worsened over 30 minutes. The patient became hypotensive (systolic blood pressure 70-80 mmHg) and hypoxemic (oxygen saturation 84%). We administered intravenous fluids immediately, and sent him back to the catheterization room. Re-check angiography showed closure distal to the prior RCA intervention (Figure E), leading to ST segment elevation in the inferior leads. IVUS examination was not performed due to hemodynamic instability. The RCA was engaged with a 7-French AL-1 guide catheter and PCI was performed with a DES stent to the distal dissection with closure (Figure F), but subsequently another spastic lesion developed just at the distal end of the DES implantation (Figure G). Isosorbide dinitrate solution 0.3 mg intracoronary infusion was given but the spastic lesion was only resolved transiently for minutes. Suspecting that the spastic lesion was related to the DES, we performed

successful stenting with bare metal stent to the spastic lesion. Thereafter, the RCA coronary flow was restored to TIMI 3 antegrade flow (Figures H, I) and no further spastic lesion was noted. The patient was hemodynamically stable after successful RCA recanalization. After 3 days hospital stay, his general condition was stable and without any chest discomfort, whereupon he was discharged without any sequelae.

Discussion

Our presentation contains several important clinical points for the interventional cardiologist. We have classified the points in this case under 2 topics.

■ How Can We Diagnose and Treat Coronary Dissection?

Coronary artery dissection can be spontaneous, a result of trauma, or due to iatrogenic causes. The artery wall has three layers and when a tear occurs, blood is able to pass through the innermost layer and become trapped, causing an inward bulge. This narrows or blocks the artery and can cause a heart attack because blood flow cannot reach the heart muscle. Iatrogenic coronary artery dissection is a feared complication of percutaneous coronary intervention as it can potentially lead to severe myocardial ischemia, arrhythmia, shock, and death. Bailout-stenting, or less often, emergency coronary artery bypass graft surgery may be needed to restore antegrade flow. Coronary artery dissection arises from a tear in the tunica intima of the blood vessel, with blood entering behind and separating the layers of the arterial wall. A false lumen is eventually created in the medial layer which is filled with intramural hematoma. The increasing pressure of the enlarging hematoma within the false lumen causes compression of the true coronary lumen resulting in restricted coronary blood flow and eventually leading to coronary insufficiency. This should be differentiated from atherosclerotic

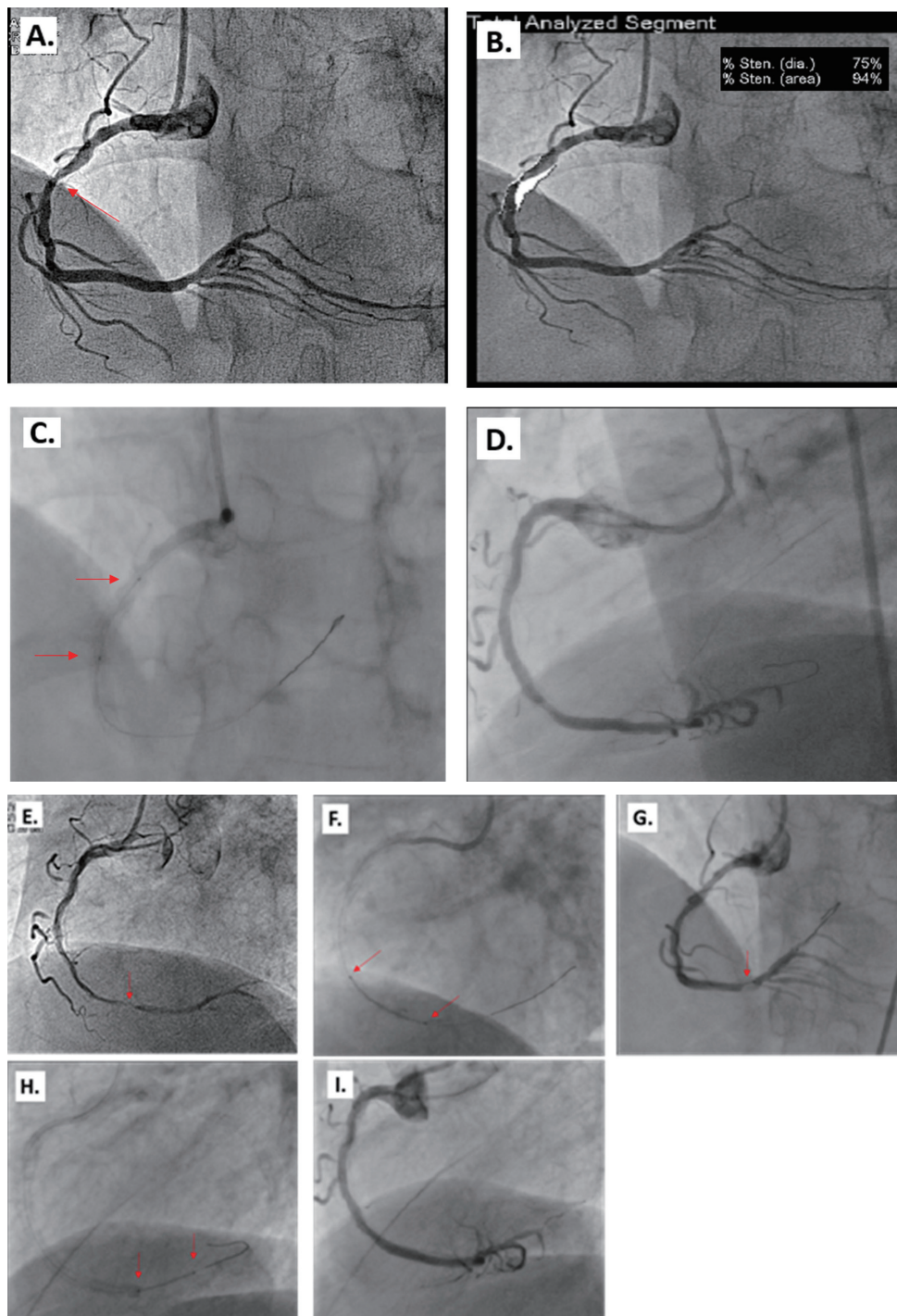


Figure 1. From A) to D); the 1st percutaneous angioplastic intervention. A) Red arrow shows stenotic lesion. B) The RCA middle part shows 75% diameter stenosis, 94% area stenosis. C) Two red arrows show stent implantation site. D) Good result after stent implantation. From E) to I); the 2nd percutaneous angioplastic intervention. E) Red arrow shows coronary artery dissection plus closure (type E). F) Two red arrows show 2nd percutaneous angioplastic intervention stent (DES) implantation site. G) Red arrow shows coronary artery spasm after DES stent implantation. H) Two red arrows show BMS implantation site. I) Good result after BMS implantation.



dissection, which results from plaque rupture or erosions allowing blood to enter the intimal space and from iatrogenic dissections that occur during coronary procedures. Occasionally patients with well-developed collateral circulation do not develop chest pain or signs of ischemia, remain hemodynamically stable, and can be treated conservatively. Definition of the type of dissection is also important. The National Heart, Lung, and Blood Institute classifies coronary dissections into 6 types (A-F) based upon their angiographic appearance 4:

- A: Minor radiolucent areas with little or no persistence of contrast.
- B: Parallel tracts or a double lumen with little or no persistence of contrast.
- C: Contrast outside the coronary lumen with persistence of contrast.
- D: Spiral dissection with filling defects.
- E: Persistent filling defects in the lumen.
- F: Total occlusion without distal flow.

Iatrogenic coronary artery spasm is a further feared complication of percutaneous coronary intervention as it can potentially lead to the same set of further complications as dissection. Bailout-stenting or less often, emergency coronary artery bypass graft surgery may be needed to restore antegrade flow.

We do not fully understand why some people have coronary artery spasms.

One of the most common risk factors is smoking. Our patient was a heavy smoker. Other potential causes or triggers of a coronary artery spasm include:

- using vasoconstrictor drugs, including beta blockers
- exposure to cold
- extreme stress
- use of stimulant drugs, such as cocaine
- excessive alcohol use or alcohol withdrawal
- excessive cannabis use
- chemotherapy
- magnesium deficiency

We describe a case of non-ST elevation

myocardial infarction. Percutaneous coronary intervention was complicated by distal right coronary artery dissection (type E) plus closure and spasm (Figures E, F, G). In our patient, acute RCA closure occurred after PCI + DES (after the first PCI). We performed the second PCI about 30 minutes later for his angina symptoms and aggravated, unstable hemodynamic status, followed by coronary artery spasm attacks just after bail-out DES implantation. This report presents a case in which coronary artery spasm without organic stenosis occurred after PCI for ACS. Repeated coronary angiogram showed significant coronary artery spasms in the RCA distal part just after DES, and these were eventually resolved only transiently after the intracoronary injection of isosorbide dinitrate. Intracoronary injection of isosorbide dinitrate usually relieves spasm promptly, but in our case, it was only transiently. This may have been due to the persistent stimulation to the coronary artery presented by the implanted DES.

■ How Can We Manage DES-Induced Coronary Artery Spasm?

There have been several reports regarding coronary artery spasm associated with life-threatening events after the implantation of drug-eluting stents (DESs).^{5,6} Hypersensitivity reactions to stent components (e.g. coated polymers, drugs, and metal) and endothelial dysfunction have been recognized as important factors influencing the occurrence of coronary artery spasms.⁷⁻⁹ Most reports on this topic have described coronary artery spasms occurring in stent-implanted vessels or in proximal or distal stent segments.^{5,10} A recent study showed that endothelial dysfunction and enhanced vascular smooth muscle contractility with the involvement of the Rho-kinase pathway play an important role in the pathogenesis of DES-induced coronary vasospasm.^{11,12} Coronary vasoconstrictive responses are more pronounced at the edges of coronary segments implanted with DES, as compared with BMS. The incidence of provoked spasm does not differ between patients



with and without coronary vasospastic angina before stenting;¹³ therefore, it is important to be concerned about the occurrence of new stent-edge spasm in patients both with and without coronary vasospastic angina. This case is clinically important because it describes the potential hazard of DES-induced coronary vasospasm, which may have caused subacute stent thrombosis. Various risk factors overlap to contribute to the development of stent thrombosis, and we believe stent-edge spasm also plays an important role in stent thrombosis development. Therefore, we should monitor new-onset rest angina after stent implantation and carefully assess DES-induced coronary vasospasm.

Conclusion

Preventing complications is preferable to treatment, but should complications arise, having additional treatment options is invaluable. We describe a case of Non-ST-segment elevation myocardial infarction. Percutaneous coronary intervention was complicated by acute distal right coronary artery dissection closure and spasm after middle right coronary intervention. Because the spastic lesion was just at the distal edge of the DES stent and occurred moments after DES implantation, the spasm was highly suspected of being related to the DES. We deployed a BMS for the DES-related spastic lesion with good result, suggesting that the spastic lesion was indeed DES-related.

Abbreviations

ACS : acute coronary syndrome
BMS : bare metal stent
DES : drug eluting stent
ICU : intensive care unit
PCI : percutaneous coronary intervention
RCA: right coronary artery

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