

Afebrile Mycotic Aneurysm with Rupture in Right Coronary Artery after Bare-Metal Stent Implantation

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Mycotic coronary aneurysm is a rare complication of coronary angioplasty. We report an unusual case, a 58-year-old male with diabetes mellitus and end-stage renal disease, who underwent bare-metal stent implantation at the right coronary artery for acute coronary syndrome. The patient subsequently developed mycotic aneurysm at the stenting site which manifested as chest pain and severe back pain. Later, a lethal aneurysm rupture occurred, resulting in cardiac tamponade. Surgical debridement with emergent coronary artery bypass grafting was carried out, and post-surgical tissue specimen culture grew methicillin-resistant *Staphylococcus aureus*. The patient died of mediastinitis and massive bleeding 2 weeks after the operation. Thereafter, we completed a review of the literature due to the rarely-occurring nature of this patient's case.

Key Words: Bare-metal stent • Coronary aneurysm rupture • Mycotic coronary aneurysm

INTRODUCTION

An infected coronary artery aneurysm is an extremely rare complication of percutaneous coronary intervention (PCI), and has been reported in patients treated with bare-metal stents (BMS) as well as drug-eluting stents (DES). It can present as a myocardial abscess or pericarditis with an exudative pericardial effusion.¹ Herein, we report a relatively immuno-compro-

mised patient who experienced recurrent chest pain and severe back pain without fever, followed by fatal cardiac tamponade attributable to mycotic aneurysm rupture of the right coronary artery (RCA).

CASE REPORT

A 58-year-old man, with a history of diabetes mellitus, hypertension and chronic kidney disease in uremic status, had presented at our hospital on August 27, 2009 due to unstable angina with pulmonary edema. Thereafter, emergency hemodialysis was performed due to acute respiratory distress. Subsequent coronary angiography revealed a critical stenotic lesion at the middle RCA (Figure 1A). Then, angioplasty was performed by deploying two overlapping BMS (Driver®, Medtronic, Fridley, MN, USA) (3.5 mm/30 mm and 3.5 mm/24 mm, respectively) from the proximal-to-middle part of the RCA (Figure 1B). However, recurrent chest pain with cold sweating occurred thereafter. Coronary angiography was repeated on November 11, 2009 and showed an 80% focal in-stent restenosis at the middle RCA.

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Consequently, balloon angioplasty on the in-stent restenotic site with a compliant balloon (Sapphire®, OrbusNeich, Netherlands) (3.5 mm/20 mm) was performed, with high-pressure inflation up to 20 atm. Unfortunately, this patient again presented at our emergency department 10 days later due to complaints of chest pain and severe back pain with cold sweating. On examination, his blood pressure was 210/119 mmHg and pulse rate was 115/min. He was afebrile, and other physical examinations were unremarkable as well. Laboratory data showed leukocytosis (17031/ μ L) without elevated cardiac enzymes. Although several electrocardiograms did not reveal specific ST-T changes, chest computed tomography with contrast enhancement was arranged and disclosed the presence of a small amount of pericardial effusion. The patient's chest pain persisted, and he developed shock the day after hospitalization; hemodynamic stability could only be maintained through fluid challenge and inotropic agent use. Subsequent physical examinations were unremarkable and electrocardiograms also did not reveal any specific changes. Emergent coronary angiography revealed a huge aneurysm rupture around the stenting site at the middle RCA (Figure 1C). The patient was transferred to a medical center for emergent surgery. However, cardiac tamponade resulting in pulseless electrical activity occurred on arrival at the ER, where a bedside emergent pericardial window was created and direct manual cardiac massage was performed. Coronary artery bypass grafting was done immediately after successful resuscitation. Mycotic aneurysm rupture in RCA with pericarditis was noted (Figures 1D and E) and aneurysm repair was performed. The culture specimen taken from the aneurysm site yielded methicillin-resistant *Staphylococcus aureus*, and the patient was treated with vancomycin. Unfortunately, he died of mediastinitis and massive bleeding 2 weeks after the emergency operation.

DISCUSSION

Coronary aneurysms after PCI are rare (0.3-0.6%), most being pseudoaneurysms rather than true aneurysms.^{1,2} Mycotic coronary aneurysm, an even rarer complication of PCI, has been reported following BMS or DES implantation. To the best of our knowledge, there were only 18 cases with PCI-related mycotic coronary aneurysm reported in the literature. However, it has never been reported in Taiwan. Furthermore, all of the reported cases of PCI-related mycotic coronary aneurysm presented with fever. Our case demonstrated, for the first time, that PCI-related mycotic coronary aneurysm can occur without fever, therefore leading to increasing diagnostic challenges.

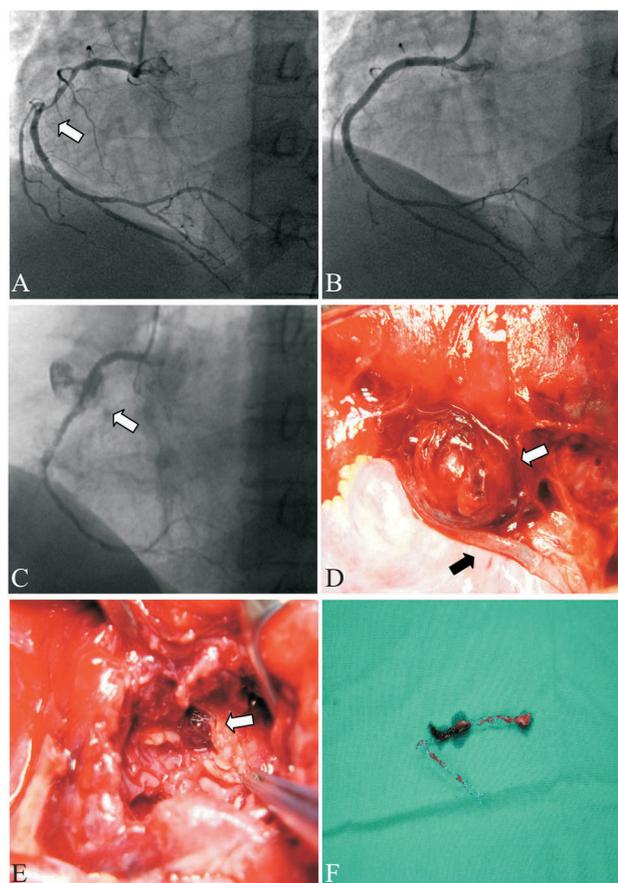


Figure 1. The 40° left anterior-oblique view with 10° cranial angulation showed (A) a critical stenosis at the middle right coronary artery (RCA) (white arrow). (B) Angiographic results after deployment of two Driver® stents. (C) The last coronary angiography showed a huge aneurysm with rupture at the middle RCA stenting site (white arrow). (D) Mycotic coronary aneurysm rupture with pseudoaneurysm formation (white arrow) in RCA (black arrow) with pericarditis was noted during operation. (E) Part of the stents at the rupture site of the mycotic coronary aneurysm was noted after exploring the pseudoaneurysm. (F) Two stents were removed.

Previous case reports included heterogeneous cases with varied enrolled criteria and etiologies which presumably provided unreliable information.^{3,4} In contrast, our comparable cases and review of the literature was specifically focused on mycotic coronary aneurysm after

stent deployment. Overview of the characteristics of the reported cases is summarized in Table 1.³⁻¹¹ According to our review, the prevalence rate of mycotic coronary aneurysm was surprisingly high in men (18/19 = 95%), which varied considerably from the well-known gender

distribution in patients with coronary artery disease.¹² A similar phenomenon was also observed in patients with infection of the aortic endograft prosthesis, with an implanted foreign body against the vessel wall.¹³ The potential mechanisms responsible for this discrepancy are

Table 1. Clinical summary of 19 patients with mycotic coronary aneurysm after stent deployment in the literature

Case age/gender	Vessel	Stent	Organism	Time elapse from index PCI	Symptoms and/or complication	OP	Outcome	Author
49 y/M	LAD	BMS	<i>P. aeruginosa</i>	7 days	Fever	+	death	1996 Leroy O
38 y/M	LCX	BMS	<i>P. aeruginosa</i>	4 days	chest pain, fever/partial rupture with purulent pericarditis	+	survived	1997 Bouchart F
72 y/M	LAD	BMS	<i>S. aureus</i>	18 days	chest pain, fever	+	survived	2003 Liu JC
55 y/M	LAD	PES	<i>S. aureus</i>	3 months	fever/NSTEMI	+	survived	2005 Marcu CB
56 y/M	LAD	SES	<i>S. aureus</i>	4 days	fever, dyspnea/AMI	+	survived	2005 Singh H
47 y/M	RCA	SES	<i>S. aureus</i>	2 days	fever/ purulent pericarditis	-	death	2006 Alfonso F
73 y/M	LCX	SES	<i>S. aureus</i>	3 months	fever/complete destruction of the later LV wall and free-floating LCX	+	death	2007 Le MQ
70 y/M	RCA	SES	<i>S. aureus</i>	1 day	fever/RV fistula	+	survived	2007 Kishida K
75 y/M	RCA	PES	MRSA	11 months	fever, chest pain/abscess	+	survived	2007 Gonda E
54 y/M	RCA	PES	<i>S. aureus</i>	4 months	fever/fistula into RA	+	survived	2007 Jang JJ
43 y/M	RCA and LCX	NA	MRSA	7 days	fever/abscess, severe MR	+	death	2007 Salinas G
86 y/F	LAD	SES	MRSA	14 days	Chills and fever, chest pain/perforation (hemostasis by prolonged balloon inflation)	-	death	2007 Garg RK
59 y/M	LAD	BMS	<i>S. aureus</i>	2 days	fever/rupture into RVOT	-	death	2009 Schoenkerman AB as above
54 y/M	RCA	SES	<i>S. aureus</i>	NA	fever/rupture into RA	+	survived	
61 y/M	LM, LCX and SVG	DES	MRSA	8 months	fever, chest pain/ACS, rupture	-	death	2009 Garq N
59 y/M	LM	BMS	MRSA	6 days	Fever	-	survived (with covered stenting)	2010 Wu EB
69 y/M	LAD	EES	MRSA	4 days	fever/abscess	+	death	2011 Lim CP
62 y/M	LAD	SES	<i>P. aeruginosa</i>	14 days	fever, chest pain/purulent pericarditis	+	survived	2011 Furtado AD
58 y/M	RCA	BMS	MRSA	10 days	chest pain/rupture, acute pericarditis	+	death	2011 Chen IC

ACS, acute coronary syndrome; AMI, acute myocardial infarction; BMS, bare-metal stent; DES, drug-eluting stent; EES, everolimus-eluting stent; F, female; LAD, left anterior descending artery; LCX, left circumflex artery; LM, left main trunk; LV, left ventricle; M, male; MR, mitral regurgitation; MRSA, *methicillin-resistant Staphylococcus aureus*; NA, not available; NSTEMI, non-ST segment-elevation myocardial infarction; OP, operation; PCI, percutaneous coronary intervention; PES, paclitaxel-eluting stent; RA, right atrium; RCA, right coronary artery; RV, right ventricle; RVOT, right ventricular outflow tract; SES, sirolimus-eluting stent; SVG, saphenous venous graft; y, years old.

still unknown and warrant further investigation.

Staphylococcus aureus, also seen in this case, was the most common causal micro-organism (16/19 = 84%) as noted in the literature, perhaps attributed to the common source of bacteremia in this clinical setting and the embolic-prone nature of this micro-organism. Catheter-based infection is one of the reported risk factors for stent infection since direct stent contamination at the time of delivery,³ repeated femoral access and femoral artery sheaths left in place for a long duration⁵ may facilitate bacteremia of *Staphylococcus aureus*, a common normal flora on the skin.

According to our systemic review, the majority of patients underwent apparent mycotic coronary aneurysm within one month after PCI. The average mortality rate was quite elevated (9/19 = 47%).

Mechanical factors, infection and inflammation were three major contributors reported to lead to the development of mycotic coronary aneurysms.¹⁴ The possible mechanisms responsible for the development of mycotic aneurysm after stenting in our case might be mechanical stretch from high-pressure balloon inflation, blood-stream infection due to repeated arterial puncture during hemodialysis, and inflammation and allergic reaction of the vessel wall to the stent itself. It has been suggested that mechanical factors, such as residual dissections due to arterial wall injury caused by oversized balloons and stents, high-pressure inflations and atherectomies, could be associated with aneurysmal formation after PCI.¹⁴ In our case, high-pressure balloon inflation for the in-stent restenotic lesion of RCA during the second patient admission might be a potential mechanical factor. Banai and colleagues¹⁵ found that the incidence of bacteremia was 4.6% immediately after PCI; whereas positive blood culture could be obtained in 4.1% of patients 4 hours later. The femoral sheath in our case was removed within 4 hours after the procedure. The duration of the sheath left in situ was not so extended as to enhance the development of bacteremia. The necessity of repeated arterial puncture during routine hemodialysis was presumed to have let our patient remain more vulnerable to bacteremia. Of note, methicillin-resistant *Staphylococcus aureus*, as seen in our case, is a common micro-organism isolated from patients with end-stage renal disease.

The inflammatory and allergic reactions of the vessel wall to nickel and molybdenum, major components

of BMS, may account for the development of aneurysmal formation.¹⁴ When DESs are considered, growing evidence suggests that aneurysmal dilatation of the stented arterial segment is mediated by a local hypersensitive reaction to the metallic stent, polymer or eluting drug.³ According to our review, the Sirolimus-coated stent was most commonly used (7/12 = 58%) for all DES-related mycotic coronary aneurysms. This phenomenon could probably result from Sirolimus-induced blunted innate inflammatory response to bacterial invasion locally by attenuation of interleukin-10 production in humans, thereby leading to an increased susceptibility to sepsis.¹⁶

The correct diagnosis of mycotic coronary aneurysm can be very challenging for clinical physicians. While patients with this disease typically have a PCI history with recurrent chest pain, as well as persistent bacteremia but no identifiable source of infection, a high index of suspicion along with the use of multimodality imaging may be helpful in facilitating diagnosis. Our case report suggested that immuno-compromised patients who have undergone stent deployment experience recurrent angina pectoris with leukocytosis and thus should be carefully examined, notwithstanding a lack of fever. Early surgical management of all mycotic coronary aneurysms following stenting is warranted due to its high mortality and morbidity rate without surgical intervention.

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