

# Very Late Coronary Stent Infection and Abscess following *Staphylococcus aureus* Bacteremia



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## INTRODUCTION

Despite widespread use of percutaneous coronary intervention (PCI) and stenting, infective complications are rare.<sup>1,2</sup> Coronary stent infection is difficult to treat and is potentially disastrous, with a high mortality rate.<sup>1,3</sup> We present a case of very late coronary stent infection with a large abscess 5 years after coronary stent implantation.

## CASE PRESENTATION

A 50-year-old woman was admitted to our institution with dyspnea and pleuritic left-sided chest pain with a background of coryzal symptoms for 1-week. She had a very complex medical history including type 2 diabetes mellitus, diabetic nephropathy and end-stage renal failure on hemodialysis, hypertension, and paroxysmal atrial fibrillation. She also had known ischemic heart disease with a left anterior descending artery (LAD) stent implantation (Xience Prime, Everolimus eluting stent—Abbott Vascular, Gurnee, IL) 5 years prior.

Investigations at the time showed sinus tachycardia on electrocardiography with subtle T-wave inversion in lateral leads (I and aVL), raised serum inflammatory markers (white cell count  $13.76 \times 10^6$ , C-reactive protein 590), and high troponin levels (3,130 ng/L). Computed tomography pulmonary angiography was negative for pulmonary embolus but showed small pericardial effusion and pulmonary consolidation. Her transthoracic echocardiography (TTE) showed mild global left ventricular systolic dysfunction (left ventricular ejection fraction of 45%-50% by biplane Simpson's method) and small to moderate pericardial effusion (0.5 cm posteriorly and 0.8 cm anteriorly) with no characteristic features of pericardial tamponade (Video 1). Considering her presentation, cardiovascular risk factors, and elevated cardiac biomarkers, she underwent coronary angiography, which showed a widely patent LAD stent with no obstructive coronary stenosis that could contribute to myocardial infarction (Figure 1A). Because of chronic renal failure, cardiac mag-

netic resonance imaging with gadolinium contrast was contraindicated, and she was treated as myopericarditis and type 2 myocardial infarction.<sup>4</sup> Outpatient follow-up TTE in 1 week showed reduction in pericardial effusion and improved serum inflammatory markers, and the patient reported no symptoms.

Twenty days later, the patient was transferred from a regional hospital with chest and left shoulder pain, reduced exercise tolerance, and fever of 39°C. On initial examination she was afebrile and had no cardiac murmurs. She had a raised serum C-reactive protein level of 340 and troponin level of 11,200 ng/L, and her electrocardiography showed deep T-wave inversion in anterolateral leads. Repeat TTE showed new severe hypokinesia of the basal to mid anterior and inferior septum (Videos 2 and 3). Three sets of blood cultures grew *Staphylococcus aureus* sensitive to dicloxacillin, and treatment was instituted immediately with intravenous flucloxacillin and a renally adjusted dose of vancomycin.

Repeat coronary angiography was performed, which demonstrated a large aneurysmal dilatation arising from the stented segment of LAD (Figure 1B, Video 4). There was no significant in-stent stenosis and no other new coronary lesions. We decided not to proceed with intracoronary imaging due to the potential risk of perforation or rupture of the aneurysmal segment with coronary instrumentation. Cardiovascular magnetic resonance would have been valuable and informative with high imaging resolution, but the patient could not be given gadolinium contrast due to chronic renal failure. Therefore, we decided to proceed with transesophageal echocardiography to further characterize the etiology and extent of the condition and also rule out any other possible source of bacteremia such as infective endocarditis. Transesophageal echocardiography revealed a 21.5 mm × 18.7 mm circular bilobed echo-free region surrounding the LAD stent, extending epicardially as well as into the septum consistent with an abscess cavity or pseudoaneurysm (Figure 2, Video 5).

Due to the scope of cardiac involvement, size of coronary aneurysmal dilatation, and control source of infection, the cardiothoracic surgeon undertook an urgent thoracotomy with a left internal mammary graft to the mid LAD, drainage of abscess and excision of part of the LAD stent, resection of mycotic aneurysm, and ligation of the LAD proximal to the stented segment. Microbiological culture of the stent and abscess also grew *Staphylococcus aureus*, but unfortunately histopathology was not requested on the specimen. This is a limitation as it is not clear whether the aneurysmal dilatation was a true aneurysm, pseudoaneurysm, or mycotic aneurysm.

The likely source of staphylococcal bacteremia was believed to be from home hemodialysis and an unsterile technique. The patient did not have any other identifiable source of infection, recent surgeries, or dental procedures. Another potential source of infection could be from intravenous cannula insertion during her initial admission at which she was treated with intravenous antibiotics for pneumonia. The patient

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Conflicts of Interest: None.

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**VIDEO HIGHLIGHTS**

**Video 1:** Initial TTE apical four-chamber view showing mild global left ventricular systolic dysfunction and small to moderate pericardial effusion.

**Video 2:** Repeat TTE in apical four-chamber view showing new severe hypokinesia of basal to mid inferior septum.

**Video 3:** Repeat TTE in apical three-chamber view showing new severe hypokinesia of basal to mid anterior septum.

**Video 4:** Coronary angiography posteroanterior/cranial view demonstrating left coronary system with a new aneurysmal dilatation arising from the LAD stent.

**Video 5:** Transesophageal echocardiography transgastric biplane view showing a bilobed cavity surrounding the LAD stent.

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was maintained on intravenous flucloxacillin for 6 weeks. This admission was complicated with post-operative tamponade requiring pericardial washout, thrombosed arteriovenous fistula requiring revision, and skin pressure sores that were managed with wound care. At 6- and 12-month follow-up, the patient remained well with no recurrence of sepsis, and the inflammatory markers normalized.

**DISCUSSION****Coronary Artery Aneurysms**

Coronary artery aneurysms are rare, with an overall incidence of 0.3%-5.3%.<sup>5,6</sup> The pathophysiology of coronary aneurysm remains controversial, and it is generally attributed to vessel wall weakening and subsequent dilatation.<sup>7</sup> The most common cause of coronary

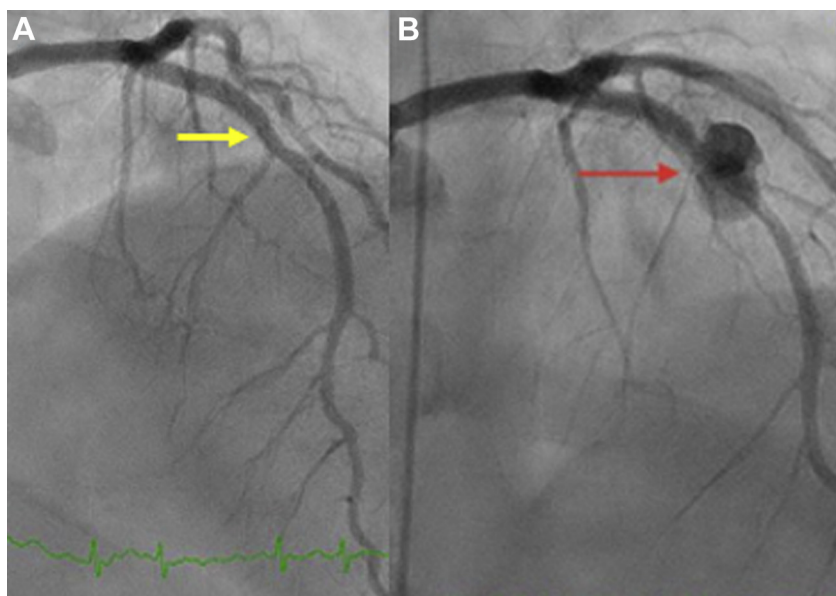
aneurysm is atherosclerosis, with connective tissue disorders and vasculitis (such as Kawasaki disease) being rare causes of coronary aneurysms. Infections rarely lead to coronary aneurysm as a result of direct invasion of pathogens from surrounding structures, septic emboli, or immune complex deposition.<sup>8</sup> Percutaneous coronary intervention and drug-eluting stent (DES) insertion also were reported to contribute to formation of coronary aneurysm due to vessel wall trauma, intimal dissection, and delayed endothelialization as a result of stent malapposition or the antiproliferative nature of DES coating.<sup>9</sup>

**An Uncommon but Catastrophic Complication of PCI**

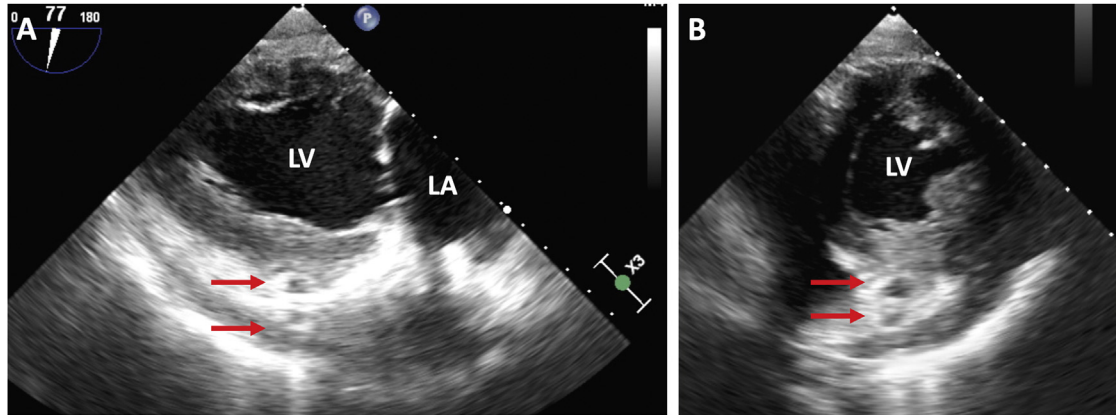
An increasing number of PCIs are performed annually; however, coronary stent infection and myocardial abscess are exceedingly rare. In a literature review from 1987 to 2012, a total of 17 cases of coronary stent infection were reported,<sup>1</sup> but the mortality rate has been reported to be as high as 38%-47%.<sup>1,3</sup> Coronary stent infections most commonly occur within 4 weeks of index procedure (88%),<sup>1</sup> and *Staphylococcus aureus* is the most common organism involved (86%-88%).<sup>1,3</sup>

It is believed that early coronary stent infection is a result of equipment contamination or another concurrent distant source of infection at the time of stent insertion.<sup>3</sup> Bacteria can adhere to the stent and spread to the arterial wall, initiating an inflammatory response leading to necrosis.<sup>10,11</sup> Endothelialization of stent struts may play an important role in the prevention of stent infections.<sup>2</sup> However, it is uncertain whether infection prevents stent endothelialization or poor endothelialization leads to bacterial adherence and stent infection.<sup>10</sup> Drug-eluting stents delay endothelialization more than 6 months, and this may lead to uncovered endoluminal struts, creating an ideal focus for bacterial adherence. This suggests another possible complication of stent underexpansion and its resultant delayed endothelialization.

This case of *Staphylococcal aureus* coronary stent infection years after PCI is unique because it was the longest interval from the index coronary procedure to the manifestation of symptoms, it was promptly diagnosed based on abnormal coronary angiography and echocardiography, and, importantly, we successfully treated the



**Figure 1** (A) Coronary angiogram posteroanterior/cranial view showing a widely patent stent in LAD (yellow arrow). (B) Coronary angiography posteroanterior/cranial view after 1 month showing aneurysm formation at the stented segment of LAD (red arrow).



**Figure 2** Transesophageal echocardiography transgastric biplane view showing myocardial abscess in anterior/septal LV wall adjacent to the LAD stent (red arrows). (A) Long-axis view. (B) Short-axis view. LA, Left atrium; LV, left ventricle.

extensive infection with prolonged intravenous antibiotics and surgical debridement. We believe the likely cause of coronary stent infection in this case was a distant source of infection and bacteremia along with either septic emboli or seeding of bacteria on incompletely endothelialized stent struts. However, it is not possible to prove this hypothesis without intracoronary imaging.

### Diagnosis

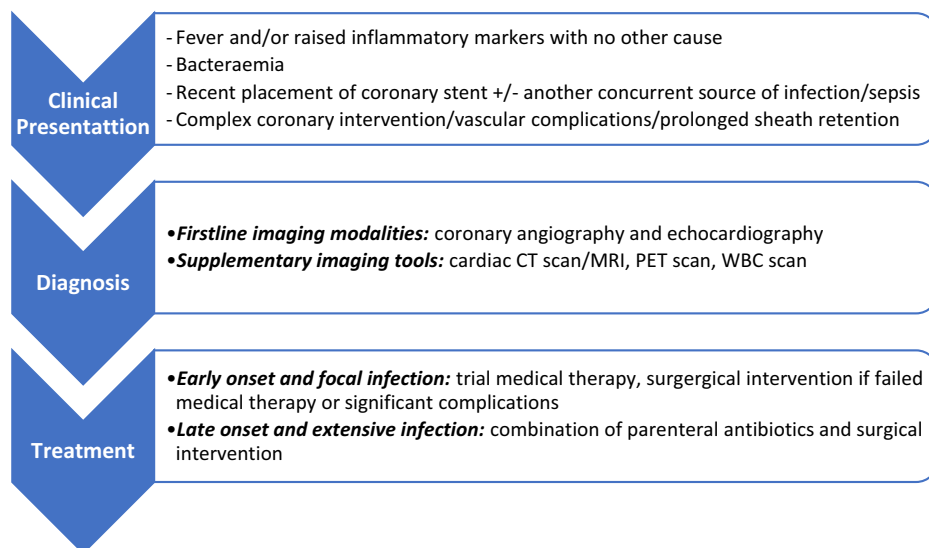
Diagnosis of coronary stent infection is definitive if the diagnosis is made by autopsy or by examination of surgical material.<sup>12</sup> Possible diagnosis is made if three of the following criteria are present: placement of a coronary stent within the previous 4 weeks; multiple repeat procedures performed through the same arterial sheath; the presence of bacteremia, significant fever, or leukocytosis with no other cause; acute coronary syndrome; or abnormal cardiac imaging findings.

Diagnosing coronary stent infection and abscess years after stent implantation is formidable and depends on a high index of clinical suspicion, especially if patients present with a combination of cardiac and

systemic inflammatory symptoms. A wide range of imaging tools has been employed to diagnose this dangerous condition, and in most cases coronary angiography and echocardiography are sufficient for diagnosis. Occasionally, other imaging modalities such as cardiac magnetic resonance imaging, white blood cell scan, cardiac computed tomography, or positron emission tomography could be beneficial if the diagnosis is undetermined. In this case, coronary angiography was significantly abnormal for a new aneurysmal dilatation surrounding the LAD stent segment, and transesophageal echocardiography supported the diagnosis.

### Treatment

Management of coronary stent infection is problematic as both conservative and surgical treatments pose a high morbidity and mortality risk. Successful treatment of stent infection with intravenous antibiotics has been reported, but a lethal outcome is unavoidable in up to 50% of patients. Surgical intervention and excision of the infected stent and surrounding material is preferred, but this therapy can carry



**Figure 3** Summary of infected coronary stent clinical presentation, diagnosis, and treatment. CT, Computed tomography; MRI, magnetic resonance imaging; PET, positron emission tomography; WBC, white blood cell.

a high mortality rate of 38%. It has been suggested that surgery should be considered early in cases of late-onset infections and medical therapy alone in early-onset infections unless significant complications are manifest on imaging or if medical therapy appears to be unsuccessful.<sup>1</sup> Parenteral antibiotic therapy should be maintained for about 4 weeks or possibly longer. Figure 3 provides a summary of infected coronary stent clinical presentation, diagnosis, and treatment.

In summary, we report a rare case of *Staphylococcal aureus* infection involving a DES stent 5 years after the index procedure, which was complicated with coronary mycotic aneurysm and myocardial abscess formation. Delayed endothelialization might have contributed to this very late presentation of stent infection. The infection was successfully treated with excision of coronary aneurysm/stent and prolonged antibiotics therapy.

### SUPPLEMENTARY DATA

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Supplementary data related to this article can be found at <https://doi.org/10.1016/j.case.2021.09.001>.

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