Coronary artery aneurysm occurring very late after drug-eluting stent implantation

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Received 22 May 2014; received in revised form 25 July 2014; accepted 1 August 2014

Abstract
An 82-year old woman presented with chest pain and was diagnosed as having acute myocardial infarction. Coronary angiography (CAG) showed 90% stenosis in the proximal left anterior descending artery (LAD). The patient underwent percutaneous coronary intervention using a sirolimus-eluting stent (SES). A repeat CAG performed 6 months after SES implantation revealed no problems. Eight years later, the patient presented with recurrent angina. CAG showed severe stenosis of the SES with a large aneurysm. We performed off-pump coronary artery bypass grafting without ligation or plication of the LAD, but with the application of fibrin glue to the coronary artery aneurysm. The postoperative course was uneventful. The mechanism responsible for the occurrence of coronary artery aneurysms occurring late after drug-eluting stent implantation remains unclear, and the treatment strategy remains controversial. Herein, we discuss a surgical treatment for this rare entity.

Keywords: Coronary artery aneurysm • Drug-eluting stent • Sirolimus-eluting stent • Coronary artery bypass grafting

INTRODUCTION
Coronary artery aneurysm (CAA) is a rare complication occurring after drug-eluting stent (DES) implantation. DES implantation predisposes an individual to DES thrombosis, which is a potentially fatal event because of acute vessel occlusion. The incidence of DES thrombosis seems to be increasing. Recently, major attention has been focused on late CAAs after DES implantation. A DES may affect the normal healing process of the vessel wall as well as the remodelling process, leading to late stent malposition. Here, we report a case of CAA 8 years after DES implantation, which was surgically treated.

CASE REPORT
An 82-year old woman with a past medical history of hypertension, diabetes mellitus type 2 and depression presented with chest pain at a previous hospital and was diagnosed as having acute myocardial infarction in the left anterior descending artery (LAD). Coronary angiography (CAG) showed 90% stenosis in the proximal LAD, and the patient underwent percutaneous coronary intervention (PCI) using a 3 mm × 18 mm sirolimus-eluting stent (SES) (Cypher, Cordis; Johnson and Johnson Corp., Miami, FL, USA). Six months later, repeat CAG revealed no restenosis of the SES in the LAD.

Eight years after SES implantation, the patient presented with acute anterior ST-elevated myocardial infarction and underwent further CAG at the previous hospital. CAG examination revealed severe stenosis of the LAD stent, with the formation of a large aneurysm in the middle portion of the stent and filling of the distal LAD from the proximal LAD via collaterals (Fig. 1). She was immediately transferred to our hospital for surgery. Preoperative computed tomography (CT) angiography showed giant CAA that was 16 mm in diameter in addition to stent malposition (Fig. 1). She underwent off-pump coronary artery bypass grafting (CABG) with a left internal thoracic artery (LITA) graft to the distal LAD, but the transit-time flow measurement of the LITA was not acceptable; we then added a great saphenous vein (GSV) graft to the median LAD, and the GSV graft flow was acceptable. We applied fibrin glue to reinforce the CAA and to prevent potential rupture. Ligation or plication of the CAA was not performed. The patient had an uneventful recovery and was discharged 13 days after the operation.

A CT angiography performed before discharge showed the patency of the GSV graft, a slow flow through the LITA graft and thrombosis in the aneurysm (Fig. 2).

DISCUSSION
CAA is defined as dilatation of the coronary artery that exceeds at least 1.5 times the adjacent reference diameter of normal vessel segments [1]. The rate of late stent malposition and aneurysmal formation is higher for DESs than for bare metal stents (BMSs). The incidence rate of late stent malposition after SES implantation is 8–10% of patients [1]. DES-related CAA has been reported for most kinds of DESs, including sirolimus-eluting, paclitaxel-eluting, everolimus-eluting and zotarolimus-eluting stents and endothelial...
progenitor cell-capturing stents [1–3]. CAAs have been detected from 3 days up to 4 years after DES implantation and from 6 days up to 9 years after BMS placement [1]. To the best of our knowledge, the present patient had the slowest onset of CAA reported to date, occurring 8 years after SES implantation and detected because of acute myocardial infarction.

The mechanism for this phenomenon remains unclear, even though previous reports have described local hypersensitivity and chronic inflammation. The polymer carriers of DESs can induce an inflammatory reaction of the arterial wall [1]. Factors such as drug toxicity and infection, and mechanical factors such as residual dissection, injury to arterial wall caused by oversized balloons and stents, high-pressure inflations, atherectomy and perforations may also be associated with aneurysm formation after PCI.

A treatment strategy has not been established for this rare clinical entity. Recently, some authors have reported therapeutic options such as interventional treatments (stent grafts or coils or BMSs) and surgery [1]. Concerning the indications for invasive treatments, Aoki et al. [1] recommended that treatment should depend on the aneurysm, expansion history, pathophysiology (true or false aneurysm) and symptoms of the patient. Feng et al. [4] reported that DES-related CAAs increased cardiac events, such as acute myocardial infarction or angina pectoris, in a long-term follow-up study, with more diffuse CAA formations indicating a greater risk of cardiac events.

CABG has always been performed, as a matter of course [1], but ligation or plication accompanying CABG remains controversial. Ligation or plication accompanied by CABG has been reported in patients with DES-related CAAs; however, such procedures are sometimes difficult from a technical perspective because the area of treatment exists in the dorsal portion of the main pulmonary artery if CAA exists in the proximal LAD, and the procedure can cause myocardial ischaemia because of the need to deal with contiguous side branches arising from CAA. In addition, the procedure makes it impossible to perform PCI from the native coronary artery if graft failure occurs in the future. Thus, we performed an isolated CABG in this case without ligation or plication, and applied fibrin glue to reinforce the CAA and to prevent potential rupture. Luthra et al. [5] reported that the late rupture of DES-related CAAs was clearly an over-riding concern, and patch reinforcement seemed to be the most appropriate strategy, since it avoids disturbing the native coronary artery; consequently, they applied an autologous pericardial patch and BioGlue (Cryolife, Kennesaw, GA, USA) on the CAA in addition to CABG. Indeed, patch reinforcement leaves a potential source of coronary thromboembolism, but the application of BioGlue and a pericardial patch on the CAA is more effective than applying only fibrin glue.

In conclusion, we have presented the case of an 82-year old woman who developed CAA 8 years after SES implantation in the LAD. CAA was successfully treated with CABG without ligation or plication of the LAD but with the application of fibrin glue on the CAA. Patch reinforcement using BioGlue might be effective for preventing potential rupture.

Conflict of interest: none declared.

REFERENCES

Coronary artery aneurysm following stent implantation, hypersensitivity and Kounis syndrome

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doi: 10.1093/icvts/ivu333
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In the very interesting report published in Interactive CardioVascular and Thoracic Surgery [1] concerning a patient with coronary artery aneurysm occurring late (eight years) after drug-eluting stent implantation, the authors speculate on the pathophysiology of this event, referring to possible local hypersensitivity and chronic inflammation and suggesting that patch reinforcement using BioGlue might be effective for preventing potential rupture.

Coronary aneurysms have been detected as early as three days after drug-eluting, and as late as nine years after bare metal stent implantation, and are usually associated with dangerous stent thrombosis [2]. Some studies have reported that coronary artery aneurysms occurred in 1.25-3.9% of patients after stent implantation [3]. However, recent studies have shown that mast cells contribute importantly to the pathogenesis of abdominal aortic aneurysms and aneurysms of the cerebral arteries. Indeed, ruptured aneurysms had prominently more mast cells stained with monoclonal antibody for anti-mast cells tryptase clone AA1 compared with unruptured aneurysms [4]. The Kounis hypersensitivity-associated acute thrombotic coronary syndrome is the result of the action of inflammatory mediators released locally or in the systemic circulation following mast cell degranulation. Vasoplastic angina (type I variant) and acute coronary thrombosis (type II variant) are two variants of this syndrome that have been described so far.

Recently, a type III variant is diagnosed in stent thrombosis when aspirated thrombus stained with Giemsa and haematoxylin-eosin reveals infiltration by mast cells and eosinophils respectively [5]. It has been found that mast cells degranulate when 2000 nearby antibodies attached to their surface are bridged by corresponding antigens and make the critical number of 1000 bridges. The hypersensitivity thrombotic process can also follow activation, by mast cell mediators, of high affinity and low affinity FcγRI, FcγRII, FcγRI and FcγRII receptors situated within the platelet surface. Metal stent components, polymers, and eluted drugs constitute an antigenic complex that applies a continuous and persistent hypersensitivity inflammation on the coronary vessel as long as they last. Mast cell-specific proteases such as chymase and tryptase have been found to induce vascular cell apoptosis thus facilitating adventitial enlargement. All of the above show that stent implantation can promote aneurysm formation.

Therefore, allergy-free stent materials and stents coated with CD34 antibodies that can capture circulating progenitor endothelial cells and increase the acceleration of endothelial coverage, stents coated with NO donors which can decrease platelet adhesion, activation and aggregation, stents able to elute drugs with anti-inflammatory and anti-allergic properties that can abrogate late thrombotic events experimentally, seem to constitute future preventive modalities for coronary aneurysm formation.

Conflict of interest: none declared.

References