Case report
Drug eluting stent induced coronary artery aneurysm repair by exclusion. Where are we headed?

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Abstract
We present a case of left anterior descending (LAD) coronary artery aneurysm at the site of previous stent placement 3 years previously. The patient presented with recent worsening of angina. Angiography and 64 slice CT angiography confirmed the presence of 6 mm aneurysm of LAD at the site of previous stent involving the origin of diagonal, with thrombus proximal and distal to the stent. This patient was successfully managed by taking the posterior wall of the anterior descending artery while suturing the heel of left internal mammary artery (LIMA)-LAD anastomosis. The idea was to create severe stenosis upstream to prevent distal embolisation from the site of aneurysm. The diagonal was grafted with a saphenous venous graft. Follow-up angiogram at 3 months demonstrated successful exclusion of the aneurysm and unobstructed flow through the grafts.

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1. Introduction
The incidence of coronary aneurysm following drug eluting stent (DES) implantation is not known. We report a patient who developed left anterior descending (LAD) coronary artery aneurysm with thrombus formation 3 years following DES implantation. The patient presented worsening angina and the diagnosis was confirmed with angiography and 64 slice CT scan. This was managed by taking the posterior wall of the LAD while suturing the heel of left internal mammary artery (LIMA); LAD anastomosis. A saphenous vein graft (SVG) was anastomosed to first diagonal branch which was involved in the aneurysm formation. Follow-up angiogram after 3 months showed exclusion of the aneurysm with patent grafts.

2. Case report
A 65-year-old woman with a background of ischaemic heart disease presented with recent worsening angina. She had a prior history of CYPHER stent (2.5 mm × 18 mm Cordis, Miami Lakes, FL) placement in LAD 3 years ago. She had angiography which showed an aneurysm with thrombus formation at the site of previous CYPHER stent. A 64 slice CT angiography showed a 6 mm aneurysm extending to the bifurcation with the diagonal (Fig. 1). The stent lay within the aneurysm but the proximal half of the stent was thrombosed with flow occurring in the aneurysmal space and not within the stent. Distally the stent was opposed to the wall and the contrast column came back in through the side of the stent where it became patent again. There was luminal thrombus distally. A surgical option was considered safer.

It was elected to do it under cardiopulmonary bypass. LIMA and saphenous vein were used as conduits. On opening the pericardium there was no externally obvious aneurysm. The stent was palpable in the proximal part of LAD, epicardial fat covered this portion of LAD and the aneurysm itself was not distinct. Diastolic arrest was achieved by antegrade cardioplegia solution, LAD opened distal to the site of stent placement was 2 mm diameter vessel which was disease free.

The main concern was distal embolisation of thrombus from the site of aneurysm formation. This was addressed by suturing the posterior wall of the LAD with LIMA at the heel of the anastomosis with 8-0 polypropylene suture. In addition to preventing distal embolisation, it was thought that this would also reduce the competitive flow through the native coronary artery. The saphenous vein graft was sutured to the first diagonal branch which was 1.75 mm in size and was disease free at the site of anastomosis. The patient had an uneventful postoperative course; at 3 months follow-up she was asymptomatic and angiogram showed occluded LAD at the site of stent. There was good flow down the grafts (Fig. 2).
3. Discussion

In 1986 Puel and Isgwart implanted the first coronary stent. Several trials in 1990s showed the superiority of the stent over balloon angioplasty. Stent reduced restenosis by acting as a scaffold and repaired dissections of the arterial wall. By 1989, stents were used in 84% of percutaneous interventions (PCI). Risk of early thrombosis with stents was initially addressed by coating stainless steel with gold or platinum, using high-pressure balloon expansion of the stent to ensure full apposition to the arterial wall and drug therapy with aspirin and clopidogrel [1]. Though less frequent, stents still remained vulnerable to restenosis caused almost exclusively by neointimal tissue growth. Drug eluting stents were developed to tackle this problem. CYPHER (J&J, Cordis) stent was the first Sirolimus DES that received FDA approval in 2003 [1].

Drug eluting stents (CYPHER in particular) consist of three parts:

(1) Stent platform: an expandable metal alloy framework made of 316L stainless steel with 140 μm struts. (Iron, nickel and chromium with occasional molybdenum as impurity.)

(2) The coating: consisting of polymethacrylates and polyolefin copolymers, which elute the drug by contact transfer. There is a three-layer coating with the base layer for adhesion, a main layer for holding the drug and a topcoat to slow down the release of the drug to extend its effect. (2 μm base coat, 10 μm main coat and 0.6 μm topcoat.)

(3) Drug: Sirolimus to reduce the neointimal growth, mainly by inhibiting the proliferation of smooth muscle cells. The drug elutes over a period of about 30 days [1].

No randomised trail comparing DES and CABG has been completed, though SYNTAX (Synergy Between Percutaneous Coronary Intervention with Taxus and Cardiac Surgery) and FREEDOM (Future Revascularization Evaluation in Patients with Diabetes Mellitus) are currently enrolling patients. The superiority of DES over bare-metal stents for late thrombosis is intensely debated, with a recent meta-analysis concluding that mortality risk is similar [2]. The currently accepted standards of safety in 90-day and 180-day pig and rabbit models may not be directly extrapolated to human atherosclerotic endothelium.

There are two potential mechanisms behind the development of aneurysm following DES. One is stent malapposition at the time of initial placement and second is the late phase of vascular remodelling in response to components of the stent, particularly the polymer resulting in weakening of media and dilatation [3,4].

Aneurysms arising at the site of previous stent implantation have been managed percutaneously using covered stents; however these need careful follow-up for subacute stent thrombosis and restenosis [5]. Surgically they can be managed by explanting the stent, plicating the aneurysm and distal bypass grafting [6]. Luthra et al. [7] report of using Bioglue (Cryolife, Kennesaw, GA) with autologous pericardial patch and LIMA-LAD anastomosis to tackle similar condition.

Our patient was managed by taking the posterior wall of the coronary artery while suturing the heel of the internal mammary; LAD anastomosis. Stent explantation may be necessary in cases of suspected pseudoaneurysm to prevent subsequent rupture. Manipulating the stent, which is usually well embedded in the coronary wall would not only cause further damage but may also entail the risk of distal embolisation [6]. The aneurysm was not visible externally in our case, covered by epicardial fat. The embolic potential of the thrombus in the aneurysmal portion is uncertain. We believe that excluding the thrombus laden aneurysmal portion by occluding the upstream portion of the coronary artery is not only simpler but also safer. This was confirmed by
subsequent angiogram, which showed complete thrombosis of the aneurysmal portion of the coronary artery with good flow down the grafts. Moreover, LIMA sutured this way has unhindered distal run off without any competitive flow, which may theoretically improve the already proven long-term patency rates of LIMA-LAD anastomosis. Only time will answer if DES related aneurysms are isolated sporadic events or unanticipated complication as more patients with DES enter into late phase of vascular remodelling.

References


