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Coronary artery aneurysm after implantation of an endothelial progenitor cell capturing stent

Tętniak tętnicy wieńcowej po wszczepieniu stentu wiążącego komórki progenitorowe śródbłonka

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Abstract

The Genous™ stent coated with anti-CD34 antibodies has been designed to accelerate healing of the vessel by attracting circulating endothelial progenitor cells. Rapid restoration of a functional endothelial layer with a full coverage of the stent struts aims to minimise arterial injury after coronary stenting and to prevent thrombus formation and neointima proliferation. We report a case of a 56 year-old man who developed a coronary artery aneurysm after the implantation of a Genous™ stent due to an edge restenosis in sirolimus-eluting stent. We present diagnostics of our patient with the application of intravascular ultrasound and coronary computed tomography angiography, discuss his management, and hypothesise about the pathomechanism of aneurysm formation.

Key words: endothelial progenitor cell capturing stent, aneurysm, IVUS

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INTRODUCTION

Coronary artery aneurysm represents an uncommon finding after coronary balloon angioplasty or stent implantation [1, 2]. It is usually defined as a dilatation of the lumen of a coronary artery exceeding the diameter of the normal vessel segments by at least 1.5 times [3]. The natural history and optimal therapy in patients with post intervention coronary artery aneurysm remain unclear.

CASE REPORT

We report the case of a 56 year-old man with hyperlipidaemia, hypertension, and a history of non-ST-elevation myocardial infarction who was referred to our department due to anterior ST-elevation acute myocardial infarction with ongoing chest pain of three hours' duration.

The patient immediately underwent primary percutaneous coronary intervention. The culprit lesion was located in the proximal segment of the left anterior descending coronary artery (LAD) (Fig. 1). It was a restenotic lesion at the proximal edge of a sirolimus-eluting stent (SES) implanted three years previously. Coronary angiography also demonstrated significant stenoses in the middle part of the LAD and in the right coronary artery (RCA). After intracoronary administration of abciximab and subsequent aspiration thrombectomy, a Genous™ stent (OrbusNeich Medical Technologies, Fort Lauderdale, FL, USA) coated with anti-CD34 antibodies (3.5 × 18 mm, 18 atm) was deployed in the culprit lesion overlapping by about 3 mm the previously implanted SES. The procedure was uneventful and an excellent immediate angiographic result was achieved (Fig. 1). Treatment of the other coronary lesions was scheduled for a second session a few weeks later. The patient was discharged home in a good condition on the seventh postprocedural day.

After three months, the patient was readmitted for elective coronary angioplasties. An aneurysm in the proximal

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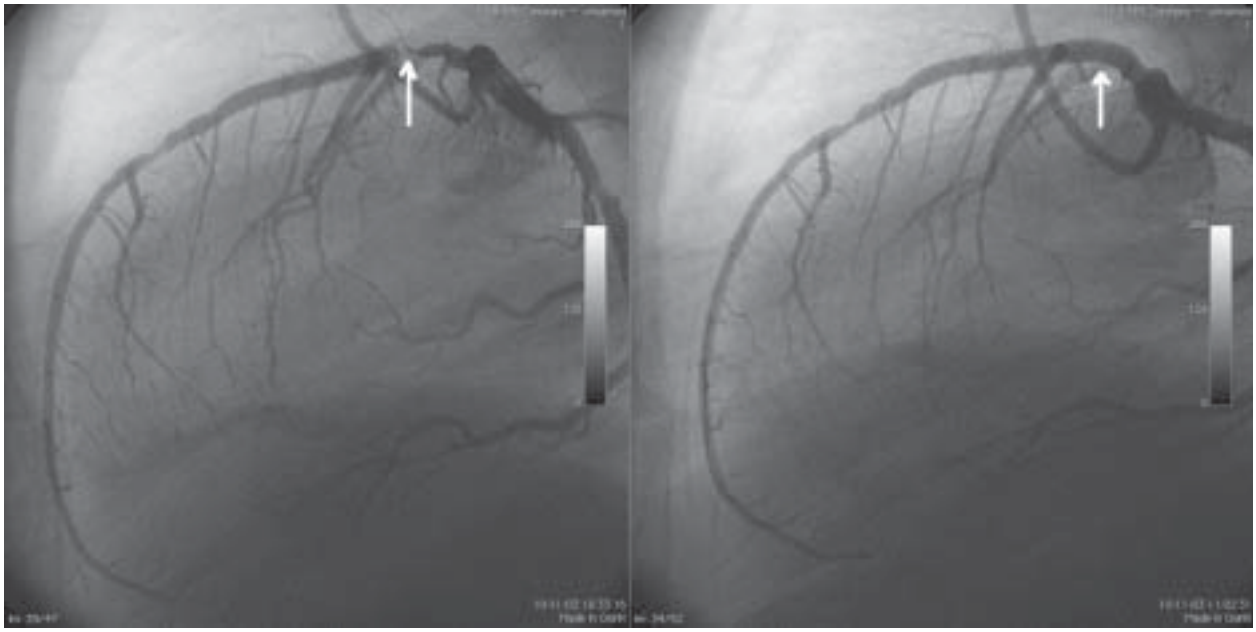

Figure 1. Critical edge restenosis in a sirolimus-eluting stent (on the left) and immediate effect after the Genous™ stent implantation (on the right)

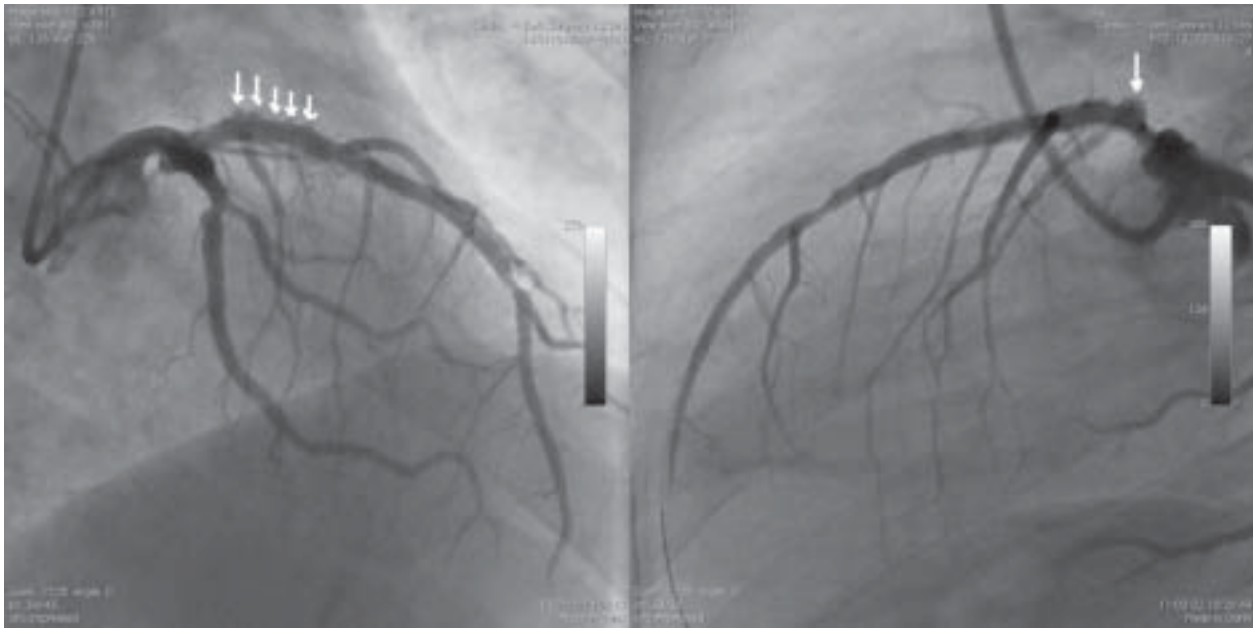

Figure 2. A coronary artery aneurysm after the Genous™ stent placement in angiography in RAO and LAO view

LAD at the site of the previous Genous™ stent deployment was present in coronary angiography performed before the procedure (Fig. 2). Intravascular ultrasound (IVUS) confirmed the presence of the aneurysm. Using special software dedicated to colour imaging of blood flow (Volcano), we observed blood flow from the lumen of the vessel towards the aneurysm (Fig. 3). However, there was a filling defect with intense echogenicity within the aneurysm probably caused by a residual thrombus. At the same session, the other coronary lesions were treated with stenting. Angioplasty of the middle part of the LAD was completed with an optimal result, whereas stenting of the RCA was complicated by no-reflow phenomenon and periprocedural myocardial infarction despite intracoronary abciximab administration with restoration of normal epicardial flow. The patient was discharged from the hospital and a coro-

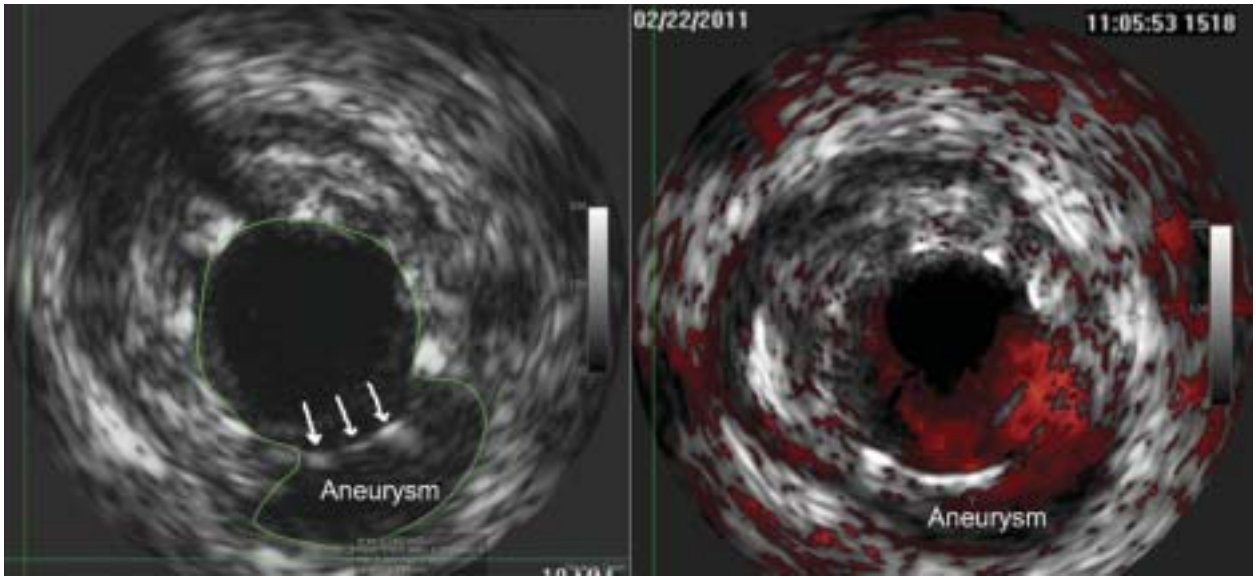

Figure 3. A coronary artery aneurysm in intravascular ultrasound. Arrows on the left indicate stent struts. A filling defect with intense echogenicity linked with the stent struts on the right suggests a thrombus

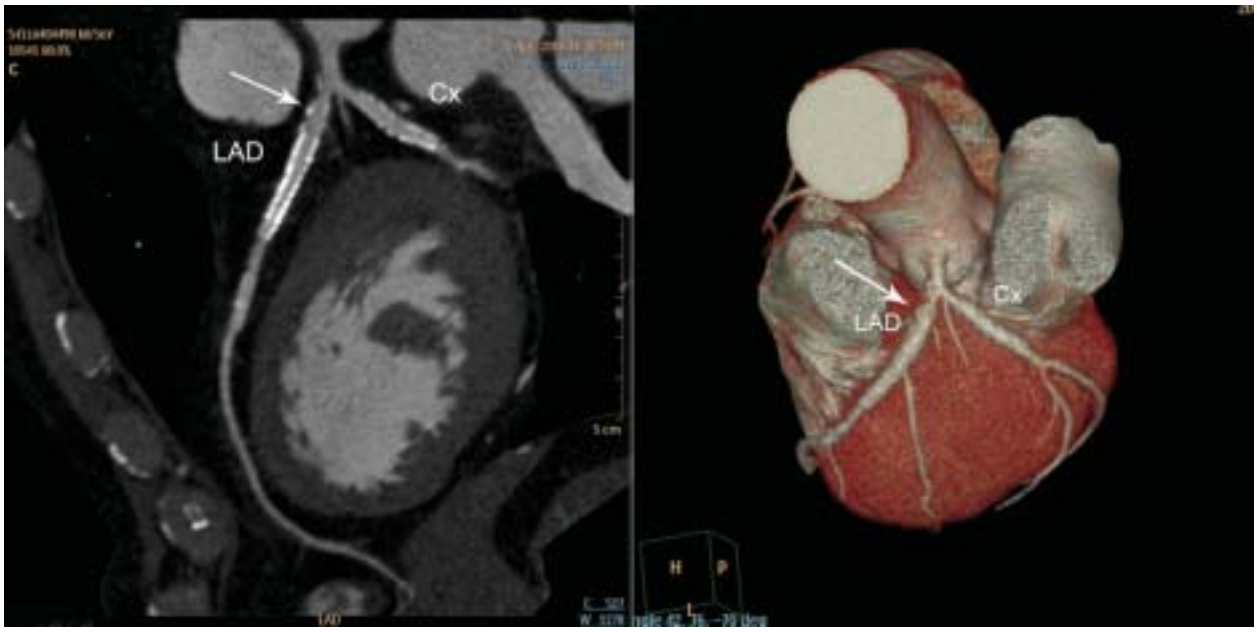

Figure 4. Computed tomography angiography five months after the Genous™ stent placement. The examination revealed a residual atheromatous plaque with calcification before the stent and no progression of coronary aneurysm (arrows); LAD — left anterior descending coronary artery; Cx — circumflex coronary artery

nary computed tomography angiography (CTA) was scheduled after eight weeks in order to monitor the coronary aneurysm.

CTA at eight weeks depicted no progression of the aneurysm and maintained optimal results within the first intracoronary stent (Fig. 4). Since the first admission to our department, the patient has been continuing dual antiplatelet therapy with aspirin and clopidogrel. During six months of follow-up, the patient remains asymptomatic.

DISCUSSION

The appearance of angiographic coronary artery aneurysms after coronary interventions is rare, with a reported incidence varying between 0.3% and 6.0% [3]. Coronary artery aneurysms have been detected from three days to up to four years after drug-eluting stent (DES) implantation, and from six days to up to six years after bare metal stent (BMS) placement [4].

To the best of our knowledge, we report for the first time the development of an aneurysm after the implantation of

a Genous™ stent coated with anti-CD34 antibodies. The Genous™ endothelial progenitor cell (EPC) capturing stent is intended to accelerate healing of the vessel by attracting circulating EPCs which mature into endothelial cells and cover the stent struts to minimise vessel injury after coronary intervention and prevent both thrombosis and restenosis [5].

There are about 30 case reports of aneurysms after DES in PubMed, mainly concerning sirolimus and paclitaxel [6, 7], one case of an everolimus-eluting stent-related aneurysm [8], and one case of an aneurysm after a zotarolimus-eluting stent implantation [6]. The incidence of coronary aneurysms was similar overall with DES compared to BMS (1.1% [18 of 1,615] with DES and 0.8% [12 of 1,587] with BMS in the pivotal DES *vs* BMS randomised trials, in which a routine angiographic follow-up was performed six to nine months after the initial procedure [4]. However, these studies applied a different definition of coronary artery aneurysms as a vessel distension of 20% or more in diameter compared to the reference vessel. Furthermore, in a real-world setting, most post-procedural coronary aneurysms are probably never diagnosed due to asymptomatic course in the majority of cases.

Residual dissection and deep arterial wall injury (rupture or resection of the vessel media) caused by oversized balloons or stents and high-pressure balloon inflations have all been associated with coronary artery aneurysms after coronary intervention [3].

A possible explanation for the aneurysm in our patient is the creation of an ulcer and micro-haemorrhage at the site of the atheromatous plaque during the primary angioplasty. It is likely that a small dissection, which was not visible on conventional angiography, caused the formation of an ulcer and a micro-aneurysm. In our case, another possible mechanism for the aneurysm formation is stent malapposition that occurred late after the procedure. This phenomenon is observed with IVUS in about 4% of cases after BMS implantation [9] and in 12.1% of patients after DES stenting [10].

DES delay the healing process secondary to the antiproliferative action of the eluting drug, cell necrosis and/or apoptosis resulting from the antimetabolite effect of the drug, and hypersensitivity reactions to the drug/polymer mixture on the DES [11]. Other reasons for stent malapposition are: regression of the atheromatous plaque, the incidence of late positive remodelling (vessel dilatation) at the site of the implanted stent, allergic reaction to stent components (more common with DES), and late dissolution of thrombotic material trapped behind the stent struts in case of primary angioplasty [9]. In our case, IVUS showed a filling defect in the aneurysm, possibly due to a partially dissolved thrombus (Fig. 3).

New generation DES and EPC capturing stents have been designed to improve the safety profile including the problem of late acquired stent malapposition. However, in our patient, stent covered with anti-CD34 antibodies failed to accelerate the healing process. A large mass of neointima in the critically restenotic lesion and a high pressure inflation might compress vasa vasorum in the peristent region and cause local necrosis of the vessel wall.

We decided to use CTA to follow our patient, mainly to avoid an invasive coronary artery catheterisation. In some patients, particularly in asymptomatic ones and those with small coronary aneurysms, the application of coronary CTA should be considered as a non-invasive alternative. The efficacy of CTA for identifying coronary artery ectasias and aneurysms has been already proven [12].

The natural history of post-intervention coronary aneurysms appears to be benign in most cases [1, 2]. Aoki et al. [4] proposed an individualised approach to coronary aneurysms using a combination of aneurysm size assessed by IVUS, expansion history, pathophysiology (true or false aneurysm), and symptoms to decide when and if to apply therapy alternatives. Large and symptomatic pseudoaneurysms, rapidly growing true aneurysms, and especially dangerous infectious aneurysms should be treated interventionally or surgically to avoid potentially life-threatening complications regardless of the stent type implanted. On the other hand, in conservative management, long-term dual antiplatelet therapy to prevent stent thrombosis and distal embolism is recommended [4].

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Conflict of interest: *none declared*

References

1. Alfonso F, Pérez-Vizcayno MJ, Ruiz M et al. Coronary aneurysms after drug-eluting stent implantation: clinical, angiographic, and intravascular ultrasound findings. J Am Coll Cardiol, 2009; 53: 2053–2060.
2. Ahn CM, Hong BK, Kim JY et al. Incidence and natural history of coronary artery aneurysm developing after drug-eluting stent implantation. Am Heart J, 2010; 160: 987–994.
3. Slota PA, Fischman DL, Savage M, Rake R, Goldberg S. Frequency and outcome of development of coronary artery aneurysm after intracoronary stent placement and angioplasty. Am J Cardiol, 1997; 79: 1104–1106.
4. Aoki J, Kirtane A, Leon MB, Dangas G. Coronary artery aneurysms after drug-eluting stent implantation. J Am Coll Cardiol Cardiovasc Interv, 2008; 1: 14–21.
5. Aoki J, Serruys PW, van Beusekom H et al. Endothelial progenitor cell capture by stents coated by antibody against CD34: the HEALING-FIM Registry. J Am Coll Cardiol, 2005; 45: 1574–1579.
6. Lee YS, Kim KS, Chang SG. Three aneurysms developed in three different drug-eluting stents. Eur Heart J, 2009; 30: 1309.
7. Koziński M, Jabłoński M, Sukiennik A, Białoszyński T, Surman D, Kubica J. Tętniak prawej tętnicy wieńcowej po implantacji stentu pokrywanego paklitakselem. Folia Cardiol, 2005; 12: 873–878.
8. Zbinden R, Eshtehardi P, Cook S. Coronary aneurysm formation in a patient early after everolimus-eluting stent implantation. J Invasive Cardiol, 2008; 20: E174–E175.
9. Mintz GS, Shah VM, Weissman NJ. Regional remodelling as the cause of late malapposition. Circulation, 2003; 107: 2660–2663.
10. Hong M-K, Mintz GS, Lee CW et al. Late stent malapposition after drug-eluting stent implantation: an intravascular ultrasound analysis with long-term follow-up. Circulation, 2006; 113: 414–419.
11. Joner M, Finn AV, Farb A et al. Pathology of drug-eluting stents in humans: delayed healing and late thrombotic risk. J Am Coll Cardiol, 2006; 48: 193–202.
12. Leschka S, Stolzmann P, Scheffel H et al. Prevalence and morphology of coronary artery ectasia with dual-source CT coronary angiography. Eur Radiol, 2008; 18: 2776–2784.