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A Case of Subacute Bioresorbable Vascular Scaffold Thrombosis, What was Wrong?

Authors' Contribution:
Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
Literature Search F
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Patient: Male, 42
Final Diagnosis: Mid to distal left anterior artery disease
Symptoms: Chest pain
Medication: —
Clinical Procedure: Percutaneous coronary intervention
Specialty: Cardiology

Objective: Unusual clinical course
Background: The introduction of bioresorbable vascular scaffolds (BVS) into the field of percutaneous coronary intervention (PCI) was thought to be a promising step in solving the issues raised with the use of early bare metal stents (BMS) and drug eluting stents (DES); however, studies have raised concerns regarding thrombosis risk associated with the use of these stents.

Case Report: A 42-year-old male presented with acute coronary syndrome (ACS), on diagnostic coronary angiography he had 75% and 70% stenosis in mid and distal left anterior descending artery (LAD) respectively, PCI with BVS implantation was done. A week later, he came with non-ST segment elevation myocardial infarction due to an in-stent thrombosis. Procedures to open the LAD were done with multiple balloon angioplasties and aspiration thrombectomy, following aggressive dilatation there was a class-III perforation which was sealed by covered stent. A second look angiography was done which showed patent LAD and well expanded stents.

Conclusions: Since several factors play a role in decision-making regarding the selection of patient in whom BVS usage can be beneficial, larger studies are needed. Moreover, the safety profile of BVS should be investigated thoroughly.

MeSH Keywords: Angioplasty • Coronary Thrombosis • Percutaneous Coronary Intervention

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Background

In early percutaneous coronary interventions (PCI), bare metal stents were found to have a high rate of in-stent-restenosis, necessitating the introduction of first generation drug eluting stents. However, the latter had a high rate of late stent thrombosis [1,2]. New bioresorbable vascular scaffolds (BVS), which enable the restoration of normal vessel vasomotion and long-term modeling, were thought to have solved the issues of permanent vessel caging and late stent thrombosis [1]. However, recent studies have reported that BVS have a higher rate of in-stent thrombosis. The BVS-EXAMINATION study showed a 2.4% rate, making its safety profile questionable [1]. Moreover, in the ABSORB-III study, subacute-stent thrombosis was higher in patients treated with BVS than in those treated with the everolimus eluting XIENCE stent [3]. The greater likelihood of stent malapposition, uncoverage, and protrusion when using metal stents in acute coronary syndrome (ACS) patients increases thrombosis risk [4]. Felix et al. suggested that BVS are the preferred option in ACS patients since these they are younger. However, the higher pro-thrombotic state in ACS, in addition to the thick BVS struts, further increases the risk of early thrombosis [4]. We report a case of subacute BVS thrombosis.

Case Report

A 42-year-old Saudi male with a history of type-II diabetes-mellitus, hypertension, and dyslipidemia presented to the emergency department complaining of typical angina. Electrocardiography (ECG) showed normal sinus rhythm with non-specific ST-T wave

Figure 2. OCT showing good apposition of BVS struts.
OCT – optical coherence tomography;
BVS – bioresorbable vascular scaffolds.

changes. Echocardiography returned normal results. Coronary angiography using a 6F right radial approach showed mid (mLAD) to distal (dLAD) LAD lesions with 75% and 70% stenosis, respectively, and diffuse dLAD disease reaching the apex (Figure 1). The lesions were pre-dilated with a 2.5×20 mm balloon and stented with Abbott-BVS (3.0×28 mm in the mLAD and 2.5×28 mm in the dLAD). Post-dilatation with 3.0 and 3.5 non-compliant balloons was performed in the mid and distal stents. Optical coherence tomography (OCT) confirmed good apposition of both stents and diffuse dLAD disease (Figure 2).

Figure 1. (A) Angiogram during the first PCI showing a stenotic lesion in the mLAD and dLAD with 75% and 70% stenosis, respectively. (B) Final coronary angiography at the end of the first PCI showing the BVS after implantation with no residual disease in the mLAD. PCI – percutaneous; mLAD – mid left anterior descending artery; dLAD – distal left anterior descending artery.

The patient was kept on dual antiplatelet therapy (DAPT) consisting of aspirin and clopidogrel. One week later, he presented with continuous mild chest pain. He showed T-wave inversion in the anterolateral leads and elevated troponin I (8.817 ng/mL). The patient was diagnosed with non-ST elevation myocardial infarction. The next day, coronary angiography showed in-stent thrombosis with TIMI-0 flow in the mLAD (Figure 3A). Multiple attempts to open the LAD were made with multiple balloon angioplasties and aspiration thrombectomy. Aggressive dilatation caused a class-III perforation, which was sealed with a 2.8×19 mm covered-stent and post-dilated with a 3.0 non-compliant balloon (Figure 3B, 3C). TIMI-III flow was restored despite diffuse LAD disease. Residual stenosis was 70% and 50% in the dLAD and mLAD, respectively. After 72 hours, a second-look angiography using a 6F radial approach showed a patent LAD, well expanded stents, and diffuse LAD disease with dLAD dissection (Figure 4). Residual stenosis in the proximal

LAD, mLAD, and dLAD was 0%, 50%, and 40%, respectively. The patient was kept on GPIIb/IIIa inhibitors for another 24 hours, with ticagrelor instead of clopidogrel.

Discussion

BVS were considered a step forward; however, studies showed a high rate of in-stent thrombosis [1]. The decision to use BVS in a specific lesion depends largely on the patient and lesion characteristics. Our patient was young with no previous history of coronary artery disease. Diagnostic coronary angiography showed an atherosclerotic LAD with no heavy calcification. The decision to use BVS was made to save his LAD for possible future-grafting [2]. However, six days after implantation, the patient presented with in-stent thrombosis. This incident might be attributed to several factors, including lesion

Figure 3. (A) Initial angiogram of the second PCI showing occluded mLAD with in-stent thrombosis. (B) Angiogram during the second procedure showing perforation of the mLAD after aggressive dilatation. (C) Angiogram showing sealing of the perforation with covered stent. PCI – percutaneous; mLAD – mid left anterior descending artery; dLAD.

Figure 4. (A) OCT showing intramural hematoma. (B) Angiogram of the coronary arteries during the third-angiography showing patent lumen with well expanded stents. OCT – optical coherence tomography.

and stent characteristics, and implantation technique related factors. We followed the proper implantation technique. Regarding the lesion, the patient most probably had distal dissection following the procedure, leading to compromised distal flow. BVS have thicker struts [3], which may disturb laminar blood flow and cause subsequent activation of platelets, increasing thrombosis risk. Overlapping stents might also be a factor, since they are associated with thrombosis [1]. Deploying BVS is more sophisticated than previous stents since their weak radial strength means aggressive lesion preparation is required to prevent elastic recoil [1]. This may increase the risk of vessel dissection. BVS implantation should be performed under the guidance of intracoronary imaging using OCT or intravascular ultrasound for better vessel sizing and optimal lesion coverage [1,4]. In our case, after scaffold implantation, OCT was performed to confirm good apposition. After aggressive dilatation during the second PCI, a perforation occurred that was sealed with a covered stent. Therefore, instead of saving his LAD for future grafting, he had two overlapping BVS and

a covered stent in the mLAD. Risk factors for BVS thrombosis include uncovered stent struts, incomplete stent expansion, stent fractures, and inadequate lesion preparation [2]; however, these were not present in our case.

Conclusions

To overcome the limitations of BVS and achieve better procedural and clinical outcomes, scaffolds with thinner struts, better drug deliverability, and increased radial strength are needed. Special emphasis on the importance of using intracoronary imaging guidance pre- and post-BVS implantation is needed. Special care for the proximal inflow and distal outflow following scaffold deployment is recommended. Furthermore, caution must be exercised before using BVS in patients where compliance to DAPT is uncertain or the use of DAPT is contraindicated. Appropriate patient selection is required for the best results.

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