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Case report

Percutaneous coronary angioplasty of a bifurcation lesion in the Y saphenous vein graft

Leos Pleva ^{a,c,*}, Tomas Jonszta ^{b,1}, Pavel Kukla ^{a,c,2}^a Cardiovascular Department, University Hospital Ostrava, 17.listopadu 1790, 708 52 Ostrava-Poruba, Czech Republic^b Radiagnostic Department, University Hospital Ostrava, 17.listopadu 1790, 708 52 Ostrava-Poruba, Czech Republic^c Medical Faculty, University of Ostrava, 17.listopadu 1790, 708 52 Ostrava-Poruba, Czech Republic

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ABSTRACT

Background: The use of Y-shaped aorto-coronary saphenous vein grafts is most commonly driven by efforts to replace the poor quality (length) of the vein grafts or to minimise manipulation of the atheromatous ascending aorta (Jarvis [1]). We found only a few case reports describing PCI of bifurcation lesions in vein grafts in the available scientific literature (Karalis [2], Prosser and Bailey [3], Chan et al. [4]).

Method: We present two case reports of patients with bifurcation lesions in Y saphenous vein grafts. In case No. 1, implantation of a dedicated bifurcation stent Tryton (4.0/3.5×18 mm) and DES Promus Element (4.0×20 mm) was used to treat the Y-graft bifurcation lesion. In case No. 2, due to satisfying result of side branch stenosis predilation, the bifurcation lesion was treated by a drug-eluting balloon catheter SeQuent Please (4.0×15 mm) and only a short stent (Liberte 4.0×8 mm) was implanted in the proximal residual stenosis of the main branch.

Results: In both cases satisfying periprocedural angiographic results with final TIMI flow 3 were achieved. During the 12-month follow-up no MACE (CV death, AMI, TVR) has been recorded and both patients were without residual angina pectoris. Persistent satisfying angiographic results were confirmed on MS-CT coronarography.

Conclusion: PCI of the bifurcation lesions in the vein grafts is a rare but complicated condition. In our two case reports we demonstrated that the use of a dedicated bifurcation Tryton Side Branch Stent, as well as the SeQuent Please paclitaxel coated balloon catheter for PCI of the bifurcation lesions in Y vein grafts, is technically feasible with satisfactory long-term results.

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* Corresponding author at: Cardiovascular Department, University Hospital Ostrava, 17.listopadu 1790, 708 52 Ostrava-Poruba, Czech Republic. Tel.: +420 733414740.

E-mail addresses: leos.pleva@volny.cz (L. Pleva), jonszta@post.cz (T. Jonszta), paja.kukla@gmail.com (P. Kukla).

¹ Tel.: +420 597372172.

² Tel.: +420 7373216.

Abbreviations: LM, left main coronary artery; LAD, left anterior descending artery; Dx, diagonal artery; LCx, left circumflex artery; RCA, right coronary artery; PDA, posterior descending artery; LIMA, left internal mammary artery; ACB, aorto-coronary by-pass; SVG, saphenous vein graft; MS-CT, multi-slice computer tomography; MACE, major adverse cardiac event; TVR/TLR, target vessel/lesion revascularisation; BMS, bare metal stent.

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Introduction

The use of Y-shaped aorto-coronary saphenous vein grafts is most commonly driven by efforts to replace the poor quality (length) of the vein grafts or to minimise manipulation of the atheromatous ascending aorta [1]. We found only a few case reports describing PCI of bifurcation lesions in vein grafts in the available scientific literature [2-4].

We present two case reports of patients with bifurcation lesions in Y-shaped vein grafts.

Case report 1

A 67-year-old male underwent CABG surgery in 2008 (LIMA to LAD, Y saphenous vein graft to Diagonal and LCx; SVG central anastomosis to the Diagonal was grafted "end-to-side" to the SVG to LCx), followed by PCI of the middle third of the SVG to the LCx and drug eluting stent implantation (Cypher 3.5×18 mm) in 2010. Echocardiography revealed mildly reduced left ventricular systolic function, i.e. LVEF was 45%. The patient suffered from hypertension and hyperlipoproteinaemia.

This patient was admitted in 2012 for a progressive, new onset exertional angina CCS class III. Selective coronary angiography was performed via the right femoral artery, which revealed a significant involvement of the native vessels (significant stenosis of the distal LM trunk, tight stenosis of the proximal LAD and large Diagonal, chronic occlusion of the LCx) with patent LIMA to LAD bypass and critical bifurcation stenosis in the Y-graft to the Diagonal and LCx (Medina 1,1,1) with TIMI flow grade 1-2 in the Diagonal artery area (Fig. 1). 20 mg of Reopro (Abciximab) was administered intracoronary, the 6F guiding LCB was inserted and two PT MS guidewires were introduced into the periphery of both branches. Predilatation was performed using Apex 2.5×12 mm/6 atm

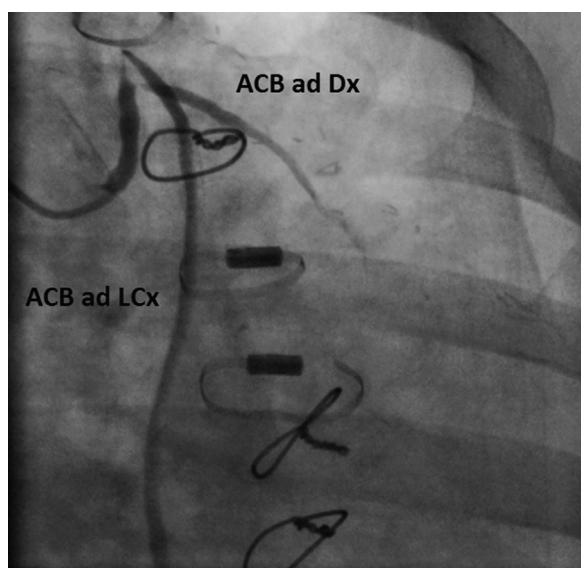


Fig. 1 – Right anterior oblique (RAO 15, Cran 30) projection; tight bifurcation lesion (Medina 1,1,1) in Y saphenous vein graft to LCx and Dx.

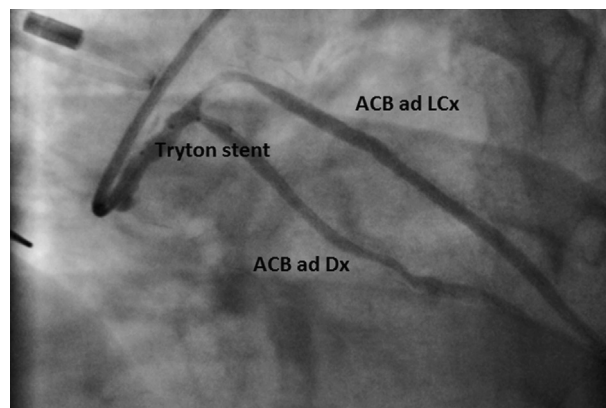


Fig. 2 – Process of Tryton stent implantation into the side branch SVD to Diagonal.

and 3.0×12 mm/8 atm balloon catheters at the origins of both SVG branches, which resulted in an improved filling of the Diagonal area (TIMI flow grade 3). The Tryton 4.0/3.5×18 mm bifurcation stent was implanted at 12 atm with its distal arm oriented towards the SVG to Diagonal (Fig. 2). The stent struts were recrossed with a wire from SVG–Diagonal to the LCx, predilatation was performed using the Quantum 3.5×12 mm non-compliant balloon catheter at 10 atm and the Promus Element 4.0×20 mm drug eluting stent was implanted in the SVG–LCx direction. Subsequently, the wire was pulled back to the SVG–Diagonal, both branches were pre-dilated and final kissing post-dilatation was performed using Apex 3.0 and 3.5×12 mm balloon catheters at 6 atm with a satisfactory outcome in the Y-graft bifurcation area, and TIMI flow grade 3 to the periphery of both branches (Figs. 3 and 4).

The patient was discharged the following day in a stabilised condition with dual anti-platelet therapy (ASA 100 mg+clopidogrel 75 mg) for 12 months, a beta blocker (betaxolol 20 mg) and statins (atorvastatin 40 mg).

At the 12-month follow-up visit, the patient had no exertional angina and the MS-CT coronary angiography showed satisfactory findings at the site of the bifurcation stent in the Y-shaped vein graft (Figs. 5 and 6).

Case report 2

A 75-year-old female with terminal renal insufficiency, included in the haemodialysis programme, with a history of MI and repeated PCI of the native arteries, underwent CABG surgery (LIMA to LAD, Y saphenous vein graft to the LCx and PDA) and mitral annuloplasty in 2009. The Y-graft was constructed by grafting the central anastomosis of the SVG–PDA "end-to side" to the SVG–LCx due to a diffuse atheromatous involvement of the ascending aorta. In 2010, this patient was admitted for NSTEMI (troponin I 37 ng/mL) which occurred during the course of haemodialysis. Echocardiography revealed a mildly reduced left ventricular systolic function with 40% LVEF. Following initial conservative stabilisation (LMW heparin, dual anti-platelet therapy ASA 100 mg+clopidogrel 75 mg and nitrates infusion therapy), selective coronary angiography was performed via the

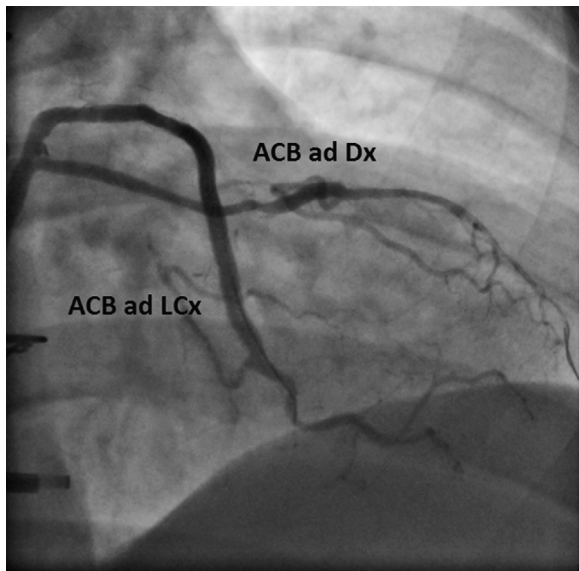


Fig. 3 – Right anterior oblique (RAO 15, Caud 30) projection; final result after implantation of Tryton (4.0/3.5×18 mm) and DES Promus Element (4.0×20 mm) stents.

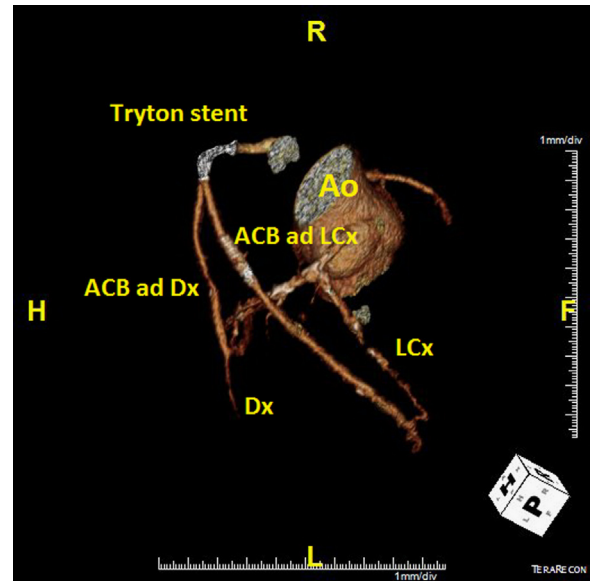


Fig. 5 – 12 Month follow-up; MS-CT volume-rendered 3-D image.

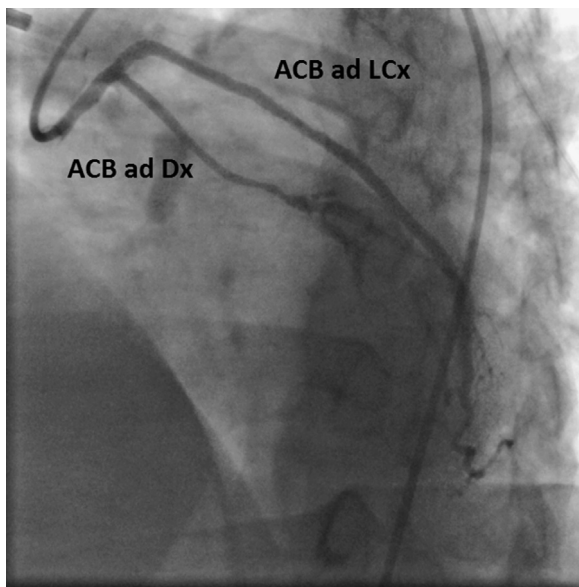


Fig. 4 – Left anterior oblique (LAO 30, Cran 30) projection; final result after implantation of Tryton (4.0/3.5×18 mm) and DES Promus Element (4.0×20 mm) stents.

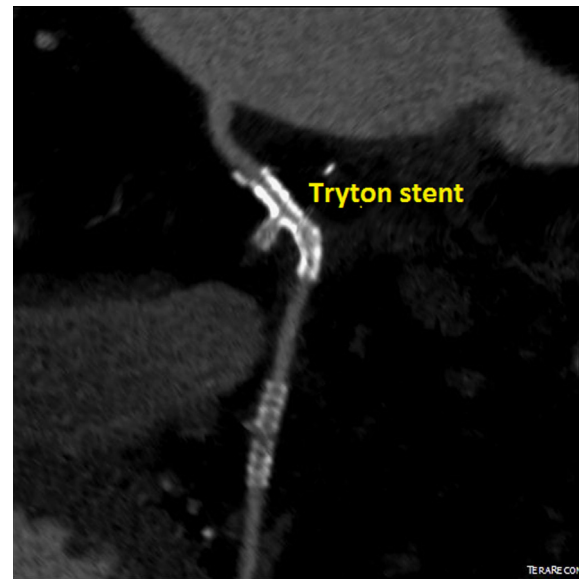


Fig. 6 – 12 Month follow-up; maximum intensity projection. Patent dedicated bifurcation stent Tryton.

right femoral artery, which revealed a significant involvement of the native coronary arteries (tight stenosis of the LAD, LCx and Marginal and chronic occlusion of the RCA), with a patent LIMA to LAD bypass and tight bifurcation stenosis in the Y-graft to PDA and LCx. (80% stenosis extending centrally to the origin of the side branch of the SVG to PDA, where 90% stenosis is present, Medina 1,0,1 (Fig. 7).)

Given the involvement of the vein bypass graft, Reopro 16.4 mg was administered intracoronary, the 6F guiding LCB was inserted and two PT MS guidewires were used to pass through the lesions in both saphenous vein grafts to the

PDA and LCx. We predilated both lesions using the Apex 3.0×12 mm balloon catheter at 12 atm. While the distal lesion at the side branch SVG–PDA origin was successfully predilated, a significant residual stenosis at the proximal lesion persisted. That is why we decided to treat both lesions using the Sequent Please 4.0×15 mm drug eluting balloon catheter at 6 atm and a short stent implantation (Liberte 4.0×8 mm/12 atm) only into the proximal residual stenosis. The result at the site of bifurcation was satisfactory, with TIMI class 3 flow into the periphery of both branches (Figs. 8 and 9).

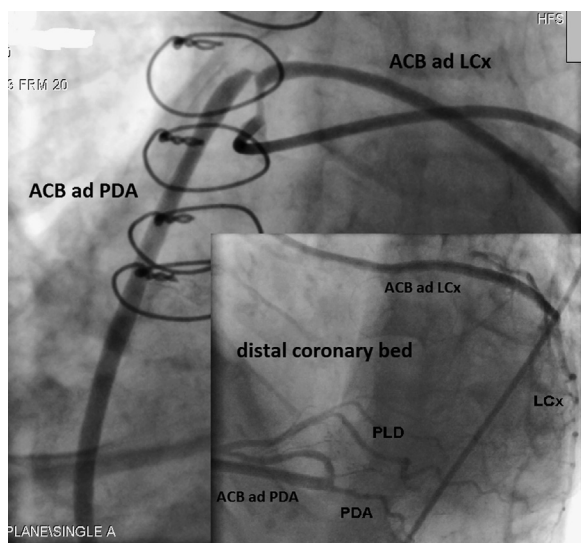


Fig. 7 – Left anterior oblique (LAO 30, Cran 15) projection; tight bifurcation lesion (Medina 1,0,1) in Y saphenous vein graft to LCx and PDA; (A)—detailed, distal saphenous vein grafts and native coronary bed.

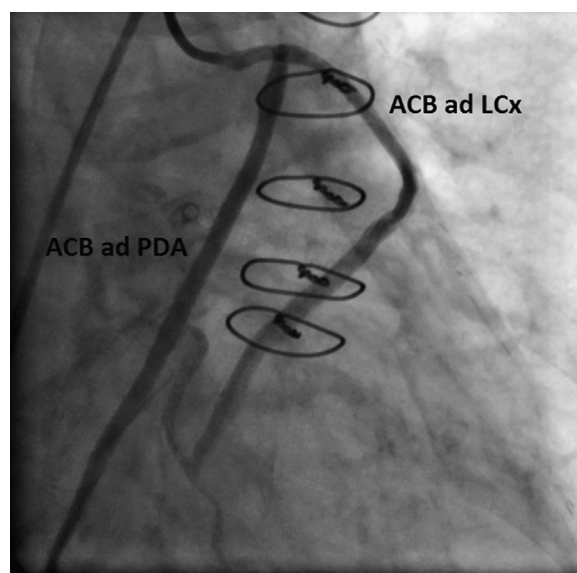


Fig. 9 – Right anterior oblique (RAO 30, Caud 15) projection; final result after DEB Sequent Please (4.0x15 mm) and Liberte stent (4x8 mm) implantation.

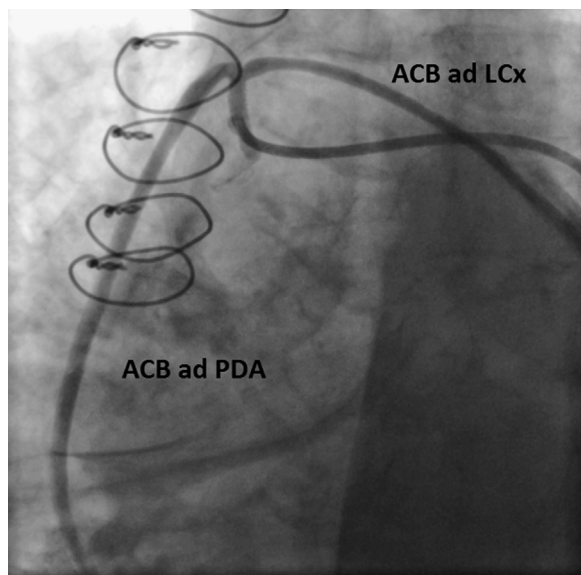


Fig. 8 – Left anterior oblique (LAO 45, Caud 30) projection; final result after DEB Sequent Please (4.0x15 mm) and Liberte stent (4x8 mm) implantation.

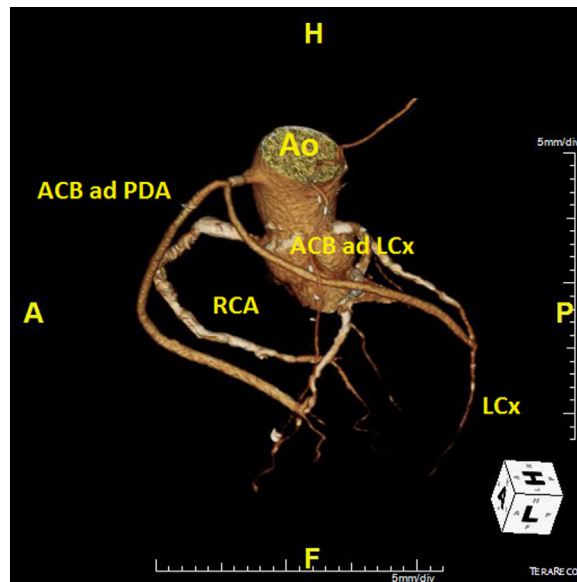


Fig. 10 – 12 Month follow-up; MS-CT volume-rendered 3-D image.

During further course of the treatment, the patient was stabilised and was discharged home following the planned haemodialysis. The treatment continued with 12-month dual anti-platelet therapy (ASA 100 mg+clopidogrel 75 mg), beta blockers (metoprolol 100 mg) and statins (simvastatin 40 mg).

At the 12-month follow-up visit, the patient had no residual angina, and she had only mild heart failure symptoms (NYHA class 2), MS-CT scan was further performed, with persistent satisfactory findings at the Y-shaped vein graft bifurcation site (Figs. 10 and 11).

Results

In both cases a satisfying angiographic result was achieved. No periprocedural complication has been recorded. Despite the fact that we cannot use a distal protection, final TIMI flow 3 was reached.

The patients were followed up during 12 months. During this follow-up period no major adverse cardiac events (MACE: cardiac death, myocardial infarction and target vessel revascularisation) have been recorded. Both patients were without residual angina pectoris and in one case with clinical signs of

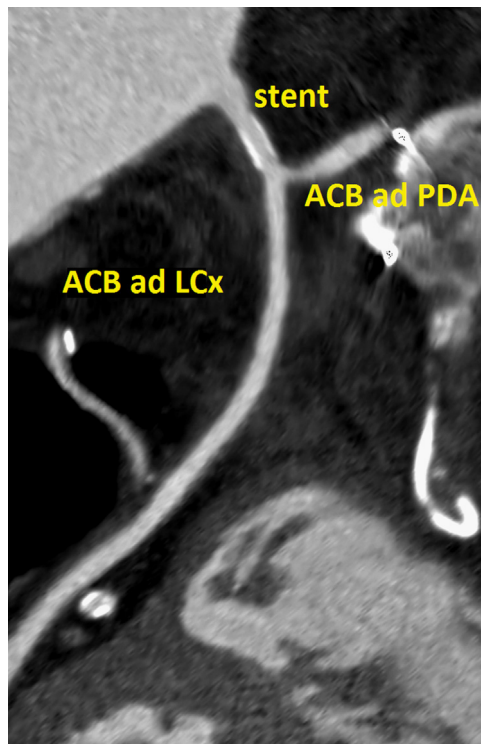


Fig. 11 – 12 Month follow-up; maximum intensity projection. Persistent satisfactory angiographic result.

light heart insufficiency of NYHA class II. Persistent satisfying angiographic results were confirmed on MS-CT coronarography with confirmation of patent both Y-graft branches, without the presence of restenosis in the bifurcation lesions.

Discussion

The use of Y-shaped aorto-coronary saphenous vein grafts is most commonly driven by efforts to replace the poor quality (length) of the vein grafts or to minimise manipulation of the atheromatous ascending aorta, thus reducing the risk of perioperative atheroembolic cerebrovascular accidents. The basic requirements for a satisfactory function of the Y-graft are its proper construction with an adequate length of the daughter vein graft and appropriate position of the central anastomosis on the main graft. Inappropriate length can lead to a kinking of the daughter or parent grafts and inappropriately located central anastomosis may result in twisting of the parent graft and flattening of the anastomosis [1].

In general, percutaneous coronary intervention of SVGs results in higher rates of mortality, periprocedural myocardial infarction and restenosis when compared to native vessel PCI [5].

Many strategies have been proposed for the treatment of bifurcation lesions in the native coronary vessels; however, due to their low incidence, there has been no data concerning the treatment of bifurcation lesions in Y saphenous vein grafts

in the literature. These communications are limited to anecdotal case reports only [2–4].

Given the foregoing, we should rely on the therapy of analogous lesions in the native vessels, while considering the PCI specifics of saphenous vein grafts. According to the consensus of the European Bifurcation Club, provisional T-stenting is considered the golden standard of treatment for most bifurcation lesions. However, bifurcation lesions with involvement of a large SB, which exceeds 5 mm from the carina, usually primarily require the implantation of two stents. In this case the Culotte technique brings some advantages over the crush technique due to significantly lower periprocedural AMI and ISR [6,7].

The **Tryton Side Branch Stent** (Tryton Medical, USA) used by us in the first case, is a dedicated bifurcation chromium–cobalt stent consisting of three parts: the distal segment which is a common stent for implantation in the lateral branches; the middle or “thin” transitional segment; and the proximal segment to fit in the main branch. The stent allows simple performance of the “reverse Culotte technique” [8].

In the real world the use of the Tryton Side Branch stent was studied in the **E-Tryton registry** (302 patients) and **Rotterdam-Poznan registry** (96 patients with coronary bifurcation lesions). Both these registries show that treatment of bifurcation lesions with a dedicated Tryton stent is safe and feasible, with good technical and procedural success and very low major adverse cardiac events at 6-month clinical follow-up. Procedural success rate was 94% and 6-month MACE/cardiac death, myocardial infarction and target lesion revascularisation/rate were 6%, 4% and 6% respectively [9,10].

In the second case we used a drug eluting balloon and bare metal spot stenting to treat so-called not true bifurcation lesion (Medina 1,0,1). Paclitaxel drug-eluting balloons (DEB) could provide an attractive alternative to treat bifurcations in combination with a provisional T-stenting technique in order to minimise SB restenosis.

In the **DEBUIIT trial**, a randomized 3-arm study (117 patients with coronary bifurcation lesions), however, treatment with the 1st generation DIOR™ paclitaxel coated balloon+BMS in the main branch did not lead to a significant improvement in the primary endpoint, the 6-month angiographic late luminal loss (LLL) or in the secondary end points (6-month binary restenosis and 12-month major adverse cardiac events) between DEB+BMS arm versus BMS only arm and DES arm. The main cause for the unsatisfactory outcome in the DEB arm was the use of the 1st generation Dior DEB, without hydrophilic coating, which provides inferior results compared to the hydrophilic coated DEB, and is no longer used [11].

The **Pepcad V trial** involving 28 patients with coronary bifurcational lesions demonstrated the feasibility of angioplasty using the SeQuent™ Please balloon in the main and the side branch of the bifurcation followed by bare metal stent implantation in the main branch. This treatment resulted in a 100% procedural success (primary end-point), no 30-day major adverse cardiac events (MACE) and the 9-month angiography follow-up showed DES-like results in MB and SB (comparable with LLL in the DES arm of Pepcad IV trial) [12].

The ongoing randomised **PEPCAD BIF trial** compares the treatment of the side branch with SeQuent™ Please or conventional angioplasty.

We used multi-slice CT coronary angiography to demonstrate the long-term patency of the implanted stents. Usage of CT coronarography in the demonstration of in-stent restenosis was assessed by Sun in his meta-analysis. The achieved sensitivity and specificity of 64-slice CT angiography with the detection of in-stent restenosis were 90% and 91%, respectively. Significantly higher diagnostic success was achieved during the evaluation of stents with the diameter greater than 3 mm (in comparison with stents under 2.75 or 2.5 mm) [13]. The success achieved during the evaluation of patency of venous bypass was still higher. Weusting in his report has shown up to 100% sensitivity of 64-slice CT angiography in the detection of obstructive impairment of venous grafts [14].

Conclusion

Percutaneous coronary angioplasty of the bifurcation lesions in the venous bypass grafts is a rare but complicated condition. In the therapy of these lesions, we can only rely on the PCI of analogous lesions in the native vasculature, considering the specifics of the interventions in the saphenous vein grafts.

In our two case reports we demonstrated that the use of a dedicated bifurcation Tryton Side Branch Stent, as well as the SeQuent Please paclitaxel coated balloon catheter for PCI of the bifurcation lesions in Y-shaped saphenous vein grafts, is technically feasible with satisfactory long-term results and represents our contribution to the debate on this particular issue.

Conflict of interest

No conflict of interest.

Funding body

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Ethical statement

We hereby declare that the principles of publication ethics were followed during our manuscript preparation.

Informed consent

All patients gave informed consent with the publication of their case reports.

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